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Governance through global networks and corporate signaling

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Abstract

This article exposes a new form of global governance based on an emergent network of corporate social responsibility (CSR) schemes. Our study is the first to uncover the network structure of this system, based on a dataset that includes 61 transnational CSR schemes and 31,987 firms. We demonstrate that the network exhibits a significant level of cohesiveness, despite having evolved without any form of hierarchical control. Drawing on a social network analysis, we find a positive correlation among the sustainability performance of the firms, their membership in CSR schemes, and their network characteristics. We show that membership in multiple schemes and the firms' position in the CSR-schemes network constitute credible predictors of their sustainability performance, generating a separating equilibrium that distinguishes high from low CSR performers. We develop a model that explains the effectiveness of the CSR-schemes network based on the synergistic properties of the network and on a distinctive signaling dynamic. Our findings highlight the potential contribution of CSR to the resolution of global governance dilemmas.

Keywords: CSR, greenwash, multilayered networks, network governance, synergy, transnational regulation.

1. Introduction

Global governance is in crisis. The conventional treaty-based system is struggling to cope with the multiple challenges faced by global society (UN General Assembly 2015). This failure is evident in various areas, including climate change (Weaver & Kysar 2017; Milman 2018), protection of labor rights across global supply and commodity chains (Locke *et al.* 2009), global biodiversity (Cardinale *et al.* 2012), and the spread of communicable diseases (Gostin *et al.* 2016). The dependence of the treaty system on inter-state cooperation and its rigid bureaucratic structure has weakened its capacity to effectively respond to mounting global risks (Hale *et al.* 2013). This governance crisis has motivated the creation of multiple private corporate social responsibility (CSR) schemes that operate alongside the treaty-based system and cover many of the issues governed by conventional public international law regimes, from environment to human rights (Perez 2007, p. 54; Barak-Erez & Perez 2013). These transnational CSR schemes include voluntary corporate codes, environmental management systems, various labeling and certification schemes, sustainability reporting standards, and global ranking schemes (Perez 2016, pp. 163–170). Most CSR schemes include both a normative element (a standard that sets out detailed performance guidelines) and a compliance framework. CSR standards offer a way to circumvent the regulatory weaknesses of the international treaty system by directly regulating the behavior of corporations on a global scale. The efficacy of CSR schemes as regulatory instruments and their credibility as indicators of sustainability performance therefore constitute an important policy question (Hale 2016; Ruggie 2017). Various authors, however, have voiced skepticism about the credibility (or trustworthiness) of CSR instruments, arguing that they are nothing more than greenwash or cheap talk (Berliner & Prakash 2015, p. 116; Zerbini 2015, pp. 14–15).[1]

The present study sheds light on this policy dilemma by examining the credibility of CSR schemes based on a network analysis of a large sample of such schemes and affiliated firms. Our article contributes in several ways to

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the growing body of literature that examines private transnational regulation through a network or interactionist perspective (Bartley & Smith 2010; Eberlein *et al.* 2013; Green 2013, 2017; Abbott *et al.* 2016; Fransen *et al.*, 2018).[2] First, we conceptualize the authority of CSR schemes, that is, their capacity to exert normative force, as an *emergent, network-based property*, dependent on certain structural features of the network. Specifically, we argue that this networked-based authority is dependent on the evolvement of a multiplexed (ensemble) structure of closely connected CSR schemes. Multiplex networks exist when actors are connected through more than one type of socially relevant tie (Hu *et al.* 2011; Heaney 2014, p. 67; Pilosof *et al.* 2017). The evolvement of multilayered connections between the CSR schemes is critical, we argue, to the consolidation of the standards' authority, to the realization of the network's synergistic potential, and to the flow of information within the network.[3] We link this argument to a phenomenon we call "networked signaling," which plays a crucial role in the evolution and operational dynamic of the CSR network. As we will elaborate, our framework connects between the firms' communication strategies and the evolving structure of the network. By studying the regulatory efficacy of CSR schemes from a network perspective, our theoretical framework departs from the standard approach in the literature that considered each CSR regime separately (Potoski & Prakash 2005; Schembera 2016). Our theoretical framework also goes beyond mere interactionist models (Eberlein *et al.* 2013; Wood *et al.* 2015) by seeking to elucidate the exact institutional pathways through which the network's structure affects its overall regulatory impact.

Second, we test our conceptual framework using a holistic empirical strategy, drawing on social network analysis techniques. We base our empirical analysis on an original and extensive dataset that includes 61 environmental and CSR organizations and 31,987 firms. Our holistic empirical approach goes beyond the current literature, which consists mostly of piecemeal studies of single CSR schemes or sectors (Dashwood 2014; Fransen & Burgoon 2014; Kayser *et al.* 2014; Berliner & Prakash 2015).[4] Another novelty of our empirical strategy is that it reaches past a mere topological analysis by seeking to examine the regulatory impact of the network as a whole (Bartley & Smith 2010; Green 2013; Fransen *et al.* 2018).

The article proceeds as follows. Section 2 describes our theoretical framework. Section 3 introduces the methodology. Section 4 describes the results. Sections 5 and 6 conclude with a discussion of the results and policy implications.

2. Theoretical framework: Ensemble regulation and networked signaling

We base our argument on two key theses: ensemble regulation and networked signaling. We argue that the transnational system of CSR schemes forms a dense and multilayered (multiplexed) network with synergistic properties, constituting what we term an *ensemble regulatory structure*.[5] The network's multiplexed structure is realized through four layers that reflect different types of interactions between CSR schemes: (i) indirect links that are established through the co-affiliation of a single corporation in different schemes; (ii) direct links between the organizations that administer the standards of varied institutional forms; (iii) cross-referencing between the CSR standards; and (iv) a common reference to general concepts (e.g. sustainability) in the texts associated with the schemes (Pilosof *et al.* 2017; Perez & Stegmann 2018). While the CSR schemes appear (as nodes) in all layers, each layer captures a different manifestation of the scheme. It is thus possible to distinguish between "elementary nodes," which represent the basic institutional entities, and "state nodes," which represent the manifestation of a given elementary node on a specific layer (Pilosof *et al.* 2017). We argue that these multiplexed connections have a synergistic effect that contributes to the network's regulatory power (Perez 2011).

The synergistic effect is manifested through cross-supportive and cross-validating interactions between the schemes' normative and compliance frameworks, which are realized across the four layers. The synergistic aspect of the CSR ensemble means that the regulatory impact of the ensemble as a whole is greater than the sum of the individual effects of each CSR regime taken alone (Corning 2002, pp. 22–23; Luukkanen *et al.* 2012). In particular, we argue that the normative and compliance complementarities between the CSR schemes make it more difficult for firms that commit to several schemes to renege on their CSR commitments. A good example of this synergistic effect is the issue of disclosure. Many CSR schemes include disclosure requirements. For example, Global Compact, Responsible Care, and Equator Principles have developed unique reporting frameworks that are embedded in their institutional structure.[6] As a firm takes on the disclosure requirements of several CSR schemes, which may cover different aspects of its operations, it becomes much more difficult for the firm to cheat vis-à-vis

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each of the CSR schemes because its organizational structure becomes more transparent as a whole. The synergistic effect represents an emergent property of the network, and it is therefore not easy to quantify.

The ensemble regulation model leaves open the question of why firms should commit to implementing the costly requirements of a variety of CSR schemes when they are not bound to do so by law. The literature has offered several explanations as to why firms invest in CSR: to enhance the company's brand and image, to respond to its managers' ideological preferences, to enhance employees' organizational trust, or to provide insurance against reputation loss in the case of adverse events (Berns *et al.* 2009; Minor & Morgan 2011; Lourenço *et al.* 2014). Firms may also invest in CSR to preempt or shape future regulation in ways that are not necessarily beneficial to society as a whole (Lyon & Maxwell 2008). There is broad evidence, however, that reputation is a main factor in firms' CSR decisions (Berns *et al.* 2009; Tetrault Sirsly & Lvina 2016; Reputation-Institute 2017). A recent global survey found that executives predominantly "cite reputation as a top reason their companies address sustainability" (McKinsey 2014). Because it is difficult to directly test the reasons that motivate firms to join CSR schemes, we test this assumption indirectly in our empirical analysis.

To the extent that firms want to use their commitment to sustainability values as a way to enhance their reputation, they need to find a way to *credibly signal* their commitment. We distinguish between firms that join CSR schemes and are committed to implementing their norms (*genuinely sustainable firms* or *green*) and firms that join CSR schemes but have no intention of implementing the recommendations (*greenwashers*). By representing themselves as green without changing their behavior accordingly, greenwashers produce false signals (Lyon & Montgomery 2015, p. 226). The challenge for genuinely sustainable firms is to find a way to distinguish themselves from greenwashers, given the situation of informational asymmetry in which they are situated. The literature refers to the circumstance of firms that obtain certification or membership in a CSR scheme without continuously complying with its requirements as "decoupling" (Aravind & Christmann 2015, p. 73; Graafland & Smid 2016, p. 3). Note that greenwashers may also use other signals (e.g. advertising, logo design etc.) to falsely represent themselves as green. The challenge for genuinely sustainable firms is to find a simple and credible signal that can distinguish them from greenwashers. Green advertisements offer a simple communication strategy but their credibility is low (Fernando *et al.* 2014; Leonidou *et al.* 2014). Sustainability reports (SRs) offer an alternative option. By using objective metrics to measure CSR activity, SRs can operate as a signal that distinguishes between green and greenwasher firms. But the complexity of SRs could undermine their capacity to distinguish between firm types because deciphering the reports may be too costly (KPMG-International 2014, p. 10).

A possible solution to the communication dilemma lies in a phenomenon we call *networked signaling*. Firms signal their commitment to sustainability by linking, through certification or membership, to multiple CSR schemes that are part of the CSR network (rather than linking only to a single code). The inspiration for this argument comes from the model of costly signaling that was developed (independently) by biologist Amotz Zahavi (Zahavi & Zahavi 1999) and economist Michael Spence (Spence 2002). The puzzle at the core of Zahavi and Spence's work is this: Why do animals and humans produce costly and potentially detrimental signals? Prominent examples from biology include the stotting behavior of gazelles, the altruistic behavior of the Arabian babbler, and the peacock's tail (FitzGibbon & Fanshawe 1988; Zahavi & Zahavi 1999, p. xiii); examples from the economic literature include the costs of a Masters of Business Administration from an ivy league institution or advertising expenditure (Kirmani & Rao 2000; Kübler *et al.* 2008; Yang & Harstad 2017).[7] Zahavi and Spence explained this seemingly puzzling behavior as a signaling device, in Zahavi's terminology, the "handicap principle." Highly productive workers invest in costly education to distinguish themselves from less productive ones (Kübler *et al.* 2008; Bergh & Fink 2009), and high-quality producers spend large sums of money on advertising to distinguish themselves from low-quality producers (Kirmani & Rao 2000, p. 69). Animals use costly signals to convey their fitness and to distinguish themselves from unfit individuals (Johnstone 1995; Zahavi & Zahavi 1999).

In the corporate world, firms use certification or membership in CSR schemes to signal their commitment to sustainability values and to distinguish themselves from greenwashers. What makes certification or membership in CSR schemes a credible signal is the *differential cost structure* of multiple certifications. The cost of reliable quality signals is higher for an untruthful signaler than for an honest one (Laidre & Johnstone 2013, p. R832). This is because the cost of maintaining a decoupled or deceitful organizational structure (in which an organization commits to a CSR scheme with no intention of implementing it) increases with the number of certifications

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or memberships the organization holds. These costs reflect both the direct costs of maintaining a decoupled structure and the expected reputational costs that may accrue if the deceit is exposed (Greyser 2009).[8] We argue that there is a negative correlation between the sustainability performance of an organization and the *cost of cheating*: organizations that are low sustainability performers need to invest more in presenting themselves as green than those that are better performers (Connelly *et al.* 2011, p. 45). Note that greenwashers are not merely low-quality implementers (Aravind & Christmann 2015, p. 74) but engage in deceit by trying to present themselves as high-quality implementers. For low-quality implementers, designing an elaborate system of deceit tailored to each of the various standards may end up costing more than implementing these standards outright (Connelly *et al.* 2011, p. 45).[9] When the *differential cost* condition is satisfied, a *separating equilibrium* that distinguishes between firms that are truly committed to CSR values and greenwashers emerges (Lyon & Montgomery 2015, p. 226). In a *separating equilibrium,* the market can accurately distinguish between the two types (Connelly *et al.* 2011, p. 43; Zerbini 2015).

There is, we argue, a reciprocal and cross-supportive linkage between the firms' signaling dynamics and the networked structure through which the CSR schemes are organized. The first aspect of this reciprocal linkage concerns the issue of *signal consistency*. When firms use multiple signals they face the risk of confusing the receiver through conflicting signals, making communication less effective (Gao *et al.* 2008, p. 13; Connelly *et al.* 2011, p. 54). The network structure provides firms with a pool of potential signals that can be linked together consistently in a way that enhances the force of the signal (Hart *et al.* 2015, p. 707; Kudłak & Low 2015, p. 218).[10] This is what makes multiple certifications a case of *networked signaling.* At the same time, the strategic need for signal consistency also provides an incentive for CSR organizations to expand their ties with other organizations. A second manifestation of this reciprocal connection concerns the influence of the signaling game on the behavior of CSR organizations. Because CSR organizations are mindful of the signaling logic that drives certification, they recognize that they must sustain their credibility otherwise firms will not join. This implies that CSR organizations have an incentive to develop sound performance rules and credible compliance mechanisms, which jointly make cheating more difficult. The search by companies for credible signals and the capacity of the CSR network to respond to this demand create a self-reinforcing feedback loop that positively affects the efficacy of the regulatory network, creating a positive reciprocal linkage between the signaling dynamic and the regulatory robustness of the network as a whole. Note, however, that this positive reciprocal process is not a necessary phenomenon but rather part of our hypothesis. There could be other potential equilibria where network-driven convergence leads to weaker forms of sustainability.

3. Method

3.1. The induced (affiliation) corporate social responsibility (CSR) codes network (IACN)

To construct our sample of CSR schemes, we created an initial list of candidate schemes based on a review of the literature (McKague & Cragg 2003; Abbott & Snidal 2009; Hohnen 2009; Organisation for Economic Co-operation and Development 2009) and then expanded the list through an internet search.[11] We included in the sample only CSR schemes that have a certification or membership mechanism (open to firms) that is supported by an institutionalized compliance framework (even if a relatively weak one). This restriction produced a sample that enabled us to test the network signaling hypothesis. We therefore omitted schemes that have no certification or membership option (such as ISO 26000), schemes that certify only public organizations (e.g. universities),[12] schemes that certify only products (green-label schemes), and CSR-related schemes where the signatories are states from our preliminary sample.[13] The compliance criterion means that a firm that seeks to make a commitment to that standard would be subject to some form of ex ante screening (entry costs) and ex post monitoring (continuing compliance costs). For our purposes, it did not matter whether the screening or monitoring process has been institutionalized in the form of certification or membership. For example, to become a member of Global Compact (GC), a firm must pledge, among other conditions, to operate responsibly, in alignment with GC principles,[14] and to report annually on its ongoing efforts.[15] In the case of GC, the ex ante selection principle (the firm's willingness to formally commit to GC) and the ex post compliance mechanism (based on annual reports), are both relatively weak. Nonetheless, GC meets our criterion of operating within an elaborated institutional structure. SA8000 has a different institutional structure: it requires firms that want to demonstrate

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compliance to undergo a process of certification carried out by third-party auditors, and to commit to a process of continuing third-party auditing.[16] The Global Reporting Initiative (GRI), which is also among the standards we cover, is based on a self-declaration that the organization publishes its sustainability reports in accordance to GRI principles, but it also includes an optional stricter form of compliance based on third-party audit.[17]

We collected the data by searching the websites of the schemes and by contacting their governing bodies if data were not available online. We omitted some relevant schemes for which we were not able to obtain data on members or certified firms from the final database.[18] We collected the data during 2015, a process that took approximately one year. The final IACN network includes 49 CSR schemes and 31,987 firms. All of the data refer to membership or certification as of 31 December 2014.

In our raw data, firms were not identified with a unique identifier, such as the Central Index Key, used by the U.S. Securities and Exchange Commission[19] or by Stock Exchange Daily Official List codes, used by the London Stock Exchange.[20] As a result, many firms with several certifications had non-uniform representation in different codes. To eliminate this non-uniformity, we used Fuzzy Lookup (Microsoft), software that performs fuzzy matching of textual data.[21]

3.2. The institutionally derived codes network (IDCN)

To complement the structural analysis of the CSR schemes network, we also studied the direct institutional links between the organizations that run the schemes.[22] The analysis of the institutionally derived codes network (IDCN) is consistent with our thesis that the socio-legal dynamics of the CSR network can only be fully understood if we study it as a multiplexed network. To construct the IDCN, we used a snowball strategy based on data we extracted from the websites of the schemes. The snowball strategy, which starts from a set of focal actors, is a common data collection technique in network research (Farquharson 2005; Chan & Liebowitz 2006; Fieseler *et al.* 2010). This analysis produced another mapping of the network, which included 61 schemes, in contrast to the 49 in IACN.[23] Because this analysis focused on the linkages between the organizations that administer the schemes, we also included schemes for which we did not have certification data (e.g. the International Organization for Standardization [ISO]), and schemes that do not have firms as members (e.g. United Nations Environment Programme [UNEP], International Social and Environmental Accreditation and Labeling [ISEAL]). For the purpose of the analysis, we developed a taxonomy distinguishing between five types of institutional connections:[24]

- *Governance* covers participation in the governance bodies of other schemes, in the founding of other schemes, and other historical connections. For example, FairTrade International (FI) is a co-founder of ISEAL[25] and is represented on board of directors of ISEAL;[26] Good Weave (GW) is represented on the board of directors of the Fair Labor Association (FLA).[27]
- *Partnership* covers partners, collaborators, cooperators, and allies. For example, the GRI is an ally of the Carbon Disclosure Project (CDP),[28] and the Forest Stewardship Council (FSC) maintains a liaison with ISO.[29]
- *Compliance cooperation* covers schemes that provide traceability or compliance services to other schemes. The only example of such a connection that we found is the UTZ Code of Conduct for the Tea, Coffee and Cocoa Sectors, which provides traceability services to the Roundtable on Sustainable Palm Oil (RSPO).[30]
- *Membership* covers schemes that are members[31] of other schemes. For example, Textile Exchange (TE) is a member of the Better Cotton Initiative (BCI),[32] and the Union for Ethical Bio-Trade (UEBT) is a full member of ISEAL.[33]
- *Support* covers schemes that support other schemes. The term "support" designates a lower level of institutional linkage than partnership or membership – a signal of ideological affinity. For example, the Round Table on Responsible Soy (RTRS) supports the United Nations Global Compact (UNGC),[34] and the Coalition for Environmentally Responsible Economies (CERES) is one of the supporting institutions of the Principles for Sustainable Insurance, an initiative of the United Nations Environment Programme (UNEP PSI).[35]

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In assessing the presence of any of these links we relied exclusively on the characterization of the link on the scheme website and have not examined it independently. Therefore, we lack data about the intensity of any connection (e.g. how involved schemes are in the governance of other schemes).

We analyzed each of the schemes by examining its website to determine whether it is connected to any of the other schemes through one of the above organizational paths.[36] Other than partnership, which is reciprocal, all of the paths listed above are *directed* and not symmetrical. The analysis was conducted in August to September 2015 and it included a search for information about the members, partners, supporters, governance, and history of each code. The results of the analysis were inserted into a matrix that included all of the schemes, which we then analyzed using the social network analysis tools. For example, if code A was in the governance bodies of code B, an edge pointing to B was drawn.[37]

3.3. Descriptive statistics of IACN and IDCN

The CSR schemes network is not homogeneous. To capture its heterogeneity, we analyzed the network according to a taxonomy we developed for this purpose.[38] Our taxonomy distinguishes between the schemes based on four criteria, as follows.

3.3.1. General versus specific

General schemes apply to firms across multiple industrial sectors. GRI, UNGC, CDP, Women's Empowerment Principles (WEP), and Eco-Management and Environment Scheme (EMAS) are general schemes because their objectives and evaluation criteria (e.g. on sustainability reporting, gender equality, environmental management) are not sector specific. Although EMAS focuses on environmental management and therefore may be considered to be less general than UNGC (which seeks to establish general sustainability principles that apply to all aspects of corporate behavior), we considered it to be general because it applies to a range of industries. *Specific schemes* apply to individual sectors such as banking, fishery, and forests. Responsible Care and EMAS are designated differently as the former applies only to the chemical industry. Examples of specific schemes are the World Diamond Council [WDC], UTZ, and Responsible Care.

3.3.2. Stringency of the compliance regime

This criterion distinguishes between the schemes based on the stringency of their compliance regime. We divided the schemes into three classes:

1. *Soft*: schemes that have no compliance mechanisms and rely on self-reporting or declaration of commitment (e.g. UNGC, WEP).
2. *Intermediate:* schemes that offer various compliance options to firms, including verification by third parties, but leave the final decision as to which option to choose to the firm (e.g. GRI, Responsible Care).
3. *Strict:* schemes that have compliance mechanisms with third-party assurance. These mechanisms are integral to the program and non-negotiable. The key element is the presence of an enforcement process that is *external* to the certified firm (e.g. SA8000, FSC).

Note that the stringency of a CSR scheme can be measured along two dimensions, focusing either on the compliance structure or on the substantive content of its norms. The latter may be analyzed by considering the prescriptiveness of the scheme requirements, its scope (how many issues are covered), and the exigence of the requirements within the domain of each issue (Judge-Lord *et al.* 2018). But because our sample consists of CSR schemes in various issue domains, it was not possible to empirically analyze the comparative stringency of the CSR standards in the sample from a substantive perspective.[39] Nevertheless, we do not disregard the substantive dimension, but rather study it indirectly. Our hypothesis is that if the substantive norms of the CSR schemes in our sample had not imposed significant requirements on participating firms, multiple certification would not have led to a separating equilibrium, as both "brown" and "green" firms could have subscribed to multiple schemes at negligible cost.

3.3.3. Governance

For this criterion, we have generally adopted the methodology developed by Abbott and Snidal (2010), which distinguishes between organizations based on the entities governing them. These entities are categorized into three

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types: civic society, industry, and states, producing seven possible categories: schemes governed by only one type of the governing body (states, firms, or non-governmental organizations [NGOs]), by two (states-firms, NGOs-firms, or states-NGOs), or by all three.

3.3.4. Industry sector

We distinguished between the following sectors, relying on the Industry Classification Benchmark (ICB) scheme:[40] agriculture, chemicals, financial services, textile, mining and metals, forestry, marine, tourism and leisure, utilities, toys, and electronics.

Analysis of the schemes based on these classifications produced the following results.[41] First, we found that there were more specific (40) than general (21) schemes (out of total of 61 schemes).[42] We expected specific schemes to adopt a more stringent compliance framework than general ones, but a chi square test[43] did not reject the null hypothesis that the stringency of the compliance system is independent of the scheme type. This result may be explained by the fact that our sample size was not large enough or by evolutionary changes in the institutional structure of general schemes. A second intriguing finding concerns the distribution of the stringency levels: we found that there were more strict (36) than soft (15) or intermediate (9) schemes (with 1 inapplicable, UNEP).[44] Third, we analyzed the governance structures of the schemes and found that the governance bodies of the CSR organizations were dominated by civil society and industry sectors, which were represented in the governance of 41 and 51 schemes, respectively, with the state assuming a secondary role (participating in the governance of 16 schemes).[45]

4. Results: the Structure of the CSR network

To expose the topological structure of the CSR regimes network, we analyzed it first as an affiliation or bipartite network (Borgatti & Everett 1997; Beckfield 2010; Huang *et al.* 2011). The affiliation CSR network contains 49 regimes as one set of nodes (Appendix A), and 31,987 firms as another. All the data refer to membership or certification as of 31 December 2014. Our analysis focused on the induced graph, depicting the relations between the CSR schemes (*the IACN mapping*). Each node in the IACN represents a CSR scheme. Two nodes are connected by an edge if a firm exists that is a member of both schemes or holds a certificate from both. We first analyzed the unweighted graph of the induced CSR schemes network (IACN), in which we disregarded the number of firms that two schemes have in common. We then relaxed this assumption and considered weights as well.[46]

Figure 1 shows the unweighted graph of the IACN together with its centrality properties. The network consists of $|V| = 49$ vertices and $|E| = 362$ edges. Table 1 describes the distribution of firms with multiple certifications.

The network was found to be rather cohesive, as suggested by the following measures: *average distance* (1.723), *diameter* (3), *density* (0.308), and *average clustering coefficient* (0.715). Excluding the Pro Terra (PT) code, all of the schemes are connected. This result is surprising because the network has evolved outside the domains of either state law or international treaty law, without formal hierarchical control. To place our findings in perspective, we compared them with the findings of two recent studies that analyzed the network of multilateral environmental treaties (MET) (Kim 2013–2014) and public international organizations (PIO) (Beckfield 2010). While the MET and PIO are different from the CSR network in the sense that they focus on states, treaties, and treaty-related organizations, they share a common structure when considered at a higher level of abstraction. Like the CSR network, the MET and PIO networks have a multiplexed structure, which consists of several layers of interactions that include legal texts, governing institutions, and affiliated entities. Each of these studies analyzed a different layer of the multiplexed network. For the MET network, which consists of 747 multilateral environmental agreements connected by cross-references, Kim (2013–2014) reported an average path length of 4.70 and a diameter of 12 (for 2002). For the bipartite PIO network, consisting of international organizations and states, Beckfield (2010) reported an average path length of 2.678 and a density of 0.528 (for 2000). Despite the fact that the MET and PIO networks have a longer history (their origins go back to the early 20th century) they display a level of cohesiveness that is quite similar to that of the induced CSR schemes network.

We used several measures of centrality to analyze the relative importance of the different schemes (degree, betweenness centrality, Dangalchev closeness centrality, and eigencentrality). Integrating the results across

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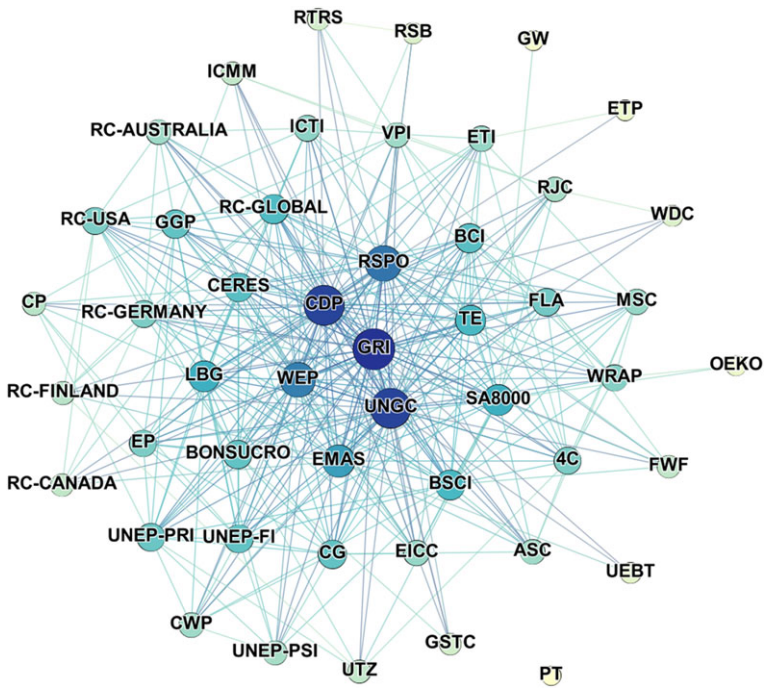


Figure 1 The induced (affiliation) corporate social responsibility (CSR) scheme network (IACN). Central nodes with large degrees are denoted by dark filled circles. Peripheral nodes with a small degree are light colored. Note the single unconnected node of PT at the bottom. All figures were created using the Gephi software package and Fruchterman Reingold algorithm (Bastian et al. 2009).

Table 1 Distribution of firms with multiple certifications

Number of connections	Number of firms
2	2,153
3	477
4	122
5	59
6	26
7	12
8	3
9	2

measures reveals the following schemes to be most central: GRI, UNGC, CDP, RSPO, WEP, and SA8000. Table 2 includes a summary of our analytical results for the IACN. [47]

Figure 2 graphically depicts the IACN, where each edge is weighted as follows: for any two CSR schemes, i, j, with l_i, l_j members, respectively, and w_{ij} common firms, the weight is $w_{ij}/\sqrt{l_i l_j}$. We found that the strength of the weight reflects two phenomena. First, it reflects the tendency of firms in a specific sector to join several schemes that operate in that sector. For example, UNEP-FI and UNEP-PSI (financial sector) have the largest weighted edge (0.316), although the nominal number of firms they share is relatively small (30). Similar links exist in the fishery (Aquaculture Stewardship Council [ASC]-Marine Stewardship Council [MSC]), extractive and mining (International Council on Mining and Metals [ICMM]-Voluntary Principles Initiative [VPI]), and diamond and jewelry (Responsible Jewellery Council [RJC]-WDC) sectors. Second, the links between the largest general schemes, CDP-GRI, GRI-UNGC, and CDP-UNGC, were also comparatively strong. This may reflect a social expectation for a firm committed to CSR values to be linked to these central schemes.[48]

We wanted to check whether the topological structure produced by the bipartite analysis is consistent with the mapping of the direct institutional links between the CSR schemes produced by *the institutionally derived* or

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Table 2 Summary of network statistics (IDCN and IACN)

Measure	IACN			IDCN (WCC)	
Nodes	49			46	
Edges	362			84	
Diameter	3			6	
Average distance	1.723 (0.538)			2.749 (0.983)	
Density	0.308			0.081	
Centralization	0.635			0.310	
	Average	Leading schemes		Average	Leading schemes	
Degree	14.776	GRI	44	3.652	ISEAL	17
	(10.241)	CDP	41	(3.591)	UNGC	15
		UNGC	41		GRI	11
		RSPO	33		ISO	9
		WEP	31		UNEP + UNEP Financial Codes	8
Dangalchev closeness centrality	14.949 (3.538)	GRI	22.75	8.274	UNGC	13.688
		CDP	22	(2.378)	ISEAL	13.313
		UNGC	22		GRI	12.688
		RSPO	20		SA8000	12
		WEP	19.5		ISO	11.688
Betweenness centrality (normalized)	0.015 (0.032)	GRI	0.149	0.040	UNGC	0.339
		CDP	0.127	(0.081)	ISEAL	0.321
		UNGC	0.104		GRI	0.223
		SA8000	0.079		RC-GLOBAL	0.214
		RSPO	0.053		ISO	0.163
Eigenvector centrality	0.020 (0.011)	GRI	0.047	0.022	UNGC	0.076
		UNGC	0.045(4)	(0.018)	ISEAL	0.070
		CDP	0.045(2)		SA8000	0.057
		RSPO	0.040		GRI	0.056(8)
		WEP	0.039		CERES	0.046
Clustering coefficient (normalized)	0.715 (0.235)			0.187 (0.303)		

Numbers in parentheses are standard deviations of the averages. All measures in the institutionally derived codes network (IDCN) refer to the weakly connected component (WCC). The largest values associated with the measures (excluding the clustering coefficient), together with the five corresponding schemes, are given in the leading schemes columns. IACN, induced (affiliation) corporate social responsibility (CSR) scheme network.

IDCN mapping. As noted above, we distinguished between five types of institutional connections: governance, partnership, compliance cooperation, membership, and support. The institutional links are directed, except partnership, which is symmetrical. This generated a directed and unconnected graph with 61 nodes ($|V| = 61$) and 116 edges ($|E| = 116$). In our analysis, however, we considered all edges as bidirectional, because the direction of the edges has little relevance to our analysis of network dynamics (e.g. diffusion of ideas and norms). We focused on the largest weakly connected component, which consists of 46 organizations. The IDCN had similar structural attributes to the IACN, revealing a significant level of cohesiveness (Table 2). We also found an overlap in the identity of the dominant schemes, which included GRI*, ISEAL, UNGC*, ISO, SA8000*, and UNEP as the most central, with CDP*, CERES, and RC-GLOBAL somewhat lagging behind (overlapping schemes are marked by *). Consistent with the central position of several organizations, we also found relatively high centralization scores, especially for the IACN (0.635, IDCN = 0.310). Again, this result was unexpected, given the lack of formal hierarchical control.

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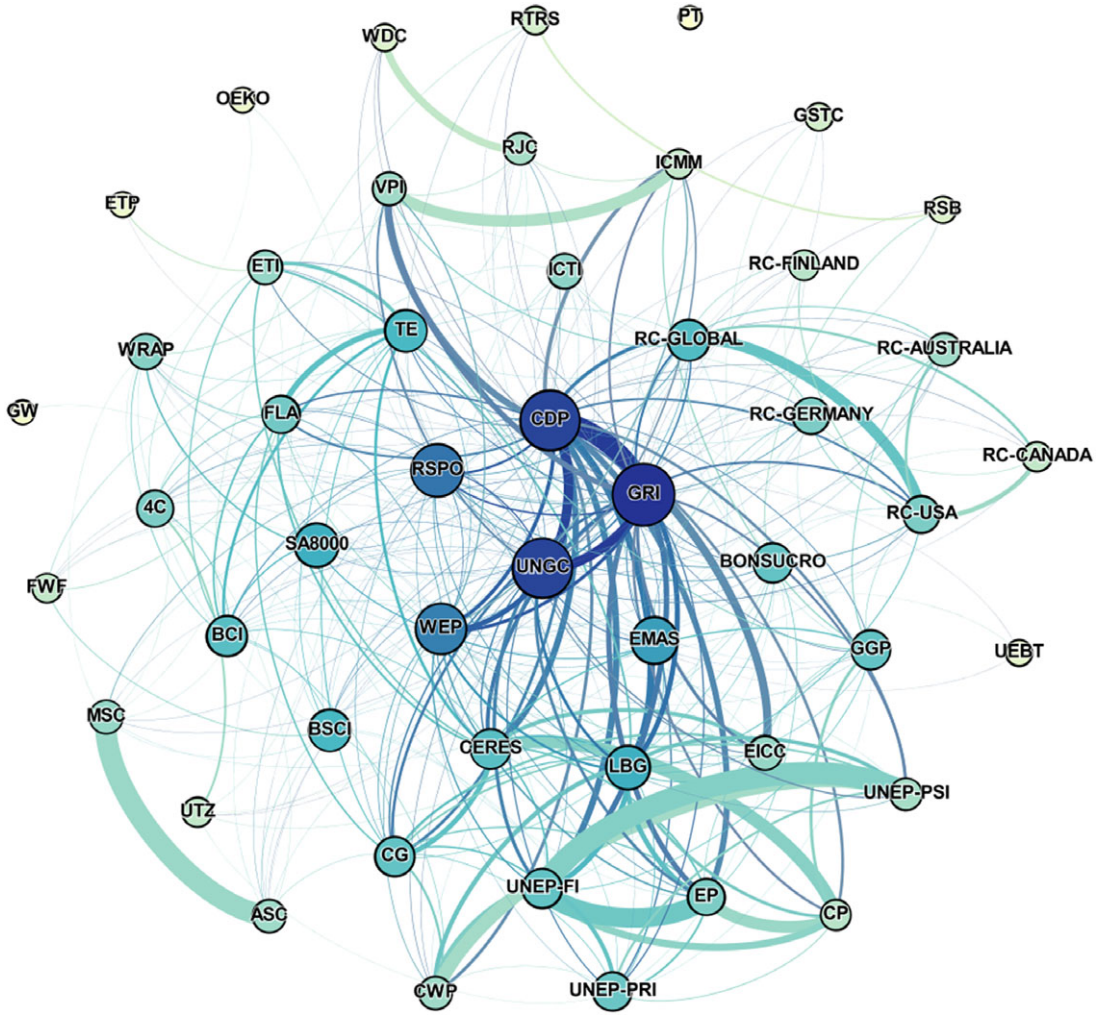


Figure 2 The induced (affiliation) corporate social responsibility (CSR) scheme network (IACN) with normalized weights. Dark-colored circles together with their edges are associated with a larger degree. Thick edges represent larger weights.

Figure 3 provides a visual representation of the IDCN.[49] Table 2 summarizes our results regarding the topological structure of the induced CSR network, comparing the IACN and IDCN mappings. The leading schemes in Table 2 are analyzed with respect to the three measures of centrality.

5. Greenwashing or honest signaling? Analysis of the networked signaling hypothesis

The networked signaling model presented above conceptualizes multiple certifications as a form of costly signaling (socio-legal handicaps) that exploits the networked structure of the domain of CSR schemes. It also explains how this mode of networked signaling can produce a separating equilibrium, which distinguishes between high/low sustainability performers. We hypothesized that firms with multiple certifications display stronger CSR performance than their peers with fewer certifications. According to the networked signaling model, the number of certifications should correlate positively with CSR performance. To test this hypothesis, we compared our data on multiple certifications with data on global CSR rankings, obtained from Dow Jones Sustainability Indices and FTSE4Good, which are widely considered to be credible proxies for good CSR performance (Wu & Shen 2013, p. 3,531; Lourenço *et al.* 2014; Montiel & Delgado-Ceballos 2014). Most of the empirical literature on corporate sustainability has similarly used external organizations, such as the Dow Jones Sustainability Index (DJSI), FTSE4Good, Kinder, Lydenberg, Domini Research & Analytics indices, and others to measure the level of sustainability achieved by different companies (Montiel & Delgado-Ceballos 2014, p. 127; Antolín-López *et al.* 2016, p. 9). A recent survey of

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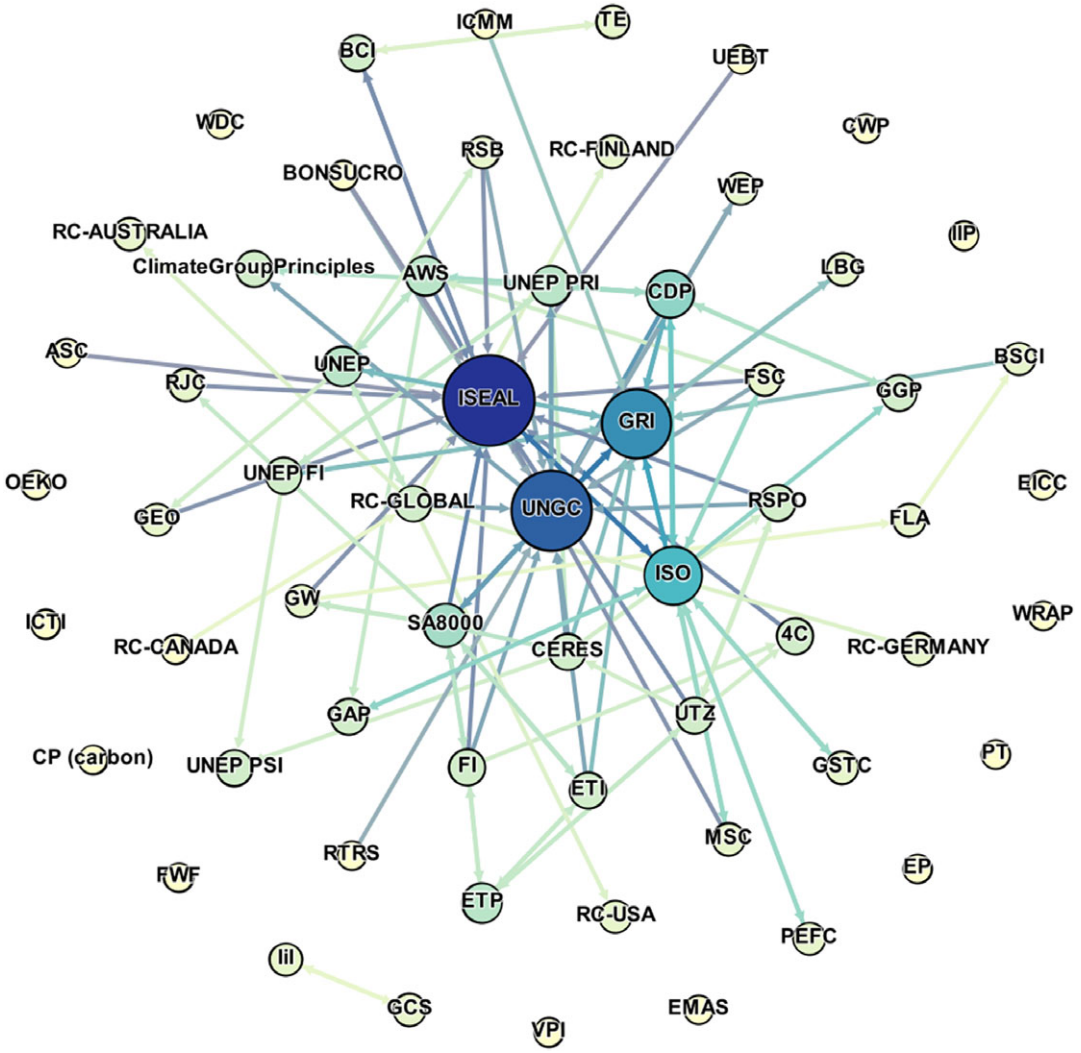


Figure 3 The institutionally derived codes network (IDCN). Large and dark circles correspond to nodes with large incoming degree. The brightness of the edges is proportional to incoming and outgoing degree of the node.

CSR experts found DJSI and FTSE4Good to be among the four most credible global sustainability ratings, out of a total of 18 (GlobeScan/SustainAbility 2013).

We obtained two datasets from both DJSI and FTSE4Good: one that includes the universe of firms from which the sustainability indices were constructed; and another that includes ultimate constituents of the indices, which are a subset of the total universe. DJSI and FTSE4Good Indices are designed to measure the performance of companies demonstrating strong environmental, social, and governance (ESG) practices. They have a dual goal: to provide a tool for the creation of index-tracking investments, financial instruments, and fund products focused on responsible investment; and, more important for our study, to help identify the leading environmentally and socially responsible companies.[50]

The DJSI and FTSE indices focus on positive criteria for selecting companies,[51] but have developed different selection approaches. DJSI selects the companies in its various indices based on a *best-in-class* approach, which picks out the best performers in each industrial subsector. Each DJSI benchmark index has a different target number. For example, the Dow Jones Sustainability World Index (DJSI World) includes the top 10 percent of the leading sustainability companies out of the largest 2,500 companies in the S&P Global Broad Market Index, whereas DJSI Europe includes the top 20 percent of companies among the 600 largest developed European companies listed in the S&P Global Broad Market Index. Since the launch of DJSI World in 1999, other indices have been added to the series.[52] Unlike the DJSI series, the FTSE4Good series is based on a principle of eligibility

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(an absolute threshold approach), so that "[a]ll companies in each constituent Universe index that pass the eligibility criteria detailed in the FTSE4Good Index Inclusion Rules at the review date are included in the relevant FTSE4Good Benchmark Index."[53]

Both indices employ a complex array of criteria to decide which firm to include in their sustainability indices (Slager & Chapple 2015, p. 406; FTSE4Good 2016b; RobecoSAM 2016a). The FTSE4Good rating is based on 300 individual indicators distributed across three pillars (environmental, social, governance) and 14 themes (FTSE-Russell 2018). The DJSI ranking is similarly based on three pillars (economic, environmental, social), which are comprised of multiple questions (S&P-Dow-Jones-Indices & ROBECO-SAM 2016).[54] The selection of firms to the DJSI and FTSE sustainability indices is based on multiple criteria and it is therefore not determined by a single proxy, such as their certification by certain CSR programs or membership in them.

DJSI and FTSE4Good rely on a variety of sources in their ranking process. DJSI uses detailed questionnaires developed by RobecoSam, which are tailored to each industrial sector.[55] In addition to the data collected through questionnaires, RobecoSam also relies on:

> *[O]ngoing monitoring of media and stakeholder commentaries and other publicly available information from consumer organizations, NGOs, governments or international organizations to identify companies' involvement and response to environmental, economic and social crisis situations that may have a damaging effect on their reputation and core business. (S&P-Dow-Jones-Indices & ROBECO-SAM 2016, p. 16)*

For many questions, companies receive the maximum score only if they have provided adequate supporting material (RobecoSAM 2016b, p. 8). FTSE4Good uses only publicly available data in assessing ESG practice and does not accept information provided privately by companies (FTSE4Good 2017, p. 4). DJSI relies on the expertise of a leading global environmental research agency, the SAM Group; FTSE has recently ended its long-term relationship with the British-based agency, Eiris, and has started to perform ESG assessment in-house.

In the case of DJSI, our sample includes data about the constituents of the following six indices: DJSI World, DJSI North America, DJSI Europe, DJSI Korea, DJSI Australia, and DJSI Asia-Pacific;[56] in the case of FTSE4Good, we received data on the constituents of FTSE4Good Global (FTSE All World Developed Indices Constituent Data). For both, the data were for 31 December 2014.

We used the data to test three complementary hypotheses, which jointly examine the networked signaling model and the existence of a separating equilibrium. Our first hypothesis states:

> ***Hypothesis 1:*** *Firms selected (denoted by s) as constituents of either the DJSI or the FTSE4Good sustainability indices are more likely to be part of the CSR scheme network (denoted by* NW*), that is, to be certified by at least one code, than firms that were not selected from the universe of candidate firms (denoted by* $\sim s$*).*

Mathematically, H1 can be formulated as follows:

$$\frac{|s \cap NW|}{|s|} > \frac{|\sim s \cap NW|}{|\sim s|}. \tag{1}$$

Equation (1) implies that:

$$\Pr(NW|s) > \Pr(NW|\sim s). \tag{2}$$

We found that Equation (2) holds for both DJSI and FTSE4GOOD (Table 3, rightmost column), which supports our first hypothesis.

To verify that inclusion in the indices is uniquely related to the network and not driven by a correlation with another variable, we conducted additional analysis to check whether our hypothesis also holds across several categories of attributes of the firms. We focused on three categories: industrial sector (measured according to the categories used by the FTSE and the DJSI), country, and market capitalization. To this end, we considered the

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Table 3 Likelihood that firms are part of the affiliation network

	$\|s\|$	$\|\sim s\|$	$\|s \cap NW\|$	$\|\sim s \cap NW\|$	$\Pr(NW\mid s)$	$\Pr(NW\mid\sim s)$	$\frac{\Pr(NW\mid s)}{\Pr(NW\mid\sim s)}$
DJSI	505	2,393	486	1,004	0.96	0.43	2.29
FTSE	760	1,327	585	652	0.77	0.49	1.57

DJSI, Dow Jones Sustainability Index.

reduced probabilities $\Pr(NW\mid \sim s \cap *_\alpha)$, $\Pr(NW\mid s \cap *_\alpha)$, $\alpha = 1, 2, \ldots n_*$, where * stands for any of the foregoing categories, and n_* is the number of constituents in category *. We argue that if:

$$\Pr(NW|s\cap *_\alpha) > \Pr(NW|\sim s\cap *_\alpha) \tag{3}$$

is satisfied for every * and α, the correlation between certification and inclusion is unique. In general, we found that Equation 3 is satisfied for each of the categories we tested, rejecting the alternative hypothesis that our results were driven by these three attributes.[57]

To complement our first hypothesis, we considered the relation between the number of certifications a firm has and the likelihood of its inclusion in the indices. We hypothesized that:

> ***Hypothesis 2:*** *A firm that is certified by multiple schemes is more likely to be included in the indices than one with fewer certifications, that is, as the number of certifications grows, so does the probability of a firm being included.*

To avoid the fluctuations caused by a relatively low number of firms with more than four certifications, we pooled these firms together. As shown in Table 4, after pooling, the probabilities increase *monotonically* with the number of certifications (n_s). We also tested H2 without pooling the firms with $n_s \geq 5$ and received similar results.[58]

To rule out the possibility that the effect of increased probability for inclusion in the indices is a result of correlation with another variable (in particular, the firm's market capitalization and its industrial sector), we also performed a logistic regression where the predictors were the number of certifications, n_s, and the response was a binary vector assigned a value of 1 if a firm is included and 0 if not. We then considered industry and market capitalization as additional dummy variables.[59] As can be seen from the results, inclusion in the indices is positively correlated with n_s. Furthermore, adding the dummy variables did not affect the significance and monotonicity of the coefficients. This suggests that the monotone increase in the probability of a firm being included is positively correlated with its number of certifications, even when controlling for the effect of its industrial sector or its market capitalization.

It could be argued that firms' inclusion in FTSE4Good and DJSI is related to the stringency of the CSR schemes and not to the number of certifications, as postulated by H2. According to this argument, firms certified by stringent schemes are more likely to be included in the indices than firms that are affiliated with less stringent ones. We distinguished between three types of CSR stringency levels: strict, intermediate, and soft (26, 8, 15 codes, respectively). Table 5 (top) summarizes the distribution of firms with respect to the stringency level of the

Table 4 Probability of inclusion in the indices as a function of the number of certifications (n_s)

n_s	DJSI			FTSE		
	$\|s \cap n_s\|$	$\|\sim s \cap n_s\|$	$Pr(s\|n_s)$	$\|s \cap n_s\|$	$\|\sim s \cap n_s\|$	$Pr(s\|n_s)$
1	112	563	0.17	199	334	0.37
2	153	266	0.37	152	184	0.45
3	121	122	0.50	125	97	0.56
4	41	34	0.55	47	22	0.68
5–9	59	19	0.76	62	15	0.81

Firms with $n_s \geq 5$ are pooled. DJSI, Dow Jones Sustainability Index.

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Table 5 Inclusion versus stringency and certification in general

	DJSI		FTSE	
	Included	Not included	Included	Not included
Strict	81	124	90	94
Soft	405	880	495	558
χ^2	0.023		0.633	
Soft	405	880	585	652
Not certified	19	1,389	175	675
χ^2	3E−102		4E−33	

DJSI, Dow Jones Sustainability Index.

schemes they are associated with. For the purpose of the analysis, we distinguished first between firms that are certified only by soft schemes (which include intermediate and soft)[60] and firms with no certification. We performed an χ^2 test to check the null hypothesis of independence between firm's inclusion in the indices and its certification by soft schemes. As is evident in Table 5 (bottom), the null hypothesis for this analysis is strongly rejected for both indices. Firms certified exclusively by soft schemes have a significantly higher probability of inclusion compared to firms that are not affiliated with any standard. We complemented this analysis by comparing between firms that are certified by at least one strict CSR scheme and firms that are certified exclusively by soft schemes. We considered (via χ^2 test) the null hypothesis of independence between firm's inclusion in the indices and its affiliation with at least one strict scheme. According to this analysis, in FTSE there is no indication that certification by at least one strict scheme has any effect on the probability of inclusion compared to certification by soft schemes only. For DJSI, the null hypothesis is rejected. Firms affiliated with at least one strict scheme are more likely to be included than firms only certified by soft schemes.

We further examined the identity of the firms at the tail of the distribution, namely, firms with 7–9 certifications (Table 6). According to the networked signaling hypothesis, these firms should exhibit strong CSR performance. Indeed, most of them were included in either the DJSI or the FTSE4GOOD (14 out of 17, 82 percent), and a somewhat smaller group in both indices (11 out of 17, 65 percent). Note that out of these 17 firms, eight belong to the financial sector and are members of one of the financial CSR schemes sponsored by UNEP, UNEP-FI, or UNEP-PSI. We suggest two complementary explanations for this finding. First, the large financial firms at

Table 6 Firms with 7–9 certifications

Firm	Degree	DJSI	FTSE	UNEP-FI or UNEP-PSI membership
1 3 M	7	1	0	0
2 Anglo American	7	1	1	0
3 Arkema†	7	0	0	0
4 BASF	7	1	1	0
5 BNP Paribas	7	1	1	1
6 British Petroleum (BP)	7	0	0	0
7 Credit Suisse	7	1	1	1
8 Evonik Industries	7	0	1	0
9 Kao	7	1	1	0
10 Nestle	7	1	1	0
11 Royal Bank of Scotland	7	1	1	1
12 RSA Insurance	7	0	1	1
13 Aviva	8	1	1	1
14 HSBC Holdings	8	0	1	1
15 Nike	8	1	1	0
16 Bank of America	9	1	1	1
17 Swiss Re	9	1	1	1

DJSI, Dow Jones Sustainability Index; FI, Finance Initiative; PSI, Principles for Sustainable Insurance.

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the top of the certification list have wide public exposure and therefore may value their reputation more than comparable firms in other sectors (Wu & Shen 2013). Second, the cost of certification may be lower for these conglomerates than for comparable firms in other sectors.

Finally, we examined the linkage between the eigenvector centrality of a firm and the probability of it being included. We hypothesized that:

Hypothesis 3: *There is a positive correlation between the eigenvector centrality of a firm and its probability of being included.*

Eigenvector centrality (or eigencentrality) provides a more refined notion of centrality than degree because it takes into account the importance of the nodes to which a node is linked. Unlike degree centrality, which simply measures the local connectivity of node *i*,eigencentrality x_i provides a measure of the global importance of a node in view of the total connectivity of the network. Thus, eigencentrality serves as a better indication of the role played by a node in the diffusion of information across the entire network. Firms with high eigencentrality act as information hubs, relaying information created in other nodes to the rest of the network. Our hypothesis was driven by the idea that high eigencentrality extends the public exposure of firms (because it implies that they are connected to other nodes with high eigencentrality). It therefore also increases the costs of infringement and provides firms with a higher eigencentrality (compared to firms with the same number and type of certifications) a stronger incentive to comply with the requirements of CSR standards or potentially to go beyond them.[61]

Eigencentrality can be calculated by making x_i proportional to the average of the eigencentralities of the nodes neighboring node *i*. It can be formulated as:

$$x_i = \frac{1}{\lambda} \sum_{j=1}^{n} A_{ij} x_j, \tag{4}$$

where A_{ij} is the adjacency matrix (i.e. $A_{ij} = 1$ if nodes i and j are connected, and $A_{ij} = 0$ otherwise), and λ is a constant. For most values of λ, the only solution to Equation (4) is that all x_i values are zero. But for specific values of λ, these equations also admit non-zero solutions. Such values of λ are eigenvalues of the network, and the corresponding lists of solutions, $x = (x_1, x_2, x_3, \ldots, x_n)$, are called eigenvectors.

The eigenvector centrality of a node i is determined by the value of x_i in the eigenvector corresponding to the largest eigenvalue (largest value of λ for which there are non-zero solutions). The Perron–Frobenius theorem mathematically guarantees that a maximal value of λ exists, for which there is a unique eigenvector (if the graph is connected), and that all of the corresponding values of x_i are positive and non-zero. Because there is a strong correlation between the degree of a node and its importance based on the eigenvector centrality measure, which becomes more pronounced as the number of certifications increases, we controlled for the degree to be able to measure the additional effect of eigenvector centrality on the probability of each node being included.

To test this, we measured eigenvector centrality values for all firms and schemes in the bipartite network. We then performed a logistic regression, where the predictors are the eigencentralities (normalized by maximal value) of firms that are also included in an index, and where the number of certifications, $n_s = 1, 2, 3, 4$ and > 4, is fixed. The response is a binary vector that assumes the values 0 or 1 for firms excluded from or included in the index, respectively. Results for both indices are summarized in Table 7 (top, original). We found that it is more likely

Table 7 Eigenvector centrality and signaling

n_s	DJSI			FTSE		
	Coefficient	SE	p value	Coefficient	SE	p value
1	−1.22337	0.579031	0.034618	−0.31202	0.441213	0.479453
2	0.964174	0.233935	3.76E−05	0.474461	0.245178	0.052969
3	1.13039	0.192463	4.27E−09	0.88933	0.197982	7.06E−06
4	1.495633	0.300365	6.38E−07	1.354748	0.332581	4.63E−05
5–9	2.437975	0.316972	1.45E−14	2.148093	0.359651	2.33E−09

DJSI, Dow Jones Sustainability Index; SE, standard error.

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that a firm with a large eigenvector centrality is included than excluded, and the likelihood increases as n_s increase ($n_s \geq 2$). The effect is significant for both indices.[62]

To reject the possibility that the effect is a result of correlation with the market capitalization of the firm, we performed another regression where the latter served as an additional predictor.[63] Again, as in the case of H2, our analysis confirms that the influence of eigencentrality on the probability of a firm being included does not change when the market capitalization of the firm is also considered.

5.1. Limitations

The study has several limitations. The first has to do with the fundamental features of network analysis. The network-based approach provides a method to uncover the underlying architecture of the CSR system by reducing it to an abstract structure of connection patterns (Kim 2013–2014, p. 980). But although this type of analysis allows us to expose large-scale linking patterns, it cannot capture processes that take place at the micro-level within firms or CSR organizations. Our network-driven analysis should therefore be supplemented by studies that examine institutional micro-processes in light of the network perspective we propose.

A second limitation concerns the need for analysis that considers longer time ranges. Our research is based on data focusing on a single-year membership or certification. To achieve a better understanding of the structural evolution of the CSR network and of the signaling behavior of firms, it would be necessary to perform a dynamic analysis that uses longitudinal data. Such analysis can utilize, for example, longitudinal data of firm membership or certification, together with historical data on sustainability performance (e.g. obtained from DJSI and FTSE). This would make it possible to examine whether an increase in the number of memberships or certifications is associated with improved performance. Private bodies hold data on membership and certification and some are not willing to share data with researchers. As a result, we were unable to develop a sufficiently large historical dataset, which would have allowed us to conduct a more extensive dynamic analysis. By contrast, in the field of international relations there has been a concerted effort, going back to the 1980s, to develop datasets focusing on inter-state militarized conflicts, international crisis behavior, treaty membership, and more (for a detailed description, see Maoz 2010, pp. 16–17). Our work is pioneering in its attempt to develop a similar dataset in the field of CSR regulation.

6. Discussion and policy implications

We argued in the introduction that the authority of CSR schemes should be viewed as an *emergent, network-based property*, that is dependent on the evolvement of a multiplexed (ensemble) structure of closely connected CSR schemes. The topological analysis provides preliminary support for that argument, by showing that both the IDCN and the IACN exhibit a high level of correlated cohesiveness. In a companion paper, Perez and Stegmann (2018) study the layer of cross-citations between the standards associated with the IDCN and find that this layer forms a well-connected network.[64] The multiplexed cross-supportive and cross-validating interactions between the CSR schemes have, we argue, a synergistic effect that enhances the network's regulatory power (both in general and at the level of individual schemes). However, more studies are needed to elucidate how the different layers are linked and how this inter-layer connectivity is theoretically and empirically related to the evolution of global governance structures. There is an emerging literature in physics and ecology that has studied multiplexed networks and has developed various quantitative tools that can be used in future studies (Hu *et al.* 2011; Pilosof *et al.* 2017). We believe that the networked governance paradigm can be usefully extended to other areas of transnational law. For example, the Ebola crisis of 2014–2015 exposed the crucial role of NGOs in fighting the spread of the disease, together with the World Health Organization. NGOs such as Médecins Sans Frontières, Partners in Health, and Samaritan's Purse were central in providing medical assistance on the ground and in sounding a global alert (Gostin & Friedman 2015, p. 1905). Network analysis can expose the structure and dynamics of the field of global health governance (Gostin & Katz 2016).

Our findings also suggest that in evaluating the contribution of certain CSR standards to global governance processes one should examine not only their intrinsic properties but also their network-related attributes. Integrating the results of the four measures of centrality we used (degree, closeness, betweenness, and eigenvector

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centralities) in the context of the IACN and IDCN mappings highlighted the central position of several organizations: GRI, UNGC, CDP, RSPO, WEP, SA8000, ISEAL, ISO, UNEP, CERES, and RC-GLOBAL. This finding suggests that these bodies play a coordinating role in the network, consistent with the arguments of Ruggie (2001) and Abbott and Snidal (2010). The central position of these schemes can be attributed to the service they provide to the network as a whole: some of them produce general norms (GRI, UNGC, CERES); others produce norms in a certain field (gender equality, labor rights, carbon accounting), albeit with a cross-sectorial influence (WEP, SA8000, CDP); or provide umbrella institutional services (ISEAL, ISO, and UNEP). These findings suggest that the criticism leveled against some CSR organizations, such as the GC and WEP (Bexell 2012; Berliner & Prakash 2015), may have missed their synergistic contribution to the network dynamics.

We argued that firms use *multiple certifications* to signal their commitment to CSR values. Multiple certifications function as handicaps with differential cost structure (Zahavi & Zahavi 1999). Our findings provide support for the existence of a separating equilibrium by showing that firms with multiple certifications display stronger CSR performance (as reflected in the DJSI and FTSE4GOOD rankings) than do their peers with fewer certifications. This finding fills a significant lacuna in the literature on signaling and CSR (Zerbini 2015, p. 11). The idea that firms may use certification as a credible signaling device has been noted before (Connelly *et al.* 2011, p. 45; Kayser *et al.* 2014; Zerbini 2015, p. 6), but these studies focused on single certifications and ignored the network aspect (which allows firms to produce an enhanced signal by combining certifications). We have also shown that stronger CSR performance correlates positively with higher eigencentrality values, even when the degree of the firms is kept fixed. This suggests that the position of a firm within the network may play a role, in addition to its number of certifications, in predicting CSR performance. More work is needed in order to fully corroborate our thesis, both by drawing on other more refined sustainability measures[65] and by considering longer time horizons.

The present article weighs in on the ongoing debate between those who claim that CSR instruments constitute greenwash with no behavioral effects (Berliner & Prakash 2015, p. 116; Zerbini 2015, pp. 14–15) and those who see them as a new form of global regulatory authority (Pattberg & Widerberg 2015, p. 689; Heilmayr & Lambin 2016). By demonstrating a positive correlation between certification by multiple CSR schemes and sustainability performance, our analysis shows that certification or membership in CSR schemes is not just cheap talk. The finding that multiple certifications constitute a robust proxy for strong sustainability performance suggests that regulators should integrate CSR schemes in their regulatory strategy, for example, by encouraging firms to seek certification by several CSR schemes. Our study has not considered, however, the overall effect of the CSR network as a whole on sustainability. More research needs to be conducted to clarify the optimal mixture of public and private instruments and to what extent public bodies should seek to intervene in the design and implementation of CSR norms.

Acknowledgements

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Notes

1 "Credibility" reflects the extent to which the membership or certification of a firm in a CSR scheme provides a trustworthy indication of the firm's sustainability performance. For a similar view, see Ven (2015).

2 In the literature on international relations, the use of social network analysis has been more prevalent, although its effect has only started to be felt in the past 10 years (Hafner-Burton & Kahler 2009; Maoz 2010; Kim 2013–2014).

3 For further exploration of this thesis, see Perez & Stegmann (2018).

4 See also studies by Aravind and Christmann (2015), Graafland and Smid (2016), and Boiral *et al.* (2017), which examine the greenwash question but similarly focus on single CSR programs.

5 Formally, a multiplex or multilayer network can be defined as a quadruple M = (*A*, *L*, *V*, *E*), where *A* is a set of actors (or nodes), *L* is set of layers, (*V, E*) is a graph and $V \subseteq A$ x *L* (Dickison *et al.* 2016, p. 18).

6 Global Compact signatories are required to produce an annual "Communication on Progress" (COP), which is considered a key component of their commitment (www.unglobalcompact.org/participation/report) [Last accessed 7 November

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2018.]; Article 10 of the 2013 Equator Principles sets out detailed reporting obligations for members (http://equator-principles.com/members-reporting/) [Last accessed 7 November 2018.]; performance monitoring and reporting is also considered a pillar of the Responsible Care program (https://responsiblecare.americanchemistry.com/Performance-Management/) [Last accessed 7 November 2018.].

7 The puzzle in the job market context arises because of the assumption that the investment, for example, in an MBA degree, has no productive or intrinsic value (Kübler *et al.* 2008, p. 220).

8 The organizational costs include the costs of establishing the organizational procedures needed to create a façade of implementation without changing the organization's behavior in practice; reputational costs include both external costs associated, for example, with consumers' reactions to brand damage, and indirect costs associated, for example, with employee reaction to the deceit (Greyser 2009; De Roeck *et al.* 2016).

9 The cost of implementing a CSR standard includes both "entry costs" – the initial costs that a firm has to bear in order to join the "club" – and "maintenance costs" – required to continuously meet the standard's requirements.

10 The linkage between CSR and sustainability is deep and well recognized in the literature (Lacy *et al.* 2010; Kudłak & Low 2015; Pistoni *et al.* 2016).

11 To validate our findings, we sent our preliminary list to several international experts on CSR who commented and pointed out additional codes. The experts we consulted include Kenneth Abbott, Stepan Wood, and Benjamin Richardson. We thank them for their assistance.

12 An example is Worker Rights Consortium, which focuses on universities and their relationship with textile factories; see, http://www.workersrights.org/. [Last accessed 7 November 2018.]

13 For example, the Kimberley Process Certification Scheme, Organisation for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises (2011), and the Extractive Industries Transparency Initiative (EITI).

14 See https://www.unglobalcompact.org/participation/join/commitment. [Last accessed 7 November 2018.]

15 See https://www.unglobalcompact.org/participation/report. [Last accessed 7 November 2018.]

16 "Certification lasts for three years, with a series of required surveillance audits throughout the three year period;" http://www.saasaccreditation.org/certification. [Last accessed 7 November 2018.]

17 See https://g4.globalreporting.org/how-you-should-report/in-accordance-criteria/pages/default.aspx. [Last accessed 7 November 2018.]

18 This ruled out, for example, the following CSR codes: Programme for the Endorsement of Forest Certification (PEFC), Forest Stewardship Council (FSC), ISO14000, and Global Organic Textile Standard (GOTS).

19 See https://www.sec.gov/edgar/searchedgar/cik.htm. [Last accessed 7 November 2018.]

20 See http://www.londonstockexchange.com/products-and-services/reference-data/sedol-master-file/sedol-master-file.htm. [Last accessed 7 November 2018.]

21 See https://www.microsoft.com/en-us/download/details.aspx?id=15011. [Last accessed 7 November 2018.]

22 We have studied the citation layer of this network in a separate study, see Perez and Stegmann (2018).

23 See the supplementary materials, particularly Appendix A, available in the SSRN version of the paper. For the additional 12 codes (in the IDCN vs. IACN) we could not find data on firm membership or this data were not relevant (e.g. in the case of UNEP and ISEAL). We applied the snowball strategy based on a single iteration (we did not look for new connections potentially produced by the additional 12 codes).

24 This analysis does not expose all of the interactions between schemes. One can go deeper by analyzing major global conferences in which representatives from these organizations meet, personal relations between directors or employees and more (Fransen *et al.* 2018).

25 https://www.isealalliance.org/about-iseal [Last accessed 9 November 2018.]

26 https://www.isealalliance.org/about-iseal/iseal-members [Last accessed 9 November 2018.]

27 http://www.fairlabor.org/about-us/board-directors [Last accessed 9 November 2018.]

28 https://www.cdp.net/en/info/collaborations [Last accessed 9 November 2018.]

29 http://www.iso.org/iso/home/about/organizations_in_liaison.htm [Last accessed 9 November 2018.]

30 https://www.utzcertified.org/en/traceabilityservices/traceability-services [Last accessed 9 November 2018.]

31 UNGC uses the term "participants" instead of "members." Many codes distinguish between membership and certification. Membership reflects participation in the governance of the code as an organization; certification is provided to organizations that meet the requirements of the standard promulgated by the relevant CSR-Code. In some cases, the two

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categories overlap. In this analysis, we focused on membership while in the analysis of the affiliation network we focused on certification (or membership that is equivalent in substance to certification).

32 http://bettercotton.org/wp-content/uploads/2015/09/20160606_BCI-Members-List-Jun.xls [Last accessed 9 November 2018.]

33 http://www.isealalliance.org/our-members/full-members [Last accessed 9 November 2018.]

34 http://www.responsiblesoy.org/about-rtrs/members/?lang=en [Last accessed 9 November 2018.]; the codes, which support UNGC, are those that have the "We Support the Global Compact" logo on their websites. This logo is used by codes that participate in the UNGC initiative, and it demonstrates the commitment of these codes to UNGC and its principles. https://www.unglobalcompact.org/participation/getting-started/brand-guidelines

35 http://www.unepfi.org/psi/supporting-institutions/

36 See Appendix A in Appendix S1 for the exact list; the codes that are part of IDCN but not of IACN are marked with *.

37 Note further that partnership was marked as symmetrical (mutual) even if one of the partners did not mention the other as a partner or did not include a partners list on its website. We also analyzed the membership or representation of the codes in the governance of ISEAL, which is an umbrella organization of CSR codes. If we found relations between codes and local representatives of global codes, we treated the local organizations as identical to the global one. For example, FI: Fair Trade (Fair Trade Organization Kenya, Fair Trade USA, Fairtrade Australia and New Zealand); GAP: Global G.A.P (GLOBAL G.A.P. North America); ETI: Ethical Trading Initiative Base Code (ETI Norway, The Danish ETI); FLA: Fair Labor Association Workplace Code of Conduct (FLA Europe); GRI: Global Reporting Initiative (Global Reporting Sweden).

38 A detailed exposition of the standards and their varied characteristics is provided in Appendix D.

39 Thus, for example, Judge-Lord, McDermott, and Cashore's recent analysis focuses on the differences between two forestry CSR programs: FSC and the Sustainable Forestry Initiative (Judge-Lord *et al.* 2018).

40 Our classification of sectors is generally based on the ICB scheme, but does not follow it exactly; see Appendix **C** for the exact allocation, and http://www.icbenchmark.com/Site/ICB_Structure for the ICB scheme.

41 See Appendix B for the complete analysis.

42 The exact distribution of the sectors by category was: 10 food & agriculture, 6 chemicals, 6 financial services, 5 textile, 3 mining & metals, 2 forestry, 2 marine, 2 tourism & leisure, 1 utilities, 1 toys, and 1 electronics.

43 We considered 9 (31) soft (non-soft) specific codes and 6 (14) soft (non-soft) general codes. The expected values were 10 (30) soft (non-soft) specific codes and 5 (15) soft (non-soft) general codes. The test produced p=0.527.

44 The inner distribution of the stringency subcategories was as follows: strict (36): 12 general, 24 specific; soft (15): 6 general, 9 specific; intermediate (9): 2 general, 7 specific; and UNEP (inapplicable): general.

45 The exact distribution was: civil society and industry (23); civil society, industry and states (10); industry and states (4); industry (14); civil society (8); and states (2).

46 Detailed description of the data collection process and other methodological issues are found in the methodological appendix. See the supplementary materials, available in the SSRN version of the paper.

47 A more detailed description of our analysis and of the mathematical measures and methods we used is provided in Appendix C.

48 A detailed list of the largest weighted links is given in Appendix B2. Appendix B1 provides another graphic visualization of IACN, focusing on the nominal weights of the edges.

49 See Appendix D for the complete analysis. In Appendix E we also provide a visual representation of IDCN, which includes a functional analysis of the nodes.

50 See, for FTSE4GOOD, http://www.ftse.com/products/indices/FTSE4Good?_ga=1.174472427.877647568.1464114119 and for DJSI, see Dow Jones Sustainability Indices Methodology (March 2016) available at: http://eu.spindices.com/indices/equity/dow-jones-sustainability-world-index. [Last accessed 9 November 2018.]

51 FTSE uses some built-in exclusion criteria, whereas DJSI, which does not rely on negative screening in its general indices, offers some exclusion indices. For example, *Dow Jones Sustainability World Enlarged Index ex Alcohol, Tobacco, Gambling, Armaments & Firearms and Adult Entertainment.* For a detailed description of the selection methodologies of both index families, see *FTSE, Index Inclusion Rules for the* FTSE4Good *Index Series* (version 1.6, June 2015) [hereinafter FTSE4Good Index Inclusion Rules], Dow Jones Sustainability Indices Methodology (Oct. 2017) [hereinafter DJSI Methodology].

52 For the full list, see *DJSI Family Overview,* ROBECOSAM, http://www.sustainability-indices.com/index-family-overview/djsi-family-overview/index.jsp [Last accessed 9 November 2018.]

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53 FTSE RUSSELL, GROUND RULES: FTSE4GOOD INDEX SERIES §§ 5.3.2 (version 2.3, Oct. 2015). https://web.archive.org/web/20160108211822/http://www.ftse.com/products/downloads/FTSE4Good_Index_Series.pdf. [Last accessed 9 November 2018.]

54 Further details on FTSE4GOOD assessment criteria can be found in Slager and Chapple (2015) and FTSE4Good (2016a).

55 See, for example, the questionnaires used to evaluate firms in the Metals and Mining and in the Diversified Consumer Services sectors: http://www.robecosam.com/en/sustainability-insights/about-sustainability/corporate-sustainability-assessment/sample-questionnaire.jsp [Last accessed 9 November 2018.]

56 To make our analysis consistent, we removed the firms that were considered for participation only in DJSI World Enlarged or DJSI Emerging Market because we did not have data on the constituents of these indices.

57 The complete analysis of each category is provided in Appendices F1, F2, and F3.

58 See Appendix F4 for the complete analysis.

59 The complete analysis is given in Appendix F5.

60 Because intermediate schemes leave the final decision as to which compliance option to choose to the regulated firm, we combined the soft and intermediate categories for the purpose of this analysis.

61 It can also be argued that linking with codes with higher eigencentrality conveys a stronger signal.

62 As eigencentralities are network variables that may bias a logit model, we performed a similar logistic regression using a new network constructed by firms redistributed at random at each code, keeping the code size (total number of firms) fixed. A detailed analysis is given in Appendix G.

63 See Appendix F5.

64 Perez and Stegmann find that 53 of 57 codes (92.98 percent) were part of one network; that is they either cited at least one other code or were cited by another code. The average path length was 2.86.

65 For example, Vigeo/Eiris rankings (http://www.vigeo-eiris.com/solutions-for-investors/sustainability-ratings/) or MSCI rankings (https://www.msci.com/msci-acwi-sustainable-impact-index). [Last accessed 9 November 2018.]

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Appendix S1. Supplementary Materials.

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