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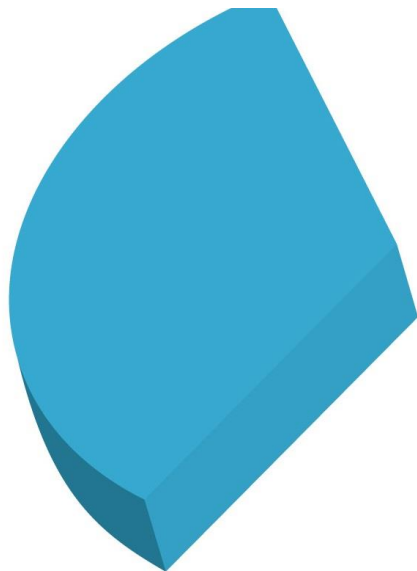
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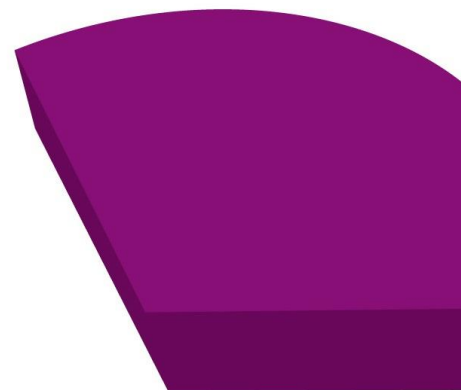
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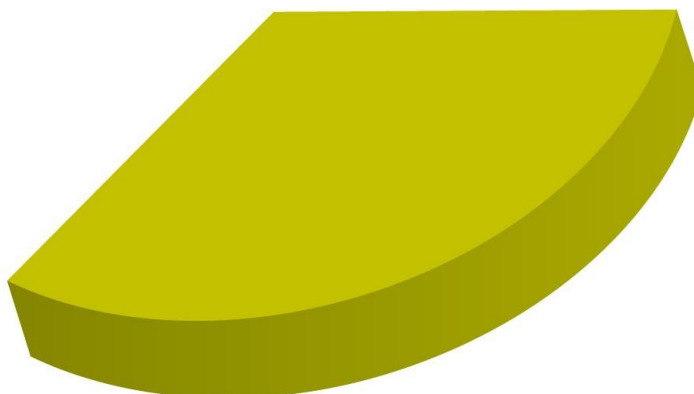
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# What type of trade is promoted by environmental regulations?<sup>1</sup>

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## Abstract

The objective of this paper is to investigate the extent to which international trade is affected by environmental stringency. The impact of environmental regulations on exports is evaluated by using a gravity model of trade, which is estimated for a global sample of countries over the period from 1995 to 2015, distinguishing between clean, footloose, and dirty products. This enables us to investigate whether more stringent environmental provisions and environmental laws lead countries to relocate dirty production and exports, as predicted by the Pollution Haven Hypothesis. Data on environmental provisions that are legally enforceable is obtained from the Deep Trade Agreement dataset (World Bank) and environmental laws and treaties are from Ecolex. Our results show that, in aggregated form for the deeper environmental provision we can expect a decrease in trade of “normal” goods, but not those of the dirty and footloose products. When focusing about the combinations with legislation, only national laws seem being working. The environmental provisions and laws, de jure, the domestic legislation does exert a significant effect on trade, we observe a decrease in trade of the deepest categories of the provisions but this only holds for footloose and not dirty products and is mostly true for the exporter, and combined with the deepest environmental provisions, confirming the Pollution Haven Effect. Additionally, when analyzing the environmental provision depth by country groups, we confirm that strictness in environmental regulation reinforce the PHH with more the provisions increasing exports of NON-OECD and decreasing on those of OECD in dirty products.

**Keywords:** Environmental regulations, emissions, international trade, gravity model.

**JEL:** F14, F18, F64, K32.

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## 1. Introduction

Since the preindustrial era greenhouse gas emissions (GHG) have been growing steadily over time, with the only exception of the period corresponding to the hart lockdowns that followed the Covid-19 outbreak in 2020. There is a wide consensus (IPCC, 2021) in that a big decarbonization effort is required without delay if we want to avoid the detrimental consequences for the planet of increasing temperatures and increasing frequency of climatic disasters. More than ever, a regulatory effort is called for that should accompany the investment in disrupting green innovations, the imposition of product standards and the like. Nevertheless, some of these regulations can have a negative effect on economic activities and competitiveness. For this reason, this paper tries to examine the extent to which more stringent environmental provisions and environmental laws lead countries to move away from dirty production and exports, as predicted by the Pollution Haven Hypothesis (PHH).

The related literature can be classified into two strands. The PHH predicts that more stringent regulations in developed countries reduce the availability of their environmental inputs and increase environmental control costs in pollution-intensive sectors. Hence, these countries specialize in the production of clean goods while developing countries with less stringent regulations gain comparative advantages in pollution-intensive goods and are turned into pollution havens. The second strand pertains to the “Porter Hypothesis” (PH), according to which well-designed environmental policies combined with innovation strategies would lead to productivity gains, improved international competitiveness, and environmental efficiency (Costantini and Mazzanti, 2011).

Whereas the environmental economics literature has widely investigated the effect of environmental regulations on improving environmental quality mostly at the aggregate level (Frankel and Rose [2005], Botta and Kozluk [2014], Brunel and Levinson [2016], Sauvage [2014], Copeland and Taylor [2003], Misra and Pandey [2005] Kellenberg [2009] and Pratt and Mauri [2005].), there is a lack of studies focusing on the effect on trade and competitiveness (Brandi et al., 2021). Moreover, few of them descend to the more disaggregated sectoral or industry analysis to infer the extent to which the regulatory efforts made in the past have been able to reduce emissions. We aim to close this gap by investigating the extent to which international trade is affected by environmental stringency. In particular, the impact of environmental regulations on exports is evaluated by using a gravity model of trade, which is estimated for a global sample of countries over the period from 2001 to 2015, distinguishing between clean and dirty products. This enables us to investigate whether more stringent environmental provisions and environmental laws lead countries to move away from dirty production and exports, as predicted by the PHH. Data on environmental provisions that are legally enforceable is obtained from the Deep Trade Agreement dataset (World Bank) and environmental laws and treaties are from Ecollex.

The main novelty with respect to previous works consist on using disaggregated data and distinguishing between the facto and de jure environmental legislation. In this way we are able to differentiate our research from Brandi et al. and from Martinez-Zarzoso et al. in that the former used only aggregated trade data and the latter used industry data but only covered EU countries and did not used environmental legislation, but only environmental taxes as a proxy.

Our results show that, in aggregated form for the deeper environmental provision we can expect a decrease in trade of “normal” goods, but not those of the dirty and footloose products. When focusing about the combinations with legislation, only national laws seem being working. The

environmental provisions and laws, de jure, the domestic legislation does exert a significant effect on trade, we observe a decrease in trade of the deepest categories of the provisions but this only holds for footloose and not dirty products and is mostly true for the exporter, and combined with the deepest environmental provisions, confirming the Pollution Haven Effect. Additionally, when analyzing the environmental provision depth by country groups, we confirm that strictness in environmental regulation reinforce the PHH with more the provisions increasing exports of NON-OECD and decreasing on those of OECD in dirty products.

The rest of the paper is organized as follows. Section 2 reviews the literature. Section 3 presents the data used and some stylized facts. Section 4 is dedicated to the methodology and section 5 presents the empirical results. Section 6 concludes and provides some policy recommendations.

## **2. Literature Review**

The link between trade and the environment and the fears of environmental relocation of industries due to lax regulations was first investigated by Grossman and Krueger (1993). They find no significant evidence that production in the United States (US) shifted investment to Mexico in order to take advantage of low abatement costs when the North American Free Trade Agreement (NAFTA) was initiated.

Since the early 1990s it has been widely accepted in the economics field that a country's emissions increase with per capita income, the so-called scale effect, but as countries get richer there is also an increasing demand for environmental quality and better regulations. Mexico's trajectory following NAFTA was one of the first confirmations of the Environmental Kuznets Curve (EKC), according to which the level of emissions shows an inverted U-shaped relationship with per capita income. Moreover, trade patterns between US and Mexico are partly explained by the factor endowment hypothesis (FEH), as Mexico shifted resources toward industries more labor-intensive, while the US specialized in more capital-intensive goods, following NAFTA. This indicates that there is no clear evidence of a potential Pollution Haven Effect (PHE), that is, international differences pollution laws being main drivers of competitiveness and international trade flows.

Antweiler et al. (2001) found similar results and provided a theoretical breakdown of the effects of increasing trade on the environment into the three factors already acknowledge in the abovementioned seminal paper. First, trade expands a country's production, leading to a scale effect of increased pollution. Second, the composition effect takes into consideration both the adoption of a cleaner mix of inputs and a green shift towards industries that produce lower emissions. Third, the technique effect is motivated by the fact that as income expands through trade, countries are more likely to demand investment in cleaner production technologies. A number of studies suggest that the partial negative effects of the scale effect are offset by the positive composition and technique effects, implying that trade liberalization is beneficial to the environment in the long run (Frankel and Rose, 2005, Cherniwchan, 2017; Cherniwchan et al. 2017; Holladay and LaPlue III, 2021, among others). This suggests that adjustments to changes in relative prices within a country could motivate cleaner behavior, without relying on lax pollution laws abroad, and questions the credibility of the PHH.

However, it is worth to explore the channels through which countries realize their composition and technique effects. Two particular channels are the frequency with which the two effects are influenced by shifts to offshoring emission-intensive stages of production or induced

through reliance on dirty intermediate inputs from countries with lax restrictions. Cherniwchan (2017), Holladay and LaPlue III (2017), and Levinson and Taylor (2008) argue that such behavior could be interpreted as partial evidence for a PHE, but overall production is still dominated by the FEH.

In line with the EKC theory, Frankel and Rose (2005) investigate the effects of trade on the environment for particular levels of per capita income. Income considerations spur two competing approaches. Trading countries either race to the bottom where they are more likely to adopt looser regulations to maintain competitiveness, enabling them to act as pollution havens, or focus on expanding income through trade, which enables them to expand their abatement production technologies. The authors find that a country's trading status per given level of income per capita had a positive effect on SO<sub>2</sub> levels, suggesting that the adverse effects of the race to the bottom are dominated by the considerations for gains from trade. They find no evidence that poorer, land-abundant, and labor-intensive countries use trade to exploit a comparative advantage in pollution. Kellenberg (2009) provides robust evidence for the PHH. He uses the differences in stringency and enforcement of environmental policy across trading partners of the US to investigate whether a decrease in environmental quality abroad increases the American value-added on their products and finds that stricter enforcement of environmental policy in the US hurts the production processes of American multinational firms. This implies that less capital-intensive productions such as food and electrical equipment are influenced at the margin, pushing them toward outward production mechanisms. The decision is influenced by the fact that poorer countries suffer from weaker institutions where the actual enforcement of similar policies is less transparent and strict.

Frankel and Rose (2005) suggest that pollution, especially GHG emissions such as CO<sub>2</sub>, is a global externality that cannot be fully addressed by national-level regulations. A particularly concerning finding in the literature is that landmark regulations that were introduced to curb pollution at the global level have not succeed. Aichele and Felbermayr (2015) find that the Kyoto Protocol, which placed binding commitments on emission targets, led to carbon leakages arising from a switch in production to countries that did not ratify the agreement and kept in place lax restrictions, offsetting the progress in lowering domestic emissions. They exploited exogenous differences in the adoption of the treaty across various trading partners to establish a plausible PHE. Imports of carbon-intensive products from a non-committed trading partner increased and were much higher than imports from a committed trading partner. Only partial implementations of important global policy responses where large emitters such as the US avoid signing due to fears of loss of competitiveness can undermine efforts of international cooperation. Their results have been confirmed by Grunewald, N., & Martinez-Zarzoso, I. (2016).

Another global approach to addressing worldwide emissions has been the introduction of pollution permits and emissions trading systems that act as pollution taxes equivalent to a firm's marginal damage of domestic emissions. However, these permits can be traded across countries leading to distortions where firms seek to profit. Lapan and Sikdar (2019) argue that this limits incentives for firms to maintain abatement strategies or enforce stricter pollution policies, causing prices of all factors of production, including pollution costs, to equalize across trading partners. Despite the demand for a clean environment, the introduction of permits and the associated trading induce higher global emissions.

Despite the concerns brought up by some of these environmental policies, trade liberalization with due consideration for the environment has generated positive, intended effects.

Cherniwchan (2017) estimates that the introduction of NAFTA contributed to almost two-thirds of the decline in emissions from the manufacturing sector in the US. Baghdadi et al. (2013) point out that regional trade agreements (RTAs) with special provisions for environmental regulation, once controlled for selection into them, lower emissions in participating countries. While the exact channels may be ambiguous, Qirjo and Pascalau (2019) suggest that the implementation of the Transatlantic Trade and Investment Partnership (TTIP) between the European Union (EU) and the US had a positive impact on curbing GHG emissions. The heterogeneity of each member makes causal identification difficult, as most of the European trading partners are poorer, more densely populated, and rely on labor-intensive production compared to the US. A closer inspection of some of the channels concludes that while the PHH holds some merit, any detrimental effects are offset by the comparative advantage associated with factor endowment.

This paper contributes to this literature in two ways. First, it investigates whether more stringent environmental provisions and environmental laws lead countries to move away from dirty production and exports, as predicted by the Pollution Haven hypothesis. Hence, we distinguish between different types of goods (normal, footloose and dirty). To do so, we use new data on environmental provisions that are legally enforceable from the Deep Trade Agreement dataset (World Bank) and environmental laws and treaties are from Ecolex. We also assess the depth of the agreement by comparing the legal enforcement of provisions with the ones that are not.

### **3. Data, Variables and Stylized Facts**

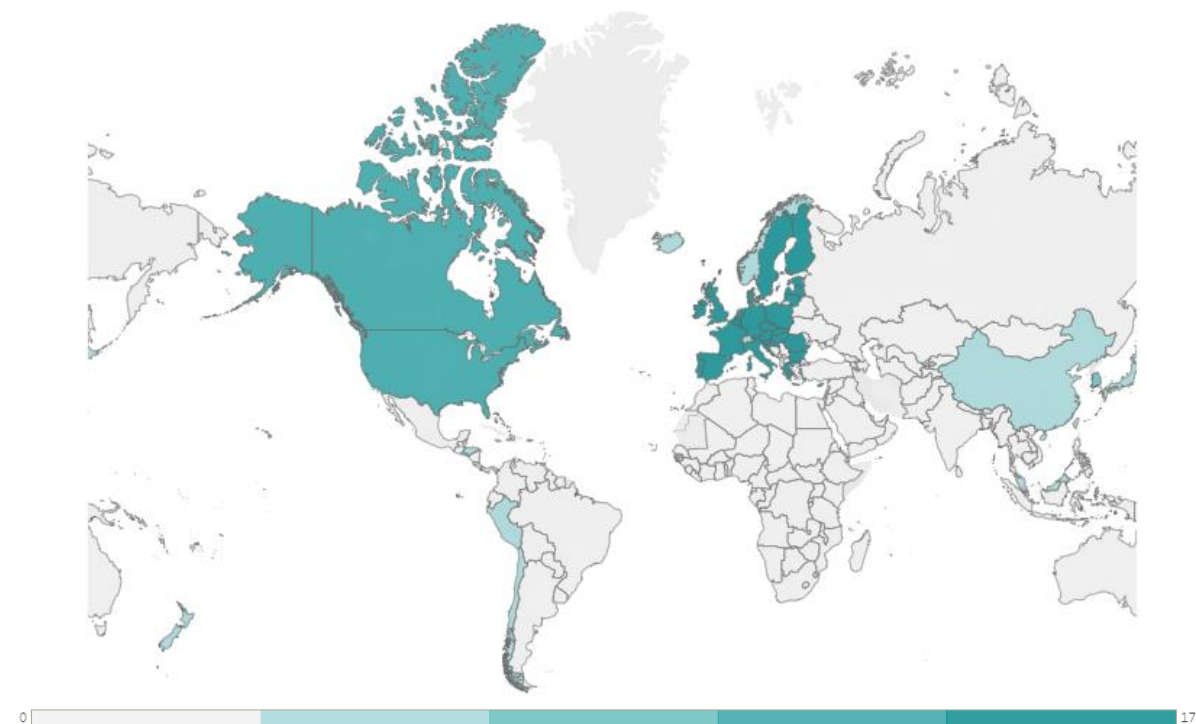
In order to answer the above questions, we merge trade data with other datasets on treaties, agreements and laws related to the environment. Thus, our dependent variable is the bilateral trade expressed either in metric tons (*sum\_q*) for the quantity and in thousands of current USD for the value (*sum\_v*). These data were obtained by CEPII (Gaulier, G. and Zignago, S., 2010). Yet, in order to examine the trade effects for different types of products, we distinguish between three groups of products: normal goods, footloose goods and dirty goods. This classification is inspired by Martinez-Zarzoso et al. (2017).

The two explanatory variables related to environmental regulations come from two sources. The first source is the Deep Trade Agreement dataset (World Bank), where we can examine whether the trade agreement includes any environmental provision. For this variable we use two variables: bilateral trade agreements that have an environmental provisions, combined with the legally bindingness (Hofmann, C., Osnago, A., & Ruta, M. (2017)) of the agreements, in order to avoid selection bias. This variable takes the value of zero when there is no agreement, one if there is an agreement, two if there is an environmental provisions in the agreement, three if this environmental provision is legally binding, but there is no available dispute settlement and four if there is an available dispute settlement process.

The second source for environmental laws is Ecolex, the environmental regulation variable are laws that countries have passed. They have 15 subjects (see Table A1 and Figure A1, A2 in Appendix). We have used the three more trade-related subjects in terms of the PHH such as Air and Atmosphere, Energy and Environment in General. We have constructed a variable that aggregate the number of laws passed by country per year. This variable is either national, then we denote it as National Law; or international environmental and we denote it as Treaty. This variable comes from Ecolex and has been used in Martinez-Zarzoso, I., & Núñez-Rocha, T. (2018).

Figure 1 shows that, globally, the number of agreements including environmental laws is low and mainly concentrated in advanced economies (OECD countries). This could potentially point out the PHH assumptions as developed countries might have more stringent standards implied by their trade agreements.

Figure 1: Number of Agreements Including Environmental Laws

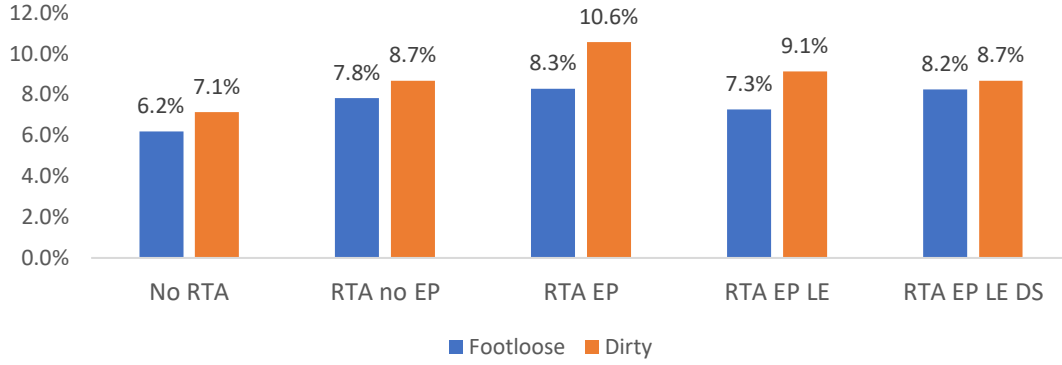


Source: Deep Trade Agreements dataset (World Bank).

As it was mentioned before, the existence of a treaty or the enforceability of the environmental provisions can lead to more trade in clean goods. Figure 2 shows that the more stringent environmental provisions the lower value of trade in dirty goods. However, this is not the case for the quantity as the share of dirty goods is 24% when the provision is legally enforceable and subject to a dispute settlement, whereas this is share is 20% when there is no provision. This is why it is important first to distinguish between the value and the quantity, and to take into account the level of enforcement.



Figure 2: Share of Footloose and Dirty in Total Trade – by Agreement Depth



Source: Authors' own elaboration using BACI and Deep Trade Agreement dataset.

Notes: (i) EP stands for Environmental Provision, LE legally enforceable, and DS for Dispute Settlement. (ii) The reference category is no agreements between trade partners

#### 4. Model specification

In order to examine the effect of environmental regulations on trade, we estimate a gravity model of trade and proceed in two stages. We estimate two models:

The first uses the depth in environmental provisions and the second considers the depth in environmental provisions variable interacted with the legislations.

In both cases, in line with the structural gravity approach, we include three set of fixed effects, that is, exporter-time ( $\theta_{it}$ ), importer-time ( $\theta_{jt}$ ) and bilateral ( $\delta_{ij}$ ) as follows:

$$(X_{ijkt}) = \alpha_1 ER_{ijt} + \theta_{ikt} + \theta_{jkt} + \delta_{ij} + \eta_{ijkt} \quad (1)$$

where  $X_{ijkt}$  denotes the level of bilateral trade between exporter  $i$  importer  $j$  in year  $t$  of product  $k$ ,  $ER_{ijt}$  is a dummy variable that takes the value of 1 if the country-pair has and environmental provision and this for each depth category and  $\eta_{ijkt}$  is the idiosyncratic error term.

Table 1 shows the results from the first specification of the model given by equation (1) (for total trade, footloose and dirty) and (2), which includes interactions with the depth of the environmental provisions and the type of trade.

$$(X_{ijkt}) = \alpha_1 RTA EnvPro_{ijt} + \theta_{it} + \theta_{jt} + \delta_{ij} + \eta_{ijkt} \quad (1)$$

Equation (2) is extended by adding dummy variables for the different types of products considered and their interactions with the environmental regulation variable, in order to see the heterogenous effect of the latter footloose and dirty goods as follows:

$$(X_{ijkt}) = \alpha_1 ER_{ijt} + \alpha_2 footloose_{ijt} + \alpha_3 dirty + \alpha_4 ER_{ijt} * footloose_{ijt} + \alpha_5 ER_{ijt} * dirty_{jt} + \theta_{it} + \theta_{jt} + \delta_{ij} + \eta_{ijkt} \quad (2)$$

where footloose refer to goods that are pollution intensive and are the least geographically mobile (as defined in Ederington et al., 2005) and dirty refers to good that are pollution intensive but geographically mobile.

Next, we add the environmental regulations variable by trade partner to the environmental provisions' strictness one and this by type of products. This will allow us to evaluate the effect of agreements conditional on the type of products in terms of their pollution potential (Table 2, 3, 4):

$$(X_{ijkt}) = \alpha_1 RTA EnvProv_{ijt} + \alpha_2 Legislation_{it} + \alpha_3 Legislation_{jt} + \alpha_4 RTA EnvProv_{ijt} * Legislation_{it} + \alpha_5 RTA EnvProv_{ijt} * Legislation_{jt} + \theta_{it} + \theta_{jt} + \delta_{ij} + \eta_{ijkt} \quad (3)$$

The specified models are estimated using the Poisson Pseudo-Maximum Likelihood estimator (PPML), in order to take into consideration zero trade flows and the potential heteroscedasticity (Silva and Teneyrero, 2006).

## 5. Empirical results

The first set of results from estimating model (1) are presented in Table 1. The first and second columns present the results for total exports with and without good-specific coefficients, whereas columns (3) and (4) present the results for footloose and dirty goods. In column (1), can be seen that the estimated coefficient for RTA with environmental provisions (Eps) is statistically significant at the five percent level and indicates that total exports are around 7 percent higher when countries participate in RTAs with environmental provisions that are legally enforceable. In column 2, different RTA effects are estimated by type of good. The results indicate that trade in footloose and dirty goods is higher for countries in RTAs without Eps or in those with RTAs with Eps not legally enforceable than in countries without RTAs, and trade is even higher in RTAs with legally enforceable Eps included in the dispute settlement (DS).

The next set of results is shown in Table 2. In the left-hand-side of the table national legislations in several subjects, air pollution, energy and environmental general, are considered, whereas in the second, international treaties are introduced. Both sets of legislation are interacted with the RTA variables, as explained in the previous section. On the one hand our results show that, de jure, most of the domestic legislation, which is in place in the exporter country, exert a negative and significant effect on trade that takes place within RTAs without Eps. On the other hand, de facto, when the exporter has environmental legislation and trade is happening within RTAs with Eps that are subject to DS, is lower than trade between countries no participating in RTAs. Nevertheless, the existence of environmental legislations in the importer countries does not seem to matter much. With respect to international treaties, general environmental ones seem to increase trade when no EP are in place in the RTAs (see left-hand-side of Table 2, last column). While several coefficients are positive pointing out that international treaties can increase trade, such treaties reduce trade when they focus on energy and are in place for the importer country.

The next two tables focus on trade in footloose and dirty exports. Table 3 shows the results for trade in dirty goods. We can observe that whereas RTAs with or without Eps increase trade. The existence of a national legislation are likely to reduce trade in footloose products when they are in place in combination with RTAs for all subjects, when the exporter has enacted such legislation. However, this is not the case for international treaties, which tend to increase trade in footloose exports when they are in place in combination with RTAs without EP and also RTAs with EP and DS.

Table 4 presents the same results for trade in footloose goods. RTAs with EPs also increase trade in dirty goods when they have EPs and these are legally enforceable. address energy and mineral resources issues. However, the combination of being in RTAs and having national legislation or treaties does not seem to reduce trade. Yet, de facto, when the environmental provisions are legally enforceable, not subject to a dispute settlement mechanism and in combination with environmental treaties, they seem to reduce trade but they do not reduce trade in footloose goods (last column of Table 4).

A further analysis consists on distinguishing by type of exporter/importer depending on the income level. We have grouped countries according to their membership in the OECD and in tables 5-7 we present separated results for exports from OECD to Non-OECD country members, first for all goods and next for footloose and dirty goods. The reason for focusing on OECD as origin and non-OECD as destination of exports is to be able to test more closely the PHH, according to which exports from developed to developing countries could decrease if the stringency of the environmental regulations in the destination countries increase de facto.

Table 5 (left-part) shows the results for exports for all goods. The results show that although export increase with RTAs, and more so when those include EPs and DS, the increases are moderated by the existence of national environmental legislations in the exporter and importer countries, mainly for the exporter when RTAs contain EPs and for the importer when RTAs contain EPs and DS and the national laws refer to air pollution and general environmental matters. The right-hand-side of Table 5 contains similar results for international treaties. The results show that when the exporter is member of the treaties and the RTAs are in place, both tend to increase exports and the treaties (concerning energy and general environmental issues) seem to reinforce the effect of the RTAs in terms of trade promotion. However, when the importer is a member of treaties covering general issues and RTAs contain EPs, the coefficient shown in the last column of Table 5 (*RTA w. EP LE DS\*Legis.Imp*) is negative and significant indicating that exports decrease in net terms. When this de facto legislation is in place. This could indicate the importance of addressing environmental issues with specific international agreements, and not only within RTAs.

Table 6 shows, which shows the results for exports from OECD to Non-OECD for footloose goods, is also divided in two parts, considering national laws (left) and international treaties (right). The most interesting results are that RTAs with EPs promote trade in footloose goods only when there are EPs, but independently of whether those are legally enforceable or not...

Table 7 shows the results for exports from OECD to Non-OECD for dirty goods.

Table 1: Trade Agreements' Depth and Exports by Type of Good

Dependent variable: Exports Type of Goods:	All		Footloose	Dirty
Footloose		-2.653*** (0.0986)		
Dirty		-1.309*** (0.0871)		
RTA (no EP)	-0.0270 (0.0371)	-0.0597 (0.0370)	0.125*** (0.0348)	0.0449 (0.0355)
RTA EP (no LE)	0.0115 (0.0298)	-0.0316 (0.0326)	0.103** (0.0421)	0.0806 (0.0619)
RTA EP-LE	0.0701** (0.0324)	0.0468 (0.0348)	0.173*** (0.0327)	0.167*** (0.0600)
RTA EP-LE-DS	-0.00241 (0.0329)	-0.0955*** (0.0329)	0.164*** (0.0322)	0.0858** (0.0377)
RTA (no EP)*Footloose		0.0819* (0.0472)		
RTA EP (no LE)*Footloose		0.162*** (0.0559)		
RTA EP-LE*Footloose		0.0392 (0.0841)		
RTA EP LE DS*Footloose		0.496*** (0.0405)		
RTA (no EP)*Dirty		0.330*** (0.0796)		
RTA EP (no LE)*Dirty		0.324*** (0.0977)		
RTA EP-LE*Dirty		0.271* (0.154)		

RTA EP-LE-DS*Dirty	0.566*** (0.0976)			
Observations	10,487,354	10,487,354	762,003	1,212,272
Exp*Prod*Year	Yes	Yes	Yes	Yes
Imp*Prod*Year	Yes	Yes	Yes	Yes
Exp*Imp	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. (i) EP stands for Environmental Provision, LE legally enforceable, and DS for Dispute Settlement. (ii) The reference category is no agreements between trade partners.

Table 2: National Legislations, Treaties, Agreement Depth, and Exports– all goods

Dependent variable: Exports Type of law/treaty: Subject of the law/treaty:	National Law			Treaties		
	Air	Energy	Env.	Air	Energy	Env.
RTA EP	-0.0166 (0.0373)	-0.00599 (0.0358)	-0.0146 (0.0375)	-0.0328 (0.0375)	-0.0344 (0.0367)	-0.0366 (0.0379)
RTA EP not LE	0.0190 (0.0319)	0.0153 (0.0331)	0.0179 (0.0350)	0.000686 (0.0291)	0.00998 (0.0300)	0.00623 (0.0313)
RTA EP LE	0.0773** (0.0321)	0.0591* (0.0323)	0.0482 (0.0358)	0.0528* (0.0320)	0.0607* (0.0322)	0.0682** (0.0334)
RTA EP LE DS	-0.00111 (0.0328)	-0.00252 (0.0325)	0.00562 (0.0331)	-0.00921 (0.0330)	0.00444 (0.0331)	0.00421 (0.0334)
Legis. Exp.	0.0105** (0.00445)	-0.00879 (0.00695)	0.00597 (0.0108)	0.438* (0.246)	-0.157* (0.0876)	-0.0201 (0.0839)
RTA EP*Legis. Exp.	-0.00623*** (0.00177)	-0.00523*** (0.00144)	-0.00212*** (0.000603)	-0.00461 (0.0143)	0.0154 (0.0120)	0.0153** (0.00653)
RTA EP not LE*Legis. Exp.	-0.00422* (0.00216)	-0.00205* (0.00110)	-0.000627 (0.00111)	0.00277 (0.0108)	0.00805 (0.0101)	0.0199** (0.00855)
RTA EP LE*Legis. Exp.	0.00923** (0.00416)	0.00413* (0.00220)	0.00355 (0.00225)	0.0577* (0.0329)	0.0986*** (0.0319)	0.0416 (0.0378)
RTA EP LE DS*Legis. Exp.	-0.00320*** (0.00122)	-0.00206*** (0.000765)	-0.00203*** (0.000670)	-0.00125 (0.00661)	-0.000582 (0.00578)	-0.00589 (0.00529)

Legis. Imp.				0.139 (0.209)	-0.263 (0.463)	0.144 (0.249)
RTA EP*Legis. Imp.	0.00208 (0.00202)	0.000132 (0.00154)	-0.000854 (0.000630)	0.0241 (0.0168)	0.0189 (0.0127)	0.0181** (0.00737)
RTA EP not LE*Legis. Imp.	0.000207 (0.00234)	0.000741 (0.000979)	-0.00112 (0.00119)	0.0236* (0.0139)	-0.00682 (0.0109)	-0.00134 (0.00842)
RTA EP LE*Legis. Imp.	-0.0122* (0.00742)	-0.00135 (0.00337)	0.00105 (0.00256)	-0.00503 (0.0309)	-0.0508 (0.0375)	-0.0294 (0.0416)
RTA EP LE DS*Legis. Imp.	0.00147 (0.000915)	0.000410 (0.000598)	-0.000359 (0.000527)	0.0205*** (0.00674)	-0.0162*** (0.00619)	0.00767* (0.00446)
Observations	10,487,354	10,487,354	10,487,354	10,487,354	10,487,354	10,487,354
Exp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes
Imp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes
Exp*Imp	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. (i) EP stands for Environmental Provision, LE legally enforceable, and DS for Dispute Settlement. (ii) The reference category is no agreements between trade partners.

Table 3: National Legislations, Treaties, Agreement Depth, and Exports – footloose goods

Dependent variable: Exports Type of law/treaty:	National			Treaties		
	Air	Energy	Env.	Air	Energy	Env.
RTA EP	0.126*** (0.0354)	0.132*** (0.0354)	0.133*** (0.0356)	0.102*** (0.0346)	0.114*** (0.0345)	0.114*** (0.0349)
RTA EP not LE	0.128*** (0.0444)	0.114** (0.0444)	0.109** (0.0450)	0.101** (0.0420)	0.102** (0.0429)	0.0963** (0.0439)
RTA EP LE	0.176*** (0.0344)	0.175*** (0.0353)	0.176*** (0.0364)	0.129*** (0.0331)	0.153*** (0.0318)	0.171*** (0.0335)
RTA EP LE DS	0.180*** (0.0327)	0.174*** (0.0327)	0.186*** (0.0331)	0.148*** (0.0320)	0.164*** (0.0323)	0.160*** (0.0330)

Legis. Exp.	0.0101* (0.00581)	-0.00782 (0.00874)	0.0147* (0.00886)	-0.527 (0.926)	-0.154 (0.123)	1.044*** (0.266)
RTA EP*Legis. Exp.	-0.00145 (0.00270)	-0.00176 (0.00168)	-0.00157** (0.000704)	0.0116 (0.0152)	0.0179 (0.0149)	-0.00888 (0.0110)
RTA EP not LE*Legis. Exp.	-0.00696* (0.00384)	-0.00661*** (0.00222)	-0.00447** (0.00225)	-0.00790 (0.0202)	-0.00743 (0.0164)	-0.00613 (0.0145)
RTA EP LE*Legis. Exp.	0.00615 (0.00426)	0.000463 (0.00270)	4.38e-05 (0.00330)	0.0784** (0.0345)	0.0298 (0.0540)	-0.0295 (0.0492)
RTA EP LE DS*Legis. Exp.	-0.00436** (0.00219)	-0.00280** (0.00129)	-0.00313*** (0.00101)	0.0174** (0.00865)	0.00717 (0.00966)	0.00183 (0.00736)
Legis. Imp.						1.379*** (0.116)
RTA EP*Legis. Imp.	0.00132 (0.00270)	-0.000610 (0.00204)	-0.000390 (0.000791)	0.0637*** (0.0174)	0.0560*** (0.0183)	0.0531*** (0.0135)
RTA EP not LE*Legis. Imp.	-0.00698 (0.00539)	0.00235 (0.00183)	0.00183 (0.00211)	0.0104 (0.0206)	0.0326 (0.0220)	0.0332* (0.0186)
RTA EP LE*Legis. Imp.	-0.00718 (0.00607)	-0.00125 (0.00271)	-0.000914 (0.00247)	0.0544* (0.0302)	0.0911 (0.0657)	0.0103 (0.0483)
RTA EP LE DS*Legis. Imp.	-0.000517 (0.00159)	-0.000402 (0.000957)	-0.00124 (0.000950)	0.0302** (0.0123)	0.0243** (0.0111)	0.0220*** (0.00780)
Observations	762,003	762,003	762,003	762,003	762,003	762,003
Exp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes
Imp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes
Exp*Imp	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. (i) EP stands for Environmental Provision, LE legally enforceable, and DS for Dispute Settlement. (ii) The reference category is no agreements between trade partners.

Table 4: National Legislations, Treaties, Agreement Depth, and Exports – dirty goods

Dependent variable: Exports	National Law			Treaties		
Type of law/treaty:	Air	Energy	Env.	Air	Energy	Env.
Subject of the law/treaty:						
RTA EP	0.0257 (0.0357)	0.0306 (0.0360)	0.0366 (0.0353)	0.0373 (0.0353)	0.0391 (0.0359)	0.0391 (0.0365)
RTA EP not LE	0.109* (0.0593)	0.0811 (0.0667)	0.0858 (0.0676)	0.0762 (0.0637)	0.0746 (0.0629)	0.0767 (0.0639)
RTA EP LE	0.154** (0.0624)	0.115* (0.0624)	0.135** (0.0616)	0.153*** (0.0573)	0.143** (0.0559)	0.167*** (0.0626)
RTA EP LE DS	0.0888** (0.0392)	0.0808** (0.0392)	0.0891** (0.0388)	0.0701* (0.0385)	0.0856** (0.0386)	0.0850** (0.0389)
Legis. Exp.	-0.158* (0.0839)	-0.0686 (0.0467)	-0.786 (0.579)	0.786 (0.579)	-0.388 (0.741)	2.247*** (0.317)
RTA EP*Legis. Exp.	0.00470 (0.00309)	0.000902 (0.00225)	0.000594 (0.000789)	0.0223 (0.0186)	-0.0109 (0.0167)	0.00738 (0.0115)
RTA EP not LE*Legis. Exp.	-0.00274 (0.00444)	0.00335 (0.00273)	0.00193 (0.00282)	-0.0321 (0.0282)	0.00514 (0.0232)	-0.0197 (0.0204)
RTA EP LE*Legis. Exp.	-0.00838 (0.00984)	-7.13e-05 (0.00351)	-0.00607 (0.00373)	0.131* (0.0773)	0.124* (0.0704)	0.263** (0.107)
RTA EP LE DS*Legis. Exp.	0.00245* (0.00148)	0.00182* (0.000969)	-3.66e-05 (0.000947)	0.0269* (0.0138)	-0.0160 (0.0118)	-0.0125 (0.00855)
Legis. Imp.					-0.770** (0.300)	
RTA EP*Legis. Imp.	0.00424 (0.00366)	0.00144 (0.00265)	0.000617 (0.00121)	0.00251 (0.0194)	0.0428** (0.0172)	0.00841 (0.0151)
RTA EP not LE*Legis. Imp.	-0.00992 (0.00705)	-0.00413* (0.00238)	-0.00294 (0.00274)	0.0295 (0.0326)	0.0290 (0.0254)	0.0273 (0.0180)
RTA EP LE*Legis. Imp.	0.0199*** (0.00745)	0.0109*** (0.00341)	0.0145*** (0.00455)	-0.103 (0.0779)	0.0197 (0.0874)	-0.263** (0.104)
RTA EP LE DS*Legis. Imp.	4.05e-05 (0.00214)	-0.000668 (0.00151)	-0.000294 (0.00139)	0.0156 (0.0158)	0.0297** (0.0141)	0.0192* (0.0111)
Observations	1,212,272	1,212,272	1,212,272	1,212,272	1,212,272	1,212,272
Exp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes
Imp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes



Exp*Imp	Yes	Yes	Yes	Yes	Yes	Yes
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Notes: Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. (i) EP stands for Environmental Provision, LE legally enforceable, and DS for Dispute Settlement. (ii) The reference category is no agreements between trade partners.

Table 5: National Legislations, Treaties, Agreement Depth, and Exports (from OECD to Non-OECD) – all goods

Dependent variable: Exports Type of law/treaty: Subject of the law/treaty	National			Treaties		
	Air	Energy	Env.	Air	Energy	Env.
RTA EP	0.0576 (0.0511)	0.0426 (0.0533)	0.0402 (0.0565)	0.0202 (0.0467)	0.0261 (0.0482)	0.0268 (0.0495)
RTA EP not LE	0.0947* (0.0535)	0.0889* (0.0508)	0.0943* (0.0555)	0.0798* (0.0472)	0.0866* (0.0467)	0.0824* (0.0487)
RTA EP LE	0.125** (0.0503)	0.111** (0.0475)	0.128** (0.0524)	0.0695* (0.0398)	0.0982** (0.0473)	0.0905* (0.0471)
RTA EP LE DS	0.129** (0.0540)	0.119** (0.0555)	0.137** (0.0571)	0.113** (0.0466)	0.119** (0.0514)	0.101* (0.0532)
Legis. Exp.	-0.0204 (0.0725)	0.0548* (0.0333)	0.00223 (0.0301)	0.533 (0.613)	0.617 (0.412)	0.0510 (0.126)
RTA EP*Legis. Exp.	-0.00501 (0.00514)	-0.000147 (0.00427)	-0.000316 (0.00327)	0.0238 (0.0317)	0.0739*** (0.0281)	0.0212 (0.0183)
RTA EP not LE*Legis. Exp.	-0.00350 (0.00253)	-0.00121 (0.00177)	0.000952 (0.00149)	0.00388 (0.0132)	0.0113 (0.0131)	0.000444 (0.00905)
RTA EP LE*Legis. Exp.	-0.0171** (0.00774)	-0.00999** (0.00413)	-0.00768** (0.00314)	-0.0119 (0.0484)	0.0439 (0.0630)	0.242** (0.101)
RTA EP LE DS*Legis. Exp.	0.00303 (0.00300)	-0.000216 (0.00203)	-0.00235 (0.00161)	0.0176 (0.0260)	-0.0138 (0.0185)	-0.00504 (0.0207)
Legis. Imp.					0.866*** (0.206)	
RTA EP*Legis. Imp.	-0.0189** (0.00960)	-0.00423 (0.00261)	0.00141 (0.00297)	0.0200 (0.0363)	-0.0835** (0.0329)	0.0143 (0.0271)
RTA EP not LE*Legis. Imp.	0.000268 (0.00943)	0.00121 (0.00114)	-0.00208 (0.00214)	0.0144 (0.0221)	-0.0267 (0.0193)	-0.000880 (0.0243)
RTA EP LE*Legis. Imp.	-0.00626	0.00248	-0.000341	0.0706	-0.112	-0.212**

RTA EP LE DS*Legis. Imp.	(0.0104) -0.0229** (0.00893)	(0.00270) -0.000686 (0.00133)	(0.00264) -0.00413* (0.00224)	(0.0533) -0.0181 (0.0546)	(0.0886) -0.0293 (0.0276)	(0.102) 0.111*** (0.0361)
Observations	3,238,615	3,238,615	3,238,615	3,238,615	3,238,615	3,238,615
Exp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes
Imp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes
Exp*Imp	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. (i) EP stands for Environmental Provision, LE legally enforceable, and DS for Dispute Settlement. (ii) The reference category is no agreements between trade partners.

Table 6: National Legislations, Treaties, Agreement Depth, and Exports (from OECD to Non-OECD) – footloose goods

Dependent variable: Exports	National			Treaties		
Type of law/treaty:						
Subject of the law/treaty:	Air	Energy	Env.	Air	Energy	Env.
RTA EP	0.0848 (0.0637)	0.0733 (0.0637)	0.0751 (0.0658)	0.0575 (0.0562)	0.0609 (0.0586)	0.0666 (0.0611)
RTA EP not LE	0.185** (0.0741)	0.158** (0.0708)	0.171** (0.0761)	0.150** (0.0649)	0.160** (0.0676)	0.150** (0.0674)
RTA EP LE	0.0308 (0.0729)	0.0132 (0.0713)	0.0285 (0.0770)	0.00894 (0.0580)	0.0302 (0.0664)	0.0173 (0.0684)
RTA EP LE DS	0.203*** (0.0645)	0.211*** (0.0623)	0.238*** (0.0643)	0.144*** (0.0548)	0.198*** (0.0612)	0.191*** (0.0621)
Legis. Exp.				0.414*** (0.141)		0.820*** (0.281)
RTA EP*Legis. Exp.	-0.00857 (0.00677)	-0.000128 (0.00382)	0.000894 (0.00417)	0.0853* (0.0477)	0.162*** (0.0472)	0.0206 (0.0305)
RTA EP not LE*Legis. Exp.	-0.00651 (0.00420)	-0.00171 (0.00319)	8.77e-05 (0.00292)	0.0200 (0.0280)	-0.0360 (0.0254)	-0.0508*** (0.0197)
RTA EP LE*Legis. Exp.	0.00570 (0.00705)	0.00396 (0.00390)	0.00654* (0.00396)	-0.00562 (0.0750)	-0.106* (0.0567)	-0.0562 (0.103)
RTA EP LE DS*Legis. Exp.	-0.000454 (0.00440)	-0.000702 (0.00290)	-0.00277 (0.00252)	0.0239 (0.0205)	0.0393* (0.0216)	-0.0499** (0.0198)
Legis. Imp.				-0.0272 (0.433)		1.094*** (0.144)
RTA EP*Legis. Imp.	0.00311 (0.0141)	-9.01e-05 (0.00447)	-0.00218 (0.00471)	-0.00257 (0.0451)	-0.174*** (0.0505)	0.0230 (0.0511)
RTA EP not LE*Legis. Imp.	-0.0269* (0.0150)	-0.00152 (0.00255)	-0.00675 (0.00430)	-0.0130 (0.0330)	-0.0433 (0.0424)	0.0374 (0.0360)
RTA EP LE*Legis. Imp.	-0.0129 (0.0211)	-0.000456 (0.00386)	-0.00639 (0.00478)	0.0256 (0.0488)	0.0507 (0.106)	0.0321 (0.0981)
RTA EP LE DS*Legis. Imp.	-0.0156 (0.0143)	-0.00443* (0.00242)	-0.0109** (0.00441)	0.132*** (0.0379)	-0.0896** (0.0415)	0.109** (0.0548)
Observations	241,434	241,434	241,434	241,434	241,434	241,434
Exp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes
Imp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes

Exp*Imp	Yes	Yes	Yes	Yes	Yes	Yes
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Notes: Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. (i) EP stands for Environmental Provision, LE legally enforceable, and DS for Dispute Settlement. (ii) The reference category is no agreements between trade partners.

Table 7: National Legislations, Treaties, Agreement Depth, and Exports (from OECD to Non-OECD) – dirty goods

Dependent variable: Exports Type of law/treaty:	National			Treaties		
	Air	Energy	Env.	Air	Energy	Env.
RTA EP	0.136** (0.0581)	0.113* (0.0611)	0.137** (0.0616)	0.0805 (0.0530)	0.104* (0.0567)	0.115** (0.0581)
RTA EP not LE	0.393*** (0.0733)	0.389*** (0.0758)	0.403*** (0.0771)	0.343*** (0.0703)	0.345*** (0.0707)	0.359*** (0.0723)
RTA EP LE	0.246*** (0.0604)	0.208*** (0.0660)	0.288*** (0.0673)	0.186*** (0.0617)	0.194*** (0.0658)	0.214*** (0.0667)
RTA EP LE DS	0.184** (0.0873)	0.162* (0.0910)	0.172* (0.0916)	0.216*** (0.0770)	0.211** (0.0934)	0.201** (0.0965)
Legis. Exp.	-0.870** (0.349)	0.0656*** (0.0246)	-3.268** (1.552)	7.179*** (0.217)		
RTA EP*Legis. Exp.	-0.00502 (0.00719)	0.00232 (0.00676)	0.00149 (0.00554)	-0.107** (0.0487)	-0.0138 (0.0434)	-0.00288 (0.0391)
RTA EP not LE*Legis. Exp.	-0.00242 (0.00518)	0.00354 (0.00361)	0.00508 (0.00361)	-0.0538 (0.0333)	0.0228 (0.0326)	-0.0555** (0.0237)
RTA EP LE*Legis. Exp.	-0.0395*** (0.0117)	-0.0180*** (0.00538)	-0.0184*** (0.00477)	0.0876 (0.0938)	-0.171* (0.0947)	0.453*** (0.0958)
RTA EP LE DS*Legis. Exp.	0.00669 (0.00488)	0.00374 (0.00349)	0.00149 (0.00286)	-0.0488 (0.0515)	-0.0290 (0.0393)	0.0446 (0.0404)
Legis. Imp.		0.177 (0.211)		0.608** (0.269)		0.285* (0.164)
RTA EP*Legis. Imp.	-0.00494 (0.0202)	-0.00757 (0.00562)	-0.00716 (0.00542)	0.140** (0.0546)	-0.0429 (0.0692)	-0.0696 (0.0570)
RTA EP not LE*Legis. Imp.	-0.0315** (0.0145)	-0.00732*** (0.00201)	-0.0114*** (0.00406)	0.0501 (0.0487)	-0.128*** (0.0443)	-0.0385 (0.0483)
RTA EP LE*Legis. Imp.	0.0118	0.00615	-0.000582	-0.0555	0.191*	-0.436***

	(0.0119)	(0.00399)	(0.00638)	(0.0876)	(0.111)	(0.0928)
RTA EP LE DS*Legis. Imp.	0.00997	0.00589**	0.00477	0.0257	0.00840	0.0330
	(0.0180)	(0.00300)	(0.00493)	(0.101)	(0.0642)	(0.0557)
Observations	406,910	406,910	406,910	406,910	406,910	406,910
Exp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes
Imp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes
Exp*Imp	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. (i) EP stands for Environmental Provision, LE legally enforceable, and DS for Dispute Settlement. (ii) The reference category is no agreements between trade partners.

Table 8: Trade Partners, Agreement Depth, and Exports – by type

Dependent variable: exports Type of Good:	Footloose				Dirty			
	Non-OECD	Non-OECD	OECD	OECD	Non-OECD	Non-OECD	OECD	OECD
Exporter:	Non-OECD	OECD	Non-OECD	OECD	Non-OECD	OECD	Non-OECD	OECD
Importer:	Non-OECD	OECD	Non-OECD	OECD	Non-OECD	OECD	Non-OECD	OECD
RTA EP	0.00588	0.328***	0.0714	0.129*	-0.136**	0.0696	0.0993*	0.0935
	(0.0554)	(0.0870)	(0.0580)	(0.0720)	(0.0634)	(0.117)	(0.0553)	(0.0884)
RTA EP not LE	0.100	0.101	0.146**	-0.00185	0.142	-0.110	0.344***	-0.0236
	(0.0646)	(0.0807)	(0.0648)	(0.0916)	(0.121)	(0.100)	(0.0702)	(0.161)
RTA EP LE	-0.133	0.330**	0.0154	0.189***	-0.262	0.0391	0.199***	-0.0815
	(0.139)	(0.135)	(0.0636)	(0.0552)	(0.295)	(0.110)	(0.0648)	(0.0783)
RTA EP LE DS	0.170**	0.402***	0.194***	0.111	-0.0345	0.114	0.211**	0.0901
	(0.0699)	(0.114)	(0.0610)	(0.0725)	(0.0938)	(0.118)	(0.0917)	(0.0872)
Observations	294,525	142,324	241,434	82,470	417,947	216,016	406,910	167,211
Exp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Imp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exp*Imp	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. (i) EP stands for Environmental Provision, LE legally enforceable, and DS for Dispute Settlement. (ii) The reference category is no agreements between trade partners.

## 6. Conclusion and Policy Recommendations

The objective of this paper is to investigate the extent to which international trade is affected by environmental stringency. The impact of environmental regulations on exports is evaluated by using a gravity model of trade, which is estimated for a global sample of countries over the period from 2001 to 2015, distinguishing between clean, footloose, and dirty products. This enables us to investigate whether more stringent environmental provisions and environmental laws lead countries to move away from dirty production and exports, as predicted by the Pollution Haven hypothesis. Data on environmental provisions that are legally enforceable is obtained from the Deep Trade Agreement dataset (World Bank) and environmental laws and treaties are from Ecolex

Our results show that, in aggregated form for the deeper environmental provision we can expect a decrease in trade of “normal” goods, but not those of the dirty and footloose products. When focusing about the combinations with legislation, only national laws seem being working. The environmental provisions and laws, de jure, the domestic legislation does exert a significant effect on trade, we observe a decrease in trade of the deepest categories of the provisions but this only holds for footloose and not dirty products and is mostly true for the exporter, and combined with the deepest environmental provisions, confirming the Pollution Haven Effect. Additionally, when analyzing the environmental provision depth by country groups, we confirm that strictness in environmental regulation reinforce the PHH with more the provisions increasing exports of NON-OECD and decreasing on those of OECD in dirty products.

From a policy perspective, this paper highlights a couple of policy relevant findings. First, the existence of a law does not necessarily lead to a concrete and tangible effect on trade. This is why while the de jure dimension is necessary, it is not sufficient. Thus, making the laws legally enforceable and subject to a dispute settlement –the de facto dimension– makes them more effective. Second, for developing countries, there is still a long way to take such provisions into account and to implement them as most of the treaties and trade agreements with environmental provisions are more concentrated in advanced economies, confirming the PHH hypothesis.

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## Appendix

**Table A1.** List of Industries and Classification.

Code	Description	Classification	Emissions intensity
SITC 251	Pulp and waste paper	Dirty	0.608
SITC 334	Petroleum products	Dirty	1.210
SITC 335	Residual petroleum products	Dirty	2.743
SITC 51	Organic chemicals	Dirty	0.967
SITC 52	Inorganic chemicals	Dirty	2.331
SITC 562	Fertilizers	Dirty	3.530
SITC 59	Chemical materials	Footloose	1.019
SITC 634	Veneers, plywood	Dirty	0.121
SITC 635	Wood manufactures	Dirty	0.121
SITC 64	Paper, paperboard	Dirty	0.608
SITC 661	Lime, cement, construction materials	Footloose	12.01
SITC 67	Iron and steel	Footloose	1.054
SITC 68	Non-ferrous metals	Dirty	1.613
SITC 69	Metals manufactures	Footloose	0.188

Source. Classification from Harris et al. (2002). Emissions intensity is from ESA (2010). It is measured as metric tons of CO<sub>2</sub> per \$1,000 in constant \$2,000. Also see <http://www.esa.doc.gov/sites/default/files/reports/documents/co2reportfinal.pdf>.

Table A2: Regional Trade Agreements and Exports- by type

	All		Normal	Footloose	Dirty
	Exports	Exports	Exports	Exports	Exports
RTA	0.0102 (0.0281)	-0.0510* (0.0276)	-0.0166 (0.0302)	0.143*** (0.0269)	0.0874*** (0.0320)
Footloose		-2.628*** (0.101)			
Dirty		-1.303*** (0.0866)			
RTA*Footloose		0.303*** (0.0319)			
RTA*Dirty		0.457*** (0.0673)			
Constant	26.92*** (0.0136)	27.23*** (0.0172)	27.16*** (0.0143)	26.19*** (0.0145)	25.71*** (0.0169)
Observations	10,487,354	10,487,354	8,505,698	762,003	1,212,272
Exp*Prod*Year	Yes	Yes	Yes	Yes	Yes
Imp*Prod*Year	Yes	Yes	Yes	Yes	Yes
Exp*Imp	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table A3: Regional Trade Agreements and Exports- by type

	All		Normal	Footloose	Dirty
	Exports	Exports	Exports	Exports	Exports
RTA w/o EP	-0.0167 (0.0349)	-0.0505 (0.0350)	-0.0385 (0.0385)	0.121*** (0.0324)	0.0547 (0.0344)
RTA w. EP	0.0257 (0.0250)	-0.0530** (0.0259)	-0.00397 (0.0264)	0.154*** (0.0256)	0.109*** (0.0340)
Footloose		-2.641*** (0.0991)			
Dirty		-1.306*** (0.0869)			
RTA w/o EP*Footloose		0.100** (0.0476)			
RTA w/o EP*Dirty		0.341*** (0.0796)			
RTA w. EP*Footloose		0.413*** (0.0351)			
RTA w. EP*Dirty		0.514*** (0.0832)			
Constant	26.91*** (0.0127)	27.23*** (0.0165)	27.16*** (0.0133)	26.19*** (0.0139)	25.71*** (0.0172)
Observations	10,487,354	10,487,354	8,505,698	762,003	1,212,272
Exp*Prod*Year	Yes	Yes	Yes	Yes	Yes
Imp*Prod*Year	Yes	Yes	Yes	Yes	Yes
Exp*Imp	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.  
EP stands for Environmental Provisions.

Table A4: National Legislations, Treaties, Agreement Depth, and Exports (from Non-OECD to -OECD) – all goods

	National			Treaties		
	Air Exports	Energy Exports	Env. Exports	Air Exports	Energy Exports	Env. Exports
RTA w/o EP	0.120** (0.0493)	0.137*** (0.0472)	0.142*** (0.0478)	0.139*** (0.0399)	0.120*** (0.0419)	0.135*** (0.0436)
RTA w. EP not LE	0.125** (0.0584)	0.114* (0.0607)	0.128** (0.0606)	0.0905* (0.0504)	0.110** (0.0535)	0.106* (0.0548)
RTA w. EP LE	0.285*** (0.0523)	0.273*** (0.0543)	0.295*** (0.0549)	0.255*** (0.0482)	0.273*** (0.0505)	0.279*** (0.0491)
RTA w. EP LE DS	0.00665 (0.0412)	0.0142 (0.0430)	0.0146 (0.0434)	0.00975 (0.0401)	0.0235 (0.0433)	0.0318 (0.0449)
Legis. Exp.	-0.0432 (0.316)	-0.202 (0.191)		-0.313 (0.199)	0.353 (0.501)	0.327 (0.439)
RTA w/o EP*Legis. Exp.	0.0159 (0.0162)	-0.00190 (0.00370)	-0.00351 (0.00360)	-0.0243 (0.0291)	-0.107* (0.0609)	-0.0286 (0.0371)
RTA w. EP not LE*Legis. Exp.	-0.0217** (0.00964)	-0.00218 (0.00197)	-0.00282 (0.00241)	0.0186 (0.0260)	0.0134 (0.0240)	-0.000543 (0.0294)
RTA w. EP LE*Legis. Exp.	-0.00997 (0.00948)	0.000623 (0.00313)	-0.00478 (0.00379)	0.00484 (0.0360)	-0.0959 (0.0593)	-0.0684 (0.0425)
RTA w. EP LE DS*Legis. Exp.	0.0127 (0.0104)	0.000761 (0.00298)	0.00171 (0.00366)	0.00774 (0.0299)	0.0160 (0.0319)	-0.00832 (0.0318)
Legis. Imp.	-0.0288 (0.0333)	-0.149*** (0.0453)	0.0991** (0.0414)	0.666** (0.330)	-1.144*** (0.311)	0.948 (0.595)
RTA w/o EP*Legis. Imp.	0.00229 (0.00523)	-0.000790 (0.00350)	-0.000905 (0.00331)	-0.0126 (0.0247)	0.0984*** (0.0322)	-0.0233 (0.0260)
RTA w. EP not LE*Legis. Imp.	0.00452 (0.00284)	0.00421* (0.00217)	-0.000684 (0.00192)	0.0469** (0.0197)	0.0117 (0.0190)	0.0175 (0.0121)
RTA w. EP LE*Legis. Imp.	-0.00306 (0.00481)	-0.00313 (0.00282)	-0.000164 (0.00316)	0.0516 (0.0511)	0.0610 (0.0485)	0.00894 (0.0418)
RTA w. EP LE DS*Legis. Imp.	0.00610** (0.00273)	0.00424** (0.00173)	0.000957 (0.00165)	0.0622*** (0.0141)	0.0277 (0.0179)	-0.00237 (0.0161)
Constant	27.25*** (0.686)	28.60*** (0.911)	26.57*** (0.215)	26.95*** (0.137)	27.24*** (0.153)	26.60*** (0.273)
Observations	2,093,225	2,093,225	2,093,225	2,093,225	2,093,225	2,093,225
Exp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes
Imp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes
Exp*Imp	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Notes: (i) EP stands for Environmental Provision, LE legally enforceable, and DS for Dispute Settlement. (ii) The reference category is no agreements between trade partners.

Table A5: National Legislations, Treaties, Agreement Depth, and Exports (from Non-OECD to -OECD) – footloose goods

	National			Treaties		
	Air Exports	Energy Exports	Env. Exports	Air Exports	Energy Exports	Env. Exports
RTA w/o EP	0.337*** (0.0870)	0.341*** (0.0876)	0.377*** (0.0816)	0.301*** (0.0813)	0.293*** (0.0884)	0.365*** (0.0901)
RTA w. EP not LE	0.0828 (0.0860)	0.124 (0.0839)	0.107 (0.0875)	0.0736 (0.0831)	0.0820 (0.0812)	0.102 (0.0843)
RTA w. EP LE	0.218* (0.114)	0.267** (0.123)	0.292** (0.113)	0.295** (0.129)	0.306** (0.138)	0.354** (0.147)
RTA w. EP LE DS	0.399*** (0.118)	0.413*** (0.119)	0.406*** (0.118)	0.324*** (0.111)	0.375*** (0.116)	0.392*** (0.115)
Legis. Exp.				-1.686** (0.679)	-5.947*** (0.536)	
RTA w/o EP*Legis. Exp.	-0.0286 (0.0211)	-0.0156 (0.0151)	-0.0211*** (0.00765)	-0.152** (0.0667)	-0.153 (0.166)	-0.160* (0.0829)
RTA w. EP not LE*Legis. Exp.	-0.0155 (0.0211)	-0.00705 (0.00518)	-0.00784 (0.00515)	0.0314 (0.0753)	0.0261 (0.0503)	-0.0332 (0.0692)
RTA w. EP LE*Legis. Exp.	0.0677*** (0.0153)	0.0101 (0.00952)	-0.000412 (0.0101)	-0.280** (0.128)	0.243*** (0.0750)	-0.422*** (0.161)
RTA w. EP LE DS*Legis. Exp.	-0.0262 (0.0166)	-0.0147** (0.00603)	-0.00577 (0.00720)	0.107 (0.0654)	-0.0370 (0.0938)	-0.0493 (0.0937)
Legis. Imp.				1.917*** (0.234)		
RTA w/o EP*Legis. Imp.	-0.00767 (0.0115)	-0.00103 (0.00763)	-0.00538 (0.00752)	0.209*** (0.0531)	0.226*** (0.0764)	-0.0549 (0.0548)
RTA w. EP not LE*Legis. Imp.	0.00676 (0.00594)	0.00489 (0.00452)	0.00420 (0.00358)	0.0808* (0.0445)	0.0730** (0.0352)	0.0293 (0.0282)
RTA w. EP LE*Legis. Imp.	0.0147 (0.0129)	0.00217 (0.00612)	0.0168* (0.00877)	0.629*** (0.222)	-0.115 (0.0764)	0.392*** (0.135)
RTA w. EP LE DS*Legis. Imp.	0.00201 (0.00428)	0.00122 (0.00253)	-0.000577 (0.00277)	0.107*** (0.0284)	0.140*** (0.0435)	0.0490 (0.0319)
Constant	26.46*** (0.00934)	26.46*** (0.00976)	26.46*** (0.00968)	26.44*** (0.252)	28.66*** (0.198)	26.46*** (0.00966)
Observations	142,324	142,324	142,324	142,324	142,324	142,324
Exp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes
Imp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes
Exp*Imp	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Notes: (i) EP stands for Environmental Provision, LE legally enforceable, and DS for Dispute Settlement. (ii)

The reference category is no agreements between trade partners.

Table A6: National Legislations, Treaties, Agreement Depth, and Exports (from Non-OECD to -OECD) – dirty goods

	National			Treaties		
	Air Exports	Energy Exports	Env. Exports	Air Exports	Energy Exports	Env. Exports
RTA w/o EP	-0.0854 (0.0874)	-0.0241 (0.0888)	-0.0164 (0.0891)	0.0612 (0.104)	0.0370 (0.115)	0.0509 (0.116)
RTA w. EP not LE	-0.141 (0.117)	-0.0996 (0.116)	-0.123 (0.121)	-0.0986 (0.102)	-0.129 (0.104)	-0.110 (0.102)
RTA w. EP LE	-0.0595 (0.114)	-0.0395 (0.114)	-0.0439 (0.123)	0.0579 (0.0997)	0.0318 (0.117)	0.0207 (0.112)
RTA w. EP LE DS	0.0807 (0.120)	0.138 (0.131)	0.117 (0.133)	0.0704 (0.114)	0.0929 (0.118)	0.125 (0.118)
Legis. Exp.	2.410*** (0.344)			-0.208 (0.238)	7.538*** (0.841)	3.345*** (0.492)
RTA w/o EP*Legis. Exp.	0.0674* (0.0384)	0.00476 (0.0104)	0.0122 (0.00965)	-0.0838 (0.0990)	-0.252*** (0.0613)	-0.115* (0.0647)
RTA w. EP not LE*Legis. Exp.	0.0168 (0.0284)	-0.000747 (0.00308)	0.000587 (0.00570)	-0.00953 (0.0663)	0.0143 (0.0598)	-0.0447 (0.0622)
RTA w. EP LE*Legis. Exp.	0.0485*** (0.0176)	0.00896** (0.00384)	0.0101 (0.00714)	0.0898 (0.123)	0.266** (0.110)	0.188* (0.105)
RTA w. EP LE DS*Legis. Exp.	0.0101 (0.0282)	-0.00278 (0.00367)	-0.00250 (0.00724)	0.169** (0.0778)	0.0320 (0.0765)	-0.0470 (0.0707)
Legis. Imp.			0.480** (0.190)	-0.242 (0.340)		
RTA w/o EP*Legis. Imp.	0.0328** (0.0146)	0.0148 (0.0111)	0.00829 (0.00767)	0.128 (0.112)	0.292*** (0.0696)	0.157** (0.0777)
RTA w. EP not LE*Legis. Imp.	-0.00146 (0.00556)	-0.00536 (0.00672)	-0.00212 (0.00578)	-0.00779 (0.0611)	0.0894** (0.0371)	0.0524 (0.0347)
RTA w. EP LE*Legis. Imp.	0.00404 (0.00801)	0.000816 (0.00413)	0.00341 (0.00516)	-0.200 (0.155)	-0.162 (0.120)	-0.116 (0.0709)
RTA w. EP LE DS*Legis. Imp.	0.00811 (0.00759)	0.00535 (0.00564)	0.00638 (0.00448)	-0.0329 (0.0434)	0.0802** (0.0393)	-0.0629 (0.0537)
Constant	18.62*** (1.014)	25.71*** (0.0117)	23.18*** (0.997)	25.87*** (0.145)	22.42*** (0.368)	23.45*** (0.332)
Observations	216,016	216,016	216,016	216,016	216,016	216,016
Exp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes
Imp*Prod*Year	Yes	Yes	Yes	Yes	Yes	Yes
Exp*Imp	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Notes: (i) EP stands for Environmental Provision, LE legally enforceable, and DS for Dispute Settlement. (ii)

The reference category is no agreements between trade partners.

Table A7: Trade Partners, Agreement Depth, and Exports I

Exporter	Non-OECD	Non-OECD	OECD	OECD
Importer	Non-OECD	OECD	Non-OECD	OECD
RTA w/o EP	-0.234*** (0.0451)	0.0302 (0.0604)	-0.0393 (0.0529)	0.0461 (0.0445)
RTA w. EP not LE	-0.0350 (0.0571)	0.123** (0.0603)	-0.0233 (0.0527)	-0.0431 (0.0538)
RTA w. EP LE	0.0147 (0.122)	0.228*** (0.0523)	-0.0227 (0.0511)	0.147** (0.0648)
RTA w. EP LE DS	-0.00656 (0.0694)	-0.0360 (0.0468)	0.0420 (0.0518)	-0.0385 (0.0404)
Footloose	-2.322*** (0.209)	-2.122*** (0.224)	-2.808*** (0.211)	-2.926*** (0.152)
Dirty	-1.447*** (0.145)	-1.785*** (0.132)	0.589*** (0.213)	-0.493** (0.219)
RTA w/o EP*Footloose	0.0460 (0.0674)	0.452*** (0.148)	0.358*** (0.0802)	0.104 (0.119)
RTA w/o EP*Dirty	0.544*** (0.152)	0.787** (0.319)	0.477*** (0.141)	-0.295** (0.137)
RTA w. EP not LE*Footloose	0.289*** (0.0914)	-0.0298 (0.133)	0.422*** (0.0908)	0.206 (0.137)
RTA w. EP not LE*Dirty	0.158 (0.176)	-0.131 (0.173)	0.815*** (0.111)	0.0753 (0.193)
RTA w. EP LE *Footloose	0.469* (0.252)	0.238 (0.212)	0.260*** (0.0998)	-0.408 (0.277)
RTA w. EP LE *Dirty	0.574** (0.279)	0.384* (0.228)	1.031*** (0.204)	-0.822*** (0.240)
RTA w. EP LE DS*Footloose	0.587*** (0.0842)	0.0372 (0.152)	0.378*** (0.0711)	0.489*** (0.0695)
RTA w. EP LE DS*Dirty	-0.372* (0.224)	0.648*** (0.177)	0.569*** (0.148)	0.108 (0.0858)
Constant	26.82*** (0.0317)	27.41*** (0.0205)	26.29*** (0.0223)	27.62*** (0.0333)
Observations	3,840,721	2,093,225	3,238,615	1,285,196
Exp*Prod*Year	Yes	Yes	Yes	Yes
Imp*Prod*Year	Yes	Yes	Yes	Yes
Exp*Imp	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Notes: (i) EP stands for Environmental Provision, LE legally enforceable, and DS for Dispute Settlement. (ii) The reference category is no agreements between trade partners.

Table A8: Trade Partners, Agreement Depth, and Exports II

	All	Footloose	Dirty
RTA w/o EP	-0.147** (0.0713)	-0.00531 (0.0726)	-0.133** (0.0652)
RTA w. EP not LE	-0.00725 (0.0673)	0.133 (0.0947)	0.226 (0.182)
RTA w. EP LE	0.0192 (0.136)	-0.128 (0.159)	0.0791 (0.254)
RTA w. EP LE DS	-0.0377 (0.0725)	0.163* (0.0895)	-0.0390 (0.105)
RTA w/o EP*Non-OECD/OECD	0.241*** (0.0739)	0.275*** (0.0986)	0.293*** (0.0979)
RTA w/o EP*OECD/Non-OECD	0.185** (0.0788)	0.114 (0.0901)	0.240*** (0.0831)
RTA w/o EP*OECD/OECD	0.183** (0.0778)	0.171* (0.0925)	0.295*** (0.101)
RTA w. EP not LE*Non-OECD/OECD	0.0914 (0.0777)	-0.0587 (0.111)	-0.249 (0.206)
RTA w. EP not LE*OECD/Non-OECD	0.0249 (0.0803)	-0.0155 (0.111)	0.0226 (0.193)
RTA w. EP not LE*OECD/OECD	-0.0305 (0.0822)	-0.107 (0.128)	-0.299 (0.247)
RTA w. EP LE*Non-OECD/OECD	0.160 (0.140)	0.300* (0.179)	0.0716 (0.266)
RTA w. EP LE *OECD/Non-OECD	0.0766 (0.143)	0.227 (0.164)	0.182 (0.263)
RTA w. EP LE *OECD/OECD	0.0225 (0.147)	0.373** (0.167)	0.0526 (0.277)
RTA w. EP LE DS*Non-OECD/OECD	-0.0651 (0.110)	0.276** (0.127)	0.177 (0.152)
RTA w. EP LE DS*OECD/Non-OECD	0.150* (0.0766)	0.0546 (0.109)	0.252** (0.122)
RTA w. EP LE DS*OECD/OECD	0.0740 (0.0786)	-0.0148 (0.106)	0.200 (0.129)
Constant	26.92*** (0.0123)	26.19*** (0.0226)	25.70*** (0.0279)
Observations	10,487,354	762,003	1,212,272
Exp*Prod*Year	Yes	Yes	Yes
Imp*Prod*Year	Yes	Yes	Yes
Exp*Imp	Yes	Yes	Yes

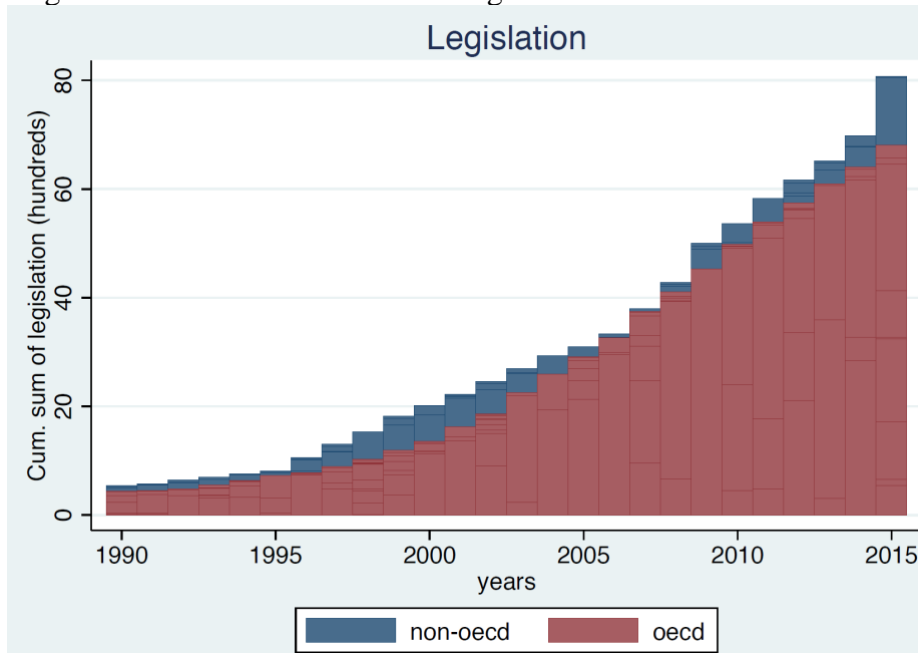
Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Notes: (i) EP stands for Environmental Provision, LE legally enforceable, and DS for Dispute Settlement. (ii) The reference category is no agreements between trade partners.

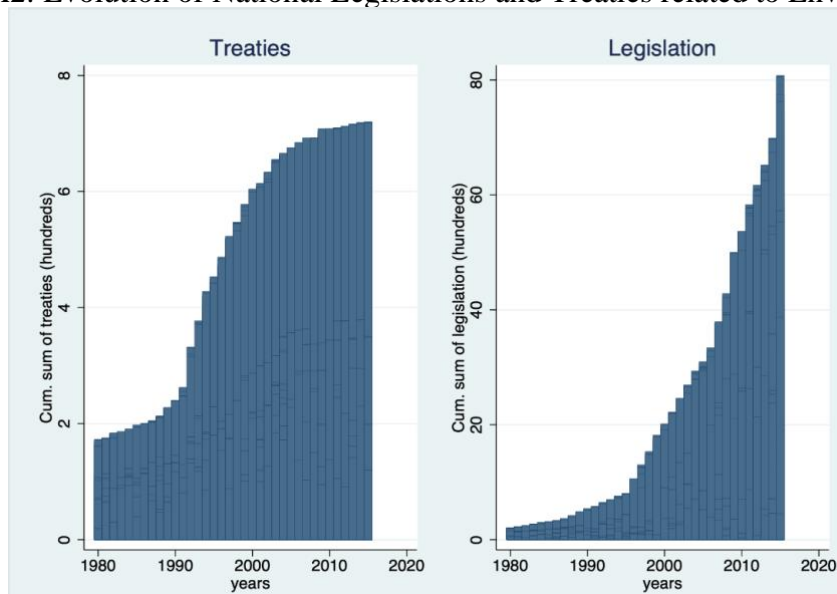


Figure A1: Evolution of National Legislations related to Environment



Source: Authors' own elaboration using Ecolex dataset.

Figure A2: Evolution of National Legislations and Treaties related to Environment



Source: Authors' own elaboration using Ecolex dataset.