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RESEARCH ARTICLE

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ISO 14001 and CO_2 emissions: An analysis of the contingent role of country features

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Abstract

This study explores whether the association between the aggregate level of ISO 14001 adoption in a country and the reduction of its CO_2 emissions differs across national settings. We analyze potential variations in three country features: intensity of competition, inclination of firms to behave ethically, and the importance that firms attach to relationships with stakeholders. Based on a sample of 53 countries for the period 2007–2017, our results show that the connection between the aggregate level of ISO 14001 adoption and lower levels of CO_2 emissions is stronger in countries where firms tend to behave ethically but is weaker in countries where there is intense competition or where firms place high emphasis on relationships with stakeholders. These findings expand our understanding about the macrolevel consequences of ISO 14001 adoption.

KEYWORDS

CO_2 emissions, ethical behavior, intensity of competition, ISO 14001, stakeholders' legitimation

1 | INTRODUCTION

There has been a growing awareness of the impact of economic activity on pollution in recent decades, which has increased pressure on firms to assume the negative consequences of their activities on the environment (Colwell & Joshi, 2013). To satisfy the social expectations about the role of firms in the preservation of natural resources, many managers may decide to adopt a certified environmental management standard (EMS). Certified EMSs guide firms in the development and implementation of an environmental management system by providing a set of organizational practices that make the environmental impact of the firm more visible and easier to control. The implementation of such practices is expected to lead eventually to an improvement in the environmental performance of the firm. Certified EMSs are adopted on a voluntary basis, and a certification body verifies that the firm conforms to the requirements of the standard (Heras-Saizarbitoria & Boiral, 2013).

ISO 14001 is the most widely diffused certified EMS at the international level. There were 358,953 ISO 14001 certifications awarded in 2017 across 181 countries (ISO Survey, 2017). ISO 14001 was published by the International Organization for Standardization in 1996. It allows firms to improve the management of their polluting activities, while externally signaling their willingness to protect the environment (Aravind & Christmann, 2011; Boiral, 2011; Boiral & Henri, 2012; Jiang & Bansal, 2003). First, as a management tool, ISO 14001 requires firms to restructure and redesign internal procedures directly related to waste management, energy use, and water consumption. Second, as a signal of environmental commitment, ISO 14001 allows firms to improve their relationships with several stakeholders by showing their environmental proactivity (King, Lenox, & Terlaak, 2005).

The motives that lead firms to adopt ISO 14001 have attracted considerable attention from scholars (e.g., Boiral, 2007; Darnall, 2006; Heras-Saizarbitoria, Arana, & Boiral, 2016; Morrow & Rondinelli, 2002; Prajogo, Tang, & Lai, 2012). Among the many motives identified by previous literature, the taxonomy proposed by Bansal and Roth (2000) is especially noteworthy. According to these authors, firms develop environmental behaviors such as ISO 14001 implementation, for three reasons: competitiveness, social

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responsibility, and legitimacy. Following Gonzalez-Benito and Gonzalez-Benito (2005), we call these competitive, ethical, and relational motives, respectively. Competitive concerns result from the search for competitive advantages, ethical concerns arise from a true awareness of social responsibility, and relational concerns emerge from the attempt to gain legitimacy in the eyes of stakeholders.

The motives underpinning ISO 14001 adoption determine the extent to which firms internalize its organizational practices and, therefore, how it contributes to reduce pollution (Boiral, 2011; Castka & Prajogo, 2013; Heras-Saizarbitoria, Arana, & Molina-Azorín, 2011; Iatridis & Kesidou, 2018; Testa, Boiral, & Iraldo, 2018). In particular, the motives for which firms adopt ISO 14001 shape whether they implement its practices in a substantive or a symbolic way (Aravind & Christmann, 2011; Lannelongue, Gonzalez-Benito, & Gonzalez-Benito, 2014). The effectiveness of ISO 14001 in reducing pollution is expected to be higher when firms develop a substantive implementation rather than a symbolic one (Aravind & Christmann, 2011; Boiral, 2011; Ferrón-Vílchez, 2016).

A substantive implementation of ISO 14001 involves full and continuous adhesion to its requirements. For instance, ISO 14001 requires firms to identify the environmental aspects of their daily work practices, develop training programs for managers and employees, and document and revise procedures that have an environmental impact (Jiang & Bansal, 2003; Oliveira, Serra, & Salgado, 2010). A substantive implementation of ISO 14001 requires a deep internalization of all of these practices, which allows firms to obtain all of the intended environmental benefits of ISO 14001 (Testa, Iraldo, & Daddi, 2017; Yin & Schmeidler, 2009).

A symbolic adoption of ISO 14001, however, means superficially integrating these organizational practices. Despite the control exerted by the certification bodies, some firms are capable of obtaining the certification without complying with all of the ISO 14001 requirements (Boiral, 2003; Christmann & Taylor, 2006; Yeung & Mok, 2005). This is known as decoupling and enables firms to obtain legitimacy while minimizing the disruption of incorporating new practices into existing activities (Meyer & Rowan, 1977). Firms that implement the standard symbolically introduce minimal changes into their daily operations and, as a consequence, are not likely to experience the environmental benefits intended by ISO 14001 (Aravind & Christmann, 2011; Yin & Schmeidler, 2009).

Regarding the environmental consequences of ISO 14001 adoption, they have been mainly evaluated at the facility level or at the firm level (e.g., Comoglio & Botta, 2012; Gomez & Rodriguez, 2011; Hasan & Chan, 2014; Zobel, 2013). The impact of ISO 14001 at the country level, however, has been underexplored. To our knowledge, only Potoski and Prakash (2013) and Prakash and Potoski (2014) have focused on the macrolevel impact of this certification, finding that the aggregate level of ISO 14001 adoption—the number of ISO 14001 certifications awarded in a country—is associated with a lower level of air pollution.

To expand previous research on the impact of ISO 14001, our study explores whether the negative relationship between the aggregate level of ISO 14001 adoption and CO_2 emissions differs across countries. Specifically, we follow Bansal and Roth (2000) to argue that the efficacy of the aggregate level of ISO 14001 adoption to reduce CO_2 emissions varies according to three country features: competition intensity, the inclination of firms to behave ethically, and the importance that firms attach to stakeholder relationships.[1] Our basic argument is that the selected country features, by shaping the motives underpinning ISO 14001 adoption, also affect the extent to which firms internalize its organizational practices and, as a consequence, determine the environmental outcomes from the aggregate implementation level (Guoyou, Saixing, Xiaodong, & Chiming, 2012).

We contend that the aggregate level of ISO 14001 adoption results from competitive motives in countries with intense competition and from ethical motives in countries where firms tend to behave ethically. We argue that when firms adopt ISO 14001 due to these motives, they completely integrate its organizational practices into their daily operations. This means that the aggregate level of ISO 14001 adoption tends to be substantial in countries where competition is intense and where firms behave following ethical precepts. As substantial implementation enhances the capacity of ISO 14001 to reduce pollution (Yin & Schmeidler, 2009), our expectation is that the association between the number of ISO 14001 certifications and a lower level of CO_2 emissions will be stronger in these countries.

We maintain, however, that the aggregate level of ISO 14001 adoption results from relational motives in countries where obtaining legitimacy from stakeholders is important for firms. We argue that when firms adopt ISO 14001 because of relational motives, they do not completely internalize its organizational practices. As a consequence, the aggregate level of ISO 14001 adoption will tend to be symbolic in countries where achieving legitimacy from stakeholders is key in business. Because symbolic implementation decreases the capacity of ISO 14001 to reduce pollution (Aravind & Christmann, 2011), we expect that the association between the number of ISO 14001 certifications and a lower level of CO_2 emissions will be weaker in these countries.

2 | THEORETICAL MODEL AND HYPOTHESES

Our theoretical model is articulated around one baseline expectation and three hypotheses. The baseline expectation refers to the expected negative relationship between the aggregate level of ISO 14001 adoption and CO_2 emissions (Potoski & Prakash, 2013; Prakash & Potoski, 2014). Our main contribution comes from three hypotheses that examine the moderating effect of country features on this relationship, and they analyze how the association between the aggregate level of ISO 14001 adoption and CO_2 emissions differs across countries in light of competition intensity competition, the extent to which

[1]Potoski and Prakash (2013) and Prakash and Potoski (2014) have analyzed the effect of the aggregate level of ISO 14001 adoption on SO_2 emissions during the period 1991–2005. The present study focuses on CO_2 emissions because of data availability.

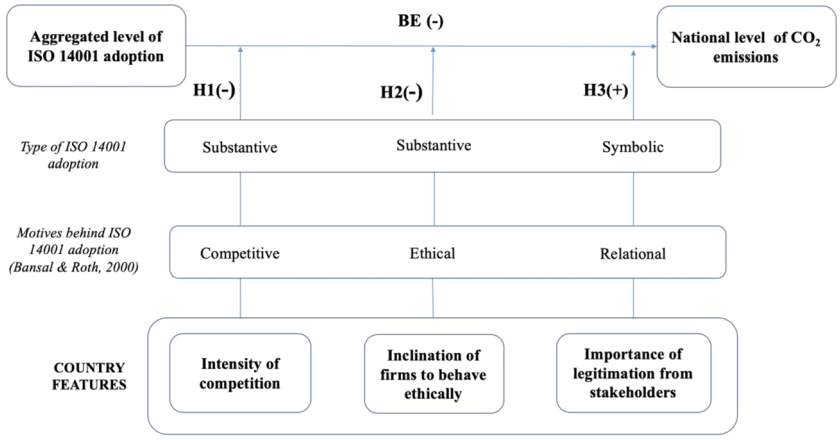

FIGURE 1 Theoretical framework and hypotheses [Colour figure can be viewed at wileyonlinelibrary.com]

firms behave ethically, and the importance that firms attach to achieving legitimacy from stakeholders. Figure 1 offers a graphical representation of our theoretical model.

2.1 | Aggregate level of ISO 14001 adoption and CO_2 emissions

Although the previous literature has identified important factors affecting the national level of air pollution (e.g., Cole & Neumayer, 2004; Lyu et al., 2016), scholars have put less emphasis on assessing the role of ISO 14001. To our knowledge, only Potoski and Prakash (2013) and Prakash and Potoski (2014) have focused on ISO 14001 as a determinant of the national level of air pollution. They found that the higher the aggregate level of ISO 14001 adoption in a country, the lower its level of air pollution, for two reasons.

First, ISO 14001 aims to improve firms' environmental management. To receive ISO 14001 certification, firms must formulate and implement an action plan for environmental management, set priorities and environmental targets, identify internal governance responsibilities for environmental issues, and carry out control and correction actions to minimize their environmental impacts (Potoski & Prakash, 2005; Radonjic & Tominc, 2007). This systematic management of environmental issues is expected to result in pollution prevention by encouraging companies to substitute harmful inputs with more environmentally conscious ones and avoid pollutant processes (Coglianese & Nash, 2001; Darnall, 2006; Delmas & Montes-Sancho, 2011).

Second, the macrolevel effect of ISO 14001 is higher than the sum of its microlevel impacts because there are spillovers from its adoption (Miyamoto & Managi, 2014; Prakash & Potoski, 2014) arising from two mechanisms: (a) coercive pressures, through which ISO 14001–certified firms require more progressive environmental practices from their suppliers and (b) mimetic and normative isomorphism, through which nonparticipants located near ISO 14001 participants may imitate their environmental practices (Arimura, Darnall, & Katayama, 2011; Prakash & Potoski, 2014). On the basis of these two arguments, our baseline expectation is as follows:

BE: *The aggregate level of ISO 14001 adoption in a country contributes to reduce CO_2 emissions.*

2.2 | Country features moderating the impact of aggregate ISO 14001 adoption level

2.2.1 | Intensity of competition and ISO 14001

The traditional view of environmental management considers environmental practices as a source of costs. This has been challenged by several studies arguing that these practices may have a positive effect on firms' economic performance (Ambec & Lanoie, 2008; Hart, 1995; Porter & van der Linde, 1995) because environmental management may increase firm productivity by leading to a more efficient use of resources. Attracted by the potential of environmental management to improve firm profitability, managers may embrace environmental practices for competitive motives (Bansal & Roth, 2000). These motives arise from the need to remain competitive within the market and usually result in greater attention to cost-benefit analysis of environmental practices.

Managers that adopt ISO 14001 in an attempt to improve firm competitiveness are mainly interested in its capacity to enhance operational efficiency (Gonzalez-Benito & Gonzalez-Benito, 2005). These managers are more likely to implement the practices established by ISO 14001 in a substantive way to fully benefit from their operational advantages. Because ISO 14001 is more effective in controlling pollution when firms implement it substantially (Aravind & Christmann, 2011; Yin & Schmeidler, 2009), it is safe to say that firms adopting ISO 14001 for competitive reasons may achieve greater reductions in their environmental impact.

We maintain that firms adopt ISO 14001 for competitive reasons in countries where the level of competition is intense because competitive pressures force firms to adopt practices that improve their competitiveness (Danis, Chiaburu, & Lyles, 2010). This means that the aggregate level of ISO 14001 adoption in highly competitive settings may be the result of firms' efforts to improve their competitive position. When this is the case, the overall level of ISO 14001

adoption is expected to be substantive, as firms moved by competitive concerns seek to benefit from the operational features of ISO 14001 by completely internalizing its practices. Because substantial implementation increases the efficacy of ISO 14001 in reducing pollution, our first hypothesis posits:

> H1. *The reduction of CO_2 emissions caused by the aggregate level of ISO 14001 adoption is higher in countries where there is intense competition.*

2.2.2 | Ethical behavior and ISO 14001

The environmental values and attitudes of managers are significant determinants of the adoption of voluntary environmentally friendly practices (Ervin, Wu, Khanna, Jones, & Wirkkala, 2013; Nakamura, Takahashi, & Vertinsky, 2001). The adoption of ISO 14001 may therefore be a result of managers' environmental awareness and sense of social responsibility. Managers who decide to implement ISO 14001 because of their ethical concerns consider that protecting the environment is the "right thing to do" (Bansal & Roth, 2000; Lampe, Ellis, & Drummond, 1991). They are thus more likely to value the environmental standard for its capacity to control their firms' environmental impact rather than for the official recognition provided by certification (Gonzalez-Benito & Gonzalez-Benito, 2005).

Ethically motivated managers are guided by their own values rather than external pressures demanding environmental preservation. As a result, they tend to implement ISO 14001 in a substantive way. These managers really believe in environmental management and are therefore more likely to deeply integrate the procedures provided by the standard (Boiral, 2011; Guoyou et al., 2012; Iatridis & Kesidou, 2018). Because firms adopting ISO 14001 for ethical reasons substantially internalize its practices, they may show lower pollution levels.

We contend that ethical reasons drive ISO 14001 adoption in countries where managers believe their firms have social obligations. In such countries, the aggregate level of ISO 14001 adoption may result from firms' ethical concerns. In these circumstances, the overall level of ISO 14001 implementation is expected to be substantive, because the aim of managers is to reduce pollution caused by their firms through actual integration of ISO 14001 practices. When the aggregate level of ISO 14001 adoption is substantial, its efficacy in reducing CO_2 emissions will be higher. Our second hypothesis therefore proposes:

> H2. *The reduction of CO_2 emissions caused by the aggregate level of ISO 14001 adoption is higher in countries where firms behave following ethical precepts.*

2.2.3 | Stakeholder legitimation and ISO 14001

Firms' adoption of certain practices may be the result of their search for social approval and legitimacy (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). Firms are interested in achieving legitimacy because it secures institutional support and increases their chances of survival (Suchman, 1995; Zucker, 1987). In their search for legitimacy, firms tend to comply with the expectations of stakeholders by incorporating practices that they consider appropriate within the established framework of norms and values (Suchman, 1995). In the field of environmental management, there is a long tradition that provides evidence of the relationship between pressure from stakeholders and the adoption of environmental practices (Perez-Batres, Doh, Miller, & Pisani, 2012). It has been established that managers may develop environmental behaviors driven by relational motives—that is, as an attempt to adapt their activities to the prevailing socioeconomic context and, in turn, to conform to stakeholder expectations (Bansal & Roth, 2000; Boiral & Sala, 1998; Gonzalez-Benito & Gonzalez-Benito, 2005).

The previous literature has shown that relational motives play an important role in the decision to adopt ISO 14001. It has been found that, by implementing ISO 14001, firms seek to improve their relationships with stakeholders such as the government, civil society, non-governmental organizations, multinational corporations, or professional associations (Delmas & Montes-Sancho, 2011; Delmas & Montiel, 2008; Delmas & Toffel, 2004; Kollman & Prakash, 2002; Neumayer & Perkins, 2004; Potoski & Prakash, 2004; Qi et al., 2011). Firms that adopt ISO 14001 for relational motives may perceive the standard as a means to achieve legitimacy rather than a management tool for controlling their environmental impact (Boiral, 2011). As a consequence, they are more likely to implement it in a symbolic way, without developing a real environmental transformation of their activities (Christmann & Taylor, 2006). As firms motivated by relational concerns tend not to integrate the practices of ISO 14001 into their regular operations, they may not fully achieve the standard's environmental benefits.

We argue that firms adopt ISO 14001 because of relational concerns in countries where maintaining cordial relationships with stakeholders is important. When this is the case, the aggregate level of ISO 14001 adoption may result from firms' efforts to satisfy social expectations. Consequently, the overall level of ISO 14001 implementation is expected to be symbolic, as firms assess this certified EMS as a means of gaining legitimacy rather than as a management tool to improve their environmental management. Because a symbolic implementation reduces the efficacy of ISO 14001 to reduce pollution, our last hypothesis establishes:

> H3. *The reduction of CO_2 emissions caused by the aggregate level of ISO 14001 adoption is lower in countries where maintaining cordial relationships with stakeholders is important.*

3 | EMPIRICAL ANALYSIS

3.1 | Research setting

We analyzed the impact of the aggregate level of ISO 14001 adoption on CO_2 emissions using a panel of 53 countries for the years 2007–2017. These countries belong to different regions, as shown in Table 1, which allows us to cover heterogeneous contexts. We obtained our data from five publicly available sources: the ISO Survey 2017 of the International Organization for Standardization,[2] the

[2]Available at https://www.iso.org/the-iso-survey.html.

TABLE 1 Countries by region included in our sample

Region	Countries	ISO certifications (2017)	% over total certifications per region
Africa	Egypt, Morocco, Namibia, Nigeria, South Africa, Zambia, Zimbawe	2,305	74.8
America	Argentina, Bolivia, Brazil, Canada, Colombia, Costa Rica, El Salvador, Guatemala, Mexico, United States of America, Venezuela	15,734	85.4
Asia, Middle East & Pacific	Australia, China, India, Indonesia, Israel, Japan, Kazakhstan, Kuwait, Malaysia, New Zealand, Philippines, Qatar, Singapore, Thailand	213,452	93.5
Europe	Albania, Austria, Czech Republic, Denmark, Finland, France, Georgia, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Poland, Russian Federation, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom	91,111	83.5
	Total	358,953	89.9

Emissions Database for Global Atmospheric Research (EDGAR),[3] the World Development Indicators of the World Bank,[4] the GLOBE project about cultural values and practices,[5] and the Global Competitiveness Index dataset provided by the World Economic Forum.[6] Although each of these datasets offers information about many countries and years, their combination only provides full information for the 53 countries in our sample for period from 2007 to 2017.[7] It is important to note that our sample of countries at the end of 2017 accounts for 89.9% of the world's ISO 14001 certifications, so it is reasonably representative of ISO 14001 adoption globally.

3.2 | Variables

3.2.1 | Dependent variable

We analyzed how the aggregate level of ISO 14001 adoption in a country determines its CO_2 emissions. To measure the level of CO_2 emissions per country and year, we used the fossil carbon dioxide emissions (expressed in Mt CO_2 per capita) provided by EDGAR in the report from Muntean et al. (2018). This variable includes emissions from fossil fuel use (combustion and flaring), industrial processes (cement, steel and chemicals), and product use. CO_2 emissions are an air pollutant, and it has been noted that air pollution is intimately related to the level of economic development that a country achieves over time (Panayotou, 1993). The yearly level of air pollution thus depends on past and contemporaneous CO_2 emissions. As noted by Testa et al. (2014), it is important to identify not only the level of air pollution but also the change in CO_2 emissions. Subsequently, our dependent variable *CO_2 emissions (% variation)* has been measured for each country and period as follows:

$$\frac{(CO_2\ emissions_t - CO_2\ emissions_{t-1})}{CO_2\ emissions_{t-1}} \times 100.$$

3.2.2 | Independent variables

The main independent variables refer to the number of ISO 14001 certifications within a country and the three country features that we analyzed. First, the variable *ISO 14001* reflects the number of certifications issued by the certification bodies of each country per year. This information was obtained from the ISO Survey 2017 provided by the International Organization for Standardization. We have weighted this figure by the country's population, so that our variable *ISO 14001* measures the number of certifications over the total population (in millions). This measure corrects for potential variations in the aggregate level of ISO 14001 adoption due to country size.

Regarding country features, we measured the level of competition within a country and the extent to which firms behave ethically using the Global Competitiveness Index (World Economic Forum, 2018). This index is developed yearly by the World Economic Forum and measures the determinants of the level of economic prosperity and productivity in a country according to national indicators and the Executive Opinion Survey. We measured the intensity of competition in a country using the dimension "intensity of local competition," which reflects how high business executives in a country perceive the intensity of local competition to be and ranges from 1 *not intensive at all* to 7 *extremely intense*. We label this variable *competitive features*. We proxy the inclination of firms to behave ethically according to the variable "corporate ethics," which measures the degree to which business executives in a country perceive that firms behave ethically in their interaction with public officials, politicians, and other firms. It ranges from 1 *extremely poor* to 7 *excellent*. We label this variable *ethical features*.

To approach the extent to which firms within a country focus on improving their relationships with stakeholders, we employ the cultural dimension "institutional collectivism," which characterizes societies where individuals are encouraged to be integrated into groups (Javidan & House, 2001; Triandis & Gelfand, 2012). Managers in societies with a high degree of institutional collectivism are expected to

[3]Available at https://edgar.jrc.ec.europa.eu/.

[4]Available at http://databank.worldbank.org/data/source/world-development-indicators.

[5]Available at http://globeproject.com/study_2004_2007#data.

[6]Available at https://www.weforum.org/reports/the-global-competitveness-report-2018.

[7]The size of our sample is limited by the countries considered by the GLOBE project because one of our main theoretical variables, namely, *relational features* (explained in Section 3.2) comes from this project. Originally, we collected data for 56 countries. Note that the GLOBE project offers values for subregions that do not correspond to whole countries. For instance, it offers cultural practices for East and West Germany and White and Black South Africa. We have not considered these subregions in our study. Our final sample includes 53 countries because we did not obtain data for all control variables for Bolivia, Namibia, and New Zealand.

make decisions according to their need to be accepted by society and gain legitimacy (Gelfand, Bhawuk, Nishii, & Bechtold, 2004). We proxy this cultural dimension through the GLOBE project's variable "institutional collectivism practices," which ranges from 1 *individualism* to 7 *collectivism*. The GLOBE project was developed by Robert J. House in 1991 and measures cultural variables that affect leadership and organizational processes according to surveys completed by middle managers from several industries. We label the institutional collectivism variable *relational features*

3.2.3 | Control variables

To isolate the effect of the aggregate level of ISO 14001 adoption on the reduction of CO_2 emissions, our analysis includes several control variables. First, it should be noted that a revised version of ISO 14001 was launched in 2015. This revised version introduced several changes in the practices specified by the standard, including the addition of a life-cycle perspective, an increase in the requirements for top manager commitment, and enhanced flexibility in the use of documentation, among others. To control for this change in ISO 14001 requirements, we have included a dummy variable ISO 14001:, 2015 that takes the value 1 from 2015 to 2017 and 0 otherwise. Our model also considers the aggregate level of the adoption of other management standards that may affect CO_2 emission levels. We control for the number of *ISO 9001* and *ISO 50001* certifications issued yearly by certification bodies in each country. ISO 9001 guides the implementation of a quality management system that can also motivate a reduction of CO_2 emissions (Potoski & Prakash, 2013), whereas ISO 50001 guides the implementation of an energy management system that can improve energy efficiency and result in gas emissions (Böttcher & Müller, 2016). Like *ISO 14001*, both variables have been weighted by the total population of the country and were obtained from the ISO Survey 2017. These variables have been lagged one period.

We also control for formal environmental protection efforts. First, we consider the country's regulatory stringency in this regard by including the variable *legislation*, which measures the number of laws about air and atmosphere protection that the country has enacted per year. Second, our model takes into account formal participation in international treaties aimed at mitigating climate change. The variable *international treaties* is calculated as the number of international agreements related to air and atmosphere protection that the country has ratified per year. Information for both variables was obtained from the Ecolex dataset.[8] As these formal efforts to protect the environment are not expected to have an immediate effect on the reduction of CO_2 emissions, both variables have been lagged one period. Finally, we included the variable *government intrusiveness* to control for the degree of government intrusiveness in economic activity. It is calculated as the average value for each country and year for the dimensions government spending and the tax burden, as provided by the Index of Economic Freedom (Heritage Foundation, 2018). This variable ranges from 0 *low government intrusiveness* to 100 *high government intrusiveness*.[9] We expect that formal efforts to protect the environment will be higher in countries where the government intervenes to a higher extent in the economy.

[8]Available at https://www.ecolex.org/.

TABLE 2 Descriptive statistics

Variable	Mean	Std. Dev.	Min.	Max.
CO_2 emissions (% variation)	0.05	5.82	−14.11	35.52
ISO 14001	92.31	118.28	0.00	632.88
Competitive features	5.16	0.62	2.87	6.38
Ethical features	4.49	1.05	2.65	6.78
Relational features	4.73	0.51	3.83	5.65
ISO 14001:2015	0.22	0.41	0.00	1.00
ISO 9001	367.26	449.26	0.17	2417.53
ISO 50001	1.26	4.93	0.00	72.61
International treaties	0.35	0.57	0.00	3.00
Legislation	3.15	4.82	0.00	35.00
Government intrusiveness	34.51	17.75	7.00	81.70
GDP per capita	24.58	22.09	0.33	88.56
GDP growth	2.61	3.98	−17.67	25.56
Employment in agriculture	15.78	16.60	0.12	73.67
Employment in industry	22.92	7.27	7.28	59.58
FDI stocks	4.02	7.13	−15.99	80.98
Exports	41.62	30.34	9.22	231.19
Population density	0.28	1.02	0.00	7.91
Population	100.02	251.12	1.39	1378.67

Our model also controls for several economic factors, because previous studies revealed that a country's economic conditions are key determinants of the level of air pollution (Potoski & Prakash, 2013). We included *GDP per capita* (in thousands) to control for degree of economic development and *GDP growth* to control for economic dynamism. We also included two variables that control for the importance of agriculture and industry in the economy (with the service sector as the base category). The variables *employment in agriculture* and *employment in industry* reflect the percentage of employment in each of these two sectors. Air pollution tends to be higher in agricultural and industrial activities than in services, especially for activities related to petrol, basic metals and minerals, and chemicals (Cole, Elliott, & Shimamoto, 2005). All prior variables were retrieved from the World Bank (2018).

As prior studies have observed that air pollution may be determined not only by the domestic economic activity but also by the economy's level of internationalization (Potoski & Prakash, 2013; Testa et al., 2014), we have also included the variable *FDI stocks*, which measures the net inflows of investment from foreign investors, and the variable *exports*, which includes the value of all goods and other market services

[9]The original data from the Heritage Foundation (2018) measure this variable from 0 *high taxation and government spending* to 100 *low taxation and government spending*. For our research purposes, we refer to government intrusiveness, so we transformed the variable by calculating 100 minus the original value.

TABLE 3 Correlation matrix

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. CO_2 emissions (% variation)	1.00																	
2. ISO 14001	−0.19***	1.00																
3. Competitive features	−0.13***	0.41***	1.00															
4. Ethical features	−0.19***	0.44***	0.59***	1.00														
5. Relational features	0.01	−0.38***	−0.24***	−0.42***	1.00													
6. ISO 14001:2015	0.06	0.05	0.10**	−0.05	−0.01	1.00												
7. ISO 9001	−0.23***	0.77***	0.31***	0.30***	−0.18***	−0.02	1.00											
8. ISO 50001	−0.01	0.21***	0.17***	0.17***	−0.07	0.27***	0.17***	1.00										
9. International treaties	−0.04	0.16***	0.11**	0.03	−0.05	0.11**	0.08*	0.22***	1.00									
10. Legislation	−0.14***	0.19***	0.23***	0.24***	−0.19***	0.06	0.21***	0.26***	0.10**	1.00								
11. Government intrusiveness	−0.23***	0.52***	0.29***	0.41***	−0.25***	−0.00	0.49***	0.25***	0.14***	0.24***	1.00							
12. GDP per capita	−0.30***	0.54***	0.51***	0.81***	−0.31***	−0.03	0.48***	0.22***	0.08	0.25***	0.47***	1.00						
13. GDP growth	0.20***	−0.23***	−0.03	−0.08	0.04	0.03	−0.27***	0.00	−0.04	−0.08	−0.37***	−0.15***	1.00					
14. Employment in agriculture	0.35***	−0.51***	−0.41***	−0.49***	0.18***	−0.03	−0.51***	−0.18***	−0.08	−0.30***	−0.46***	−0.70***	0.29***	1.00				
15. Employment in industry	−0.15***	0.20***	0.21***	0.06	0.03	−0.03	0.19***	0.02	−0.06	0.05	−0.02	0.25***	0.05	−0.46***	1.00			
16. FDI stocks	0.02	0.07	0.02	0.18***	−0.13***	0.09	0.12**	0.09	−0.03	0.02	−0.03	0.15***	0.19***	−0.05	−0.14***	1.00		
17. Exports	−0.08	0.35***	0.21***	0.38***	−0.20***	−0.03	0.33***	0.12**	−0.01	0.00	−0.05	0.36***	0.07	−0.26***	0.17***	0.48***	1.00	
18. Population density	0.01	0.19***	0.13***	0.27***	−0.06	0.01	0.22***	0.00	0.00	−0.07	−0.20***	0.18***	0.07	−0.14***	−0.03	0.30***	0.71***	1.00
19. Population	0.13***	−0.17***	0.09	−0.13***	−0.02	0.01	−0.17***	−0.06	0.01	0.02	−0.16***	−0.22***	0.26***	0.24***	0.06	−0.09	−0.21***	−0.03

**$p < .05$. ***$p < .01$.

sold to other countries. Both variables are calculated as a percentage of GDP and have been obtained from the World Bank (2018).

Finally, we also controlled for demographic factors through two variables, *population* (in millions) and *population density* (in thousands of inhabitants per square kilometer), because more populated areas—such as urban areas—tend to generate more pollution (Raupach, Rayner, & Paget, 2010).

Descriptive statistics and correlations can be found in Tables 2 and 3, respectively. As can be observed, overall, CO_2 emissions are negatively related to *ISO 14001*, the level of local competition, and the level of business ethics in a country, as well as to other control variables such as *ISO 9001*, *legislation*, and *GDP per capita*. CO_2 emissions, in contrast, show a positive correlation with other control variables such as *government intrusiveness*, *GDP growth*, and *population*. Regarding the correlations between the independent and control variables, these are generally moderated, although with some exceptions, such as the correlation between *ISO 14001* and *ISO 9001* (r = .77), *ethical features* and *GDP per capita* (r = .81), *GDP per capita* and *employment in agriculture* (r = −.70), and *exports* and *population density* (r = .71). After checking that the variance inflation factors for all variables are lower than 10, we can discard multicollinearity as a problem that could bias our results.

4 | RESULTS

As we have a panel of 53 countries for the period 2007–2017, we applied a random effect generalized least squares technique because the variable *relational features* does not change over time. Table 4 shows the results for our estimations. To test our hypotheses, we estimated five models in a nested way. Model 1 is the baseline model with control variables, and Model 2 includes the main independent variable *ISO 14001* (baseline expectation). The next three models sequentially add the three interactions of *ISO 14001* with *competitive features* (Model 3), *ethical features* (Model 4), and *relational features* (Model 5). Thus, Model 5 is the full model with the three interactions

TABLE 4 The effect of the aggregated level of ISO 14001 adoption on CO_2 emissions

Dependent variable CO_2 emissions (% variation)	Model 1	Model 2	Model 3	Model 4	Model 5
ISO 14001		0.001 (0.003)	−0.012* (0.007)	0.001 (0.010)	−0.042* (0.025)
ISO 14001x Competitive features			0.002 (0.002)	0.003 (0.002)	0.004* (0.002)
ISO 14001x Ethical features				−0.003*** (0.000)	−0.002*** (0.000)
ISO 14001x Relational features					0.008** (0.003)
ISO 140001:2015	0.924 (1.263)	0.914 (1.255)	0.937 (1.258)	0.981 (1.216)	0.927 (1.241)
ISO 9001	−0.000 (0.000)	−0.001 (0.001)	−0.000 (0.001)	−0.001 (0.001)	−0.002* (0.001)
ISO 50001	0.062 (0.047)	0.061 (0.045)	0.060 (0.045)	0.059 (0.045)	0.060 (0.041)
International treaties	−0.436*** (0.117)	−0.454*** (0.135)	−0.435*** (0.130)	−0.453*** (0.100)	−0.473*** (0.120)
Legislation	−0.040*** (0.008)	−0.037*** (0.009)	−0.040*** (0.009)	−0.036*** (0.010)	−0.055*** (0.007)
Government intrusiveness	0.001 (0.008)	0.000 (0.006)	0.001 (0.006)	0.002 (0.008)	0.005 (0.011)
GDP per capita	−0.045*** (0.001)	−0.045*** (0.001)	−0.046*** (0.001)	−0.042*** (0.004)	−0.048*** (0.009)
GDP growth	0.289*** (0.022)	0.289*** (0.019)	0.289*** (0.018)	0.290*** (0.018)	0.294*** (0.010)
Employment in agriculture	0.064*** (0.010)	0.064*** (0.009)	0.063*** (0.008)	0.064*** (0.006)	0.059*** (0.001)
Employment in industry	−0.006 (0.055)	−0.008 (0.052)	−0.008 (0.050)	−0.021 (0.057)	−0.013 (0.045)
FDI stocks	0.014 (0.022)	0.014 (0.022)	0.014 (0.023)	0.011 (0.025)	0.009 (0.020)
Exports	−0.010 (0.016)	−0.010 (0.017)	−0.009 (0.016)	−0.010 (0.015)	−0.009 (0.016)
Population density	0.407 (0.355)	0.407 (0.342)	0.380 (0.316)	0.463 (0.334)	0.443 (0.360)
Population	−0.000 (0.001)	−0.000 (0.001)	−0.000 (0.001)	0.000 (0.001)	−0.000 (0.001)
Competitive features	0.079 (0.100)	0.045 (0.143)	−0.069 (0.112)	−0.293*** (0.040)	−0.283*** (0.090)
Ethical features	0.131*** (0.012)	0.117*** (0.014)	0.133*** (0.032)	0.482** (0.239)	0.420* (0.215)
Relational features	−0.920 (0.919)	−0.854 (0.876)	−0.829 (0.850)	−0.676 (0.892)	−1.264* (0.764)
Constant	3.614 (3.002)	3.490 (2.928)	3.925 (2.698)	2.689 (3.376)	6.448** (2.850)
N (total)	465	465	465	465	465
N (countries)	53	53	53	53	53
R^2	0.2610	0.2610	0.2613	0.2621	0.2654

Note. Robust standard errors in parentheses. Estimations have been carried out through the *xtreg*, *re* command in Stata 15.0 with the *cluster* option to correct for the intragroup correlation of observations from European Union countries (33.8% out of 465) that are compelled by common environmental regulations towards CO_2 emission reductions. All models include year dummies to control for time effects.

*p < .10. **p < .05. ***p < .01.

proposed in Hypotheses 1, 2, and 3. The R-squared values show that the latter is the model that best fits our data, so we focus our comments on the completely specified model.

Regarding the control variables, the coefficients are quite stable across all models. As can be observed in the fully specified model, ISO 14001:, 2015 does not have a significant effect. The fact that our sample only considers three periods after the release of the new version of the standard might explain this lack of significance. Our model also shows that CO_2 emissions decrease with formal efforts related to regulatory stringency (*legislation*) and participation in international initiatives (*international treaties*). Additionally, our results suggest that the higher the per capita GDP, the lower the increase in CO_2 emissions. The results also show, however, that CO_2 emissions increase with the GDP growth and the percentage of employment in agriculture. Unexpectedly, the ethical features of a country are positively related to its CO_2 emissions. A possible explanation comes from the fact that countries with higher ethical features are also countries with higher levels of economic development. The correlation between *ethical features* and *GDP per capita* is.81.

Model 5 shows that the variable *ISO 14001* has a negative and significant effect on *CO_2 emissions* ($\beta = -.042$; $p < .10$). This means that countries with a higher aggregate level of ISO 14001 adoption experience reductions in their levels of CO_2 emissions, which supports our baseline expectation. It is important to note that the coefficient of this variable is not significant in Model 2, when the moderating role of country features is not considered. This shows that the significance of the aggregate level of ISO 14001 adoption depends on the particularities of each national setting.

Hypothesis 1 argues that the negative effect of the number of ISO 14001 certifications on CO_2 emissions is stronger in countries with a greater level of competition. However, the interaction term between *competitive features* and the number of ISO 14001 certifications shows a positive and significant effect on pollution levels ($\beta = .004$; $p < .10$), rejecting our Hypothesis 1. In other words, in countries with high competitive pressures, the capacity of ISO 14001 to reduce CO_2 emissions seems to be lower. We will elaborate on this finding in Section 6.

Hypothesis 2 proposes that the reduction of CO_2 emissions caused by the aggregate level of ISO 14001 adoption is higher in countries where individuals and organizations tend to behave ethically. Model 5 shows that the interaction between *ISO 14001* and *ethical features* is negative and significant ($\beta = -.002$; $p < .01$), supporting Hypothesis 2. In countries with a higher level of ethical behavior, the capacity of ISO 14001 to reduce CO_2 emissions seems to be higher.

Hypothesis 3 states that, in countries where firms care about maintaining cordial relationships with stakeholders to gain legitimacy, the reduction of CO_2 emissions caused by the aggregate level of ISO 14001 adoption is lower. The coefficient of the interaction term between *relational features* and the number of ISO 14001 certifications is positive and significant ($\beta = .008$; $p < .05$), which supports this hypothesis. In countries with higher levels of institutional collectivism, where managers are focused on the importance of obtaining legitimacy from society and, especially, from their stakeholders, the aggregate implementation of ISO 14001 seems to result in a lower reduction of the levels of CO_2.

5 | DISCUSSION AND CONCLUSIONS

5.1 | Discussion, implications, and limitations

Our study expands knowledge of the impact of ISO 14001. First, it offers additional empirical evidence about the macrolevel effect of the aggregate level of ISO 14001 adoption. In line with Potoski and Prakash (2013) and Prakash and Potoski (2014), we found that the higher the number of ISO 14001 certifications in a country, the lower its level of CO_2 emissions. Therefore, whereas there is a lack of agreement regarding the impact of ISO 14001 adoption at the firm or facility level (Gomez & Rodriguez, 2011; Zobel, 2013, 2016), it seems that its consequences on air pollution are clearer at the country level. Because empirical evidence in this regard is still limited, its future research should seek to confirm the macrobenefits of the aggregate level of ISO 14001 adoption through other empirical studies.

Second, we found that the capacity of the aggregate level of ISO 14001 adoption to reduce CO_2 emissions depended on country features. Indeed, according to our results, the impact of the aggregate level of ISO 14001 adoption on CO_2 emissions was only significant when the three analyzed country features came into play. In particular, our study revealed that the reduction in CO_2 emissions due to the aggregate level of ISO 14001 adoption was stronger in countries where firms tended to behave ethically and weaker in countries with intense competition or where managers focused on building cordial relations with stakeholders.

It is important to mention that we found a result contrary to what we expected in the case of countries with intense competition. The previous literature has defended the idea that the adoption of environmental behaviors may allow firms to improve the efficiency of their operations by reducing operating costs (Ambec & Lanoie, 2008; Hart, 1995; Porter & van der Linde, 1995). Accordingly, we argued that firms are more likely to substantively adopt ISO 14001 as a means of obtaining competitive advantages on the basis of higher efficiency and lower costs in countries with a high level of competition. However, we did not take into account that competitive advantages may also be obtained through differentiation (Porter, 1985). The previous literature has also argued that ISO 14001 may be perceived as a competitive tool that helps firms to strategically differentiate themselves from their rivals (Lannelongue et al., 2014). This could explain the weaker connection that we found between the aggregate level of ISO 14001 adoption and the reduction of CO_2 emissions in countries with intense competition. Our contention is that in these countries, managers might assess ISO 14001 a mechanism to differentiate themselves from their rivals rather than a way to increase operational efficiency. If this were the case, they would tend to implement ISO 14001 symbolically, decreasing its efficacy in reducing CO_2 emissions. This insight is in line with previous studies that suggested distinguishing between operational competitive motives, which are related to cost

reductions and productivity, and commercial competitive motives, which are related to the search for differentiation (Gonzalez-Benito & Gonzalez-Benito, 2005; Lannelongue et al., 2014). Future research could corroborate whether these expectations really apply.

Our research has several policy implications. Policy makers are usually attracted to the potential of certified EMSs to protect the environment (Darnall, Henriques, & Sadorsky, 2008), and these are often used them to complement environmental legislation (Gilbert & Rasche, 2007). Our study shows that, in the case of ISO 14001, this may be wise choice, because its aggregate level of adoption is a factor contributing to reduce national CO_2 emissions, especially in countries where firms are inclined to behave ethically. We therefore recommend that policy makers in countries characterized by a strong tendency for firms to behave ethically introduce formal policies to encourage firms to implement ISO 14001, such as by reducing the number of environmental inspections of certified facilities, offering fiscal benefits to firms adopting ISO 14001, or facilitating the process of certification.

Although it is not easy to establish a clear causal relationship between the choices of policy makers and societal values, it is important that governments are conscious of the positive consequences of these types of decisions. As a consequence, public authorities should promote measures at different educational levels to improve the social recognition of environmental benefits to sensitize citizens to more responsible behavior. Guidelines, codes of conduct, research and educational activities, or information and advice centers focuses on social responsibility are only some examples of possible measures to integrate social and environmental concerns into business routines (Albareda, Lozano, & Ysa, 2007).

Our study is not without its limitations. First, our theoretical model departs from the premise that country features determine the prevailing motives behind the aggregate level of ISO 14001 adoption. This means assuming that all managers within a country are guided by the same concerns when deciding whether or not to adopt ISO 14001. Although it has been shown that certain country features determine the behavior of all individuals and organizations (e.g., DiMaggio & Powell, 1983; North, 1990; Scott, 1995), we recognize that exploring motivations at the firm level could corroborate our results. One future research avenue would be to check whether the assumed country-level motivations to adopt ISO 14001 coincide with firm-level motivations and to identify the factors that might explain the differences between them, such as the education, experience, and training of managers.

Second, this paper analyzed the macrolevel consequences of ISO 14001 adoption by focusing on CO_2 emissions. However, we acknowledge that ISO 14001 may have an impact on other environmental variables. Future research could analyze the effect of the aggregate level of ISO 14001 adoption on alternative environmental outcomes such as water pollution (Potoski & Prakash, 2013; Prakash & Potoski, 2014), energy use (Zobel, 2013), and solid waste generation (Franchetti, 2011). In the case of water pollution, Potoski and Prakash (2013) and Prakash and Potoski (2014) have found a nonsignificant relationship with the aggregate level of ISO 14001 adoption, which they explain on the basis of the low visibility of this type of pollution. In light of our results, the impact of the aggregate level of ISO 14001 adoption on water pollution could be positive in countries where firms behave ethically. In such countries, according to our theoretical arguments, managers may adopt ISO 14001 to suit their social obligations rather than to improve their image. As a consequence, they might be interested in reducing any type of pollution, not just the visible types. Future research could explore the moderating role of firms' ethical behaviors on the relationship between ISO 14001 and water pollution to determine whether these expectations are fulfilled.

Third, our research did not explore potential variations in the relationship between the aggregate level of ISO 14001 adoption and CO_2 emissions for the different versions of ISO 14001. Although we considered the launch of the latest version of the standard as a control variable in our empirical model, future research could pay specific attention to this issue. ISO 14001:, 2015 is more demanding than its antecedents, so its efficacy in improving the operations of firms and its capacity to attain legitimacy from stakeholders may differ from previous versions of the standard. Our point is that changes in the features of the standard may affect the motives underpinning its adoption and, therefore, the extent to which its practices tend to be internalized. This may have consequences at the country level that could be explored in future research.

5.2 | Conclusion

Our research revealed that the analyzed country features determined the impact of the aggregate level of ISO 14001 adoption. We found that the inclination of firms to behave according to ethical precepts enhanced the capacity of the aggregate level of ISO 14001 adoption to reduce CO_2 emissions. We therefore consider that ISO 14001 might use a mechanism to control air pollution in countries where the choices of firms are mainly guided by ethical concerns. For instance, the Global Competitiveness Index (World Economic Forum, 2018) classifies New Zealand, Finland, and Singapore as countries where ethical behaviors are very common in business. In these countries, governments could take advantage of ISO 14001 by articulating their environmental policies with the support of this certified EMS.

Our results also revealed that both the importance that managers attach to achieving stakeholder legitimacy and the intensity of competition decrease the efficacy of the aggregate level of ISO 14001 adoption in reducing CO_2 emissions. In our view, using ISO 14001 as a mechanism to control air pollution is therefore less suitable in countries where firms make choices focused on improving their relationships with stakeholders or their competitive position. The capacity of ISO 14001 to support environmental policies in these countries would be lower. We hope that our findings are helpful and interesting to governments and social groups that care about environmental protection.

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