Environmental agreements as clubs: Evidence from a new dataset of trade provisions

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Abstract

Creating intergovernmental environmental clubs is a prominent policy proposal for addressing global environmental problems. According to their proponents, environmental clubs provide an incentive to join them and accept their environmental obligations by generating exclusive "club goods" for their members. Yet, the existing literature considers environmental clubs as a theoretical idea that still has to be put into practice. This article asks whether, in fact, the numerous international environmental agreements (IEAs) containing trade-related provisions provide club goods to their parties. It does so by investigating the effects of these provisions on trade flows among parties compared to flows with non-parties. We introduce an original dataset on 48 types of trade provisions in 2,097 IEAs that we make available with the publication of this article. Based on this new data and a panel of worldwide bilateral trade flows, we find evidence that existing IEAs and their trade-liberalizing content are associated with increased trade among their parties relative to trade with non-parties. We conclude from this finding that systems of IEAs provide club goods to their parties. Uncovering the existence of environmental clubs has significant methodological and policy implications. It is an important first step for future research on the actual effectiveness of clubs in attracting participation and raising environmental standards.

Keywords International Environmental Agreements (IEAs) · Trade and environment · Climate clubs · Club goods

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Do international environmental agreements (IEAs) create club goods for their parties? Club goods entail excludable benefits, that is, their consumption can be restricted to club members only (Buchanan, 1965). The quintessential example of an intergovernmental club is a free trade agreement: It provides its parties privileged trade access that is denied to third countries. However, it is unclear whether some IEAs provide similar club goods for their parties.[1]

More than 2000 IEAs exist around the world, addressing various environmental challenges such air pollution, overfishing and deforestation. It is imperative to investigate whether some of these IEAs provide club goods to their parties at a time when there is increasing enthusiasm for the creation of climate clubs (e.g., Victor, 2011; Weischer et al., 2012; Hovi et al., 2019; Falkner, 2016; Keohane et al., 2017; Green & Rudyk, 2020; Pihl, 2020; Falkner et al., 2022). The Nobel laureate William Nordhaus is one of the most well-known advocates of climate clubs. He argues that an agreement which links ambitious climate obligations with the provision of an exclusive club good would create incentives for parties to implement their commitments and for non-parties to join and accept its obligations (Nordhaus, 2015). From this perspective, a climate club can solve the ambition–participation dilemma that, according to some scholars, plagues international climate lawmaking (Bernauer et al., 2013; Gilligan, 2004; Tørstad, 2020). Yet, recent studies suggest that this policy proposal rests on shaky assumptions. The risk of free riders might have been overestimated as an obstacle to climate negotiation (Aklin & Mildenberger, 2020; Colgan et al., 2020), and the trade-off between climate ambition and participation is not clear-cut (Farias & Roger, 2023; Rowan, 2021). A significant impediment to this debate is the lack of empirical studies on environmental clubs, whether they are focused on climate change or any other environmental issue.[2]

Although some empirical studies have investigated environmental clubs created by or for non-state actors (Green, 2017; Potoski & Prakash, 2005; Prakash & Potoski, 2007), few have documented the existence of an intergovernmental environmental club. The great optimism that the idea of intergovernmental environmental clubs generates contrasts sharply with the lack of empirical evidence on them, including on their very existence. The idea of an IEA providing club goods to its parties is usually treated as a policy proposal that still lacks an empirical manifestation. As a consequence, the literature on environmental club is mainly based on theoretical inquiries, survey experiments, numerical simulations, and agent-based models (e.g., Cirone & Urpelainen, 2013; Eichner & Pethig, 2015; Gampfer, 2016; Hagen & Schneider, 2017; Hovi et al., 2019; Kemfert, 2004; Lessmann et al., 2009; Montagna et al., 2019; Sælen, 2016; Sprinz et al., 2018).[3]

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[1] The defining characteristics of an intergovernmental club is that it provides a club goods to its members. It is not the number of its parties. A club does not necessarily imply minilateralism. A multilateral agreement with more than one hundred parties, such as the General Agreement on Tariffs and Trade (GATT), can still be considered as an intergovernmental club.

[2] With a few exceptions, including studies on fisheries (e.g., DeSombre, 2008; Green & Rudyk, 2020) and fur seals (Barrett, 2011:7; Young & Osherenko, 1993: 224) the literature has paid relatively little attention to environmental clubs on issues other than climate.

[3] On the role of transfers to mitigate free-rider incentives of IEAs, see Carraro et al. (2006).

We adopt a different perspective and investigate the existence of environmental clubs in a population of 1,539 active IEAs. Since IEAs are highly heterogeneous, there is no reason to expect that they should all provide club goods to their parties. The most likely variable to determine the generation of a club good is the design of the agreement itself. There are several ways to create club goods in the context of an IEA, including by setting up a licensing pool to use patents on green technologies or institutionalizing a mutual assistance pact in case of extreme weather events (Kemfert, 2004). However, the use of trade measures is arguably the simplest and most effective way to generate club goods at the intergovernmental level (Nordhaus, 2020). Based on this assumption, we analyze whether trade provisions in the system of existing IEAs favor trade flows among parties relative to non-parties. If this is the case, then these IEAs provide a club good to their parties and, hence, these IEAs can be conceptualized as *de facto* environmental clubs.[4] To be clear, assessing whether IEAs provide club goods and assessing whether these club goods are sufficient to incentivize behavioral change are two different questions. This paper tackles the first question and does not assume that environmental clubs are effective at increasing environmental performance or attracting new members.

Making use of a novel dataset on the trade provisions of IEAs and a panel of worldwide bilateral trade flows, we uncover the existence of *de facto* environmental clubs. The extent of this club effect depends on the type of trade provisions included in the IEAs. We find that the inclusion of trade-liberalizing provisions is associated with increased trade flows among parties to IEAs relative to trade with non-parties. However, we do not find that trade-restrictive measures are associated with a similar club effect. We conclude that environmental clubs are far from being just an abstract policy proposal. Instead, they are already an existing feature of environmental governance thanks in part to the frequent inclusion of trade-liberalizing provisions in IEAs.

This article makes four contributions to the literature. First, we make available for future research a new dataset documenting the occurrence of 48 types of trade provisions in 2,097 IEAs. Some of these provisions are meant to restrict trade (e.g., on dangerous waste), whereas others liberalize trade (e.g., on environmental goods). Second, we estimate the effects of IEAs on trade flows while differentiating trade among parties and with non-parties. We find evidence that systems of IEAs create club goods by increasing trade flows among their parties relative to non-parties. Third, by identifying the type of provision associated with the creation of club goods, we provide insights into the design of future IEAs. Our findings suggest that treaty negotiators can use trade-liberalizing provisions, as the ones identified in our dataset, to provide a club good to their members. This is a policy-relevant finding considering that many political decision-makers are considering or moving towards the establishment of club-like approaches with a focus on trade-restrictive measures for non-members (e.g. the European Union's

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[4] We coined the term "*de facto* environmental clubs" because these IEAs are not explicitly called "clubs", and until now were not recognized as such, but their discriminatory effects nevertheless provide club goods to their members.

carbon border adjustment mechanism). Lastly, by showing that environmental clubs are already abundant, we provide the empirical basis for future research on whether these clubs favor behavioral changes. We show that IEAs can use trade provisions to create club goods of substantial value, but it remains to be seen if these club goods provide the incentive that proponents of environmental clubs are hoping for.

The remainder of this article is organized as follows. Section 1 outlines the relevant literature before Section 2 presents our theoretical framework. Section 3 introduces the dataset. Section 4 lays out the empirical approach before Section 5 presents and discusses the results of the analysis. The final section outlines policy implications and avenues for future research.

1 The literature on the trade effects of IEAs

The literature has paid scant attention to the effects that IEAs have on trade flows. Although there is a burgeoning literature on the environmental impacts of trade agreements (e.g., Bastiaens & Postnikov, 2017), the trade effects of IEAs remain underexplored. Some studies suggest that countries which are open to trade are more likely to conclude IEAs (Neumayer, 2002; Egger et al., 2011, 2013). Others find that the credible threat of trade sanctions against a party that fails to comply with an IEA reduces the risk of free riding (Barrett, 1997). Yet, there is little empirical research on the effects of IEAs on trade flows.

This neglect of focus on the trade effects of IEAs is surprising considering that several IEAs are well-known for their trade provisions. Take the 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes. It contains several trade provisions that aim at protecting human health and the environment against risks associated with hazardous waste. Among these provisions is a general prohibition on the exportation or importation of waste between parties and non-parties to the convention. Parties to the Basel Convention can only trade dangerous waste among them, provided that some requirements are met, including prior notification by the exporting state, written consent from the importing state, and proper packaging and labeling. Other notorious IEAs with trade provisions include the Montreal Protocol on Substances that Deplete the Ozone Layer, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the Cartagena Protocol on Biosafety, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemical and Pesticides, and the Minamata Convention on Mercury. Several scholars have discussed the trade provisions of these multilateral IEAs and their compatibility with World Trade Organization (WTO) agreements (e.g., Gehring & Oberthür, 2009; Young, 2008; Zelli et al., 2013).[5] However, their actual effects on trade flow have not been thoroughly researched.

Alongside well-known multilateral agreements, there are also several lesser-known IEAs that include trade provisions. According to Mitchell et al. (2020), more than 2,000 IEAs have been concluded since 1945, and more than 73% of them are

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[5] On the role of the environment in the WTO, see Johnson (2015).

bilateral or trilateral. The negotiating process and the contents of these "minilateral" agreements differ from multilateral ones. In particular, states might be more inclined to include trade concessions in an IEA with neighboring countries than in a multilateral IEA negotiated under the auspices of the United Nations. DeSombre (2008), for example, notes that several regional fisheries management organizations restrict imports of fish from non-parties. Still, the trade provisions of these IEAs have not been systematically surveyed.

The few existing papers exploring the trade effects of IEAs generate inconclusive results. Studies of the Kyoto Protocol find that membership to this agreement reduces trade in general (Aichele & Felbermayr, 2013; Kim, 2016) but increases trade in environmental goods (Tran, 2022). An article on the Basel Convention finds no evidence that the Convention has reduced the amount of waste being shipped among parties (Kellenberg & Levinson, 2014) while an article on the Rotterdam Convention and the Stockholm Convention finds that their ratification reduces trade of hazardous substances from OECD to non-OECD countries (Núñez-Rocha & Martínez-Zarzoso, 2019). Another paper concludes that the UNFCCC, the Kyoto Protocol and the Montreal Protocol had a positive impact on EU trade exports (De Santis, 2012). An analysis of the International Tropical Timber Agreement suggests that participation in this IEA increases trade value from 4 to 6% (Borsky et al., 2018). A study of the Convention on International Trade in Endangered Species of Wildlife and Fauna (CITES) indicates it decreases the number of animals traded (Borsky et al., 2020). Looking at 13 different IEAs, Ederington et al. (2022) find that their ratification has, in the long run, a negative effect on exports of dirtier industries but a positive effect on the exports of cleaner industries. Besedeš et al. (2017), who assess more than 1000 MEAs, find a negative impact of environmental agreements on trade flows.

Overall, existing studies suggest that IEAs can have significant and substantial effects on trade flows. However, few studies investigate the trade effects of a high number of IEAs. Moreover, no study assesses the trade effects of a specific type of provision in IEAs. This article is the first to explore the possibility that the trade provisions of IEAs generate club goods by increasing trade flows among their parties relative to trade flows with non-parties.

2 Theoretical framework

Two causal pathways can link trade provisions of IEAs to the creation of trade-based club goods. The first pathway is the direct effect of these provisions on trade flows. Some agreements on the protection of plant varieties, for example, submit the imports of agricultural products from third countries to additional inspections for plant pests and diseases. Likewise, agreements related to the safe use of nuclear energy provide for the transfer of nuclear reactors and other equipment from one party to another, but they prohibit the transfer of these goods to third countries. If implemented, these provisions can directly increase trade among parties relative to

trade with non-parties after the IEA has entered into force (although not necessarily in absolute terms).

The second pathway is more indirect. A vague commitment to cooperation on trade matters can give rise to further cooperation, either among private actors or among regulators. This cooperation can, in turn, generate club goods for parties to the IEAs. For example, the 1980 Convention on the Conservation of Antarctic Marine Living Resources created a commission, which established a catch documentation scheme in 1999. Parties to the convention have an obligation to prohibit the imports of fish caught in an inappropriate manner, and this catch documentation scheme made it easier for parties to the convention to document that their catches were legal and reported (DeSombre, 2008).

We expect that even specialized IEAs can impact trade flows in various trade sectors. This expectation is based on four observations. First, some regulated products are cross-sectoral. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITIES), for example, regulates trade in products made from endangered species, which can include furniture, traditional medicines, jewelry, construction material, clothes, and works of art, among other items. Second, some IEAs regulate substances and technologies used in a wide variety of production processes. The Montreal Protocol's trade restriction on chlorofluorocarbons (CFCs) impacts trade flows not only in products containing CFCs, such as aerosols, refrigerators, and solvents, but also in products using CFCs in their production processes, including electronic products and frozen foods. Third, several IEAs cover multiple environmental issues or address environmental cooperation in general ways. This is the case of the North American Agreement on Environmental Cooperation, whose commission has worked on various issues, from trade in agricultural products to the development of regional energy-efficiency certifications. Fourth, increased trade in one sector can have spillover effects in other sectors. For example, the Framework Convention on the Protection and Sustainable Development of the Carpathians includes provisions on the development of the local ecotourism industry, which can lead to increased trade in food products, plant varieties, and art products across countries of the region. For these four reasons, we do not believe that broad groups of IEAs can be associated with specific trade sectors.

Instead, this article looks at different types of trade provisions that are expected to create club goods. For this purpose, we build on the legal literature describing two broad categories of trade-related provisions in IEAs: *trade-liberalizing* and *trade-restrictive provisions* (UNEP, 2007; WTO, 2017). Trade-liberalizing provisions cover rules intended to encourage trade flows. For example, the 1972 Agreement between Brazil and the United States concerning shrimps states that "Parties shall examine the possibilities of cooperating in […] the expansion of the international trade of fishery products" (article 8). Trade-restrictive provisions are rules that seek to restrict certain imports or exports. For instance, the 2000 Cartagena Protocol on Biosafety introduces a complex procedure requiring exporters of living modified organisms to obtain the prior informed consent of the importing state, making trade in living modified organisms more burdensome than for other

food and agricultural products. Trade-liberalizing and trade-restrictive measures are also the two main policy options discussed regarding the creation of future environmental clubs.

Several IEAs are explicitly (*de jure*) discriminatory against non-parties. For example, the 1987 Montreal Protocol on the ozone layer provides that "each Party shall ban the import of controlled substances from any State not party to this Protocol." (art. 4). That said, not all trade-liberalizing provisions explicitly favor trade between parties, and not all trade-restrictive provisions explicitly restrict trade with non-parties. Nevertheless, we expect that both trade-liberalizing and trade-restrictive provisions have the potential to generate *de facto* club goods. If it was not explicit in the IEA itself, discrimination against third countries might arise out of the cooperation relationship due to the ways the IEA is being implemented or enforced. Take trade-liberalizing provisions in IEAs. Even if these provisions are not *de jure* discriminatory, we expect them to privilege parties and have *de facto* discriminatory effects against non-parties. There is little interest among states in formalizing a trade-liberalizing concession in a treaty and extending this privilege to all states, including non-parties. If a state wants to liberalize its imports of certain goods, irrespective of their origins, it can easily do so unilaterally, and there is nothing to gain by locking this policy into an IEA. It is more likely that states will include trade-liberalizing provisions in their IEAs in order to extract similar concessions from other parties. If states were to multilateralize this commitment to non-parties, they would give away a bargaining chip that might be useful for future negotiations. In light of this, we hypothesize that:

> H_1: *The more trade-liberalizing IEAs are, the more trade flows are likely to increase between any two parties relative to trade flows between any party and a non-party.*

We also expect trade-restrictive provisions to have discriminatory effects against non-parties. This might be counterintuitive at first if one does not consider the broader regulatory context of trade-restrictive provisions. These provisions typically apply to goods for which trade is deemed potentially harmful to the environment, such as endangered species, genetically modified organisms, dangerous waste, and pollutants. Trade-restrictive measures for these goods include labeling requirements, trade permits, mandatory quarantines, and quotas. These measures are likely to decrease trade flows in general: among parties and with non-parties. However, non-parties are likely to face trade measures that are even more restrictive than parties. For example, state A might prohibit the import of specific chemical products except from state B that has agreed to comply with certain labeling requirements and prior-informed consent procedures. If these requirements and procedures are provided in an IEA, they would be considered as trade-restrictive since they do not generally apply to other types of goods exchanged between states A and B. These provisions are nevertheless more favorable for state B than the import prohibition that state A unilaterally enforces for these chemical products from other states. Thus, although the implementation of IEAs with trade-restrictive rules might decrease the

volume of trade among parties, we expect trade with non-parties to decrease even more. In other words:

H_2: *The more trade-restrictive IEAs are, the less trade flows are likely to decrease between any two parties relative to trade flows between any party and a non-party.*

A single IEA can include a combination of trade-liberalizing and trade-restrictive provisions. Instead of canceling each other out, we expect both provisions to have similar effects that favor club members over non-members.

Of course, WTO agreements prohibit *de jure* and *de facto* discrimination between WTO members. However, WTO agreements also include exceptions for the protection of "animal or plant life or health" and for "the conservation of exhaustible natural resources" (General Agreement on Tariffs and Trade [GATT] art. XX). Arguably, these exceptions are sufficiently broad to authorize various discriminatory measures included in several IEAs (Charnovitz, 2015; Horn & Mavroidis, 2010). Insofar as IEAs provide that certain trade privileges are limited to their parties, this discrimination is thus not necessarily WTO incompatible. Most trade measures in IEAs serve environmental purposes. If they are a frequent feature of IEAs, it is likely because they are neither "means of arbitrary or unjustifiable discrimination" nor "disguised restriction to international trade," and might thus be authorized under the exceptions of GATT article XX. That said, it is not unreasonable to think that some trade provisions included in IEAs serve protectionist interests or aim at building privileged trade relations. If this is the case, their environmental cover seems to offer sufficient political protection against complaints under the WTO dispute settlement mechanism. Such complaints would undoubtedly be highly controversial and risk backfiring. Even the United States – one of the most litigious WTO members – has not used the WTO to file complaints against the various IEAs with discriminatory trade provisions that it is not part of, such as the Basel Convention on hazardous wastes. This suggests that IEAs benefit from some political – if not legal – immunity at the WTO. Therefore, despite some uncertainty relative to the scope of WTO environmental exceptions, we do not expect WTO law to significantly influence how states implement the trade-related provisions of IEAs.

To be clear, we do not make any assumptions regarding states' motivations for introducing trade-related provisions in their IEAs. These motivations might be primarily environmental or trade-related. More broadly, states create *de facto* intergovernmental environmental clubs when their IEAs generate club goods, even if discrimination against non-members was not their initial intention. The creation of a club good might be an unintended and unanticipated consequence of some other strategy. Likewise, we do not investigate whether trade discrimination against non-parties provides sufficient incentives for them to accede to IEAs or create their own clubs. The question regarding the mere existence of intergovernmental clubs is distinct from questions about their consequences for environmental performance and participation, which are beyond the scope of this study. This article tackles the former question, which is a
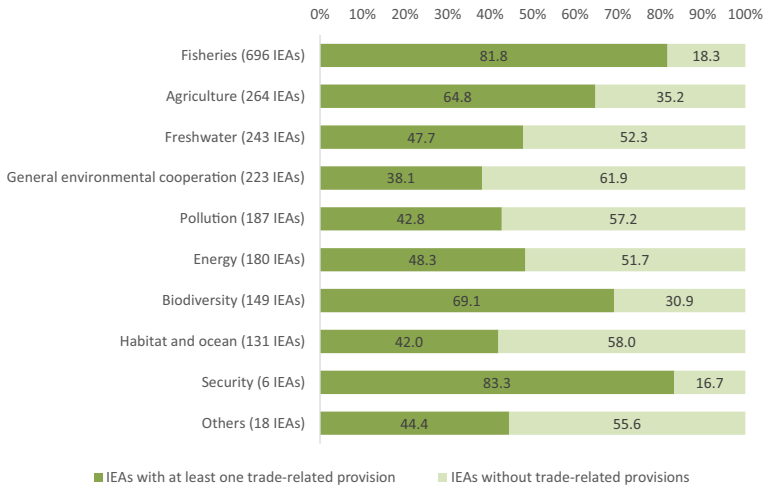
Fig. 1 Share of IEAs containing at least one trade-related provision by IEA subject area. Notes: This figure shows the share of IEAs that contain at least one trade-related provision by the subject area of the respective IEA, ordered by the number of IEAs existing within the subject areas

necessary prerequisite for the latter, and it analyzes whether IEAs with trade provisions create club goods for their parties.

3 A new dataset

With this article, we make public a new dataset of trade provisions in IEAs, our main explanatory variable. We call this dataset the Trade- and Investment-related Provisions in Environmental Agreements (TIPEA).[6]

TIPEA covers 2,097 IEAs concluded from 1945 to 2015. The full texts of these IEAs, as well as information on their parties, were drawn from the International Environmental Agreements Database Project (Mitchell 2002–2023), supplemented by additional searches where necessary. Following the definition of the International Environmental Agreements Database Project, all of these IEAs share three defining characteristics: 1) They are binding treaties under international law; 2) they were concluded by two or more sovereign states; 3) their primary purpose is the protection of the natural world or the sustainable exploitation of natural resources.

We conducted a detailed content analysis to identify specific trade-related clauses provided in each of these 2,097 IEAs. We instructed a team of trained coders to read each IEA using the software Nvivo and a detailed codebook. The TIPEA codebook defines 48 types of provisions that are expected to affect trade flows (see Appendix A). They include provisions favorable to trade, such as the principle that domestic

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[6] The dataset is available on the website of the International Environmental Agreements Database Project.
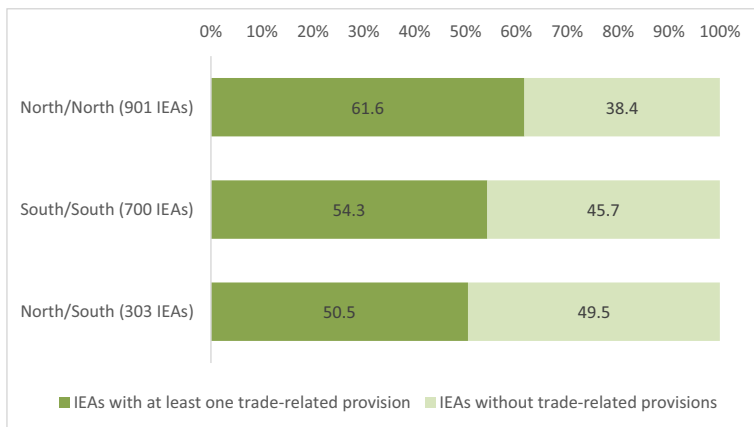
Fig. 2 Share of IEAs containing at least one trade-related provision by development status of IEA parties. Notes: This figure shows the share of IEAs that contain at least one trade-related provision by the development status of the parties to the respective IEA, ordered by the number of IEAs existing within each combination of development status characteristics. Development status is defined by the World Bank classification for high-income or non-high-income countries

environmental measures should not hamper trade or the commitment to develop the ecotourism industry. Other provisions are trade-restrictive, for example import bans on certain products or restrictions on foreign investments in certain sectors.

Manual coding was preferred over automatic coding insofar as it facilitates the classification of ambiguous provisions worded differently across IEAs. We weeded out false positive results by using different coders to double-check the selected provisions. We assessed the frequency of false negatives by asking a different coder to code 10% of the IEAs a second time. Inter-encoder reliability for this double coding, as measured by Cohen's kappa, is 0.784, which is considered a substantial level of agreement (Landis & Koch, 1977).

Using this method, we found 1,279 IEAs with at least one trade-related provision, which corresponds to 61% of all IEAs coded. This is significantly more than previous estimates.[7] Figure 1 presents the frequency of these IEAs by subject area, ordered by the number of IEAs in each subject area. For four out of ten subject areas, a majority of IEAs have trade-related provisions. These subject areas are: security (mainly on nuclear weapons tests), fisheries (including several regional fishery management agreements), biodiversity (most of them on specific species), and agriculture (including on pest control and plant quarantine). Since there are more IEAs governing fisheries (696 in total) than any other subject matters, 44% of all IEAs with at least one trade-related provision govern fisheries.

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[7] Qiu and Yu estimate that "over 20 IEAs have included trade measures to induce non-parties to sign these agreements" (2009: 409).
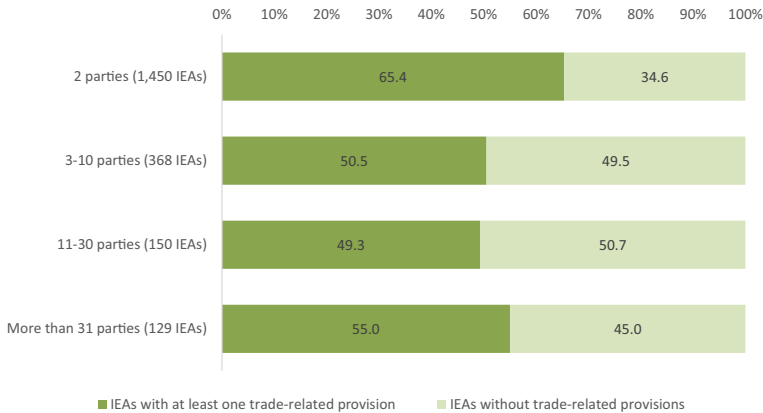
Fig. 3 Share of IEAs containing at least one trade-related provision by number of IEA parties. Notes: This figure shows the share of IEAs that contain at least one trade-related provision by the number of members of the respective IEA, ordered by the number of parties

Figure 2 present three categories of IEAs, according to the development status of their parties, again ordered by the number of IEAs in each category.[8] Some are concluded among high-income countries (North–North agreements); others are concluded among developing countries (South–South agreements); and still others unite developing and developed countries (North–South agreements). Although IEAs with at least one trade-related provision appear in all three categories, trade-related provisions are slightly more prevalent among IEAs concluded between high-income countries.

Figure 3 groups IEAs into different categories based on their number of parties and presents the share of IEAs containing at least one trade-related provision for each category. All categories include a substantial share of IEAs with trade-related provisions. IEAs with at least one trade provision are particularly frequent (65%) among bilateral IEAs. Since most IEAs are bilateral (TIPEA includes 1,450 bilateral IEAs), 948 bilateral IEAs include a trade provision. Another way to put it is that 74% of all IEAs with at least one trade provision are bilateral.

Entities that have signed the highest number of IEAs with at least one TIPEA provision are the countries of the European Union, the United States, France, and Russia. Overall, states that have signed a high number of IEAs with trade provisions tend to be high-income countries, which largely reflects participation in IEAs in general. For some states, however, a greater share of their IEAs include at least one trade-related provision. Several states that have an above average (61.0%) share of the IEAs with at least one trade-related provision fall into the sub-Saharan and low-income category. On average, these countries have concluded a small number of IEAs. In contrast, only 53% of IEAs signed by the United States and 50% signed by France include at least one trade-related provision.

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[8] On the developing countries' stance on the nexus of trade and environmental policy, see Johnson and Urpelainen (2020).
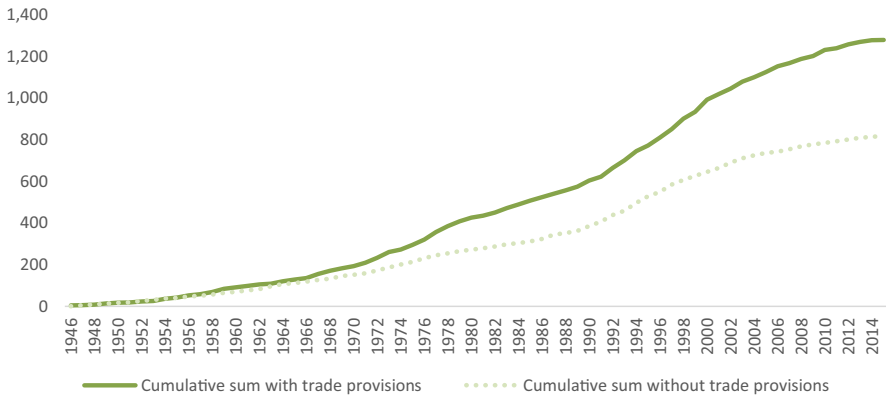
Fig. 4 Number of IEAs signed globally by presence of trade provisions. Notes: This figure shows the cumulative number of IEAs that contain at least one trade-related provision and those that do not over time
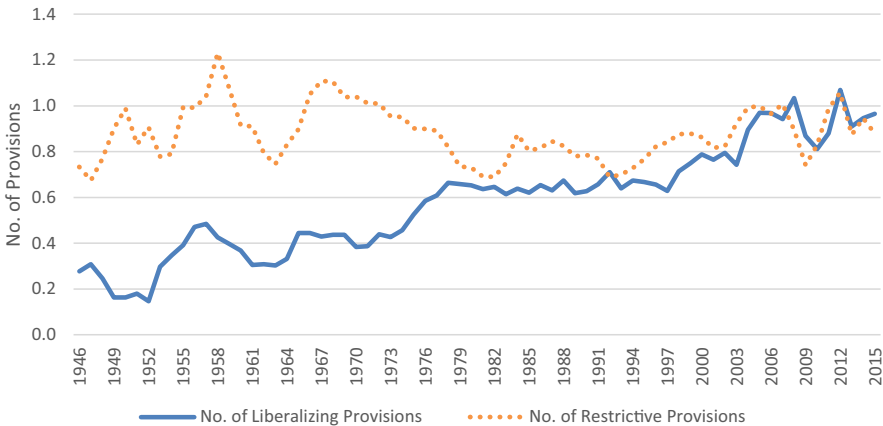

Fig. 5 Average number of trade-liberalizing and trade-restrictive provisions included in new IEAs over time. Notes: This figure shows the number of trade-restrictive and trade-liberalizing contained on average in IEAs concluded in a certain year over time, using a moving average of ± 2 years

The ratio of IEAs with trade-related provisions over the total number of IEAs has remained relatively constant over time. Even some of the oldest IEAs included trade provisions. For example, the 1878 Convention on Measures to Be Taken against Phylloxera Vastatrix included several import and export restrictions to protect European grapevines from a North American pest. The overall number of IEAs with at least one provision from the TIPEA codebook increased substantially in the 1970s, grew more slowly in the 1980s, and then rose again, faster, in the 1990s, which is reflective of the conclusion of IEAs in general (see Fig. 4). The cumulative share of IEAs with at least one TIPEA provision period has remained around 60% over the last five decades.

The most frequent provisions of the TIPEA codebook refer to restrictions on the extraction of natural resources (618 IEAs), a preferential trade agreement (378

IEAs), access to natural resources (323 IEAs), and restrictions on the consumption of specific goods (226 IEAs). On average, IEAs include 1.5 provisions from the TIPEA codebook, but a number of agreements contain many more. For instance, the 1994 Energy Charter Treaty includes 17 TIPEA provisions and the 1994 Protocol on Environment to the Treaty for the Establishment of the East African Community includes 14.

To test our hypotheses, we use TIPEA to measure how trade-liberalizing and trade-restrictive IEAs are. One variable is not the opposite of the other, as a single IEA can promote trade for certain goods while simultaneously restricting trade for other goods. Figure 5 shows the average number of trade-liberalizing and trade-restrictive provisions included in newly concluded IEAs over time.

We recognize that some trade provisions are more substantive and more specific than others. Although we expect that trade provisions which directly restrict or liberalize trade are more important than those stating general and vague principles, the latter should not be ignored because they remain indicative of the general character of the IEA. To take this variation into account, we create two distinct indices based on the trade-related provisions of IEAs: a trade-liberalizing index and a trade-restrictive index. We weighted the different components of the indices according to how substantive they are.[9] Our weighting process involves two steps (Goertz, 2006). First, each index was decomposed into dimensions. The trade-liberalizing index, for example, includes dimensions such as "Non-discrimination," "Promoting trade activities," "Promoting economic activities," and "Acknowledgment of trade institutions," which constitute sub-indices of the overall index. Second, each dimension is measured by a number of indicators, each corresponding to the presence of a specific type of provision in the measured IEA. For example, the dimension "Acknowledgement of trade commitments" includes four indicators: "Cooperation with the WTO," "Cooperation with a preferential trade agreement," "Reference to the WTO," and "Other reference to a preferential trade agreement." These indicators are then assigned a weight within their dimension. For instance, since cooperating with the WTO is a stronger indication that international trade commitments are acknowledged than a mere reference to the WTO, the former indicator is assigned the double weight of the latter. The weights range on a scale from 1 (=unspecific or indirect relation to trade) to 4 (=highly specific regulation directly related to trade with non-parties). We measure most sub-indices by adding their weighted indicators. When the indicators are substitutes, we keep only the one with the greatest weight as the measure of the sub-index. For example, if an IEA includes a commitment to cooperate with the WTO and a reference to the WTO, we consider these two provisions as substitutes and keep only the score associated with the commitment to cooperate with the WTO. Appendix B details the formula for the computation of these indices. The overall indices for the trade-liberalizing and trade-restrictive nature of an IEA range between 0 and 1.[10] The summary statistics for all IEAs are listed in Table C1 of Appendix C.

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[9] Although this weighting exercise involves arbitrary decisions, not actively weighting indicators is equally arbitrary, as it would implicitly give equal weight to each component. As imperfect as a weighted index is, it remains a better approximation of our measured concept.

[10] The absolute scores of the two indices cannot be compared directly as they refer to different dimensions.
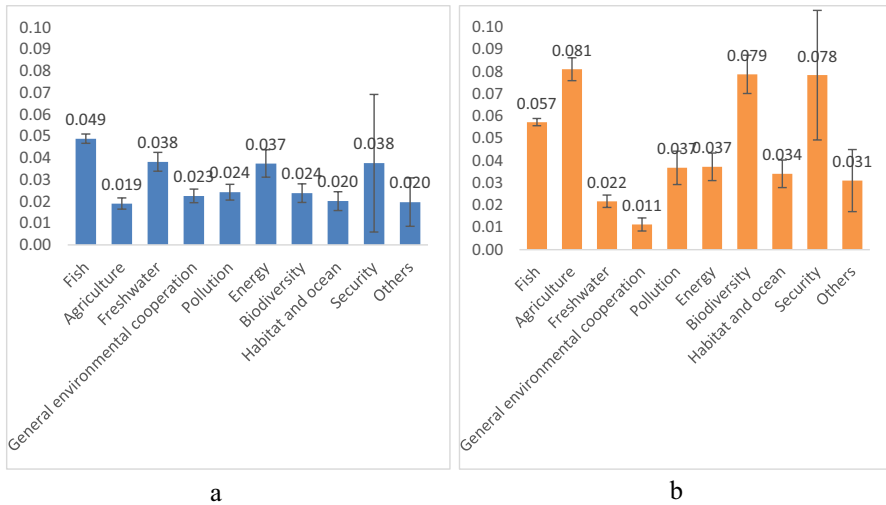
Fig. 6 **a** Liberalizing Index by IEA subject area. **b** Restrictive Index by IEA subject area
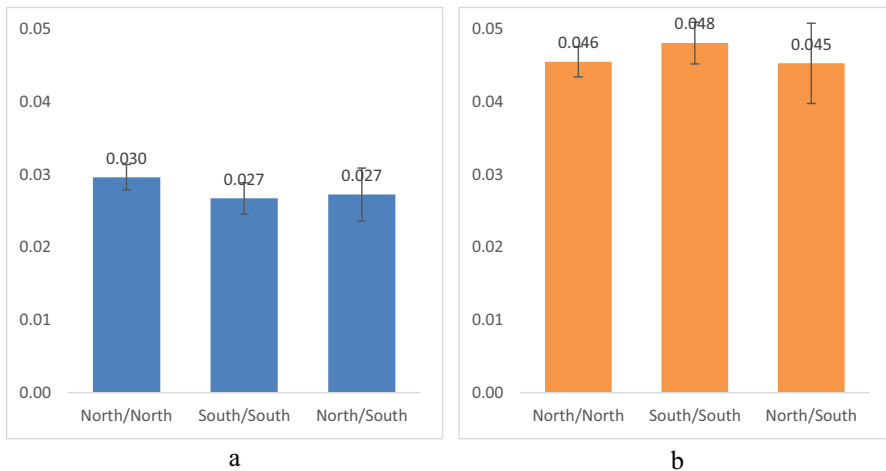

Fig. 7 **a** Liberalizing Index by development status of IEA parties. **b** Restrictive Index by development status of IEA parties

According to these indices, the most trade-liberalizing IEAs are the 1994 Energy Charter Treaty, the 1998 Agreement on Energy Integration between Argentina and Bolivia, the 1977 Agreement in the Field of Marine Fisheries between Cote d'Ivoire and Senegal, and the 1994 International Tropical Timber Agreement. The most trade-restrictive IEAs include the 2013 Minamata Convention on Mercury, the 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, and the 1998 Protocol to the Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution.
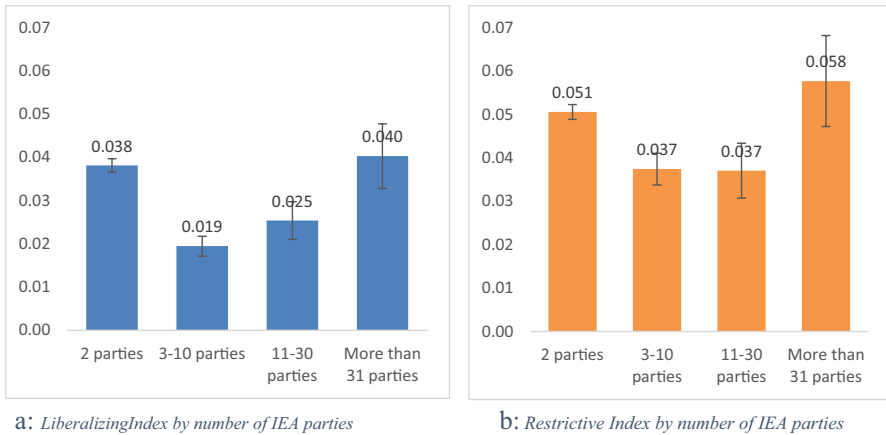
a: *LiberalizingIndex by number of IEA parties*   b: *Restrictive Index by number of IEA parties*

Fig. 8 a Liberalizing Index by number of IEA parties. **b** Restrictive Index by number of IEA parties. Notes: These figures show the trade-liberalizing and trade-restrictive index scores, respectively, of IEAs by subject area, development status of the IEA's parties, and number of parties, ordered by the number of IEAs existing within the respective subject areas (Fig. 6), by different combinations of parties' development status (Fig. 7) and by the number of parties (Fig. 8). Development status is defined by the World Bank classification for high-income or non-high-income countries. Error bars depict the standard errors of the mean

The trade-liberalizing and trade-restrictive nature of IEAs vary with their characteristics. Figures 6, 7, and 8 show the average score on the Liberalizing and Restrictive Indices by subject area (ordered by the number of IEAs), development status of their parties, and number of parties. Error bars depict the standard errors of the means in each direction. IEAs on fisheries tend to be more liberalizing than others, whereas IEAs on agriculture and biodiversity score, on average, high on the trade-restrictive index. These differences are jointly and for the visible differences also pairwise statistically significant. Bilateral and large multilateral IEAs score higher on both the Liberalizing and the Restrictive indices than plurilateral IEAs with 3 to 30 parties, the differences again being statistically significant. There are no statistically significant differences in their trade-liberalizing or trade-restrictive nature between North–North, South-South and North–South agreements.

4 Empirical approach

We aim to identify the difference between trade among parties to a specifically designed IEA and trade with non-parties. To this end, we follow the literature on the trade effects of preferential trade agreements' (PTAs) design features by employing a gravity model in the panel (Baier & Bergstrand, 2007; Baier et al., 2019; Dür et al., 2014).[11]

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[11] On the effects of the design features of PTAs, also see Lechner (2018).

Using a panel dataset of bilateral merchandise exports of more than 150 countries from 1984 to 2017 (UN Comtrade),[12] we regress the yearly exports from exporter e to importer i on the number of IEAs in force between the two countries, and on the respective Liberalizing or Restrictive content of these agreements. Note that the analysis is restricted to the 1,539 IEAs that entered into force before or in the sample period, and it does not include the IEAs from the TIPEA dataset that have not entered into force. IEAs concluded by the European Union are treated such that each member country is viewed as party to the agreement. By this, we do justice to the fact that EU member countries have idiosyncratic movements in trade with non-EU countries.[13] Table C2 in Appendix C shows the descriptive statistics of the active IEAs.

Most countries have several IEAs in place between them. To account for the fact that IEAs vary greatly from one another and their trade-related content complements each other, we add all provisions across IEAs while keeping the weighting scheme for the construction of the indices. We thereby create a Liberalizing and a Restrictive Score across all IEAs between two countries at time t.[14] This method of aggregation preserves the weighting scheme from the indices, but surrenders their normalization. The resulting Scores of trade liberalization or trade restriction across all IEAs between two countries are our main explanatory variables. We include the number of IEAs (instead of a dummy) as a further explanatory variable, because more IEAs are also more likely to jointly include more trade-related provisions, as are more recently concluded IEAs. 74% of all country-pair observations (82% of all with positive trade flows) have at least one IEA in place over the sample period. The estimated effect is thus to be interpreted as the effect of an additional IEA over an existing one.

For the estimation of the effects, we employ a Poisson pseudo maximum likelihood estimation (PPML, Silva & Tenreyro, 2006, 2010). The advantage of the PPML regression is that it addresses heteroscedasticity of the error term and that it can deal with zero trade flows, which log-linear estimations cannot. We, furthermore, address the fact that both the error terms (Pfaffermayr, 2019) and the estimated coefficients may be biased in PPML regressions in finite samples by applying the bias correction procedure by Weidner and Zylkin (2021).

We control for the level of complexity of the IEAs involved and for whether there is a PTA in place between the two countries in the same year, since both may be correlated with the trade-related content of an IEA. Furthermore, we include country-pair and exporter- and importer-year effects to control for most forms of endogeneity. Our main regression equation thus reads:

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

[13] New member countries are only counted as parties to active EU agreements after they have joined the EU.

[14] For those subindices, where individual provision types are treated as substitutes, we also treat provision types as substitutes, thus taking only the (weighted) maximum of any of the provision types, but add individual provision types across IEAs.

$$EXPORTS_{eit} = \exp(\beta_L * Liberalizing_{eit} + \beta_R * Restrictive_{eit} + \gamma * IEA_{eit} + \delta * Complexity_{eit} + \lambda * PTA_{eit} + \alpha_{ei} + \alpha_{et} + \alpha_{it} + \varepsilon_{eit})$$

(1)

EXPORTS are the volume of exports of exporter *e* to importer *i* in year *t* in US Dollars. *Liberalizing* and *Restrictive* are the respective scores of trade-liberalizing or trade-restrictive IEA provisions in place between the two countries. *IEA* is the number of IEAs is in place between *e* and *i* in *t*. The variable *Complexity* is the sum of the number of words of IEAs in place, standardized to have mean zero and a standard deviation of one among all observations under at least one IEA in order to facilitate interpretation of the effects on *IEA*.[15] Because more complex IEAs are also likely to require more text, the relative length of agreements is a sound and easy-to-implement proxy for its complexity. *PTA* is a dummy for whether a PTA is in place between the two states in year *t*. Appendix C also reports the summary statistics on the exporter–importer level (Table C3) and the respective correlations of the variables used in the estimations (Table C4).

The exporter–importer fixed effects α_{ei} capture all time-invariant characteristics of a trading relationship that may be correlated with selection into signing IEAs with certain types of trade-related provisions and the level of exports between the states, such as regional or cultural distance. They also capture the average level of exports between trading partners. The exporter- and importer-year fixed effects α_{et} and α_{it} capture all time-variant individual country characteristics that may be correlated with selection into certain IEAs, such as the level of gross domestic product (GDP), demand structures, production capacities, or overall developments of national trade costs ("multilateral resistance", Anderson & van Wincoop, 2003). The resulting estimates on the explanatory variables (including the Liberalizing and Restrictive Scores) derive from the within-variation in trade flows over time between country pairs.

Thus, the empirical strategy compares the changes of bilateral export flows among states that have entered into IEAs (to a varying degree in their trade-restrictive or trade-liberalizing nature) to bilateral export flows between parties and non-parties to these IEAs. This comparison allows us to identify the discriminatory effects of the trade-related provisions of IEAs on trade flows, answering the question: What trade effect does an additional IEA generate, depending on its trade-related content? However, our strategy cannot exclude reverse causality related to selection into certain IEAs in expectation of future trade flows which are driven by exogenous time-variant bilateral characteristics. We run a battery of robustness tests to the baseline estimation to address this issue in the best way possible and some other issues that deserve attention. We present these robustness tests after discussing the results of the baseline estimation.

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[15] Since *Liberalizing, Restrictive,* and *Complexity* only display numbers different from zero if an IEA is in place, the coefficient for *IEA* can be interpreted as the effect of an additional IEA without any trade-related provisions and the average complexity.

Table 1 The effects of IEAs and trade-related provisions on exports between parties

	(1) EXPORTS	(2) EXPORTS	(3) EXPORTS
Liberalizing	0.004**	0.004**	
	(0.002)	(0.002)	
Restrictive	-0.000		-0.000
	(0.001)		(0.001)
IEA	0.010**	0.010**	0.013***
	(0.004)	(0.005)	(0.004)
Complexity	-0.121**	-0.014	-0.093**
	(0.047)	(0.043)	(0.046)
PTA	-0.068	-0.126	-0.068
	(0.079)	(0.079)	(0.079)
Exporter-importer fixed effects	Yes	Yes	Yes
Exporter- and importer-year fixed effects	Yes	Yes	Yes
Observations	1,343,031	1,343,031	1,343,031
Pseudo R^2	0.989	0.989	0.989

This table shows the results from estimating Eq. (1), with *Liberalizing* and *Restrictive* included jointly (Column 1), and individually (Columns 2 and 3, respectively) as explanatory variables. The dependent variable is the value of *EXPORTS*. *Liberalizing* and *Restrictive* are the respective scores of trade liberalization and restriction through IEAs, *IEA* is the number of IEAs between a country pair at time *t*, *Complexity* is the standardized number of words contained in all IEAs between the countries. *PTA* is a dummy that equals 1 if there is a PTA in place between the two countries. Robust standard errors clustered at the exporter–importer level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5 Empirical findings

We estimate Eq. (1) and include the trade-liberalizing or the trade-restrictive nature of trade provisions. Both indices are positively correlated. We therefore include them in the regression both at once, and each separately. The former excludes the common variation of the Liberalizing and Restrictive Scores and its effect, and thus gives a lower bound estimate. The latter ascribes it to the respectively included content, and thus gives an upper bound estimate. Table 1 presents the results.[16]

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[16] The positive correlation of the independent variables may give rise to concerns of multicollinearity. We therefore report in Appendix D, Table D1, the variance inflation factors (VIFs) from the estimation when both trade indices are included in the regression. None of the variables exhibit a problematic error correlation with the others (VIFs are below 10), so that multicollinearity is of no concern in the estimations presented.
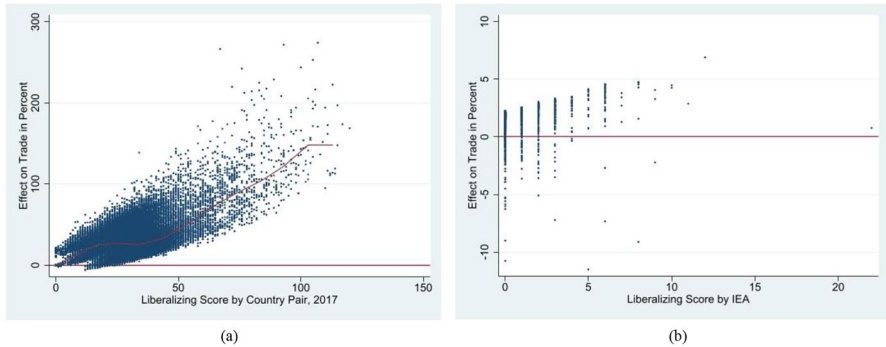
Fig. 9 Predicted Relative Trade per Country-pair Observation in 2017 (Panel a) and per IEA (Panel b). Notes: The graphs show the predicted increase in exports by country pair in the year 2017 (**a**) or by IEA (**b**) according to the estimated effects of the Liberalizing Score, the level of IEA complexity, and the number of IEA involved (equal to 1 per IEA in Panel b), given by [e(IEA $*$ NumberIEAs$_i$ + Liberalizing $*$ Liberalizing$_i$ + Complexity $*$ Complexity$_i$)-1]*100, where variables without a subscript denote estimated coefficients from estimating Eq. (1) with Liberalizing and Restrictive included jointly, and variables with subscript denote the respective realizations per observation. The red line in Panel (a) depicts the median band

We find that joining an additional IEA is associated with higher trade flows between parties. An additional IEA (based on the findings reported in Column 1 of Table 1) is associated with an $e^{0.01} - 1 = 1\%$ increase in trade between parties (relative to changes in trade with non-parties).

The trade-increasing effect increases when more liberalizing provisions are added. The estimated coefficients for the Liberalizing Score are positive and significant. One additional point on the Liberalizing Score is, *ceteris paribus*, associated with an $e^{0.004} - 1 = 0.4\%$ increase in trade between parties relative to trade with non-parties. We thus find evidence for H$_1$. We do not, however, find a significant effect of externally trade-restrictive provisions on trade flows between parties, thus not confirming H$_2$.

The level of complexity of IEAs, measured by their (standardized) number of words, is a proxy for their degree of legalization or "depth." As such, it is not surprising to find that the *Complexity* variable has a negative impact on trade. On the other hand, *Complexity* of an IEA is positively correlated with trade-related provisions, so that those IEAs which have positive trade-increasing effects also tend to be the more complex ones.

For the average country pair in 2017 (the latest year in the sample), all IEAs and their trade-liberalizing features (as well as their average complexity) are associated with additional trade flows of roughly 16% (relative to changes in trade with non-parties). The country pair with the highest level of trade liberalization in our sample in 2017, Italy and Sweden, had a combined Liberalizing Score of 120 from 67 IEAs between them, and a combined complexity score of 4.2 (corresponding to 497,871 words in all 67 IEAs). According to our estimations, this would have led to an increase in trade between these two countries of 90% compared to the situation without any of these IEAs. While this number may appear quite large, it provides

an upper bound estimate of the extent of trade liberalization through IEAs. Because this is the effect of all IEAs and their trade-related content taken together, those of individual IEAs are naturally substantially smaller.[17] As one of the four most trade-liberalizing IEAs in our sample, the International Tropical Timber Agreement, aiming to provide an effective framework for cooperation between tropical timber producers and consumers, with a Liberalizing Score of 11, and a Complexity of 0.21, would be predicted to increase trade between its parties by about 2.8%, compared to trade with non-parties. The average agreement across these dimensions would still increase trade by 1.3% relative to trade with non-parties. This finding suggests that several IEAs might actually by driven by trade motivations and could be seen as trade agreements, even if they are not typically considered as such. The International Tropical Timber Agreement and the Energy Charter are two examples of IEAs, as defined by the International Environmental Agreements Database Project (Mitchell 2002–2023), that might have more to do with trade than with environmental concerns.

Figure 9 depicts the predicted increase in trade associated with the IEA-related characteristics of all country-pairs in the sample in 2017 and of all IEAs in panels (a) and (b), respectively, against the Liberalizing Score of each (aggregated over IEAs for country pairs and individually for each IEA). While there are some country pairs with specific characteristics that would predict trade to be greater by more than 100% compared to trade with non-parties of the concluded IEAs, the bulk of pairs is concentrated between zero and 100%. The line in Panel (a) of Fig. 9 depicts the median band. Overall, 50% of observations have a predicted associated greater trade of not more than 20%. For individual IEAs, Panel (b) of Fig. 9 shows that more liberalizing IEAs indeed also tend to predict greater trade flows.[18] While high complexity and little trade-liberalization may result in negative values for the predicted trade increase associated with individual IEAs, the majority of IEAs, namely 1,368 out of the 1,539 active agreements has a positive predicted value of associated change in trade related to the specific IEA characteristics. The predicted average trade increase across all IEAs amounts to 1.3% while the maximum value associated with an individual IEA is 6.8%.

Our findings suggest that PTAs have no effect on trade between countries relative to trade with non-parties. Although this finding may be counterintuitive in contrast to previous findings (e.g. Baier & Bergstrand, 2007), it is in line with more recent estimations of the effect of PTAs on trade (e.g. Baier et al., 2019), which find that also the trade-creating effect of PTAs is heterogeneous and strongly depends on their

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[17] The predicted effect of an individual IEA may also to some extent depend on the content of already existing IEAs between two countries as far as provisions in it are substitutes by already existing provisions as laid out in the description of the weighting scheme in Appendix A. For predictions of associated trade increases on the IEA level, we de-mean the *Complexity*-score by IEAs, in order to elicit the contribution that an individual IEA adds to overall complexity of the IEAs concluded between two countries.

[18] For reasons of representation, we exclude two (negative) outliers from Fig. 9(b), which are agreements with high complexity but little trade-related content: The United Nations Convention On The Law Of The Sea (predicted -23% trade associated), and the Convention On The Prohibition Of The Development, Production, Stockpiling And Use Of Chemical Weapons And On Their Destruction (-16%).

characteristics. While the 1% increase of trade through an IEA is in the dimension of the effects typically found for PTAs, particularly trade-liberalizing IEAs may be even more strongly associated with higher trade flows between its parties (compared to trade with non-parties) than the average PTA, suggesting that some of the most ambitious IEAs might be driven by trade concerns and target non-tariffs barriers left unaddressed by modest PTAs.

The correlations between the number of IEAs and their trade-related characteristics may give rise to concerns of multicollinearity. We therefore report the variance inflation factors (VIFs) to the estimations of Eq. (1) with both the Liberalizing and Restrictive Score jointly included in the estimation as well as with each on its own. They are shown in Appendix D. For the joint estimation, the VIF for the trade-liberalizing score is just above the critical threshold value of 10. If both scores are included individually, however, the VIFs indicate unproblematic error correlation, with no change of the results.

5.1 Extensions and robustness checks

The results presented so far provide a general picture on the potential (hitherto undisclosed) effects of IEAs and their trade provisions. In the following, we detail the general results and test their robustness against different specifications of the estimation. We conduct one extension at a time in order to better compare the results.

First, the specification of the Liberalizing and Restrictive Indices (and the respective Scores across IEAs) is somewhat subjective. To test whether the results presented above depend on the applied weighting scheme, we re-run the estimations with the simple count number of trade-relevant provisions. Column 1 of Table 2 shows the results when including the overall number of all trade-related provisions in all IEAs between two countries as the main explanatory variable. The result is slightly positive, but insignificant. However, Column 2 of Table 2 shows that differentiating between the two types of trade provisions is important, because liberalizing provisions exhibit a significantly positive effect, in line with the main findings.

Furthermore, we investigate more closely the role played by the specific PTA status of partner countries in IEAs, as these may be correlated or interact with the extent of trade liberalization through IEAs. First, we control for the regulatory depth of PTAs in place between countries, provided by the DESTA database, in order to exclude the possibility that the estimated effects of the trade-related content of IEAs captures the effects of the characteristics of the PTAs (rather than the IEAs) between two parties. The results, depicted in Column 3 of Table 2, show that the estimated effect of the Liberalizing Score through IEAs does not change when accounting for the depth of PTAs between countries. Second, it is conceivable that PTA and IEA characteristics are not only correlated, but that it matters for the strength of the effects of trade provisions in IEAs, whether they are effective between countries that have a PTA in force between them or not. This could theoretically go in both directions. Trade-related provisions could substitute for those in PTAs, or they could complement them. Column 4 of Table 2 shows the results of interacting all

IEA-variables of interest with whether countries have a PTA in force between them or not. They show that the effect of liberalizing provisions is stronger in (and actually driven by) those country pairs that do not have a PTA in place between them. On the other hand, the effect of an IEA itself is more (and only significantly) relevant for countries that already do have a joint PTA. It might be the case that IEAs address non-tariff barriers and this liberalization achieve(S) little results when tariff barriers remain for countries that do not have a joint PTA.

The inclusion of trade flows of zero allows us to further disentangle the effects between those at the extensive and at the intensive margin. Trade flows may increase between two countries in an already existing bilateral relationship (intensive margin) but trade flows may also increase if a bilateral relationship is newly created between countries that have previously not traded with each other (extensive margin) (e.g. Felbermayr & Kohler, 2006). To test for the effect at the intensive margin, we restrict the sample to positive (non-zero) trade flows. The results are depicted in Column 5 of Table 2. They show that IEAs and their trade-liberalizing content are also associated with relatively more trade between countries that already have traded before, so that the results at the intensive margin resemble those for the entire sample. To test for the effect at the extensive margin, we use as dependent variable a dummy for whether a country pair observation has a positive (non-zero) export value, with the results depicted in Column 6 of Table 2. They show that at the extensive margin, trade-liberalizing provisions are particularly relevant. IEAs themselves have a negative effect on the probability for two countries to trade with each other if they have not traded before the agreement's conclusion (compared to the effect of trading with non-parties). At the same time, this effect is reversed if the IEAs are explicitly trade-liberalizing. In contrast, trade-restrictive IEAs even further decrease the relative probability of two countries to trade at all.

Some further robustness tests are conducted in Appendices E–G. First, we also control for WTO membership of the trading partners (Appendix E). Then, instead of using country and exporter- and importer-year fixed effects, we explicitly model the selection into IEAs with certain trade-related characteristics on the basis of country- and country-pair specific characteristics in a two-stage estimation, using the unpredicted trade liberalization and restriction as independent variables (Appendix F). In another robustness test (Appendix G), we apply different levels of multiway-clustering of standard errors (see Cameron et al., 2011; Egger & Tarlea, 2015). All these robustness tests confirm the general thrust of the results shown in the main text.

Appendices H and I provide some further informative extensions of the model. Appendix H shows the estimations at the sub-index – or even provision – level. Compared to using a composite score, these estimations are likely to suffer either from omitted variable bias or multicollinearity, but by providing upper and lower bound estimates of the effects of individual sub-indices or provisions, they can still give an indication as to which of these are particularly effective in creating club goods through fostering trade. We furthermore provide the results by subject area of the IEAs, the development status of their parties, and the number of parties to an IEA (Appendix I). These further differentiations reveal that the aggregate results are driven mostly by trade liberalization in plurilateral agreements (in contrast to bilateral or large multinational agreements), and hold for all trade relationships between

Table 2 Extensions and robustness checks

	(1) EXPORTS	(2) EXPORTS	(3) EXPORTS	(4) EXPORTS	(5) EXPORTS	(6) Prob (EXPORTS > 0)
# of Trade Provisions	0.002					
	(0.001)					
# of Liberalizing Provisions		0.005**				
		(0.002)				
# of Restrictive Provisions		-0.001				
		(0.002)				
Liberalizing			0.004**	0.001	0.004***	0.003***
			(0.001)	(0.002)	(0.001)	(0.000)
X NO_PTA				0.003*		
				(0.002)		
Restrictive			-0.000	-0.001	-0.000	-0.002***
			(0.001)	(0.001)	(0.001)	(0.000)
X NO_PTA				0.000		
				(0.001)		
IEA	0.010**	0.009*	0.010**	0.009**	0.009**	-0.003***
	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.001)
X NO_PTA				-0.007**		
				(0.003)		
Complexity	-0.110**	-0.118***	-0.120**	-0.047	-0.106**	-0.008
	(0.045)	(0.045)	(0.047)	(0.038)	(0.047)	(0.007)
X NO_PTA				-0.076**		
				(0.032)		
PTA	-0.067	-0.068	-0.092	-0.154	-0.073	-0.087***
	(0.078)	(0.079)	(0.095)	(0.127)	(0.080)	(0.008)

Table 2 (continued)

	(1) EXPORTS	(2) EXPORTS	(3) EXPORTS	(4) EXPORTS	(5) EXPORTS	(6) Prob (EXPORTS > 0)
Depth of PTA			0.027			
			(0.029)			
Exporter-Importer Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Exporter- and Importer-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,343,031	1,343,031	1,343,031	1,343,031	794,164	1,343,031
Pseudo R²	0.989	0.989	0.989	0.989	0.991	0.182

This table shows the results from estimating Eq. (1) with the number of overall (Column 1) and liberalizing and restrictive provisions (Column 2) as explanatory variables, and *Liberalizing* and *Restrictive* included jointly (Columns 3–6). The dependent variable is the value of *EXPORTS* (Columns 1–5). Column 3 controls for the depth of the active PTAs, and Column 4 shows the results when interacting the IEA-related variables with a (no-)PTA dummy. The results in Column 5 refer to the estimation on only the sample of non-zero trade flows (intensive margin), while those in Column 6 refer to the estimation on the whole sample but using a dummy for non-zero trade flows as dependent variable (extensive margin). *Liberalizing* and *Restrictive* are the respective Scores of trade liberalization and restriction through IEAs, *IEA* is the number of IEAs between a country pair at time *t*, *Complexity* is the standardized number of words contained in all IEAs between the countries. *PTA* is a dummy that equals 1 if there is a PTA in place between the two countries. Robust standard errors clustered at the exporter–importer level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

same or different development levels, except for trade relations between developing countries.

We also explore the timing of the effect, using leads and lags of the explanatory variables (Appendix J), which, however, provides no further insight into the channels of the effect. This may be due to the fact that including lags and leads reduces the sample significantly and also drops observations from the most recent periods. It may also be the case that, according to existing evidence (Lakatos & Nilsson, 2017; Magee, 2008; Mölders & Volz, 2011), there are anticipatory trade effects when PTAs are concluded, which could also be the case in the context of IEAs, stretching out the overall effect of the agreements over a longer period around their conclusion.

In Appendix K, we explore the effects of IEAs in specific issue areas and their trade-related content on sectoral trade flows related to the respective issue area. As discussed above, it is not straightforwardly possible to link many issue areas to specific sectoral trade flows, and trade-related content in the respective IEAs may go beyond the regulation of these specific sectors. We nonetheless link them for trade in fish-related products and agriculture, respectively, and differentiate between upstream and downstream sectors. Sectoral trade observations are only available to a lesser extent and for shorter time periods for many countries. In effect, this exercise does not produce any significant results that link sector-specific trade flows to IEAs in the respective issue areas.

6 Conclusion

In Molière's satirical play *The Bourgeois Gentleman*, Mr. Jourdain is delighted to learn that he has been speaking "prose" all his life without knowing it. In a way, this article shows that global environmental governance has generated club goods for decades without acknowledging them as such.

Several scholars and political decision-makers are calling for the creation of climate clubs and other intergovernmental environmental clubs. Most of these calls are rooted in normative considerations, deductive reasoning, or agent-based modeling rather than empirical investigations, as if environmental clubs were an abstract idea deprived of empirical manifestations. Our findings suggest that the academic literature might have overestimated the "chilling effect" that WTO agreements have on the inclusion of trade measures in IEAs (Eckersley, 2004).

This article first introduces the new TIPEA dataset, which includes 48 types of trade-related provisions in 2,097 IEAs. We find that 1,279 IEAs include at least one trade-related provision. Second, this article provides strong evidence that liberalizing trade provisions in IEAs is associated with increased trade flows between parties relative to non-parties. We interpret this finding as a discriminatory effect that provides club goods for parties to IEAs. We call the IEAs that generate such club goods "de facto environmental clubs".

These findings are relevant for the design of IEAs. They point to specific design features that can make IEAs more palatable to stakeholders and policymakers concerned about their economic consequences. Since only 17% of all IEAs (365 IEAs)

include more than one trade-liberalizing provision, IEA negotiators can leverage these win–win potentials much more forcefully.

By uncovering the existence of de facto environmental clubs, this article also shows that the road to the creation of environmental clubs might be more evolutionary than Nordhaus (2015) and other proponents of environmental clubs assume. Whereas Nordhaus advocates for the design of environmental clubs from scratch, our findings suggest that environmental clubs can (also) emerge incrementally from existing institutions.

This article opens new avenues for future empirical research on intergovernmental environmental clubs. Four questions appear particularly important. First, it remains unclear if the creation of club goods was deliberate and intentional. This article does not provide evidence on states' motivations for including trade provisions in IEAs. Guided by the TIPEA dataset, case studies and interviews with negotiators could help to shed more light on what drives the inclusion of trade provisions in IEAs. Second, it would be interesting and useful to study if non-parties react to the presence of discriminatory trade measures by joining environmental clubs. Providing incentives for accession is a central assertion in Nordhaus' argument for the creation of climate clubs (Nordhaus, 2015). An understanding of the range of conditions that lead non-participatory states to accede to existing IEAs (if at all) is essential in order to assess Nordhaus' proposal to create climate clubs. Third, non-parties can react to their exclusion from club goods by creating their own club instead of joining existing ones, contributing to the proliferation of environmental clubs. Such a domino effect is a well-documented consequence of trade diversion induced by trade agreements (Baldwin & Jaimovich, 2012), but it remains unknown whether a similar pattern is occurring for environmental clubs.[19] Fourth, the consequences of club goods for participating states remain to be explored. Does the provision of club goods reduce the withdrawal rate from IEAs, increase compliance levels, and induce the adoption of amendments, annexes, or protocols? By uncovering the existence of club goods in global environmental governance, this article accomplishes the necessary first step in answering these important questions.

In this context, the TIPEA dataset provides the basis for further fruitful research on global environmental governance. It enables researchers to investigate the drivers of including trade provisions in IEAs or how and why they diffuse across agreements. This new dataset can also be used to conduct additional research on the various consequences of including trade provisions in IEAs. For example, does the inclusion of trade provisions in IEAs generate better environmental outcomes? Another promising option for future research might be to combine the TIPEA dataset with the Trade and Environment Database (TREND), which covers environmental provisions in trade agreements (Morin et al., 2018; Brandi et al., 2020). Combing the TIPEA data with the mirror dataset TREND makes it possible to assess how the trade and environmental regimes are co-evolving as distinct but open systems. These avenues for future research are also relevant from a policy perspective (Kim & Morin, 2021). The interplay between trade and environmental governance might

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[19] It is even unclear whether environmental clubs create or divert trade.

hold substantial potential for addressing environmental challenges around the world and thus deserves more attention both in research and in practice.

Declarations

This research did not involve human participants and did not require ethical approval.
The authors have no relevant financial or non-financial interest to disclose.
The data on trade provisions in environmental agreements will be available on the website of the International Environmental Agreements Database Project at https://iea.uoregon.edu/codings-IEA-design-features. All other material necessary to replicate findings is on file with the corresponding author.

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