Research Articles

# When Do International Treaties Matter for Domestic Environmental Legislation?

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**Abstract**

While thousands of international treaties have been concluded, it remains unclear whether they have been implemented. This article investigates the relationship between the conclusion of environment-related international treaties and the adoption of domestic environmental legislation. Thanks to data sets that are considerably more comprehensive and fine-grained than those previously used, we can analyze the direct link to environmental legislation rather than the less direct link to environmental outcomes. Moreover, we can disaggregate for specific environmental issue areas. Our results suggest a positive relationship between domestic environmental legislation with both international environmental agreements and preferential trade agreements (PTAs) with environmental provisions. This link is more robust for PTAs, mostly present in developing countries, more pronounced before rather than after the treaties' entry into force, and shows significant variation depending on the issue area. These findings contribute to the literature on environmental regime effectiveness and the domestic impact of treaties.

Treaties are a central component of global environmental governance. The cumulative number of international environmental agreements (IEAs) is impressive: more than two thousand environmental agreements and protocols have been concluded since 1945 (Mitchell 2019). Some of the oldest IEAs govern fisheries, endangered species, agriculture, and freshwater, but an increasing share of IEAs also address the protection of ecosystems, energy production, hazardous waste, and the emission of pollutants (Egger et al. 2013).

In addition to these IEAs, preferential trade agreements (PTAs) increasingly contribute to global environmental governance. Modern PTAs typically include a fully fledged chapter on environmental protection, with obligations that are sometimes more precise and stringent than those included in IEAs (Jinnah 2011); 94.3 percent of PTAs concluded since 2000 include at least one environmental provision, and 78.4 percent include at least one provision addressing specific environmental issues, such as whaling, waste management, migratory birds, mercury emission, or ocean pollution (Morin et al. 2018, 2019). PTAs

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can therefore be regarded as a subset of environmental agreements. The combined proliferation of IEAs and PTAs is so prominent that some experts do not hesitate to talk about "treaty congestion" in environmental governance (Anton 2013).

Thus, it is essential for our understanding of environmental governance to know whether, when, and by which countries they are implemented. Do the agreed environmental commitments translate into tangible regulatory change at the domestic level, or do they remain empty promises? If environmental treaties induce domestic changes, the considerable amount of time, effort, and funding invested in treaty making might be worthwhile. However, if treaties do not have any effect domestically, proponents of environmental governance should consider turning to alternative institutional forms, such as informal groups, civil society forums, transnational networks, or public–private partnerships. Whether, when, and by which countries' international agreements are implemented are thus very important questions from a policy perspective.

Despite the importance of these questions, data shortcomings have limited research on the implementation of environment-related treaties. We exploit recent data sets to investigate for the first time the relationship of more than a thousand treaties (almost universal coverage for the period) with domestic environmental legislation across nearly 150 countries and 13 distinct environmental issue areas over a period of 23 years. Our results reveal a significant and positive relationship between treaties and domestic legislation, which we find to be more robust for PTAs than for IEAs. We also find the relationship between treaties and domestic legislation to be stronger in developing countries, where it is also stronger *before* entry into force. This relationship can also be observed for several specific environmental issue areas, but not all of them. While we do not find a positive relationship between treaties and environmental legislation for high-income countries in the aggregate, we do find a link between environmental provisions in PTAs and legislative change in high-income countries from North–North PTAs, suggesting that treaties can also generate domestic change in high-income countries under specific circumstances.

## Studying Treaty Implementation

This article focuses on treaty implementation, defined as the adoption of legal measures by states to translate their international commitments in their domestic legal order (Weiss and Jacobson 1998, 4). In doing so, it contributes to the broader regime effectiveness literature while taking a different approach than the one favored by most other studies. Following Young (1994), effectiveness can be broken down into several steps, including, from the most immediate to the most distant, domestic legal action, resource allocation, behavioral change, goal attainment, and problem solving. Several studies on treaty effectiveness investigate the most distant measure of effectiveness and aim to assess treaties' environmental impact (Hovi et al. 2003). Just a few studies, including this

one, instead look at domestic legal actions, the most immediate step toward effectiveness.

We recognize that assessing treaties' distant environmental impact is an attractive proposition for those who care about the state of the environment. However, establishing a causal relationship between treaty adoption and problem solving is challenging. Despite the deployment of sophisticated techniques, the causal chain linking the adoption of a treaty to mitigation of environmental degradation remains long, indirect, and uncertain. Because of the complexity of social, political, economic, and natural systems, multiple intervening, mediating, moderating, and confounding variables are at play and can lead to an over- or underestimation of treaty effectiveness (Bernstein and Cashore 2012). A number of recent statistical analyses, for example, have established a relationship between the signing of PTAs and the reduction of carbon dioxide emissions and suspended particulate matter (Baghdadi et al. 2013; Bastiaens and Postnikov 2017). Yet, it remains unclear how PTAs lead to these positive impacts on the environment, since most of them do not include provisions on carbon dioxide or suspended particulate matter. As a result of this ambitious approach focusing on distant impacts, the causal chain of treaty effectiveness remains poorly understood, despite being one of the most important questions of global environmental politics.

Studying the more direct relationship between the adoption of a treaty and its implementation offers significant benefits. As Oran Young (2001, 116) observes, "the shortness of the causal chain in such cases makes the attribution of a variety of effects to the creation of regimes relatively uncontroversial." Implementation is also a more valuable measure of effectiveness than the degree of compliance (Victor et al. 1998, 1). While implementation is necessarily an intentional state action, compliance with modest standards might be an accidental consequence of an economic downturn or a technological change (Downs et al. 1996; von Stein 2005). To be sure, implementation is only one aspect of treaty effectiveness, and it may not necessarily influence environmental performance. Nevertheless, studying implementation is a more prudent step than jumping straight to the more distant assessment of environmental impacts. This proximity, in turn, facilitates the identification of conditions that increase or decrease the likelihood of treaty implementation.

Of course, some treaties might not even require legislative changes. They might instead require signatory countries to adopt certain administrative procedures or conduct some diplomatic actions. Some treaties might also reflect existing laws of contracting parties. However, we think it is reasonable to assume that most treaties require at least some legislative changes for some parties.

We also assume that not all parties will implement their international obligations. Presumably, variations in treaty implementation depend on states' interests and their political capacity to renege on their commitments, among other factors (Bernstein and Cashore 2012). However, we still do not know whether treaty adoption is usually associated with domestic legal action or what might

drive treaty implementation. A recent study commissioned by the Organisation for Economic Co-operation and Development "reveals a considerable lack of knowledge on the implementation of environmental provisions in [trade agreements]" (George and Yamaguchi 2018, 2), and the same could be said for IEAs.

Shortcomings in data availability explain why few quantitative studies in global environmental governance have looked at this question. Most analyses of treaty implementation rely on qualitative case studies. Several edited volumes bring together studies exploring the implementation of a specific treaty. These case studies were particularly useful for theory building and gave rise to a prolific literature. Yet, they might not be representative, and their scope for generalization is uncertain. Most of these case studies focus on prominent multilateral agreements that are exceptional in various ways, including in their large membership, as more than 79 percent of IEAs are bilateral or trilateral treaties (Mitchell 2019). Likewise, studies on the domestic implementation of PTAs' environmental commitments typically look at US agreements (Jinnah 2011), which are unique in both their exceptionally strong enforcement mechanisms and their parties' sharp asymmetry of power.

The few studies in global environmental governance that have conducted cross-treaty assessments to shed light on treaty implementation have looked at a limited number of cases. The Oslo–Seattle Project has a universe of forty-four cases (Miles et al. 2002), and the International Regimes Database includes ninety-two regime elements (Breitmeier and Young 2006). Another interesting quantitative analysis was conducted by Perkins and Neumayer (2007), but it was limited to the European Union. Unsurprisingly, these quantitative analysts lamented the lack of additional data. Breitmeier et al. (2011, 599) call for an expansion in "the numbers and types of cases available for analysis," while Perkins and Neumayer (2007, 35) point to the "urgent need to assemble new implementation datasets that cover a wide range of MEAs [multilateral environmental agreements]." This study takes up this challenge and combines three fine-grained data sets to make the first contribution of the environmental governance literature to studying the implementation of IEAs and PTAs with environmental provisions that entered into force between 1990 and 2013 in almost 150 countries.

## Hypotheses

As our contribution relates to the uniquely broad coverage of our empirical investigation, we test hypotheses that build on the current literature. The majority of studies cited in the previous section support the claim that most countries generally implement their international commitments. There are many reasons why the conclusion of an international treaty would increase a country's interest to pass domestic legislation that it would not adopt in the absence of the agreement. International treaties can change a country's dominant strategy in an international coordination or collaboration game or help to work around domestic veto players in a two-level game. In other cases, treaties link the implementation

of environmental commitments to material benefits, including financial assistance or market access. We hence expect that treaties' entry into force is positively related to domestic legislative changes.

However, not all treaties provide equal incentives for their implementation. We expect IEAs to have a different effect from that of PTAs' environmental clauses, for two main reasons. First, PTAs with environmental provisions link trade and environment by their very nature. If this linkage is important for one party to a PTA, the other party might have an incentive to adopt environmental legislation in order to secure this PTA and gain privileged access to a foreign market. A few multilateral IEAs also have trade measures, but they are limited to certain goods and rarely provide powerful incentives for the adoption of domestic legislation. Second, PTAs typically rely on stronger enforcement mechanisms than IEAs. In some cases, a party to a PTA could ultimately face monetary or trade sanctions if it fails to implement its environmental commitments (Jinnah 2011). This is almost unheard of in environmental treaty making. Instead, most IEAs rely on managerial mechanisms to promote compliance, such as capacity building, transparency, and political dialogues (Chayes and Chayes 1995; Tallberg 2002). PTAs often include these soft mechanisms as well, but many of them also include hard enforcement mechanisms (Bastiaens and Postnikov 2017). Following the view that the strength of compliance mechanisms is a predictor of implementation (Downs et al. 1996), we expect the following:

> $H_1$: The relation between environmental provisions in PTAs and domestic environmental legislation is stronger than the relation between IEAs and domestic environmental legislation.

We also expect treaty implementation to vary with states' political capacity to renege on their international commitments. For this reason, we expect the effect of treaties to differ between developing and high-income countries. In light of economic and power asymmetries, developing countries are more likely to undertake regulatory change to increase their chances of finding a new trading partner and gain access to its market (Baccini and Urpelainen 2014) or to receive support for capacity building (VanDeveer and Dabelko 2001). These material incentives are more attractive for developing countries in proportion to GDP per capita. In contrast, high-income countries are unlikely to accept paying the cost of environmental reforms to increase their market access or receive assistance. Moreover, developing countries tend to have less stringent environmental policies than high-income countries and thus have to do more catching up. High-income countries, on the other hand, are typically the main demander of specific environmental treaty content (Bechtel and Tosun 2009; Sprinz and Vaahtoranta 1994), making them more likely already to comply with a treaty's prescriptive obligations (von Stein 2005).

> $H_2$: The relation between environmental legislation and IEAs or PTAs with environmental provisions is stronger in developing countries than in high-income countries.

We also anticipate that developing countries will implement their obligations prior to the entry into force of these treaties. Several treaty obligations are not subject to transitional periods and become legally binding as soon as the treaty enters into force. Developing countries might be particularly concerned about the risk associated with noncompliance and therefore foster early legal change to be on the safe side as soon as the treaty enters into force (Bastiaens and Postnikov 2017; Kim 2012). This is especially likely to be the case when the entry into force is conditional on a certain number of treaty ratifications. This condition creates uncertainty as to the exact time of entry into force and favors early implementation.

In addition to these legal considerations, material incentives can favor early implementation in developing countries. As Baccini and Urpelainen (2014, 29) put it, "if a state expects benefits from a treaty, it can increase the probability of foreign ratification by implementing policies that benefit pivotal domestic players within its partner country." These benefits can include development assistance, support for capacity building, and preferential market access. Since high-income countries are often worried about their comparative advantage due to less stringent environmental policies in developing countries, they will welcome the signal of an early implementation in developing countries, which can help them soothe the domestic opposition against treaty ratification.

We do not rule out implementation activities occurring after a treaty enters into force. A treaty already in force can strengthen political pressure to stick to substantive treaty commitments by increasing awareness, providing scientific information, promoting expertise and capacity, and empowering civil society, thereby favoring the implementation activities after entry into force (Bastiaens and Postnikov 2017; Chayes and Chayes 1995). However, these activities that occur after a treaty enters into force are expected to be diluted over a long period, while implementation prior to entry into force is expected to be more concentrated and hence more easily observable. Moreover, while these activities can improve compliance and environmental impact, they are less likely to lead to legislative change:

> $H_3$: The relation between environmental legislation and IEAs or PTAs with environmental provisions is stronger before than after entry into force.

We anticipate that the effect of treaties on legislative change in developing countries is stronger if the treaties are negotiated with high-income countries. Insofar as high-income countries have more stringent environmental polices than developing countries, the former have a strong interest in "exporting" their environmental policies (DeSombre 2000) to their partner countries with laxer policies in order to alleviate competitive pressure. Following the aforementioned logic linked to economic and power asymmetries, we expect that developing countries are particularly interested in receiving support from and gaining market access to high-income countries and promoting legislative change to favor swift treaty ratification, hence making North–South treaties

particularly effective. As Miles et al. (2002, 63) put it, "a power distribution in favor of pushers enhances regime effectiveness":

> $H_4$: The relation between environmental legislation and IEAs or PTAs with environmental provisions in developing countries is stronger when the treaties are signed with high-income partners.

We also differentiate the implementation across various environmental issue areas. We expect to find variation across issue areas since countries are likely to prioritize the implementation of the least costly measures. Three factors, well established in the literature, contribute to making some issue areas costlier to regulate than others. First, is the structure of the underlying ecological problem matters (Mitchell 2006). Regulating global common resources, such as the ocean and the atmosphere, does not bring the same immediate benefits to a country as regulating local environmental problems, such as water, air, and soil quality. Second, issue areas vary in terms of the immediate social costs and benefits induced by regulations (Sprinz and Vaahtoranta 1994). Some regulations can generate high marginal abatement costs, such as introducing fishing quotas. Other environmental policies can generate important social benefits, for example, by improving air quality in cities or by diminishing the risk of property damage in the event of a natural disaster. Third, the domestic political economy of each issue area affects the propensity of governments to regulate it (Cao and Prakash 2012). A problem is malign if the preferences of influential actors diverge, but it is benign if these influential actors converge or are left indifferent (Underdal 2002, 15). Regulating industries such that profits are reduced generates intense opposition by powerful interest groups, while creating natural reserves in isolated areas is more likely to be opposed by marginalized populations.[1] We expect the link between treaties and domestic legal change to be weaker for issues that are global, socially costly, and malign than for those that are local, socially attractive, and benign.

The relative regulatory cost associated with a given environmental issue area varies from one country to another (Sprinz and Vaahtoranta 1994). For this reason, we cannot provide a universal ranking of the least costly issue areas and the international commitments most likely to be implemented. Some issue areas nevertheless seem to display nearly universal features. The protection of freshwater and of air quality, in particular, appear to be issue areas typically associated with relatively low regulatory costs. They can be efficiently regulated at the regional level; they offer substantial benefits in various sectors, including health; and they mobilize interest groups, including NGOs, businesses, and local authorities. In contrast, the fight against climate change and the protection of fish stocks are characterized by incomplete property rights and relatively open

1. At the same time, protests against Peru's implementation of United States–Peru PTA conservation provisions resulted in extensive violence (Jinnah 2011).

access. These require significant investment to reap distant benefits, and primary industrial losers are highly concentrated:

> $H_5$: The relationship between treaties and domestic legislation will be more prominent in the freshwater and air quality regimes than in the climate change and fishery regimes.

## Data and Methodology

Our dependent variables are based on the FAOLEX database operated by the Food and Agriculture Organization (2017) of the United Nations. It is a comprehensive collection of national legislation on environmental protection across a wide range of countries and environmental issue areas. The collection draws on various sources, including online publications of national legislation, official gazettes in hard copy, and documentation from decentralized FAO offices and projects. Our dependent variable is the number of environmental laws passed per country in year *t*. We acknowledge that, in general, the number of environmental laws is only a rough proxy to measure the extent of environmental change. While some countries achieve compliance with international commitments by passing one encompassing law, other countries may address different issues in different pieces of legislation. Given our fixed-effects approach (further described below), we are, however, comparing the number of environmental laws not across countries but within countries over time. Against this background, we would argue that an increase in the amount of legislation passed in the same country over time is a good measure of the extent of regulatory activity.

In addition to the aggregate number of environmental legislations, we have disaggregated information for thirteen issue areas in order to be able to study the link between international commitments on a specific environmental issue and legislation in the same issue area.[2] Figure 1 shows how many laws countries passed between 1990 and 2013 in each of these issue areas. Biodiversity leads the list, followed with significant distance by fisheries, water, waste, and climate and energy.

Figure 2 shows the number of environmental laws countries adopted between 1990 and 2013 for the five most frequently addressed issue areas as well as the total number of environmental laws. There is a clear pattern over time that can best be approximated by a linear trend, suggesting that countries have continuously increased their awareness and willingness to address environmental challenges.

While FAOLEX is, to the best of our knowledge, the most comprehensive and up-to-date database on countries' adoption of environmental legislation, some limitations remain. Owing to resource constraints, there may be a selection

2. We gratefully acknowledge Andrés Vatter Rubio and Mariusz Suchorowski of the FAO for kindly assisting us with adjusting FAOLEX data for statistical purposes.

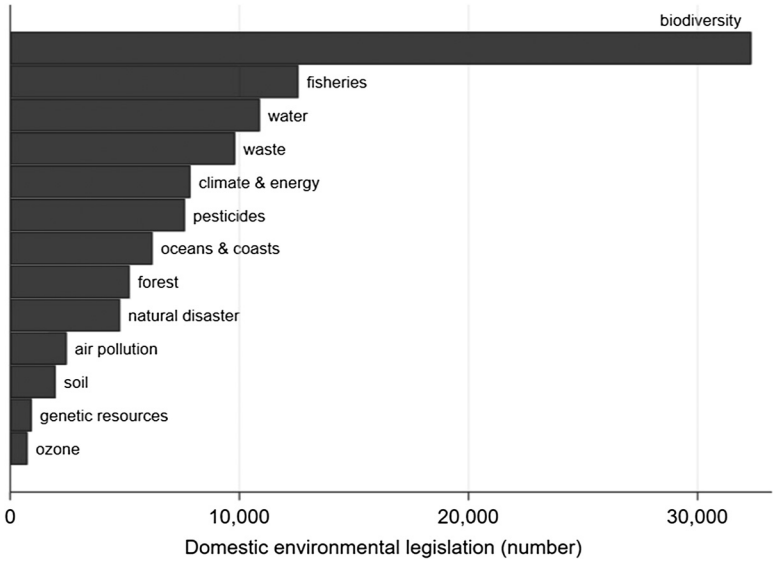


**Figure 1**
Number of Environmental Laws Introduced, 1990–2013, by Issue Area

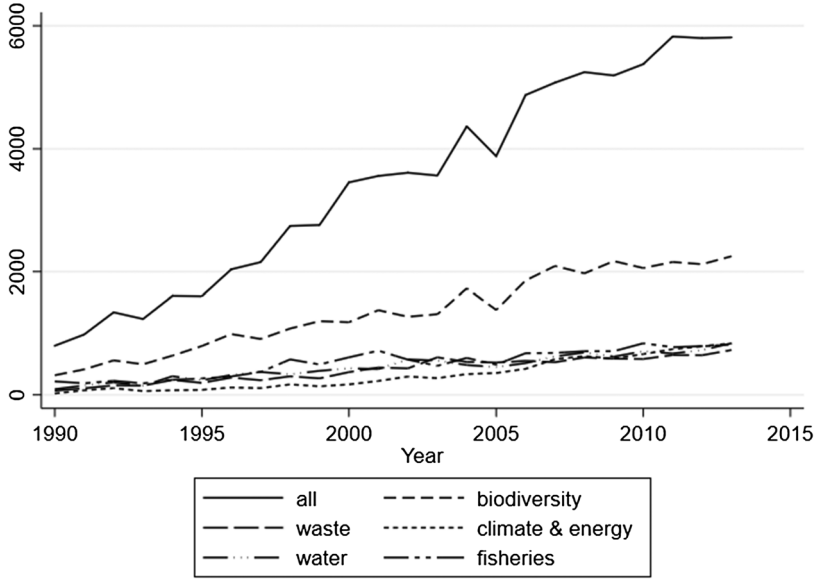


**Figure 2**
Number of Environmental Laws Adopted, 1990–2013

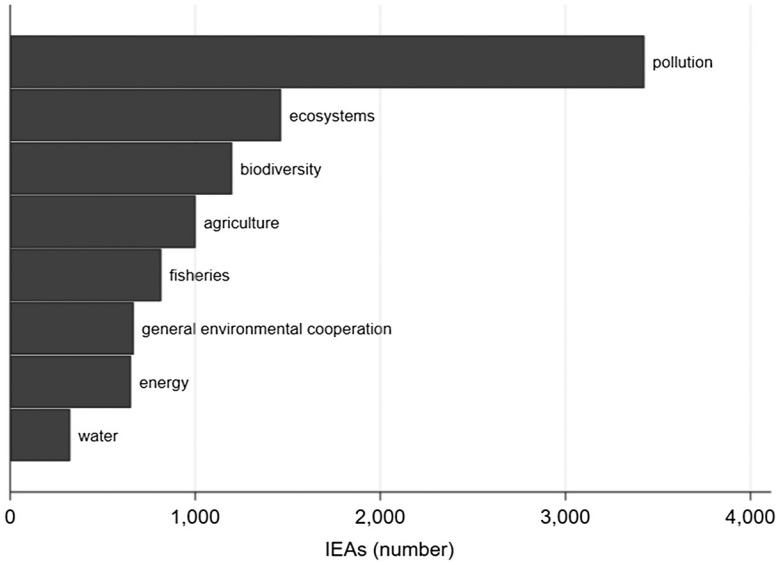


**Figure 3**
Number of IEAs Entered into Force for a Party, 1990–2013, by Issue Area

bias in favor of countries where legislation is more readily available, for example, when it is published online and written in a common language. Moreover, data points for federal countries may be inflated because some of the national legislation requires legislative change also at state or county level. We address these limitations through the choice of our estimation technique, as explained in more detail below.

Our main explanatory variable is a collection of IEAs derived from the International Environmental Agreements Database Project (IEADP) (Mitchell 2019).[3] It includes 2,242 agreements and protocols signed between 1815 and 2016 that are considered treaties in international law and whose primary purpose is to protect the environment. Of these treaties, 753 are related to fisheries, 282 to agriculture, 266 to freshwater, 228 to general environmental cooperation, 191 to pollution, 190 to energy, 178 to biodiversity, 130 to ecosystems, and 24 to other issues. Our variable is constructed by calculating the number of IEAs that entered into force in the three years after and before year *t*. Figure 3 shows how often countries adopted IEAs on the different issue areas between 1990 and 2013.

Data on PTAs with environmental provisions come from the Trade and Environment Database (TREND) (Morin et al. 2018).[4] The database includes a list and metadata on 689 trade agreements concluded between 1947 and

3. The International Environmental Agreements Database Project is available at https://iea.uoregon.edu/. We thank Ron Mitchell for providing us with access to his collection of IEAs as well as James Hollway, Jörg Balsiger, and Lorris Germann for data on additional IEAs.
4. TREND is available at www.trend.ulaval.ca.

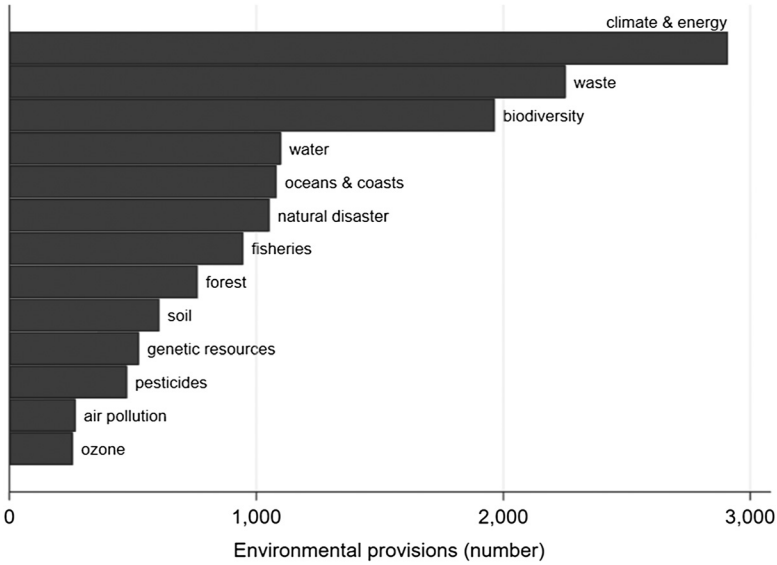


**Figure 4**
Number of PTAs' Environmental Provisions Entered into Force for a Party, 1990–2013, by Topic Area

2016, which was collected by the Design of Trade Agreements project (Dür et al. 2014). From the collection of PTAs, TREND provides information on the occurrence of 286 different types of environmental provisions, including 59 specific environmental issues, such as coral reefs, migratory species, soil erosion, and mercury. We construct our explanatory variables as the number of environmental provisions a country adopts through its PTAs that enter into force in the three years after and before the reference year *t*. Figure 4 shows the distribution of the number of provisions adopted between 1990 and 2013 across the various issue areas.[5] To the best of our knowledge, IEADP and TREND are by far the most comprehensive, reliable, and up-to-date databases on IEAs and PTAs with environmental provisions, respectively.

We control for a range of other factors that may have an impact on the adoption of new environmental legislation. To take into account the economic situation of the country as it was found to affect the capacity for treaty implementation (Gray 2014) and the propensity to adopt environmental regulations (Porter 1999), we include GDP growth and openness to trade from the World Development Indicators (World Bank 2017).[6] To approximate the political

5. This means that the graph is not necessarily showing the frequency in which specific issue areas are addressed in PTAs but rather how many countries commit to these issue areas through their PTAs.
6. The literature on the effects of PTAs finds that PTA formation increases trade flows and openness to trade, potentially leading to an endogeneity problem by including this variable in our model (reverse causality). However, our PTA variable only measures environmental content in

**Table 1**
Descriptive Statistics

| *Variable* | *Obs.* | *Mean* | *Std.* | *Min.* | *Max.* |
|---|---|---|---|---|---|
| Environmental laws | 5,544 | 14.95 | 33.31 | 0 | 424 |
| Environmental provisions (EPs) before PTA entry into force (e.i.f.) | 4,851 | 24.75 | 42.19 | 0 | 260 |
| EPs (after PTA e.i.f.) | 4,851 | 18.35 | 31.97 | 0 | 211 |
| International environmental agreements (IEAs) before e.i.f. | 4,851 | 7.77 | 6.85 | 0 | 56 |
| IEAs (after e.i.f.) | 4,851 | 5.86 | 5.51 | 0 | 50 |
| Growth | 4,559 | 3.66 | 6.78 | −64.05 | 149.97 |
| Trade openness | 4,131 | 0.73 | 17.46 | −519.59 | 303.88 |
| GHG emissions | 3,971 | 3.78 | 124.28 | −3,849.65 | 3,726.78 |
| Checks and balances | 3,563 | 0.02 | 0.80 | −13 | 14 |
| Democracy | 3,599 | 0.13 | 1.52 | −15 | 15 |
| Civil society participation | 3,697 | 0.57 | 4.38 | −32.921 | 50.960 |
| Global legislative changes | 5,313 | 14.51 | 7.02 | 3.46 | 25.22 |
| Neighbors' legislative changes | 4,986 | 14.61 | 17.01 | 0 | 167.34 |
| Year/time trend | 5,544 | 2,001.50 | 6.92 | 1,990 | 2,013 |
| PTA partner GDP (max., US$ bn) | 5,506 | 3,14.48 | 1,162.45 | 0 | 15,542.16 |
| PTA partner share in total exports (max.) | 5,544 | 0.014 | 0.062 | 0 | 0.911 |
| PTA partner environmental credibility (max.) | 5,543 | 0.058 | 0.112 | 0 | 0.420 |

environment, which can also affect treaty implementation (Carbonell and Allison 2015), we control for the level of democracy and the number of veto players that might block policy changes (checks and balances), obtained from the Quality of Government Standard data set (Teorell et al. 2017). Civil society also plays an important role in promoting environmental protection, so we include a composite civil society participation index obtained from Varieties of Democracy data set (Coppedge et al. 2016). It captures whether civil society

PTAs. We would expect a much weaker effect of green provisions on trade openness than of PTA formation on trade openness.

organizations are routinely consulted by policy makers, to what extent people are participating in these organizations, and whether candidates in the legislative are selected in a decentralized way. As a proxy for the environmental state of the country, we include total greenhouse gas emissions (World Development Indicators). Note that we measure all explanatory variables in changes, as the dependent variable (number of new environmental laws) also measures a change with regard to the previous period.

Instead of being a reaction to international treaties, changes in domestic environmental legislation may be caused by global normative shifts. For example, an issue area may attract attention at a global scale, causing countries to review both their national legislation and adapt their treaty making. In addition, countries may imitate others who have changed their environmental legislation. To test whether this type of policy diffusion is present for environmental legislation, we include the average number of legislative environmental changes (in the respective issue area) adopted by other countries in the past year. To capture global normative shifts, we include the world average of legislative environmental changes, and to measure contagion among neighbors, we only include neighboring countries with a capital no further than 2000 kilometers away.

Finally, in some specifications, we capture PTA partner characteristics, including PTA partners' GDP (World Bank 2017), the share of PTA partners in the respective country's total exports (UN Comtrade) (United Nations 2018), and PTA partners' environmental credibility approximated by the share of MEAs ratified (IEADP) (Mitchell 2019). Table 1 presents the descriptive statistics.

We estimate the relationship between international treaties and domestic environmental legislation using a cross-country panel from 1990 to 2013. Our dependent variable $\gamma_{it}$ is the number of environmental laws a country $i$ introduced in year $t$. Due to the nature of our dependent variable, which consists of nonnegative integers or "counts," we estimate a Poisson model with the conditional mean specified as

$$\begin{aligned}&\mathrm{E}(\gamma_{it}|\boldsymbol{X}_{it}, \mathrm{EPs\_before\_eif}_{it}, \mathrm{EPs\_after\_eif}_{it}, \mathrm{IEAs\_before\_eif}_{it}, \mathrm{IEAs\_after\_eif}_{it}, \alpha_i, t)\\ &\quad = \exp(\beta_{11}\mathrm{EPs\_before\_eif}_{it} + \beta_{12}\mathrm{EPs\_after\_eif}_{it} + \beta_{21}\mathrm{IEAs\_before\_eif}_{it}\\ &\qquad + \beta_{22}\mathrm{IEAs\_after\_eif}_{it} + \boldsymbol{X}_{it}\delta + \alpha_i + t)\end{aligned} \tag{1}$$

The variables $\mathrm{EPs\_before\_eif}_{it}$ and $\mathrm{IEAs\_before\_eif}_{it}$ are defined as the number of PTA environmental provisions and the number of IEAs, respectively, that entered into force in country $i$ in year $t$ and the three years after year $t$. The coefficients $\beta_{11}$ and $\beta_{21}$ therefore measure the relationship between environmental legislation and international agreements *before* their entry into force. The variables $\mathrm{EPs\_after\_eif}_{it}$ and $\mathrm{IEAs\_after\_eif}_{it}$ are defined as the number of PTA environmental provisions and the number of IEAs, respectively, that entered into

force in country $i$ within the three years before year $t$. The coefficients $\beta_{12}$ and $\beta_{22}$ therefore measure the relationship between environmental legislation and international agreements *after* their entry into force. $\boldsymbol{X}_{it}$ includes the control variables; $\alpha_i$ includes the time-invariant, unobserved country characteristics; and $t$ captures the linear time trend.

One advantage of the Poisson model is that it does not suffer from the incidental parameters problem. It is possible to consistently estimate the coefficients on the main regressors in a nonlinear panel while eliminating the time-invariant, unobserved individual effects by quasi-differencing. Another advantage of the Poisson estimator is that it is consistent even when the data are not Poisson distributed, as long as the conditional mean is correctly specified. Therefore, even though the Poisson estimator assumes equidispersion, that is, equality between the mean and the variance, we prefer the robust Poisson estimator over the alternative negative binomial model that explicitly models overdispersion, since the negative binomial model does not eliminate unobserved heterogeneity in a panel setting unless very specific assumptions are met (Allison and Waterman 2002; Guimarães 2008).

We opt for fixed effects estimation for three main reasons. First, we are mostly interested in countries' reactions over time to signing up to environmental provisions in PTAs (the "within" variation in the data) rather than explaining differences in adoption of environmental legislation across countries (the "between" variation). Second, we have reason to believe that unobserved country-specific characteristics influence the adoption of environmental legislation. Fixed effects allow us to control for time-invariant, unobserved country characteristics and eliminate a potential source of selection bias. Third, fixed-effects estimation mediates some of the limitations of the data on environmental legislation that we have outlined above. We reasonably assume that these data limitations that stem from legislative practices, federal political systems, and official languages persist for the same countries across time. As long as they are time invariant for the estimation period of approximately twenty years, they will be subsumed via the fixed effects and will not affect our estimation of the variation within countries over time.

As illustrated in Figure 2, the number of environmental policies that countries adopted between 1990 and 2013 increased notably over time. The data suggest a linear trend that can be due to both rising environmental awareness and the data collection procedure, which relies mostly on legal texts published online. To control for these factors—or any other unobserved variables that increase linearly over time—we include a linear time trend in our models.

Finally, we acknowledge that, despite our fixed-effects approach, we cannot completely rule out endogeneity from reverse causality or self-selection. Countries that have achieved strong domestic environmental legislation may try to "export" their rules via international agreements (DeSombre 2000), and countries in favor of domestic environmental change may self-select into these agreements. However, these methodological problems are assumed to be less

pronounced for developing countries than for high-income countries and less pronounced for PTAs than for IEAs. Developing countries agree to sign PTAs for economic or security reasons, but presumably much less so for environmental reasons. Several environmental provisions originate from the template agreements of high-income countries and are not always open to negotiation. Thus developing countries presumably accept PTA environmental commitments for reasons that are unrelated to their domestic environmental law. Even if they use PTAs to push through domestic reforms, and even if developing countries adopt environmental legislation to be attractive PTA partners for the European Union or United States, this would still measure the effect of treaties on domestic law (despite the fact that domestic change would occur before treaty signature or entry into force). We therefore argue that self-selection causes less of a problem for developing countries and green PTAs, which is one of the reasons why we include environmental provisions in PTAs alongside IEAs in our analysis.

## Empirical Analysis

The results from our Poisson regressions are reported in Table 2. Column 1 presents the results for all countries. We find a positive and significant relationship between entry into force of IEAs and domestic environmental legislation. When disaggregating by country group, we also find that PTA environmental provisions are positively related to changes in environmental legislation (column 2). Indeed, we find the results for PTAs to be more robust than they are for IEAs (see robustness check below), and this is in line with $H_1$, which posits that the relation between international agreements and domestic legislation is clearer in the case of PTAs than in the case of IEAs.

In accordance with $H_2$, IEAs and PTAs with environmental provisions are more strongly related to environmental legislative change in developing countries than in high-income countries. We find a positive and significant coefficient only for developing countries (column 2). Moreover, and in line with $H_3$, the relationship between IEAs and PTAs with environmental provisions and environmental legislative change in developing countries is stronger before than after entry into force.

In addition, we investigated whether it matters with whom countries sign their international agreements. We define North–North agreements as being signed among high-income countries only, North–South agreements as being signed between at least one high-income country and at least one developing country, and South–South agreements as being signed among developing countries only. Table 3 reports our findings.

According to $H_4$, we expect IEAs and PTAs with environmental provisions to be more strongly related to environmental legislative change when they are signed with high-income partners. The evidence to support this hypothesis is relatively weak. In column 4, we only find a positive and significant relationship for North–South IEAs but not for PTAs. For South–South agreements, there

**Table 2**
Explaining Environmental Legislation (Poisson, Coefficients)

| | *Countries* | | |
|---|---|---|---|
| | *(1) All* | *(2) Developing* | *(3) High Income* |
| EPs (before PTA e.i.f.) | −0.000 | 0.002** | −0.003** |
| | (0.001) | (0.001) | (0.001) |
| EPs (after PTA e.i.f.) | −0.000 | 0.000 | −0.001 |
| | (0.001) | (0.002) | (0.001) |
| IEAs (before e.i.f.) | 0.008* | 0.011* | 0.002 |
| | (0.004) | (0.006) | (0.005) |
| IEAs (after e.i.f.) | 0.005* | 0.004 | 0.003 |
| | (0.003) | (0.006) | (0.003) |
| Growth | 0.011 | 0.008 | 0.018 |
| | (0.009) | (0.010) | (0.013) |
| Trade openness | 0.001 | 0.002 | 0.001 |
| | (0.002) | (0.002) | (0.003) |
| GHG emissions | −0.120*** | −0.123*** | 0.100 |
| | (0.030) | (0.036) | (0.332) |
| Checks and balances | −0.020 | −0.020 | −0.019 |
| | (0.014) | (0.018) | (0.024) |
| Democracy | 0.006 | 0.013 | −0.020 |
| | (0.017) | (0.017) | (0.029) |
| Civil society participation | 0.014*** | 0.017*** | 0.005 |
| | (0.005) | (0.005) | (0.017) |
| Global legislative changes | −0.000 | 0.012 | 0.009 |
| | (0.017) | (0.027) | (0.021) |
| Neighbors' legislative changes | 0.003 | 0.003 | −0.009** |
| | (0.002) | (0.003) | (0.004) |
| Year/time trend | 0.075*** | 0.060** | 0.108*** |
| | (0.018) | (0.027) | (0.020) |
| Country fixed effects | Yes | Yes | Yes |
| Observations | 2,403 | 1,767 | 636 |
| Number of id | 146 | 108 | 38 |

*Note.* Robust standard errors are in parentheses.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.1$.

**Table 3**
Explaining Environmental Legislation, by Treaty Type (Poisson, Coefficients)

| | *Countries/Treaties* | | | |
|---|---|---|---|---|
| | *(4) Developing/ North–South* | *(5) Developing/ South–South* | *(6) High Income/ North–South* | *(7) High Income/ North–North* |
| EPs (before PTA e.i.f.) | 0.001 | 0.006** | −0.002** | −0.001 |
| | (0.001) | (0.002) | (0.001) | (0.001) |
| EPs (after PTA e.i.f.) | 0.001 | −0.003 | −0.002** | 0.003*** |
| | (0.002) | (0.002) | (0.001) | (0.001) |
| IEAs (before e.i.f.) | 0.017** | 0.005 | 0.005 | 0.020 |
| | (0.008) | (0.006) | (0.006) | (0.027) |
| IEAs (after e.i.f.) | 0.013** | −0.006 | 0.005 | -0.035 |
| | (0.006) | (0.011) | (0.005) | (0.022) |
| Growth | 0.010 | 0.010 | 0.016 | 0.022 |
| | (0.009) | (0.010) | (0.014) | (0.014) |
| Trade openness | 0.003 | 0.003 | −0.001 | −0.004 |
| | (0.002) | (0.002) | (0.003) | (0.004) |
| GHG emissions | −0.123*** | −0.134*** | 0.081 | 0.118 |
| | (0.032) | (0.038) | (0.325) | (0.335) |
| Checks and balances | −0.024 | −0.016 | −0.011 | −0.019 |
| | (0.020) | (0.014) | (0.028) | (0.028) |
| Democracy | 0.019 | 0.014 | −0.022 | −0.043 |
| | (0.015) | (0.016) | (0.030) | (0.026) |
| Civil society participation | 0.015*** | 0.016*** | 0.008 | 0.002 |
| | (0.005) | (0.005) | (0.017) | (0.017) |
| Global legislative changes | 0.017 | 0.011 | −0.003 | −0.009 |
| | (0.027) | (0.027) | (0.022) | (0.018) |
| Neighbors' legislative changes | 0.004** | 0.002 | -0.004 | -0.006 |
| | (0.002) | (0.003) | (0.004) | (0.005) |
| Year/time trend | 0.053** | 0.057** | 0.116*** | 0.100*** |
| | (0.026) | (0.027) | (0.026) | (0.021) |
| Observations | 1,767 | 1,767 | 636 | 636 |
| Number of id | 108 | 108 | 38 | 38 |

*Note.* Robust standard errors are in parentheses.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.1$.

seems to be a stronger link between PTA environmental provisions and legislative change prior to their entry into force (column 5). Potentially, developing countries make environmental commitments vis-à-vis high-income countries before including them in their South–South agreements.

For high-income countries, we have reported a negative relationship between treaties and domestic legislation in Table 2 (column 3). One possible explanation for this puzzling finding is that high-income countries only react to treaties that they sign with other high-income countries. Indeed, we find a positive and significant relationship between regulatory change in high-income countries and environmental provisions in PTAs after their entry into force when looking only at North–North agreements (column 7).

In order to shed light on $H_5$, we also disaggregate by environmental issue area. We choose the level of disaggregation such that the data are detailed enough to correctly match the issue areas to each other and broad enough to manage the number of zeros in our data. For example, we test whether IEA and PTA provisions on air pollution are associated with domestic environmental legislation on air pollution (Table 4, column 11). The results for developing countries for all thirteen issue areas are reported in Tables 4a and 4b.

There is a significant variation both regarding the significance and the size of the coefficients; one additional IEA or environmental provision is related to a change in the number of environmental laws by between less than zero and positive 35 percent. For example, for one additional environmental provision about to enter into force, we find a strong influence on legislation in the issue areas of water (16.4 percent), air (35.4 percent), soil (30.6 percent), and pesticides (28.3 percent). We find a much smaller relationship for the environmental issue areas of climate and energy (6.0 percent), genetic resources (2.7 percent), and waste (7.3 percent) and no significant relationship for biodiversity, ozone, fisheries, forest, natural disasters, or oceans and coasts. A number of these disaggregated, issue-specific results are in line with $H_5$ that IEAs and PTAs with environmental provisions will be most effective in promoting legislative change in issue areas that are local, socially attractive, and benign rather than global, socially costly, and malign. For example, the relation between international treaties and domestic legislation is stronger in the case of clean water and clean air than in the case of climate change.

Note also that most of the coefficients are much larger than the coefficients we have reported for the aggregate case in Table 2. This is not surprising: we would expect a much clearer relationship between treaties with commitments on air and domestic legislation on air than with lumping everything together. In that sense, the results highlight the value added by disaggregating by topic areas and the important contribution this article makes to the literature.

We do not find consistent results on the role of global normative shifts or contagion across countries for environmental legislation. Possibly, PTAs are more likely to be influenced by other countries' actions than are IEAs, as they are by nature designed to regulate relations between countries. A country's environmental

**Table 4a**
Explaining Environmental Legislation in Developing Countries, by Issue Area (Poisson, Coefficients)

| | *Topics* | | | | | | |
|---|---|---|---|---|---|---|---|
| | *(8) Climate and Energy* | *(9) Biodiversity* | *(10) Water* | *(11) Air Pollution* | *(12) Ozone* | *(13) Soil* | *(14) Fisheries* |
| EPs (before PTA e.i.f.) | 0.060** | 0.009 | 0.164*** | 0.354*** | –0.086 | 0.306*** | 0.025 |
| | (0.029) | (0.007) | (0.045) | (0.123) | (0.060) | (0.107) | (0.017) |
| EPs (after PTA e.i.f.) | 0.112 | 0.017 | 0.065 | 0.008 | 0.099 | 0.056 | 0.047 |
| | (0.076) | (0.012) | (0.057) | (0.143) | (0.195) | (0.096) | (0.058) |
| IEAs (before e.i.f.) | 0.016 | –0.001 | 0.138* | 0.128*** | 0.047* | –0.037 | 0.031 |
| | (0.030) | (0.039) | (0.084) | (0.030) | (0.029) | (0.049) | (0.033) |
| IEAs (after e.i.f.) | –0.027 | 0.021 | 0.152** | 0.032 | 0.043 | –0.097** | –0.019 |
| | (0.021) | (0.063) | (0.076) | (0.027) | (0.036) | (0.039) | (0.061) |
| Growth | –0.024*** | 0.003 | 0.009 | 0.009 | 0.019 | –0.009 | 0.010 |
| | (0.007) | (0.016) | (0.008) | (0.010) | (0.015) | (0.010) | (0.008) |
| Trade openness | –0.003 | 0.002 | 0.002 | 0.001 | 0.009 | –0.003 | –0.006* |
| | (0.004) | (0.002) | (0.003) | (0.004) | (0.007) | (0.005) | (0.003) |
| GHG emissions | 0.046 | –0.227*** | –0.028 | –0.212 | –0.775** | –0.247*** | –0.036 |
| | (0.050) | (0.085) | (0.076) | (0.225) | (0.340) | (0.074) | (0.057) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Checks and balances | −0.051 | −0.048 | −0.021 | 0.011 | −0.070 | −0.043 | 0.028 |
| | (0.069) | (0.040) | (0.015) | (0.016) | (0.111) | (0.063) | (0.033) |
| Democracy | −0.057 | 0.011 | 0.024 | −0.034 | 0.087* | 0.034 | 0.036 |
| | (0.072) | (0.025) | (0.039) | (0.048) | (0.048) | (0.032) | (0.024) |
| Civil society participation | 0.006 | 0.023*** | 0.003 | 0.020 | −0.008 | −0.011 | 0.009 |
| | (0.013) | (0.007) | (0.013) | (0.018) | (0.031) | (0.009) | (0.008) |
| Global legislative changes | −0.580** | −0.025 | 0.290** | −0.251 | 0.533 | −0.684 | 0.078 |
| | (0.261) | (0.062) | (0.140) | (0.646) | (1.989) | (0.725) | (0.149) |
| Neighbors' legislative changes | 0.086 | 0.015 | −0.022 | −0.037 | −0.819* | 0.034 | 0.001 |
| | (0.087) | (0.010) | (0.035) | (0.127) | (0.440) | (0.078) | (0.026) |
| Year/time trend | 0.174*** | 0.070*** | 0.019 | 0.089*** | 0.091*** | 0.048*** | 0.043** |
| | (0.042) | (0.021) | (0.018) | (0.024) | (0.028) | (0.017) | (0.021) |
| Country fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 303 | 1,767 | 1,727 | 1,319 | 1,160 | 1,647 | 1,661 |
| Number of id | 43 | 108 | 105 | 78 | 68 | 98 | 101 |

*Note.* Robust standard errors are in parentheses.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.1$.

**Table 4b**
Environmental Legislation in Developing Countries, by Issue Area (Poisson, Coefficients)

| | *Topics* | | | | | |
|---|---|---|---|---|---|---|
| | *(15) Forest* | *(16) Natural Disaster* | *(17) Genetic Resources* | *(18) Waste* | *(19) Pesticides* | *(20) Oceans and Coasts* |
| EPs (before PTA e.i.f.) | 0.054 | 0.008 | 0.027* | 0.073*** | 0.283*** | 0.024 |
| | (0.036) | (0.063) | (0.015) | (0.017) | (0.066) | (0.034) |
| EPs (after PTA e.i.f.) | 0.017 | −0.062 | −0.059 | −0.000 | 0.090 | −0.059 |
| | (0.082) | (0.046) | (0.086) | (0.032) | (0.073) | (0.071) |
| IEAs (before e.i.f.) | 0.276 | 0.070 | 0.181*** | 0.046** | 0.111*** | 0.009 |
| | (0.727) | (0.043) | (0.059) | (0.018) | (0.031) | (0.040) |
| IEAs (after e.i.f.) | −0.017 | 0.054*** | 0.083 | 0.004 | 0.033 | −0.062** |
| | (0.060) | (0.019) | (0.082) | (0.019) | (0.039) | (0.030) |
| Growth | 0.012* | −0.006 | 0.003 | 0.006 | 0.005 | 0.008 |
| | (0.007) | (0.010) | (0.012) | (0.009) | (0.008) | (0.011) |
| Trade openness | −0.009*** | 0.001 | −0.008 | −0.001 | −0.000 | 0.001 |
| | (0.003) | (0.003) | (0.008) | (0.003) | (0.004) | (0.003) |
| GHG emissions | −0.197* | −0.058 | 0.040 | −0.045 | −0.093** | 0.014 |
| | (0.108) | (0.076) | (0.267) | (0.070) | (0.042) | (0.083) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Checks and balances | −0.030 | −0.018 | −0.062** | −0.018 | −0.026 | 0.000 |
| | (0.030) | (0.029) | (0.028) | (0.015) | (0.018) | (0.023) |
| Democracy | −0.082 | 0.017 | −0.019 | 0.003 | 0.015 | 0.029 |
| | (0.064) | (0.024) | (0.051) | (0.024) | (0.027) | (0.021) |
| Civil society participation | 0.033** | −0.009 | 0.016 | −0.011* | 0.021** | −0.008 |
| | (0.016) | (0.008) | (0.014) | (0.006) | (0.010) | (0.008) |
| Global legislative changes | −0.006 | −0.932*** | −1.553 | −0.045 | 0.361 | −0.005 |
| | (0.037) | (0.339) | (1.339) | (0.165) | (0.245) | (0.494) |
| Neighbors' legislative changes | 0.100** | 0.064 | −0.219 | 0.016 | −0.022 | 0.033 |
| | (0.049) | (0.090) | (0.346) | (0.026) | (0.049) | (0.066) |
| Year/ time trend | 0.040 | 0.120*** | 0.089*** | 0.056** | 0.015 | 0.043 |
| | (0.033) | (0.023) | (0.025) | (0.022) | (0.024) | (0.031) |
| Country fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 1,646 | 1,621 | 1,490 | 1,713 | 1,704 | 1,690 |
| Number of id | 99 | 98 | 88 | 104 | 103 | 103 |

*Note.* Robust standard errors are in parentheses.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.1$.

legislation seems to be affected by its own international commitments but not so much by other countries' adoption of national environmental laws.

We acknowledge that observing legislative change before entry into force does not necessarily imply that the direction of causality goes from the international to the national level. There might not be a treaty effect on legislation but instead a legislation effect on treaties. In some cases, a state will first adopt a domestic environmental law and then try to diffuse its domestic standards globally, either because of their perceived intrinsic normative value or to level the playing field with countries with lower standards. This mixed causal relationship between international negotiation and domestic legislation is particularly likely for powerful, influential, and leading countries in environmental regulation. However, for high-income countries, we only have positive results of treaties after their entry into force. The flow of causality is presumably clearer for developing countries. Since developing countries are typically not leaders of international negotiations, it is unlikely that they will project their domestic regulation globally.

To better isolate the causal effect of international treaties and reduce selection bias from countries that may self-select into IEAs or green PTAs (e.g., with the intention of promoting environmental policy change at home), we employ propensity score matching as a robustness check. For each observation in the sample we estimate the likelihood or "propensity" to receive treatment (using GDP, GDPpc, trade openness, level of democracy, number of veto players, and greenhouse gas emissions as explanatory factors). Treatment is defined as signing up to at least one (or five) IEAs or environmental provisions in PTAs. In a next step, we match observations with similar propensity scores (with a deviation of no more than 0.1). The average treatment effect (ATT) then estimates the difference in the outcome of interest (here number of environmental laws adopted in the five years around treatment $[t - 2, t + 2]$) between the treated unit and the matched control units (three nearest neighbors). Intuitively, the technique allows us to isolate the effect of treaties by comparing observations in the data that differ regarding the treatment but are otherwise very similar.

We find a significant effect of treaties on legislative activity for PTA environmental provisions, which provides additional evidence for a causal effect of green trade agreements on environmental legislation (Table 5). We do not find an effect for IEAs. The reason may be that the matching estimator does not perform very well for IEAs: the model predicting the propensity scores has a low goodness of fit. However, as we have pointed out earlier, it is also possible that there is a higher degree of self-selection into IEAs, meaning that the direct effect of IEAs on environmental legislation is less clear.

We acknowledge that propensity score matching is not a perfect cure against endogeneity problems in our setting: it forces us to transform the dependent variable into a binary indicator, resulting in a loss of information, and it hinges on the assumption of selection on observables.

In addition, we replicate our results from Table 3 using treaty signature dates instead of entry-into-force dates. This allows us to further investigate the

**Table 5**
Results of Propensity Score Matching

| Treatment | *ATT (at least one EP)* | *ATT (at least 5 EPs)* | *ATT (at least one IEA)* | *ATT (at least five IEAs)* |
|---|---|---|---|---|
| EPs (at least one) | 35.32*** | | | |
| | (9.71) | | | |
| EPs (at least five) | | 48.24*** | | |
| | | (10.73) | | |
| IEAs (at least one) | | | 10.53 | |
| | | | (10.91) | |
| IEAs (at least five) | | | | −3.28 |
| | | | | (10.09) |
| Observations | 2,792 | 2,792 | 2,792 | 2,792 |
| R-squared (goodness of fit in probit model/selection stage) | 0.1105 | 0.1173 | 0.0498 | 0.0404 |
| Mean bias after matching (%) | 4.7 | 4.4 | 7.5 | 3.2 |

*Note.* Standard errors (proposed by Abadie and Imbens 2006) are in parentheses.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.1$.

timing of the effect and detect potential reverse causality. If environmental legislation does indeed change as a reaction to treaties, we would expect legal action not only before entry into force but also after signature. The results in Table 6 indicate that countries only react to PTAs after signature if they are signed with Northern (high-income) partners, suggesting that some power dynamics might be at play. IEAs only seem to have an effect on legislation before signature. This substantiates our suspicion that countries might self-select into IEAs after they have passed domestic environmental legislation, while this does not seem to be the case for green PTAs.

To better identify the underlying causal mechanism, we also test whether the effect of environmental provisions before entry into force in developing countries depends on their PTA partner characteristics, including economic power, the importance of the partners' shares in total exports, and environmental credibility. However, we do not find evidence in support of our expectations that partner characteristics make green PTAs more effective: the interaction terms in Table 7 are not significantly different from zero.

**Table 6**
Poisson Results Using Signature Dates, by Country Group and Treaty Type

| | *Countries/Treaties* | | | |
|---|---|---|---|---|
| | *(21) Developing/ North–South* | *(22) Developing/ South–South* | *(23) High income/ North–South* | *(24)High income/ North–North* |
| EPs (before PTA e.i.f.) | 0.002* | 0.007** | −0.003*** | −0.000 |
| | (0.001) | (0.003) | (0.001) | (0.002) |
| EPs (after PTA e.i.f.) | 0.002* | 0.003 | −0.001 | 0.002* |
| | (0.001) | (0.002) | (0.001) | (0.001) |
| IEAs (before e.i.f.) | 0.018** | 0.019** | 0.018* | 0.034 |
| | (0.009) | (0.008) | (0.010) | (0.036) |
| IEAs (after e.i.f.) | −0.001 | −0.002 | −0.007 | −0.011 |
| | (0.008) | (0.017) | (0.012) | (0.032) |
| Growth | 0.012 | 0.010 | 0.021* | 0.026* |
| | (0.009) | (0.009) | (0.012) | (0.014) |
| Trade openness | 0.003 | 0.003 | −0.002 | −0.005 |
| | (0.002) | (0.002) | (0.004) | (0.003) |
| GHG emissions | −0.121*** | −0.141*** | 0.172 | 0.129 |
| | (0.032) | (0.040) | (0.282) | (0.332) |
| Checks and balances | −0.017 | −0.014 | −0.011 | −0.009 |
| | (0.021) | (0.017) | (0.023) | (0.028) |
| Democracy | 0.021 | 0.013 | −0.024 | −0.024 |
| | (0.014) | (0.015) | (0.031) | (0.031) |
| Civil society participation | 0.015*** | 0.017*** | 0.003 | 0.002 |
| | (0.005) | (0.005) | (0.020) | (0.018) |
| Global legislative changes | 0.017 | 0.018 | 0.004 | 0.002 |
| | (0.031) | (0.028) | (0.018) | (0.022) |
| Neighbors' legislative changes | 0.002 | 0.001 | −0.007 | −0.006 |
| | (0.003) | (0.003) | (0.005) | (0.004) |
| Year/time trend | 0.050* | 0.057** | 0.122*** | 0.093*** |
| | (0.030) | (0.027) | (0.022) | (0.027) |
| Observations | 1,767 | 1,767 | 636 | 636 |
| Number of id | 108 | 108 | 38 | 38 |

*Note.* Robust standard errors are in parentheses.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.1$.

**Table 7**
Poisson Results Including Interaction Terms for PTA Partner Characteristics

| | *Countries* | | |
|---|---|---|---|
| | *(25) Developing* | *(26) Developing* | *(27) Developing* |
| EPs (before PTA e.i.f.) | 0.002** | 0.002** | 0.003*** |
| | (0.001) | (0.001) | (0.001) |
| PTA partners' GDP | 0.000 | | |
| | (0.000) | | |
| Interaction between EPs × PTA Partner GDP | −0.000 | | |
| | (0.000) | | |
| PTA partners' share in total exports | | 0.476* | |
| | | (0.267) | |
| Interaction between EPs × PTA Partner Export Share | | −0.001 | |
| | | (0.004) | |
| PTA partners' environmental credibility | | | 0.202 |
| | | | (0.247) |
| Interaction between EPs × PTA Partner Environmental Credibility | | | −0.008 |
| | | | (0.005) |
| EPs (after PTA e.i.f.) | 0.000 | 0.000 | 0.000 |
| | (0.002) | (0.002) | (0.002) |
| IEAs (before e.i.f.) | 0.011* | 0.010* | 0.011* |
| | (0.006) | (0.006) | (0.006) |
| IEAs (after e.i.f.) | 0.003 | 0.004 | 0.003 |
| | (0.006) | (0.006) | (0.005) |
| Growth | 0.008 | 0.008 | 0.007 |
| | (0.010) | (0.010) | (0.010) |
| Trade openness | 0.002 | 0.002 | 0.002 |
| | (0.002) | (0.002) | (0.002) |
| GHG emissions | −0.122*** | −0.119*** | −0.117*** |
| | (0.036) | (0.035) | (0.034) |
| Checks and balances | −0.020 | −0.020 | −0.021 |
| | (0.018) | (0.017) | (0.017) |
| Democracy | 0.012 | 0.011 | 0.013 |
| | (0.017) | (0.016) | (0.017) |

**Table 7**
*(Continued)*

| | *Countries* | | |
|---|---|---|---|
| | *(25) Developing* | *(26) Developing* | *(27) Developing* |
| Civil society participation | 0.017*** | 0.018*** | 0.017*** |
| | (0.005) | (0.005) | (0.005) |
| Global legislative changes | 0.008 | 0.013 | 0.006 |
| | (0.028) | (0.028) | (0.028) |
| Neighbors' legislative changes | 0.003 | 0.003 | 0.003 |
| | (0.004) | (0.003) | (0.003) |
| Year/time trend | 0.062** | 0.058** | 0.065** |
| | (0.027) | (0.027) | (0.028) |
| Country fixed effects | Yes | Yes | Yes |
| Observations | 1,765 | 1,767 | 1,767 |
| Number of id | 108 | 108 | 108 |

*Note.* Robust standard errors are in parentheses.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.1$.

In sum, our results provide evidence for a meaningful link between green PTAs and environmental policies, with regulatory change, especially in developing countries, being in reaction to trade agreements with environmental provisions. Nevertheless, further research is required to better identify causal effects and the underlying mechanisms.

## Conclusions

Thanks to data sets that are significantly more comprehensive and fine grained than those previously used, this article investigates the relationship between national environmental legislation and international environmental commitments in a way that has not been possible before. In particular, we have measured treaty implementation directly without having to rely on environmental performance data as a proxy. We also go beyond the aggregate numbers and trace the link between international commitments on a specific environmental issue and legislations in this same issue area. What is more, by studying the implementation of PTAs and not simply of IEAs, and by focusing on developing countries, but also by using methodologies like matching, we reduce endogeneity problems traditionally associated with implementation studies.

Overall, our results support the hypothesis of a positive relationship between both IEAs and PTAs with domestic legislative change. In line with our expectations, we find the link between treaties and domestic legislation to be more robust for PTAs, mostly present in developing countries, and to be stronger before rather than after the treaties' entry into force. When we link treaties and environmental legislation by environmental issue areas, the disaggregation yields a substantial variation among issue areas but displays a pattern that shows a stronger connection in the case of local, socially attractive, and benign issue areas such as air quality. We acknowledge that the domestic implementation of international commitments is neither necessary nor sufficient to prove regime effectiveness in terms of improved environmental outcomes. The fact that we observe a positive link between treaties and domestic legislative change does not mean that the new regulation fully implements the treaty, is more stringent than the previous legislations, is de facto enforced, or leads to better environmental outcomes. Also, treaties can have an impact on the environment without impacting legislation by, for example, fostering civil society activity, increasing green aid, raising public awareness, or promoting governmental capacity. Nevertheless, we think it is a fair assumption that most environmental treaties call for legislative action as a necessary step to protect the environment.

While our research question is not easy to answer due to several difficult methodological challenges, it is crucial to better understand whether, when, and by which countries international agreements are implemented. Our analysis offers promising findings on environment-related treaties, based on a large-*N* study across many countries and issue areas. It also points to new research avenues. In particular, more research should be conducted to investigate the variation of treaty effects across levels of economic development and across environmental issue areas. Our findings should also be complemented by future quantitative or qualitative research to better identify the underlying causal mechanisms that make international agreements work. Insofar as IEAs and PTAs might generate change in terms of environmental performance even if they do not prompt legislative change, a logical next step is to investigate the link between these treaties and improved environmental outcomes across issue areas in order to study these potentially overlooked effects of treaties.

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