RSC 2022/05
Robert Schuman Centre for Advanced Studies
Global Governance Programme-463

WORKING PAPER

**Voluntary programs and emissions revisited:
What is the effect of EU trade agreements
with environmental provisions?**

Mattia Di Ubaldo, Steven McGuire,
and Vikrant Shirodkar

European University Institute
Robert Schuman Centre for Advanced Studies
Global Governance Programme

**Voluntary programs and emissions revisited:
What is the effect of EU trade agreements
with environmental provisions?**

Mattia Di Ubaldo, Steven McGuire,
and Vikrant Shirodkar

RSC Working Paper 2022/05

© Mattia Di Ubaldo, Steven McGuire, and Vikrant Shirodkar, 2022

This work is licensed under the [Creative Commons Attribution 4.0 \(CC-BY 4.0\)](https://creativecommons.org/licenses/by/4.0/) International license which governs the terms of access and reuse for this work.

If cited or quoted, reference should be made to the full name of the author(s), editor(s), the title, the series and number, the year and the publisher.

Published in February 2022 by the European University Institute.

Badia Fiesolana, via dei Roccettini 9

I – 50014 San Domenico di Fiesole (FI)

Italy

www.eui.eu

Views expressed in this publication reflect the opinion of individual author(s) and not those of the European University Institute.

This publication is available in Open Access in [Cadmus](https://cadmus.eui.eu/), the EUI Research Repository

With the support of the
Erasmus+ Programme
of the European Union

The European Commission supports the EUI through the European Union budget. This publication reflects the views only of the author(s), and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Robert Schuman Centre for Advanced Studies

The Robert Schuman Centre for Advanced Studies, created in 1992 and currently directed by Professor Erik Jones, aims to develop inter-disciplinary and comparative research on the major issues facing the process of European integration, European societies and Europe's place in 21st century global politics.

The Centre is home to a large post-doctoral programme and hosts major research programmes, projects and data sets, in addition to a range of working groups and *ad hoc* initiatives. The research agenda is organised around a set of core themes and is continuously evolving, reflecting the changing agenda of European integration, the expanding membership of the European Union, developments in Europe's neighbourhood and the wider world.

For more information: <http://eui.eu/rscas>

The EUI and the RSC are not responsible for the opinion expressed by the author(s).

The Global Governance Programme

The Global Governance Programme is one of the flagship programmes of the Robert Schuman Centre. It is a community of outstanding professors and scholars, that produces high quality research and engages with the world of practice through policy dialogue. Established and early-career scholars work on issues of global governance within and beyond academia, focusing on four broad and interdisciplinary areas: Global Economics, Europe in the World, Cultural Pluralism and Global Citizenship.

The Programme also aims to contribute to the fostering of present and future generations of policy and decision makers through its executive training programme: the Academy of Global Governance, where theory and 'real world' experience meet and where leading academics, top-level officials, heads of international organisations and senior executives discuss on topical issues relating to global governance.

For more information: <http://globalgovernanceprogramme.eui.eu>

Abstract

Multinational enterprises operating global value chains are being increasingly pressured to source from suppliers that adopt green private standards. Likewise, public policymakers are also pressured to reduce national pollution levels to contribute to sustainable development initiatives. In this context, while there is extensive debate on how domestic, country-specific environmental regulations interact with private standards (adopted by firms) in reducing national pollution levels, less is known about the role of international trade policies, which have recently embraced an array of sustainability issues. Our paper seeks to extend our understanding of the extent to which ISO environmental certifications affect a country's level of emissions of greenhouse gases and air pollutants, and whether the European Union's environmental protection (EP) standards – as mediated through trade agreements – condition this response. Prior research provides mixed evidence on the impact of the adoption of ISO-14001 on pollution reduction. Based on prior literature and using institutional theory and environmental stewardship perspectives, we expect that membership of trade agreements with EP provisions would complement the effect of ISO-14001 uptakes in reducing national pollution levels. Our arguments and results emphasize the complexity between private and public regulations on pollution reduction.

Keywords

ISO-14001; European Union; Trade Agreements; Emissions; Private Regulation.

Introduction*

Environmental concerns are increasingly driving both multinational enterprises (MNEs) and regulators to seek less polluting and more sustainable methods of production (Christmann, 2004, Delmas & Toffel, 2004, Hartmann & Uhlenbruck, 2015, Ramus, 2002). Reducing emissions is an important part of combating climate change, as denoted during the COP26 climate conference, where 153 countries announced new targets for reducing emissions, covering over 90% of global GDP (COP26, 2021). However, there remain cross-country differences in terms of environmental regulations and their enforcement, largely due to scientific uncertainties about the consequences of pollution and disagreements about the costs vs. the benefits of environmental protection schemes. In this context, the adoption of private regulatory standards has been popular, arising both from corporate self-interest (a desire to exploit market-based advantages) and institutional pressures (Kolk, 2016, Prakash & Potoski, 2006). Nonetheless, the implications on the environment from the adoption of specific environmental standards remain contested.

In global value chains (GVCs), compliance with international private standards is becoming increasingly important, especially for exporting companies in developing countries, where local regulations are weak (Nadvi, 2008, Schmitz, 2004). The International Standards Organization (ISO) 14001 environmental standard has attracted particular attention in the literature (Arimura, Darnall, Ganguli, & Katayama, 2016, Delmas & Montes-Sancho, 2011, Jiang & Bansal, 2003, King, Lenox, & Terlaak, 2005). This is because it has diffused most widely among the corporate communities across both industries and economic regions. As a result, it has proved to be a popular governance mechanism in GVCs within the environmental context, so examining its impact is apposite. Additionally, it is a private regulation, so its diffusion speaks to the phenomenon of private regulation, which is distinct from state regulation in the international economy (Büthe, 2010). Private regulatory regimes have gained considerable academic attention over the past three decades, as their existence and development appear to challenge conventional notions of state-centric governance (Boddewyn, 1985, Vogel, 2008).

A central question in the private-public governance debate is the extent to which private regulatory regimes are complementary to public regulation (Coslovsky & Locke, 2013, Heyes & Maxwell, 2004, Potoski & Prakash, 2005). In the context of ISO-14001, on the one hand, some studies suggest that stringent domestic environmental regulations are likely to substitute the utility of ISO-14001 in reducing pollution because stronger domestic regulations will reduce the benefits of adopting the standard in terms of reputational gains (Prakash & Potoski, 2014). On the other hand, there is also evidence of a complementary effect between public and private regimes in the other related contexts of labor standards in GVCs (Locke, Rissing, & Pal, 2013). Prior research on this joint effect does not examine trade agreements, however. The business literature considers private regulation as a mechanism for firms to reduce transaction costs in the context of weak market supporting institutions (El Ghoul, Guedhami, & Kim, 2017). Political economy and international law perspectives are more varied, not the least in acknowledging the potential complementarities between the two. It has been argued that policymakers welcome private regulation where issues are novel or complex (Lawton & McGuire, 2003, Mügge, 2006).

As part of the ongoing debate on the effectiveness of public-private governance in GVCs, our paper examines the impacts of both public and private regulatory actions on greenhouse gas (GHG) and air pollutant emissions. Although the effectiveness of voluntary environmental programs has been questioned, Potoski and Prakash (2013) demonstrated that ISO-14001 certifications reduce SO₂ emissions at the country level, indicating that private standards can be helpful in achieving sustainable development (Kolk & Pinkse, 2008). We aim to revisit their study, but to also extend

* We would like to thank the European Union for funding our research under the Horizon 2020 scheme. This is a post-peer-review, pre-copyedit version of the article published in the Journal of International Business Policy. Please cite as: Di Ubaldo, M., McGuire, S., & Shirodkar, V. (2022) Voluntary programs and emissions revisited: What is the effect of EU trade agreements with environmental provisions?. Journal of International Business Policy (Forthcoming). Corresponding author: v.shirodkar@sussex.ac.uk

the scope of the analysis to a broader set of emissions, including GHGs, which have been held significantly responsible for global warming and climate change (Cucchiella, Gastaldi, & Miliacca, 2017, Nordhaus, 1993). Yet, most prior studies on the impact of ISO-14001 have focused on air pollutants (such as SO₂), rather than on GHGs, such as carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), which collectively account for approximately 97% of GHGs. Thus, examining the relationship between ISO-14001 adoption and the emissions of GHGs at the national level is important to achieve a fuller picture of the effectiveness of the ISO-14001 standard.

A second important point is that prior research on the joint effect of private and public regulations on pollution reduction has focused primarily on the stringency of ‘domestic’ (or national) regulations (Heyes & Maxwell, 2004, Prakash & Potoski, 2014) and surprisingly little on ‘international’ trade policies, despite private standards (such as the ISO-14001) being the most popular among exporting firms in GVCs (Christmann, 2004, Christmann & Taylor, 2002). Over the past few decades, the number of trade agreements with environmental provisions has risen. For instance, the Trans-Pacific Partnership (TPP) is argued to have approximately 136 environmental norms, whereas the Canada-EU trade agreement has approximately 114 such norms (Morin, Pauwelyn, & Hollway, 2017). Due to these recent developments, we focus on the EU’s environmental policies in its trade agreements (as a form of public regulation) to test its moderating effect on ISO-14001 in reducing emissions. The EU has been largely successful in reducing the emissions of both GHG and air pollutants, and is seen as a leader in driving the global climate agenda. Between 1990 and 2012, GHG emissions in Europe decreased by 18%, and the European Council plans to reduce emissions by a further 40% by 2030 (Cucchiella, Gastaldi, & Miliacca, 2017). The EU has also been successful in exporting its regulatory model (Falkner, 2007, Kelemen, 2010): the EU has both a large internal market and a large number of MNEs that lead global value chains and thus benefits from bargaining power to diffuse both private and public regulatory standards globally (Lavenex & Schimmelfennig, 2009).

Our analysis, based on ISO-14001 adoption levels in 147 countries over the 1999-2014 period, shows that a greater uptake of the ISO-14001 standard is associated with lower levels of emissions of greenhouse gases (GHGs), namely carbon dioxide (CO₂) and methane (CH₄). At the same time, membership of EU trade agreements with environmental protection provisions is directly associated with lower emissions of harmful air pollutants (SO₂ and NO_x) but has no direct effect on emissions of GHGs. Importantly, for carbon dioxide (CO₂) we find that the effect of ISO-14001 on pollution reduction is greater for countries that become part of EU trade agreements with environmental provisions, implying a positive interaction effect between the levels of ISO-14001 adoption (at the country level) and the membership of trade agreement with the EU with environmental protection provisions. We thus contribute to the literature discussing the efficacy of private standards in reducing pollution at the national levels, as well as on the complementary effect of trade policy as a public regulation.

The remainder of this paper is organized as follows. The next section provides a review of the literature. Following this, we provide a theoretical background and develop our hypotheses. This is followed by a description of our methods and our data, followed by the presentation of our empirical results. Finally, we discuss our findings and highlight the implications and limitations of our research.

Literature Review

Private and Public Regulation in Environmental Protection

Cross-border economic activity raises the prospect of multinational enterprises (MNEs) exploiting national regulatory differences and engaging in regulatory arbitrage. In the context of environmental standards, concerns that MNEs would invest in developing countries to escape more stringent regulations at home gave rise to the ‘pollution haven’ hypothesis (Cole, 2004, Harrison & Eskeland,

1997). The extent of this downward pressure on environmental standards is unclear, however. Porter's hypothesis alternatively argues that stringent environmental regulations in fact enable firms to engage in greener practices as well as in environmental innovations, which provide firms with competitive advantages (Porter & Van der Linde, 1995).

Broadly, studies show that regulatory arbitrage can be reduced through formal governmental regulations or voluntary, self-regulatory action by firms. Potoski and Prakash argued across a series of papers (see for example, Potoski & Prakash, 2013, Potoski & Prakash, 2005, Potoski & Prakash, 2004, Prakash & Potoski, 2007, Prakash & Potoski, 2006) that the diffusion of ISO environmental standards has challenged the pollution haven hypothesis. Private regulatory arrangements have attracted considerable academic and policymaking interest, as a wide range of company-sponsored regulatory arrangements have proliferated (Mayer & Gereffi, 2010). Why we have seen this proliferation is disputed. For some it reflects a broader triumph of neo-liberal ideas about how to operate a market economy, with a concomitant preference for private activity over public (Mayer & Gereffi, 2010). Alternatively, private regulation arises as a response to 'governance gaps', particularly in developing countries where the capacity and capability to regulate is low. Private regulation fills these institutional voids (Christmann & Taylor, 2001, Silvestre, 2015). Finally, self-regulation by firms, especially for those operating in developing countries, is argued to act as an important signal to consumers and regulators in their target markets about firms' commitment to socially responsible behavior (Fiaschi, Giuliani, & Nieri, 2017, Leipziger, 2017, Marano, Tashman, & Kostova, 2017).

Among the more prominent private regimes are those relating to environmental and labor standards, where consumer preferences in developed economies motivate companies to create private standards in host countries (Leonidou, Fotiadis, Christodoulides, Spyropoulou, & Katsikeas, 2015). As Bartley (2003) argues, in areas such as apparel production and forestry, this has been done in response to pressures from social groups and consumer interests in key final markets. Private regulatory standards are not, in the strictest sense, a new phenomenon. For instance, Bütte (2010) suggests that international standards for telecommunications equipment have for a long time fallen under the ambit of the International Electrotechnical Commission (IEC), a private organization founded in 1906 that saw the need for common and accepted standards to facilitate the sector's growth. Firms have, in fact, powerful incentives to create common standards that open opportunities to exploit economies of scale. Furthermore, innovation in products or processes poses regulatory challenges to governments, that face demands to regulate (Stewart, 1993). In these circumstances, firms themselves have incentives to support private regulatory innovation and exploit their greater understanding of the relevant product or service markets.

A growing body of literature seeks to understand the interaction of private regulation, public regulation, and firm strategies and responses. International trade agreements increasingly contain provisions relating to a number of non-traditional trade issues, such as labor standards and environmental protection (Lechner, 2016). Making good on these commitments can involve the adoption of international standards, such as the ISO (Heras-Saizarbitoria, 2021). It is seen that the level of integration into the international trading system affects firms' tendency to adopt more socially responsible practices (Dau, Moore, Doh, & Soto, 2021). However, the extent to which policy initiatives, including trade agreements and regulatory standards, reach local firms – even those nested in global value chains (GVCs) – can be questioned. Much of the literature focuses on the role of lead firms, usually MNEs. The presumption is one of control: GVCs are dominated by MNEs, although this is not to suggest that GVCs are not subject to important external pressures (Buckley, 2021). These firms are assumed to enforce standards for a mix of competitiveness and reputational reasons, as well as stakeholder expectations (Heras-Saizarbitoria, 2021). This overlooks both the complexity and difficulty of enforcing agreements, and the agency of firms farther down the value chain. In fact, enforcement can be difficult. Relying on episodic inspections of facilities may be an inadequate means of verification, with local firms able to game the process (Nadvi, 2008). More

positively, simply seeing international regulatory standards to be transmitted down from MNEs overlooks the embeddedness of local firms, which provides them with context-specific knowledge and social capital that can be used to support social goals, albeit in ways not anticipated by the MNE or policymakers. National or local policy environments would thus seem to be important enablers. The literature on institutional voids has been used to account for ways in which firms step in to fill governance gaps in economies in order to facilitate their operations. However, the robustness of the domestic regulatory environment can be a crucial explanatory variable in understanding why local firms adopt policies linked to trade agreements (Dau, Moore, Doh, & Soto, 2021). In this way, the literature on regulatory standards is enriched by an understanding of how firms embedded in GVCs respond to incentives (Sinkovics, Sinkovics, & Archie-Acheampong, 2021b).

Adoption and Outcomes of ISO-14001

The ISO-14001 provides an important voluntary standard to reduce the scope for regulatory arbitrage in environmental protection; although, whether this standard actually works to reduce pollution at both the facility and national levels is disputed in the literature. In addition, ISO-14001 adoption can be seen as having a signaling effect, likewise the adoption of, for example, standards for sustainable forestry. Firms signal their interest in maintaining standards to important stakeholder groups.

Various studies have focused on the specific reasons why firms adopt ISO-14001 (Aragón-Correa & Sharma, 2003, Darnall, Henriques, & Sadorsky, 2008, Delmas & Montiel, 2008). These studies mainly suggest that pressure from lead firms in the value chain, international regulators, and other stakeholders, such as local non-governmental organizations (NGOs), are important reasons for manufacturing plants to adopt ISO-14001. The benefits to *firms* from the adoption of ISO-14001 include improved efficiency of energy and resource consumption (Radonjić & Tominc, 2006), lesser risks of environmental accidents, better compliance with environmental regulations, improved corporate image, better motivated employees working in pollution-intensive manufacturing, and greater competitiveness in the market (Morrow & Rondinelli, 2002). Recent studies have also found evidence of other indirect benefits of adopting ISO-14001, such as greater innovative capabilities (He & Shen, 2019).

However, several studies did not find any significant effect of ISO-14001 adoption on the above firm-level aspects (for a full review, see Boiral, Guillaumie, Heras-Saizarbitoria, & Tayo Tene, 2018), thus resulting in overall mixed evidence of the impact of the standard on firm-level benefits. In this respect, contextual factors related to the ways in which the standard is implemented have been argued as being important in achieving success from the ISO-14001. Managerial commitment is an important factor (Chan & Wong, 2006, Curkovic & Sroufe, 2011), while effective training and involvement of employees in the adoption of the standard also plays an important contingent role (Djekic, Miocinovic, Tomasevic, Smigic, & Tomic, 2014, Ivanova, Gray, & Sinha, 2014). Firm size and maturity of the certification has also been found to have an effect, such that larger firms with greater resources and capabilities are known to implement the standard more successfully (Yin & Schmeidler, 2009).

A number of studies have also focused on whether the adoption of ISO-14001 has a positive impact on pollution reduction at a national (or regional) level. Boiral et al. (2018) suggest that waste minimization and air emission reduction have been the most important indicators used to assess the impact of ISO-14001 on pollution reduction at such aggregate levels. They suggest that, again, the evidence about the impact of ISO-14001 on both waste management and emission reduction is mixed; however, a large number of studies report a positive impact of the standard. Prakash and Potoski (2014), for instance, found that greater adoption of ISO-14001 at the country level is associated with reduced levels of SO₂ and particulate matter (PM₁₀) emissions. However, whereas most studies have focused on the impact of ISO-14001 on visible air emissions, very few studies

have investigated the impact of ISO-14001 on the reduction in water contamination, and these did not find that the ISO-14001 standard contributes significantly to this issue (Potoski & Prakash, 2013).

Theoretical Background And Hypotheses

We develop our hypotheses by combining insights from institutional theory (DiMaggio & Powell, 1983) alongside the literature on environmental stewardship (Guimaraes & Liska, 1995, Potoski & Prakash, 2013). It is well known that institutional forces (coercive, mimetic and normative) pressurize firms to conform to the 'rules of the game' (North, 1996). Institutional pressures for environmental management can be (i) 'coercive' - via strong environmental regulations enforced by countries; (ii) 'normative' - via strong civic cultures and consumers' demands or activist groups promoting green products and processes; and (iii) 'mimetic' - via imitation of competitors and other similar firms' processes and practices (Darnall, Henriques, & Sadorsky, 2008, Delmas & Toffel, 2004). Conformance to these different pressures has been regarded as important for firms involved in trading internationally and in achieving legitimacy (or 'social license' to operate) among a wide range of stakeholders (DiMaggio & Powell, 1983).

The literature on environmental stewardship complements this view. Under this concept, some firms take on strong environmental management activities to position themselves as environmentally responsible citizens (Guimaraes & Liska, 1995). This is because they believe that being environmentally friendly will not only lead to a better efficiency of their operations, but also allow them to compete on the basis of 'greener' products and services (Iatridis & Kesidou, 2018). Environmental stewards commit a large amount of resources to monitoring, researching, fundraising and developing leadership on specific environmental issues. They also invest in learning in detail about the adverse effects of local air pollution and its effects on the ecosystem by taking field trips with environmentalists and engaging politically with the media and other lobby groups to become an effective voice in the policymaking arena (Lerner & Carr, 1994). This view is also reflected in the 'responsibility matrix' framework (Sinkovics, Sinkovics, & Archie-Acheampong, 2021a, Sinkovics, Sinkovics, & Archie-Acheampong, 2021b), which maps firms' responsible actions in terms of their width and depth. Here, firms taking on operational activities at advanced levels are able to tackle the root causes of environmental issues, such as by encouraging their suppliers to use renewable resources, avoiding unnecessary transportation, reusing production materials and reintegrating them into their supply chains. Some firms also embed their business activities at an advanced level of responsibility by engaging in environmental innovations (Horbach, 2008, Veugelers, 2012) and by developing products and services that reduce environmental harm, such as by replacing chemical-based products with plant-based products (Sinkovics, Sinkovics, & Archie-Acheampong, 2021a). Overall, environmental stewards spill over their good environmental practices to other firms in the community both nationally and internationally (Rondinelli & Berry, 2000).

ISO-14001 and Pollution Reduction

Adopting private regulations (such as the ISO-14001) has been argued as an important manifestation of environmental stewardship, as the adoption of such voluntary standards signals a firm's commitment to environmental performance beyond legal requirements (Potoski & Prakash, 2013). Obtaining and maintaining the ISO-14001 certification requires a firm to setup an environmental management system, to make substantial investment in training its personnel to maintain the system, and to accredit the system from third-party auditors (Berliner & Prakash, 2013). The obligations of ISO-14001 are continual, and firms are expected to analyze their current position regarding pollution and waste management and establish a policy to reduce them using practices in day-to-day implementation (Iatridis & Kesidou, 2018). Several studies have found that the adoption of ISO-14001 leads to an improved compliance with environmental standards, as well as reductions

in air pollution at the facility level (Arimura, Hibiki, & Katayama, 2008, Potoski & Prakash, 2005). We expect that (as a baseline hypothesis) greater levels of adoption of ISO-14001 should lead to reduced emission levels at the country level, as previously argued (Potoski & Prakash, 2013).

First, the relationship between greater levels of firms' adoption of ISO-14001 and country-level pollution reduction is attributed to the diffusion of the standard by environmental stewards or by firms taking on environmental responsibility at advanced levels (Sinkovics, Sinkovics, & Archie-Acheampong, 2021a). Typically, large or visible firms adopt the ISO-14001 standard themselves and require their relevant suppliers to do so (Rondinelli & Berry, 2000). As such firms lead regional or global value chains, they often (coercively) require their suppliers to 'harmonize' various management systems, such as production and accounting systems, with their own systems. In this context, requiring suppliers to adopt ISO-14001 to harmonize their environmental management system with theirs is considered a normal practice (Berliner & Prakash, 2013, Christmann & Taylor, 2001, Iatridis & Kesidou, 2018, Jiang & Bansal, 2003, Sims, 1999). Such coercive pressures cause suppliers in GVCs to enhance their responsible operational actions to maintain their legitimacy in the GVC setting (Sinkovics, Sinkovics, & Archie-Acheampong, 2021a). Eventually, as each facility undertaking the ISO-14001 standard is obligated to reduce pollution by achieving quantifiable targets, one could expect that it would contribute to reducing pollution at the national level (Potoski and Prakash, 2013).

Second, and importantly, the effect of ISO-14001 on pollution reduction is also attributed to 'spillover effects' of the standard occurring via mimetic and normative isomorphism mechanisms, as well as through knowledge dissemination by firms adopting the ISO standard. An important aspect of ISO-14001 adoption is to disseminate information about pollution throughout the industry, to rivet attention toward the resource efficiencies and technological improvements gained from minimizing hazardous waste, and to reduce uncertainty that investments in doing so will be valuable (Delmas & Montes-Sancho, 2011). Due to such knowledge dissemination, manufacturing plants operating in the vicinity of an ISO-14001 certified plant are likely to adopt 'ISO-14001-like' practices (Potoski & Prakash, 2013). Other reasons for doing so could also be because ISO-certified firms are often seen to service important foreign customers and to have better relationships with external stakeholders (Jiang & Bansal, 2003). In some cases, firms – typically small and medium-sized enterprises – adopt a partial set of ISO-14001 implementation methods because they lack the resources to adopt the fully 'codified' set of processes and organize an expensive third-party audit. By adopting partial processes, they claim to be 'ISO-ready' to attract consumers. Thus, *non-participating* firms, i.e., those outside the formal ISO-14001 'club', would also be influenced to adopt greener practices in their own facilities, as ISO-14001 adopters are expected to share their knowledge and skills in reducing pollution to other non-participants within the cluster to enable them to reduce pollution at lower costs. Thus, the overall impact of ISO-14001 in reducing the national pollution levels may reflect not only the efforts of firms adopting the standard, but also the diffusion and spillover of greener practices to other firms.

Overall, similar to the arguments made by Potoski and Prakash (2013), we expect that the adoption of ISO-14001 by firms should diffuse through both participating and non-participating firms in countries and should result in reduced levels of air pollution in the country. Based on this, we propose the following hypothesis:

Hypothesis 1: Greater levels of ISO-14001 adoption in countries should lead to reduced levels of air pollution.

The Moderating Effect of Trade Agreements with Environmental Provisions

As previously suggested, there is limited prior research showing how private governance can interact with international trade policy instruments in terms of pollution reduction. Work on the apparel sector in southern Africa demonstrates how changes in regional value chains are a function of both private decisions by firms and the policy constraints and opportunities created by regional trade agreements (Pasquali, Godfrey, & Nadvi, 2020). Similarly, research shows that sustainability initiatives at the corporate level can be driven not merely by stakeholder pressure, but also by domestic regulatory change that incentivizes behavior (Lashitew, 2021).

A variety of reasons have led to the introduction of non-trade (i.e., sustainability) issues into trade agreements (Bechtel & Tosun, 2009, Lechner, 2016). A key reason, drawing from the institutional perspective, is policymakers' own preferences – especially in developed countries – that are also lobbied through NGOs and other environmental activists (Postnikov, 2014). The European Union (EU), for instance, is widely seen as the “greenest” of major economic powers. The increasing integration of EU states via the single market has also had an effect of enhancing the coherence of EU policy-making at the supranational level. The EU's experience of regulating a large internal market was essentially ‘exportable’ (Damro, 2012, Lavenex, 2014). The EU has used its trade policy to export its regulatory model to developing countries. This so-called ‘Brussels Effect’ is a version of the ‘California Effect’ articulated by Vogel (1986), whereby the largest and most populous US state was able to unilaterally implement environmental regulations, knowing that firms would comply or risk exclusion from the market. Across a range of issue areas, the EU has acted similarly, exporting its regulatory model in areas aside from environmental compliance to include labor standards (Sinopoli & Purnhagen, 2016).

Environmental provisions in trade agreements are intended to create a ‘level playing field’ with the view of reducing cross-country differences in environmental protection so that firms cannot arbitrage from these differences (Bechtel & Tosun, 2009). As previously suggested, the economic weight of the country (or the political unit) demanding these provisions also matters. The provisions are implemented through the involvement of civil society actors who provide advisory services and set up forums to facilitate the direct exchange of information between regulators involved in the trade agreement implementation process and other stakeholders, including firms. There is little evidence of ‘hard’ mechanisms (e.g., sanctions) if partner countries fail to comply with trade policy obligations on sustainability issues, and typically non-compliance is argued to be managed through the dispute-settlement process between trading partners (Kettunen, Bodin, Davey, Gionfra, & Charveriat, 2020). Due to such relatively ‘softer’ approaches in trade policy implementation regarding environmental provisions, firms exporting to a region that demands an environmentally friendly trade policy (the EU, in our case) will have greater incentives to effectively utilize voluntary initiatives, such as ISO-14001, as well as to spillover their knowledge to other firms in the vicinity to reduce national pollution levels. This is because reduced national pollution levels will engender greater stability of the trade agreement (e.g., via lesser disputes), allowing exporting firms located in the focal country to gain distinct long-term competitive advantages in terms of gaining preferential market access to the demanding country (or region). At the same time, being a member of both a ‘green club’ (such as ISO-14001) and being located in a country having such ‘green trade agreements’, an exporting firm would also be able to potentially reduce its ‘liabilities of origin’ (Marano et al., 2017) through reputational and legitimacy advantages. As such, we expect that trade agreements with EP provisions would complement the core effect of ISO-14001 adoption by firms in improving the positive impact on the environment through reduced levels of pollution. We thus formulate our moderating hypothesis as follows:

Hypothesis 2: The effect of the adoption of ISO-14001 in countries leading to reduced levels of air pollution will be greater among countries having trade agreements with environmental protection provisions.

Methodology

Sample and Data

We utilize a panel dataset of 147 countries over the 1999-2014 period to analyze how the adoption of ISO-14001 certifications by firms affects countries' emissions of a variety of gases and pollutants. The time period under analysis is dictated by the available data. We extract the number of ISO certifications per country from the ISO-14001 survey¹, which is available from 1999 to 2017. We matched the ISO data with data on emissions from the 2018 Environmental Performance Index (EPI) report. We use information on all emissions with data over the 1999-2014 period (2014 being the latest available year): carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and black carbon (BLC) are greenhouse gases, and sulfur dioxide (SO₂) and nitrogen oxide (NO_x) are air pollutants.²

Figure 1 shows the uptake of ISO-14001 certifications over time, cumulated by groups of countries: we distinguish between (1) countries that from 1999 onwards were always members of EU trade agreements containing EP provisions (e.g., EU countries, north-African countries); (2) countries that, over this period, entered EU agreements with EP provisions (e.g., African countries, members of European Partnership Agreements, Canada, Chile, central American countries); and (3) countries that never entered EU agreements with EP provisions (e.g., Australia, India, Russia and the USA, among others), and China, which is by far the country with the largest number of certifications. The growth of ISO-14001 certifications was rapid, but it was uneven across countries, with differences emerging mostly in the post-2009 period, when the overall growth slowed down. Countries in the EU trade agreements with EP provisions kept increasing the number of ISO-14001 certifications, as did China, at an even faster rate. In countries that never entered EU trade agreements with EP provisions, instead the growth of ISO-14001 certifications seems instead to have plateaued post 2009. Joiners of EU trade agreements find themselves in the middle, exhibiting a modest growth of ISO certifications throughout the period under analysis.

¹ <https://www.iso.org/the-iso-survey.html>

² The EPI data also includes other emissions, such as nitrogen oxide (NO_x) and black carbon, but these are only available up to 2010. This reduced time period results in issues in the empirical analysis, as we detail below.

Figure 1: ISO-14001 certifications and members of EU agreements with EP provisions

(Source: Authors' elaboration on data from ISO survey and DESTA)

In Table 1, we provide further insight into the distribution of ISO-14001 certifications across countries by showing, in terms of total ISO-14001 certifications since 1999, the top ten countries from each of the groups in Figure 1. China is by far the country with the most certifications, followed by Japan and large European countries.

Table 1: Number of ISO-14001 certifications by country

Always in EU agr. w. EP		Joiners of EU agr. w. EP		Never in EU agr. w. EP	
Italy	230,508	Korea	97,330	China	960,990
Spain	208,522	Canada	23,566	Japan	427,126
UK	192,233	Colombia	21,403	USA	84,213
Germany	106,871	Singapore	17,338	India	63,956
France	83,220	Mexico	14,871	Australia	40,277
Romania	79,338	South Africa	12,663	Brazil	39,807
Sweden	64,935	Chile	11,125	Thailand	33,869
Czech Rep.	55,785	Vietnam	9,089	Malaysia	23,217
Switzerland	38,158	Croatia	7,885	Indonesia	16,872
Netherlands	29,536	Peru	3,690	Argentina	15,540

Source: Authors' elaboration on data from the ISO survey.

Measurements

Our **dependent** variable is the level of emissions of air pollutants and greenhouse gases at the country level. Compared to Potoski and Prakash (2013), who account for levels of SO₂ (for air pollution) and BOD (for water pollution), we account for a wider variety of emissions, i.e., carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and black carbon (BLC), which are greenhouse gases, and sulfur dioxide (SO₂) and nitrogen oxide (NO_x), which are air pollutants. The emission levels are obtained from the EPI report (Wendling, Emerson, Esty, Levy, & Sherbinin, 2018). The EPI report has been widely used to measure a country's environmental performance (Atici, 2009, Roy & Goll, 2014, Zhou, Ang, & Poh, 2008).

Our **independent** variable is the aggregate number of ISO-14001 certifications at the country level. These were obtained from the ISO, following Potoski and Prakash (2013).

For our **moderating** effect, to assess the role of EU trade agreements that feature EP provisions, we combine the data on the content of trade agreements from the 'Design of Trade Agreements' (DESTA) project (Dür, Baccini, & Elsig, 2014), together with data on the degree of legalization of each agreement built by Lechner (2016). DESTA allows us to identify countries that become part of trade agreements, the year in which the agreement entered into force, and the countries that participate in each agreement. Lechner's data are based on the set of agreements in the DESTA project and extend its content identifying agreements with environmental protection (EP) provisions, as well as the degree of EP legalization of each agreement. Lechner (2016) identifies all the EP provisions included in an agreement and classifies them according to three dimensions of legalization – 'obligation', 'precision' and 'delegation' – according to a methodology first introduced by Abbot et al. (2000). A score for each dimension is computed based on the total number of areas covered.³ We then construct two trade policy indicators to (1) identify countries that are part of EU trade agreements and feature EP provisions and (2) identify countries that are part of EU trade agreements with an *above median* legalization of EP provisions. The rationale behind the construction of two indicators is that EU trade agreements differ widely in their coverage of EP issues, with a marked gap representing the EU Treaty of Lisbon in 2009: it is since then that "sustainable development", the umbrella under which EP issues are included in trade agreements, has become one of the key principles of the EU's trade policy (Borchert, Conconi, Di Ubaldo, & Herghelegiu, 2021). EP principles have acquired a significantly larger dimension in all the "new generation" trade agreements, starting with the EU-Cariforum agreement, marking a neat distinction between the agreements signed since the late 2000s and the preceding ones.

To isolate the effect of ISO-14001 certifications on emissions, we compile a list of **control variables** that are likely to impact national pollution levels by following Potoski and Prakash (2013). Since a country's wealth, urbanization and industrialization have been argued to impact pollution levels (Grossman & Krueger, 1995), we extract data on countries' 'GDP', 'GDP per capita', the 'share of industrial production in GDP', and the 'share of urban population' from the World Bank's World Development Indicators (WDI).

To account for the role of international factors, we use the share of exports in GDP (WDI data) and the stock of inward Foreign Direct Investment (FDI) from UNCTAD: a higher level of exports, signaling trade dependence, can lead governments to tolerate higher pollution levels, with a similar argument being made for FDI (Vogel, 2008).

To account for political and regulatory factors, we include in the analysis a country's 'level of democracy' (Polity2 database) (Fredriksson, Neumayer, Damania, & Gates, 2005) and, importantly, the effect of 'environmental regulations coming from international treaties'. This latter variable was constructed utilizing the number of each country's environmental treaty commitments in each year

³ We refer the reader to Lecher's 2016 paper for more details on the calculation of the legalization score.

from the International Environmental Agreements (IEA) database (Mitchell, 2002-2019)⁴. Other than on the countries part of the agreements, environmental treaties could also have an effect on emissions through exports, as importers whose citizens demand environmental protection might indirectly pressure the exporter to reduce its level of pollution (Vogel, 2008). To capture this aspect, we construct a variable that measures each country's exports as a proportion of its GDP, weighted by the number of environmental treaties in the destination country.

Finally, we control for the share of each country's 'exports directed to the EU'. This variable serves two purposes. On one hand, we account for the effect of EU citizens' demand for 'green' products on exporters' emissions. On the other hand, we reduce concerns of omitted variable bias, which could arise from the likely relation between the presence of EP provisions in trade agreements and the importance of the EU as a trade partner.

This list of control variables accounts rigorously for time-varying country-specific confounding factors, such as countries' size and wealth, industrial activity, international economic involvement (trade and investment), and regulatory policies. Our empirical approach, described in the previous section, also controls for all time-constant factors within each country (country fixed effects) and all time-varying effects common to all countries (time fixed effects). Appendix 1 in the 'Supplementary file'⁵ provides a full list of our variables and measures.

Empirical Model Specification

To estimate how countries' emissions are affected by the adoption of ISO-14001 certifications, together with the impact of EP provisions in EU trade agreements, we follow the empirical approach of Potoski and Prakash (2013) and use a generalized method of moments (GMM) estimator in a dynamic panel setting. We formally estimate the following equation:

$$\ln Y_{i,t} = \alpha + \delta \ln Y_{i,t-1} + \gamma \ln ISO14001_{i,t-1} + \vartheta TA_{i,t-1}^{EU} + \rho (\ln ISO14001_{i,t-1} * TA_{i,t-1}^{EU}) + \sum_z \beta_z X_{i,t} + \sigma_i + \tau_t + \varepsilon_{i,t}$$

where $Y_{i,t}$ denotes the level of emissions of country i in year t , $Y_{i,t-1}$ denotes the level of emissions in year $t-1$, $ISO14001_{i,t-1}$ denotes the number of ISO-14001 certifications in country i in year $t-1$, $TA_{i,t-1}^{EU}$ is a binary variable denoting countries part of EU trade agreements with EP provisions in year $t-1$, $X_{i,t}$ denotes a vector of control variables at the country-year level, σ_i denotes country fixed effects, τ_t denotes time fixed effects, and $\varepsilon_{i,t}$ denotes an idiosyncratic error term.

The main equation is estimated with the system GMM estimator developed by Blundell and Bond (1998). The system GMM jointly estimates the dynamic model both in differences and in levels (of emissions), using lagged levels as instruments for the regression in differences and lagged differences as instruments for the regression in levels.⁶ This estimator allows us to account for the strong persistence in the level of emissions by using a lagged dependent variable while simultaneously addressing a series of endogeneity concerns. The use of a lagged dependent

⁴ Data from Ronald B. Mitchell. 2002-2019. *International Environmental Agreements Database Project (Version 2018.1)*. Available at: <http://iea.uoregon.edu/>. We thank Prof. Mitchell for his precious help with extracting information from the IEA database.

⁵ The supplementary file can be downloaded from the online version of the paper.

⁶ Estimating the model in terms of both differences and levels addresses the weak instrument problem arising from using lagged-levels of persistent explanatory variables as instruments for the regression in differences (Blundell and Bond, 1998).

variable in a specification with fixed effects at the level of the cross-sectional panel dimension (i.e., countries, in our application) is problematic, as it generates a correlation with the error term (Nickell bias). This requires instrumenting $Y_{i,t-1}$, and the GMM estimator does so by utilizing further lags of the dependent variable. Additionally, the number of ISO-14001 certifications could spur reverse causality concerns. Utilizing lags of ISO-14001 certifications as instruments in the GMM setting allows us to deal with this source of endogeneity⁷.

The main coefficients of interest are γ , the effect of ISO-14001 certifications, ϑ , the effect of being part of an EU trade agreement with EP provisions, and ρ , which picks up the differential effect of ISO-14001 certifications for countries part of such trade agreements. We expect γ and ϑ to be negative, implying that a larger number of ISO certifications, as well as the presence of EP provisions in EU trade agreements, determine a reduction in the level of emissions. The ρ coefficient on the interaction term is also expected to be negative if the effect of EU trade agreements is to reinforce the impact of ISO certifications on emissions.

Results

Descriptive Statistics and Correlations

Our descriptive statistics and correlations are presented in Table 2. The correlation table shows that some of the control variables (such as GDP, GDP per capita and urban population) are highly correlated with one another. We address potential multicollinearity issues in the following ways. First, we estimate our GMM model in first differences to remove any country-specific unobservable time-constant factors. The pairwise correlations between the variables in first-differences⁸ are much lower than those in the actual levels shown in Table 2. Thus, we believe that our estimation approach further mitigates any multicollinearity concerns (Schroeder, Lander, & Levine-Silverman, 1990). Second, we also rerun the regressions by selectively dropping some of the regressors that are more highly correlated. This alters some of the estimates but leaves the results unchanged⁹. However, we believe that the model would be mis-specified if we removed some of these regressors, so we therefore opted for the specification presented in the paper.

⁷ As we interact the number of ISO-14001 certifications with the trade agreement indicators, we instrument these latter interaction terms with lags of themselves as well.

⁸ The table with the correlations of the variables in first-differences can be made available upon request.

⁹ We re-ran the regressions by dropping the highly correlated regressors and these results are also available upon request.

Table 2: Descriptive statistics and Correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
(1) Ln(ISO-14001)	1																		
(2) Ln(CO ₂)	0.813*	1																	
(3) Ln(CH ₄)	0.445*	0.714*	1																
(4) Ln(N ₂ O)	0.476*	0.651*	0.892*	1															
(5) Ln(BLC)	0.471*	0.642*	0.833*	0.856*	1														
(6) Ln(SO ₂)	0.688*	0.909*	0.749*	0.692*	0.722*	1													
(7) Ln(NO _x)	0.746*	0.955*	0.818*	0.772*	0.799*	0.948*	1												
(8) Ln(GDP)	0.868*	0.947*	0.687*	0.676*	0.667*	0.838*	0.924*	1											
(9) Ln(GDP pc)	0.728*	0.603*	0.064*	0.059*	-0.010	0.400*	0.454*	0.683*	1										
(10) Democracy	0.393*	0.170*	-0.118*	0.045	-0.028	0.096*	0.128*	0.280*	0.477*	1									
(11) Ln(Industry)	0.221*	0.431*	0.364*	0.182*	0.210*	0.396*	0.406*	0.328*	0.239*	-0.302*	1								
(12) Ln(FDI)	0.862*	0.852*	0.510*	0.507*	0.476*	0.721*	0.796*	0.898*	0.754*	0.339*	0.255*	1							
(13) Ln(Exports)	0.149*	0.095*	-0.250*	-0.321*	-0.337*	-0.025	-0.040	0.024	0.416*	0.058*	0.342*	0.241*	1						
(14) Ln(Urban Pop.)	0.557*	0.558*	0.116*	0.072*	-0.054*	0.379*	0.405*	0.551*	0.796*	0.336*	0.289*	0.649*	0.379*	1					
(15) Ln(Exp treaties)	0.281*	0.253*	0.088*	0.110*	0.051*	0.205*	0.225*	0.208*	0.280*	0.094*	0.385*	0.299*	0.589*	0.205*	1				
(16) Ln(sh. exp. to EU)	0.195*	0.048*	-0.123*	0.037	-0.034	0.000	0.002	0.102*	0.184*	0.306*	-0.276*	0.159*	0.062*	0.062*	0.058*	1			
(17) Ln(Env. Treaties)	0.558*	0.416*	0.110*	0.240*	0.094*	0.253*	0.339*	0.511*	0.592*	0.515*	-0.106*	0.588*	0.108*	0.477*	0.184*	0.360*	1		
(18) EU T.A. with EP	0.477*	0.274*	-0.160*	-0.065*	-0.069	0.195*	0.196*	0.326*	0.542*	0.438*	-0.093*	0.449*	0.251*	0.411*	0.209*	0.409*	0.522*	1	
(19) EU T.A. with (above median) EP	0.462*	0.258*	-0.116*	-0.022	-0.040	0.166*	0.190*	0.307*	0.516*	0.497*	-0.090*	0.412*	0.236*	0.350*	0.211*	0.391*	0.521*	0.851*	1
Min	0	-2.276	-2.632	-3.101	-3.187	-1.044	-0.3075	20.297	5.39	0	2.175	1.779	-2.307	2.109	-13.18	-10.949	4.29	0	0
Max	11.502	9.242	6.839	6.082	7.363	10.316	10.09	30.418	11.625	10	4.382	15.51	5.443	4.605	-4.167	-0.013	5.209	1	1
Mean	3.783	3.164	2.518	1.746	1.844	4.394	4.835	24.821	8.509	6.883	3.268	9.45	3.539	3.955	-6.399	-1.376	4.631	0.355	0.285
SD	2.965	2.191	1.659	1.657	1.611	2.044	1.778	2.093	1.518	2.885	0.353	2.388	0.605	0.477	0.918	1.075	0.168	0.478	0.451

Note: * p < 0.1

Replication of Potoski and Prakash (2013)

We begin by attempting to replicate the main result of Potoski and Prakash (2013) for emissions of sulfur dioxide (SO₂). A perfect replication exercise is, unfortunately, impaired by the lack of our data on ISO-14001 certifications over the same period that Potoski and Prakash (2013) use in their analysis. Potoski and Prakash (2013) use data over the 1991-2005 period, whereas the ISO survey we have access to includes data that start in 1999 only. We were able to retrieve data from the ISO archives¹⁰ on certifications from 1995 to 1999, although we were warned that these initial years cannot be considered as informative as data post-1999.¹¹ We nonetheless attempted to replicate the results of Potoski and Prakash (2013), utilizing data over the 1995-2005 period, being aware of the limitations imposed by the provisional nature of pre-1999 ISO-14001 data, and the lack of data from 1991 to 1995. Table 3 shows these results.

In column 1, we adopt the same methodology as Potoski and Prakash (2013), i.e., a difference GMM estimator (Arellano & Bond, 1991). We confirm that ISO-14001 certifications have a negative impact on SO₂ emissions, but the coefficient that we estimate is smaller and statistically insignificant. The lack of significance can be attributed to the shorter time period at our disposal, and to the difference in size.

To guide the choice of the estimator and reassure the correct specification of the GMM model, in the remaining columns of Table 3, we compare the results by utilizing different estimators and periods of analysis. In contrast with Potoski and Prakash (2013), in this paper we make a choice in favor of the system-GMM estimator. In columns 2 and 3 we compare the results from a fixed-effects (FE) “within” estimator and a system-GMM estimator. While biased in a dynamic panel setting, the FE estimator can be taken as a lower bound estimate of the lagged dependent variable coefficient. Bond (2002) suggests that the system-GMM is to be preferred to the difference-GMM in case the GMM estimate of the lagged dependent variable ($\text{Ln}(\text{SO}_2)_{t-1}$) is close to or below the FE estimate: the difference-GMM estimate in column 1 is well below the FE estimate in column 2, suggesting that the system-GMM is the preferable estimator to use in our context.

In columns 4 and 5 we show how the results change when we extend the period under analysis to 2014, the latest available year in our data. In column 4, the effect of ISO-14001 certifications is reduced a great deal with respect to the results up to 2005, and in column 5, where we restrict the data to the (preferred) post-1999 period, the sign switches to positive: in both cases, however, the coefficients lack statistical significance.

¹⁰ We thank Laurent Charlet from the ISO for help with this.

¹¹ The ISO-14001 survey was at its very preliminary stages in 1995, and for this reason a decision was made by ISO to only make the 1999 onwards data available in the online version of the ISO survey. Additionally, another limitation is that the sample of countries included in the 1995-1999 data is only half of that included in the 1999-onwards data.

Table 3: Emissions of SO₂ – Comparison with Potoski and Prakash (2013)

	(1)	(2)	(3)	(4)	(5)
Dep Var:	Ln(SO ₂)	Ln(SO ₂)	Ln(SO ₂)	Ln(SO ₂)	Ln(SO ₂)
Estimator	PP 2013 - Difference GMM	Within-FE	System GMM	System GMM	System GMM
Years	1995-2005	1995-2005	1995-2005	1995-2014	1999-2014
Ln(SO ₂) _{t-1}	0.482*** (0.139)	0.717*** (0.0270)	0.976*** (0.0213)	0.985*** (0.0104)	0.985*** (0.0107)
Ln(ISO-14001)_{t-1}	-0.0137 (0.0111)	-0.00519 (0.00706)	-0.00571' (0.00380)	-0.000634 (0.00310)	0.00672 (0.00503)
Ln(GDP) _t	0.609*** (0.163)	0.218* (0.124)	0.0417 (0.0296)	0.0209 (0.0150)	0.00339 (0.0167)
GDP _{pc}	-0.000021* (0.000012)	-0.000021** (0.00001)	-0.000004' (0.000002)	-0.0000026* (0.0000013)	-0.0000023* (0.0000014)
GDP _{pc} ²	7.36e-11 (1.07e-10)	1.06e-10' (6.83e-11)	3.60e-11' (2.25e-11)	1.83e-11 (1.28e-11)	1.95e-11' (1.19e-11)
Ln(Industry) _t	-0.0460 (0.0677)	0.0407 (0.0608)	0.0139 (0.0224)	0.00174 (0.0185)	0.0183 (0.0201)
Ln(FDI) _t	0.00438 (0.0158)	-0.00710 (0.0140)	0.00586 (0.00570)	0.00557 (0.00565)	0.00681 (0.00623)
Ln(Exports) _t	0.0661 (0.0464)	-0.000380 (0.0380)	0.00408 (0.0211)	-0.00258 (0.00940)	-0.00779 (0.0112)
Ln(Urb. Pop) _t	0.248 (0.479)	-0.00410 (0.213)	-0.0401** (0.0187)	-0.0264' (0.0165)	-0.0233 (0.0174)
Ln(Exp. Treaties) _t	-0.00839 (0.0176)	-0.0113 (0.0165)	-0.0142' (0.00962)	-0.00322 (0.00497)	-0.00325 (0.00642)
Ln(Env. Treaties) _{t-1}	0.328 (0.691)	-0.725' (0.460)	-0.140*** (0.0465)	-0.132*** (0.0450)	-0.109** (0.0547)
Ln(Pop.)	0.813 (0.635)	0.0840 (0.217)	-0.0169 (0.0141)	-0.00749 (0.00839)	0.000353 (0.0103)
<i>N Observations</i>	1135	1135	1135	2050	1616
<i>N GMM Instr.</i>	58		92	175	169
<i>GMM Lags</i>	t-2-t-3		t-2-t-4	t-2-t-5	t-2-t-6
<i>AR 2 p-value</i>	0.462		0.149	0.376	0.450
<i>Hansen p-value</i>	0.227		0.213	0.784	0.542

Notes: We instrument the lagged dependent variable and the number of ISO-14001 certifications with lagged levels in the equation in difference (GMM lags) and lagged differences. The number of lags is adjusted across specifications to obtain estimates with valid instruments according to the AR and Hansen tests. Robust errors in parentheses; ' p <0.15, * p <0.10, ** p <0.05, ***p < 0.01

Main Empirical Findings

Given the findings in Table 3, for the remainder of the analysis we utilize the system GMM estimator and data from 1999 to 2014. The subsequent tables report the results for emissions of carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and black carbon (BLC), as well as air pollutants, such as sulfur dioxide (SO₂) and nitrogen oxide (NO_x). The coefficient on the lagged dependent variable is positive and strongly significant in all the reported specifications and in all the results tables. This is an expected finding, confirming that emissions have a very high degree of persistence from one year to the next and that our empirical model needs to include this regressor.

Table 4 shows the results for emissions of nitrous oxide (N₂O) and black carbon (BLC). For nitrous oxide (columns 1-4), neither ISO-14001 certification nor membership in an EU trade agreement with EP provisions appears to have an impact on emissions. For black carbon (columns 5-8), ISO-14001 certification appears to have no impact on these emissions after all the controls are added in the estimation. There is a negative effect emerging (column 6) when inspecting the role of trade agreements with any degree of legalization of EP provisions: surprisingly this is found to be significant only for countries with no ISO certifications. When using the stricter trade policy indicator, no negative effect on emissions is detected, with no significant interaction with the ISO certifications. Taken together, for black carbon there is little evidence that either ISO certification or EU trade agreements influence countries' emissions. Thus, in the context of nitrous oxide (N₂O) and black carbon (BLC) emissions, neither hypothesis 1 nor hypothesis 2 is supported.

Table 4: Emissions of N₂O and BLC

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ln(N ₂ O)				Ln(BLC)			
	EU TA EP		EU TA EP > med.		EU TA EP		EU TA EP > med.	
Ln(Y) _{t-1}	0.997*** (0.0106)	0.992*** (0.00889)	0.994*** (0.0118)	0.989*** (0.00900)	1.052*** (0.0139)	1.027*** (0.0150)	1.036*** (0.0130)	1.018*** (0.0145)
Ln(ISO 14001) _{t-1}	-0.00285 (0.00356)	-0.000547 (0.00325)	-0.00175 (0.00344)	0.000136 (0.00404)	-0.00305 (0.00490)	-0.00189 (0.00595)	-0.00278 (0.00472)	-0.00415 (0.00521)
EU T.A. env. _{t-1}	0.0156 (0.0155)	0.0140 (0.0203)	0.00294 (0.0123)	0.0125 (0.0204)	-0.00420 (0.0167)	-0.0352* (0.0196)	-0.0210 (0.0182)	0.00463 (0.0291)
Ln(ISO 14001) _{t-1} *EU TA		-0.00278 (0.00314)		-0.00274 (0.00329)		0.00505 (0.00441)		-0.00172 (0.00502)
Ln(GDP) _t	0.0108 (0.00939)	0.0136* (0.00821)	0.0117 (0.00979)	0.0157* (0.00848)	-0.0471*** (0.0154)	-0.0232 (0.0173)	-0.0309** (0.0149)	-0.00944 (0.0166)
Ln(GDPpc) _t	-0.00904 (0.0100)	-0.0130* (0.00741)	-0.0108 (0.0103)	-0.0173** (0.00769)	0.0301*** (0.0113)	0.00863 (0.0127)	0.0212** (0.00989)	0.00486 (0.0130)
Democracy _t	-0.000453 (0.000887)	-0.000101 (0.000731)	-0.000302 (0.000915)	-0.000110 (0.000873)	-0.00187 (0.00162)	-0.00120 (0.00173)	-0.00119 (0.00198)	-0.000625 (0.00153)
Ln(Industry) _t	0.00165 (0.00815)	0.00112 (0.00745)	0.000298 (0.00740)	0.00149 (0.00751)	0.00969 (0.0147)	0.0133 (0.0152)	0.00763 (0.0145)	0.00927 (0.0127)
Ln(FDI) _t	-0.00336 (0.00245)	-0.00308 (0.00266)	-0.00301 (0.00260)	-0.00293 (0.00264)	-0.00346 (0.00431)	-0.00457 (0.00524)	-0.00436 (0.00464)	-0.00594 (0.00440)
Ln(Exports) _t	0.00962* (0.00534)	0.00779' (0.00474)	0.00743 (0.00603)	0.00644 (0.00524)	0.00284 (0.00983)	0.00380 (0.00923)	0.00291 (0.00829)	0.00484 (0.00824)

Ln(Urb. Pop) _t	-0.00733 (0.00771)	-0.00621 (0.00623)	-0.00411 (0.00665)	-0.00268 (0.00616)	0.0373*** (0.0138)	0.0257* (0.0148)	0.0216* (0.0130)	0.0139 (0.0109)
Ln(Exp. Treaties) _t	-0.000543 (0.00274)	0.000324 (0.00227)	0.000484 (0.00293)	0.00131 (0.00269)	-0.00370 (0.00538)	-0.00284 (0.00559)	-0.00184 (0.00592)	-0.00136 (0.00548)
Ln(Share of exp. to EU)	-0.000471 (0.00270)	0.00123 (0.00259)	0.000510 (0.00245)	0.00149 (0.00223)	0.000893 (0.00520)	0.000198 (0.00484)	0.00195 (0.00489)	-0.00166 (0.00452)
Ln(Env. Treaties) _{t-1}	-0.00467 (0.0205)	0.0130 (0.0164)	0.00348 (0.0168)	0.0151 (0.0138)	0.0452 (0.0458)	0.0364 (0.0476)	0.0387 (0.0412)	0.0210 (0.0407)
Country FEs	Y	Y	Y	Y	Y	Y	Y	Y
Time FEs	Y	Y	Y	Y	Y	Y	Y	Y
N Observations	1889	1889	1889	1889	1360	1360	1360	1360
N GMM Instr.	142	186	142	186	109	142	138	182
AR(2) p-value	0.0124	0.0123	0.0125	0.0123	0.761	0.751	0.748	0.754
AR(4) p-value	0.0822	0.0803	0.0819	0.0803				
AR(5) p-value	0.235	0.239	0.238	0.239				
Hansen p-value	0.203	0.971	0.230	0.975	0.224	0.319	0.422	0.936

Notes: Estimates are obtained with a system-GMM estimator. For N₂O, we instrument the lagged dependent variable and the number of ISO-14001 certifications with lagged levels dated from t-5 to t-8 in the equation in difference and lagged differences dated t-1 in the equation in levels. For BLC, we instrument the lagged dependent variable and the number of ISO-14001 certifications with lagged levels dated from t-2 to t-4 in the equation in difference and lagged differences dated t-1 in the equation in levels. Robust errors in parentheses; ' p < 0.15, * p < 0.10, ** p < 0.05, ***p < 0.01

Table 5 shows that the number of ISO-14001 certifications has a negative impact on CO₂ emissions (columns 1-4). Importantly, this negative impact is strongly driven by the subset of countries that are part of an EU trade agreement with EP provisions, with no impact of ISO-14001 certifications for countries not part of such agreements. On the other hand, EU trade agreements are not associated with lower CO₂ emissions: no impact is detected on aggregate (columns 1 and 3), and a positive coefficient is found for countries part of an EU trade agreement with EP provisions but with zero ISO certifications.

Table 5: Emissions of CO₂ and CH₄

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ln(CO ₂)				Ln(CH ₄)			
	EU TA EP		EU TA EP > med.		EU TA EP		EU TA EP > med.	
Ln(Y) _{t-1}	0.982*** (0.00929)	0.979*** (0.00828)	0.986*** (0.00965)	0.983*** (0.00885)	0.989*** (0.0166)	1.003*** (0.0161)	0.988*** (0.0171)	0.996*** (0.0172)
Ln(ISO 14001) _{t-1}	-0.00715** (0.00343)	-0.00244 (0.00356)	-0.00621** (0.00312)	-0.00299 (0.00346)	-0.00999*** (0.00334)	-0.00600*** (0.00220)	-0.0103*** (0.00371)	-0.00606*** (0.00226)
EU T.A. env. _{t-1}	0.0133 (0.0119)	0.0344** (0.0140)	-0.00253 (0.0106)	0.0277* (0.0152)	0.0237 (0.0203)	0.0166 (0.0310)	0.0163 (0.0162)	0.0196 (0.0264)
Ln(ISO 14001) _{t-1} *EU TA		-0.00728*** (0.00245)		-0.00599** (0.00245)		-0.00207 (0.00465)		-0.00301 (0.00402)
Ln(GDP) _t	0.0267*** (0.00998)	0.0253*** (0.00859)	0.0201** (0.0102)	0.0221** (0.00906)	0.0234' (0.0148)	0.00836 (0.0141)	0.0247' (0.0164)	0.0140 (0.0169)
Ln(GDPpc) _t	-0.0156*** (0.00515)	-0.0156*** (0.00475)	-0.0123** (0.00535)	-0.0148*** (0.00514)	-0.0114 (0.0126)	-0.000124 (0.0134)	-0.0120 (0.0125)	-0.00539 (0.0145)
Democracy _t	0.000469 (0.00116)	0.000614 (0.00110)	0.000662 (0.00114)	0.000367 (0.00112)	-0.000731 (0.00120)	-0.000446 (0.000989)	-0.00113 (0.00106)	-0.000773 (0.00114)
Ln(Industry) _t	0.0247** (0.0122)	0.0280** (0.0120)	0.0207* (0.0122)	0.0224* (0.0117)	0.0135 (0.0115)	0.00598 (0.0119)	0.0109 (0.0103)	0.00926 (0.00877)
Ln(FDI) _t	0.00312 (0.00342)	0.00342 (0.00334)	0.00351 (0.00331)	0.00326 (0.00332)	-0.00145 (0.00283)	-0.00106 (0.00202)	-0.000497 (0.00241)	-0.000708 (0.00218)
Ln(Exports) _t	0.0108** (0.00550)	0.0114** (0.00526)	0.00953* (0.00533)	0.0113** (0.00548)	0.00729 (0.00574)	0.00924** (0.00467)	0.00835' (0.00578)	0.00887** (0.00427)
Ln(Urb. Pop) _t	-0.00426 (0.0106)	-0.00765 (0.0102)	-0.00771 (0.0113)	-0.00696 (0.0108)	-0.00897 (0.0101)	-0.0148' (0.00924)	-0.00642 (0.00886)	-0.0123 (0.0114)
Ln(Exp. Treaties) _t	-0.00667** (0.00326)	-0.00687** (0.00316)	-0.00615** (0.00299)	-0.00667** (0.00310)	-0.00240 (0.00321)	-0.00347 (0.00272)	-0.00254 (0.00316)	-0.00335' (0.00231)

Ln(Share of exp. to EU)	-0.00735*** (0.00276)	-0.00707*** (0.00253)	-0.00638** (0.00251)	-0.00695*** (0.00244)	-0.00111 (0.00268)	0.0000458 (0.00226)	-0.000390 (0.00250)	0.000442 (0.00210)
Ln(Env. Treaties) _{t-1}	-0.0666*** (0.0200)	-0.0342* (0.0204)	-0.0571*** (0.0187)	-0.0395** (0.0189)	-0.0213 (0.0232)	-0.00908 (0.0220)	-0.0238 (0.0232)	-0.00763 (0.0163)
Country FEs	Y	Y	Y	Y	Y	Y	Y	Y
Time FEs	Y	Y	Y	Y	Y	Y	Y	Y
N Observations	1889	1889	1889	1889	1889	1889	1889	1889
N GMM Instr.	131	169	131	169	147	192	148	193
AR(2) p-value	0.398	0.395	0.409	0.403	0.163	0.162	0.162	0.161
AR(3) p-value					0.476	0.472	0.476	0.473
Hansen p-value	0.200	0.739	0.199	0.818	0.234	0.977	0.266	0.989

Notes: Estimates are obtained with a system-GMM estimator. For CO₂, we instrument the lagged dependent variable and the number of ISO-14001 certifications with lagged levels dated from t-2 to t-3 in the equation in difference and lagged differences dated t-1 in the equation in levels. For CH₄, we instrument the lagged dependent variable and the number of ISO-14001 certifications with lagged levels dated from t-2 to t-3 in the equation in difference and lagged differences dated t-1 in the equation in levels. Robust errors in parentheses; ' p < 0.15, * p < 0.10, ** p < 0.05, ***p < 0.01

This latter, apparently odd finding can be explained by comparing columns 2 and 4. Countries with no ISO certifications are those at a lower level of development and tend to have a low degree of legalization of EP provisions in their agreements with the EU. When we restrict the trade agreement indicator to identify only those countries in agreements with a high degree of EP legalization (columns 3 and 4), the positive effect for countries with zero ISO certifications is weakened, while the negative interaction between ISO certifications and trade agreements remains negative and significant. Taken together, these findings suggest that ISO certifications are crucial for lowering CO₂ emissions, but only for countries that are part of EU trade agreements with EP provisions. Simply being part of an EU trade agreement with EP issues, however, especially where EP issues are not strongly legalized, has no impact on reducing CO₂ emissions. Thus, in the context of carbon dioxide (CO₂) emissions, both hypothesis 1 and hypothesis 2 are supported.

Table 5 also shows the results for emissions of CH₄. Similar to CO₂, ISO-14001 certifications have a strong and negative impact on methane emissions. The impact is robust to including all controls, but it does not appear to be driven by members of EU trade agreements with EP provisions. Interacting the trade agreement indicators with the number of ISO certifications in columns 6 and 8 cuts the coefficient of ISO certifications by approximately half, but does not yield a statistically significant coefficient on the interaction term. This implies that ISO certifications reduce methane emissions regardless of the countries' membership in EU trade agreements with EP provisions. Finally, there is no statistically significant impact on methane emissions from these trade agreements, per se. Thus, in the context of methane (CH₄) emissions, hypothesis 1 is supported, but hypothesis 2 is not.

Table 6 explores the effect of ISO certification and EP issues in EU trade agreements on air pollution (SO₂ and NO_x). We first examine the impact of emissions of sulfur dioxide (SO₂). For this pollutant, ISO-14001 certifications are found to have a positive effect on emissions. On a more positive note, however, being part of EU trade agreements containing EP provisions, in particular agreements with an above median legalization of EP provisions, has a negative impact on SO₂ emissions. The negative effect of trade agreements is larger than the positive effect of ISO

certifications, but the interaction term between the two variables is not statistically significant. Finally, nitrogen oxide (NO_x) emissions also appear to be negatively affected by membership in EU trade agreements with EP provisions, but not by ISO certifications. Thus, in the context of sulfur dioxide (SO₂) and nitrogen oxide (NO_x) emissions, neither hypothesis 1 nor hypothesis 2 is supported.

Table 6: Emissions of SO₂ and NO_x

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ln(SO ₂)				Ln(NO _x)			
	EU TA EP		EU TA EP > med.		EU TA EP		EU TA EP > med.	
Ln(Y) _{t-1}	1.005*** (0.00754)	1.002*** (0.00783)	1.001*** (0.00843)	0.998*** (0.00785)	0.984*** (0.0175)	0.981*** (0.0152)	0.978*** (0.0176)	0.991*** (0.0169)
Ln(ISO 14001) _{t-1}	0.0105* (0.00609)	0.0102* (0.00552)	0.0152** (0.00774)	0.0118* (0.00645)	0.00609 (0.00602)	0.00300 (0.00603)	0.00597 (0.00656)	0.00129 (0.00602)
EU T.A. env. _{t-1}	-0.0278' (0.0178)	-0.0337 (0.0284)	-0.0409** (0.0190)	-0.0395 (0.0369)	-0.0326* (0.0184)	-0.0608*** (0.0235)	-0.0226 (0.0166)	-0.0343 (0.0323)
Ln(ISO 14001) _{t-1} *EU TA		0.00159 (0.00502)		0.00190 (0.00619)		0.00645 (0.00453)		0.00240 (0.00523)
Ln(GDP) _t	-0.0194** (0.00966)	-0.0155' (0.0103)	-0.0185' (0.0117)	-0.0135 (0.0104)	0.0147 (0.0160)	0.0197' (0.0126)	0.0205 (0.0159)	0.0141 (0.0145)
Ln(GDPpc) _t	-0.00427 (0.00747)	-0.00678 (0.00719)	-0.00826 (0.00806)	-0.00890 (0.00833)	-0.0205* (0.0111)	-0.0223** (0.00918)	-0.0241** (0.0110)	-0.0153' (0.00976)
Democracy _t	0.00133 (0.00175)	0.00104 (0.00192)	0.00172 (0.00200)	0.00166 (0.00190)	0.000939 (0.00118)	0.00121 (0.00117)	0.00127 (0.00119)	0.00121 (0.00118)
Ln(Industry) _t	0.0237' (0.0164)	0.0203 (0.0183)	0.0175 (0.0211)	0.0222 (0.0194)	0.0273* (0.0156)	0.0210' (0.0140)	0.0303** (0.0153)	0.0155 (0.0151)
Ln(FDI) _t	0.00437 (0.00545)	0.00463 (0.00551)	0.00436 (0.00568)	0.00529 (0.00593)	-0.00201 (0.00303)	-0.000560 (0.00313)	-0.00224 (0.00303)	-0.00355 (0.00297)
Ln(Exports) _t	-0.00645 (0.00936)	-0.00306 (0.00859)	0.000165 (0.00993)	0.000867 (0.00965)	0.0174** (0.00779)	0.0208** (0.00861)	0.0184** (0.00751)	0.0205** (0.00837)
Ln(Urb. Pop) _t	-0.0195 (0.0147)	-0.0198' (0.0133)	-0.0258** (0.0131)	-0.0242* (0.0135)	-0.00531 (0.0108)	0.000902 (0.0108)	-0.00451 (0.0111)	-0.00771 (0.0103)

Ln(Exp. Treaties) _t	-0.00403 (0.00449)	-0.00327 (0.00490)	-0.00455 (0.00541)	-0.00366 (0.00581)	-0.0113** (0.00501)	-0.0123*** (0.00430)	-0.0125*** (0.00458)	-0.0117*** (0.00426)
Ln(Share of exp. to EU)	-0.00182 (0.00410)	-0.00444 (0.00437)	-0.00631 (0.00548)	-0.00613 (0.00480)	-0.00127 (0.00491)	-0.00349 (0.00392)	-0.00284 (0.00428)	-0.00273 (0.00399)
Ln(Env. Treaties) _{t-1}	-0.0637 (0.0528)	-0.0585 (0.0556)	-0.0412 (0.0518)	-0.0586 (0.0550)	0.00857 (0.0321)	-0.0194 (0.0293)	-0.00284 (0.0314)	-0.0115 (0.0241)
Country FEs	Y	Y	Y	Y	Y	Y	Y	Y
Time FEs	Y	Y	Y	Y	Y	Y	Y	Y
N Observations	1616	1616	1616	1616	1360	1360	1360	1360
N GMM Instr.	133	174	153	202	136	180	137	181
AR(2) p-value	0.787	0.791	0.790	0.795	0.0670	0.0587	0.0675	0.0650
AR(3) p-value					0.984	0.993	0.983	0.999
Hansen p-value	0.170	0.832	0.260	0.983	0.198	0.911	0.200	0.866

Notes: Estimates are obtained with a system-GMM estimator. For SO₂, we instrument the lagged dependent variable and the number of ISO-14001 certifications with lagged levels dated from t-2 to t-4 in the equation in difference and lagged differences dated t-1 in the equation in levels. For NO_x, we instrument the lagged dependent variable and the number of ISO-14001 certifications with lagged levels dated from t-3 to t-9 in the equation in difference and lagged differences dated t-1 in the equation in levels. Robust errors in parentheses; ' p < 0.15, * p < 0.10, ** p < 0.05, *** p < 0.01

Robustness Tests

To test the robustness of our findings, we conducted a series of further analyses. First, we re-ran our analyses by excluding EU member countries from our sample. This is because of hypothesis 2, where we argued that trade agreements with the EU having environmental protection (EP) provisions moderate the effect of ISO-14001 on emissions. Although EP provisions in these trade agreements apply to both EU and non-EU members, one may argue that the EU is 'demanding' the inclusion of these provisions in trade agreements. It is therefore of interest to inspect whether EP provisions also have an effect on emissions of the subsample of countries on which these provisions are 'imposed'. Our results are presented in the online 'Supplementary File' in Tables A1.1, A1.2, and A1.3. All of our main results are confirmed.

Second, since the ISO survey was at its preliminary stages at the beginning of our observation period (1999), it may be possible that the effect of the ISO-14001 certifications on emissions might have taken some time to materialize. Additionally, the work of Potoski and Prakash (2013), which we replicate and substantially extend, utilized data over the 1995-2005 period. It is of interest, therefore, to explore whether restricting our analysis to more recent years shows results that differ significantly from those obtained with the full data. This allows us to exclude particular effects that might have been at work during the early years over which firms could obtain the ISO-14001 certification, and to conduct an analysis over a set of years that do not overlap with those examined by Potoski and Prakash (2013). In this test, we restrict the time dimension of our panel by dropping one year of data at the time to observe whether the impact of ISO-14001 certifications and EU trade agreements with EP provisions is affected by the exclusion of the initial years of our data. Our results are presented in Tables A2.1-A2.6 of the online 'Supplementary File', where we re-estimate our main empirical models over different time periods. The empirical results are broadly confirmed.

Third, because institutional pressures on environmental protection will increase with a greater population (Aravind & Christmann, 2011), we investigate whether our results hold if we used the per-capita emissions of the countries rather than the overall aggregate volume of emissions (as included in our main analysis) or by controlling for the population of the countries. We re-ran our analysis by doing so. The results are presented in the online 'Supplementary File' in Tables A3.1.1 – A3.3.3. Our results, largely, remain intact.

Finally, we re-estimated our main empirical models by adding the (log) value of export of mineral fuels as a control variable. This variable includes exports of coal and peat, petroleum and derived products, and gas, both natural and manufactured. The data for this test were obtained from the UN Comtrade database, from which we used exports of Section 3 of the Standard International Trade Classification (SITC) for all the countries in our sample. Controlling for exports of fuels could be of relevance if this variable were correlated with our main variable of interest, i.e., the number of ISO-14001 certifications or the presence of a trade agreement with environmental provisions, thereby causing an omitted variable bias. The results are presented in our online 'Supplementary File' in Tables A4.1, A4.2, and A4.3. All our results remain intact.

Discussion And Conclusions

The great challenges of global warming and climate change certainly require coordinated efforts by a variety of stakeholders, including businesses and governments, on a global scale. Emissions of air pollutants and greenhouse gases significantly contribute to these issues and will increasingly have an adverse impact on human health and sustainable development (Kolk & Pinkse, 2008). The spread of private regulatory standards for environmental management, importantly the ISO-14001, has been argued to prevent MNEs from locating their polluting subsidiaries in countries with lax environmental regulations (Christmann & Taylor, 2001), although the impact of this standard on the environment is contested (Boiral, Guillaumie, Heras-Saizarbitoria, & Tayo Tene, 2018). There is extensive literature on the reasons for the adoption of ISO-14001, which includes the role of the expectations of companies higher up the supply chain on lower tier suppliers (Boiral, Guillaumie, Heras-Saizarbitoria, & Tayo Tene, 2018). Our paper seeks to build on and extend the existing literature on the impact of both the private ISO 14001 standards and that of international governance mechanisms on the emissions of air pollutants and greenhouse gases (Delmas & Montiel, 2008, Jiang & Bansal, 2003, Potoski & Prakash, 2013).

Theoretical Implications

Our paper looked at (1) whether ISO-14001 levels are associated with reduced levels of greenhouse gases (CO₂, CH₄, N₂O and BLC) and air pollutants (SO₂ and NO_x) and (2) how ISO-14001 certification interacts with broader political and regulatory expectations by considering EU trade agreements and the environmental protections contained therein. In hypothesis 1, we expected that greater levels of ISO-14001 adoption would reduce national emissions of both greenhouse gases and air pollutants, following the same theoretical logics as Potoski and Prakash (2013), and complementing with environmental stewardship and MNE responsibility frameworks (Dau, Moore, Doh, & Soto, 2021, Guimaraes & Liska, 1995, Kolk, 2016, Kolk & Van Tulder, 2010, Sinkovics, Sinkovics, & Archie-Acheampong, 2021a, Sinkovics, Sinkovics, & Archie-Acheampong, 2021b). The results paint a somewhat more complicated picture than might be expected: ISO-14001 certifications are associated with lower emissions of the greenhouse gases CO₂ and CH₄, but not in the case of N₂O and BLC. An explanation of this could be that CO₂ and CH₄ comprise 91% of greenhouse gases and are thus 'highly visible'. CO₂, in fact, comprises approximately 81% of the greenhouse gases and is thus a leading contributor to climate change. It is thus plausible that there is greater focus on

reducing CO₂ and CH₄ emissions within the ISO-14001 standard; however, this warrants further research. This finding also implies that corporations focus on sustainability matters that are prominent or salient to the wider public because of potential reputational effects, as distinct from a desire to achieve an environmental goal (Lashitew, 2021). It also implies that most firms, especially those engaged in GVCs, apply sustainability standards at operational levels to maintain their legitimacy, and only a few firms may be able to undertake deeper levels of responsible actions (Sinkovics, Sinkovics, & Archie-Acheampong, 2021a).

We also find that ISO-14001 certifications are not associated with lower levels of emissions of air pollutants SO₂ and NO_x. Other than unexpected, this finding is at odds with the results of Potoski and Prakash (2013), who found a negative impact of ISO-14001 on SO₂ emissions. A possible explanation of this could be that due to tighter public regulations in reducing these ‘harmful’ industrial pollutants in many emerging economies (Ni, Tamechika, Otsuki, & Honda, 2019; Pei, Sturm, & Yu, 2020), the utility of ISO-14001 in reducing these emissions might have been reduced. This can also be reflected in our finding that membership of an EU trade agreement with EP provisions is (directly) associated with lower emissions of SO₂ and NO_x.

In relation to hypothesis 2, the moderating effect of EU trade agreements with EP provisions on the association between ISO-14001 and reduced emissions is only supported for the case of CO₂. As such, the joint effect is seen only in the case of the highly visible greenhouse gas, but not in the case of other pollutants. Again, one could argue that this is due to the larger focus on CO₂ in climate change discussions, thus engendering collective action at a global level (Ostrom, 2010). This is also largely due to countries’ commitment to reducing CO₂ emissions under the Kyoto Agreement and the greater focus on reducing GHGs in the UN’s Sustainable Development Goals (Goal 13). Our findings in this regard speak to the complex interactions of international trade agreements, national governance, and firm responses. Dau et al. (2021) suggested that national regulatory quality was an important element in the transfer of international agreements to local firms. Gereffi, Lim and Lee (2021) examined how trade agreements affect firm strategies, arguing that trade restrictions present opportunities for firms to upgrade their operations or reconfigure them. There is no reason to think that it is only due to traditional trade restrictions; voluntary export restraints, for example, are also implicated here. Our findings suggest that firms adapt to environmental provisions in much the same manner.

Policy Implications

The findings from our study offer a number of policy implications for both public policymakers and firms. Since reducing pollution requires a global and collective effort, the United Nations (UN) has proposed the National Sustainable Development Strategy (NSDS) since 1992 to call upon countries to integrate economic objectives with social and environmental initiatives. The UN also encourages governments to incorporate the 17 Sustainable Development Goals (SDGs) into their national strategies to achieve the 2030 agenda. In this context, the European Union (EU) is widely seen as having a strong commitment to sustainability, as manifested in the non-trade elements of its international relationships (Lashitew, 2021). As such, for *public policymakers*, our findings based on the EU’s trade agreements with sustainability provisions show that such trade policy arrangements with environmental provisions positively interact with private or voluntary systems, such as ISO-14001, in reducing emissions of GHGs (especially CO₂) at the national level. We also find that environmental policy provisions in trade agreements have a direct effect on reducing harmful SO₂ and NO_x pollutants. In short, for policymakers we present a positive case of trade policy arrangements with environmental provisions, as these tend to be effective (at least partially) in achieving climate change and other environmental objectives (SDG-13, for example).

Our empirical findings also indirectly suggest that developing countries (with lower levels of GDP per capita) are more likely to pollute. Developing countries (e.g., the global South) are important locations for MNEs to conduct their manufacturing activity and to export intermediate and finished products to global markets. Policymakers in these countries are often pressured, on the one hand, to lower their environmental regulations in order to attract pollution-intensive manufacturing activity and maintain trade competitiveness, leading many developing countries to be “stuck at the bottom” (Porter, 1999). On the other hand, they are also pressured to engage in sustainable development, despite internal institutional voids and governance gaps in enforcing strong environmental regulations (Blackman, 2008, Cave & Blomquist, 2008). According to our findings, developing countries can approach this dilemma by negotiating trade agreements (e.g. lower trade barriers) that include sustainability provisions with their major export markets (such as the EU, in our case), since environmental provisions provide a ‘soft law’ approach and complement voluntary programs mandated by lead firms in GVCs. Brandi et al. (2019) find that non-trade provisions in trade agreements represent credible commitments, and translate into regulations that impose higher costs on the operations of foreign multinationals. Further, Brandi et al (2020) find that environmental provisions in trade agreements reduce dirty exports and increase green exports from developing countries. The “greening” of trade agreements also enjoy strong public support in developed markets (Esty, 2001), potentially reducing the liabilities of origin (Marano & Kostova, 2016) of imports from developing countries. Overall, our work relates to other observations about the interaction of policy – particularly EU policies – on voluntary standards and corporate responses to societal pressures (Lashitew, 2021). Our work has also sought to engage with Van Assche’s (2018) call for international business (IB) scholarship to gain a seat at the policymaking table alongside international economics. The relative absence of an account of the interaction of policy and corporate activity has placed IB scholarship in a peripheral position (Gereffi, 2019). We also engage with calls for IB scholarship to respond to the great challenges of our time, in this case climate change and pollution (Buckley, Doh, & Benischke, 2017).

For *managers*, although our analysis does not account for micro-firm-level factors, we do present a positive case for the adoption of voluntary standards, as well as for engaging in deeper levels of responsible behavior in environmental management (Sinkovics, Sinkovics, & Archie-Acheampong, 2021a). Managers have mixed perceptions about whether the adoption of voluntary standards and conformance to public policies makes a real difference (Cacioppe, Forster, & Fox, 2008, Murmura, Bravi, & Palazzi, 2017). They are also constrained by firm-level resources and capabilities in adopting responsible actions and thus engage in such actions at different levels in terms of their width and depth (Sinkovics, Sinkovics, & Archie-Acheampong, 2021a). However, at the same time firms are increasingly required to report their responsible actions and link them to wider sustainability frameworks such as the UN’s SDGs and the UN Global Compact’s principles. Our findings show that for CO₂ (carbon dioxide) and CH₄ (methane), which comprise approximately 91% of the GHGs, the adoption of ISO-14001 significantly reduces their emissions. Thus, the adoption of voluntary environmental standards (especially ISO-14001, which we focus on) is associated with lowering GHG emissions; goal 13 under UN SDGs and principles 7, 8 and 9 under the UN Global Compact. As there has been mixed evidence (and belief) on whether ISO-14001 indeed helps reduce emissions, our positive finding on the impact of this standard can be encouraging for firms to adopt this standard.

Limitations

Despite our contributions, and like all academic studies, we acknowledge that our study has limitations, and we suggest that these provide worthwhile avenues for further research. First, our study is based on cross-country data on both ISO-14001 adoptions and emission levels and lacks a firm-level analysis. Analysis at the firm or MNE level would have allowed us to explicate the deeper

nuances of the competitive effects of firm and industry characteristics and would have significantly improved our contributions and implications. Secondary data on firm-level adoption of ISO-14001 certifications are, however, very rare and would have required us to conduct a questionnaire survey, which itself results in data limitations. Our limitation of using country-level data also limits us from testing the effect of firm-level factors (in our case, ISO-14001 adoption) on country-level outcomes (i.e., reduction of emissions) in a more robust way. One may argue that the ‘aggregation’ logic of firm-level decisions on country-level outcomes would require a certain threshold of firms in adopting ISO-14001 to have a normative force on other firms to adopt environmentally friendly practices to subsequently impact country-level emissions. This could be possible if we had the data at a firm level or at subnational levels and by using multilevel techniques of analysis (Hitt, Beamish, Jackson, & Mathieu, 2007). We suggest future research to explore this. Second, despite ISO-14001 being a globally and widely adopted environmental certification standard, we also acknowledge that we do not account for other standards, such as the EU’s Eco-management and Audit Scheme (EMAS) and Responsible Care. Both of these standards are, however, region specific – for example, the EMAS is diffused more widely in the EU, whereas Responsible Care is diffused more widely in the United States’ chemical industry. Including a number of standards would again have reduced our sample significantly and would have undermined the generalizability of our findings regarding ISO-14001. We suggest that future studies can consider the aforementioned possibilities.

Bibliography

- Bednar-Friedl, B., Schinko, T. and Steininger, K. (2012), 'The relevance of process emissions for carbon leakage: A comparison of unilateral climate policy options with and without border carbon adjustment' *Energy Economics* 34: S168–S180
- Abbott, K. W., Keohane, R. O., Moravcsik, A., Slaughter, A.-M., & Snidal, D. 2000. The concept of legalization. *International Organization*, 54(3): 401-19.
- Aragón-Correa, J. A. & Sharma, S. 2003. A contingent resource-based view of proactive corporate environmental strategy. *Academy of Management Review*, 28(1): 71-88.
- Aravind, D. & Christmann, P. 2011. Decoupling of standard implementation from certification: does quality of ISO 14001 implementation affect facilities' environmental performance? *Business Ethics Quarterly*, 21(1): 73-102.
- Arellano, M. & Bond, S. 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2): 277-97.
- Arimura, T. H., Darnall, N., Ganguli, R., & Katayama, H. 2016. The effect of ISO 14001 on environmental performance: Resolving equivocal findings. *Journal of Environmental Management*, 166: 556-66.
- Arimura, T. H., Hibiki, A., & Katayama, H. 2008. Is a voluntary approach an effective environmental policy instrument?: A case for environmental management systems. *Journal of Environmental Economics and Management*, 55(3): 281-95.
- Atici, C. 2009. Pollution without subsidy? What is the environmental performance index overlooking? *Ecological Economics*, 68(7): 1903-07.
- Bartley, T. 2003. Certifying forests and factories: States, social movements, and the rise of private regulation in the apparel and forest products fields. *Politics & Society*, 31(3): 433-64.
- Bechtel, M. M. & Tosun, J. 2009. Changing economic openness for environmental policy convergence: When can bilateral trade agreements induce convergence of environmental regulation? *International Studies Quarterly*, 53(4): 931-53.
- Berliner, D. & Prakash, A. 2013. Signaling environmental stewardship in the shadow of weak governance: The global diffusion of ISO 14001. *Law & Society Review*, 47(2): 345-73.
- Blackman, A. 2008. Can voluntary environmental regulation work in developing countries? Lessons from case studies. *Policy Studies Journal*, 36(1): 119-41.
- Blundell, R. & Bond, S. 1998. Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1): 115-43.
- Boddewyn, J. J. 1985. Advertising self-regulation: private government and agent of public policy. *Journal of Public Policy & Marketing*, 4(1): 129-41.
- Boiral, O., Guillaumie, L., Heras-Saizarbitoria, I., & Tayo Tene, C. V. 2018. Adoption and outcomes of ISO 14001: a systematic review. *International Journal of Management Reviews*, 20(2): 411-32.
- Bond, S. R. 2002. Dynamic panel data models: a guide to micro data methods and practice. *Portuguese Economic Journal*, 1(2): 141-62.
- Borchert, I., Conconi, P., Di Ubaldo, M., & Herghelegiu, C. 2021. The Pursuit of Non-Trade Policy Objectives in EU Trade Policy. *World Trade Review*, 20(5): 623-647.

- Brandi, C., Blümer, D., & Morin, J.-F. 2019. When do international treaties matter for domestic environmental legislation? *Global Environmental Politics*, 19(4): 14-44.
- Brandi, C., Schwab, J., Berger, A., & Morin, J.-F. 2020. Do environmental provisions in trade agreements make exports from developing countries greener? *World Development*, 129: 104899.
- Buckley, P. J. 2021. Exogenous and endogenous change in global value chains. *Journal of International Business Policy*, 4: 221–227 (2021). <https://doi.org/10.1057/s42214-021-00110-z>
- Buckley, P. J., Doh, J. P., & Benischke, M. H. 2017. Towards a renaissance in international business research? Big questions, grand challenges, and the future of IB scholarship. *Journal of International Business Studies*, 48(9): 1045-64.
- Büthe, T. 2010. Private regulation in the global economy: a (P) review. *Business and Politics*, 12(3): 1-38.
- Cacioppe, R., Forster, N., & Fox, M. 2008. A survey of managers' perceptions of corporate ethics and social responsibility and actions that may affect companies' success. *Journal of Business Ethics*, 82(3): 681-700.
- Cave, L. A. & Blomquist, G. C. 2008. Environmental policy in the European Union: Fostering the development of pollution havens? *Ecological Economics*, 65(2): 253-61.
- Chan, E. S. & Wong, S. C. 2006. Motivations for ISO 14001 in the hotel industry. *Tourism Management*, 27(3): 481-92.
- Christmann, P. 2004. Multinational companies and the natural environment: Determinants of global environmental policy. *Academy of Management Journal*, 47(5): 747-60.
- Christmann, P. & Taylor, G. 2001. Globalization and the environment: Determinants of firm self-regulation in China. *Journal of International Business Studies*, 32(3): 439-58.
- Christmann, P. & Taylor, G. 2002. Globalization and the environment: Strategies for international voluntary environmental initiatives. *Academy of Management Perspectives*, 16(3): 121-35.
- Cole, M. A. 2004. Trade, the pollution haven hypothesis and the environmental Kuznets curve: examining the linkages. *Ecological Economics*, 48(1): 71-81.
- COP26. 2021. COP26 The Glasgow Climate Pact. Paper presented at UN Climate Change Conference Glasgow.
- Coslovsky, S. V. & Locke, R. 2013. Parallel paths to enforcement: Private compliance, public regulation, and labor standards in the Brazilian sugar sector. *Politics & Society*, 41(4): 497-526.
- Cucchiella, F., Gastaldi, M., & Miliacca, M. 2017. The management of greenhouse gas emissions and its effects on firm performance. *Journal of Cleaner Production*, 167: 1387-400.
- Curkovic, S. & Sroufe, R. 2011. Using ISO 14001 to promote a sustainable supply chain strategy. *Business Strategy and the Environment*, 20(2): 71-93.
- Damro, C. 2012. Market power europe. *Journal of European Public Policy*, 19(5): 682-99.
- Darnall, N., Henriques, I., & Sadorsky, P. 2008. Do environmental management systems improve business performance in an international setting? *Journal of International Management*, 14(4): 364-76.
- Dau, L. A., Moore, E. M., Doh, J. P., & Soto, M. A. 2021. Does global integration stimulate corporate citizenship? The effect of international trade agreements and regulatory quality on state and private firm adoption of CSR standards. *Journal of International Business Policy* (2021). <https://doi.org/10.1057/s42214-021-00104-x>

- Delmas, M. & Montiel, I. 2008. The diffusion of voluntary international management standards: Responsible Care, ISO 9000, and ISO 14001 in the chemical industry. *Policy Studies Journal*, 36(1): 65-93.
- Delmas, M. & Toffel, M. W. 2004. Stakeholders and environmental management practices: an institutional framework. *Business strategy and the Environment*, 13(4): 209-22.
- Delmas, M. A. & Montes-Sancho, M. J. 2011. An institutional perspective on the diffusion of international management system standards: The case of the environmental management standard ISO 14001. *Business Ethics Quarterly*, 21(1): 103-32.
- DiMaggio, P. J. & Powell, W. W. 1983. The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48(2): 147-60.
- Djekic, I., Miocinovic, J., Tomasevic, I., Smigic, N., & Tomic, N. 2014. Environmental life-cycle assessment of various dairy products. *Journal of Cleaner Production*, 68: 64-72.
- Dür, A., Baccini, L., & Elsig, M. 2014. The design of international trade agreements: Introducing a new dataset. *The Review of International Organizations*, 9(3): 353-75.
- El Ghoul, S., Guedhami, O., & Kim, Y. 2017. Country-level institutions, firm value, and the role of corporate social responsibility initiatives. *Journal of International Business Studies*, 48(3): 360-85.
- Esty, D. C. 2001. Bridging the trade-environment divide. *Journal of Economic Perspectives*, 15(3): 113-30.
- Falkner, R. 2007. The political economy of 'normative power' Europe: EU environmental leadership in international biotechnology regulation. *Journal of European Public Policy*, 14(4): 507-26.
- Fiaschi, D., Giuliani, E., & Nieri, F. 2017. Overcoming the liability of origin by doing no-harm: Emerging country firms' social irresponsibility as they go global. *Journal of World Business*, 52(4): 546-63.
- Fredriksson, P. G., Neumayer, E., Damania, R., & Gates, S. 2005. Environmentalism, democracy, and pollution control. *Journal of Environmental Economics and Management*, 49(2): 343-65.
- Gereffi, G. 2019. Global value chains and international development policy: Bringing firms, networks and policy-engaged scholarship back in. *Journal of International Business Policy*, 2(3): 195-210.
- Gereffi, G., Lim, H.-C., & Lee, J. 2021. Trade policies, firm strategies, and adaptive reconfigurations of global value chains. *Journal of International Business Policy*, 4: 506–522 (2021). <https://doi.org/10.1057/s42214-021-00102-z>
- Grossman, G. M. & Krueger, A. B. 1995. Economic growth and the environment. *The Quarterly Journal of Economics*, 110(2): 353-77.
- Guimaraes, T. & Liska, K. 1995. Exploring the business benefits of environmental stewardship. *Business Strategy and the Environment*, 4(1): 9-22.
- Harrison, A. E. & Eskeland, G. 1997. *Moving to greener pastures? Multinationals and the pollution-haven hypothesis*: The World Bank.
- Hartmann, J. & Uhlenbruck, K. 2015. National institutional antecedents to corporate environmental performance. *Journal of World Business*, 50(4): 729-41.
- He, W. & Shen, R. 2019. ISO 14001 certification and corporate technological innovation: Evidence from Chinese firms. *Journal of Business Ethics*, 158(1): 97-117.

- Heras-Saizarbitoria, I. 2021. *ISO 9001, ISO 14001, and new management standards*: Springer.
- Heyes, A. G. & Maxwell, J. W. 2004. Private vs. public regulation: political economy of the international environment. *Journal of Environmental Economics and Management*, 48(2): 978-96.
- Hitt, M. A., Beamish, P. W., Jackson, S. E., & Mathieu, J. E. 2007. Building theoretical and empirical bridges across levels: Multilevel research in management. *Academy of Management journal*, 50(6): 1385-99.
- Horbach, J. 2008. Determinants of environmental innovation—New evidence from German panel data sources. *Research Policy*, 37(1): 163-73.
- Iatridis, K. & Kesidou, E. 2018. What drives substantive versus symbolic implementation of ISO 14001 in a time of economic crisis? Insights from Greek manufacturing companies. *Journal of Business Ethics*, 148(4): 859-77.
- Ivanova, A., Gray, J., & Sinha, K. 2014. Towards a unifying theory of management standard implementation. *International Journal of Operations & Production Management*, 34(10): 1269-1306
- Jiang, R. J. & Bansal, P. 2003. Seeing the need for ISO 14001. *Journal of Management Studies*, 40(4): 1047-67.
- Kelemen, R. D. 2010. Globalizing European union environmental policy. *Journal of European Public Policy*, 17(3): 335-49.
- Kettunen, M., Bodin, E., Davey, E., Gionfra, S., & Charveriat, C. 2020. An EU Green Deal for trade policy and the environment: Aligning trade with climate and sustainable development objectives: Institute for European Environmental Policy
- King, A. A., Lenox, M. J., & Terlaak, A. 2005. The strategic use of decentralized institutions: Exploring certification with the ISO 14001 management standard. *Academy of Management Journal*, 48(6): 1091-106.
- Kolk, A. 2016. The social responsibility of international business: From ethics and the environment to CSR and sustainable development. *Journal of World Business*, 51(1): 23-34.
- Kolk, A. & Pinkse, J. 2008. A perspective on multinational enterprises and climate change: Learning from “an inconvenient truth”? *Journal of International Business Studies*, 39(8): 1359-78.
- Kolk, A. & Van Tulder, R. 2010. International business, corporate social responsibility and sustainable development. *International Business Review*, 19(2): 119-25.
- Lashitew, A. A. 2021. Corporate uptake of the Sustainable Development Goals: Mere greenwashing or an advent of institutional change? *Journal of International Business Policy*, 4:184–200 (2021). <https://doi.org/10.1057/s42214-020-00092-4>
- Lavenex, S. 2014. The power of functionalist extension: how EU rules travel. *Journal of European Public Policy*, 21(6): 885-903.
- Lavenex, S. & Schimmelfennig, F. 2009. EU rules beyond EU borders: theorizing external governance in European politics. *Journal of European Public Policy*, 16(6): 791-812.
- Lawton, T. C. & McGuire, S. M. 2003. Governing the Electronic Market Space: Appraising the Apparent Global Consensus on E-Commerce Self-regulation. In: Macharzina K. (eds) *Management International Review. Journal of Business MIR*, vol 1. Gabler Verlag, Wiesbaden.
- Lechner, L. 2016. The domestic battle over the design of non-trade issues in preferential trade agreements. *Review of International Political Economy*, 23(5): 840-71.
- Leipziger, D. 2017. *The corporate responsibility code book*: Routledge.

- Leonidou, L. C., Fotiadis, T. A., Christodoulides, P., Spyropoulou, S., & Katsikeas, C. S. 2015. Environmentally friendly export business strategy: Its determinants and effects on competitive advantage and performance. *International Business Review*, 24(5): 798-811.
- Lerner, S. & Carr, A. 1994. Local stewardship. *Alternatives*, 20(2): 14-19.
- Locke, R. M., Rissing, B. A., & Pal, T. 2013. Complements or substitutes? Private codes, state regulation and the enforcement of labour standards in global supply chains. *British Journal of Industrial Relations*, 51(3): 519-52.
- Marano, V. & Kostova, T. 2016. Unpacking the institutional complexity in adoption of CSR practices in multinational enterprises. *Journal of Management Studies*, 53(1): 28-54.
- Marano, V., Tashman, P., & Kostova, T. 2017. Escaping the iron cage: Liabilities of origin and CSR reporting of emerging market multinational enterprises. *Journal of International Business Studies*, 48(3): 386-408.
- Mayer, F. & Gereffi, G. 2010. Regulation and economic globalization: Prospects and limits of private governance. *Business and Politics*, 12(3): 1-25.
- Morin, J. F., Pauwelyn, J., & Hollway, J. 2017. The trade regime as a complex adaptive system: Exploration and exploitation of environmental norms in trade agreements. *Journal of International Economic Law*, 20(2): 365-90.
- Morrow, D. & Rondinelli, D. 2002. Adopting corporate environmental management systems:: Motivations and results of ISO 14001 and EMAS certification. *European Management Journal*, 20(2): 159-71.
- Mügge, D. 2006. Private-public puzzles: inter-firm competition and transnational private regulation. *New Political Economy*, 11(2): 177-200.
- Murmura, F., Bravi, L., & Palazzi, F. 2017. Evaluating companies' commitment to corporate social responsibility: Perceptions of the SA 8000 standard. *Journal of Cleaner Production*, 164: 1406-18.
- Nadvi, K. 2008. Global standards, global governance and the organization of global value chains. *Journal of Economic Geography*, 8(3): 323-43.
- Ni, B., Tamechika, H., Otsuki, T., & Honda, K. 2019. Does ISO14001 raise firms' awareness of environmental protection? The case of Vietnam. *Environment and Development Economics*, 24(1): 47.
- Nordhaus, W. D. 1993. Reflections on the economics of climate change. *Journal of Economic Perspectives*, 7(4): 11-25.
- North, D. C. 1996. *Institutions, institutional change and economic performance*. Cambridge; New York [etc]: Cambridge University press.
- Ostrom, E. 2010. Polycentric systems for coping with collective action and global environmental change. *Global environmental change*, 20(4): 550-57.
- Pasquali, G., Godfrey, S., & Nadvi, K. 2020. Understanding regional value chains through the interaction of public and private governance: Insights from Southern Africa's apparel sector. *Journal of International Business Policy*, 4, 368–389 (2021). <https://doi.org/10.1057/s42214-020-00071-9>
- Pei, J., Sturm, B., & Yu, A. 2020. Are exporters more environmentally friendly? A re-appraisal that uses China's micro-data. *The World Economy*, 44(5):1402-27.
- Porter, G. 1999. Trade competition and pollution standards: "race to the bottom" or "stuck at the bottom". *The Journal of Environment & Development*, 8(2): 133-51.

- Porter, M. E. & Van der Linde, C. 1995. Toward a new conception of the environment-competitiveness relationship. *Journal of economic perspectives*, 9(4): 97-118.
- Postnikov, E. 2014. The design of social standards in EU and US preferential trade agreements, *Handbook of the international political economy of trade*: Edward Elgar Publishing.
- Potoski, M. & Prakash, A. 2005. Covenants with weak swords: ISO 14001 and facilities' environmental performance. *Journal of Policy Analysis and Management: The Journal of the Association for Public Policy Analysis and Management*, 24(4): 745-69.
- Potoski, M. & Prakash, A. 2013. Do voluntary programs reduce pollution? Examining ISO 14001's effectiveness across countries. *Policy Studies Journal*, 41(2): 273-94.
- Potoski, M. & Prakash, A. 2005. Green clubs and voluntary governance: ISO 14001 and firms' regulatory compliance. *American Journal of Political Science*, 49(2): 235-48.
- Potoski, M. & Prakash, A. 2004. The regulation dilemma: Cooperation and conflict in environmental governance. *Public Administration Review*, 64(2): 152-63.
- Prakash, A. & Potoski, M. 2014. Global private regimes, domestic public law: ISO 14001 and pollution reduction. *Comparative Political Studies*, 47(3): 369-94.
- Prakash, A. & Potoski, M. 2007. Investing up: FDI and the cross-country diffusion of ISO 14001 management systems. *International Studies Quarterly*, 51(3): 723-44.
- Prakash, A. & Potoski, M. 2006. Racing to the bottom? Trade, environmental governance, and ISO 14001. *American journal of political science*, 50(2): 350-64.
- Radonjič, G. & Tominc, P. 2006. The impact and significance of ISO 14001 certification on the adoption of new technologies. *Management of Environmental Quality*, 17(6): 707-727.
- Ramus, C. A. 2002. Encouraging innovative environmental actions: what companies and managers must do. *Journal of World Business*, 37(2): 151-64.
- Rondinelli, D. A. & Berry, M. A. 2000. Environmental citizenship in multinational corporations: social responsibility and sustainable development. *European Management Journal*, 18(1): 70-84.
- Roy, A. & Goll, I. 2014. Predictors of various facets of sustainability of nations: The role of cultural and economic factors. *International Business Review*, 23(5): 849-61.
- Schmitz, H. 2004. *Local enterprises in the global economy*: Edward Elgar Publishing.
- Schroeder, M. A., Lander, J., & Levine-Silverman, S. 1990. Diagnosing and dealing with multicollinearity. *Western Journal of Nursing Research*, 12(2): 175-87.
- Silvestre, B. S. 2015. Sustainable supply chain management in emerging economies: Environmental turbulence, institutional voids and sustainability trajectories. *International Journal of Production Economics*, 167: 156-69.
- Sims, H. 1999. One-fifth of the Sky: China's Environmental Stewardship. *World Development*, 27(7): 1227-45.
- Sinkovics, N., Sinkovics, R. R., & Archie-Acheampong, J. 2021a. The business responsibility matrix: a diagnostic tool to aid the design of better interventions for achieving the SDGs. *Multinational Business Review*, 29(1): 1-20.
- Sinkovics, N., Sinkovics, R. R., & Archie-Acheampong, J. 2021b. Small-and medium-sized enterprises and sustainable development: In the shadows of large lead firms in global value chains. *Journal of International Business Policy*, 4(1): 80-101.

- Sinopoli, D. & Purnhagen, K. 2016. Reversed Harmonization or Horizontalization of EU Standards: Does WTO Law Facilitate or Constrain the Brussels Effect. *Wisconsin International Law Journal*, 34: 92-128.
- Stewart, R. B. 1993. Environmental regulation and international competitiveness. *The Yale Law Journal*, 102(8): 2039-106.
- Van Assche, A. 2018. From the editor: Steering a policy turn in international business—opportunities and challenges, *Journal of International Business Policy*, 1(3): 117-127.
- Veugelers, R. 2012. Which policy instruments to induce clean innovating? *Research Policy*, 41(10): 1770-78.
- Vogel, D. 1986. *National styles of regulation: Environmental policy in Great Britain and the United States*: Cornell Univ Pr.
- Vogel, D. 2008. Private global business regulation. *Annual Review of Political Science*, 11: 261-82.
- Wendling, Z., Emerson, J., Esty, D. C., Levy, M. A., & Sherbinin, A. d. 2018. The 2018 Environmental Performance Index Report. New Haven, CT: Yale Center for Environmental Law and Policy.
- Yin, H. & Schmeidler, P. J. 2009. Why do standardized ISO 14001 environmental management systems lead to heterogeneous environmental outcomes? *Business Strategy and the Environment*, 18(7): 469-86.
- Zhou, P., Ang, B. W., & Poh, K. L. 2008. Measuring environmental performance under different environmental DEA technologies. *Energy Economics*, 30(1): 1-14.

Authors contacts:

Mattia Di Ubaldo

University of Sussex Business School
University of Sussex
Brighton, BN1 9SL
United Kingdom
Email: M.Di-Ubaldo@sussex.ac.uk

Steven McGuire

University of Sussex Business School
University of Sussex
Brighton, BN1 9SL
United Kingdom
Email: S.Mcguire@sussex.ac.uk

Vikrant Shirodkar

University of Sussex Business School
University of Sussex
Brighton, BN1 9SL
United Kingdom
Email: V.Shirodkar@sussex.ac.uk