Hierarchy in Complexity: PTAs and the Regime Complex in Intellectual Property Rights

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Abstract

This paper examines the impact of the intellectual property (IP) regime complex on the formation of preferential trade agreements (PTAs). The analysis utilizes data on IP references made in the universe of PTAs that have been signed since 1985. The theoretical framework advances the argument that a regime complex may be characterized by a hierarchy of institutions as some institutions, such as PTAs, incorporate explicit references to institutions, such as IP treaties, outside the agreement. Visualization using bipartite networks show that a cluster of treaties governing IP emerge to form the core regime within the regime complex for IP governance. This is a result of frequent inclusion of particular IP treaties and accompanied by strong legal obligation in IP commitments in PTAs. The empirical analysis examines the effect of this network of IP treaties on the evolution of the network. The results of the analysis indicate a significant effect of network externalities, that is, as references to a set of institutions increases (or as these institutions becomes more central in the network), PTAs are more likely to reference those institutions in PTAs. Among country-level covariates, the analysis finds that World Trade Organization (WTO) membership also has a significant positive effect on the formation of PTAs with references to the core group of IP treaties. This study has applicability beyond the regime complex of IPRs, as the number of institutions within governance areas increases and and linkages between them also intensifies, resulting in more hierarchical structures of governance in international regime complexes.

Introduction

Recent research on regime complexity has challenged the conventional wisdom that regime complexes are non-hierarchical, instead showing that there is considerable variability in authority relations across different complexes. Some regime complexes contain multiple, overlapping institutions that are functionally and authoritatively similar, whereas some contain institutions and norms that are clearly more central than others (Pratt 2018, Eilstrup-Sangiovanni 2022, Henning and Pratt 2023). Yet, to date, most analyses have not considered how regimes complexes change over time to become more or less hierarchical. Instead, most studies assume that regime complexes evolve randomly, often due to forces beyond the control of the individual states. This perspective views the structure of regime complexes as an incidental outcome, the result of uncoordinated processes rather than the strategic or intentional efforts by individual states to shape the broader architecture of global governance. In this view, states are forced to react to their environment, pursuing strategies that are in the short-term best interest but may or may not be in their long-term interest.

The view that states are, in effect, bystanders as regime complexes evolve around them flies in the face of most traditional approaches to IR, which assume that states have agency to affect the architecture of global governance (Ikenberry 2002, Lake 2009). Recent research on regime complexity shows that states endeavor to strategically craft connections to their preferred institutions (Allee et al. 2017, Dür and Mödlhamer 2022, Elsig et al. 2024). What we do not know, however, is how these short-term strategies affects the evolution of regime complexes over time as well as whether their overall structure exerts an independent impact. In other words, we want to understand theoretically whether the structure of a given regime complex has an effect on its evolution, complicating or perhaps even complementing state efforts to manage a given regime. If states make an effort to promote hierarchy in a regime complex through connection-building, how does this affect how actors interact with the regime complex? Ultimately, does hierarchy become self-reinforcing by creating a positive feedback loop that promotes consolidation of the regime over time?

In this paper we challenge the notion that regime complexes evolve randomly or haphazardly. Instead, we investigate the forces that contribute to the creation (or consolidation) of hierarchy in a given regime complex. Our core argument is that once certain rules and institutions become more central in a regime complex, typically because actors within the complex have pursued strategies to make them more central, then at some point this nascent hierarchy becomes self-reinforcing. In other words, by pursuing strategies to create (or reinforce) hieararchy in the short term, this creates inertia for consolidation of the regime complex over time. Eventually, as certain institutions and norms in the complex become increasingly central, this will generate network externalities that compel other states to adopt those institutions and norms such that

preferences will eventually converge on a set of core institutions. As more states connect and reinforce these central institutions, the costs of alignment with these preferred institutions decreases – or the costs of *not* being aligned increases. This network effect puts pressure on states to connect to the central institutions and rules. Moreover, as certain institutions become more central, states can use their institutional power to further encourage hierarchy. In short, increasing hierarchy in the regime complex reinforces the centrality of core institutions and compels others to act similarly.

To empirically evaluate our argument, we employ inferential network analysis on data on intellectual property (IP) references in preferential trade agreements (PTAs). Empirically, we treat PTAs and their IP connections as a dynamic network as the formation of new PTAs and their inclusion of references to IP treaties changes the structure of the regime complex. The constantly evolving network changes the strategic environment in which states negotiate their PTAs and the IP commitments within. We employ network concepts and measures to capture these network externalities. Using a temporal exponential random graph model (TERGM), we assess how network externalities affect the likelihood of a country making connections to core IP rights agreed in the World Trade Organization (WTO), to conventions elaborated in the context of the World Intellectual Property Organization (WIPO), as well as alternative IP instruments.

The empirical evidence shows that there are network externalities when it comes to provisions on IP governance in PTAs in the form of references to and obligations toward particular international IP treaties. Whether a given PTA includes affirmation of and obligation to specific IP treaties is driven by the shape of the regime complex itself, that is, the constellation of IP treaties that are also prevalent in other PTAs in effect. International treaties in the IP regime complex that are extensively referenced in PTAs, in turn, promote the formation of further ties to these treaties in subsequent PTAs. The centrality of the WTO's TRIPS Agreement arising out of extensive references in PTAs in the WTO era, for example, has encouraged its active inclusion in PTAs that were subsequently signed, which has further reproduced and reinforced the TRIPS-centered section of the regime complex for IP governance. This study provides empirical evidence of this dynamic process in the IP regime complex, utilizing the tools of network analysis that can account for its temporal aspects.

The paper proceeds by discussing the rich scholarship on regime complexes, highlighting how network intuitions are deeply embedded in core concepts in the research program. We then develop our theory which highlights the importance of network externalities as well as how states can excercise institutional power within the network to encourage hierarchy. The data and methodolody are discussed, followed by the findings. The paper concludes with a discussion of the implications of the findings for international cooperation.

Regime complexity in IP Governance

The regime complex of IP governance includes international treaties on IP protection that are embedded in other treaties such as trade agreements, together forming a network of overlapping institutions. While the original definition of a regime complex included a non-hierarchical structure (Raustiala and Victor 2004, Alter and Meunier 2009), more recent studies have challenged this view (Randall Henning and Pratt 2023, Green 2022). Others have advanced a more expansive conceptualization with the term global governance complex (GGC) to reflect the view that a regime complex can include both formal and informal institutions. Within the regime complex of IP governance, regime-shifting (Helfer 2004) is reflected in the degree to which PTAs have incorporated obligations from the WTO's Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement and other IP treaties. This has resulted in IP governance shifting from, for example, WIPO to the WTO and further on to the PTAs that include IP-related provisions developed in WIPO and confirmed in the WTO (mainly through case law interpretation). The idea of the shift is based on higher enforcement capabilities both in the WTO as well as in PTAs relative to the WIPO regime. With more institutions now populating the governance space and reinforcing particular IP treaties, the IP regime complex exhibits greater regime complexity.

This paper engages the lively debate on the merits and shortcomings of regime complexity as well as their value in global governance. The analysis examines the impact of the regime complex for IP governance on the provisions for the same in PTAs. We advance the argument that regime complexity arising from references to specific IP treaties in PTAs contributes both to the formation of hierarchy in the regime complex for IP governance and to subsequent PTAs in their provisions on IP governance.

PTAs and IPR provisions

The IP provisions in PTAs include a wide range of commitments, among which are provisions on obligations to comply with specific international treaties. In order to better understand these connections, an original data collection effort was undertaken in the Design of Trade Agreements (DESTA) project including treaty references of IP rights in PTAs.

Existing scholarship has generated key insights as to why PTAs may include IP provisions (Elsig and Surbeck 2016). One common narrative highlights the developmental divide, in particular demands by developed countries to include provisions for IP protection in PTAs with developing countries, who concede even though it is against their interests (Chen and Puttitanun 2005, Helpman 1992). Scholarship advances several possible mechanisms that link IP commitments in PTAs between developed and developing

countries. First, where developed countries, as the more economically powerful parties, leverage their economic power to impose their preferred IP governance standards on developing countries (Dür and Mödlhamer 2022, Escobar-Andrae 2011, Shadlen et al. 2005, Grossman and Lai 2004). Second, developing countries may accept IP commitments as concession in exchange for access to developed markets (Manger and Shadlen 2014, Shadlen 2008). Third, among developed countries there may be common norms concerning knowledge ownership, which results in strong provisions for IP protection in PTAs negotiated among developed countries (Cheng 2006). On the other hand, PTAs may include weak IP provisions when negotiated among developing countries as they are highly reliant on knowledge spill-overs and imitation but sensitive to the costs when IP protection is strict and comprehensive (Wu 2020, Campi and Dueñas 2019, Branstetter et al. 2011, 2007). A recent systematic study on IPR provisions in all PTAs shows that both power asymmetry in conjuction with innovative capacities drive up the ambitions in PTAs (Dür et al. 2014, Dür and Mödlhamer 2022).

Where IP protection in PTAs engages the development divide, PTAs among developing countries are expected to include weak IP protection provisions while PTAs between developed countries or between developed and developing country signatories would contain relatively stronger ad more comprehensive IP protection commitments. However, it is also the case that South-South trade agreements (e.g., between Mexico and Uruguay (2004) and between Panama and Peru (2011)) contain strong IP commitments. Looking more closely at the PTAs among developing countries and their provisions on IP, there is significant variation distinguishing PTAs that contain strong IP commitments and those that do not.

The literature presents mixed findings concerning the specific effects of IP provisions in PTAs on trade and investment (Ghosh and Yamarik 2019). Campi and Dueñas (2019) report somewhat inconsistent results showing that PTAs with enforceable IP commitments increase exports, yet PTAs without IP provisions increase exports more. Further, Maskus and Ridley (2023) as well as Ridley (2019) also advance the counterintuitive findings that PTAs with enforceable IP provisions enhance knowledge-intensive trade with third parties, that is parties outside the trade agreement, rather than between PTA signatories themselves. The broader scholarship is similarly inconclusive and inconsistent on the effects of IP protection on investment (Osgood and Feng 2018, Lee and Mansfield 1996, Mansfield and Mundial 1994). Studies have found both negative (Mathew and Mukherjee 2014, Glass and Wu 2007) and positive effects (Tanaka and Iwaisako 2014, Branstetter et al. 2011). Other studies find that weak IP protection deters FDI, but more investment flows to high-tech industries with increased IP protection (Nicholson 2007, Maskus and Fink 2005, Nunnenkamp and Spatz 2004) or that IP protection may have an indirect effect on investment as it increases licensing but not overal investment (Ivus et al. 2016).

This paper builds on the insights of current scholarship and advances scholarly in-

quiry into the impact of the regime complex for IP governance on the formation of PTAs with IP commitments. In doing so, it engages issues raised in the regime complexity literature, namely on how regime complexes matter (Alter 2022), applying their insights to PTAs and their IP commitments.

Connections between PTAs and IP Treaties

Within the IP governance regime complex, formal institutions such as international treaties on IP are often mentioned and rights incorporated in PTAs, thus linking trade agreements with the IP regime complex through institutional deference (Pratt 2018). While each reference may be an instance of institutional deference, in the aggregate these references give rise to a hierarchy in the IP governance landscape. The relationship between the trade agreements and the IP regime complex can be visualized using network graphs, specifically bipartite network graphs that connects PTas and IP treaties.[1] A PTA and an IP treaty are connected when a PTA contains a reference to an IP treaty. The reference can be made at varying levels of obligation, from a simple reference to treaty obligation; reaffirmation of certain parts (articles, paragraphs) and obligation to comply; or commitments towards accession to the given IP convention, where the last level represents the strongest IP reference.

Figures 1 to 6 present a series of bipartite network graphs across the years 1995 to 2018. The data rely on an original mapping exercise for IP commitments found in trade agreements (Surbeck 2019), which has been integrated into the DESTA database.[2] PTAs are represented by the nodes on the left-hand side of each graph and IP institutions are represented by nodes on the right-hand side. If a PTA includes at least one reference to a given IP treaty, this is indicated by a connecting line (or tie) between the two nodes. The trade agreement may contain references to multiple IP treaties, which would result in more than one tie between the trade agreement on the left and the IP treaties on the right. When the trade agreement does not contain any reference to an IP treaty, there is no tie. The ties are also weighted by the level of obligation: a simple acknowldgement of obligation (=1); reaffirmation of certain parts (articles, paragraphs) and obligation to comply (=2); or commitment to accede to a given IP treaty (=3), where the last level (3) represents the strongest IP provision.

There are two key characteristics in these graphs that reflect the evolving structure of the regime complex for IP governance. First, the relative size of the IP treaties. The size of the nodes on the right-hand side indicates how extensive are the references to particular IP treaties in existing trade agreements. The larger the size of nodes thus

[1] A bipartite network, or a two-mode network, is a network where two different sets of nodes are linked to each other. For the IP governance case, one set of nodes comprises PTAs and the other set consists of the IP treaties.

[2] www.designoftradeagreements.org.

indicates how influential and prominent are particular IP treaties as referents in trade agreements. Second, the relative positions of IP treaties across time. IP treaties that more central to the regime complex are located closer to the centre of the graph. IP treaties that are referenced by more PTAs and at higher levels of obligations are more central to the regime complex.

Figure 1 which presents the network in 1995, the year the WTO entered into agreement, sees a fragmented link with the IP governance regime, with few trade agreements including IP commitments and the references themselves scattered across many treaties with no discernible hierarchy among them. In previous years, only the US-Israel free trade agreement signed in 1985 included any references to IP treaties. As the WTO era advances, and the perceived authority of the WTO and its various agreements increase (e.g., TRIPS Agreement), the graph for the year 2005 in Figure 3 shows the strong emergence of a cluster of a set of heavily referenced IP treaties, including the WTO's TRIPS, alongside prominent WIPO Conventions (e.g., Rome, Paris, and Bern).[3] Helfer (2009, 40) argues that the TRIPS Agreement grenerated substantive and procedural tensions between developed and developing countries. It incentivized developed countries such as the United States and the European Communities and intellectual property industries in both to enhance and extend TRIPS commitments by incorporating them into their trade agreements and investment treaties. Longitudinal patterns in the post-2000 years reflect this influence, as this group of treaties are featured through increasingly large nodes at the forefront of the right-hand side group of IP treaties in subsequent graphs (Figures 4 - 6). The latter years also feature the emergence of another group of treaties that are critical of the existing WTO/WIPO consensus on IP (e.g. including the Convention on Biological Diversity (CBD), International Union for the Protection of New Varieties of Plants (UPOV), the International Plant Protection Convention (IPPC)) or allow flexibilites as to a rigid interpretation of the TRIPS agreement (the Doha Declaration on the TRIPS Agreement and Public Health (Doha)). Yet, these "counter-regime" (Helfer 2004) references are not becoming central in the network.

The longitudinal patterns show that the WTO's TRIPS agreement is the most widely cited international institution in PTAs for governing intellectual property related to trade. Clustered around the TRIPS Agreement are the nodes for the Paris, Bern, and Rome agreements as well as the WIPO convention, all of which are explicitly referenced in TRIPS Article 2, paragraph 2. Overall, Figures 1-6 illustrate two important developments: first, increasing regime complexity as institutions for trade governance become part of the regime complex governing intellectual property, reflecting regime-shifting or regime-extension across the governance areas of trade and IP rights (Helfer 2004). Second, the emergence of a prominent cluster of IP treaties shows that a hierarchy of institutions centered on the TRIPS agreement and its related conventions under the

[3]The Bern Convention governs copyrights, the Paris Agreement applies to patents and trademarks, and the Rome Convention protects performer's rights.

WIPO has developed over time. The more often particular IP treaties are explicitly cited and the degree to which they become enforceable in trade agreements are both indicative of their relative importance and influence in the IP governance space. The data show consistency and coherence with the WTO in the regulation and management of IP rights as provided in trade agreements. At the same time, the longitudinal analysis provides an evolutionary perspective for IP governance, which also shows that less powerful actors from the developing world also came to hold strategic advantages from the growing complexity in the regime. This is indicated by the emerging centrality of IP treaties representing counter-regime norms, including the CBD, the Doha Declaration on TRIPS and Public Health, and the UPOV.

Figure 1. PTAs and IP Treaties: 1995

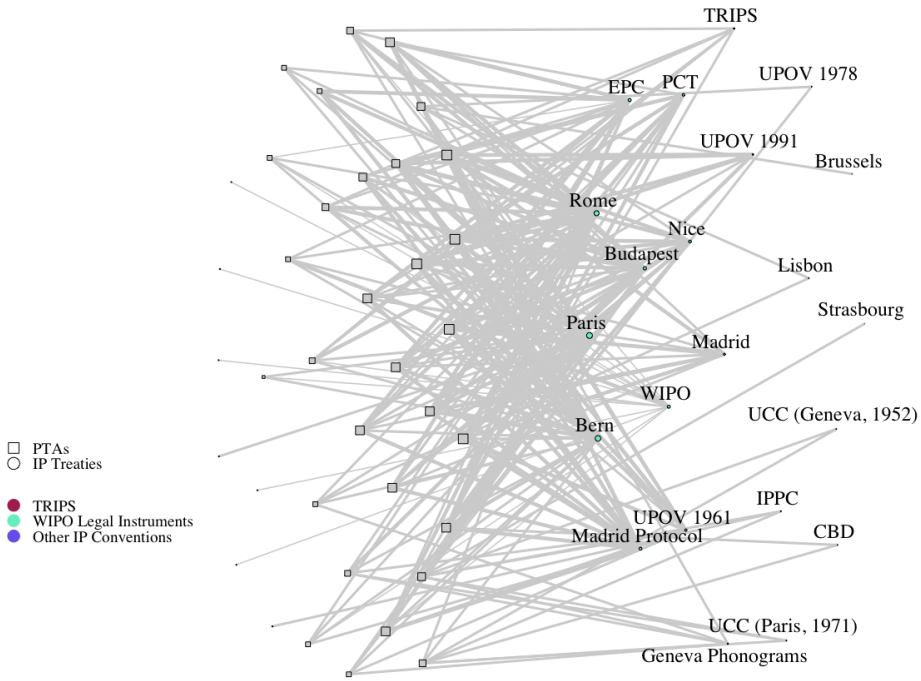


Figure 2. PTAs and IP Treaties: 2000

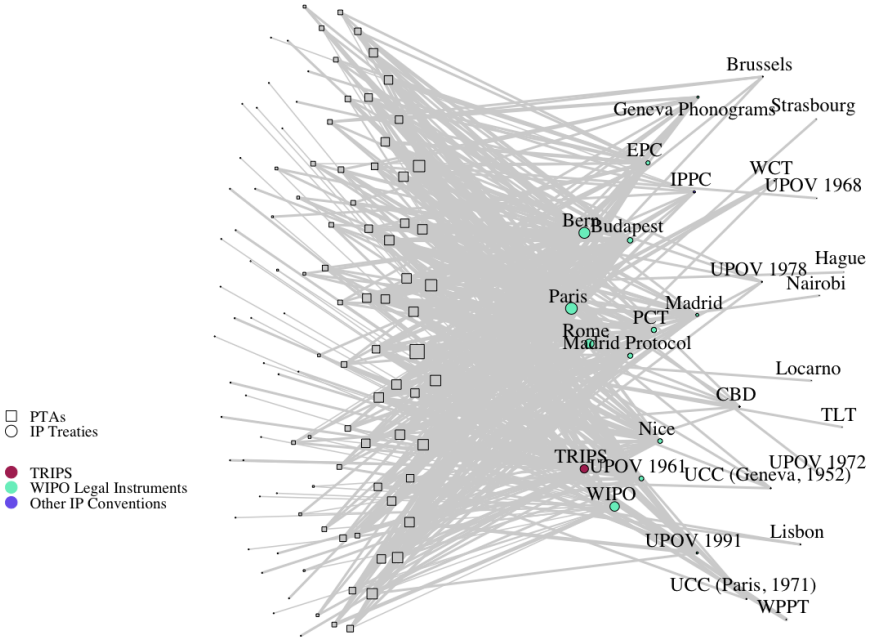


Figure 3. PTAs and IP Treaties: 2005

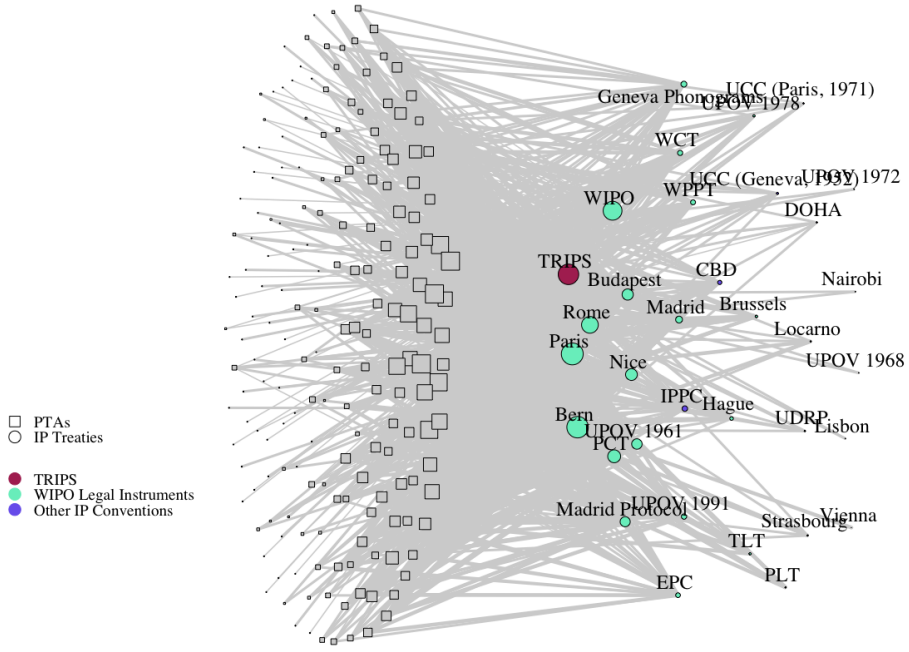


Figure 4. PTAs and IP Treaties: 2010

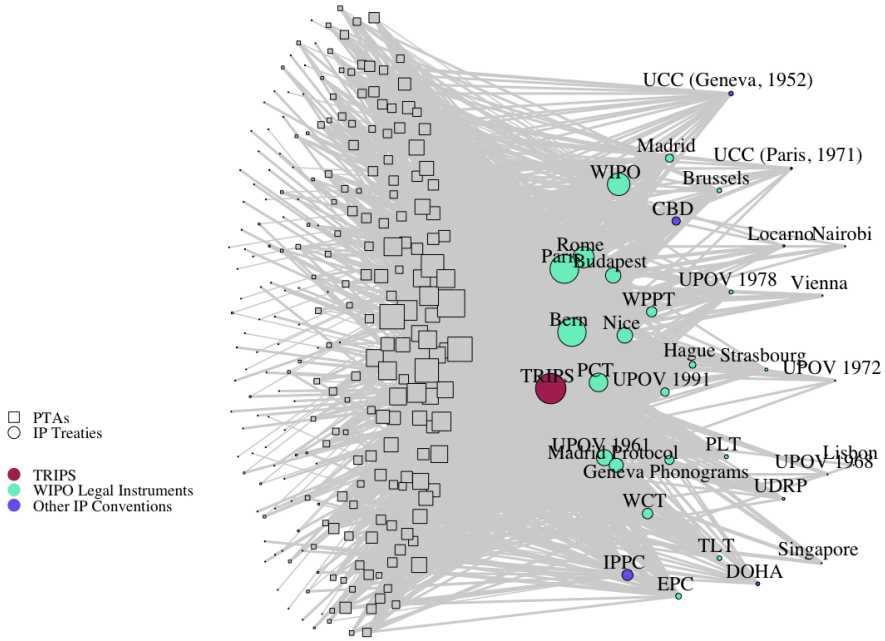


Figure 5. PTAs and IP Treaties: 2015

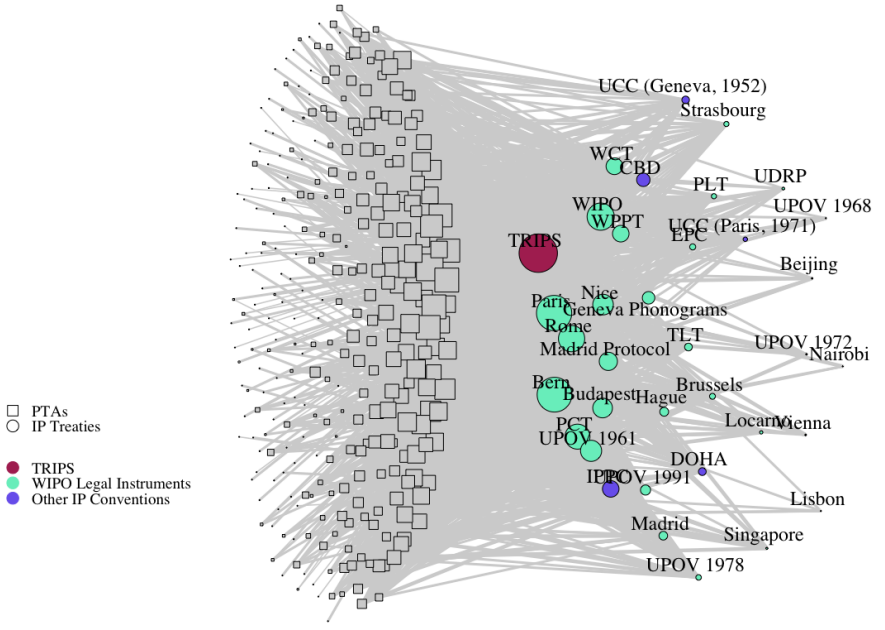
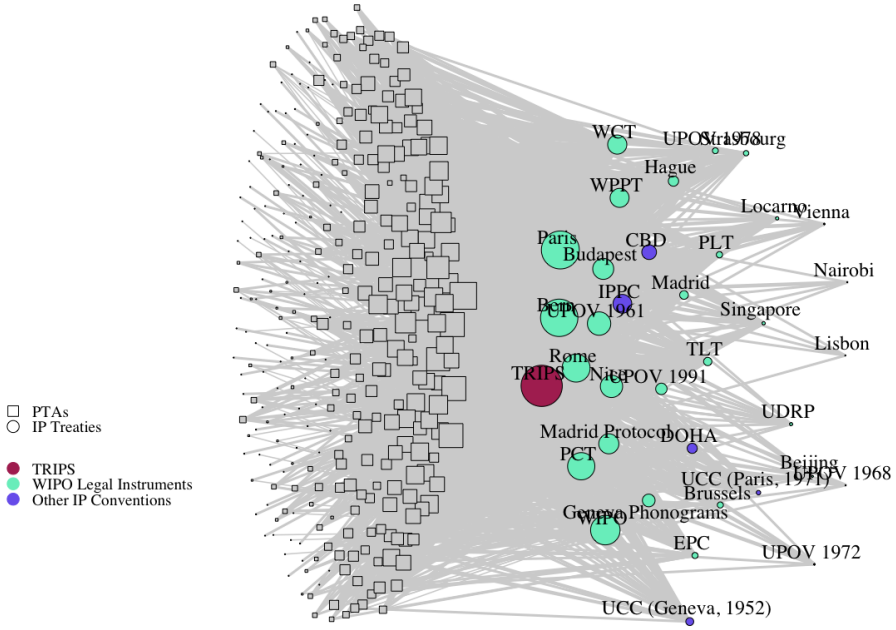


Figure 6. PTAs and IP Treaties: 2018



Theory

Our core theoretical endeavor in this paper is to better understand the forces that contribute to growing levels of hierarchy in a regime complex. Specifically, we develop and then empirically test hypotheses examining how the structure of a regime complex might impact the strategies of states, which we investigate by looking at IP commitments in PTAs. A variety of research in IR holds that states negotiate over the design of international institutions, such as PTAs and other economic treaties (Koremenos et al. 2001, Dür et al. 2014, Allee and Peinhardt 2014, Voeten 2019, Verdier 2022). These studies show that the power and preferences of states, as well as features of the underlying cooperation problem, exert a strong effect on design outcomes. These dissagregated actions, bargaining over the design of single treaties at a specific moment in time, should also impact the development of regime complexes over time (Elsig et al. 2024). As actors compete in a regime complex by building connections to (and reinforcing) their preferred institutions, they establish their favored rules as the dominant rules in the regime. The best outcome for each state is to consolidate the regime around an institution, or institutions, that aligns perfectly with their preferences, but in the context of regime complexity this is complicated, so they have to pursue short-term strategies in an effort to nudge the regime complex in their preferred direction incrementally. To the extent that they are successful, this will be reflected in the evolution of the struc-

ture of the regime complex towards hierarchy. If their institutional connections become widely adopted, the regime complex will become more hierarchical and less fragmented, coalescing around a single dominant set of institutions and rules. To accomplish this, states will leverage the forms of power they have at their disposal, which they will use to help manage the evolution of the regime complex.

Yet, we should not expect that these dissagregated, static developments are the only factor that affects how regime complexes evolve. Recent scholarship has argued that the structure of a given regime complex should create different opportunities and constraints for states (Helfer 2004, Jupille et al. 2013, Copelovitch and Putnam 2014, Alter and Raustiala 2018, Randall Henning and Pratt 2023). Moreover, studies that have sought to bring network analysis into IR point out that network dynamics can have a profound causal effect on state behavior (Hafner-Burton et al. 2009). Specifically, they point out that there is considerable interdependence between units, and that complex social systems, such as regime complexes, are emergent structures that translate the actions of the indidivual units in non-linear ways (Maoz 2012). Importantly, what this means is that we should not only expect that the actors in a regime complex impact the structure of that system but that the structure should also impact actor behavior. Applied to the evolution of the regime complex for IP governance, moving from a static to a more dynamic approach focuses on the development of the regime complex over time, incorporating "simultaneous and sequential negotiations in multiple venues" (Helfer 2009, 40) including PTAs, WTO, WIPO, and the larger network of IP treaties.

Here we build on this literature by proposing theoretical mechanisms that can help explain how the emergent structure of a regime complex impacts the choices states make within that system. In this case, we aim to understand how the networked structure of PTAs with IP references in them contribute to the evolution of the regime complex over time.

Network Externalities

We theorise that network externalities, commonly referred to as a "network effect" (e.g. Lipscy 2015), can impact the development of a regime complex. When it comes to regime complexes that involve standards, such as IP protection, the rules of the regime are the most contested component.[4] All actors favor rules tailored to their specific purposes, but many actors will also be better off if they can agree on common rules (Snidal 1985, Drezner 2008). In these cases there are likely to be significant network effects, which is when the marginal utility of an institution – and its associated rules

[4]Not only do states compete for rule-making authority by, for example, creating overlapping institutions (Helfer 2004, Drahos 2002), but governing authority is also a source of inter-institutional competition among institutions (Muzaka 2011, Gehring and Faude 2014). Where international organizations defer to each other, such institutional deference is also a strategic act that is shaped by both efficiency concerns and power politics (Pratt 2018).

and procedures – increases as it becomes more widely adopted (see Kijima and Lipscy 2023, 2152). As one set of institutions becomes increasingly focal in the regime complex, the rules of those institutions become the common standard used by a larger group of countries, which increases the value of adopting the standard. Thus, the marginal utility of making a connection increases as the number of connections made by others climbs higher.

Examples of network externalities are plentiful in international politics. The value of adopting international standards like technical protocols for Internet domain names increases as more actors participate in the same regulatory scheme (Drezner 2004). States will also select into institutions with more rigorous standards in order to benefit from signaling and reicprocal behaviour from other states that participate in the same institution, such is the case in the election monitoring regime (Pratt 2023). Beyond regulatory institutions, network externalities are also at play in other institutions where wider participation in the institution yields greater benefits for members. For example, it is the near universal membership of the IMF that enables it to provide global surveillance and political cover for its members. Further, these benefits in turn enhances the problem-solving capacity and credibility of the IMF, preserving its posiion as the central institution in balance of payments lending (Lipscy 2015).

Network externalities create positive feedback effects in the IP governance regime complex which generates clusters of partners. As an IP treaty is increasingly adopted by countries, this correspondly increases the IP protection that acceding countries receive as the territory in which their nationals enjoy IP protection enlarges. Increasing returns to commiting to an IP treaty compels countries to sign up to treaties that are widely adopted by other countries. Strong network externalities drive the adoption of IP standards because the process of bilateral or multilateral agreement-making "never derogates from existing standards and very often sets new ones" (Drahos 2002, 776). This means each subsequent bilateral or multilateral agreement establishes a higher standard, which is most concretely reflected in the references in new agreements to other IP treaties. The TRIPS Agreement, for one, incorporates provisions of several of the main international instruments for IP protection. It explicitly refers to the 1967 Paris Convention for the Protection of Industrial Property, the 1971 Berne Convention for the Protection of Literary and Artistic Works, among others, and also incorporates other substantive provisions without specific reference (Agreement on Trade-related Aspects of Intellectual Property Rights 1994). This leads to a ratcheting up of IP protection standards and also entails that countries' accession to one IP treaty requires concomitant commitment to prior IP deals.

The bundling of TRIPS as part of a "WTO package deal" (Helfer 2004, 3) tied IP protection to greater market access, amplying the gains from including references to IP treaties in bilateral and plurilateral agreements. At the same time, the larger the network of TRIPS-compliant countries, the more pressure there was on other countries

to adopt similar standards. The reframing of "IPRs as trade issue" and the efforts to "discursively legitimize TRIPS" by framing the lack of IP protection as a non-tariff barriers (Muzaka 2012, 79) increased the costs of not complying with the TRIPS and efforts to incorporate IP provisions in trade agreements.

Together, what this suggests is that beyond the efforts of individual countries to promote their preferred IP institutions when they bargain bilaterally in PTAs, we should also observe an increasing rate of connections to specific institutions as the number of such connections increases over time. In other words, the structure of the PTA network itself generates incentives for countries to form PTAs which contain IP references. This motivates hypothesis 1, below.

> Hypothesis 1 (*Network Externalities*): As references to a set of institutions increases (or as these institutions becomes more central in the network) we should expect that countries will be more likely to reference those institutions.

WTO Influence

A basis for preferential attachment that is likely to be at play in connection-building in a competitive regime environment can also be witnessed through the nature of the institutions populating the complex. Specifically, what we mean here is that as the WTO has emerged as a central institution in the "bimodal" regime for IP governance (Helfer 2004, 25), it can begin to use its position to exert influence on the development of the regime complex, further reinforcing its centrality. When countries negotiate entry into the WTO they are exposed to rigid accession negotiations where each WTO member holds veto power over final acceptance. This allows single WTO members to extract specific concessions from countries willing to join the club (see Allee and Scalera 2012). Therefore we would expect that acceding countries not only accept high IP standards, but that potentially they need to signal through PTA signings their willingness to upold strong IP rights. We should observe that when a country becomes a WTO member, and is required to adhere to strong standards by means of their accession process, this also will change how these countries design subsequent PTAs with new partners. In particular, here we expect that WTO membership should have an effect on the probability that a country adopts strong IP connections. This motivates hypothesis 2 below:

> Hypothesis 2 (*WTO Influence*): Countries that become members of the WTO will be more likely to make connections to TRIPS as well as "liberal" states' preferred IP institutions.

Research Design

To test the effect of the structure of a regime complex on the strategies of states, we examine the dynamics of institutional connections in the regime complex governing IP using a temporal exponential graph model (TERGM). A TERGM estimates the likelihood of observing specific configurations of ties between actors over time (Desmarais and Cranmer 2012). Here, we use a TERGM to estimate the probability that any two countries share a PTA that contains IP references. TERGM fits our purposes well for several reasons: first, TERGM allows us to capture network externalities of connection-building where the overall connectedness of an actor generates additional connections. TERGM enables us to model the impact of network structure on the propensity for a country to reference specific IP treaties in their PTAs. Put differently, tie formation in the network is conditional upon the rest of the network. Second, countries' decision to sign PTAs and to include IP references in PTAs are informed by their prior PTAs and PTAs that other countries including those that their partners sign with other countries. The interdependence of PTA formation by countries indicates that conventional approaches using regression models which require the assumption that dyadic observations are independent and identically distributed will yield biased estimates. The TERGM overcomes this constraint.

We utilize data on IP references made in the full universe of PTAs that have been signed since 1945 until 2018(Surbeck 2019) which is incorporated in the DESTA database (Dür et al. 2014). We include PTAs from 1985 onwards because that is when the first IP reference was made in the Israel-US PTA. The dataset distinguishes between three kinds of IP references contained in PTAs: simple references to various IP treaties, reaffirmation and/or compliance of certain rights and obligations under these IP treaties, and recommendations or accession to specific IP treaties for PTA partners who are not yet members of these treaties. The last level represents the strongest IP provision. These are positive references by way of reaffirming or extending commitments to IP protection. Where IP treaties are more highly referenced, it suggests that they are more central and authoritative in IP governance. We illustrate below these provisions. First, an example of a reaffirmation and compliance of existing commitments under the WTO TRIPS Agreement is in the Korea-Chile FTA where parties are obligated:

> "To provide adequate and effective protection and enforcement of intellectual property rights, each Party shall faithfully implement the international conventions it has acceded to, including the TRIPS Agreement." [5]

Similarly, we see a reaffirmation the WTO TRIPS Agreement in the Australia-China FTA:

[5] Korea-Chile FTA, Article 16.1.2.

"Each Party affirms its commitment to the TRIPS Agreement and any other multilateral agreement relating to intellectual property to which both Parties are party." [6]

A commitment to accede to a given IP treaty is an extension of IP commitments and represents the highest level of obligation. This is seen in the US-Morocco FTA, where parties are required to accede to IP treaties of which they are not yet a member of:

"Each Party shall ratify or accede to the following agreements:
(a) the Patent Cooperation Treaty (1970), as amended in 1979;
(b) the Convention Relating to the Distribution of Programme- Carrying Signals Transmitted by Satellite (1974);
(c) the Protocol Relating to the Madrid Agreement Concerning the International Registration of Marks (1989);
(d) the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure (1977), as amended in 1980;
(e) the International Convention for the Protection of New Varieties of Plants (1991) (UPOV Convention);
(f) the Trademark Law Treaty (1994);
(g) the WIPO Copyright Treaty (1996); and
(h) the WIPO Performances and Phonograms Treaty (1996)." [7]

Dependent variable

Our dependent variable measures connections to IP institutions as well as the strength of these obligations. We focus on connections to the WTO and WIPO IP governance regimes. The dependent variable is whether a pair of countries have a PTA that contains a reference to the WTO TRIPS Agreement or a WIPO IP treaty.

Independent variables

We expect that network externalities have an independent effect on countries' preferences for IP references in their PTAs beyond individual country attributes and preferences. The PTA network produces network externalities where the presence of multiple mutual connections among a group of countries encourages tie formation within the group and which also creates barriers to forming ties outside the cluster. This leads to a tendency

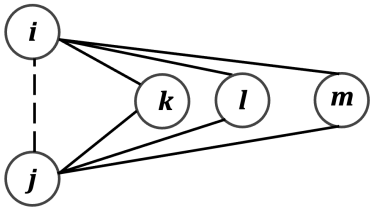
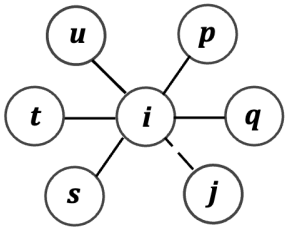
[6] Australia-China FTA, Article 11.4.
[7] US-Morocco Agreement, Articles 15.2

towards dense interconnected clusters within the larger network structure. We capture this structural effect of network externalities using *Transitivity* which is a network measure of the tendency for two countries that have shared partners to form a tie with each other. This process is also known as triadic closure or a "the friend of a friend is a friend" effect. As seen in Table 1, where country i and country j have more shared partners in countries k, l, and m, they are more likely to also form a tie with each other. This closes the 'triangle'. This captures the self-reinforcing dynamic of hierarchy in a regime complex that we are interested in because a higher level of transitivity means that more countries are highly inter-connected with one another. At the network level, this means countries are highly interconnected with one another, being nested in dense clusters.

Following our theoretical expectations, a densely interconnected group is more likely to attract additional ties; as more countries become connected to one another forming clusters, this is going to attract other countries to also make connections to the same institutions. The coefficient on this term allows us to understand the overall tendency towards clustering in the network. A positive coefficient for this term indicates that the higher the number of shared partners between two countries, the higher the likelihood that the two countries will have a tie with each other. Substantively, this provides evidence of network externalities where high interconnectedness among countries, where references to a common set of institutions, encourages further tie formation to these same institutions.

Our second hypothesis evaluates the extent to which the WTO influences preferential attachment between countries. Our argument suggests that WTO members are more likely to adhere to high IP standards and thus reference WTO TRIPS and WIPO treaties in their PTAs. We include *Length of WTO membership* which is the number of years for which a country has been a WTO member in a given year.

Table 1. Model Specification Summary

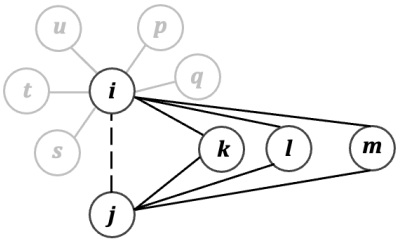
Effect Type	**Variable**	**Expectation**
Network externalities	Transitivity[8]	+
		
WTO influence	Length of WTO membership	+
Centrality	Degree popularity	+
		
Other country attributes	IP earnings (log)	+
	IP earnings as share of GDP	+
	GDP per capita (log)	+
	Democracy	+

Control variables

We include several control variables to account for alternative explanations for connection-building in a regime complex. A prominent explanation for the diffusion of rules is the role of powerful actors. Centrality in a network confers social power that translates into influence over agenda-setting and information brokerage, to name a few (e.g. (Hafner-Burton and Montgomery 2006, Beckfield 2008). Central actors, countries that are able to enact many IP references across their PTAs, are more likely to succeed in becoming more influential, thereby making it more likely that they will be able to create further ties with other actors. We expect such preferential attachment to occur among countries that have many existing PTAs with IP references. We include *Actor centrality* which is a measure of the relative number of existing ties that a country has. This is calculated based on the overall distribution of the number of ties in the network. This

[8]Transitivity is also known as traidic closure or a "the friend of a friend is a friend" effect.

Figure 7. Controlling for the nesting structure of ties in a network



is also known as degree popularity in network terms. Country i with many existing ties is highly likely to attract an additional tie with country j (see Table 1). A country with higher centrality measured as such is considered to be more central or influential in the IP governance regime complex. A positive coefficient on this term means that the higher the number of ties a countries has increases the likelihood of additional ties. In substantive terms, this means that there is a preference for countries to form ties with countries with many existing PTAs with IP references.

The inclusion of this term also enables us to isolate the effect of network externalities. If we do not control for such preferential attachment based on the relative centrality of countries, we cannot determine whether a positive coefficient on the *Transitivity* term reflects the tendency for ties to form between two actors because of their shared partners (i.e. to close triangles) or a tendency for ties to form because of highly central actors. As shown in Figure 7, this means the likelihood of country i and country j to form a tie with each other could be driven by their shared connections or because country i is a higly central actor.

We further include other country-level characteristics that aim to capture country's preferences for IP protection. *IP receipts (log)* is a measure of the total payments between residents and non-residents for the use of IP, including patents, trademarks, copyrights, industrial processes, and designs. We also use an alternative measure *IP receipts as share of GDP*. We include *GDP per capita (log)* where we expect that a country's level of development proxies for its IP preferences. We expect that countries with higher IP earnings and higher GDP per capita are more likely to have PTAs that contain IP references. We include *Democracy* which is the polyarchy score based on the VDEM data (Coppedge et al. 2024). We expect that regime type characteristics associated with democracy are more likely to shape the formation of PTAs with IP references.

We summarise our model specification in Table 1.

We estimate a TERGM by constructing networks for each year between 1985 and 2018, with countries as the nodes. The results of a TERGM can be interpreted at the dyad level or the network level (Cranmer and Desmarais 2011). At the dyad level,

the interpretation is analogous to a logit regression where the estimated parameters reflect the estimated change in log-odds of observing a tie between two actors given a unit change in predictors. At the network level, the parameters indicate the impact of changes in specific network configurations – such as the level of clustering or the level of a particular country attribute – on the predicted probability of observing a given network.

Findings

Table 2 presents the results for the TERGM for the IP governance regime complex. The coefficients here reflect the log-odds change in the probability of an IP reference being formed due to one-unit increase in the corresponding independent variable, while holding other variables constant. We also present the predicted probabilities in Figure 8.

Across all model specifications, the *Transitivity* parameter has a positive sign and is statistically significant. In the baseline model, Model 1, the average marginal effect of a one-unit increase in the level of clustering in the network is associated with a 18 percentage point increase in the probability that countries form a PTA with an IP reference by around 18 percentage points. Accounting for a potential "WTO effect" and the role of influential actors, as in Model 2, the coefficient decreases significantly but remains positive and statistically significant. These results hold even when controlling for other country-level characteristics, as shown in Models 3 and 4. Substantively, this means that there is a strong tendency towards clustering in the PTA network. Higher levels of clustering increases the likelihood of a tie forming. As countries have an increasingly higher number of connections with one another, the likelihood of an additional tie forming increases. This corroborates our earlier observations based on the longitudinal network graphs that the the IP governance regime complex has become more dense over time. In particular, the growth of ties in the network is occurring in clusters.

Table 2. TERGM Fit for PTAs with IP References

	Dependent variable:			
	PTA with IP Reference			
	(1)	(2)	(3)	(4)
Transitivity	0.868***	0.127***	0.155***	0.157***
	(0.154)	(0.031)	(0.036)	(0.034)
Length of WTO membership		0.006***	0.007***	0.007***
		(0.0008)	(0.001)	(0.001)
Centrality		0.264***	0.273***	0.271***
		(0.010)	(0.009)	(0.008)
IP receipts (log)			0.013***	
			(0.002)	
IP receipts as share of GDP				2.756***
				(1.013)
GDP per capita (log)			−0.141***	−0.129***
			(0.014)	(0.013)
Democracy			−0.016	−0.001
			(0.052)	(0.055)
Edges	−1.740***	−7.158***	−5.552***	−5.320***
	(0.107)	(0.254)	(0.412)	(0.397)
Note:				*p<0.1; **p<0.05; ***p<0.01

Figure 8. Coefficient Estimates

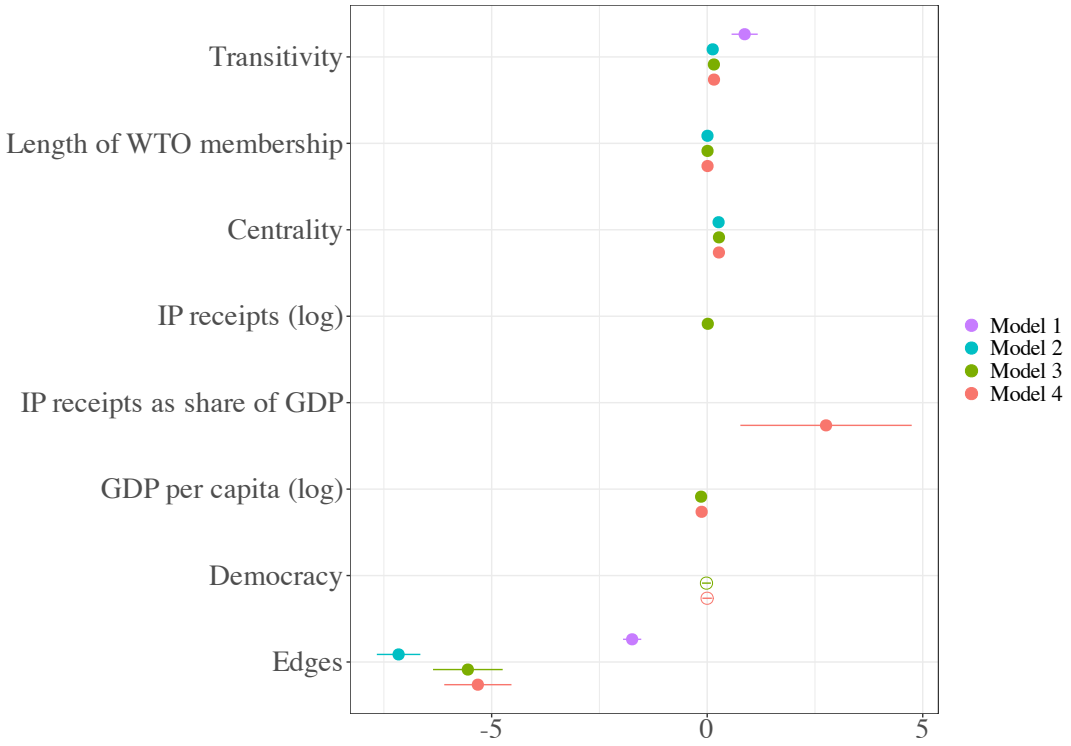


Table 3. TERGM Fit for PTAs with IP References: Average Marginal Effects

	IP Reference			
	(1)	(2)	(3)	(4)
Transitivity	18.08	3.18	3.85	3.91
Length of WTO membership		0.16	0.18	0.19
Centrality		6.49	6.70	6.67
IP receipts (log)			0.34	
IP receipts as share of GDP				15.47
GDP per capita (log)			−3.51	−3.21
Democracy			−0.42	−0.04
Edges	−22.09	−0.55	−2.13	−2.57

The *Length of WTO membership* has positive coefficients as expected which indicates that WTO members are more likely to form a PTA that makes an IP reference. Original members, or countries that have been WTO members for longer, are more likely to form a tie. For each additional year that a country is a WTO member, the probability of them forming a PTA that contains an IP reference increases by approximately 0.16 percentage points. This supports our second hypothesis that there is a WTO effect where accession to the WTO motivates the deeper commitments in PTAs, including on issues related to

IP.

Positive coefficients on *Centrality* indicates that countries that are highly central or influential, already deeply embedded the IP governance regime complex through multiple PTAs that contain IP commitments, are more likely to form an additional tie. A one-unit increase in the relative centrality of a country increases the probability of an additional tie forming by approximately 6 percentage points, which is twice as large as the effect of *Transitivity*. This suggests that the formation of ties in the network for IP governance is strongly driven by influential actors with many connections in the network. These dynamics of preferential attachment possibly drives the emergence of densely connected clusters in the network. This also highlights the role of influential or well-connected countries in proliferating IP commitments in the regime complex.

As for our control variables, *IP receipts (log)* has a positive and statistically significant effect. This suggests that countries with higher IP are more likely to form PTAs with IP references. The coefficient for *IP receipts as share of GDP* is significantly larger which suggests that it is less the absolute volume of IP output but its share relative to the country's GDP that matters for more countries' preferences for IP references in their PTAs. The higher the proportion of IP output as a share of GDP, the more likely the country is to form such as a PTA.

GDP per capita (log) has negative cofficients which suggests that as GDP per capita of a country increases, the likelihood of forming a PTA with an IP reference decreases. This negative effect suggests that it is IP output that matters for preferences for IP commitments rather than the country's development status. High-income countries may have relatively low IP output despite high development levels. *Democracy* also has negative coefficients but these are not statistically significant. The *Edges* parameter shows the baseline probability of a PTA with an IP reference being formed. The negative coefficients on the parameter across all the models indicates that network is a relatively sparse one.

We further investigate the effect of network externalities on tie formation with additional control variables. Table 4 present TERGM results with these alternative model specifications. In Models 1 and 2, we include *USTR Watchlist (dummy)* to account for how external pressure that operates independently of network dynamics could shape the development of a regime complex. Specifically, pressure from the US to comply or uphold IP standards constitutes a form of external pressure on countries, underscoring how powerful states can shape global norms through mechanisms beyond direct network interactions. The US starting with the US-Israel PTA has shown strong preferences not only to uphold strong IP rights but embed these in PTAs. While the US has only signed a limited number of PTAs, they are carefuly watching the IP practice in different parts of the world and how these practices affect US companies. The US Trade Representative (USTR) has been compiling an annual list of countries that not meeting

US expectations regarding IP protection, highlighting them in the Special 301 Report which was first published in 1989. Countries listed on this report face the threat of some sort of sanctions if they are not addresssing US councerns. Therefore, we expect that this public "shaming" impacts on countries' willingness to include IP references in their respective PTAs, notwithstanding who the PTA partner is. We include *USTR watchlist* which is a measure of whether a country is on the Priority Watch List, Watch List, or Special 301 Report in a given year.

The coefficient for *USTR Watchlist (dummy)* is negative in both models and statistically significant only in Model 2. This suggests that being on the watchlist does not have a meaningful impact on the likelihood of countries making references in their PTAs. More importantly, the coefficients for our main explanatory variable *Transitivity* remain positive and statistically significant even when controlling for potential pressure from the US.

We also include *WTO membership (dummy)* as an alternative measure for investigating the WTO effect. This is a simple dummy for whether a country is a WTO member in a given year. Simply being a WTO member has a positive effect on tie formation, as shown in Models 3 and 4, but the coefficient on this term is not consistently statistically significant. This sugggests that it might not be so much the accession effect (which are countries with fewer years of membership), but that it is the dominating WTO members and active traders who in their own PTAs are pushing these connections (in line with findings by (Allee et al. 2017)).

The effect of network exernality holds across all four models. The coefficients for *Transivity* remain postive and statistically significant. This provides evidence that the presence of a strong, highly inter-connected network structure fosters the formation of new PTAs with IP references. Taken together, the results suggest that there is a positive feedback loop that re-inforces the formation of PTAs with IP commitments. THe findings underscore the importance of network structures in shaping the formation of ties in the IP goverannce regime complex.

Conclusion

This paper advances the argument that a regime complex may be characterized by hierarchy and the structure of the regime complex has an independent effect on the evolution of the regime complex. We demonstrate these dynamics by examining the IP governance regime complex. Descriptive network analysis shows that a cluster of treaties governing IP treaties, centred around the WTO TRIPS agreement and prominent IP conventions (e.g., Rome, Paris, and Bern), form the core regime within the regime complex. Regime-shifting or regime-extension has occurred over time as the WTO TRIPS assumes greater centrality in the regime complex. The findings of inferential

network analysis indicate a significant effect of network externalities in the evolution of the regime complex. As references to a set of institutions increases, PTAs are more likely to reference those same institutions in PTAs. Regime complexity arising from references to specific IP treaties in PTAs contributes to the formation of hierarchy in the regime complex for IP governance and to subsequent PTAs in their provisions on IP governance. The findings of this analysis extend beyond the IP governance regime complex, applying more broadly to governance areas that are characterized by linkages between institutions. The findings contribute to understandings of how hierarchical structures of governance emerge.

References

Agreement on Trade-related Aspects of Intellectual Property Rights (1994).

Allee, T., Elsig, M., and Lugg, A. (2017). The ties between the world trade organization and preferential trade agreements: A textual analysis. *Journal of international economic law*, 20(2):333–363.

Allee, T. and Peinhardt, C. (2014). Evaluating three explanations for the design of bilateral investment treaties. *World Politics*, 66(1):47–87.

Allee, T. L. and Scalera, J. E. (2012). The divergent effects of joining international organizations: Trade gains and the rigors of wto accession. *International Organization*, 66(2):243–276.

Alter, K. J. (2022). The promise and perils of theorizing international regime complexity in an evolving world. *The Review of International Organizations*, 17(2):375–396.

Alter, K. J. and Meunier, S. (2009). The politics of international regime complexity. *Perspectives on politics*, 7(1):13–24.

Alter, K. J. and Raustiala, K. (2018). The rise of international regime complexity. *Annual Review of Law and Social Science*, 14(1):329–349.

Beckfield, J. (2008). The dual world polity: Fragmentation and integration in the network of intergovernmental organizations. *Social Problems*, 55(3):419–442.

Branstetter, L., Fisman, R., Foley, C. F., and Saggi, K. (2011). Does intellectual property rights reform spur industrial development? *Journal of International Economics*, 83(1):27–36.

Branstetter, L. G., Fisman, R., Foley, C. F., and Saggi, K. (2007). Intellectual property rights, imitation, and foreign direct investment: Theory and evidence.

Campi, M. and Dueñas, M. (2019). Intellectual property rights, trade agreements, and international trade. *Research Policy*, 48(3):531–545.

Chen, Y. and Puttitanun, T. (2005). Intellectual property rights and innovation in developing countries. *Journal of development economics*, 78(2):474–493.

Cheng, T.-H. (2006). Power, norms, and international intellectual property law. *Mich. J. Int'l L.*, 28:109.

Copelovitch, M. S. and Putnam, T. L. (2014). Design in context: Existing international agreements and new cooperation. *International Organization*, 68(2):471–493.

Cranmer, S. J. and Desmarais, B. A. (2011). Inferential network analysis with exponential random graph models. *Political analysis*, 19(1):66–86.

Desmarais, B. A. and Cranmer, S. J. (2012). Statistical mechanics of networks: Estimation and uncertainty. *Physica A: statistical mechanics and its applications*, 391(4):1865–1876.

Drahos, P. (2002). Developing countries and international intellectual property standard-setting. *J. World Intell. Prop.*, 5:765.

Drezner, D. W. (2004). The global governance of the internet: Bringing the state back in. *Pol. Sci. Q.*, 119:477.

Drezner, D. W. (2008). Two challenges to institutionalism. *Can the world be governed? Possibilities for effective multilateralism*, pages 139–159.

Dür, A., Baccini, L., and Elsig, M. (2014). The design of international trade agreements: Introducing a new dataset. *The Review of International Organizations*, 9:353–375.

Dür, A. and Mödlhamer, C. (2022). Power and innovative capacity: Explaining variation in intellectual property rights regulation across trade agreements. *International Interactions*, 48(1):23–48.

Eilstrup-Sangiovanni, M. (2022). Ordering global governance complexes: The evolution of the governance complex for international civil aviation. *The Review of International Organizations*, 17(2):293–322.

Elsig, M., Kim, S. Y., Lee, J., and Lugg, A. (2024). Connecting regimes: Preferential Trade Agreements and the Management of the Intellectual Property Rights Regime.

Elsig, M. and Surbeck, J. (2016). Intellectual property rights and preferential trade agreements: Data, concepts and research avenues.

Escobar-Andrae, B. (2011). North-south agreements on trade and intellectual property beyond trips: an analysis of us bilateral agreements in comparative perspective.

Gehring, T. and Faude, B. (2014). A theory of emerging order within institutional complexes: How competition among regulatory international institutions leads to institutional adaptation and division of labor. *The Review of International Organizations*, 9:471–498.

Ghosh, S. and Yamarik, S. (2019). Do the intellectual property rights of regional trading arrangements impact foreign direct investment? an empirical examination. *International Review of Economics & Finance*, 62:180–195.

Glass, A. J. and Wu, X. (2007). Intellectual property rights and quality improvement. *Journal of Development Economics*, 82(2):393–415.

Green, J. F. (2022). Hierarchy in regime complexes: understanding authority in antarctic governance. *International Studies Quarterly*, 66(1):sqab084.

Grossman, G. M. and Lai, E. L.-C. (2004). International protection of intellectual property. *American Economic Review*, 94(5):1635–1653.

Hafner-Burton, E. M., Kahler, M., and Montgomery, A. H. (2009). Network analysis for international relations. *International organization*, 63(3):559–592.

Hafner-Burton, E. M. and Montgomery, A. H. (2006). Power positions: International organizations, social networks, and conflict. *Journal of Conflict Resolution*, 50(1):3–27.

Helfer, L. R. (2004). Regime shifting: the trips agreement and new dynamics of international intellectual property lawmaking. *Yale J. Int'l L.*, 29:1.

Helfer, L. R. (2009). Regime shifting in the international intellectual property system. *Perspectives on politics*, 7(1):39–44.

Helpman, E. (1992). Innovation, imitation, and intellectual property rights.

Henning, R. C. and Pratt, T. (2023). Hierarchy and differentiation in international regime complexes: a theoretical framework for comparative research. *Review of International Political Economy*, 30(6):2178–2205.

Ikenberry, G. J. (2002). *America unrivaled: The future of the balance of power*. Cornell University Press.

Ivus, O., Park, W., and Saggi, K. (2016). Intellectual property protection and the industrial composition of multinational activity. *Economic Inquiry*, 54(2):1068–1085.

Jupille, J. H., Mattli, W., and Snidal, D. (2013). *Institutional choice and global commerce*. Cambridge University Press.

Kijima, R. and Lipscy, P. Y. (2023). Competition and regime complex architecture: Authority relations and differentiation in international education. *Review of International Political Economy*, 30(6):2150–2177.

Koremenos, B., Lipson, C., and Snidal, D. (2001). The rational design of international institutions. *International organization*, 55(4):761–799.

Lake, D. A. (2009). Regional hierarchy: authority and local international order. *Review of International Studies*, 35(S1):35–58.

Lee, J.-Y. and Mansfield, E. (1996). Intellectual property protection and us foreign direct investment. *The review of Economics and Statistics*, pages 181–186.

Lipscy, P. Y. (2015). Explaining institutional change: Policy areas, outside options, and the bretton woods institutions. *American Journal of Political Science*, 59(2):341–356.

Manger, M. S. and Shadlen, K. C. (2014). Political trade dependence and north–south trade agreements. *International studies quarterly*, 58(1):79–91.

Mansfield, E. and Mundial, B. (1994). *Intellectual property protection, foreign direct investment, and technology transfer*, volume 19. Citeseer.

Maoz, Z. (2012). How network analysis can inform the study of international relations. *Conflict management and peace science*, 29(3):247–256.

Maskus, K. E. and Fink, C. (2005). *Intellectual property and development: lessons from recent economic research*. World Bank Publications.

Maskus, K. E. and Ridley, W. (2023). Early findings on the economic impacts of intellectual property-related trade agreements. In *Improving Intellectual Property*, pages 396–404. Edward Elgar Publishing.

Mathew, A. J. and Mukherjee, A. (2014). Intellectual property rights, southern innovation and foreign direct investment. *International Review of Economics & Finance*, 31:128–137.

Muzaka, V. (2011). Linkages, contests and overlaps in the global intellectual property rights regime. *European Journal of International Relations*, 17(4):755–776.

Muzaka, V. (2012). Intellectual property governance: The emergence of a new and contested global regime. In *The Diffusion of Power in Global Governance: International Political Economy Meets Foucault*, pages 71–90. Springer.

Nicholson, M. W. (2007). The impact of industry characteristics and ipr policy on foreign direct investment. *Review of World Economics*, 143:27–54.

Nunnenkamp, P. and Spatz, J. (2004). Intellectual property rights and foreign direct investment: A disaggregated analysis. *Review of World Economics*, 140:393–414.

Osgood, I. and Feng, Y. (2018). Intellectual property provisions and support for us trade agreements. *The Review of International Organizations*, 13:421–455.

Pratt, T. (2018). Deference and hierarchy in international regime complexes. *International Organization*, 72(3):561–590.

Pratt, T. (2023). Value differentiation, policy change and cooperation in international regime complexes. *Review of International Political Economy*, 30(6):2206–2232.

Randall Henning, C. and Pratt, T. (2023). Hierarchy and differentiation in international regime complexes: a theoretical framework for comparative research. *Review of International Political Economy*, 30(6):2178–2205.

Raustiala, K. and Victor, D. G. (2004). The regime complex for plant genetic resources. *International organization*, 58(2):277–309.

Ridley, W. C. (2019). *Essays in International Trade, Intellectual Property Rights, and Technology Transfer*. PhD thesis, University of Colorado at Boulder.

Shadlen, K. (2008). Globalisation, power and integration: The political economy of regional and bilateral trade agreements in the americas. *The Journal of Development Studies*, 44(1):1–20.

Shadlen, K. C., Schrank, A., and Kurtz, M. J. (2005). The political economy of intellectual property protection: The case of software. *International Studies Quarterly*, 49(1):45–71.

Snidal, D. (1985). Coordination versus prisoners' dilemma: Implications for international cooperation and regimes. *American Political Science Review*, 79(4):923–942.

Surbeck, J. (2019). *Intellectual property rights in preferential trade agreements: Mapping the content, analysing the design, studying the effects*. PhD thesis, Wirtschafts-und Sozialwissenschaftliche Fakultät der Universität Bern.

Tanaka, H. and Iwaisako, T. (2014). Intellectual property rights and foreign direct investment: A welfare analysis. *European Economic Review*, 67:107–124.

Verdier, D. (2022). Bargaining strategies for governance complex games. *The Review of International Organizations*, 17(2):349–371.

Voeten, E. (2019). Making sense of the design of international institutions. *Annual Review of Political Science*, 22(1):147–163.

Wu, M. (2020). Intellectual property rights. *Handbook of Deep Trade Agreements*, page 201.

Robustness Checks

Table 4. Robustness Checks for TERGM

	Dependent variable:			
	PTA with IP Reference			
	(1)	(2)	(3)	(4)
Transitivity	0.145***	0.146***	0.162***	0.137***
	(0.036)	(0.034)	(0.037)	(0.029)
Length of WTO membership	0.007***	0.007***		
	(0.001)	(0.001)		
WTO membership (dummy)			0.112**	0.009
			(0.050)	(0.039)
Actor centrality	0.283***	0.281***	0.131***	0.338***
	(0.010)	(0.009)	(0.042)	(0.021)
USTR Watchlist (dummy)	−0.013	−0.100***		
	(0.013)	(0.021)		
IP receipts (log)	0.014***		0.217***	
	(0.002)		(0.017)	
IP receipts as share of GDP		−0.024		0.294***
		(0.026)		(0.013)
GDP per capita (log)	−0.144***	−0.124***	−0.022**	−0.025
	(0.014)	(0.012)	(0.009)	(0.038)
Democracy	−0.018	0.009	0.284***	−0.101***
	(0.052)	(0.053)	(0.036)	(0.013)
Edges	−5.776***	−5.589***	−10.378***	−6.665
	(0.435)	(0.407)	(0.593)	(0.614)
Note:		*p<0.1; **p<0.05; ***p<0.01		