The Trade Effects of Environmental Provisions in Preferential Trade Agreements

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Abstract

The international community has acknowledged that international trade can be an effective means of helping to achieve the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs). Traditionally, preferential trade agreements (PTAs) were designed to promote trade flows. PTAs have become more comprehensive and now also cover non-economic policy areas, such as the environment. This chapter examines whether the inclusion of environmental provisions in PTAs changes the observed overall positive contribution that PTAs make to economic outcomes and thereby to the economic objectives of the SDGs. Specifically, we ask whether the inclusion of environmental provisions in PTAs reduces export flows between PTA partner countries. Using a novel data set on environmental provisions in PTAs, we estimate gravity type panel regressions. We find that membership in PTAs including more environmental provisions is associated with less trade among trade partners compared to PTAs that include less or no environmental provisions. This negative effect of environmental provisions is fully driven by the negative effect on South-North trade flows, i.e. exports from developing to high-income countries.

1. Introduction

The international community has acknowledged that international trade can be an effective means of helping to achieve the 2030 Agenda for Sustainable Development and the 17 Sustainable Development Goals (SDGs) (UN 2015). The 2030 Agenda covers a broad range of indicators comprising three interrelated goals of sustainability. It aims to simultaneously improve economic, social and environmental conditions worldwide. Given the all-encompassing nature of the 2030 Agenda, contradictions and trade-offs between the different goals seem inevitable (Nilsson et al. 2016). This is exacerbated by the fact that implementing the 2030 Agenda depends on improving the coordination of different international policy regimes addressing issues relating to trade, climate, deforestation and biodiversity to name just a few.

One of the potential core trade-offs that needs to be carefully managed is between trade liberalization and environmental protection. The relationship between trade and the environment is often described as one of divergence rather than synergy (Esty 1994). One key concern is that more international trade implies more production and consumption, which in turn means higher resource use and greater environmental pollution and degradation. A further concern is that environmental regulations may be used as a disguised form of protectionism. For instance, subsidizing technologies for generating renewable energy can protect domestic producers from competitive imports from abroad.

Traditionally, rules on trade and the environment were negotiated in different regimes. Now, we are witnessing increasing overlaps and interactions between the various regimes (e.g. Johnson 2015; Zelli et al. 2013). In this respect, one of the most striking developments is the integration of environmental provisions in preferential trade agreements that are negotiated on the bilateral or regional level (Lechner 2016; Milewicz et al. 2018; Morin et al. 2018).[1] While

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

trade agreements traditionally set out to eliminate tariffs, they now tend to be more comprehensive and also include non-economic policy areas, such as the environment. Environmental provisions have become a regular feature of preferential trade agreements (PTAs). Already roughly 85% of all PTAs that have been signed until 2016 include environmental provisions alongside trade-related issues (Morin et al. 2018).

In principle, environmental provisions in PTAs can affect both the environmental and the economic dimension of sustainability. The current literature focuses largely on the environmental effects of PTAs (Baghdadi et al. 2013; Bastiaens and Postnikov 2017; Morin et al. 2019; Brandi et al. 2019). Recent PTAs include prescriptions on numerous environmental issues that are directly linked to many SDGs, including provisions to encouraging trade of energy efficient goods and renewable energy (SDG 7), reduction of green house gas emissions and the ratification of the Paris Climate Agreement (SDG 13), the prevention of maritime pollution (SDG 14) and the protection and sustainable management of forests (SDG15). Therefore, it is reasonable to expect that environmental provisions in PTAs have the potential to promote several SDGs, as well as the environmental dimension of the 2030 Agenda for Sustainable Development more generally.[2]

In contrast, little is known about how environmental provisions in PTAs affect the economic dimension of sustainable development. Despite the ubiquity of environmental provisions in PTAs and their potential importance for sustainable development, how they affect economic variables such as trade flows is uncertain. Frequently, international trade is presented as being a key driver of economic development. Indeed, it is argued that many important synergies exist between trade and the SDGs. While trade liberalization always generates winners and losers and can increase inequalities, it does have positive effects on a broad range of economic variables (e.g. Baier and Bergstrand 2007; Baccini 2019). Manifold studies show that trade liberalization enhances productivity, generates higher income, increases growth and helps alleviate poverty (Winters and Martuscelli 2014). Thus, PTAs can be an effective means to help developing countries achieve a number of SDGs, including those relating to poverty (SDG 1), growth (SDG 8) and industry (SDG 9).

How does the inclusion of environmental provisions in PTAs affects this overall positive contribution to the economic dimensions of the SDGs? Can the PTA signatories pursue economic and environmental goals simultaneously or do they face a trade-off, which amounts to protecting the environment at the expense of the economy? Little is known about how environmental provisions in PTAs affect trade flows and whether they restrict trade, thereby, potentially undermining the economic aspects of sustainable development. To address these questions in this chapter, we investigate the impact of PTA environmental provisions on contracting parties' exports.

This question is particularly relevant to developing countries. Developing countries are often concerned that high-income countries misuse environmental provisions in PTAs, which is tantamount to green protectionism. Political leaders of poorer countries tend to reject demands for EPs in PTAs, sometimes pointing to "green imperialism" and to lower environmental standards simply being part of developing countries' comparative advantage (Bernauer and Nguyen 2015). Subsequently, environmental provisions in PTAs may not only undermine the purpose of the agreements (which is to increase trade), but also the overall objective of the 2030 Agenda for Sustainable Development designed to promote the environment and the economy simultaneously. In this chapter, we seek to shed more light on

[2] For a legal analysis of the environmental provisions in European Union PTAs in relation to the 2030 Agenda on Sustainable Development, see the chapter by Adinolfi in this volume.

the interplay between trade and the environment by empirically investigating the economic effects of environmental provisions in PTAs.

We use a novel data set that tracks environmental provisions across a broad range of PTAs. We estimate the effects of environmental provisions in PTAs using a gravity type panel regression. We hypothesize that the number of environmental provisions in PTAs has a negative effect on trade flows, particularly for developing countries. In line with our expectations, we find that higher number of environmental provisions in PTAs is associated with less trade between the partner countries. This negative effect is particularly apparent in South-North trade flows as the inclusion of more environmental provisions restrict developing countries' export opportunities in terms of market access in developed countries.

This chapter contributes to the literature on the design features of PTAs and their economic impact. Furthermore, it sheds light on the interplay between trade and sustainable development. We provide new evidence on the effects of including environmental provisions in PTAs, which improves our understanding of the role of trade measures when it comes to achieving the 2030 Agenda for Sustainable Development.

The chapter is organized as follows: section 2 shows that environmental provisions are now a standard feature of many PTAs and describes the main design features of these provisions. Section 3 reviews the literature and presents the hypotheses. Section 4 sets out our data and our empirical approach. Section 5 presents and discusses the empirical findings. Section 6 summarizes the results and discusses ways forward for both policy-makers and researchers.

2. Environmental Provisions in PTAs

In the past two decades, scholars have studied the drivers and effects of a number of key innovations in PTA design (e.g. Horn et al. 2010; Büthe and Milner 2014; Dür et al. 2014; Kohl et al. 2016). Traditionally, PTAs focused primarily on eliminating at-the-border measures, such as tariffs and quotas. Since the 1990s, negotiating parties increasingly include behind-the-border measures in their PTAs. For example, these measures concern investment, services, intellectual property or regulatory cooperation. Recent PTAs cover a broad range of behind-the-border issues and are designed to have a deep impact on domestic policy-making (Dür et al. 2014).

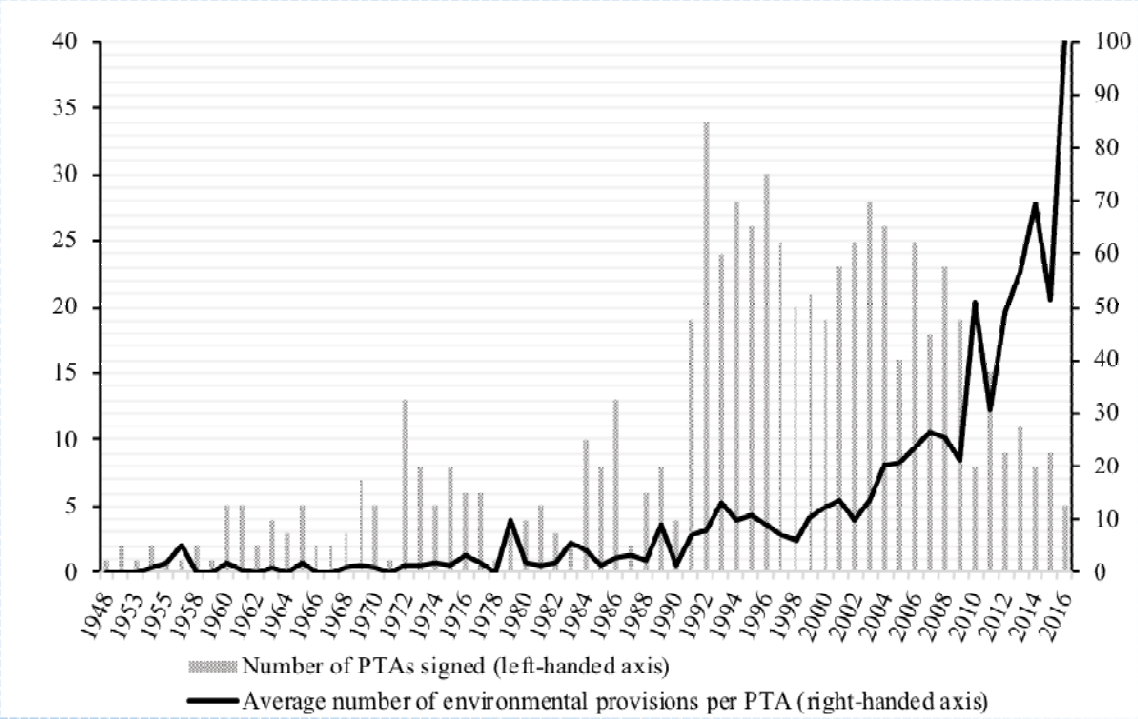
Following this rise of behind-the-border measures in PTAs, environmental provisions have also become increasingly common in PTAs. Figure 1 shows that the average number of environmental provisions per PTA has skyrocketed in the 2000s. In 2016, each new PTA contained on average around 100 different environmental provisions (Morin et al. 2018). The prevalence of environmental provisions is particularly high in agreements negotiated by developed countries.

These environmental provisions are increasingly heterogeneous and far-reaching (Milewicz et al. 2018; Lechner 2016; Morin et al. 2018). Initially, they were limited to exceptions to trade commitments that can be used to protect human, animal or plant life or health or to conserve exhaustible natural resources. However, environmental provisions now tackle an increasingly broad range of environmental issues, such as hazardous waste, deforestation, the protection of fish stocks and the mitigation of CO_2 emissions. Other environmental provisions in PTAs facilitate the harmonization of environmental policies, strengthen multilateral environmental agreements (MEAs) or require the transfer of green technologies to developing countries.

While the proliferation of deep PTAs is often explained by the spread of regional and global value chains, where companies' international activities combine trade with foreign investments and the transfer of technology abroad, the reasons for including environmental provisions in PTAs is more puzzling. Three main explanations can be identified. First, some

argue that the "greening of PTAs" is a strategic move to win the support of societal groups, which would otherwise be opposed to economic liberalization (Gallagher 2004; Hufbauer et al. 2000). Empirical works supports this explanation and finds that a majority of citizens in different countries are in favor of the inclusion of environmental provisions in PTAs (Esty 2001; Bernauer and Nguyen 2015). More recent empirical work supports these findings for citizens in developed countries but finds that citizen's in developing countries view the inclusion of environmental provisions in PTAs as a form of protectionism (Bastiaens and Postnikov 2019). Furthermore, democratic countries include on average more environmental provisions in their PTAs than autocratic countries (Morin et al. 2018).

Figure 1: Average number of environmental provisions per PTA



Source: Own compilation based on the Trade and Environment Database (TREND), Morin et al. 2018.

A second explanation is that countries use PTAs to promote higher environmental standards globally (Johnson 2015; Jinnah and Lindsay 2016). In contrast to environmental treaties, trade agreements are often perceived to offer more effective enforcement mechanisms and are therefore better suited to promote environmental concerns.[3] Furthermore, PTAs covering a number of different issue areas from trade and investment liberalisation, the protection of intellectual property rights to labour rights and environmental protection open the possibility of trade-offs across issue areas, they might therefore be seen as more effective instruments for environmental diplomacy than traditional multilateral negotiations focusing solely on environmental protection.

A third explanation is that the inclusion of environmental provisions in PTAs serves economic motivations (Bhagwati and Hudec 1996; Krugman 1997; Bechtel et al. 2012).

[3] Hafner-Burton et al. (2019) make a similar argument in the case of worker rights protection in the US General System of Preferences.

Countries with higher environmental standards might want to level the playing field with foreign competitors by correcting global differences in regulatory environment (George 2014). From the perspective of countries with lower environmental standards, environmental provisions can be used to restrict their exports and are often regarded as a green cover for protectionist interests in high-income countries. A number of studies provide evidence of the link between protectionist interests and the inclusion of environmental provisions in PTAs (Runge 1990; Subramanian 1992; Ederington and Minier 2003; Lechner 2016). While the research is being conducted on the motivations for including environmental provision in PTAs, their actual effects remain unclear.

3. Literature and Hypotheses

Multiple economic studies assess the economic effects of PTAs. In theory, PTAs can lead to the creation and diversion of trade. However, existing empirical research commonly shows that PTAs tend to increase trade between their members (Baier and Bergstrand 2007, 2009; Egger et al. 2008, 2011; Freund and Ornelas 2010; Fugazza and Nicita 2013; Magee 2008). More recent research has focused on the differential trade effects that PTAs have across various sectors (Baccini et al. 2017; Spilker et al. 2018). In the light of new data on PTA design, recent studies have also investigated whether design determines the impact of PTAs. Existing research suggests that deep PTAs tend to generate more trade than more basic agreements (Baier et al. 2014; Dür et al. 2014; Mattoo et al. 2017).

Increased trade has uncertain implications for the environment because of scale, composition and technique effects (Grossman and Krueger, 1993; Copeland and Tyler 2004). Therefore, it may not be possible to achieve environment-related SDGs that cover issues, such as water (SDG 6), climate (SDG 13), oceans (SDG 14) and land (SDG 15). First, the scale effect concerns the negative environmental consequences of increased output or greater economic activity due to the opening up of trade. Second, the composition effect indicates how trade opening leads to the re-allocation of a country's productive resources towards the products for which it has a comparative advantage. It is difficult a priori to determine whether the composition effect will increase or decrease the negative environmental impact, since the overall impact depends on the specific sectors in which a given country enjoys a comparative advantage. Third, the technique effect of trade liberalization can improve environmental protection because trade opening reduces the cost of environmentally-friendly goods, services and technologies, making them more accessible. In addition, the increased income generated by trade can lead society to demand better environmental quality.[4] The effects of scale and technique tend to work in opposite directions, while the composition effect depends on the countries' comparative advantage. Therefore, it is difficult to predict how trade will affect the environment overall.

Just a handful of studies look at the consequences of PTAs' environmental provisions. Most of them focus on their environmental impact. Baghdadi et al. (2013) distinguish PTAs with and without environmental provisions and find that the former lead to lower levels of absolute CO2 emissions and find a convergence of emissions among the partner countries. Two papers by Zhou et al. (2017) and Martínez-Zarzoso and Oueslati (2016) finds similar results for air quality measures. In a more recent paper Brandi et al. (2019) focus on the direct link of PTAs with environmental provisions on domestic environmental legislation. They find a positive relationship between the number of environmental provisions included PTAs and the adoption of domestic environmental laws in particular in developing countries. Furthermore, the

[4] On the link between individual-level environmental concerns associated with foreign direct investment and a country's level of economic development, see Kim and Lee's chapter in this volume.

authors analyse the effects of particular issue-specific environmental provisions and find strong effects in the case of water (SDG 6), air (SDG 11) and soil (SDG 15). Fewer studies investigate environmental provisions' economic consequences. One rare exception is an article by Lisa Lechner (2018) that examines how PTAs environmental provisions affect the behavior of US investors. In her study, Lechner finds that environmental provisions in PTAs reduces FDI in polluting industries while they have a promoting effect in environmentally clean industries. Yet, little is known about how environmental provisions in PTAs affect trade flows across a large number of countries.

This paper argues that environmental provisions in PTAs can restrict trade flows in two different ways. First, countries with high environmental standards can use environmental provisions to "level the playing field" with countries that have lax environmental regulations (e.g. Bhagwati 1995). A number of environmental provisions are "offensive" in nature and demand partner countries, for example, to protect the ozone layer, enforce domestic environmental legislation, and ratify international environmental agreements. Such "offensive" environmental provisions can be used to reduce the competitive advantage of countries with formerly lower environmental standards (Bluemer et al. 2019).

Second, the "defensive" nature of some environmental provisions may reduce trade flows directly. One important example is that of environmental exceptions, which allow countries to restrict trade to protect biodiversity or conserve natural resources (Bluemer et al. 2019). These exceptions were included in the 1947 General Agreement on Tariffs and Trade (GATT) and were later incorporated into hundreds of PTAs. In addition to general exceptions, PTAs now include more and more issue-specific exceptions that concern investment, services and public procurement, amongst others. As PTAs become deeper, businesses and environmental groups are calling for more exceptions to help cushion the impact of economic liberalization.

In the light of these arguments, we expect environmental provisions to reduce the additional trade induced by the PTA.

> Hypothesis 1: The higher the number of environmental provisions in PTAs, the greater the negative effect on trade flows between the partner countries.

Furthermore, the effects of environmental provisions in PTAs may vary across different country groups. Developing countries are often concerned that high-income countries use environmental provisions in PTAs to restrict market access and level the playing field in foreign countries. Therefore, we expect that environmental provisions will specifically impede market access for developing countries.

> Hypothesis 2: The higher the number of environmental provisions in PTAs, the greater the negative effect on exports from developing to high-income countries.

4. Data and Empirical Approach

To test the above hypotheses, we construct a panel on bilateral trade flows and combine it with data on the environmental provisions in PTAs ratified between the trading partners.

We use bilateral country-pair goods exports, drawn from the World Trade Flow database (Feenstra 2017), as our main dependent variable. The data covers the period 1984 to 2016 and provides the total volume of exports in manufacturing, mining and agricultural products from one country to another (in current thousand US$ for the available years). As common in the literature, we use the natural log of total exports as dependent variable (*EXPORTS*). The resulting panel is unbalanced, with a total of roughly 780,000 trade flow observations, involving approximately 50,000 exporter-importer pairs. Therefore, on average, there are 15 trade flow observations for each country pair in a given direction.

For our independent variables, namely different environmental provisions in PTAs, we use information from the Trade and Environment Database (TREND) to capture the contractual arrangement for each exporter-importer dyad. TREND, introduced by Morin et al. (2018), is the most comprehensive and fine-grained dataset of environmental provisions in PTAs. It identifies 286 environmental provisions in 598 PTAs that have entered into force. 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). Thus, the data also covers PTAs that do not include any environmental provisions. On average, all PTAs ever signed until 2016 include 14.5 environmental provisions. However, this number varies widely, with a maximum of 120 provisions (the 2014 agreement between the European Union and Moldova) and a median number of 5 provisions. In general, more recent PTAs have more environmental provisions. Given that WTO agreements concern almost every country in the trade flow sample, we do not include them in our analysis. We consider that external EC/EU treaties involve all members and the respective partner country.

Our main explanatory variable is the maximum number of environmental provisions in a PTA between a pair of countries (*ENVPROVS*). Thus, we assume that if the same provision is included in more than one PTA between two countries, it does not add any content to the contractual relationship.

In order to analyze separately the effect of the content from the plain existence of PTAs in place, in our estimation, we control for whether a PTA is in force between the trading partners. We thus construct a binary variable, whether between any exporter-importer dyad, one or more PTA(s) was (were) in place in a given year (*PTA*). Often, more than one PTA has been signed between two countries. However, the value attributed for the *PTA* is still 1 for this country pair in a given year.

To control for the varying depth of PTAs commitments related to trade liberalization, we use the DESTA depth index in our empirical analysis (Dür et al. 2014).[5] The index in the sample ranges from -1.4 to 2.3, which we normalize to range from zero to 3.7. Again, we use the maximum depth of *any* PTA between a country pair to measure the depth of PTAs between a country pair (*DEPTH*). We include this as a control variable, since deeper agreements are also likely to have more environmental provisions (the correlation coefficient between the two variables in all PTAs is 0.68), and we specifically want to examine the effect of environmental provisions.

We use the World Bank classification of (non-) high-income countries as of 2000 to classify exporters and importers as developed or developing countries (see appendix). The use of the classification in the year 2000 is not decisive for the results, but using only one classification facilitates the interpretation of our findings by keeping the country group samples constant over time. The year 2000 is the available classification closest to the middle of the time span covered by the sample and thus a good proxy for how a country was classified over the majority of years analyzed.

The aim of the identification strategy is to compare the change in exports between two countries that enter into a PTA with more environmental provisions to the change in exports between two countries that enter into a PTA with less environmental provisions. Given this strategy, those countries that never enter into any PTA throughout the period covered by our sample do not contribute to identification. We therefore simply drop them from the sample. This choice does not significantly affect our results. Thus, our sample only includes country pairs that signed a PTA at some point during the period studied. This corresponds to roughly

[5] The DESTA Depth index does not include information about environmental provisions in PTAs.

36% of all trade flow partners. In order to be able to relate the effect of including environmental provisions in PTAs to the situation of no PTA whatsoever, we include the exports between trading partners in our sample also for the time period before they signed the PTA. Furthermore, we only include countries as exporters or importers for which data is available on the country group classification in order to keep the different samples of the estimations depending on the country group classification comparable to that of the estimation on the entire sample. This reduces the overall sample of trade flow observations to 250,014.

Table A1 in the Appendix lists all the countries included in the sample as either exporters or importers and their classification (high-income and developing countries). The summary statistics of all variables on the PTA level are listed in Table A2 in the Appendix. Note that 13% of the PTAs in the sample are between high income countries only, 32% between high income and non-high income countries, and 54% between non-high income countries only. Table A3 lists the summary statistics for all variables at the country-pair level. Of all dyadic trade flows taken as observations, 76 % are under a PTA (only 24 % before signing any PTA). On average, each dyadic trade flow is under 1.6 PTAs.

Our main interest is how environmental provisions affect trade flows between partner countries. We exploit the data's panel structure 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 partially control for selection effects into signing PTAs and the inclusion of environmental provisions. This strategy allows us to capture time-invariant selection effects on a country-pair level, such as distance or the average level of trade. It cannot control for bilateral trends in or expectation of future trade levels, which could also drive selection into signing a PTA or including environmental provisions. We furthermore include exporter- and importer-year fixed effects in order to capture multilateral resistance and country specific time-variant developments. Although this generally gives a slight downward bias to our results, it allows us to control for all time-variant country specific variables, such as GDP, or a general opening up to international trade by individual countries. Thus, our baseline regression equation is as follows:

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

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. Since *EXPORTS* is measured in logs, the estimated results for the coefficients give the percentage change in exports per change in the independent variables (i.e. particularly for one additional environmental provision in a PTA). In order to account for common shocks on the country-pair level, we cluster standard errors on that level.

In 4,239 cases of an exporter-importer relationship, the number of environmental provisions in force between two countries increased when they were already in an existing PTA. In almost all cases this occurred when a new PTA (usually involving third countries) entered into force. To ascertain that the changes in exports are driven by the number of environmental provisions in place rather than by the additional PTA, we add the number (#) of PTAs in force at a given time between the trading partners as control variable. Further robustness tests include the non-linear estimation via panel pseudo maximum likelihood (PPML), and excluding all major oil exporting countries from the sample. We refer to the results of these while discussing the results of the main estimation.

5. Findings

First, we estimate Equation (1) for the entire panel. The results are shown in Column 1, Table 1. In line with Hypothesis 1, we find that environmental provisions in PTAs, in general, decrease trade between partner countries.[6] When an additional environmental provision is included in a PTA, it decreases trade between two countries by an average of 0.2 per cent, compared to countries with a PTA of equivalent depth and initial export volumes. This result is economically significant, given that on average, trade flows under a PTAs are subject to 27.36 environmental provisions.[7] Therefore, trade between countries that are party to a PTA with an average number of environmental provisions is 5 per cent less on average in the years following the PTA's entry into force than countries that sign a PTA with no environmental norms.

Table 1: The effect of environmental provisions in PTAs on trade

	(1) EXPORTS	(2) EXPORTS
ENVPROVS	-0.002***	-0.003***
	(0.001)	(0.001)
PTA	0.127***	0.162***
	(0.034)	(0.034)
# of PTAs		0.126***
		(0.015)
DEPTH	0.016	-0.026
	(0.019)	(0.019)
Country-Pair FE	Yes	Yes
Exporter- and Importer-Year FE	Yes	Yes
Observations	250,014	250,014
Share of Flows under PTA	0.76	0.76
Average No. of PTAs if Trade Flow under any PTA	2.14	2.14
Average No. of ENVPROVS per trade flow under PTA	27.36	27.36

[6] However, this finding is not very robust. In some other specifications, the statistical significance of the coefficient vanishes, such as when including all trade flow observations including between countries that never signed a PTA, or when adding up sectoral trade flows to compute aggregate trade flows, which implies a loss of observations. The point estimates are similar to the ones reported here in all these estimations, however. The finding of a negative overall effect is also statistically robust to replacing the fixed effects by constant bi- and time-variant unilateral variables, which is often pursued in the literature when no panel data is available (see Baier and Bergstrand 2007). The results on the country groupings reported below are not affected in any of these cases.

[7] The number differs from the average number of EPs in PTAs on the PTA level, as a PTA with a given number of provisions can affect several trade flow observations. The fact that the average number of EPs per trade flow is higher than the PTA average shows that those PTAs with more environmental provisions on average affect more bilateral trade relationships.

R^2	0.890	0.890

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 the environmental provisions (*ENVPROVS*) included in the PTA. Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*

For our control variables, our results show that when a PTA is in place, it increases trade between two countries by about 13 per cent, which is roughly in line with previous studies (see e.g. Baier and Bergstrand 2007). Our findings reveal that the depth of a PTA has no significant effect on overall trade flows, which runs counter to previous findings (for example, see Dür et al. 2014).[8] We also control for the fact that when countries have signed various PTAs, there are usually more environmental provisions in place between them by including the absolute number of PTAs in place between them (see results in Column 2). While the number of PTAs, given their maximum depth, does matter, the result on the effect of ENVPROS remains constant or even increases. For a given number of PTAs, the more environmental provisions they include, the less (of an increase in) trade there is between countries.

Next, we analyze the effects of environmental provisions separately for whether the exporter and the importer are developed or developing economies. Table 2 shows the results of estimating Equation (1) for the samples of trade flows between the different country categories: from developed to developed economies (Column 1), from developing to developed economies (Column 2), from developed to developing countries (Column 3), and from developing to developing economies (Column 4), respectively.

In line with Hypothesis 2, our findings show that the negative effect of environmental provisions on aggregate trade flows only occurs for trade relationships involving exports from a developing country to a developed economy (Column 2). There does not seem to be any significant effect on trade between developed economies (Column 1), exports from developed to developing economies (Column 3) or exports between developing economies (Column 4). We see that trade flows in the framework of a PTA between countries with different levels of development are on average subject to more environmental provisions than those between countries with a similar level of development. However, this only has a significant negative effect on developing countries' exports to developed countries. For the subsamples, we repeat the estimation, while controlling for the absolute number of PTAs in place between the countries. The result is shown in Table A4 in the Appendix. The variation in the numbers of PTAs in force does not appear to drive the results, although the number of environmental provisions increases as the number of PTAs increases.

Our findings are in line with the literature, which suggests that the concern expressed by developing countries about the effect of environmental provisions may be justified. For example, some "offensive" provisions require developing countries to implement international environmental agreements and enforce domestic environmental laws because, typically, they have less stringent environmental regulations. This reduces developing countries' comparative advantage, which partially stems from the exploitation of regulatory differences. Developing countries' exports to developed countries may decline as a direct consequence. In this context, developed countries may use environmental provisions as an instrument to achieve their "offensive" trade and environmental interests.

[8] However, this result is not driven by the correlation with environmental provisions, but can be explained by the extension of our sample to 2016, compared to previous studies using samples up to 2009. Thus, it appears that the positive effect of depth is worn away in recent years. We cannot identify this type of change over time for the effect of environmental provisions.

Table 2: The effect of environmental provisions in PTAs in relation to the level of development of trading partners

	(1) **North-North** EXPORTS	(2) **South-North** EXPORTS	(3) **North-South** EXPORTS	(4) **South-South** EXPORTS
ENVPROVS	-0.003	-0.005**	-0.003	-0.001
	(0.003)	(0.002)	(0.002)	(0.001)
PTA	-0.086	0.437***	0.198**	-0.080*
	(0.105)	(0.102)	(0.077)	(0.048)
DEPTH	0.119**	-0.090	0.007	0.054*
	(0.060)	(0.057)	(0.040)	(0.032)
Share of Flows under PTA	0.790	0.696	0.709	0.808
Average No. of ENVPROVS per trade flow under PTA	26.6	44.2	45.59	13.67
Country-Pair FE	Yes	Yes	Yes	Yes
Exporter- and Importer-Year FE	Yes	Yes	Yes	Yes
Observations	20,071	53,690	55,576	120,315
R^2	0.965	0.896	0.927	0.848

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 the environmental provisions (*ENVPROVS*) included in the PTA. The four columns report the results for the split sample by level of development of the exporter and importer, according to the World Bank definition of High Income (North) and non-High Income (South) countries. Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*

An alternative explanation for the negative trade effect of environmental provisions relates to countries' "defensive" interests. Trade agreements are getting deeper and more comprehensive as a result of, inter alia, the inclusion of provisions designed to facilitate trade flows, services, foreign investments, as well as to protect intellectual property rights and open up public procurement markets. Including deep provisions requires domestic policy reforms that may weaken domestic environmental regulations. Including environmental exceptions in PTAs may be interpreted as a cushioning system to mitigate the unintended regulatory effects of deep PTAs.

We also apply a pseudo maximum likelihood (PPML) estimation to the data (Santos Silva and Tenreyro 2010).[9] The dependent variable is the sum of exports (non-logarithmised). The

[9] PPML estimations are often used as robustness tests in the literature on the trade effects of PTAs, and sometimes even as main gravity model specification. However, not only do they constitute a black box, their efficiency, particularly in fixed effects models, has come under some discussions recently, see Pfaffermayr

results are presented in Table A5 in the Appendix. They suggest that the effects of environmental provisions are not statistically significant across the entire sample (Column 1) or for exports between any of the different country groups (Columns 2-5). Still, the sign is again only negative for exports from developing to developed countries.[10]

Furthermore, it is likely that for countries that export many particularly environmentally harmful goods, such as oil and petroleum products, the effects of environmental provisions in trade agreements on trade flows are somewhat different, as might be their motivation to include these provisions in a PTA in the first place. In order to exclude that this is what drives our results, we also estimate the general equation excluding all trade flows that involve the main oil exporting countries. Table A6 reports the results. Column 1 shows the results on the whole sample when all major oil exporting countries are excluded from the sample, Column 2 the results excluding only OPEC member countries. The main result that the inclusion of environmental provisions reduce the trade creation effect of PTAs also holds in the sample without oil exporters. Columns 3-6 report the breakdown by country income group of exporter and importer for the sample excluding the top oil exporters. We see that also in this sample, it is particularly export flows from developing to developed countries that are affected by the inclusion of environmental provisions. However, although on average subject to much fewer environmental provisions, trade flows *between* developing countries are also negatively affected by the inclusion of environmental provisions in this reduced sample without major oil exporting countries (Column 6).

6. Conclusion

Our main finding shows that including environmental provisions in PTAs has a restrictive effect on trade flows, albeit only slightly. We hypothesise that trade flows between two countries will be negatively affected and that this effect is stronger, the higher the number of environmental provisions included in a PTA signed by the two parties. We furthermore hypothesised that the trade-restricting effect of environmental provisions will affect developing countries more strongly than other countries. Our findings confirm both hypotheses. To be clear, PTAs in general do increase trade flows. However, the inclusion of environmental provisions in PTAs moderates this trade-increasing effect. In line with our expectations, we find empirical evidence to justify the fear expressed by developing countries, namely, that environmental provisions in PTAs have a trade restrictive effect on their economies. When PTAs include environmental provisions, there is a negative effect on developing country exports in terms of trade flows to developed countries. This suggests that there is a trade-off between the economic and environmental aims of the SDGs. Environmental provisions in PTAs can help promote environmental sustainability (e.g. SDG 13 and 15) and trade is a key engine for economic development (e.g. SDG 8). Our results suggest that developing country governments that want to sign comprehensive PTAs with developed countries are faced with this trade-off.

(2019). So far, PPML estimations appear to be slightly more efficient for indicator explanatory variables, such as the effect of an existing PTA. Further research is required to examine this discrepancy.

[10] We use the log-linear estimation in this chapter to facilitate interpretation and because the results of the log-linear approach on the PTA variable is in line with previous findings. The handling of zeros is one advantage of the PPML estimation, but our trade flow data does not contain any zeros. Therefore, we treat missing trade values as zeros for the PPML estimation in Table A5, in order to exploit the strength of PPML estimation. At the same time, not including them does not change the results of the PPML estimation substantially.

However, some types of environmental provisions are more likely to promote trade flows than others. Some actually facilitate trade by calling for the liberalization of trade in environmental goods and the reduction of environmentally harmful subsidies. Unfortunately, PTAs rarely include environmental provisions of this type. Therefore, trade negotiators keen to achieve the SDGs should focus specifically on environmental provisions that do not generate trade-offs between the environmental and economic goals of the 2030 Agenda for Sustainable Development. Alternatively, trade negotiators could consider offering additional trade concessions to developing countries to offset the negative effects of some environmental provisions. Further research is needed to improve our understanding of the trade effects of different types of environmental provisions.

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Appendix

Table A1: List of Countries by World Bank Country Group Classification (as of 2000)

High Income Countries

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

Low Income, Middle Income, Up Middle Income Country

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

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

Table A2: Summary Statistics PTAs

Variable	Observations	Mean	Std. Dev.	Min	Max
ENVPROVS	598	14.50502	21.79951	0	120
DEPTH	568	1.582993	1.019131	0	3.687593
Only North-North Agreement (Dummy)	588	0.1309524	0.3376355	0	1
North-South Agreement (Dummy)	588	0.3282313	0.4699693	0	1
Only South-South Agreement (Dummy)	588	0.5408163	0.4987555	0	1

Table A3: Summary Statistics Trade Data

Variable	Observations	Mean	Std. Dev.	Min	Max
EXPORTS	250,014	8.501814	3.861231	-6.907755	19.76745
ENVPROVS	250,014	20.79433	26.84317	0	120
PTA	250,014	0.7600054	0.4270807	0	1
# PTAs	250,014	1.628669	1.641328	0	9
DEPTH	250,014	0.9088943	1.080169	0	3.687593
High Income Importer	250,014	0.2957114	0.4563628	0	1
High Income Exporter	250,014	0.303279	0.4596756	0	1

Table A4: The effect of environmental provisions in PTAs by level of development of trading partners, controlling for the # of PTAs

	(1)	(2)	(3)	(4)
	North-North	**South-North**	**North-South**	**South-South**
	EXPORTS	EXPORTS	EXPORTS	EXPORTS
ENVPROVS	-0.003	-0.006***	-0.002	-0.001
	(0.003)	(0.002)	(0.002)	(0.001)
PTA	-0.077	0.460***	0.163**	-0.012
	(0.106)	(0.103)	(0.076)	(0.048)
# of PTAs	0.017	0.088*	-0.140***	0.175***
	(0.032)	(0.047)	(0.042)	(0.030)
DEPTH	0.113*	-0.112*	0.046	-0.035
	(0.059)	(0.058)	(0.043)	(0.035)
Share of Flows under PTA	0.790	0.696	0.709	0.808
Average No. of PTAs if any PTA in place	2.51	2.64	2.64	1.69

Average No. of ENVPROVS per trade flow under PTA	26.6	44.2	45.59	13.67
Country-Pair FE	Yes	Yes	Yes	Yes
Exporter- and Importer-Year FE	Yes	Yes	Yes	Yes
Observations	20,071	53,690	55,576	120,315
R^2	0.965	0.896	0.927	0.848

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 the environmental provisions (*ENVPROVS*) included in the PTA. The four columns report the results for the split sample by level of development of the exporter and importer, according to the World Bank definition of High Income (North) and non-High Income (South) countries. Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*

Table A5: The effect of environmental provisions in PTAs by level of development of trading partners, controlling for the # of PTAs – PPML Regressions

	(1)	(2)	(3)	(4)	(5)
	Full Sample	**North-North**	**South-North**	**North-South**	**South-South**
	EXPORTSSUM	EXPORTSSUM	EXPORTSSUM	EXPORTSSUM	EXPORTSSUM
ENVPROVS	0.001	0.000	-0.000	0.001	0.001
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
PTA	0.080**	-0.029	0.209**	0.083	0.056
	(0.035)	(0.065)	(0.098)	(0.065)	(0.052)
# of PTAs	0.017	-0.026*	0.126***	-0.069	0.018
	(0.012)	(0.015)	(0.038)	(0.055)	(0.027)
DEPTH	-0.021	-0.027	-0.073	0.019	-0.024
	(0.017)	(0.037)	(0.049)	(0.028)	(0.027)
Share of Flows under PTA	0.737	0.782	0.687	0.697	0.808
Average No. of PTAs if any PTA in place	2.02	2.50	2.61	2.61	1.60

Average No. of ENVPROVS per trade flow under PTA	25.9	26.5	44.5	45.3	14.4
Country-Pair FE	Yes	Yes	Yes	Yes	Yes
Exporter- and Importer-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	315,276	20,511	59,099	58,854	176,114
R^2	0.996	0.997	0.999	0.998	0.990

This Table shows the results from running a panel pseudo maximum likelihood (PPML) regression of the total amount of bilateral exports (*EXPORTSSUM*) between 1984 and 2016 on whether a PTA was signed and the environmental provisions (*ENVPROVS*) included in the PTA. Column 1 reports the results for the entire sample, Columns 2-5 report the results for the split sample by level of development of the exporter and importer, according to the World Bank definition of High Income (North) and non-High Income (South) countries. Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*

Table A6: The effect of environmental provisions in PTAs on trade, sample without oil exporters

	(1)	(2)	(3)	(4)	(5)	(6)
	Non-oil exporting countries	**Non-OPEC countries**	**Non-oil exporting North-North**	**Non-oil exporting South-North**	**Non-oil exporting North-South**	**Non-oil exporting South-South**
	EXPORTS	EXPORTS	EXPORTS	EXPORTS	EXPORTS	EXPORTS
ENVPROVS	-0.004***	-0.003***	-0.002	-0.006**	-0.001	-0.003*
	(0.001)	(0.001)	(0.003)	(0.003)	(0.002)	(0.002)
PTA	0.118***	0.169***	-0.129	0.553***	0.098	-0.034
	(0.039)	(0.035)	(0.111)	(0.115)	(0.085)	(0.056)
# of PTAs	0.136***	0.137***	0.095**	0.184***	-0.090*	0.173***
	(0.018)	(0.016)	(0.042)	(0.054)	(0.046)	(0.038)
DEPTH	-0.001	-0.036*	0.090	-0.177***	0.024	-0.019
	(0.022)	(0.019)	(0.070)	(0.066)	(0.046)	(0.042)
Country-Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Exporter- and Importer-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	178,280	224,941	15,108	43,726	45,737	73,193
Share of Flows under PTA	0.74	0.75	0.78	0.71	0.72	0.79

Average No. of PTAs if Trade Flow under any PTA	2.26	2.13	2.49	2.73	2.72	1.72
Average No. of ENVPROVS per trade flow under PTA	32.54	28.59	28.82	47.90	48.77	15.89
R^2	0.899	0.895	0.962	0.895	0.930	0.868

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 the environmental provisions (*ENVPROVS*) included in the PTA. The sample excludes in columns 1, 3, 4, 5, and 6 all top oil exporters (Angola, United Arab Emirates, Azerbaijan, Bahrain, Canada, Democratic Republic of the Congo, Colombia, Algeria, Ecuador, Egypt, Gabon, Equatorial Guinea, Indonesia, Iran, Iraq, Kazakhstan, Kuwait, Libya, Malaysia, Nigeria, Norway, Qatar, Russian Federation, Saudi Arabia, Sudan, Venezuela, Viet Nam, Yemen) and in column 2 all OPEC member countries (Angola, United Arab Emirates, Republic Congo, Algeria, Ecuador, Gabon, Equatorial Guinea, Iran, Iraq, Kuwait, Libya, Lithuania, Nigeria, Qatar, Saudi Arabia, Venezuela). Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*