Network Interactions and Legitimacy Patterns in the Global Sustainability Governance System

Ofir Stegmann & Oren Perez

Abstract

In this paper we introduce the dataset that we used in our previous paper (Perez and Stegmann, 2025) and provide additional statistical analysis. We also extend our analysis of the nature of private-public interactions in several directions. First, we examine to what extent private transnational regulators (PTRs) rely on public international law instruments (PILIs) to augment and solidify their legitimacy and authority. Second, we provide in-depth statistical analysis of the network's topology and key-features, focusing on the differences between distinct types of PTRs and PILIs, and connect this analysis to new theoretical hypotheses. Finally, we describe the structure of the dataset (e.g., the meaning of various fields etc.) and the method we used to construct it. Because this is a unique and specially curated dataset, we believe that releasing it to the research community is important. This documentation can assist other scholars to use our data for further research.

Keywords: private regulators, regime complex, network interactions, transnational law, international organizations

Introduction

The climate summits in Glasgow and Sharm el-Sheikh have exposed the weakness of the global environmental governance system. Although both summits adopted the 1.5°C warming threshold, they have made little progress toward implementing actions that could achieve that goal. This failure characterizes other fields of global crisis, including biodiversity, plastic pollution, and the oceans (Dasgupta et al., 2023; Romanello et al., 2022; Tekwa et al., 2023; Tregidga et al., 2022) .

Against the continuous weakness of the treaty system, a new form of world governance has emerged, in which private transnational initiatives operate alongside and in close interaction with the treaty system and its organs, intergovernmental organizations (**IOs**). Private transnational regulators (**PTRs**) play a central role in the

new global governance system by setting and enforcing standards that target states and non-state entities (e.g., companies and universities). We use the term "PTR" to refer to the institutional entities that serve these dual functions.[1] We distinguish between private transnational standards **(PTS**), which are produced by PTRs, and the rules created by the treaty system and its organs. PTRs operate in diverse areas, ranging from product standards and environmental protection to financial reporting, human and labor rights, and the ranking of academic institutions (Cashore et al., 2021).[2]

We argue that the global governance system has changed its character in the past decade, evolving into a hybrid system in which private and public institutions interact. In part, this process reflects an evolutionary response to the legitimacy challenge and democratic deficit of PTRs. A distinctive property of the evolving hybrid system is the mutual dependence between PTRs and IOs. This synergistic structure allows PTRs to rely on IOs as a source of authority and legitimacy, compensating for their democratic deficit. IOs, in turn, rely on PTRs to serve as compliance agents, exploiting their social proximity to companies and other non-state actors.

The idea that PTRs promote the norms produced by the treaty system and contribute to their implementation has been raised by other authors (Elsässer et al., 2022: 381; Hickmann, 2016). In our former research we went beyond the previous arguments by testing it quantitatively using network analysis. In their recent review of research on institutional interplay in global environmental governance, Elsässer et al. pointed to the need to complement the method of case studies, which is the most widely used approach in this field, with quantitative studies using innovative methodological approaches such as network analysis (Elsässer et al., 2022: 382).

In the current paper we introduce the dataset that we used in our former research, undertake additional statistical analyses, and examine additional hypotheses related to PTRs' legitimacy. In the next section we examine how PTRs approach the challenge of establishing their legitimacy and authority, focusing on their interaction with IOs and their rules (PILIs).

[1] In some cases, the standard setting and compliance functions are provided by different bodies.
[2] Examples of standards include: Global Organic Textile Standard; Fairtrade International; Responsible Care and ISO 14001; the International Financial Reporting Standards Foundation and **Shanghai Academic Ranking** of World Universities.

Achieving Legitimacy in PTRs-IOs Mutual Dependence

An authority that seeks to exercise normative power must be perceived as legitimate, that is, as having a right to rule, by its relevant audience. Legitimacy on this account has both a normative-jurisprudential meaning (the capacity of an authority to produce binding norms) and a social-pragmatic one (referring to its social perception and to its ability to influence people's behavior) (Sommerer et al., 2022). We argue that the network architecture of the global governance system has enabled PTRs to support their legitimacy and authority vis-a-vis corporate actors that are their primary regulatory audience by linking with international legal bodies considered to be authoritative by public international law. Such linking can compensate for the fact that PTRs operate outside the traditional legitimation mechanisms of state politics. We explored this argument by studying the citation network that links PTS and PILIs.[3] We argue that PTRs use the citation of PILIs as a grounding mechanism that supports the normative power (validity) of their rules (Jäger, 2016; Shulayeva et al., 2017).

The following examples illustrate how citation is used as a grounding mechanism. Article 6.3.10.3 of ISO 26000 Guidance on Social Responsibility supports its rule against child labor ("Organizations should not engage in or benefit from any use of child labour") by citing the International Labor Organization (ILO) conventions that determine the minimum age for work.[4] Similarly, Article 6.5.2.1, which requires organizations to respect and promote a precautionary approach, cites the Rio Declaration on Environment and Development and several other Conventions.[5] Finally, Principle 2 of the Aquaculture Stewardship Council (ASC) Freshwater Trout Standard, which deals with conservation of habitats and biodiversity, cites the Convention on Biological Diversity that was adopted at the 1992 Earth Summit.[6]

We argue that citations of PILIs have a cumulative and synergistic effect on the legitimacy of PTRs. Thus, our analysis exposes the aggregate legitimation effect of

[3] We focus on citations between legal documents although transnational NGOs also use other forms of partnership with international organizations to legitimize their actions (Collingwood, 2006: 448). For example, the GRI was founded in 1997 with the involvement of the UN Environment Programme, although this involvement has later been discontinued (see https://www.globalreporting.org/about-gri/mission-history/).

[4] E.g., International Labour Organization (ILO): Minimum Age Convention (No. 138). 1973 and International Labour Organization (ILO): Worst Forms of Child Labour Convention (No. 182). 1999.

[5] United Nations Conference on Environment and Development: Rio Declaration on Environment and Development 1992 and United Nations (UN): Cartagena Protocol on Biosafety to the Convention on Biological Diversity.

[6] ASC Freshwater Trout Standard v. 1.0, p. 21 (2013).

citations of diverse PILIs rather than that of a particular citation on the legitimacy of a given rule. We also argue that this citation pattern reflects a relation of mutual dependence: IOs benefit from linking with PTRs, which provide them with a global compliance framework. The proximity of PTRs to the corporate world makes their enforcement and dissemination powers particularly valuable to IOs, whose rules are binding only on states. Our argument differs from that made recently by Tyler Pratt (Pratt, 2018) because the structure of mutual dependence we describe does not reflect relations of deference, in which there is a shift of authority between the interacting parties. IOs rely on PTR compliance capacities implicitly, without formal delegation. PTRs, on their part, use citations as grounding mechanisms, which allow them to consolidate and validate their authority.

Methodology and Data

Our dataset includes citations from 393 legal texts associated with 55 private transnational regulators (PTRs), 261 public international law instruments (PILIs) and 43 intergovernmental organizations (IOs). The PTRs are related to multiple sectors, from textile and coffee to quarried substances and golf, and provide guidance in a variety of regulatory domains, including the environment and labor and human rights. Below we explain how the dataset and the network were created.

Data related to PTRs

To construct the PTR list, we followed the methodology used in our previous article (Perez et al., 2018: 151-152). We first created an initial list of candidate PTRs based on a review of the literature, and expanded the list through an Internet search. For the 55 PTRs in the list,[7] we collected all the associated PTS, concluding with a list of 393 documents (some PTRs have several standards associated with different products, certification type, or company type).[8] PTRs use various terms to refer to their PTS, including standards (Bonsucro), principles (WEP), criteria (GSTC), code of practices (RJC), and position statements (ICMM). We also collected "governance" standards that determine the decision-making structure of the organization and the procedures for rule-making. We collected additional data about each PTR in the

[7] The initials and full name of the PTRs are listed in Appendix A.
[8] The full PTS list appears in Appendix B.

sample, including foundation year, sector, regulatory focus (labor, environment, or other; multiple categories enabled), dominant governing stakeholder (industry, civil society, or states; multiple categories enabled), and the stringency of the compliance regime (we distinguished between "soft" schemes that rely on self-verification by member firms, "intermediate" schemes that rely on third-party verification, and "strict" schemes in which verification is undertaken by the PTR or an agent controlled by the PTR). While some PTRs in our sample feature hybrid governance involving both state and private actors (e.g., Investors in People (IIP) and the UN Principles for Sustainable Insurance (UNEP PSI)), we included them because their governance remains largely independent from the formal frameworks of either state or treaty law. This approach ensures our analysis reflects the full spectrum of private regulatory forms.

Table 1 presents descriptive statistics of PTRs' attributes:

Table 1: Descriptive Statistics of the PTR Sample

Foundation Year	**PTRs**	**Example**
2010-2012	5	ASC
2005-2009	12	RSB
2000-2004	18	UTZ
1995-1999	12	SA8000
1990-1994	6	OEKO
Before 1990	2	CERES
Sector	**PTRs**	**Example**
Plants, Forest & Sea Products	13	BONSUCRO
Quarried Substance & Electronics	10	EITI
Textile & Apparel	8	FWF
Finance, Sport & Leisure	7	GSTC
General	17	UNGC
Legal Subject	**PTRs**	**Example**
Environment Only	10	TE
Labour Only	13	FLA
Environment & Labour	29	GRI
Other	3	LBG
Stakeholders	**PTRs**	**Example**
Industry Only	10	EP

Civil Society Only	7	WRC
Industry & Civil Society	23	BCI
Industry & States	3	IIP
Industry & Civil Society & States	12	WEP

Stringency	**PTRs**	**Example**
Strict	31	ISEAL
Intermediate	9	GGP
Soft	15	UNEP PRI
Total	**55**	

Data related to PILIs

The second type of nodes included in the network are the public international law instruments that PTS cite. We first created a list of generic titles of international law instruments that could be cited by PTS, which included generic terms such as conventions, treaties, agreements, declarations, and protocols. Next, we searched for these terms in all the PTS files, using a specially developed *Python* program to identify all the citations to PILIs. The program exported a file with "texts windows" in which the designated term (e.g., "treaty") appeared (lowercase or uppercase, with or without spaces). For example, the search for "convention" generated a spreadsheet with 1,820 rows. Each row contained the sentence that included the term "convention" and some sentences before and after ("text window") so that the general context of the citation could be analyzed. Twelve PILIs files that were not machine-readable (e.g. OEKO standards) were searched manually.

In the third step we manually read the citations (texts windows) and labeled the PILIs that were mentioned. As part of this close reading, we also labeled additional types of PILIs that were found in the texts windows close to the original search term (e.g., the IUCN Red List of Threatened Species was found while searching for "conventions").[9] In some cases, the automated search did not lead to a PILI (for example, the search for "convention" led to the word "conventional;"[10] in other cases, the word was used in generically, without referencing a particular PILI).[11] Finally, we

[9] Fairtrade International (FI) (Fairtrade Hired Labour Standard 15.01.2014_v1.1, HL_EN.pdf, p.52): "In addition to local and regional information, your company may want to look at IUCN red list of threatened species at www.iucnredlist.org. For further information on alien invasive species see the Convention of Biological Diversity at www.cbd.int/invasive/".
[10] The Alliance for Water Stewardship (AWS, AWS_Standard_v1.0_April2014.pdf, p.30).
[11] ProTerra Foundation (PT, ProTerra_Standard_V3.0_EN.pdf, p.36).

merged titles that referred to the same object (PILIs), e.g., "United Nations Framework Convention on Climate Change"[12] and "International Climate Change Convention".[13] Table 2 provides summary statistics for the different PILI categories.

Table 2. Summary Statistics for the Different PILI Categories

#	Type	Raw Citations (before checking)	Distinct Valid PILIs	PILI Example
1	**Convention**	1845	115	Convention on Biological Diversity
2	**Agreement**	1334	12	Paris Agreement
3	**Treaty(ies)**	72	1	Treaty on European Union
4	**Protocol**	1333	15	Protocol concerning the Control of Emissions of Nitrogen Oxides
5	**Declaration**	452	21	Universal Declaration of Human Rights
6	**Covenant**	58	3	International Covenant on Civil and Political Rights
7	**Code**	455	8	FAO Code of Conduct for the Import and Release of Exotic Biological Control
8	**Memorandum**	14	0	
9	**Guidelines**	1177	35	The United Nations Guiding Principles on Business and Human Rights
10	**Exchange of letters**	1	0	
11	**Exchange of notes**	1	0	
12	**Goals**	Indirect search	1	The Millennium Development Goals
13	**Indicators**	Indirect search	1	UNWTO Indicators of Sustainable Development for Tourism Destinations
14	**List**	Indirect search	1	IUCN Red List of Threated Species
15	**Model**	Indirect search	1	FAO Model Code of Forest Harvesting Practice
16	**Principles**	Indirect search	2	Children's Rights and Business Principles (UNICEF)
17	**Recommendation**	mainly in ILO search	44	ILO Welfare Facilities Recommendation

[12] International Standard 26000 - Social Responsibility (ISO 26000) reference number ISO 26000:2010(E) p. 108.
[13] The Greenhouse Gas Protocol (GGP) ghg-protocol-revised.pdf p. 98.

#	Type	Raw Citations (before checking)	Distinct Valid PILIs	PILI Example
18	**Statements**	Indirect search	1	Hazard statements form part of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)
	Total PILIs		**261**	

Constructing the Edges

Our final sample included 261 PILIs.[14] We created a list of synonyms and common abbreviations for each PILI, based on the common formats of citations in PTS texts and in the websites of the PILIs, for example, "United Nations Framework Convention on Climate Change" and "UNFCCC." We then searched again the PTS dataset for each PILI abbreviation, shorthand, and the key words of the full treaty title. For each result, we checked that it reflects a citation of a PILI. If we found a valid citation of a PILI in a PTS, we coded the citation as an edge between the PTR associated with the PTS and the cited PILI. Thus, an edge between PTR-PILI indicates the existence of at least one citation between a PTR standard and a PILI. Using this method, we built the PTR-PILI network, which consisted of 914 edges.

We classified PILIs into three categories: environment, human rights and economics, multiple categories enabled. These primary categories were further divided into subtopics, as elaborated in Table 3.

Table 3: Classification of PILIs

Topic	Sub-Topic	PILIs	Example
Environment	Sustainable Development (General)	6	Rio
	Pollution	7	Basel
	Ozone & Greenhouse Gas	7	UNFCCC
	Nature Conservation	8	Ramsar
	Marine Pollution	3	MARPOL
	Chemical Use	10	Rotterdam
	Biodiversity Conservation (Genetics)	3	Nagoya
	Biodiversity Conservation	27	CITES
	Environment Sub-Total	**71**	

[14] PILIs initials and full names are listed in Appendix C.

Topic	Sub-Topic	PILIs	Example
Human Rights	State Operation	5	UNCAT
	Racism&Foreigners	5	ICERD
	Organize Crime	3	UNTIP
	Medicine	2	Bioethics
	Labour Wage	15	ILO C173
	Labour Safety&Health	24	ILO R192
	Labour Relationships	8	ILO C158
	Labour Groups	24	ILO C143
	Labour General	20	ILO C177
	Labour Conditions	25	UN Slavery
	Labour Association	11	ILO C87
	Human Rights General	8	UDHR
	Equality & Vulnerable Populations	8	CRPD
	Culture & Community	8	Cultural Heritage
	Human Rights Sub-Total	**166**	
Environment & Human rights	Sustainable Development (General) & Human Rights General	3	MDGs
Environment & Economics	Biodiversity Conservation & Economics	1	UNCLOS
Environment & Human rights & Economics	Labour General+Human Rights General+Sustainable Development (General)+Economics General	1	OECD-ME
Economics	Technical	2	WBank Operational
	International Trade	5	Cocoa
	Corruption	7	UNCAC
	Consumer & Information Protection	4	OECD Privacy
	Regime Creation	1	OECD
	Economics Sub-Total	**19**	
Total PILIs		**261**	

We distinguished between binding PILIs such as treaties that counties **can** join and ratify and non-binding PILIs, such as declarations and recommendations, that countries don't sign on. Table 4 adds the distribution of this attribute.

Table 4: Bindingness of PILIs

Bindingness	PILIs	Example
Binding	145	CBD
Non-Binding	116	UDHR
Total	**261**	

Developing a Citation Taxonomy

To better understand how PTRs cited the PILIs, we used a sample of 100 citations to develop a taxonomy that distinguishes between five categories of references.

1. **Normatively-substantive references**: the normative content of the PTS is based on the norms of a particular PILI in a concretized and detailed fashion. Example (from Aquaculture Stewardship Council (ASC) standard): "*Rationale - Adherence to the child labor codes and definitions included in this section indicates compliance with what the ILO and related international conventions generally recognize as the key areas for the protection of children and young workers.*"[15]
2. **Definitional reference:** the PTS uses the PILI as a "dictionary" to define certain terms. Example (from Ethical Tea Partnership (ETP) standard): "*except for light work as provided for by ILO Convention 138, Article 7.*"[16]
3. **Encyclopedic reference:** the PTS refers to the PILI in a general fashion that does not change the normative content of the PTS. Example (from ASC standard): "*WWF is one of four global non-governmental organizations (NGOs) that have been associated with the Ramsar Convention since its inception as… an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands ...*"[17]
4. **Procedural reference:** the PTS refers to the PILI to set some time frame that is relevant to its application. Example (from Marine Stewardship Council (MSC) and ASC joint standard): "*The timeframe adopted was originally set in the MSC program with reference to the date of adoption of the Convention on Biological Diversity (CBD) requirements on alien species.*"[18]
5. **Bibliographic reference:** The PTS includes the PILI as a source in a bibliography contained in the PTS.[19]

Using the above framework, we analyzed our complete dataset of references to conventions (1,820 raw occurrences). Two research assistants (law students) read all the citations and classified them according to the above taxonomy, each working

[15] ASC-Seriola-Cobia-Standard_v1.0, p. 42.
[16] ETP-Global-Standard-Word-June-2016_Fin, p. 26.
[17] ASC-Tilapia-Standard_v1.1_Layout_Changes, p. 19
[18] ASC-MSC-Seaweed-Standard, p. 58.
[19] See, ASC-Freshwater-Trout-Standard_v1.0, p. 55.

separately. The students also labeled citations that should be excluded from the sample, focusing on these paradigmatic examples:

1. **Sentences that are not citations**, e.g., "*the application of conventional pesticides.*"[20]
2. **Non-specific references to a convention**, e.g., "*or other sources of conventions and norms for allocating emissions.*"[21]
3. **Redundant citations**, when the same convention is mentioned twice in the same sentence; e.g., "*This definition is based on the International Labour Organization (ILO) Convention 154, Collective Bargaining Convention, 1981.*"[22]

We then compared the outputs of the two research assistants and wherever they did not agree the authors read again the citation and determined which classification suits the taxonomy. Finally, we verified a random sample of the classified citations to ensure that the classification was appropriate. The outcome of this process was a weighted edge table between PTRs (through their associated PTS) and conventions, which took into account both the number of citations between PTS and conventions and the distribution of the citation types for each PTS-convention relation.

Data related to IOs

We assembled the list of IOs by singling out those that have an institutional link with the PILIs in our list. We adopted a broad view of institutional linkage, not limited to the organ responsible for administering the convention. Based on this approach, we associated, for example, the Climate Change Convention with the UNEP, the World Meteorological Organization (WMO), and with the Intergovernmental Panel on Climate Change (IPCC). This analysis produced a list of 41 IOs.[23] In the case of umbrella organizations, such as the UN, we refined the analysis to identify the most relevant sub-unit. For example, the "UN International Convention for the Protection of All Persons from Enforced Disappearance" was associated with the UN Commission on Human Rights. Using this data, we expanded the PTR-PILI network by linking each PILI in the network to a particular IO. We then created a dataset that

[20] BCI, Better-Cotton-Production-Principles-and-Criteria-Explained_Final-2013_eng_ext, p. 6.
[21] GGP, Product-Life-Cycle-Accounting-Reporting-Standard_041613, p. 71.
[22] GRI, gri-102-general-disclosures-2016, p. 30.
[23] The initials and full names of IOs are listed in Appendix D.

included the three types of nodes and all the edges between them (PTRs-PILIs-IOs). We used *R* to analyze the network and *Gephi* to produce the network visualizations. Figure 1 provides a snapshot of the links anticipated by our model. Figure 2 presents the complete PTRs-PILIs-IOs network.

Figure 1: Snapshot of network connection: Subscribing firm-PTR-PILI-IO

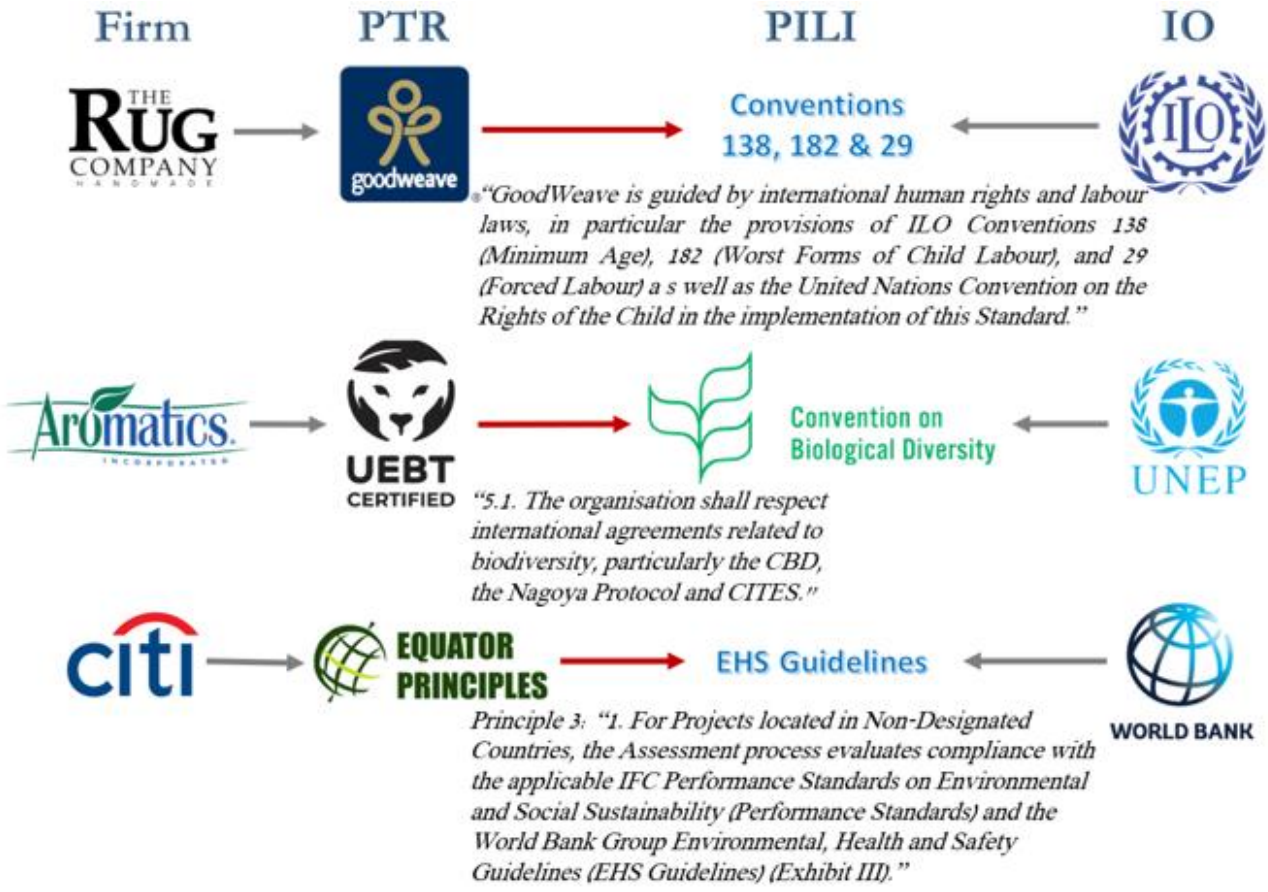
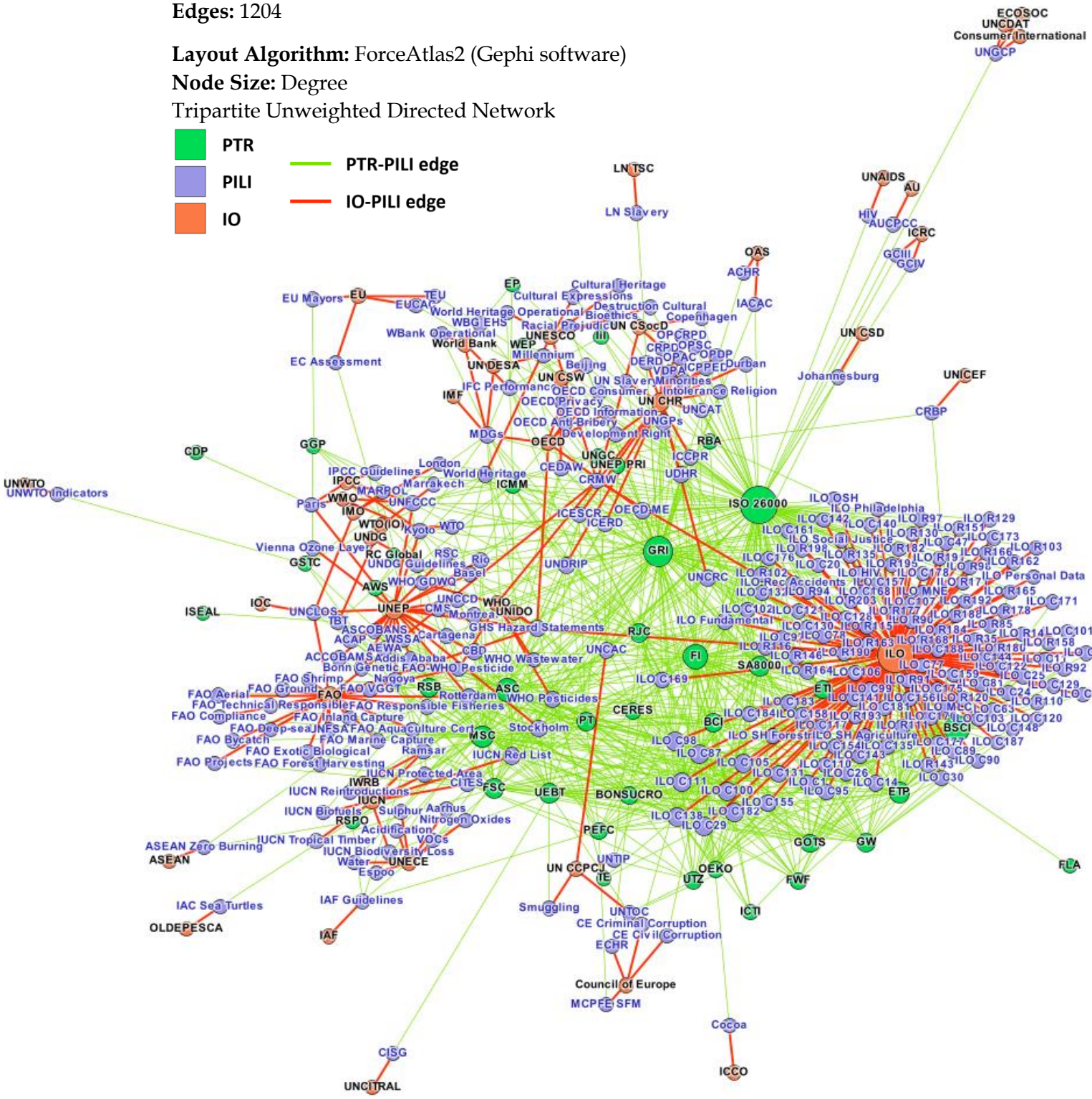


Figure 2: Complete PTRs-PILIs-IOs Network

Nodes: 342 (40 PTRs, 261 PILIs, 41 IOs)
Edges: 1204

Layout Algorithm: ForceAtlas2 (Gephi software)
Node Size: Degree
Tripartite Unweighted Directed Network



Dataset Documentation

This section describes the meaning of each field in the datasets. Each field is represented by a column in the spreadsheets. Some fields refer to attributes of PTRs and PILIs, which were elaborated before.

Dataset 1: Tri-Partite Network Edges

This dataset includes all the links (edges) that constitute the tri-partite network of PTRs, PILIs and IOs described in figure 2. The network is a hybrid-citation/institutional network. The edge between PTR and PILI represents a citation from a PTR to PILI. The edge between PILI and IO represents an institutional link – as noted above we adopted a broad view of institutional linkage, not limited to the organ responsible for administering the convention. We refer to the institutional linkage as directed, where the edge goes from an IO to a PILI, due to some measure of influence that the IO has or had on the PILI. Each row in the dataset represents a single edge, which is characterized by the following fields:

A. **Source**: As a citation network, the network is directed. Both citation-edges and institutional-edges are included in the data. In the case of a citation edge, the *source* is a *PTR* and the target is a PILI. In the case of institutional edge, the *source* is an *IO* and the target is a PILI.

   * Combination of source and target is the **table key** (unique value).

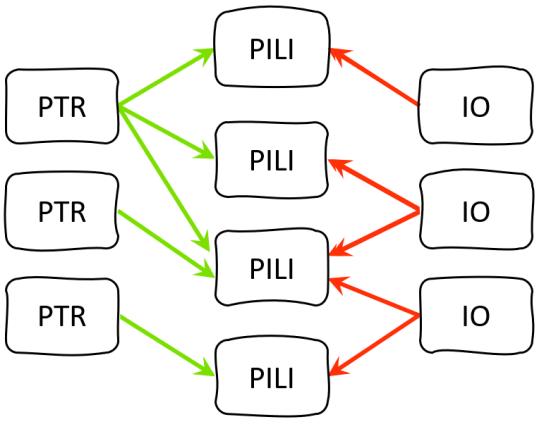
B. **Target**: the entity that is the end of an edge. It can be a *PILI* that is cited by a PTR (citation edge) or a *PILI* that is connected to an IO (institutional edge).

C. **Link Type**: since the network is a tri-partite, there are two kinds of edges: (1) citation edges from PTRs to PILIs and (2) institutional edges from IOs to PILIs. Respectively, Link Type column describes the type of each edge: PTR-PILI or IO-PILI. The data includes 914 PTR-PILI edges between 40 PTRs and 261 PILIs and 290 edges between 41 IOs and 261 PILIs.

Additional explanation on Tri-Partite Network: tri-partite networks connect between three different types of nodes, with no links within the same category. In our case the categories are PTRs, PILIs and IOs. The edges represent distinct interactions: PTRs-

PILIs links represent citations, PILI-IOs links represent institutional association. Figure 3 provides a simple example.

Figure 3: Abstract scheme of PTR-PILI-IO tri-partite network



Dataset 2: PTRs Attributes

This dataset includes the PTRs' features. Each row in the dataset contains a description of one PTR, divided into the following fields:

A. **Full Name**: the name of the PTR as appears in Appendix A.

B. **Initials**: the initials of the PTR name as appear in Appendix A.

   * This field is the **table key** (unique value).

C. **Foundation Year**: the year in which the PTR started its activity.

D. **Sector**: We grouped the PTRs into 5 sector-categories: Plants, Forest & Sea Products; Quarried Substance & Electronics; Textile & Apparel; Finance, Sport & Leisure; and General. The standards of PTRs that were classified into the general category are suitable for firms in any sector.

E. **Legal Subject**: the legal subject area covered by the PTR. We distinguished between 4 categories: Environment, Labour, Environment & Labour and Other. "Other" refers to issues outside the environment/labour domain.[24]

[24] The 3 PTRs that were classified to this category are the *Voluntary Principles on Security and Human Rights (VPI)* that aimed to better ensure human rights of communities affected by operations of oil, gas and mining companies; the *Extractive Industries Transparency Initiative (EITI)* that focus on transparency of economics aspects, related to the extraction rights, revenues form governments and investing in

F. **Stakeholders**: the dominant governing stakeholder/s of a PTR. We distinguished between three main categories: Industry, Civil Society & States. Some PTRs are governed by one type of stakeholder, whereas others are governed by stakeholders of distinct types.

G. **Stringency**: stringency of the compliance regime of a PTR. We distinguished between "soft" schemes that rely on self-verification by member firms, "intermediate" schemes that rely on third-party verification, and "strict" schemes in which verification is undertaken by the PTR or an agent controlled by the PTR.

Dataset 3: PILIs Attributes

This dataset includes the PILIs' attributes. Each row in the dataset contains a description of one PILI, distinguished by the following fields:

A. **Full Name**: the name of the PILI as it appears in Appendix C.

B. **Initials**: the initials of the PILI name as it appear in Appendix C.

   * This field is the **table key** (unique value).

C. **Topic**: the main topic of the PILI: Environment, Human Rights or Economics (multiple categories enabled).

D. **Sub-Topic**: the sub-topic of the PILI, as described in table 3.

E. **Bindingness**: we distinguished between binding PILIs, such as treaties, and non-binding PILIs, such as declarations and recommendations.

F. **Document Type**: generic title of a PILI, such as convention, treaty, agreement, declaration and protocol. The full list of document types can be found in table 2.

G. **Connected IOs**: IOs that have an institutional link to a PILI. We adopted a broad view of institutional linkage, not limited to the organ responsible for

benefiting the public; and the *London Benchmarking Group (LBG)* that deals with management and reporting of the investment and contribution to community.

administering the PILI. If a PILI has more than one connected IO, all the IOs are noted, separated by a semicolon.

Dataset 4: Taxonomy Weighted Edges

This dataset describes weighted edges from PTRs to PILIs, based on the conventions dataset and our citations taxonomy (see section "Developing a Citation Taxonomy" above). The edges are differentiated by the types of citations, therefore a PTR can have five different edges to a PILI, when each edge represents different citation type. Each row in the dataset is one edge, which is characterized by the following fields:

A. **PTR**: the initials of the PTR name as appears in Appendix A.

B. **PILI**: the initials of the PILI name as appear in Appendix C.

C. **Type**: the type of citation (from a PTR to a PILI), by the following taxonomy categories: Normatively-Substantive, Definitional, Bibliographic, Encyclopedic or Procedural.

   * Combination of PTR, PILI and Type is the **table key** (unique value).

D. **Weight**: the number of citations from a PTR to a PILI in a specific type of citation.

Statistical Analysis of the Network Legitimacy Patterns

In this section we explore the patterns of citations by PTRs and how they are influenced by the attributes of PTRs and PILIs. We measure the citations in the PTRs-PILIs bi-partite network by the out-degree of PTRs and the in-degree of PILIs. The analysis is based on the full 55 PTRs sample (and not only on the 40 PTRs that are included in the largest connected component of the citation network). PTRs that do not cite any PILI (isolated node in the network) have a zero out-degree. We present the results using both average and median measures.[25]

In this empirical section, we focus on several new hypotheses that can be analyzed by our data. We also provide a space for broader analysis of the data, adopting other theoretical perspectives, by other researchers. We verified the significance of the results by *independent t-tests* (when the sample groups were large as in the case of PILIs) or by the nonparametric *Mann-Whitney U test* (when the sample was relatively small, as in the case of PTRs). The analysis was executed through *R* script and the visualization by *Tableau* software.

A. <u>The stringency of PTRs standards and the bindingness of PILIs</u>

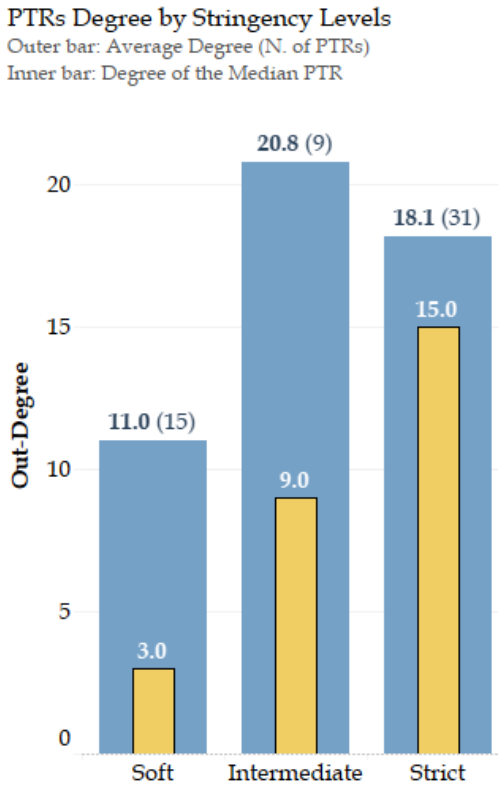
PTRs that have a stricter enforcement regime face a stronger demand for legitimacy. This will be reflected by higher tendency of these PTRs to cite PILIs, which can support their quest for legitimacy.

Proposition 1: PTRs with a more stringent compliance regime cite more PILIs than those with a "softer" regime.

It was found that a median PTR with a more stringent regime cites more PILIs than a 'soft' one. Figure 4 shows that a median 'soft' PTR cited 3 PILIs, a median 'intermediate' PTR cited 9 PILIs and a median 'strict' PTR cited 15 PILIs. In addition, it was significantly found that PTRs with 'strict' level of compliance cite more PILIs than those with 'soft' level ($p=0.009$, $W=332$, Mann-Whitney U test).

[25] The *median* is important in abnormal distributions (which characterize most real networks). The *average* is important because it takes into account outliers, which are more important in small samples (relevant to the groups of PTRs after dividing them to categories).

Figure 4: PTRs Degree by Stringency Levels

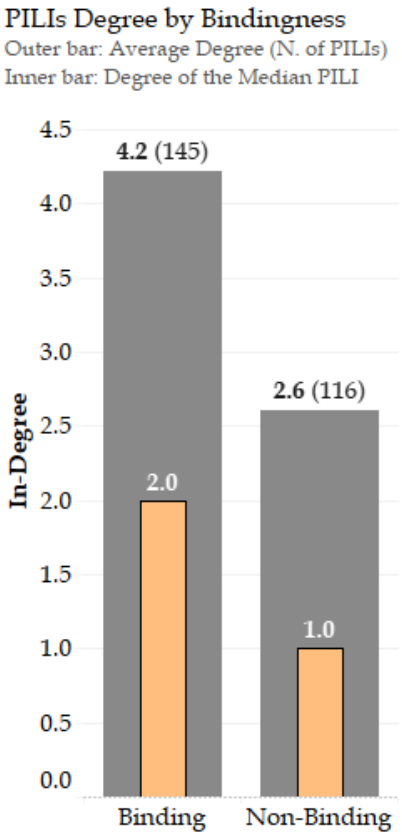


On the international public sphere, PILIs such as treaties and protocols, that counties can join and ratify, and are considered a hard source of international norms, may be considered as stronger source for legitimacy, than softer instruments such as declarations and recommendations. We therefore hypothesize that such formal texts will be cited more often by PTRs.

Proposition 2: Binding PILIs are cited by more PTRs than non-binding PILIs.

We found that 'hard' PILIs were cited by 4.2 PTRs on average (an average binding PILI was cited by 4 to 5 PTRs), while 'soft' PILIs were cited by only 2.6 PTRs on average (figure 5). 'Hard' PILIs were found to be cited by significantly more PTRs than non-binding PILIs ($p=0.002$, $t=2.899$, $df = 259$; two sample t-test).

Figure 5: PILIs Degree by Bindingness

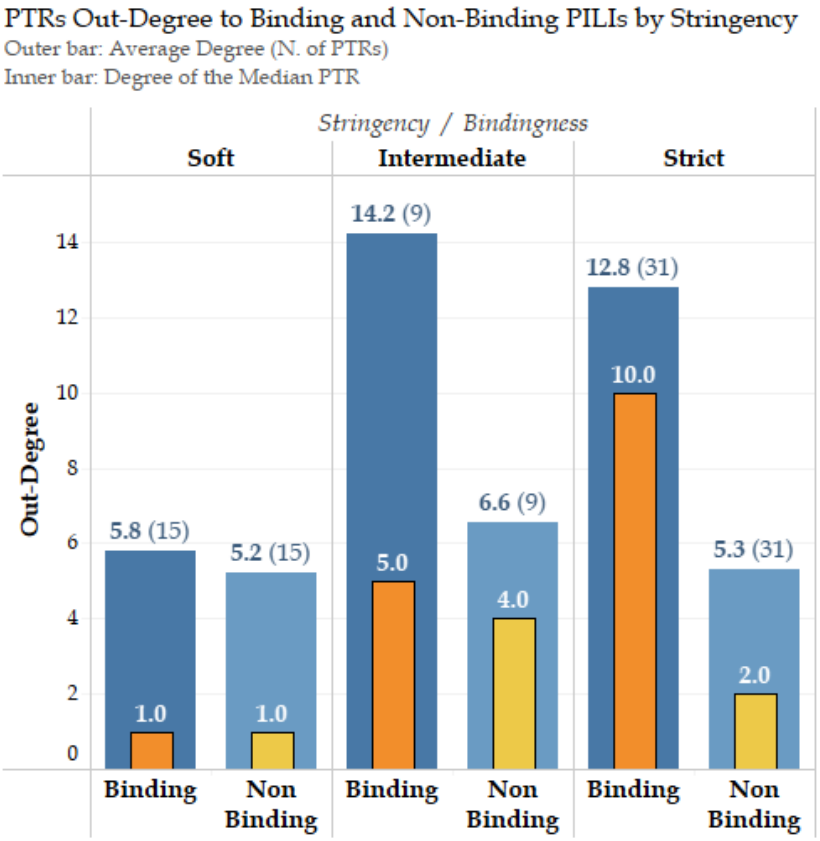


As we argued above, PTRs that have a more stringent compliance regime, will be faced with stronger expectations that their standards are legitimate. This stronger demand for legitimacy can be achieved, as noted above, through stronger reliance on PILIs (reflected by higher citation level of PILIs). However, it can also be achieved at a more nuanced level, by a stronger reliance on binding ("hard") PILIs (than on soft ones). This reflects the conception that binding PILIs constitute a stronger source for legitimation than non-binding PILIs.

Proposition 3: PTRs with a stringent compliance regime will be more inclined to cite binding PILIs than PTRs with a softer compliance regime.

We found that PTRs with softer compliance regime cited on average 5.8 binding PILIs (and median PTR cited only 1 PILI), while PTRs with strict regime cited on average 12.8 binding PILIs (and median PTR cited 10 PILI) (figure 6). Mann-Whitney U-test found it significantly greater ($p=0.005$, $W=340$).

Figure 6: PTRs Out-Degree to Binding and Non-Binding PILIs by Stringency



B. Analysis of the Stakeholders of PTRs

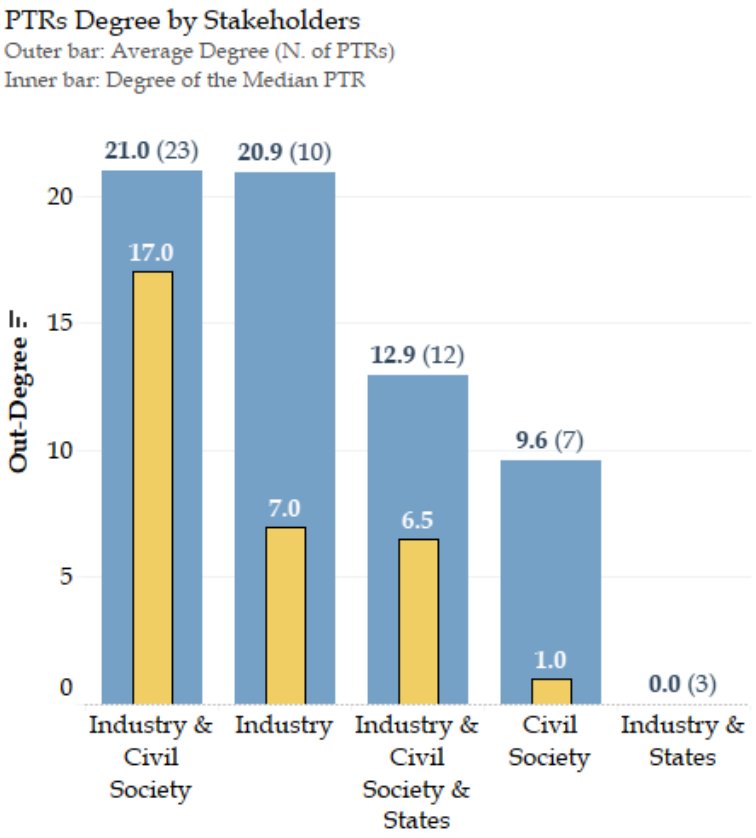
PTRs are governed by variety of stakeholders. Some are governed solely by industry actors, while other are governed by a combination of civil organizations, states and industrial actors. We assume that PTRs that are governed by civil society organizations and states are considered more legitimate than those governed by industrial actors, and thus will cite fewer PILIs. Therefore, these PTRs have smaller incentive to rely on PILIs, compared to industry-governed PTRs.

Proposition 4: PTRs controlled industry actors tend to cite more PILIs than PTRs that are governed by civil society actors.

Although PTRs that are controlled solely by civil society cited less PILIs than PTRs that are controlled solely by industry (9.6 versus 20.9 on average; figure 7), the difference was not found to be significant. Moreover, PTRs that are governed by industry and civil society cited, on average, the same number of PILIs as PTRs that are governed solely by industry. As shown in figure 7, the pattern of citations was found

to be more complex than suggested by our initial hypothesis. In this context, it is important to note that our data does not include the percentages of the three types of stakeholders (industry, civil society and states), but only the existence of each type. Collecting more data on the stakeholders distribution and extending the PTRs sample, can assist in studying this hypothesis further.

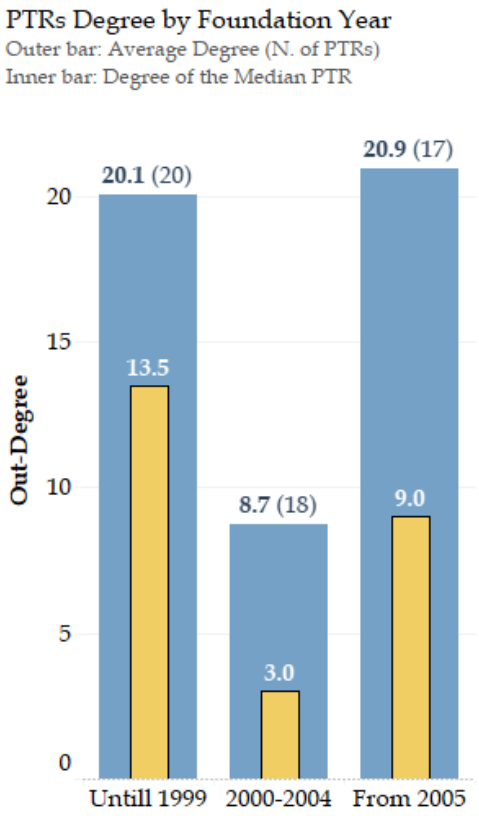
Figure 7: PTRs Degree by Stakeholders



C. PTRs Foundation Year

We found that PTRs in the middle age (with foundation year between 2000-2004) cited on average less than half number of PILIs comparing to PTRs that was founded before 2000 or after 2004 (figure 8). The reason for these differences requires separate theoretical research.

Figure 8: PTRs Degree by Foundation Year



D. PTRs Sectors

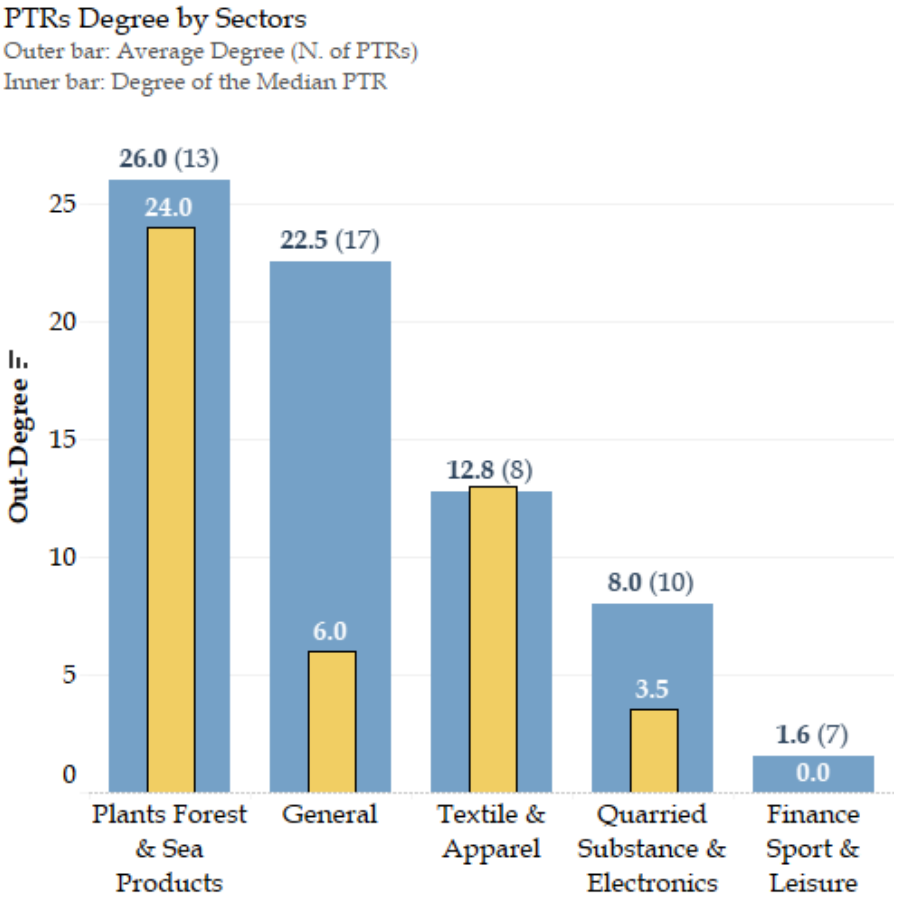
Sectors were found to be another variable that exposes different patterns of citations. Sectors that produce products for mass consumption (e.g., food products) are likely to be more sensitive to legitimacy concerns. We hypothesize therefore that PTRs that focus on such sectors will have a stronger demand for legitimacy, in order to convince firms to associate themselves with them through certification. This could generate stronger reliance on PILIs.

Proposition 5: PTRs that are designed for firms in the plants, forest and sea products (mainly food products) tend to cite more PILIs than PTRs in the other sectors.

A PTR in the plants, forest and sea products (mainly food products) cited on average 26 PILIs, which found to be significantly greater than a PTR in the other sectors, that cited on average 13.7 PILIs ($p=0.006$, $W=399$, Mann-Whitney U test). This result becomes even more significant when excluding the general-sector-PTRs from the "other sectors" group ($p=0.002$, $W=255.5$, average of the "other sectors"=7.7; excluding them is because the general-sector-PTRs may also certificate firms in the food

industry). Figure 9 presents in more detail the differences in citing PILIs between PTRs in specific sectors.

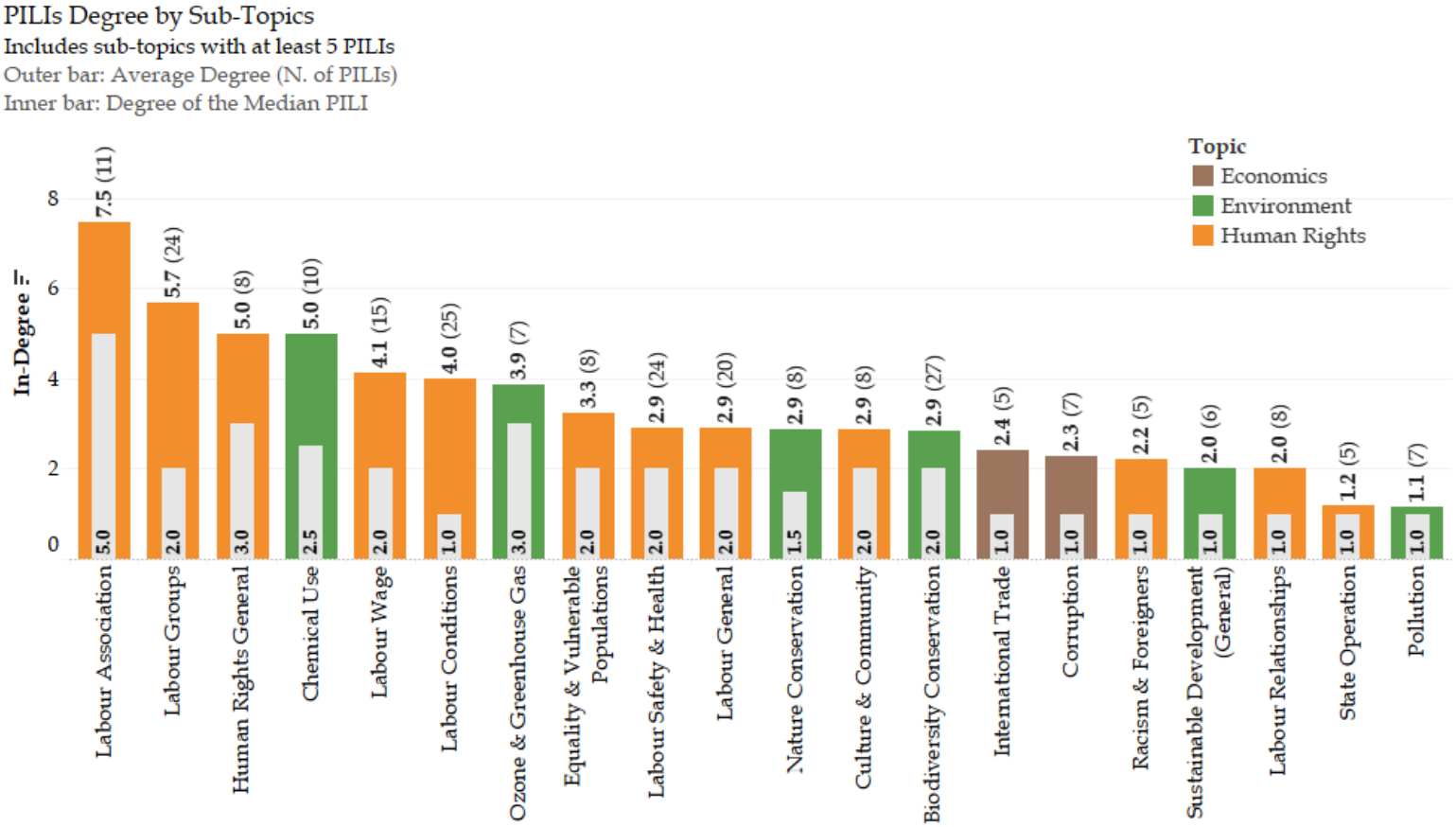
Figure 9: PTRs Degree by Sectors



E. **Reliance on PILIs in varied Sub-Topics**

Figure 10 drills down to statistics on the sub-topics of PILIs. For example, we can see that an average PILI in the subject of chemical use was cited by 5 PTRs, which is a higher average citations comparing to other environmental issues. In addition, we can see that labour association was a subject that attracted more PTRs than other subjects in human rights topic (an average PILI in this sub-topic was cited by 7.5 PTRs). These statistics can tell us which sub-topics function as an active source of legitimation of PTRs. Simultaneously, PILIs and their connected IOs in these popular sub-topics succeeded in conveying and diffusing some of their public regulations to the private firms, via the citing PTRs.

Figure 10: PILIs Degree by Sub-Topics



Summary

Empirical research on interactions between private and public regulators in the transnational law is important for analyzing theoretical hypotheses on the sustainability global governance. In this paper we discuss how relying on PILIs as conventions and protocols can enhance PTRs legitimacy and authority. We made our tri-partite networked data (PTRs-PILIs-IOs) available and documented for the research community. Finally, we analyzed new questions on PTRs legitimacy by statistical analysis.

We found that PTRs with a more stringent compliance regime cite more PILIs, and in particular more *binding* PILIs, than PTRs with a "softer" regime, because stringent compliance regime face with stronger demand for legitimacy, and because binding PILIs are a stronger source of legitimacy. Independently, binding PILIs were found to be cited by more PTRs than non-binding PILIs. We also found that PTRs that are designed for firms in the plants, forest and sea products (mainly food products) tend to cite more PILIs than PTRs in the other sectors, because products for mass consumption (e.g., food products) are likely to be more sensitive to legitimacy concerns.

We pointed on interesting differences in patterns of citations between PTRs that are controlled by different stakeholders. And we also found that PTRs in the middle age (with foundation year between 2000-2004) cited on average less than a half amount of PILIs comparing to the other PTRs. However, these differences require separate theoretical and empirical research.

At last, we presented statistics that indicate which topics function as an active source of legitimation for PTRs, like labour association and chemical use. Public regulations in these topics are better diffused to the private firms, via the citing PTRs. We hope these results will advance the study on global governance interactions and on the new private transnational regulators.

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