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Dynamic environmental agreements and lower income countries

Tobias Böhmelt[1]

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Abstract
How do lower income countries (LICs) shape multilateral environmental agreements' (MEAs) dynamism, i.e., the introduction of new legal commitments into treaty frameworks? I argue that LICs often have incentives to pursue treaty amendments that strengthen environmental commitments. However, when LICs are more deeply integrated into global trade and reliant on environmentally intensive exports, structural constraints may discourage support for MEA adaptation. In such contexts, trade dependence can undermine environmental ambition, making MEAs with a larger number of LIC members less likely to be dynamic. Drawing on the most comprehensive quantitative dataset of MEAs since 1945, the analysis shows how global economic integration conditions environmental governance and highlights persistent barriers to treaty dynamism in the Global South.

Keywords Multilateral environmental agreements · Lower income countries · Treaty dynamism · Agreement amendments

1 Introduction

How do lower income countries (LICs) shape multilateral environmental agreements' (MEAs) dynamism, i.e., the introduction of new legal commitments into treaty frameworks? Successful environmental problem-solving at the global scale increasingly depends on the robust participation of LICs (Bernauer et al., 2010; Spilker and Koubi 2016; Campbell et al., 2019; Marrs et al., 2020; Mitchell et al., 2020; see also Biancardi and Villani 2014). Less developed states host many of the world's most critical biodiversity hotspots, which are crucial for ecosystem preservation and climate mitigation efforts (e.g., Fisher and Cristopher 2007; FAO, 2019), they are characterized by rapid population growth (e.g., Lehmijoki and Palokangas 2010; Brueckner and Schwandt 2015), and they are now commonly the targets of outsourced environmental pollution (Fernández-Amador et al. 2017; Kanemoto et al.,

✉ Tobias Böhmelt
tbohmelt@essex.ac.uk

[1] University of Essex, Colchester, United Kingdom

2012; Kolcava et al. 2019; Peters, 2008; Presberger and Bernauer 2023; Jinnah, 2011; Bernauer et al. 2025a, 2025b) inducing that their environmental footprint of production is larger than that from consumption (Bagliani et al., 2008; Cabernard et al., 2019; Duarte et al., 2018; Ghertner and Fripp 2007; Peters et al., 2011). At the same time, emissions from LICs, though historically low, are now growing due to development imperatives and increasing energy demand (see Böhmelt et al. 2025).Without the inclusion and active participation of these countries in both the design and implementation of MEAs, efforts to address climate change, biodiversity loss, and environmental degradation in general are likely to be ineffective (see Lemos and Agrawal 2006; O'Neill et al., 2013; de Zeeuw, 2015; Mitchell et al., 2020).

MEAs must also evolve and adapt to ever changing environmental circumstances for being effective (see Laurens et al., 2023; Morin et al., 2025). Treaty dynamism, i.e., amending MEAs by new and additional environmental commitments, norms, or regulations over time,[1] is essential to foster more effective global environmental governance (De Bruyne et al. 2020). If MEAs are not amended and, thus, remain "static," they do not adapt to a changing context and risk becoming ineffective in addressing the environmental problems they have been created for in the first place (Morin et al., 2025). Conversely, dynamic agreements are regularly updated, altered, and changed in light of new information about treaty members' behavior, their preferences, and the state of the environment (Laurens et al., 2023). For example, the 1979 Bonn Convention on the Migratory Species of Wild Animals has been amended more than 10 times since the agreement came into force (Laurens et al., 2023: 2). And the 1946 International Convention for the Regulation of Whaling has seen about 70 amendments, making it one of the most dynamic MEAs in global governance (Oberthür, 2018; see also Morin et al., 2025). Morin et al. (2025: 2) conclude accordingly that MEA "dynamism is particularly important […] given the rapid changes in both the environment and our knowledge of it."

This article seeks to combine institutional dynamism and LICs when exploring the role of less developed states in shaping dynamic MEAs, i.e., the introduction of new and additional legal commitments to MEA members (see Laurens et al., 2023; Morin et al., 2025). Jointly focusing on the role of LICs in influencing MEAs' dynamism is crucial, particularly since the latter is a crucial dimension of global environmental governance to ensuring the adaptability and effectiveness of international cooperation in the face of escalating ecological challenges. A persistent claim in both academic and policy circles is that LICs are reluctant to join, participate in, and adapt their MEAs (see Böhmelt et al. 2025; Spilker and Koubi 2016).[2] LICs bear limited historical responsibility for global environmental degradation, and they may lack the financial and technical capacity to meet stringent international commitments (Roberts and Parks 2007). Such views are reinforced by distributive injus-

[1] As discussed in Morin et al. (2025), institutional dynamism per se does not guarantee better environmental quality. Having said that, more than 90% of the amendment cases in the data (most) likely aim at improving environmental conditions by introducing more ambitious regulations, increasing environmental protection, or bolstering institutions of governance (Morin et al., 2025: 6).

[2] All else equal, LICs are less likely to join an international environmental treaty in the first place (see, e.g., Spilker & Koubi, 2016). Thus, the *ex-ante* chances of having less developed countries in a treaty are low(er). However, whether LICs abstain from an agreement completely is not the scope of this article. Instead, I focus on those cases where LICs are in such institutions, prefer to stay, and may consider adapting the legal framework of a MEA. And indeed, despite the general pattern that LICs are less likely to join MEAs, being and remaining at the bargaining table can be more beneficial because this gives influence on the further development of a treaty, compared to being absent (see also Böhmelt et al. 2023: 513).

tices in existing MEAs, where obligations may often reflect the interests of wealthier or more powerful countries (Bernauer et al., 2010; 2013; Spilker and Koubi 2016; Mitchell et al., 2020). Moreover, LICs, particularly those pursuing policies of export-oriented economic growth, tend to prioritize economic development before environmental protection (see Grossman and Krueger 1995; Selden and Song 1994; Spilker, 2012, 2013; Böhmelt et al. 2025). Hence, LICs may only become committed environmental actors once they reach higher income levels (Dasgupta et al., 2002; Dinda, 2004; Jiang et al., 2019).

Having said that, LICs are especially vulnerable to environmental degradation. If not withdrawing or abstaining from MEAs, this could incentivize participation in treaty amendment processes differently than for more developed states. However, this may well be moderated by structural dependencies on global trade and environmentally intensive exports, resulting in the outcome that trade openness affects the relationship between LICs and MEA dynamism. Indeed, treaty dynamism can allow LICs to gradually assume more ambitious commitments as capacities grow and contexts change (Morin et al. 2020, 2025; Laurens et al., 2023). In fact, in some cases like the Alliance of Small Island States (AOSIS) in the global climate regime (e.g., Ourbak & Magnan, 2018), LICs have taken proactive roles in treaty negotiations and introduced amendments to agreements, particularly where environmental issues intersect with local livelihoods or development goals (see Najam et al. 2003). Against this background, understanding the relationship between MEA dynamism and LICs is essential for scholars and policymakers alike.

The following study develops the argument that LICs can be associated with treaty dynamism. More vulnerability and, thus, a more strongly pronounced need to effectively address environmental problems through global governance should incentivize LICs to pursue treaty amendments through new environmental commitments. However, if LICs are more strongly embedded in the global trade network and, thus, more reliant on environmentally intensive exports, they could be discouraged from supporting treaty adaptation (see Peters et al., 2009, 2011; Duarte et al., 2018; Presberger and Bernauer 2023; Kolcava et al. 2019; Bernauer et al. 2025a, 2025b). The observable implication is that MEAs are likely to be static when they comprise more LIC members that are better connected to the global market.

This article makes two central contributions to the literature. First, I add to studies on global environmental governance. Existing works on international and multilateral environmental treaties focus primarily on higher income countries (Kerret and Shvartzvald 2012; O'Neill et al., 2013; Mitchell et al., 2020; see Farias and Roger 2023; Böhmelt et al. 2025), but the agency and constraints of LICs, especially in the context of environmental institutions, are less well understood. Hence, it is important to extend this work to lower income contexts. Second, I seek to contribute to studies on institutional dynamism. The evidence on the role of LICs particularly for MEA creation and participation remains inconclusive. Laurens et al. (2023) offer a comprehensive analysis of the determinants of MEA amendments, but focus more on general state participation patterns or treaty design features as such. Morin et al. (2025) examine how trade-related provisions in MEAs shape dynamism.[3] While these and other works have produced fascinating insights into what makes environ-

[3] Morin et al. (2025) consider a variable on MEA members' average income. They report that this item is positively related to MEA dynamism, but not always statistically significant. The latter suggests that there is no consistently positive sand significant impact emerging from countries' income levels, which is likely driven by the fact that there is no homogenous treatment effect. To address this, I focus on LICs and explicitly model theoretically as well as empirically a heterogeneous treatment effect in that the relationship of treaty dynamism and LICs varies by trade.

mental agreements dynamic or static, they overlook that LICs may have other incentives, opportunities, or constraints that differ from "the average country" and, most certainly, higher income nations. Moreover, correlating treaty design features with MEA dynamism may raise concerns over endogeneity, highlighting the need to examine more closely states' actual behavior and characteristics *before* a MEA has been designed and amendments have been passed. In the following, I intend to add to these and related studies by systematically exploring how LICs are related to treaty dynamism.

2 Dynamic MEAs and Lower Income Countries: The Importance of Trade

I develop a conditional argument linking MEA dynamism to LICs. On one hand, LICs tend to be more vulnerable to environmental change, which should incentivize them to pursue more effective, more ambitious commitments through amendments in global environmental governance (see Keohane & Victor, 2011). Thus, treaty dynamism may generally well be associated with MEAs comprising more LICs. On the other hand, some LICs are strongly embedded in global trade, and are thus export-dependent on environmentally intensive goods. Under those circumstances, there are few incentives to amend MEAs toward more ambitious environmental commitments (see also Cole, 2004; Neumayer, 2002). Ultimately, trade moderates the relationship between LICs and MEA dynamism.

LICs are often among the most vulnerable to environmental degradation and climate change (e.g., Dube and Sivakuma 2015; Hallegatte et al., 2016; Saeed et al., 2023), which can heighten their willingness to actively pursue amendments to MEAs. Their reliance on agriculture, fragile ecosystems, and limited adaptive capacity make the consequences of inaction particularly severe (e.g., Mertz et al., 2009; Thomas et al., 2007). I argue here that LICs have strong incentives to implement new, additional commitments and, hence, make MEAs dynamic due to the potential benefits of reduced disaster risk, increased resilience, and access to finance or technology in treaty frameworks (see Najam et al. 2003; Morin et al. 2020). LICs thus see amendments and enhanced commitments not only as normatively desirable, but strategically necessary for long-term national survival and development (Roberts and Parks 2007). For example, several LICs in the Sahel and Horn of Africa, including Niger, Burkina Faso, or Ethiopia, have recently called for the establishment of a legally binding protocol on drought management under the UN Convention to Combat Desertification (UNCCD).[4] And the active engagement of AOSIS, which comprises mainly LICs and has been at the forefront of advocating ambitious global climate governance (Betzold, 2010), illustrates a collective effort to shape MEAs in ways that reflect their disproportionate exposure to environmental threats. In other words, vulnerability can generate agency and influence, and LICs push for institutional dynamism in MEAs as a result.[5]

[4] See online at: https://tinyurl.com/2zdstrzb.

[5] LICs may also face fewer domestic constraints when it comes to pursuing MEA dynamism. While LICs can be institutionally weaker, which challenges their ability to engage in complex treaty processes, the absence of domestic veto players, e.g., industry lobbies (Bueno de Mesquita et al. 2005); Tsebelis, 1995) allows governments to actively engage in amendment processes and push for greater equity in global governance (Najam et al. 2003). Taken together, these factors suggest that LICs are not only motivated by their vulnerability.

Although LICs may be particularly vulnerable to environmental harm, their integration into global trade can generate competing economic incentives that limit their support for treaty adaptation and new environmental commitments.[6] Many LICs rely heavily on the export of primary commodities, raw materials, and manufactured goods that are resource-intensive or environmentally damaging. This creates a structural dependency where environmental regulation, especially if it raises production costs or imposes compliance burdens, can threaten export competitiveness (Copeland and Taylor 2013). LICs are likely to resist treaty amendments that constrain their comparative advantage, particularly when alternative sources of growth are absent (see also Bernauer, 2013). The dependence on trade revenues can shift government priorities toward short-term economic gains over long-term environmental sustainability, undermining political willingness to support transformative treaty change (see also Ssekibaala et al., 2022). LICs that are integrated into trade chains may also face external pressure to maintain laxer environmental standards to remain attractive sites for outsourcing and production. International trade has been the main conduit for this process, whereby some countries import highly polluting goods from others, especially LICs, instead of manufacturing them domestically (e.g., Peters et al., 2009, 2011; Duarte et al., 2018; Presberger and Bernauer 2023; Kolcava et al. 2019; Bernauer et al. 2025a, 2025b). Trade openness in LICs can lead to environmental degradation, principally in sectors where enforcement capacity is low and environmental policy is subordinated to investment promotion (Dean et al. 2009).[7] This dynamic reinforces domestic opposition to treaty amendments that would impose stricter standards, as policymakers fear capital flight or the erosion of trade advantages. For instance, consider Mozambique, a LIC that is has emerged as one of the world's largest natural gas exporters. A recent UN report[8] reflects on the political disincentives for supporting stronger environmental commitments in light of the country's rapid fossil fuel export expansion and dependency.

As a result, MEA dynamism can be perceived as a liability. While environmental vulnerability theoretically increases the willingness to strengthen international commitments, high trade dependence can introduce structural disincentives that lower LICs' support for treaty dynamism. Trade integration shifts the cost-benefit calculus for LICs, undermining their willingness to engage with or implement environmentally progressive treaty adaptations. Eventually, this process can invert the expected relationship between LICs and institutional dynamism: at higher levels of trade integration, LICs are opposed to more ambitious and evolving treaty commitments. Having said that, MEA amendments are not the sum of inde-

[6] A counter argument might be that LICs excluded from trade have more intense aspirations for economic development at the expense of the environment. However, as argued above, LICs are especially vulnerable to environmental degradation, which then constitutes a direct constraint on development prospects rather than a secondary concern. Moreover, countries that are weakly embedded in global trade possess limited leverage in market-based arenas and, therefore, might have fewer incentives to pursue regulatory laxity to be more competitive. Instead, LICs are more likely to channel political effort toward MEAs, where influence is mediated less by market power and more by vulnerability, equity, and legitimacy claims. And this, ultimately, links LICs excluded from global trade to MEA dynamism.

[7] On the other hand, there is a large literature on trade openness and more beneficial (pro-) environmental outcomes. Cao and Prakash (2012), among others, show that trade openness does not lower regulatory stringency of environmental regulations. However, the empirical evidence for this relationship is based more on higher income countries and mixed, while recent (meta-) analyses seem to suggest that, especially for less developed countries, trade openness is more likely to be detrimental for environmental outcomes (Managiet al. 2009; Le et al., 2016; Afesorgbor & Demena, 2022; Chaudhry & Reetu, 2025).

[8] See online at: https://tinyurl.com/352jw32r.

pendent country-level choices or driven by individual states. Put differently, MEAs do not amend themselves based on marginal changes in individual preferences, but are the outcome of collective decision-making processes in which state preferences are aggregated through institutional rules. Hence, the treaty-level analysis captures the effective configuration of interests, not their raw distribution. To this end, treaty dynamism occurs not because each state (or LIC) individually pushes for amendments, but because a sufficiently large bloc of LICs can shift the perceived baseline of acceptability, and their vulnerability claims carry moral and legitimacy weight, especially in environmental governance. I, therefore, test the following hypothesis: *MEAs comprising more LIC members that are more strongly integrated into the global market are less likely to by dynamic*.

3 Research Design

The empirical analysis uses the most comprehensive data on MEAs, which were compiled by Morin et al. (2025).[9] These data comprise information on 647 environmental treaties concluded between 1945 and 2015, and were coded using agreements' legal texts as well as the International Environmental Agreements Database Project.[10] The data are cross-sectional and, therefore, time invariant with an individual treaty as the unit of analysis. For the estimations discussed below, I focus on the country and treaty characteristics at the time of MEA members' original signature. Neither the dependent variable nor the explanatory items are time-varying, making the transformation of the data set into a time-series cross-sectional format unnecessary as this would merely artificially inflate the number of observations. Due to missing values for some of my key variables, the models' samples range between 592 and 560 observations (MEAs).[11]

The dependent variable captures agreement amendments or treaty dynamism at the MEA level. I use Morin et al.'s (2025) approach and measure this via the number of amendments added to an agreement during its lifetime up until 2015. Morin et al. (2025: 6) identify amendments with the International Environmental Agreements Database Project's "lineage variable, which captures additional instruments legally linked" to an agreement. Mitchell et al. (2020: 105) define lineage as "the evolution of governance efforts by groups of states to address an environmental problem." Protocols to agreements are not coded as amendments, as Morin et al. (2025) treat them as "standalone treaties" that can be amended over time as well. For the final dependent variable, I use a binary operationalization, receiving a value of 1 if an agreement has been amended at least once until 2015. This approach addresses measurement error in the dependent variable to some extent (see Thomas and Bond 2015). Out of the 647 IEAs in the data set, almost 16% are characterized as "dynamic" according to this variable. Due to the binary nature of the outcome measure, I use logistic regression models with robust standard errors to correct for heteroskedasticity. Since I eventually focus on the impact of an interaction effect, which are difficult to interpret in non-linear models

[9] According to Morin et al. (2025: 5), "this collection of MEAs is the most exhaustive in this field."

[10] See online at: https://www.iea.ulaval.ca/en.

[11] Next to the theoretical argument presented in the last section, there is also an empirical reason to focus on the treaty level as the unit of analysis. MEA dynamism is a treaty-level outcome, and assigning the same treaty amendment to every state violates the independence assumption while it inflates sample size unnecessarily – the latter biases standard errors downwards.

(see Ai and Norton 2003), I also present linear probability models based on ordinary least squares (OLS).

The main explanatory variables are items on LICs, treaty members' trade volume, and the interaction of the two. All variables are located at the MEA level so to avoid an artificial increase in sample size; hence, the variables are aggregated over MEAs' original members. First, taken from the World Bank Development Indicators and measured in constant 2015 US Dollars, Morin et al. (2025) provide a variable for original treaty members' income (GDP per capita) at the time of their original signature. The variable ranges between $375.98 and $62,217.75, i.e., the average income level of an MEA in the data is between about $375 and more than $62,000. I calculated the four quartiles of this item and combine the lowest two into the value of 1 for the newly created variable *Lower Income Country*. Eventually, this binary item captures whether a MEA was predominantly negotiated and shaped by lower income/less developed countries (1) or not (0). This operationalization follows the approaches in Chiba et al. (2015) or Böhmelt and Butkutė (2018). According to this operationalization, about half of the treaties are coded as "lower income MEAs."

Second, there is a variable on merchandise trade as a share of GDP (also measured in 2015 US Dollars). The original information for this variable has been taken from the World Bank Development Indicators and captures the sum of merchandise exports and imports divided by the total value of GDP. Hence, by putting imports as well as exports in relation to overall economic power, this variable is a proxy for countries' importance of trade and their embeddedness in the global market. As in the case of *Lower Income Country*, I use the average value across all original members per IEA. The mean value of *Trade* is around 53% (with a minimum of around 13% and a maximum of slightly more than 160%). I log-transform the variable to account for its skewed distribution. Third, the empirical core component of my analysis is the multiplicative interaction between *Lower Income Country* and *Trade*. This specification allows me to test whether the impact of LICs on treaty dynamism is conditioned by the level of trade. I calculate and present substantive quantities of interest to facilitate interpretation (Ai and Norton 2003; Brambor et al. 2006).

Finally, the main models comprise four control variables, which feature prominently in the study of treaty dynamics (Morin et al., 2025; Laurens et al., 2023). These items address alternative mechanisms that may affect the dynamics of MEAs. First, there is the number of trade provisions in an agreement itself. One of the central claims in Morin et al. (2025) is that treaties' trade clauses – an institutionalized proxy for trade regulation – increase the chances of dynamism. The original data for this item have been compiled by Morin et al. (2024) who identify 42 types of trade-related provisions. On average, there are 0.85 trade clauses per MEA in my sample, ranging between 0 and 16 provisions. Second, there is the variable *Treaty Depth*, which is an index of non-trade-related economic regulations, i.e., restrictions on the production of specific goods, the extraction of specific natural resources, the selling of specific goods, the consumption of specific goods, the transportation of specific products, and the construction of specific infrastructure. Each component of the index is measured dichotomously, i.e., whether a treaty comprises such a regulation or not. In turn, the individual components are combined to the final index by assigning double weights to the first five components, and restrictions on construction activities are used with single weight. Third, the longer a treaty exists, the higher the likelihood that at least one amendment has been passed. I thus control for the lifetime of a MEA until the final year of observation in the data set. Fourth, regime type and democratic institutions feature prominently

in the environmental politics literature (e.g., Atwi et al., 2018; Bernauer and Koubi 2009; Dinda, 2004; Farzin and Bond 2006; Leffel et al., 2021; Kammerlander & Schulze, 2020; Bakaki et al. 2022; von Stein, 2022). In light of this, I control for an agreement's level of democracy, averaged over the original members of the treaty. The democracy scores are taken from the Polity IV data set. My final item has a mean value of 4.31 (standard deviation of 5.55).

4 Empirical Results

Table 1 summarizes the main models of the empirical analysis. In Model 1, I only consider the variables for LICs, trade, and their interaction, but leave out the control covariates. The latter are added in Model 2, which leads to a decrease in sample size due to missing values on some of the covariates. Model 3 is based on the same, reduced sample as Model 2, but again I leave out the controls. This setup demonstrates that the main result is not driven by sample particularities, and by the inclusion or exclusion of specific variables. For Models 1–3, I use logistic regression models given the binary dependent variable. I employ OLS regression in Models 4 and 5 to estimate linear probability models, where the table entries are marginal effects and can be interpreted as changes in the probability of treaty dynamism. The coefficient of the interaction term stands for the effect of *Trade* when *Lower Income Country* is set to 1, while statistical significance of the interaction term tells us whether the difference in slopes is statistically distinguishable from 0 (Brambor et al. 2006). However, the true added value of Models 4–5 is cross-specification validation (see also Fig. 3 below). Moreover, since linear probability models suffer from built-in heteroskedasticity,

Table 1 Environmental Treaty Dynamism and LICs

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Lower Income Country	6.632***	7.766***	8.179***	0.750**	0.671**
	(2.305)	(2.693)	(2.318)	(0.304)	(0.312)
Trade	0.465	1.229**	0.466	0.071	0.104
	(0.409)	(0.576)	(0.408)	(0.061)	(0.064)
Lower Income Country × Trade	-1.884***	-2.247***	-2.306***	-0.212***	-0.199**
	(0.593)	(0.690)	(0.598)	(0.076)	(0.078)
Democracy		-0.023			-0.004
		(0.024)			(0.003)
Trade Provisions		0.222***			0.032***
		(0.077)			(0.011)
Treaty Depth		0.019			0.002
		(0.090)			(0.011)
Duration		1.087***			0.089***
		(0.236)			(0.016)
Constant	-3.262**	-9.716***	-3.219**	-0.084	-0.482*
	(1.619)	(2.748)	(1.612)	(0.236)	(0.263)
Observations	592	560	560	592	560
Model	Logit	Logit	Logit	OLS	OLS

Table entries are coefficients; robust standard errors reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

cross-checking their estimates with logistic regression models remains an important part of the empirical strategy.

The inclusion or exclusion of the control variables does not drive the results – the interaction *Lower Income Country* × *Trade* is, as expected by the theoretical argument, negatively signed and statistically significant across Models 1–5. The first constituent term of the multiplicative specification, *Lower Income Country*, is associated with a positive coefficient and statistically significant. This variable's coefficient captures the influence of LICs on MEAs' dynamism when *Trade* is set to 0, i.e., a state would not be linked to the global trade network at all. While this scenario is purely hypothetical and does not exist in the data, it nonetheless approximates circumstances of weak trade relationships. I will illustrate this below when discussing the substantive quantities of interest, but note the interpretation of *Lower Income Country* already (when *Trade* is set to 0 or held at rather low levels): MEAs with a lower average income level and, hence, those agreements comprising a larger share of LICs are *more* likely to be dynamic. As a result, it can be derived that LICs do indeed favor treaty amendments. Likewise, consider the coefficient estimates for *Trade* in Table 1: these capture the impact of a country's trade interconnectedness when *Lower Income Country* is set to 0, i.e., we focus on MEAs with a higher average income level and, thus, those comprising a larger share of higher income countries. Having said that, the coefficients of the trade item are either positive or insignificant, thus lacking precision in estimation.

The empirical core aspect of my argument, nonetheless, is the interaction *Lower Income Country* × *Trade.* Interpreting such a specification is facilitated by calculating substantive quantities of interest, which I summarize in Figs. 1, 2 and 3. First, Fig. 1 plots the marginal effect at the means of *Lower Income Country* for the value range of *Trade* using logistic regression (Model 2; standard errors are adjusted according to Ai and Norton 2003). When LICs are not well connected to the global trade network, i.e., *Trade* is set to 2.5 (this equals a trade share of GDP of about 12%), my main model predicts that, overall, the likelihood of treaty dynamism is higher by almost 25% as compared to institutions mostly comprising higher income countries. The positive impact of *Lower Income Country* on treaty dynamism persists until a trade volume/GDP value of about 22.5%. Afterwards, as the amount of trade increases, the marginal effect of *Lower Income Country* decreases, though, and eventually becomes negatively signed and statistically significant. That is, as of a trade-of-GDP share of about 40.5%, my estimates stress that MEAs with more LICs are indeed less likely to alter their commitments. Hence, if less developed states have only a relatively small trade volume, the chances of MEA amendments will be higher than in cases where member LICs are more embedded in the global trade network. In the latter scenario, states' incentives are more geared toward exploiting trade for economic gains – which lowers the chances that the corresponding MEAs will pass new and potentially stronger environmental commitments. As Spilker (2013) notes, LICs may be, under those circumstances, more interested in "growing rich first, and clean up later." Trade is a key component here, which alters the incentive structure of LICs so much that their interest to pursue stronger environmental commitments goes down. Ultimately, the risk to become "pollution havens" (see Bernauer et al. 2025a, 2025b) goes up.

In Fig. 2, I plot the differences in the predicted probability of *Treaty Dynamism* (the dependent variable) scoring a value of 1. For calculating these differences, I focus on two different scenarios for low and high values of *Trade*: on one hand, when there is a MEA comprising mostly LICs and, on the other hand, an MEA with a different member configura-

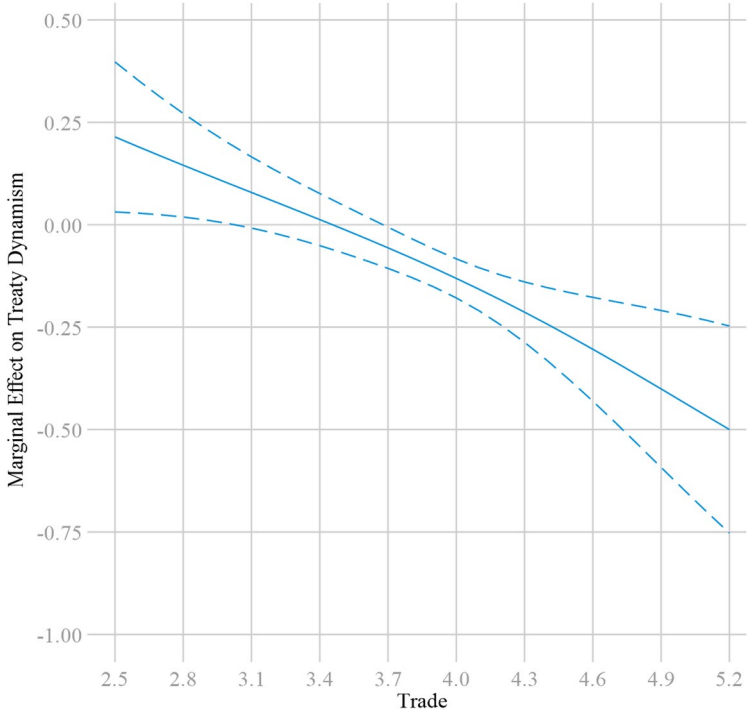


Fig. 1 Marginal Effects of LICs on *Treaty Dynamism*. *Notes.* Graph displays marginal effect values at the mean value of *Lower Income Country* for given values of *Trade*; dashed lines stand for adjusted 95% confidence intervals (MacGregor-Fors & Payton, 2013); graph based on Model 2

tion. When integration in the global market is low, there is no significant difference between LICs and higher income countries. Indeed, the likelihood of treaty dynamism here is only weakly pronounced, ranging between 5 and 25%. However, when increasing trade volume, this likelihood falls to below 5% when focusing on MEAs with LICs, while agreements with other country profiles are indeed more likely to see amendments to the treaty (more than 40%).

Finally, in Fig. 3, I simulate the effect of *Lower Income Country* × *Trade* 1,000 times (see King et al., 2000). This simulation is a "validation exercise," meant to demonstrate coefficient stability as opposed to facilitating the interpretation of marginal effects (which is done in Figs. 1 and 2 already). According to this graph (based on Model 5), the simulations point to an average marginal effect of −0.197, which is virtually identical to the coefficient estimates in Models 5 and 6. Substantively, this effect implies that for a 10% increase in the average amount of MEA members' trade, the likelihood of treaty dynamism decreases by about 2% points when these members are predominantly LICs. Out of the 1,000 simulations leading to Fig. 1, only eight of them (0.8%) have a marginal effect estimate larger than or equal to 0. Hence, there is robust evidence for coefficient stability, emphasizing that the relationship between treaty dynamism LICs depends on the level of trade.

In sum, Table 1; Figs. 1, 2 and 3 consistently and robustly point to the conclusion that LICs are strongly linked to treaty dynamism – but this effect is moderated by trade. MEAs with a lower average income level and, hence, more LICs that have a rather small trade

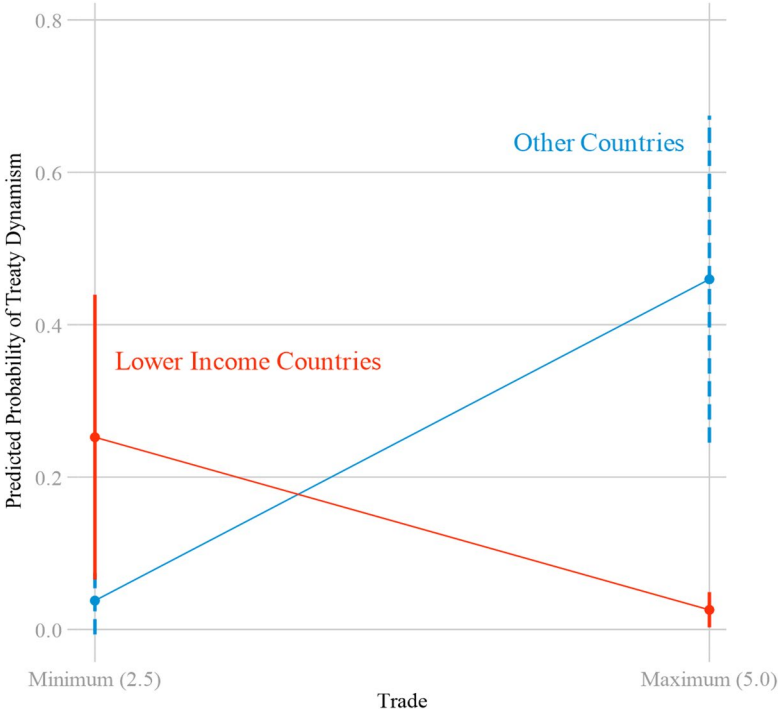
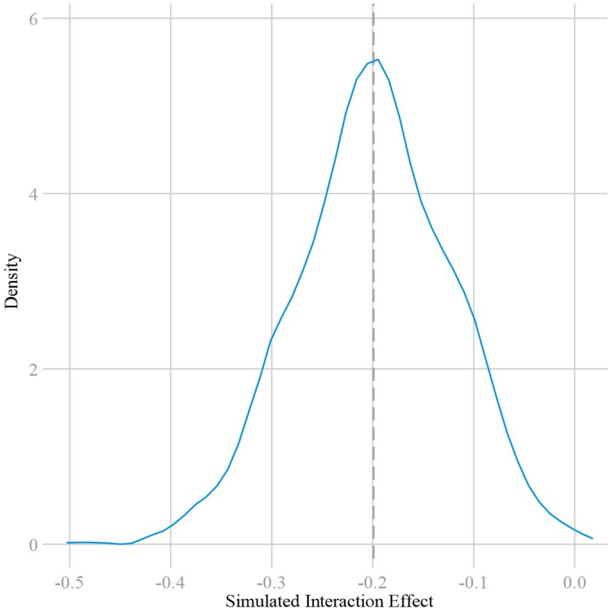


Fig. 2 Predicted Probabilities of *Treaty Dynamism*. *Notes.* Graph displays predicted probabilities of *Treaty Dynamism* (dependent variable) for the different scenarios of *Lower Income Country* at the minimum and maximum of *Trade*; dashed lines stand for adjusted 95% confidence intervals (MacGregor-Fors & Payton, 2013); graph based on Model 2

Fig. 3 Simulated Interaction Effect. *Notes.* Graph displays distribution of simulated interaction effect ($N = 1{,}000$ simulations); dashed vertical line stands for mean value of the marginal effect (−0.197); graph based on Model 5



volume are more willing to adapt and update stronger commitments in their environmental agreements and the likelihood of dynamism increases as a result. Yet, LICs that trade more may want to use and benefit from these assets first (Spilker, 2013; Dasgupta et al., 2002; Itkonen, 2012; Atwi et al., 2018) and are thus reluctant to pursue stronger environmental commitments – the likelihood of treaty adaptation declines correspondingly. The identified effect is both statistically significant and substantively important.

In the SI, I present additional analyses, and the results from these continue to support the main findings presented above. First, I consider a count variable for treaty dynamism and consider member states' preference homogeneity as an alternative mechanism (Table A1). Second, I employ a more narrowly defined operationalization for LICs in MEAs (Table A2). In Table A3, I distinguish between regional and multiregional agreements, also when implementing a three-way interaction with *Lower Income Country* × *Trade*. Fourth, I model temporal dependencies in a more flexible way in Table A4, using the polynomial approximation by Carter and Signorino (2010). In Table A5, I operationalize LICs using the actual World Bank measures for income and GDP. Sixth, considering Morin et al. (2025), I control for agreements' trade clauses in a disaggregated fashion, also when modeling a three-way interaction with *Lower Income Country* × *Trade*. In Table A7, I comprehensively take into account treaties' underlying problem structure, their design characteristics, and other confounding factors such as EU or US involvement. I exclude (minor) protocols from the analysis in Table A8, while I employ the World Bank's income groups in Table A9. This table also considers the economic growth of member states. Though not the scope of my article, I explore the effects for middle income countries in Table A10, and I assess state membership as another component of MEA dynamism in Table A11. All these additional robustness checks provide further support for the theoretical arguments and empirical findings presented here.

5 Conclusion

This article has examined the role of LICs in shaping the institutional dynamism of MEAs – a dimension of global environmental governance that is central to ensuring the adaptability and effectiveness of international cooperation in the face of escalating ecological challenges. The analysis has shown that LICs' vulnerability to environmental degradation appears to incentivize active participation in treaty amendment processes. However, this willingness can be undermined by structural dependencies on global trade and environmentally intensive exports, resulting in the outcome that trade openness moderates the relationship between LICs and MEA dynamism. These results have important theoretical, empirical, and policy implications.

At the theoretical level, this study contributes to the growing body of research on the determinants of institutional change in global environmental governance. By focusing on LICs, which have not always or thoroughly been studied in previous works, the article challenges the prevailing assumption that institutional dynamism is largely driven by higher income countries or treaty design features. Instead, it positions LICs as important, though highly contingent, agents of change. Their propensity to support treaty amendments depends not only on environmental vulnerability, but also on the structural position they occupy in the global economic system. This aligns with the insights of Morin et al. (2025) who high-

light the necessity of treaty evolution, but moves beyond a static view of state behavior by incorporating LICs' heterogeneity.

Empirically, the article responds to a significant gap in the literature by systematically analyzing how LICs affect the likelihood of amendments in MEAs. While previous research has illuminated how design features or broader geopolitical patterns shape MEA development (e.g., Laurens et al., 2023; Morin et al., 2025), there has been little systematic exploration of LICs' behavior. By emphasizing the dual pressures of vulnerability and trade dependence, this study shows that LICs' impact depends on the alignment between environmental protection and economic self-interest.

The research presented here has several important implications for global environmental policymaking. First, treaty designers seeking to promote environmental dynamism in MEAs dominated by LICs must consider these countries' alignment with trade-related incentives, potentially through green trade finance, climate-linked export credits, or border adjustment mechanisms. Second, policymakers should recognize the conditional nature of LIC participation in treaty adaptation. Environmental vulnerability can be a powerful motivator, but only if LICs are given meaningful roles in negotiation processes or the capacity to implement resulting commitments. This calls for an inclusive design of MEAs that not only considers the differential capabilities of members, but also institutionalizes mechanisms for capacity-building, financial transfers, and technical support. Third, addressing the disincentives that arise from trade dependence is critical. When environmental degradation is outsourced to LICs through global production chains, environmental ambition is undermined by creating economic incentives to resist stricter environmental norms (Fernández-Amador et al. 2017; Kanemoto et al., 2012; Kolcava et al. 2019; Presberger and Bernauer 2023; Jinnah, 2011; Bernauer et al. 2025a, 2025b; Peters, 2008; Peters et al., 2009, 2011).

The analysis also opens several promising avenues for further research. First, future studies could explore in greater detail the causal mechanisms linking trade integration to opposition against treaty adaptation. While this article highlights a broad association, a deeper investigation into sector-specific export profiles or the presence of multinational corporations in LICs could clarify why and how trade influences environmental negotiation behavior. Moreover, the empirical patterns I identify could also be consistent with donor countries pushing for amendments as they seek to improve implementation in LICs. Second, and derived from the previous point, further research is needed on the role of domestic institutions and political regimes in conditioning LIC engagement with treaty dynamism. Are democracies more likely to support treaty amendments due to higher public accountability? Do centralized versus federal systems differ in their capacity to implement MEA changes? Exploring such institutional mediators can yield a more refined understanding of variation within the LIC category. Third, future research should unpack the role of non-state actors in influencing LICs' positions on treaty amendments. International NGOs, epistemic communities, and transnational advocacy networks often serve as intermediaries in capacity-constrained environments and may facilitate LICs' engagement with dynamic governance processes.

In sum, this article demonstrates that LICs can play a significant and constructive role in shaping the evolution of MEAs, but this potential is moderated by a complex interplay of vulnerability and structural economic incentives. The article offers a balanced and empirically grounded account of their role in global environmental governance. If international policymakers are serious about building effective, adaptive, and inclusive MEAs, they must

address the structural disincentives faced by LICs and support their full participation in treaty design and dynamism. Only through such an inclusive approach can global environmental institutions evolve into truly "living legal animals" (Boisson de Chazournes, 2009: 293) that reflect the realities, needs, and aspirations of all their members.

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Declarations

Competing interests The authors declare no competing interests.

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