Int Environ Agreements
https://doi.org/10.1007/s10784-019-09464-5

ORIGINAL PAPER

Structural conditions for novelty: the introduction of new environmental clauses to the trade regime complex

James Hollway[1] · Jean-Frédéric Morin[2] · Joost Pauwelyn[1]

Accepted: 17 December 2019

Abstract
When do parties introduce novel clauses to a system of contracts or treaties? While important research has investigated how clauses diffuse once introduced, few empirical studies address their initial introduction. Drawing on network theory, this paper argues that novel clauses are introduced when agreements are concluded in certain structures of earlier agreements and the clauses they include. This paper demonstrates this argument using the example of 282 different environmental clauses introduced into the trade regime complex through 630 trade agreements concluded between 1945 and 2016. We find that trade agreements are more likely to introduce novelties when they involve parties with a diversity of experience with prior environmental clauses and introduce more novelties when more parties are less constrained by prior trade agreements between them. Contrary to prevailing wisdom, power asymmetry between the negotiating parties is not statistically significant.

Keywords Legal novelty · Network theory · Regime complexity · Institutional interaction · Legal innovation · Complex systems

1 Conditions of novel clauses

When do treaties introduce novel clauses to a system of contracts or treaties? Contemporary international treaties include clauses that earlier treaties did not. For example, only recently have trade agreements included a range of environmental and other non-trade clauses, from an invocation of the precautionary principle to a requirement to implement the Montreal or Cartagena protocols (Oberthür and Gehring 2006; Young 2008; Zelli et al. 2013). Each such clause was introduced into the trade regime complex in a particular trade agreement. Once introduced, individual novel clauses may be ineffective fig leaves or effective enhancements, progressive environmental integration or regressive green

✉ Jean-Frédéric Morin
jean-frederic.morin@pol.ulaval.ca

James Hollway
james.hollway@graduateinstitute.ch

[1] Graduate Institute of International and Development Studies, PO Box 136, 1211 Geneva, Switzerland

[2] Laval University, 1030 Avenue des Sciences Humaines, Quebec G1V 0A6, Canada

protectionism, widely or narrowly adopted. And collectively, their introduction alters the boundary or character of and dependence across issue- or domain-defined "regime complexes" (Raustiala and Victor 2004; Keohane and Victor 2011). However, clauses can only individually or collectively affect the system once introduced. Their introduction is often uneven; many agreements introduce no novel clauses, some agreements introduce a few clauses, and a few agreements introduce many new clauses (Morin et al. 2017). Understanding this variation in the introduction of novel clauses is the key to understanding past and, potentially, future institutional change.

The term "novel clauses" deserves some clarification. Clauses crystallize norms as, across, or within the provisions of formal written agreements. Clauses can thus be expressed using different texts; the first form of the precautionary principle to appear in a trade agreement was in the 1992 European Economic Area (EEA) agreement, but has since appeared elsewhere in different forms. Though clauses may derive from the translation, refinement, or recombination of clauses internal or external to a juridical system, we consider clauses "novel" to a particular system when they are introduced to that system for the first time. For example, Charnovitz notes that the GATT 1947 clause that allows for trade restrictions for the conservation of natural resources originally proposed in text submitted by the USA, "did not appear in any previous trade agreement" (1991, p. 45).[1] Novelty is therefore at the system and not the individual or dyadic level (Aiken and Alford 1970). Arguably, some clauses may be more novel than others, but our goal here is not to assess the relative novelty of all clauses. It is more feasible to identify clauses as novel than establish how novel they are. Nor do we seek to elaborate a theory for where the substance for novel clauses comes from. Some cases such as the environmental innovations in the side agreement to the 1992 North American Free Trade Agreement (NAFTA) have been well studied and provide some inspiration about the importance of power asymmetry to the introduction of novelty (e.g., Steinber 1997), but such cases also highlight how reasons why particular norms are introduced may vary more than the conditions under which they are introduced (Mohr 1969). We therefore seek to understand whether structural conditions explain variation in the introduction of novel clauses across agreements.

Conditions for legal novelty are under-theorized and under-researched. Many streams of institutionalist research in international relations (IR) tend to skirt the question of what makes some agreements include more novel clauses than others. Historical institutionalism highlights path-dependent change (Thelen 2004, p. 25) but struggles to explain discontinuous change by mechanisms other than exogenous shocks or initial conditions. Rational choice institutionalism's explanation for treaty features as rational responses to specific problem settings (Koremenos et al. 2001) leaves novel problem settings the only account for novel features. The literature on the governance of common-pool resources locates the source of new institutional arrangements in local knowledge (Ostrom 2010), but does not elaborate why there is such variation in local innovation. Experimentalist governance black-boxes novelty to focus on upstream delegation and downstream selection (Sabel and Zeitlin 2008). Even the literature on policy innovation confusingly conflates novelty and replication (Berry and Berry 1999), often substituting the puzzle of the first emergence with the more analytically tractable problem of subsequent diffusion (Gray 1973; Boushey 2016). This is lamentable, as the introduction of

[1] TREND borrowed its list of trade agreements from the Design of Trade Agreements Project (DESTA). These agreements include free trade agreements, custom unions, and sectoral agreements (Dür et al. 2014). Our list of agreements includes also GATT 1947.

novelty is a precondition to studying any diffusion (Abbott et al. 2016; Ovodenko and Keohane 2012, p. 524). Indeed, all literatures on the desirability, diffusion, or effects of the clauses in circulation within a regime are premised on an equally important but unanswered question: When are clauses first introduced to a system of agreements? In other words, our question is not whether wildfires are damaging, how damaging they are, or how they spread, but where the sparks alight.

In this context, we use network theory to explain the number of novel clauses introduced into a trade agreement as a function of the structure of previous agreements between negotiating parties and their exposure to different environmental clauses in other agreements. The literature on social networks is increasingly utilized in international studies as a method for visualizing, analyzing, and modeling regime complexes (Kim 2013; Manger et al. 2012; Manger and Pickup 2016; Widerberg 2016; Pattberg et al. 2018), but less often for its theories about how these international structures influence various socially and politically relevant outcomes (MacDonald 2018). This is unfortunate, for network analysis offers theory that has been used by other fields to explain the emergence of artistic development, scientific discoveries, and technological progress (Phillips 2011; Padgett and Powell 2012; Strumsky and Lobo 2015). Social networks provides a perspective that highlights how social structure and the resources available within it condition the introduction of legal novelties. This paper draws on network theory to argue that agreements concluded between parties with diverse experiences and unconstrained by earlier agreements between them introduce more novelty.

To illustrate this argument, we use the example of environmental clauses appearing in 630 trade agreements. Environmental clauses, like other non-trade issues (Lechner 2016; Milewicz et al. 2018), are increasingly prominent in trade agreements. The 2018 Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) includes a 26-page-long chapter devoted to environmental protection earning it a moniker as the greenest trade agreement ever concluded (Peterson Institute for International Economics 2016). Likewise, the EU Commission touted the Comprehensive Economic and Trade Agreement (CETA) between the European Union and Canada as "a new global standard for sustainability chapters in trade agreements" (European Commission 2016). But while CPTPP and CETA may be environmental champions in terms of the number of environmental clauses they include, they each introduced just one novel environmental clause to the trade regime complex: The CPTPP's novel clause calls for the elimination of fisheries subsidies; CETA's novel clause excludes freshwater from trade commitments. All other CPTPP and CETA environmental clauses were first introduced by earlier trade agreements. By contrast, NAFTA and its environmental side agreement introduced 48 novel environmental clauses to the trade regime complex. This paper tackles two questions concerning the emergence of novel legal clauses: (i) when do agreements include legal novelties and (ii) why do some agreements include more novel clauses than others?

Consistent with expectations developed from network theory, we find that trade agreements are more likely to include novelties when they include parties with diverse experiences of other environmental clauses in earlier trade agreements and are more novel when the parties are less constrained by previous trade agreements among them. Both the likelihood and the number of novelties introduced increase when the system is not yet saturated in terms of environmental clauses in the trade regime complex and the present trade agreement exploits many environmental norms already circulating with the trade regime complex. Contrary to prevailing wisdom, we do not find evidence that power asymmetry (e.g., a more powerful country imposing its environmental preference on a weaker country in exchange for market access) is unambiguously related to the emergence of novelties,

though parties' commitment to environmental norms within the environmental regime does drive the number of novelties expected. In sum, we argue that the local and global structures that instantiate past decisions condition both the likelihood and number of legal novelties.

The next section of this paper introduces the example of environmental clauses in trade agreements. Section 3 contrasts four key endogenous mechanisms (diversity, constraint, exploitation and saturation) with two principal exogenous explanations (power and commitment). Section 4 presents and describes the results from fitting a hurdle model with these variables to our data. The conclusion discusses the contributions of this paper and next steps.

2 Environmental clauses in the trade regime complex

The trade regime complex is increasingly well understood as a system. Four streams of the literature locate trade agreements in their broader institutional context and study their interactions. The first explains the conclusion of trade agreements by a contagion effect taking place across countries (Egger and Larch 2008; Chen and Joshi 2010; Jandhyala et al. 2011; Baldwin and Jaimovich 2012; Manger et al. 2012; Kinne 2013; Manger and Pickup 2016). The second studies the interactions between bilateral and multilateral agreements (Busch 2007; Davis 2009). The third pays greater attention to the legal substance of trade agreements and attempts to explain the diffusion of specific treaty characteristics across the network of trade agreements (Dür et al. 2014; Baccini et al. 2014; Milewicz et al. 2018). The fourth stream of the literature looks at adjustments among trade and non-trade institutions located within a "regime complex" (Oberthür and Gehring 2006; Young 2008; Gabler 2010; Gehring 2011; Keohane and Victor 2011; Zelli et al. 2013). We are not aware of any, however, that have tackled the problem of where legal novelties are introduced into the trade regime complex.

Environmental clauses are an excellent subset of trade clauses with which to study novelty. Many other trade clauses may predate accurate historical records, thus frustrating analysis. For example, the first use of the most favored nation concept can be traced back to at least the eleventh century, where the town of Mantua in Italy obtained in its charter from the Holy Roman Emperor, Henry III, the guarantee that it would benefit from all privileges granted to "whatsoever other town" (Davey and Pauwelyn 1998, p. 13). Even if we accept this as the point of introduction, there is only incomplete information about the system of trade agreements and their contents at that time. Identifying systemic conditions for this charter as the point of introduction could only be partial. By contrast, environmental clauses appear only to have been first introduced into trade agreements from the 1940s. This offers several decades of information about when and where each environmental clause first appeared and the conditions under which novelty appeared.

The recent TRade & ENvironment Dataset (TREND) documents the occurrence of 282 different environmental clauses in 630 bilateral, plurilateral, and multilateral trade agreements signed after 1945, starting with the 1947 GATT and ending in 2016 with CETA (Morin et al. 2018). TREND defines "clauses" quite specifically. For example, TREND considers the requirement to enhance the capacity of environmental NGOs distinct from the requirement to provide environmental capacity building assistance to a foreign government. Such granular coding allows the identification of even relatively 'minor' legal

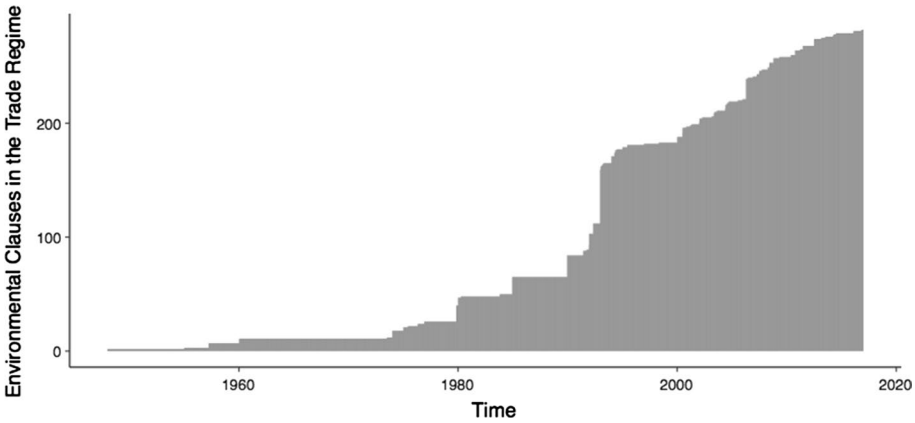

Fig. 1 Environmental clauses in the trade regime over time. *Source*: TREND

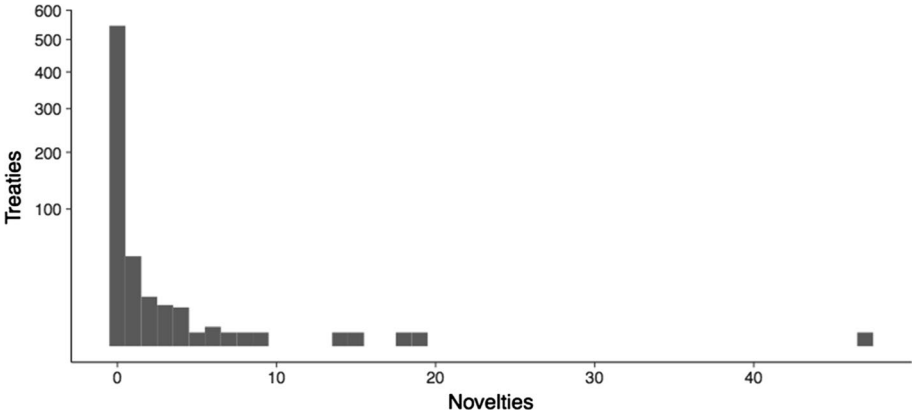

Fig. 2 Distribution of legal novelties across trade agreements. *Source*: TREND

novelties, such as a new target for capacity building. TREND was coded manually and groups together clauses that have the same meaning but were expressed with different wordings. Thus, TREND reveals legal novelties that are truly the first legal articulation of a norm within a trade agreement, rather than merely the first occurrence of some terminology.

Figure 1 shows the expansion of environmental clauses in the trade regime complex. According to TREND, GATT 1947 introduced the first two environmental clauses: an exception for the protection of human, animal, or plant life or health, and another exception for the conservation of exhaustible natural resources. Though some novel environmental clauses were introduced into the trade regime complex over the next few decades, it was not until the 1980s that we begin to see sometimes large and other times more incremental increases to their introduction. What explains the availability of so many environmental clauses in the trade regime complex? Is it just a function of the number of trade agreements concluded?

Figure 2 illustrates the distribution of legal novelty at the level of the agreement rather than the system. It shows us two things. First, only some trade agreements introduce legal novelties. While the *y*-axis is scaled by the square root to help identify agreements that introduce novel clauses, 546 (nearly 87%) of 630 trade agreements include no new environmental clauses.[2] Second, among those trade agreements that do introduce legal novelties, the number they introduce varies considerably. The agreement introducing the highest number of novel clauses, on the right of the distribution, is NAFTA of 1992. This agreement between Canada, the USA, and Mexico gave rise to an exceptionally high number of new clauses (48). Three other agreements introduced at least 15 environmental clauses to the system,[3] and another four introduced at least five environmental clauses. Still, more than 80% of agreements introducing legal novelties introduced three or less. Our aim in this paper is to explain the two parts of this distribution.

Note that TREND only covers environmental clauses found in trade agreements and is thus limited in two main ways. First, it cannot capture any impact environmental clauses in non-trade agreements (e.g., environmental treaties) or domestic settings might have on the appearance of environmental clauses in trade agreements and so proxies are needed here. Second, it cannot capture any impact non-environmental clauses present in trade agreements might have on the appearance of environmental novelties in trade agreements. Further coding would be required to mitigate this limitation. Network theory, however, points to the potential of structural, endogenous processes to explain the conditions if not the sources of legal novelty.

3 Network theory and legal novelty

While the story of the introduction of each environmental clause to the trade regime complex relies on the preferences, agency, and influence of interest groups, ultimately it is state negotiators at the negotiating table that must agree to include one or more clauses that have not appeared in trade agreements before. Social networks help us theorize how the structure of preexisting agreements and the clauses therein condition when and how much novelty is introduced. Network theory offers a systemic and endogenous perspective to understanding novelty: It suggests that novelties emerge in particular structural locations, which then condition successive opportunities for novelty (see also Granovetter 1985). Below, we discuss these endogenous mechanisms and contrast them with more conventional exogenous mechanisms.

3.1 Negotiating constraint

Perhaps the network theoretical concept most explicitly associated with novelties is that of structural holes. Ronald Burt (2004) noted that actors who filled what would otherwise be structural holes—spaces between disconnected groups in a network—saw brokerage opportunities between these groups. Burt argues that these brokers' less embedded, but group-spanning structural position affords them possibilities of information arbitrage and

[2] Though 555 (88%) of trade agreements include at least one environmental clause, whether new or not.

[3] The US-Peru agreement of 2006, the 1989 Lomé IV and 1984 Lomé III Conventions, with, respectively, 18, 17 and 16 legal innovations.

that they can better negotiate novel compromises, ameliorate misunderstandings, transfer best practices, draw analogies, or synthesize ideas than their peers (Burt 2004, p. 355). In other words, when one is connected to actors that are disconnected from one another, then there exist opportunities to make connections of coordination, ideas, or resources and introduce novelties to their system.

Because opportunities (in the form of structural holes) are inherently difficult to measure, Burt chooses to instead measure opportunity's inverse: constraint. When an actor's network is already heavily connected, there is little opportunity to introduce novelty. Heavily embedded actors will find themselves constrained by overbearing support networks and normative pressure to maintain the same routines, limiting sources for new ideas or support for their introduction. Constraint has the advantage over alternative measures, such as betweenness centrality and geodesic distance that it depends only on an actors' local network (Perry-Smith and Shalley 2003). Therefore, Burt measures the degree to which an actor is constrained by their local network (Burt 2004, p. 362):

$$C_i = \sum_j \left(p_{ij} + \sum_q p_{iq} p_{qj} \right)^2$$

$p_{ij} = z_{ij} / \sum_q z_{iq}$ captures the proportion of an actor i's ties (z, across all other actors q) spent on contact j, where $\{i, j, q, \ldots\}$ represent the set of actors in the network, but $i \neq j \neq q$. p_{iq} and p_{qj} are measured analogously, but the third party q is the focal alter and these proportions are multiplied so that only when i and j both have ties to q is this presented as a constraint and summed. This is then added to p_{ij}, squared, and then summed across all j, providing a constraint score that ranges from 0 to 1. The overall implication of this equation is that constraint on an actor is high if the person has a small local network and those contacts are strongly connected to one another, either directly or through a central, mutual contact. The sum over all j partners means that an actor's constraint depends on the size of its local network, but the proportion of j's shared with q means it is also sensitive to network density or hierarchy (Buskens and van de Rijt 2008). The more constrained an actor is, the less opportunity they have to introduce novelty to their contacts. Constraint is low when actors maintain many partners that are not themselves connected. The less constrained an actor is, the more opportunity they have to recognize, generate, or introduce novelty.

Our setting differs from traditional social networks in an important way though. Legal novelties appear in treaties, the contents of which are the result of a usually unobserved agreement process between two or more negotiating parties. This gives us two types of agency and two types of nodes (two modes) in the network: the individual negotiating parties and the collective of parties negotiating a treaty. Agency for what appears in the treaty rests on the collective. However, "projecting" to a one-mode network of just treaties linked by shared parties or parties linked by shared treaties would obscure important structural information (Borgatti and Everett 1997; Opsahl 2011; Hollway and Koskinen 2016; Poast 2016). As such, we maintain the network as a two-mode network with ties indicating which individual actors are part of the collective negotiating a trade agreement's text. This means that here the brokerage function is not performed by individual actors, as in Burt's structural holes theory, but instead by the collective of state negotiators at the table. This places each node set in potential brokerage positions for the other (Jasny and Lubell 2015): some trade agreements broker multiple otherwise unconnected parties, and some parties link multiple agreements. This demands development of a version of network constraint for two-mode networks:

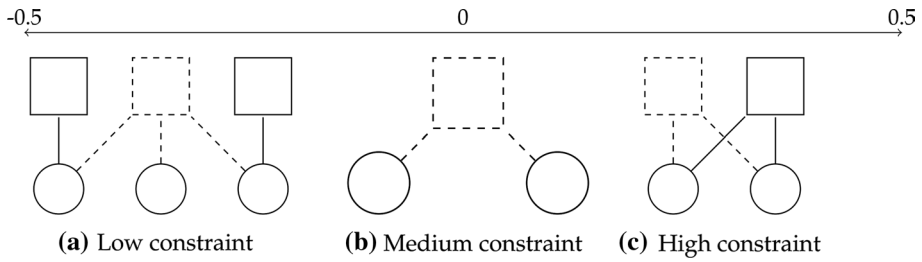

Fig. 3 Constraint and prior trade agreements: In each figure, the focal trade agreement being negotiated is represented by a dashed square and ties to it from negotiating parties in circles. Negotiating parties' other, existing trade agreements are represented by solid squares. *Source*: Authors

$$C_i = \sum_a \left(p_{ia} + \sum_{j,b} p_{ib} p_{bj} p_{ja} \right)^2$$

$p_{ia} = z_{ia} / \sum_b z_{ib}$ now presents the proportional influence of an actor a on institution i, assuming equal influence to all other parties (b), given a set of treaties $\{i, j, \ldots\}$ and a set of actors $\{a, b, \ldots\}$ where $i \neq j$ and $a \neq b$, and with p_{ib}, p_{bj}, and p_{ja} measured analogously to capture the other ties in a four-cycle *i-a-j-b-i* (Robins and Alexander 2004). Otherwise, this equation is similar to Burt's. We center the resulting score (which ranges from 0 to 1) around the median (0.5), so that constraint on a treaty's negotiation is moderate (0) if it is a bilateral treaty between two countries that have not negotiated a trade agreement before, an example of which is shown in Fig. 3b, high (0.5) if all parties are already connected by existing trade agreements, as shown in Fig. 3c, and low (approaching -0.5) if the trade agreement brings together many countries that have not negotiated a trade agreement before, as shown in Fig. 3a. The score thus privileges large plurilaterals but penalizes them where they overlap with other agreements. Note also that since the second summation in the equation sums the product of proportions in j other treaties that any b other party is a member of, those treaties that bring together parties that have independent trade agreement-making experience will have especially low constraint scores. Network constraint thus measures the extent to which parties' shared prior agreements or "institutional context" operate like a straitjacket to the negotiations, limiting negotiators' vision for or ability to justify to domestic constituents the introduction of alternative ideas (Copelovitch and Putnam 2014). Although the constraint of prior agreements operates on the collective negotiating table, it is important to note that it is the negotiators (collectively) who have the agency to introduce novel clauses into their agreement.

This equation was used to calculate scores for all bilateral and plurilateral trade agreements. The two-mode constraint equation was iterated over each institution in order of their appearance to calculate the constraint each treaty was under at the time it was signed. The scores ranged from a minimum of -0.4776 to a maximum of 0.5, with a mean of -0.0633. We expect a negative relationship with respect to this two-mode CONSTRAINT score: Less constrained treaties introduce more legal novelty; for example, all other things being equal, we would expect a higher probability of novelty being introduced into a new trade agreement between the EU and the USA, who are not yet constrained by an earlier trade agreement, than in a renegotiation of NAFTA between Canada, Mexico, and the USA who were previously constrained by the original NAFTA. Note that this is not just a description of where novelty occurs (in structural holes) but when and *why* it occurs (more) in some

agreements than others: Gains to trade from the first trade agreement between parties are attractive enough to justify the costs or risks associated with introducing legal novelty.

3.2 Diversity of experience

A regular critique of Burt's concept of constraint is that structural holes theory assumes that heterogeneous contacts hold heterogeneous representations of the world (Vedres and Stark 2010; De Vaan et al. 2015). However, unconnected agreements, such as the two existing agreements shown in Fig. 3a, may nonetheless incorporate the same environmental clauses. Therefore, despite being unconstrained by previous agreements among themselves, negotiating parties may still bring similar experiences to the negotiating table. Similarity, or its inverse diversity (Miller and Page 2007; Page 2010), can affect novelty in two main ways.

First, when parties are already subjected to the same commitments, there is little need for novel clauses. Parties can simply rely on their shared repertoire of environmental clauses when negotiating the agreement. A diverse repertoire of existing clauses, by contrast, provides a *demand* for novel clauses to reconcile or make coherent differing experiences (i.e., mitigate negative externalities: Johnson and Urpelainen 2012). Actors are adaptive, but with little heterogeneity or diversity, adaptation can only lead to convergence (Holland 1995). Novelties require diverse experiences to drive adaptation.

Second, a diverse repertoire of existing clauses presents a *supply* for novelties (Teubner 1993; Luhmann 2004). As discussed in relation to Fig. 3, novel clauses often represent combinations of existing clauses. Existing clauses are thus "resources that can be put to strategic use" (DiMaggio 1997, p. 265).[4] Whether in technology, biology, arts, philosophy, or law, everything seemingly "new" still draws from existing material either as refinements or recombinations (Strumsky and Lobo 2015). It rejects the notion that humans can design institutions that "have no historical links to any ancestral version" (Vermeij 2009, p. 121). Where states have different repertoires of existing environmental clauses in trade agreements, they therefore bring both the motivation and the material for novelties.

We define each party's portfolio, repertoire, or experience as a binary vector of the environmental clauses present in any of their earlier trade agreements, where a 1 represents exposure to a given clause, k, and 0 no exposure. Diversity has been measured in diverse ways in the literature, such as variety, (Blau, Gini-Simpson, or Gibbs-Martin) diversity, (Shannon) entropy, or (Rao) divergence (Page 2010). However, since we are more interested in difference than distribution here, we sum the Jaccard distance between each pairing of a trade agreement's parties' repertoires, where $a > b$ in the set $\{a, b, \ldots\}$ of n parties to an agreement i, as shown in the numerator of the following equation:

$$d_i = \frac{\sum_a^n \sum_b^n 1 - \frac{\sum_k \min(a_k, b_k)}{\sum_k \max(a_k, b_k)}}{n}$$

By taking the inverse of the Jaccard coefficient, $\frac{\sum_k \min(a_k, b_k)}{\sum_k \max(a_k, b_k)}$, the distance can thus be interpreted as the proportion of clauses that only one of a pair $\{a, b\}$ has been exposed over

[4] When accepting an Academy of Achievement award in 1982, Steve Jobs said: "If you're gonna make connections which are innovative […] you have to not have the same bag of experiences as everyone else does […] or else you're going to make the same connections (as everybody else)".

those to which at least one of the pair has been exposed. This means that it does not matter whether the amount of experience two states have with respect to a particular clause differs; if they have both experienced this clause in earlier agreements, then there is no diversity to demand or supply novelty. Only when one has experienced an environmental clause in a trade agreement that the other has not, do we register diversity.

Finally, since the sum of these dissimilarity indices would be much higher for multilateral trade agreements with many parties, we normalize this sum by the number of parties in the agreement, n, to obtain a DIVERSITY score for each trade agreement, d_i. Note that because the denominator scales linearly with the number of parties but the numerator scales combinatorially, agreements with more parties will have a larger diversity score than agreements with fewer parties, but the same distance between each pair of parties' experiences. This corresponds with the idea that more differences between more parties means more demand for novelties. The scores ranged from a minimum of 0 to a maximum of 42.6243, with a mean of 0.9630. We expect that, conditional on an agreement being reached, higher diversity will make it more likely that an agreement includes novel clauses and more novel clauses. For example, any trade agreement between the EU and the USA, which each have a distinctive repertoire of environmental clauses in their existing trade agreements, is more likely to include novel clauses, and more of them, than a trade agreement between, say, two Latin American countries with a less diverse experience.

3.3 Exploitation

Constraint and diversity capture what negotiating parties bring to the negotiating table, but some trade agreements engage environmental matters more than others and the degree to which they engage the environment should affect how likely an agreement is to introduce novelty. We capture this by the degree to which trade agreements exploit or utilize environmental clauses already in circulation within the trade regime complex. A trade agreement that exploits many existing environmental clauses signals how salient environmental concerns are to the parties and content of the trade agreement. But exploitation of existing environmental clauses can also drive adaptive demand in the same way that experience diversity does above. The more negotiations exploit environmental clauses already circulating in the trade regime complex, the more demand there is to reconcile any conflicts among them through novel legal clauses and the more immediately available is the supply of inspiration for new clauses (Glick and Hays 1991). For example, the exceptions for protecting animal and plant health or life and conservation of natural resources in GATT 1947 (illustrations of "exploration") were widely diffused and generated a rich tapestry of different types of environment-related exceptions in trade agreements, including exceptions to commitments on service liberalization, public procurement, and investment protection. We measure EXPLOITATION as the number of non-novel environmental clauses included in the trade agreement and expect more exploitation to make novelties more likely and more novel clauses likely.

3.4 Saturation

Moderating the effect of negotiating constraint, diversity of experience, and exploitation, is the pool of existing clauses. While existing clauses may provide inspiration for an early burst of further novelties, agents quickly turn from "exploration" (i.e., creating novel clauses) to "exploitation" (i.e., the reproduction of existing clauses) as the pool of existing

clauses gets larger (Morin et al. 2017). This is because using existing clauses is less costly and risky than exploring possible new clauses (March 1991). Innovation is unnecessary when legal solutions already exist that trade negotiators can exploit. We see this in Fig. 1 showing how the rate of novelties per agreement has been declining since the mid-1990s as the system has become more saturated with environmental clauses. Though there are positive feedbacks early on from the combinatory potential of existing clauses (see above), the rate of novelties on potential new combinations decreases over time (Youn et al. 2015). While the 1989 Lomé IV Convention and 1992 NAFTA introduced 17 and 48 novel environmental clauses, respectively, the recent CETA includes only one novel clause, despite relatively low constraint and high diversity. We therefore include a count of existing clauses as a proxy for SATURATION and expect that the more clauses already introduced into the system, the less likely agreements will include new or many new clauses.

3.5 Alternative explanations: power and commitment

Key alternatives to those expectations outlined above rely on mechanisms exogenous to the system such as power and commitment. First, power can be thought to be responsible for novelties. As Modelski (1990, p. 13) claimed: "In global politics, the driving force of innovation has been the world powers, nation-states rising in their time to positions of global leadership". This perspective suggests that the inclusion of novel clauses depends on the presence of power asymmetries between the parties. Presumably, powerful parties can use their leverage to obtain new clauses, or less powerful parties can attract powerful partners through offering novel concessions (Milewicz et al. 2018). This intuitive account leads one to expect that trade agreements that see high POWER asymmetry among the parties, measured as a Gini coefficient of the sum of the parties' trade exports and imports (Barbieri et al. 2009), will be more likely to include novel clauses and to include more novel clauses, than agreements negotiated between more evenly matched parties.

A second exogenous account is that parties will craft new legal clauses in issue areas in which they have an interest. States might introduce new environmental clauses into trade agreements because they want to secure domestic or international environmental gains against backsliding (Milewicz et al. 2018). We would expect that any variation in environmental group activism or access would be expressed in both commitments to environmental treaties as well as in novel environmental clauses to the trade regime complex. We measure such COMMITMENT as the average number of environmental agreements signed by parties to a trade agreement when it was signed. The expectation is that trade agreements with highly environmentally committed parties will be more likely to include novel clauses and more likely to include many of them.

These exogenous explanations are not incompatible with our earlier, endogenous expectations. While we expect exogenous factors to be influential, we argue that there are important endogenous factors by which the structure and distribution of previous agreements and clauses can lead to and limit novel legal clauses. First, previous agreements between parties constrain negotiators' freedom to introduce novel clauses to gain benefits (CONSTRAINT). Second, previous agreements can provide parties with diverse legal experiences that simultaneously demand novel clauses to reconcile and supply the material for that reconciliation (DIVERSITY). Third, as novel clauses are introduced to the system, the system saturates and actors turn to exploitation rather than exploration (SATURATION). And yet, more EXPLOITATION also demands and supplies material for legal clauses. Table 1 summarizes our hypotheses for the basic endogenous and exogenous effects.

Table 1 Hypotheses about legal novelties

Effect	Expectation
Power	The more asymmetric in power treaty parties are, the more likely the treaty is to introduce at least one new environmental clauses and more new environmental clauses it will introduce if it does
Commitment	The more committed to environmental agreements treaty parties are, the more likely the treaty is to introduce at least one new environmental clause and more new environmental clauses it will introduce if it does
Constraint	The more constrained treaty parties are by previous trade agreements between them, the less likely the treaty is to introduce at least one new environmental clause and fewer new environmental clauses it will introduce if it does
Diversity	The more different treaty parties' existing profiles of environmental clauses in trade agreements, the more likely the treaty is to introduce at least one new environmental clause and more new environmental clauses it will introduce if it does
Exploitation	The more existing environmental clauses are exploited in a treaty, the more likely the treaty is to introduce at least one new environmental clause and more new environmental clauses it will introduce if it does
Saturation	The more environmental clauses already introduced to the system, the less likely the treaty is to introduce at least one new environmental clause and fewer new environmental clauses it will introduce if it does

Finally, since we expect relationships between variables to be nonlinear (Gunitsky 2013, p. 39), we take the square root of EXPLOITATION, SATURATION, and COMMITMENT. This means that an additional environmental agreement (COMMITMENT) or an additional clause (EXPLOITATION and SATURATION) will not have as much of an effect at higher values as it will at lower values.

4 Results

To test for evidence of these effects in our data on the introduction of environmental clauses in trade agreements, we fit a statistical model. Since the number of novel clauses a treaty has represents count data, inferential models should respect this nonnegative, discrete distribution. However, there are two additional complicating factors. First, the breadth of the empirical distribution shown in Fig. 2 suggests data that is dispersed more than what would be captured by a standard Poisson distribution. Some agreements, such as NAFTA, introduce considerably more legal novelties than the average. One way of addressing this is to instead use a negative binomial distribution, which includes a theta to capture this extended variance. Second, the high proportion of agreements that include no novelties suggests that there is an inflation of zeros compared to what would otherwise be expected under a negative binomial distribution. In other words, there may be some additional process that makes novel legal clauses unlikely in most contexts. Together with the extreme values, this combination of a large number of zeros is poorly modeled by standard probability distributions.

To capture these twin logics, we use a two-component or two-part hurdle model that allows separate specifications of the probability of a zero count and the probability of each nonzero count (Cragg 1971; Mullahy 1986; Heilbron 1994). Separating these into two processes allows the hurdle model to accommodate both a large number of zeros in addition

Table 2 Regression results

	Full	Exogenous	Endogenous	Final
Zero model				
(Intercept)	−1.94 (0.58)***	−4.30 (0.47)***	−1.82 (0.43)***	−1.58 (0.39)***
Power	0.23 (0.98)	2.40 (0.66)***		
Commitment	0.02 (0.06)	0.14 (0.04)***		
Constraint	−1.55 (1.40)		−1.59 (1.17)	
Diversity	0.08 (0.04) ~		0.08 (0.04) ~	0.12 (0.04)**
Exploitation	0.72 (0.09)***		0.72 (0.08)***	0.72 (0.08)***
Saturation	−0.27 (0.05)***		−0.26 (0.05)***	−0.27 (0.05)***
Count model				
Log(theta)	−2.08 (1.99)	−11.30 (81.14)	−8.77 (81.77)	−2.47 (2.74)
(Intercept)	−0.58 (1.97)	−11.24 (81.14)	−6.32 (81.76)	−1.29 (2.59)
Power	−1.64 (1.87)	3.11 (1.40)*		
Commitment	0.19 (0.09)*	0.03 (0.05)		0.19 (0.09)*
Constraint	−4.80 (2.38)*		−2.63 (2.27)	−4.24 (1.74)*
Diversity	0.02 (0.05)		0.01 (0.05)	
Exploitation	0.51 (0.17)**		0.64 (0.16)***	0.50 (0.17)**
Saturation	−0.43 (0.12)***		−0.40 (0.13)**	−0.44 (0.12)***
N	630	630	630	630
AIC	624.70	774.48	626.96	622.52
Log-Like	−297.35	−380.24	−302.48	−301.26

~p < 0.05; *p < 0.1; **p < 0.01; ***p < 0.001

to some extreme counts. Essentially, the "zero" part of the model employs a Bernoulli distribution to govern the binary outcome of whether an agreement includes a novel clause or not, and then, if the realization is positive, the "hurdle" has been crossed and the conditional distribution of how many novel clauses there are is governed by a truncated-at-zero negative binomial distribution.[5] This provides a clear interpretation: The zero part of the model answers the question when novelties are likely to occur, while the count part of the model answers the question how many novel clauses are likely to occur, given that novelty does occur. The variables included in each part of the model need not be the same, though in the absence of theory to the contrary we opted for a symmetric model specification at the outset.

Table 2 presents the results of fitting hurdle models to the binary outcome of novelty ("zero") and the conditional count of novel clauses ("count"). The first model specification includes all variables, the second and third models are only the exogenous and endogenous explanations, respectively, and the fourth and final model is the result of a backward elimination procedure until we reached a model specification that minimized the Akaike information criterion (AIC) while retaining effects that were statistically significant. The result of this procedure was a relatively parsimonious model that, as shown in Fig. 4, fit a

[5] An alternative would be to use 'zero-inflated' poisson or negative binomial distributions: Lambert (1992). We prefer the hurdle model here for its clean interpretation relating to our research questions. Table 3 in the appendix demonstrates the robustness of our results to model choice.

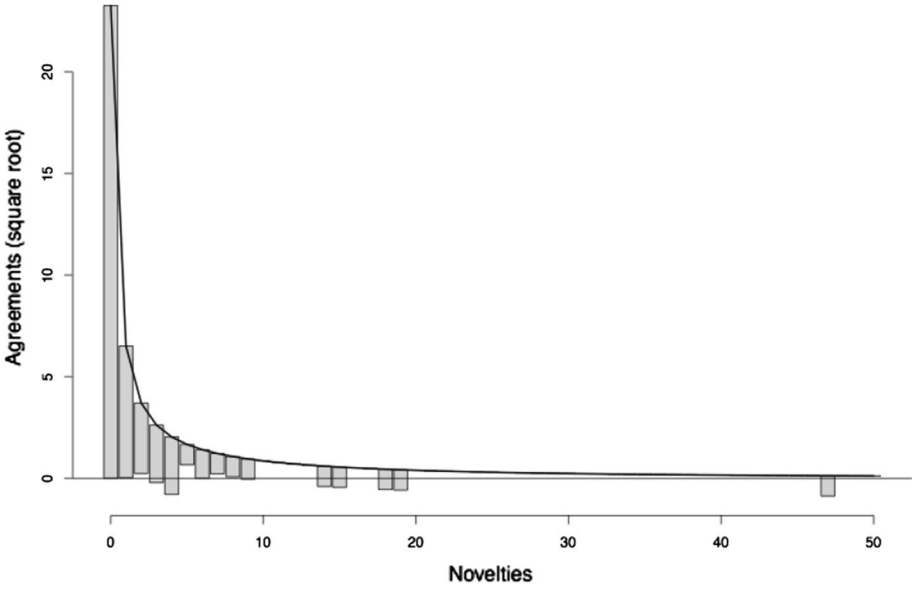

Fig. 4 Goodness of fit of final model. *Source*: Authors

challenging distribution rather well. The thick black curve represents the model, and the gray bars show the empirical distribution. Gray bars that terminate above zero are overpredicted and those that terminate below the line are underpredicted by the model.

Comparing the exogenous and endogenous models to the full model with all the controls and the final, parsimonious model tells us several important things. First, that POWER is only significant in the exogenous-only model suggests that this explanation is overshadowed by other, endogenous explanations. Although many of the agreements that introduced the most novel clauses (such as NAFTA) did involve powerful parties, the statistical model does not look only at these most novel agreements but also to those that introduced a few, one, or no novel clauses. And here the relationship between power and novelty is evidently not as strong as endogenous mechanisms. While there are a few well-known examples of novel clauses that have been introduced by or with powerful actors, power does not always lead to novelty being introduced and novelty is often introduced without the presence of power asymmetries. For example, while the 1995 agreement between the EU and Estonia and the 2007 agreement between the USA and Panama had high power/trade flow asymmetry scores (0.74 and 0.50), neither included a single novel clause. Conversely, the 1981 Finland–Poland agreement reflects little power/trade asymmetry (0.15), but sets out two novel clauses. This loss of significance for POWER was robust to a range of different model specifications, and so it was dropped from the final model in the interests of parsimony.

Second, while COMMITMENT is not significant in the count part of the exogenous-only model, it is significantly positive in the full and final models. This is consistent with the idea that the more environmentally committed parties are, the more likely their trade agreements will include (many) novel clauses.

Third, while CONSTRAINT is not significant in the independent models, it proves significant in the count part of the full and final models.[6] Here, the direction is as hypothesized. The less constrained a negotiating table is by parties' previous agreements with one another, the more novel clauses parties can introduce.[7] The 1997 Amsterdam treaty between European countries all tied by prior trade agreements, for example, had a high constraint score (the maximum of 0.5) and no novel clause. Even the 1985 USA–Israel agreement, despite having a high commitment score, had positive constraint and no novel clause. By contrast, the Common Market for Eastern and Southern Africa (constraint −0.43) and the West African Economic Community (constraint −0.3) each introduce six novel clauses.

Fourth, DIVERSITY is only borderline significant in the endogenous and full models, but is statistically significant in the zero part of the model after conducting a backward model selection procedure that removed constraint from that part of the model. The effect is positive, as expected: The more different the experiences of a trade agreement's parties, the more likely it will see some novel clauses. That constraint matters most for the count part of the model, and diversity for the zero part of the model is interesting. It suggests that the likelihood of a novel clause occurring depends on what experiences parties bring to the table, but how many novel clauses they subsequently introduce will depend on how constrained they are by previous agreements. The Lomé II, III, and IV conventions, for example, are all in the top ten in terms of diversity, had lower than average constraint due to new parties joining at each step, and consequently are among the top five of the most novel agreements in the TREND database (with, respectively, 11, 15, and 19 novel legal clauses). Interestingly, this result appears to stand in contrast to game theoretic expectations that the more diverse and greater the number of actors, the more difficulty in obtaining agreement among them. However, conditioning on agreement and from a perspective of novelty, more and more diverse players may lead to more scope extensions and issue linkages than we would otherwise expect.

Fifth, the feedback mechanisms are strong and apply both to the likelihood and number of novel clauses as expected: EXPLOITATION is positive and strongly significant, while SATURATION is significantly negative. This means that while a growing pool of environmental clauses suppresses legal novelty, this can be partly counteracted by parties incorporating a large proportion of those existing environmental clauses into the current trade agreement. Besides indicating the environmental salience of the treaty, these environmental clauses provide further demand and supply for adaptation. Note that the relative size of the coefficient for SATURATION compared to that of EXPLOITATION is higher in the count model than the zero model. This suggests that saturation especially suppresses the amount of novel clauses and exploitation especially signals the possibility of a novel clause being included. A good example of this is NAFTA: It was concluded when fewer environmental clauses were in circulation in the trade regime complex and yet utilized many of them (52) and consequently introduced many (48) novel clauses. Conversely, the recent Trade Facilitation Agreement faces a larger pool of existing environmental clauses, of which it only exploits eight (not surprising given its generic topic of facilitating trade), and introduces no novel environmental clause.

[6] Note that the count part of the endogenous and exogenous models do seem to have considerably more uncertainty in the parameter estimates than in the more comprehensive full and final models.

[7] Note that this result is robust to the introduction of the parties variable, affirming the view that it is the pattern of a treaty's surrounding network structure that enables or constrains innovation, and not (just) whether it is a bilateral, plurilateral, or multilateral agreement, or how many negotiating parties there are. See also Table 5 in the Appendix.

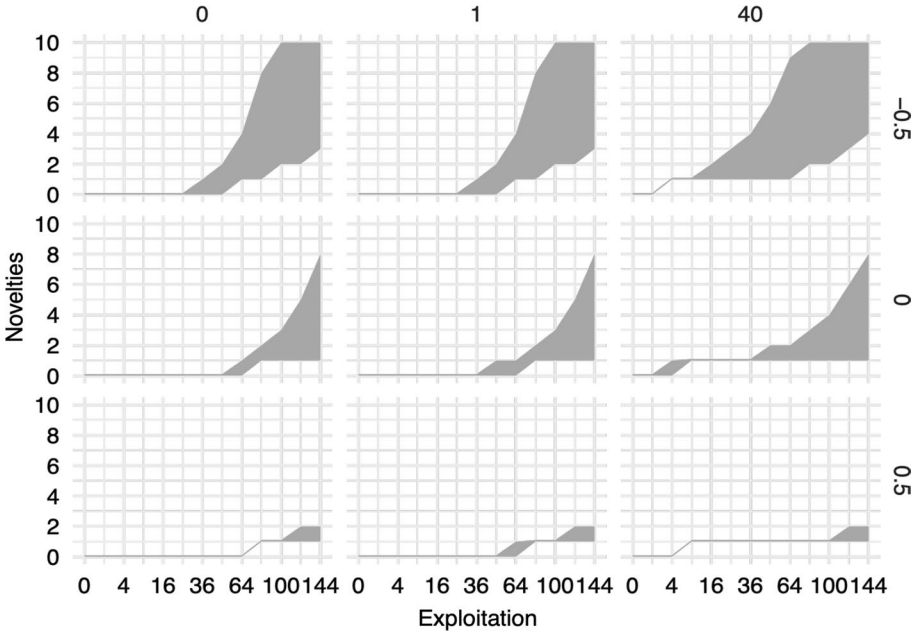

Fig. 5 Prediction curves for introducing novel clauses. *Source*: Authors

While the model is parsimonious, spreading effects across the two components of a hurdle model makes coefficient interpretation complex. To better understand how novelties respond to different values on the explanatory variables, Fig. 5 shows how many novel clauses we can expect at current SATURATION levels when varying the other four key variables in our final model: EXPLOITATION, DIVERSITY, CONSTRAINT, and COMMITMENT. Designing novel clauses (also known as exploration) is presented on the *y*-axis and EXPLOITATION (reproducing existing clauses) on the *x*-axis of each graph. Note that the *x*-axis has been labeled in terms of the original values, though the variable itself was transformed by a square root. The columns from left to right show low, medium, and high DIVERSITY, respectively, and the rows from top to bottom show low, medium, and high CONSTRAINT. Low and high COMMITMENT marks the lower and upper bounds, respectively, of the ribbons shown within each of the resulting nine graphs. The ribbons appear jagged because the predicted exploration values have been rounded to the nearest nonnegative integer.

All graphs show that novelty can be expected to increase as EXPLOITATION increases.[8] However, the figure also shows how high DIVERSITY (shown in the right three graphs) makes novelties more likely under similar levels of exploitation. All other things being equal, a trade agreement is expected to include novel clauses with around just four existing clauses in it if the parties bring maximally diverse experiences to the negotiating table.[9] A trade agreement with parties with homogenous experiences would only be expected to see novelties at much higher levels of EXPLOITATION. This suggests that there needs to be either past or present diversity on the table for the introduction of novel clauses to occur. The

[8] Note that these expectations are tied to the current saturation level; a less saturated system would see legal novelties appear more likely and more frequently.

[9] This is the maximum observed diversity score.

figure also shows how high CONSTRAINT (shown in the bottom three graphs) suppresses the amount of novel clauses possible. Under maximum CONSTRAINT, no more than two novel clauses would be expected, even at high levels of EXPLOITATION and commitment. When freed of such CONSTRAINTS, however, negotiating parties may pursue their interests as illustrated in the broader ribbons in the upper graphs. At medium CONSTRAINT, legal novelty becomes prevalent only with high levels of COMMITMENT and DIVERSITY. For example, the 2010 agreement between the European Union and South Korea has a medium CONSTRAINT score (0) but includes four novel environmental clauses. Together, this suggests that it is the combination of high DIVERSITY and low CONSTRAINT that is responsible for the punctuation of equilibria.

5 Conclusion

This paper has presented the beginnings of a theory about the conditions under which legal novelty is introduced inspired by expectations about the relationship between structure, heterogeneity, and innovation from network theory. Our results lend support to the idea that the relational structure of a governance system is important for understanding the appearance of legal novelties. In the example of environmental clauses in trade agreements, trade agreements are more likely to introduce novel environmental clauses into the trade regime complex when they bring together parties with many diverse experiences of earlier environmental clauses in the trade regime complex and will introduce more new environmental clauses when negotiating parties, committed to environmental agreements, are unconstrained by existing shared trade agreements. This suggests that existing agreements suppress the number of novel clauses we would otherwise expect to see through the pressure of habitual practice and agreement templating.

This is tuned by two feedback processes. First, as the system becomes more saturated from previous novelties, parties may choose to exploit existing clauses rather than tailor new ones, and yet, as parties utilize more clauses from this pool in a particular trade agreement, the diversity of these clauses drives further adaptive processes. We might think of diversity as an endogenously generative mechanism, constraint as endogenously facilitative, and the two feedback effects as endogenously tuning novelty. Lastly, in contrast to common wisdom, we find no effect of power present in our data.

Our theory conceives of legal novelty as more frequent than just in big "constitutional moments" such as NAFTA. Although NAFTA introduced 48 new environmental clauses to the trade regime complex, this is only 17% of the environmental clauses coded in TREND. Our theory thus provides a considerably richer perspective on innovation than the exogenous accounts most often relied upon. It provides us with a complex account of how legal novelties are introduced into governance systems, stressing endogenous processes as conditioning the variety of exogenous factors that operate at a more case-oriented level, thereby providing a parsimonious yet powerful explanation.

It suggests that innovation happens early in a system's evolution, among partners with diverse legal and structural experiences, and where the commitments of the parties and terms of the agreement align. Whether this applies also to the appearance of other

non-trade issues in trade agreements, how trade clauses are introduced into environmental agreements, and how binding these clauses are requires further research. Future research should also explore how saturation, exploitation, and novelties are related, as well as delve deeper into the desirability, diffusion, and consequences of those clauses introduced to the system.

In terms of future institutional change, our findings suggest that the days of unfettered legal novelty in this empirical setting are likely over, but, since opportunities still exist for diverse parties to negotiate new trade agreements relatively unconstrained by previous agreements, we do not yet face a "complexity catastrophe" in which systemic rigidity confounds the appearance of novel solutions.

Acknowledgements We would like to thank audiences at the universities of Saint-Louis, Laval, Leiden, and Utrecht.

Appendix

See Tables 3, 4, and 5.

Table 3 Robustness of our hurdle model choice against common alternatives for (zero-inflated) count distributions: the Poisson, the negative binomial, and the zero-inflated negative binomial model

	Poisson	Negative binomial	Zero-inflated negative binomial	Hurdle
Count model				
(Intercept)	−1.20 (0.28)***	−1.46 (0.49)**	0.58 (0.78)	−1.25 (2.45)
Constraint	−2.49 (0.50)***	−2.89 (1.06)**	−3.15 (1.31)*	−3.86 (2.14)~
Exploitation	0.59 (0.04)***	0.71 (0.07)***	0.52 (0.11)***	0.50 (0.17)**
Diversity	0.07 (0.01)***	0.05 (0.03)~	0.02 (0.03)	0.01 (0.05)
Saturation	−0.35 (0.03)***	−0.35 (0.05)***	−0.44 (0.07)***	−0.43 (0.12)***
Interest	0.13 (0.03)***	0.10 (0.05)~	0.15 (0.06)**	0.19 (0.09)*
Log(theta)			−0.49 (0.23)*	−2.40 (2.58)
Zero model				
(Intercept)			1.08 (1.12)	−1.98 (0.55)***
Constraint			−2.23 (2.53)	−1.77 (1.21)
Exploitation			−1.48 (0.48)**	0.70 (0.08)***
Diversity			−0.05) (0.07)	0.08 (0.04)~
Saturation			0.08 (0.14)	−0.27 (0.05)***
Interest			0.18 (0.14)	0.03 (0.06)
Log-Like.	−488.64	−310.60	−296.63	−300.12
AIC	989.29	635.19	619.27	626.25

As shown in this table, the log-likelihood and AIC are very similar for the zero-inflated negative binomial and the hurdle model. While the zero-inflated negative binomial has slightly lower scores, Vuong tests show these differences are not statistically significant and so we choose to employ the hurdle model for theoretical reasons

~p < 0.05; *p < 0.1; **p < 0.01; ***p < 0.001

Table 4 Robustness of the full model to different subsamples of the data

	All	NoNafta	NoLome	OnlyEnv
Count model				
(Intercept)	− 0.58 (1.97)	0.17 (1.00)	− 0.44 (1.29)	− 0.58 (1.97)
Constraint	− 4.80 (2.38)*	− 3.09 (1.77)~	− 3.27 (1.93)~	− 4.80 (2.38)*
Exploitation	0.51 (0.17)**	0.39 (0.13)**	0.36 (0.15)*	0.51 (0.17)**
Diversity	0.02 (0.05)	0.03 (0.03)	0.00 (0.04)	0.02 (0.05)
Saturation	− 0.43 (0.12)***	− 0.30 (0.10)**	− 0.28 (0.11)**	− 0.43 (0.12)***
Interest	0.19 (0.09)*	0.10 (0.08)	0.11 (0.08)	0.19 (0.09)*
Power	− 1.64 (1.87)	− 0.59 (1.41)	− 0.41 (1.57)	− 1.64 (1.87)
Log(theta)	− 2.08 (.199)	− 0.57 (0.81)	− 1.14 (1.27)	− 2.08 (1.99)
Zero model				
(Intercept)	− 1.94 (0.58)***	− 1.94 (0.58)***	− 1.93 (0.58)***	− 1.33 (0.64)*
Constraint	− 1.55 (1.40)	− 1.49 (1.40)	− 1.53 (1.40)	− 1.31 (1.43)
Exploitation	0.72 (0.09)***	0.72 (0.09)***	0.72 (0.09)***	0.72 (0.09)***
Diversity	0.08 (0.04)~	0.08 (0.04)~	0.08 (0.05)	0.08 (0.05)~
Saturation	− 0.27 (0.05)***	− 0.27 (0.05)***	− 0.27 (0.05)***	− 0.29 (0.05)***
Interest	0.02 (0.06)	0.02 (0.06)	0.02 (0.06)	− 0.00 (0.06)
Power	0.23 (0.98)	0.27 (0.98)	0.27 (0.98)	0.14 (0.97)
Obs	616	615	611	545

Unfortunately, while splitting the sample along bilateral/plurilateral lines would be informative, this results in too little statistical power in each subsample to adequately test our hypotheses. More modest divisions that only trim outliers from the main sample do demonstrate the robustness of the full model though. The left column provides a baseline of all 616 cases for which we have complete data. The following two sections test the robustness of the results once outliers are removed. NAFTA is a clear outlier with 48 innovations and supposedly would have considerable leverage, but its removal only suppresses the significance level of some variables and does not change their sign. This is true even when further outliers, the four Lomé agreements are removed, though here the diversity variable in the count model does lose significance. Lastly, if we remove all trade agreements that lack any reference to the environment (an exploitation of zero), we still get similar results

~$p < 0.05$; *$p < 0.1$; **$p < 0.01$; ***$p < 0.001$

Table 5 Robustness of the final model to the influence of temporally specific variables

	Final	Environmentalism	Recessions
Count model			
(Intercept)	− 1.29 (2.59)	− 1.93 (1.85)	− 1.37 (5.41)
Commitment	0.19 (0.09)*	0.17 (0.09)*	0.17 (0.09)~
Constraint	− 4.24 (1.74)*	− 2.54 (1.36)~	− 2.88 (1.42)*
Utilization	0.50 (0.17)**	0.53 (0.17)**	0.51 (0.17)**
Saturation	− 0.44 (0.12)***	− 0.53 (0.13)***	− 0.46 (0.13)***
Environmentalism		2.49 (1.19)*	
Recession			− 0.42 (0.79)
Log(theta)	− 2.47 (2.74)	− 2.01 (1.85)	− 3.29 (5.87)
Zero model			
(Intercept)	− 1.58 (0.39)***	− 1.86 (0.50)***	− 1.52 (0.38)***
Diversity	0.12 (0.04)**	0.10 (0.04)*	0.11 (0.04)**
Utilization	0.72 (0.08)***	0.74 (0.08)***	0.73 (0.08)***
Saturation	− 0.27 (0.05)***	− 0.32 (0.05)***	− 0.28 (0.05)***
Environmentalism		0.95 (0.61)	
Recession			0.52 (0.48)
AIC	622.52	642.92	647.88
Log-Like	− 301.26	− 309.46	− 311.94

The middle column shows how the model is robust to the impact of environmentalism. To construct the environmentalism variable, we coded each trade agreement that was signed after the conclusion of the 1972 Stockholm Convention (on June 16) with a one and all others a zero. While this environmentalism variable scavenges some statistical significance from the constraint variable in the count part of the model, constraint remains significant at $p < 0.1$ in the count part of the model and diversity remains significant at $p < 0.05$ in the zero part of the model. The right column shows how the model is robust to the impact of recessions. One might expect that the environment is of lower priority in periods of economic crisis. To test this, we coded those trade agreements concluded in a recession year (1975, 1982, 1991, and 2009, according to the IMF) with a one, expecting a negative effect if any. We see in the rightmost column that there is no global effect of economic recession on novelty and the rest of the model remains robust

~p < 0.05; *p < 0.1; **p < 0.01; ***p < 0.001

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