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A Global Value Chain Perspective Applied to Tanker Shipping

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The Potential and Limits of Environmental Disclosure Regulation: A Global Value Chain Perspective Applied to Tanker Shipping

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Abstract

Exploring how transnational environmental governance and the operation of global value chains (GVCs) intersect is key in explaining the circumstances under which mandatory disclosure can improve the environmental footprint of business operations. We investigate how the governance dynamics of the tanker shipping value chain (a major emitter of greenhouse gases) limits the effectiveness of the European Union (EU) monitoring, reporting, and verification (MRV) regulation, which mandates the disclosure of greenhouse gas emissions for ships calling at EU ports. Although MRV seeks to help shipowners and ship managers save fuel and reduce emissions, it does not address the complexity of power relations along the tanker shipping value chain and currently cannot disentangle how different actors influence the design, operational, commercial, and ocean/weather factors that together determine fuel consumption. In particular, the EU MRV neglects to reflect on how oil majors exert their power and impose their commercial priorities on other actors, and thus co-determine fuel use levels. We conclude that, in its current form, the EU MRV is unlikely to lead to significant environmental upgrading in tanker shipping. More generally, we argue that regulators seeking to facilitate environmental upgrading need to expand their focus beyond the unwanted behaviors of producers of goods and providers of services to also address the incentive structures and demands placed on them by global buyers.

Much has been made of transparency and information disclosure as a governance tool that can change the environmental practices of business. The conditions under which it can improve the environmental footprint of business operations is an important topic in the academic fields of transnational environmental

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governance (TEG) and global value chain (GVC) analysis. Yet, so far, these two academic traditions have remained separate, drawing recent calls for their conceptual insights to be combined (Havice and Campling 2017; Ponte 2019). In this article, we argue that this can be a fruitful venue as TEG scholarship explains how actors, guided by institutions, develop governance instruments and intervene to achieve environmental sustainability outcomes, and as GVC analysis seeks to understand how power dynamics among actors shape environmental upgrading. To explore the implications of GVC power structures for the potential effect of transparency as a TEG instrument, we examine the case of the European Union (EU) monitoring, reporting, and verification (MRV) regulation for CO_2 emissions and its application in tanker shipping.

International shipping accounts for approximately 2.1 percent of anthropogenic greenhouse gas (GHG) emissions (Smith et al. 2014) and faces major challenges in abating them (Gilbert et al. 2018). Tankers represent approximately 35 percent of the world fleet in terms of tonnage they can carry (UNCTAD 2018) and account for approximately 28 percent of international shipping's GHG emissions (Smith et al. 2014; see details in the section "Governance and Regulation in the Global Value Chain of Tanker Shipping"). From 2018, the EU MRV has mandated that all ships above 5,000 GT[1] calling at EU ports disclose information about their GHG emissions in view of stimulating environmental upgrading (GHG abatement). Given that the EU is a major shipping market, MRV affects the entire shipping industry.

Within the shipping industry, the tanker sector is particularly relevant for understanding the potential of mandatory transparency measures because its GVC structure in theory makes it more likely to stimulate environmental upgrading. In the tanker sector, oil majors are the "lead firms" that define operational quality standards, in particular regarding safety and oil spill prevention, while shipping companies have no choice but to comply with these to remain in business.[2] Therefore, we examine a "best case scenario" for transnational transparency regulation to have a positive influence on environmental upgrading (see the following section for the conceptual basis of this research). We leverage interviews, ethnographic observation, and document analysis (see "Methods" for an explanation of our methodology) to understand which data are collected for MRV—in the context of a broad set of factors that may influence fuel use decisions by tanker shipping GVC actors (see the section "MRV as a Mandatory Transparency Instrument" for a discussion of results and the subsequent section for more general conclusions).

The Role of GVC Governance in Shaping Transparency as a TEG Instrument

In the TEG literature, particular attention has been paid to the emergence of governance forms that go beyond formal international regimes as a way to find

1. A measure of ship size, referring to internal volume of a ship.
2. In October 2019, the market capitalization of Royal Dutch Shell was approximately 600 times higher than that of Teekay Tankers, one of the world's largest tanker shipping companies.

suitable institutional designs to achieve putative environmental objectives—including examinations of how government, civil society, and business compete and/or cooperate to shape institutions and rule systems (Dingwerth and Pattberg 2006; Fransen 2012). This literature shows that governance beyond regulation has not led to a wholesale retreat of the state but rather to new overlaps between public and private spheres and to new hybrid forms of governance. Some scholars have argued that these dynamics can provide alternative and more flexible venues to address environmental problems than regulation alone—as shown by the rich variety of transnational experiments and entrepreneurial governance initiatives that are being carried out by industry associations, alliances of cities, individual corporations, international and local nongovernmental organizations (NGOs), and other nonstate actors (see Andonova et al. 2009; Bäckstrand 2008; Hoffmann 2011; Overdevest and Zeitlin 2014; Zelli and Van Asselt 2013).

Other scholars have specifically highlighted how transparency and information disclosure are becoming mainstream TEG mechanisms and how limited is our understanding of their drivers, uptake, and effects—especially as governance by disclosure often falls short of actually improving sustainability (Gupta 2008, 2010; Gupta et al. 2020; Gupta and Mason 2014; Mason 2008; Mol 2015). Transparency is usually defined as "the public and private governance initiatives that employ targeted disclosure of information as a way to evaluate and/or steer the behavior of selected actors" (Gupta and Mason 2014, 6). It often carries positive connotations and is expected to create bottom-up counterforces against dominant market and state powers (Gupta 2008; Gupta and Mason 2014; Mol 2015). But while transparency can be powerful, information disclosure in and of itself does not necessarily lead to more sustainable outcomes (see Bullock 2017; Gardner et al. 2019; Gupta et al. 2020; Gupta and Mason 2014; Mol 2010). It is in this context that TEG scholars have called for a better understanding of the context in which transparency is enacted (Gupta and Mason 2014).

We argue that GVC analysis can help with this task, as it examines the dynamics, drivers, and barriers of environmental upgrading in the context of specific industries (see Bolwig et al. 2010; De Marchi et al., 2013a, 2013b; Gereffi and Lee 2016; Goger 2013). GVC research shows that the governance structures of different industries have differential impacts on the possibility of transnational governance instruments to successfully address environmental problems (Ponte 2019). Much of the existing GVC literature has focused on *unipolar* value chains (Gereffi 1994)—where lead firms in one functional position of the chain play a dominant role in shaping it. Some scholars have explored the dynamics of governance in GVCs characterized as *bipolar*, where two sets of actors in different functional positions both drive the chain, albeit in different ways (Fold 2002). In relation to international shipping, Poulsen et al. (2016) examined the container shipping GVC and concluded that its limited environmental upgrading could be attributed to its bipolar governance structure, with cargo owners and shipping operators vying for control (see also Lister et al. 2015). Ponte and Sturgeon (2014) expanded this direction further by suggesting examining governance across a unipolar to *multipolar* continuum and called for analyses identifying the main drivers of these GVCs and the different degrees and mechanisms of driving environmental upgrading. Multipolarity can involve other actors outside the value chain, such as international NGOs, trade unions, governments, and multistakeholder initiatives, thus aligning with the concerns of research on TEG.

Another set of contributions broadening the approach to GVC governance beyond "internal" actors and factors has focused on processes of disarticulation and counteraction (Bair and Werner 2011)—highlighting the social and spatial contours of production through everyday practices and struggles over the creation and appropriation of value. Their implicit take on governance shifts attention from integrative efforts (participation in value chains) to a more nuanced picture that includes the agency allowing less powerful actors to disarticulate and disentangle themselves from uneven and exploitative GVC relations or to refuse participation (Goger 2013; Havice and Campling 2013). An emerging literature is specifically concerned with how power relations change among value chain actors when environmental issues arise (Campling and Havice 2019; Havice and Campling 2017; Ponte 2019). These contributions highlight that environmental conditions of production and service provision are key to how different kinds of firms reshape or contest power dynamics in GVCs and that failures in TEG often arise because the targets of improvement are considered independently from the GVC dynamics and pressures in which they are embedded. Existing GVC studies suggest that lead firms tend to be the drivers of environmental upgrading in unipolar GVCs, while in multipolar GVC, a major role is played by regulators (Ponte 2019). While these are important conceptual insights, GVC governance analysis has so far failed to take transparency explicitly into consideration.

That transparency does not lead to sustainability improvements per se has already been confirmed by studies into transparency within the shipping sector. Scott et al. (2017), Poulsen et al. (2018a), and Van Leeuwen (2019) have emphasized the limitations of multistakeholder initiatives that disclose environmental performance data for individual ships, highlighting lack of effectiveness due to limited data validation, lack of ambition, and low industry legitimacy. These issues are echoed in research that studies the role of ports, one of the key value chain actors in shipping, in the abatement of air pollutants from ships. For example, Poulsen et al. (2018b) found that while major ports allocate considerable resources to air emissions abatement, lack of data on air emissions from ships hampers further environmental upgrading efforts. Lack of transparency has also attracted attention within the maritime energy efficiency literature, which examines operational and design measures that can enable ships to save fuel (International Maritime Organization [IMO] 2016). Several studies (see, e.g., Adland et al. 2017; Johnson et al. 2014; Poulsen and Johnson 2016; Rehmatulla 2014; Rehmatulla and Smith 2015) have attributed energy efficiency gaps to a diverse set of barriers, including the lack of reliable and valid data sets on vessels' fuel consumption.

In other words, while the expectation is that transparency in TEG allows for more democratic, open, and inclusive forms of collective action (Gupta and Mason

2014), in practice, we fail to see such empowering effects. In analyzing how information disclosure might stimulate environmental upgrading, in this article, we start to provide answers to three questions. *First*, what are the scope, modality, and sought-after effects of transparency (Gupta and Mason 2014)? The scope and modality of information disclosed refer to which information is disclosed and the extent to which it is accessible, relevant, and accurate. The effects of transparency can be categorized in normative outcomes (enhancing the right to know), procedural outcomes (to empower and enhance accountability and legitimacy), or substantive outcomes (reducing risks and environmental harm) (Gupta and Mason 2014). *Second*, for what actors is the information meant (Gupta 2010; Mason 2008; Mol 2015), and for what purposes? Information can be targeted to downstream value chain actors, regulatory and inspection bodies, consumers and certification bodies, and/or the public. It can be released for the purpose of disclosure (to unveil environmentally harmful behavior to others) or for the purpose of education (to provide information and thus incentives to change behavior) (Mitchell 2011). *Third*, what are the conditions under which transparency leads to behavioral change among value chain actors? The GVC literature (see Bolwig et al. 2010; De Marchi et al., 2013a, 2013b; Goger 2013) shows that environmental upgrading is more likely to be stimulated in GVCs governed by a group of lead firms located at one particular functional position (unipolar governance) and where the lead firms are consumer-facing companies with reputational risks (Ponte 2019).

Governance and Regulation in the Global Value Chain of Tanker Shipping

Having a diverse fleet of ships of different sizes, which are specialized for the transportation of different tanker cargoes (crude and refined oils, chemicals, and various gases), makes the tanker shipping GVC highly complex. In their operation, most tankers follow tramping patterns, meaning that they go wherever cargo needs transport. Some chemical and liquefied natural gas tankers, however, sail mainly on fixed routes in so-called liner services. For some ship sizes and trades, there are distinct head and back hauls. For instance, very large crude carriers transport crude oil from the Arabian Gulf to northwestern Europe, from where they return empty to the gulf (this is called *ballasting*).

At least six types of actors (and related functions) within tanker shipping GVCs directly influence ship operations and GHG emissions: cargo owners, charterers, ship owners, ship operators, and technical and commercial managers (see Table 1). *Cargo owners* are oil majors and commodity traders with a need for seaborne transportation for their cargoes. Some oil majors own tankers to cater for their transport needs, but the vast majority of tanker shipping is outsourced to shipowners. *Shipowners* are independent companies specialized in shipowning and leasing out ships in the chartering markets. Ship -leases (in shipping jargon, *charter parties*) have different durations as well as risk and cost distributions (Table 2). *Ship operators* are independent firms, which commit to

Table 1
GVC Actors in Tanker Shipping

Actor	*Description*
Cargo owner	A company with a need to transport its cargoes. In tanker shipping, the main cargo owners are oil majors and commodity traders. In some cases, oil majors own ships, but in the vast majority of cases, they charter-in vessels in the freight/charter markets to perform transport work.
Shipowner	A company that owns ships. It makes money by chartering out its ships in the freight/charter market or through asset play in the secondhand markets for ships. Some shipowners have in-house commercial and technical management for the ships, while others choose to outsource these activities to third parties.
Charterer	A company that charters in (i.e., leases) ships in the chartering market. A charterer may be an oil major in need of transportation for its cargoes, or a ship operator in need of ships to perform transport work, for which it has committed itself on behalf of a cargo owner.
Ship operator	A company that provides transportation services to cargo owners. It does not own ships but charters in these in the freight/charter markets. It subsequently charters them out and makes a profit from the margins between the charter-in and charter-out rates.
Commercial ship manager	A company that provides commercial management for ships on behalf of shipowners. It finds employment for the ships in the freight/charter markets and earns a profit from the management fee that it receives from shipowners. It is also known as a pool manager.
Technical ship manager	A company that provides crewing and technical management for ships on behalf of shipowners. It maintains and crews the ships and earns a profit from the management fee that it receives from shipowners.

Source: Elaboration by the authors.

transporting cargoes for cargo owners, without owning ships. They charter-in vessels and subsequently charter them out to perform transport work for cargo owners and make profits from the margins between the charter-in and charter-out rates. *Charterers* refer to any GVC actor that charters in a vessel.[3] *Technical*

3. To illustrate the complexity of chartering, a shipowner (company A) might choose to charter out a vessel to another company (company B) for a one-year period (on a time charter), and company B would thus act as time charterer. Company B could be an oil major in need of transportation or a ship operator, which subsequently subcharters the ship out to another company (C) for a single voyage (a voyage charter). This would make company C a voyage charterer.

Table 2
Types of Contracts Used in Chartering Markets

			Who Pays For		
Contract Type	*Duration*	*Price Per*	*Capital Costs*	*Operating Costs*	*Voyage Costs*
Voyage charter	one voyage	cargo unit	ship owner	ship owner	ship owner
Time charter	months to years	day of hire	ship owner	ship owner	charterer
Bareboat charter	months to several years	day of hire	ship owner	charterer	charterer

Capital costs refer to the ship itself (equity or debt financed); operating costs refer to crew wages, stores, repair, maintenance, insurance, and so on; and voyage costs refer to fuel costs as well as port and canal dues.
Source: Elaboration by the authors.

ship managers take responsibility for ship crewing, maintenance, and compliance with international safety and environmental regulation, while *commercial ship managers* find employment for shipowners' ships in the chartering markets. Some shipowners have in-house technical and commercial management, but cost considerations motivate many of them to outsource these functions to third-party managers, who have scale advantages that small- and medium-size owners lack.

The United Nations (UN) International Maritime Organization (IMO) is responsible for the international regulation of safety and environmental protection in international shipping. Since 2013, international shipping has been subject to IMO GHG regulation via two regulatory measures. The Energy Efficiency Design Index (EEDI) specifies minimum energy efficiency requirements for all new builds (IMO 2019), and all ships are required to have on board a Ship Energy Efficiency Management Plan (SEEMP) for energy management in ship operations (IMO 2016). In 2018, the IMO set three goals for the abatement of GHG emissions: strengthening EEDI requirements for new ships, a 40 percent reduction in CO_2 per transport work (cargo volume by distance traveled) by 2030 for existing ships, and a 50 percent reduction in total GHG emissions by 2050 (both relative to 2008) (IMO 2018). Currently the IMO is discussing how to reach the GHG goals with multiple short-, medium-, and long-term measures.

Ships calling in EU ports are also subject to EU regulation. In 2015, the EU adopted the MRV regulation, which applies to all vessels more than 5,000 GT calling at EU ports. The motivation of the system is to enhance transparency regarding an individual ship's operational energy efficiency. The first year of MRV data collection was 2018, and the data sets are subject to independent verification by verifiers officially recognized by the EU. MRV allows the public to see individual ship annual CO_2 emissions as well as their annual transport work. The EU set CO_2 per ton-mile as the key energy efficiency metric and made the data set for more than 11,000 vessels publicly available in July 2019 (European Maritime Safety Agency 2019). In response to MRV, the IMO adopted a global data collection system requiring all states to provide data on fuel consumption of their registered ships (IMO 2017). Since MRV is the more comprehensive of the two, demanding higher data granularity and public disclosure (Fedi 2017; Lonsdale et al. 2019; see also quotes in Supplementary Appendix 2), and was the first one to enter into force, we focus on this measure in this article.

Despite the complexity of actors and relations in the shipping GVCs, the regulatory approach of both the EU and IMO centers around the ship itself and the person or organization directly responsible for technical management. For MRV, for instance, all ships shall have a document of compliance (DOC) on board. There can be only one DOC holder, and this is the responsibility of "the shipowner or any other organization … which has assumed the responsibility for the operation of the ship from the shipowner" (European Union 2015, Article 3). In other words, shipping regulation focuses directly on the ship owner and technical manager—rather than the other actors in shipping GVCs (Poulsen and Sampson 2019). We explore the relevance of this disconnect later in this article.

Methods

In the research effort that underpins this article, we employed a qualitative, inductive research approach that involved three data sources: semistructured interviews, publicly available data, and ethnographic observation on board a tanker and at industry conferences.

Semistructured Interviews

In summer 2018 (the first year of MRV data collection), we conducted eight semistructured interviews with ten middle and top managers in chartering, operations, and technical departments of Nordic tanker companies (see Supplementary Appendix 1). Employing a purposive sampling strategy, we focused on Nordic shipping managers because their national ship owners' associations have generally favored a comprehensive publication of MRV data, including data on transport work, in contrast to the prevailing preferences of the global ship owner community (Danish Shipowners' Association 2014; *Lloyd's List* 2014). When the interviewees' answers differed on important points, we present these disagreements in our analysis section. In Supplementary Appendix 2, we provide comprehensive, verbatim quotes from key passages in the interviews to enhance methodological transparency. In spring 2020, we also performed an interview with an environmental NGO.

Publicly Available Data

To provide a better representation of shipping managers and environmental NGOs beyond the Nordic region, we also collected publicly available data sets of articles published in the leading global shipping newspaper *Lloyd's List*, three major international shipping associations (International Chamber of Shipping, BIMCO, and European Community Shipowners' Association [ECSA]), and two environmental NGOs (Transport and Environment and Clean Shipping Coalition [CSC]) for the last ten years. We identified and analyzed seventy-three newspaper articles regarding MRV (from its first mention, on November 28, 2011, to April 20, 2020), annual reports and other printed or online material (including submissions to the IMO) from the three ship owner associations, and all press releases and publicly available reports from the two NGOs. In our content analysis, we coded the data sets to identify the prevailing positions and arguments by shipping managers and NGOs regarding MRV.

Ethnographic Observation

To study ship operations and GVC actors' influence over shipping operations that shape GHG emissions, one of the authors did two weeks of nonparticipant ethnographic observations on board a product tanker in spring 2018. This method allowed us to study behavior in ship operations and to test findings from the content analyses of the interviews and publicly available information. Finally, two of the authors participated in a major maritime green technology conference with 350+ participants from shipping and technology providers in spring 2019. We chaired a one-and-a-half hour session on MRV, where we presented our preliminary results and received feedback from industry.

MRV as a Mandatory Transparency Instrument

In this section, we explore the key features of the EU MRV as a transparency initiative, focusing on the type of data collected, the users of these data within the value chain, and the validity concerns of these data. This is also in line with the three intentions that the EU set out to achieve with the MRV system: establishing a comprehensive system for collection of fuel consumption and GHG data, supporting shipping manager and charterer decisions, and accurately measuring vessel energy efficiency (European Union 2015).

MRV Data Collection by Tanker Ship Owners

In the public debates leading up to the adoption of the EU MRV, discussions centered on methods for collection of data on fuel consumption and GHG emissions. Four different methods were available,[4] but NGOs advocated the

4. These include, inter alia, fuel delivery records, fuel tank monitoring on board, flow meters for applicable combustion processes, and direct CO_2 emission measurements.

two that would require ship owners to install new measurement equipment on board (Transport and Environment 2014). In contrast, shipping managers voiced concerns about MRV administrative burdens, which would require "phenomenal record keeping" (*Lloyd's List* 2015). In 2015, the EU decided to allow all four different data collection methods taking "into account existing requirements and data already available on board ships" (European Union 2015, 2).

As expected, mixed opinions arose in relation to the MRV and its ability to achieve its objectives. On one hand, some ship owners and shipping managers have been highly skeptical, claiming that MRV performance metrics "are overly simplistic or even misleading" (BIMCO 2019) and that they "will lead to serious market distortion" (International Chamber of Shipping [ICS] 2015) and cause "unfair competition" (European Community Shipowners' Association [ECSA] 2013). On the other hand, environmental NGOs have pointed out that "information disclosure can motivate firms to cut emissions by enhancing pressures generated by consumers, international certification bodies, financiers, employees, regulators, NGOs, industry associations, and the judiciary. … Superior environmental performers are more forthcoming in truly discretionary disclosure channels" (CSC 2014, 3).

To build a nuanced understanding of these views and the factors that may shape them, we asked shipping managers how they collected data and if they had changed their vessel performance monitoring systems to comply with MRV. Their answers resonated with the publicly expressed opinions above (Int2, 3, 5, 7, 9, and 10). They explained that they had engaged heavily in vessel performance monitoring and fuel-saving exercises for several years—"we don't really see any issue going forward either, because we are not afraid of this. … It's good saving bunkers [i.e., fuel] … because it means we have less cost" (Int9) (for longer quotes, please see Supplementary Appendix 2). In another tanker shipping company, the CEO explained how MRV affected the company's business (Int7):

> For us it does not have any effect at all. Because it will only provide peanuts as compared to the optimizations that are doing on a daily basis. … It is relatively easy to collect these data and just submit them. So, it does not do us any good. … It creates bureaucracy. Nothing else. But having said that, yes, we are very focused on fuel efficiency.

The chief operating manager in a small chemical tanker shipping company (Int8) explained that fuel consumption monitoring practices differ significantly between shipping companies. He explained that some shipping companies, major ones in particular, had elaborate and well-proven vessel performance monitoring systems. Others, in particular, small companies, did not. His company had outsourced technical management, and MRV was the responsibility of the ship manager. He argued,

> When it comes to a small shipping company, which does not have a large organization to address these issues, it [MRV] might give someone a wake-up-call. Because here no one is working with performance at all. They will

> not get away with that. … You might raise the bar for the small companies. Not that they are bad—our own company is also small. But you could say that they are not as focused on performance. … It is difficult to monitor in these companies, with ships employed on short trades.

Overall, managers in shipping companies with comprehensive vessel performance monitoring systems saw the additional work associated with MRV as relatively limited and did not expect that it would provide them with any news on vessel performance or extra fuel savings. Yet, they also saw MRV as possibly raising awareness in small shipping companies with less focus on vessel performance monitoring. Seen in retrospect, the industry concerns regarding heavy administrative burdens voiced in the pages of *Lloyd's List* seem exaggerated. At the same time, it is clear that MRV's data collection requirements fall short of the wishes expressed by NGOs.

Use of MRV Data by Tanker Shipping Value Chain Actors

The EU intended MRV to provide valuable data for shipowners' investments in fuel savings and for charterers in guiding their decisions (European Union 2015). In relation to investments in new ships, we found that energy efficiency has developed into an important consideration for shipowners after 2008. Top managers at two companies (Int7, 9) explained how they spend considerable time to achieve fuel-efficient designs before ordering new ships—in response to rising oil prices (see also Faber et al. 2016, 32). In 2018, new tankers of 40,000 dwt had an average daily fuel consumption of 20 tons, which is 10 tons less than tankers built a decade ago.[5]

We also asked shipping managers about the use of MRV data by other actors in the shipping GVCs, most notably cargo owners that charter ships (see also Table 3). A CEO (Int7), who was generally skeptical about MRV, explained that cargo owners were not concerned with GHG emissions. He said, "Largely, shipping flies under the radar. As long as it's not an exposure area, the oil majors' end-consumers will not demand it. So why waste time and resources on it?" An NGO representative (Int9) argued similarly that if "you are carrying oil, which causes climate change, does it really matter whether your tanker is an efficient one or an inefficient one? Eventually, your cargo is going to be burdening the planet." This means that although oil majors are lead firms in the GVCs of tanker shipping, they are not especially concerned with GHG emissions from ships (see also extensive quotes from Int1, 2, and 8 in Supplementary Appendix 2).

Commercial factors, related to speed and ballasting choices, seem to have a more direct effect on fuel consumption and CO_2 emissions per ton-mile. Cargo owners, acting as charterers, specify a time window for loading and discharging of cargoes in port. This effectively determines the timing of ship arrival to port and therefore service speed for laden voyages and, in many cases, for ballast voyages as

5. Data from field notes.

Table 3
Determinants of a Ship CO_2 Footprint per Transport Work

			Main GVC Actors					
Main Factors	*Definition*	*Examples of Measures*	*Shipowners*	*Commercial Ship Managers*	*Technical Ship Managers*	*Ship Operators*	*Cargo Owners*	*Charterers*
Design	Refers to measures that require investments in equipment (fuel-saving devices) and/or ship hull (described in IMO 2016)	Installation of waste-heat recovery system; installation of auxiliary wind propulsion system (such as Flettner rotors); installation of counter-rotating propellers; slender hull designs						
Operational	Refers to measures that require improvements in ship operations to achieve fuel savings; investments in new equipment are not required (described in IMO 2016)	Propeller and hull cleanings; trim and ballast water optimization; onboard power management	When the shipowner has in-house technical management		When third-party managers do technical management for shipowners	Depends on the type of charter (influence is lowest on voyage charters and highest on bare boat charters)	Depends on the type of charter (influence is lowest on voyage charters and highest on bare boat charters)	Depends on the type of charter (influence is lowest on voyage charters and highest on bare boat charters)

Commercial	Refers to measures of commercial nature that affect vessel capacity utilization, service speed, and transport work	Speed reduction; reduced ballasting/ empty repositioning voyages; reduced waiting time at anchorage (to allow for speed reduction)	When the shipowner has in-house commercial management	When third-party managers do commercial management for shipowners				
Ocean/ weather	Refers to meteorological and oceanic factors that affect fuel consumption.	Countercurrents and head winds; high waves						

Dark shading signifies high influence. Medium shading signifies some influence. Light shading signifies no influence.
Source: Elaboration by the authors.

well. During our onboard observation study, a pilot came on board to act as local advisor to the master, and he used the expression "charterer speed," thus indicating how charterers decided the speed in open seas. In contrast, maneuvering speed—in narrow straits and fairways—depends on local navigational context. An officer also explained how the ship receives daily consumption instructions from the shipowner's operations department. For a specific voyage, for instance, when the ship is in ballast condition and the shipowner pays for fuel, the crew receive instructions not to exceed a specified daily bunker fuel consumption. In other cases, when the vessel was on time charter, the charterer pays for fuel, and the contract specifies a daily limit for fuel consumption.

A shipping manager (Int9) highlighted that ballasting or empty repositioning voyages for tankers are a major factor for CO_2 emissions per ton-mile. While any rational shipowner would try to minimize ballasting, situations arise when shipowners or their charterers would prefer long over short ballast voyages, for example, to reposition a ship to a port with higher-paying freight.

MRV Data Validity Concerns

The EU intended MRV to allow "for the determination of ships' efficiency" (European Union 2015, 3). However, both shipping managers and NGOs voiced skepticism in this regard, doubting that it provides a valid measurement of a vessel's energy efficiency. This is because the "proposed regulation does not require the accurate measurement of fuel consumption or the reporting of indicators that are specific enough for charterers to use in their evaluation of ships" (Nelissen and Faber 2014, 36). The ICS and ECSA voiced strong concerns regarding mandatory disclosure of what they regarded as commercially sensitive data about ship operations (BIMCO 2019; ECSA 2013; ICS 2018). They preferred disclosure of aggregated data at the fleet level and distance sailed rather than cargo carried as denominator (*Lloyd's List* 2016). Representatives of shipping associations were concerned about the validity of the CO_2 per ton-mile as a metric for energy efficiency. These are important issues viewed in the context of broader concerns that pressures for transparency and data sharing may lead to value capture by dominant firms in value chains (Ponte 2019).

One of the reasons for the validity concerns relates to ocean and weather conditions, which are major influencers of ship fuel consumption (ICS 2018). High waves, strong countercurrents, and winds increase fuel consumption significantly compared to calm seas and favorable weather, and these are beyond anyone's control. "Identical ships on identical voyages may have very different fuel consumption due to differing ocean and weather conditions" (ICS 2014, 5). This was strongly confirmed in our onboard study, when the vessel's crew did a performance test to estimate fuel consumption at full speed in calm weather and sea.

Other factors of fuel consumption that are largely beyond shipping manager control are of a commercial nature (ICS 2018; Int2, 4, 5, and 9). Shipping managers do not have full control of speed choice when the ship is in open seas, and ballast voyage decisions. At times when freight markets pay well, high speeds for faster delivery are preferred. From the public MRV data, an observer would not be able to ascertain which factors attribute to an increase in CO_2 intensity. BIMCO and ECSA voiced similar concerns (BIMCO 2019; ECSA 2013).[6]

Discussion

Our analysis has shown that a combination of design, operational, commercial, and ocean/weather factors influences a ship's annual CO_2 footprint per ton-mile. GVC actors have varying degrees on influence on each factor, with the exception of the ocean/weather factors, which are largely beyond anyone's control. MRV's disclosure of individual ships' annual CO_2 emissions per ton-mile does not disentangle the effects of each factor. Although MRV enhances transparency regarding CO_2 emissions from individual ships, it does not enable charterers, shipping managers, other GVC actors, or the public to identify the most and least energy-efficient ships. This is the core reason why MRV is unlikely to lead to substantial fuel savings on its own.

This suggests that even though transparency as a mandatory TEG measure holds much promise for environmental upgrading in GVCs, it is not without pitfalls (Mol 2010). The experience of the EU MRV system has shown that it was designed to overcome the lack of valid data on ship fuel consumption that was thought to be hampering energy efficiency improvements. In line with some of the literature on transparency (i.e., Bullock 2017; Gardner et al. 2019; Gupta and Mason 2014; Mol 2010), we have found that GHG data collection through the MRV is unlikely to lead to substantial fuel savings per se (see also Lonsdale et al. 2019; Panagakos et al. 2019; Psaraftis and Woodall 2019). The MRV aims at both disclosure- and education-based transparency as it focuses both on informing the public and value chain actors and on educating shipowners and managers in an attempt to reduce fuel consumption. However, the disclosure-based potential of the MRV has had a limited effect on GHG emission abatement, as it only discloses fuel usage associated with GHG emissions—and not on what basis fuel consumption decisions are made and under whose influence within the value chain. This means that while the normative effect of the MRV (the right to know) is enhanced for civil society and the public, the procedural and substantive effects of MRV remain limited.

In particular, we have shown that there is notable resistance to adopting MRV's key performance metrics because they fail to shed light on underlying factors that inform actual fuel usage during tanker operations. Shipowners can determine most of the design factors—such as hull form and vessel equipment—when ordering new ships. Shipowners and their technical managers are also largely

6. See BIMCO et al., "Further Technical and Operational Measures for Enhancing Energy Efficiency of International Shipping: Mandatory Operational Efficiency Standards: Should the IMO Pursue Development of Fleet-Wide Operational Efficiency Standards?" Submission to IMO MEPC 65, August 2014.

in control of the operational factors, such as hull and propeller cleaning and onboard power management. But two other key sets of commercial factors—speed choice and ballasting—are mainly determined by cargo owners (oil majors) acting as charterers. Ocean and weather conditions are beyond the control of any value chain actor. Therefore, while the MRV might educate and provide incentives to shipowners and managers to implement design and operational measures to reduce fuel use, it does not have the same influence on charterers and oil majors. Oil majors are not experiencing pushback dynamics from ship managers, or from owners either. Public pressure on oil majors to reduce CO_2 emissions from transport is also lacking. As a result, cargo owners continue to impose their commercial priorities onto ship managers and thus still have significant negative effects on ship fuel consumption. In tanker shipping, oil majors are more concerned with avoiding oil spills and ensuring fast delivery than with GHG emissions (Poulsen et al. 2016; Poulsen and Sampson 2019).

The design of transparency measures under MRV focuses too much on shipowners and managers and does not reflect the existing power relations and related incentives along the entire GVC, in particular, the role of oil majors as charters and their influence over commercial factors that underlie a ship's fuel use. Therefore, in its current form, the MRV will not deliver the sought-after effects of reduced fuel use and associated GHG emissions. To enact more sustainability effects, the MRV should be expanded in its reach and address all the stakeholders involved in the value chain that affect ship fuel consumption and CO_2 emissions—including, but especially, cargo owners. Therefore, shipping regulators should incorporate a GVC perspective into the regulatory process to supplement their ship-based approach and include measures that require mandatory disclosure for how all relevant value chain actors shape the design, operational, and commercial factors that direct fuel use.

Conclusions

Much of the existing debate on TEG has been focused on analyzing the design and function of international agreements and the plethora of transnational experiments and entrepreneurial governance initiatives that have been taking place at different geographic levels by different combinations of public and private actors. However, so far, much less attention has been paid to understanding the way in which these governance initiatives further environmental upgrading in the context of the everyday practices of lead firms and other actors in GVCs, even though this system of economic organization has become a dominant feature of the global economy in the past few decades.

In this article, we leveraged a GVC approach to explain how value chain governance dynamics shape the role and outcomes of transparency as a TEG instrument. We examined how a mandatory transparency initiative operates in a unipolar GVC led by branded lead firms that are consumer facing—usually a best case scenario for environmental upgrading. We have shown that the failure of regulation to achieve its objectives, even in a best case scenario, can be linked to a narrow focus on shaping the behavior of producers of goods and providers of services, and the inability of considering the influence of global buyers in shaping producers' behavior. We have examined not only who discloses what kind of information for whom but also how the power positions of different sets of value chain actors influence how the disclosed information is used for the purpose of environmental upgrading. In doing so, we covered the daily economic practices of all relevant actors that require change to further sustainability. We conclude that when a transparency initiative focuses on only one particular set of actors, it is likely to fail, as the practices of other powerful actors in a value chain can work against it.

We conclude that mandatory public disclosure of environmental information from business operators alone is insufficient in promoting environmental upgrading—especially when it is not built on reflections of existing power relations among value chain actors. Previous work has highlighted that TEG tools, including those based on transparency, are more likely to lead to environmental upgrading when they employ instruments that do not work against the grain of value chain governance—or at least that provide tools to address unequal power relations to partly reshape such governance. Regulators should thus expand their target of intervention from those directly engaged in unsustainable economic practices to the powerful actors that are connected to these practices through value chain connections.

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Stefano Ponte is a professor at Copenhagen Business School and director of the Centre for Business and Development Studies. His research concerns transnational economic and environmental governance, with a focus on overlaps and tensions between private authority and public regulation. He is particularly interested in how sustainability labels, certifications, and codes of conduct shape power relations in global value chains. He also studies business–government–civil society interactions, economic development, and environmental upgrading trajectories in global value chains—especially in Africa and the Global South. His recent publications include the book *Business, Power and Sustainability in a World of Global Value Chains*.

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