WHY DOES THE DIFFUSION OF ENVIRONMENTAL MANAGEMENT STANDARDS DIFFER ACROSS COUNTRIES? THE ROLE OF FORMAL AND INFORMAL INSTITUTIONS IN THE ADOPTION OF ISO 14001

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Abstract

This research explores the factors underpinning the international diffusion of environmental management standards (EMSs), focusing on how macro-level institutions explain differences in the extent to which ISO 14001 has penetrated into each country. We argue that macro-level institutions affect the diffusion of ISO 14001 by shaping both how managers assess it and the pressures that stakeholders exert on firms to adopt it. Our results, based on a sample of 49 countries between 2000 and 2014, show that informal and formal institutions, namely, uncertainty avoidance and market-supporting institutions, contribute to explaining cross-country variations in the number of firms implementing ISO 14001.

***Keywords*:** environmental management standards (EMSs), ISO 14001, international diffusion, uncertainty avoidance, market-supporting institutions

1. INTRODUCTION

The standardization of management practices involves the harmonization of certain procedures across firms from different countries. This stimulates international trade by eliminating obstacles arising from different national contexts and by facilitating coordination between buyers and sellers (Heras-Saizarbitoria & Boiral, 2013; Swann, 2010). The advantages of standardization in a global economy have turned the adoption of certified management standards into a worldwide phenomenon. Certified management standards are sets of internal organizational practices that define the operations of firms in several areas. They are adopted on a voluntary basis and their implementation is certified by a private auditor.

Certified management standards that structure the operations of firms to reduce their environmental impact have become very popular. One reason is that their adoption allows firms to respond to increasing pressures demanding that they control the negative effects of their activities (Bansal & Bogner, 2002; Delmas & Toffel, 2004). As a result of their popularity, several certified environmental management standards (EMSs) have been created at the supranational level. Among them, the most widely accepted is ISO 14001 (Marimon, Casadesus and Heras, 2006; Boiral et al., in press). In 2016, about 346,190 ISO 14001 certifications were awarded across 192 countries (ISO Survey, 2016).

A distinctive feature of ISO 14001 is its unequal distribution across the globe (Delmas & Montes-Sancho, 2011; Neumayer & Perkins, 2004). There is a clear variation in the number of firms implementing it depending on the country. This has been explained as due to national differences in pressures exerted by specific stakeholders such as multinational enterprises, the government, professional associations, and green consumers (Delmas & Montes-Sancho, 2011; Delmas & Toffel, 2004). The basic idea is that the number of ISO 14001 certifications is higher in countries where stakeholders exert stronger pressure on firms

to control their environmental impact. For instance, in countries where there is a dense network of environmental non-governmental organizations (NGOs) firms may be more likely to adopt ISO 14001 to signal conformity to their demands (Delmas & Montiel, 2008; Potoski & Prakash, 2004).

This view does not take into account that the pressures exerted by stakeholders depend on institutions, since what stakeholders demand and expect is shaped by the institutional context of the country (Edelman et al., 1999; Galaskiewicz, 1997; Sutton and Dobbin, 1996). This means that macro-level institutions may also contribute to explaining the international diffusion of ISO 14001. Our research proposes that macro-level institutions, by establishing a framework of social rules of behavior, determine the extent to which ISO 14001 is accepted within each society. We theoretically discuss how macro-level institutions influence both the pressures that stakeholders exert on firms to adopt ISO 14001 and the assessment of managers[1] about it.

To analyze the influence of macro-level institutions on the diffusion of ISO 14001, we distinguish between informal and formal institutions (North, 1990). We focus on uncertainty avoidance and market-supporting institutions, respectively. Uncertainty avoidance refers to the extent to which members of a society seek formalized procedures to cover situations in their daily lives and avoid unpredictable outcomes (House et al., 2004; Sully de Luque & Javidan, 2004). We focus on this informal institution because it determines the extent to which standardization is perceived as a valuable practice among individuals from a society. Our argument is that uncertainty avoidance, by influencing the desires of stakeholders and managers for formalization and certainty, shapes the value that is attached to ISO 14001 within a country.

[1] We acknowledge that managers are also a stakeholder. However, our research explicitly distinguishes them from other stakeholders. Our basic argument is that the willingness of managers to adopt ISO 14001 depends on both the pressures that they receive from stakeholders and their own assessment about the capacity of the EMS to confer legitimacy and to structure procedures. As a consequence, our theoretical framework differentiates between the particular effect that macro-level institutions have on stakeholders and managers.

Market-supporting institutions are usually employed to proxy the degree of development of formal institutions. They refer to intermediaries, such as auditors, investment bankers, and consultants, who provide information and facilitate economic transactions by guaranteeing the efficiency of a market-based economy (Fuentelsaz, Garrido, & Maicas, 2015; Meyer, Estrin, Bhaumik, & Peng, 2009). We argue that market-supporting institutions have a direct impact on the extent to which stakeholders can monitor firms' pollutant activities and determine the obstacles and benefits that managers perceive from implementing ISO 14001. Furthermore, since previous literature has shown that formal and informal institutions are interrelated (Peng, 2003; Peng, Wang & Jiang, 2008), this research explores the potential interdependences between market-supporting institutions and uncertainty avoidance to better understand cross-country differences in the diffusion of ISO 14001.

We test our theoretical model by using a panel of 49 countries from 2000 to 2014. Our findings show that countries significantly differ in the number of ISO 14001 certifications depending on the level of uncertainty avoidance and the development of market-supporting institutions. In addition, we find that the effect of uncertainty avoidance on the diffusion of ISO 14001 differs according to the degree of development of market-supporting institutions. The contribution of these findings to previous literature is threefold. First, they complement research on the diffusion of certified management standards by showing that the value that stakeholders and managers attach to them is contingent to the institutional framework of their countries (Albuquerque et al, 2007; Delmas & Montes-Sancho, 2011; Delmas & Toffel, 2004; Guler et al, 2002; Neumayer & Perkins, 2004). Second, by theoretically considering both the demands of stakeholders and the mindset of managers, we extend previous work that defends that external pressures and internal motivations of managers together explain the adoption of environmental initiatives by firms (Boiral, 2007; Boiral and Sala, 1998; Tatoglu et al, 2014). Third, our research enriches the institution-based view of business strategy (Oliver, 1997;

Peng, 2003; Peng et al., 2008) by exploring the role of macro-level institutions in the adoption of EMSs.

Our research aims to promote the diffusion of environmental-friendly practices among firms by identifying the drivers of the adoption of ISO 14001. The understanding of the factors that lead firms to respect the environment is essential for extending a sustainable approach of businesses practices that secures the preservation of natural resources for future generations. Moreover, by shedding light on the institutional factors that impede or promote the international diffusion of certified management standards, such as ISO 14001, our research seeks to favor the standardization of practices at the worldwide level. This will help to stimulate international trade and, therefore, to generate global welfare (Marimon, et al., 2006).

The rest of the article is structured as follows. Section 2 briefly summarizes the main features of certified management standards, paying special attention to ISO 14001. Section 3 develops the theoretical framework and proposes a set of hypotheses that explore the impact of uncertainty avoidance and market-supporting institutions on the adoption of ISO 14001. Section 4 contains our empirical analysis and Section 5 discusses our results. Finally, Section 6 discusses the implications of our main findings and describes future research lines.

2. CERTIFIED MANAGEMENT STANDARDS AND ISO 14001

Certified management standards define organizational practices in several areas, including quality management, social responsibility, and environmental management. They are characterized by three main elements. Firstly, they are adopted on a voluntary basis. This means that no central authority gives rewards for adopting them or sanctions for not adopting them (Ingram & Silverman, 2002). Secondly, to obtain the certification firms must pass a third-party audit, carried out by a private auditor, verifying the firm's adherence to the requirements of the standard. The certification allows firms to signal unobservable features to

external stakeholders in a credible way. Therefore, it helps to reduce information asymmetries and the fear of opportunistic behaviors (King, Lenox, & Terlaak, 2005). Thirdly, certified management standards regulate practices and procedures, not outcomes.

In the environmental field, ISO 14001 is the most widespread certified management standard. It was created in 1996 by the International Organization for Standardization (ISO). ISO 14001 is both a management tool and a means of signaling the environmental commitment of the firm (Boiral, 2007; Boiral & Henri, 2012; Christmann & Taylor, 2002; Jiang & Bansal, 2003). It defines management practices that are intended to reduce negative consequences of firms' activities on the natural environment (Bansal & Bogner, 2002). The organization of practices under ISO 14001 usually results in cost reductions and higher efficiency, since this EMS promotes the saving of resources and a more efficient use of them (Porter & Van der Linde, 1995; Rondinelly & Vastag, 2000). Furthermore the certification of ISO 14001, by showing a commitment to the protection of the environment, allows firms to improve their relationships with stakeholders and achieve legitimacy (King et al., 2005). This certification also helps firms to differentiate themselves from their competitors (Iatridis & Kesidou, 2016; Potoski & Prakash, 2004).

3. THEORETICAL FRAMEWORK AND HYPOTHESES

Previous studies have mostly explained the international diffusion of ISO 14001 on the basis of its capacity to show environmental commitment. They argue that firms adopt ISO 14001 as a signal of conformity to stakeholders' demands. The basic idea is that firms adopt ISO 14001 with the aim of achieving legitimacy and institutional support (DiMaggio & Powell, 1983; Meyer & Rowan, 1977; Tolbert & Zucker, 1983). Following this logic, it has been found that the adoption of ISO 14001 aims to establish cordial relationships with the government (Delmas & Toffel, 2004; Neumayer & Perkins, 2004; Potoski & Prakash, 2004), civil society and NGOs (Delmas & Montiel, 2008; Delmas & Montes-Sancho, 2011), firms

operating in other countries where ISO 14001 is widely extended (Albuquerque et al., 2007; Prakash & Potoski, 2007), professional associations (Delmas & Toffel, 2004), and multinational corporations (Delmas & Montes-Sancho, 2011).

Our research considers that what stakeholders demand is shaped by the institutional framework of the country (Edelman et al., 1999; Galaskiewicz, 1997; Sutton and Dobbin, 1996). This means that the extent to which the society accepts ISO 14001 depends on macro-level institutions. Macro-level institutions, which are commonly defined as the "rules of the game", play an important role in a society by establishing a consistent, stable and commonly-accepted structure for human interactions (Williamson, 2000). They can be broadly classified as either formal or informal (North, 1990). Formal institutions refer to explicit rules in a society; informal institutions are constraints that people impose upon themselves to structure their relations with others (Dunning & Lundan, 2008; Meyer et al., 2009). Laws, regulations, and property rights protection are examples of formal institutions, while traditions, religions, languages, values, and cultures are informal institutions.

It has been shown that macro-level institutions are an important determinant of entry mode choices (Estrin, Baghdasaryan, & Meyer, 2009; Meyer et al., 2009), entrepreneurship (Lee, Yamakawa, Peng, & Barney, 2011; Stephan & Uhlaner, 2010), innovation (Blind, 2012; Galang, 2012; Zhu, Wittman, & Peng, 2012), diversification (Wan, 2005; Wan & Hoskisson, 2003), and the performance of family firms (Jiang & Peng, 2011; Peng & Jiang, 2010). To our knowledge, no previous work has considered the role of macro-level institutions in the diffusion of ISO 14001.

Our research hopes to contribute to the literature about the international diffusion of certified management standards by explicitly considering the effect of formal and informal institutions. In particular, it analyzes how informal and formal institutions determine the number of ISO 14001 certifications within a country. Firstly, we explore the effect of

uncertainty avoidance and market-supporting institutions on the number of firms adopting ISO 14001. Secondly, we study how market-supporting institutions moderate the impact of uncertainty avoidance on the number of firms that implement ISO 14001.

3.1. Uncertainty avoidance and ISO 14001 diffusion

Informal institutions are enduring systems of shared meanings and collective understandings that reflect a socially constructed reality that affects how individuals interact (Scott, 2005). They comprise cultural traits that shape the behavior of a particular society (Redding, 2005). Cultural traits determine the mental models that people apply to frame their daily situations and, as a consequence, have an effect of the choices that they make (Crossland and Hambrick, 2007, 2011; Schneider and DeMeyer, 1991). In the case of stakeholders, national culture determines what they perceive, prefer and expect (see, for example, Franke and Nadler, 2008, Newburry and Yakova, 2006). In the specific case of managers, culture affects how they classify external stimuli, solve organizational problems and interpret and respond to strategic issues (Schneider and DeMeyer, 1991; Walsh, 1995). We argue that the cultural background of stakeholders and managers within a country has an effect on how they assess ISO 14001.

Among the different cultural traits that characterize a society, uncertainty avoidance directly affects how people assess the standardization of practices (Hofstede 1991; Newburry and Yakova, 2006) and, therefore, the suitability of adopting certified management standards such as ISO 14001. Uncertainty avoidance refers to the extent to which members of a society seek formalized procedures to cover situations in their daily lives and avoid unpredictable outcomes (House et al., 2004; Sully de Luque & Javidan, 2004). This cultural feature is often associated with a preference for precise instructions and answers (Hofstede, 1991). As societies with high uncertainty avoidance use formality in their interactions with others and rely on formalized practices, we argue that both stakeholders and managers embedded in such

societies have a greater appreciation of the capacity of ISO 14001 to provide orderliness and avoid ambiguity by offering information. The consideration of this cultural dimension is also justified by the important role that uncertainty plays in the diffusion of practices (DiMaggio and Powell; 1983; Shropshire, 2010). Institutional theory suggests that firms usually react to uncertainty by mimicking the actions of other firms and that this mimetic behavior may enhance the diffusion of certain practices (DiMaggio and Powell; 1983). In our framework, this means that how the society deals with uncertainty may have a direct effect on the diffusion of ISO 14001.

With regard to stakeholders from countries with a high level of uncertainty avoidance, it is important to note that the unknown ecological consequences of firms' activities are contrary to their preference for certainty (Hofstede 2001; House et al. 2001). Therefore they may be more willing to exert pressure on firms to incorporate procedures that ensure the sustainability of the environment. In these countries, the information provided by the ISO 14001 certification reduces the uncertainty about the environmental consequences of transactions with firms adopting this EMS. This may remove the anxiety associated with uncertain environmental conditions, which is especially appreciated by stakeholders that show a low tolerance for the unknown. Moreover, stakeholders from societies with a high level of uncertainty avoidance should attach high value to the formalization capacity of ISO 14001, since they tend to be reliant on written and explicit rules (Hofstede, 2001). Accordingly, stakeholders from countries with a strong tendency to avoid uncertainty may favor the diffusion of ISO 14001.

With respect to managers, it is important to point out that ISO 14001 provides the basic elements to effectively control the environmental impact of their firms. These elements include the creation of an environmental policy with specific targets, the implementation of a program to achieve these targets, monitoring the effectiveness of the program, and taking

corrective actions with the aim of promoting continual improvement (Andrews et al., 2003; Delmas and Montes-Sancho, 2011). By establishing the required steps to articulate an environmental program within the firm, ISO 14001 matches the needs of managers with high uncertainty avoidance to follow instructions and behave according to formalized procedures. These managers may adopt ISO 14001 because it provides order and structure, which is in line with their managerial logic. Moreover, managers embedded in cultures with a high uncertainty aversion may be more willing to adopt ISO 14001 because it circumvents ambiguity caused by environmental degradation (Miska, Szocs and Schiffinger, 2018; Parboteeah et al., 2012).

Following the previous reasoning, we argue that managers and stakeholders from countries with a high level of uncertainty avoidance attach more value to ISO 14001 than those from countries where formalization and certainty are less important. We sustain that managers from countries with greater levels of uncertainty avoidance will be more willing to adopt ISO 14001 for two main reasons: they are subject to higher pressures from stakeholders and their personal preferences align to the features of the EMS. At the aggregate level, this means a faster diffusion of ISO 14001 within countries with a high level of uncertainty avoidance. Our first hypothesis proposes that:

H1: *The diffusion of ISO 14001 is higher in countries with a high level of uncertainty avoidance than in countries with a low level of uncertainty avoidance.*

3.2. Market-supporting institutions and ISO 14001 diffusion

Formal institutions are explicit rules within a society (North, 1990). They support the effective functioning of a society by establishing a normative system. We proxy formal institutions through market-supporting institutions. Market supporting-institutions structure interactions by creating a more stable and trustworthy environment in which transaction and information costs are lower (Hoskisson et al., 2000; Meyer et al., 2009). They comprise

intermediaries such as auditors, investment bankers, trade associations, and consultants, who enable economic transactions by securing the efficiency of a market-based economy (Fuentelsaz et al., 2015). These intermediaries stimulate competition by facilitating capital flows, information availability and business creation (Miller and Kim, 2012). Consequently, competition in markets where institutions are highly developed tends to be intense.

Market-supporting institutions are usually classified as strong or weak. Whereas strong market-supporting institutions are those that "support the voluntary exchange underpinning an effective market mechanism", weak ones are those that "fail to ensure effective markets or even undermine markets" (Meyer et al., 2009, p.63). Weak institutional contexts are usually characterized by insufficient market intermediaries (Fuentelsaz et al., 2015). In such contexts, information asymmetries are magnified and economic agents have to spend more resources to search for information (Meyer, 2001; Tong, Reuer, and Peng, 2008). Conversely, market intermediaries secure information flows in contexts where market-supporting institutions are strong.

The low information asymmetries of countries with strong market-supporting institutions enhance market transparency, which, in turn, increases the visibility of firms' activities and facilitates public scrutiny. This makes it easier for stakeholders to detect deviations from accepted behaviors and develop corrective actions (Chiu and Sharfman, 2011). For instance, in contexts with strong-market supporting institutions, consumer groups may boycott the products of firms with a reputation for poor environmental management (Greeno and Robinson, 1992) and suppliers may stop delivering inputs to polluting firms (Henriques and Sadorsky, 1999). When the level of public scrutiny is high and, as a consequence, it is easy to detect non-legitimate practices, stakeholders can exert stronger pressures on firms to adopt socially-accepted practices, such as those related to the protection of the environment. This argument is consistent with Chiu and Sharfman (2011) who studied

the role of firms' visibility to multiple stakeholders in influencing managers' motives to pursue socially responsible practices.

From a managers' perspective, strong market-supporting institutions may facilitate the implementation of ISO 14001. Before implementing it, managers must gather information on how to adopt it and gain its certification (Bansal & Bogner, 2002). Since the costs of searching for information are lower in markets with strong institutions (Tong et al., 2008), we argue that adopting ISO 14001 may involve less effort in such markets. Implementing ISO 14001 also requires financial resources, technological capabilities and networks of governmental or non-governmental organizations committed to the promotion of the standard (Steger, 2000; Bansal & Bogner, 2002). Access to these resources and organizations may be difficult in countries with weak market-supporting institutions because they lack a dense network of market intermediaries (Delmas, 2001). For instance, in developing countries, where market-supporting institutions are weak, managers may find problems in accessing certification bodies (UNIDO, 2012). Thus, the lack of information and market intermediaries in countries with weak market-supporting institutions may discourage managers from adopting ISO 14001.

Moreover, it is important to note that managers operating in countries where market-supporting institutions are strong are usually subject to intense competition (Miller and Kim, 2012). This increases their motivation to implement practices that contribute to improving the competitiveness of their firms (Danis, Chiaburu and Lyles, 2010; Peng, 2003). As environmental proactivity may lead firms to achieve competitive advantages (Hart, 1995; Porter & Van der Linde, 1995; Russo & Fouts, 1997; Sharma & Vredenburg, 1998; Shrivastava, 1995), managers operating in competitive contexts may adopt environmental practices with the aim of improving their competitiveness (Bansal and Roth, 2000). In these contexts, environmental practices might be quickly diffused as firms imitate each other to

maintain competitive parity and avoid losing market share (DiMaggio and Powell, 1983; Haunschild and Miner, 1997). It has been shown that ISO 14001 may confer competitive advantages by reducing costs and helping firms to differentiate themselves from their competitors (Iatridis & Kesidou, 2016; Potoski & Prakash, 2004; Rondinelly and Vastag, 2000). This may be especially appreciated by managers operating in contexts with strong market-supporting institutions, where cost reduction and differentiation are essential to face the high level of competition.

In line with previous arguments, we hypothesize that managers from countries with strong market-supporting institutions will be more willing to adopt ISO 14001 for three main reasons: higher external pressures from stakeholders, easier access to the information and the intermediaries that are required for its implementation, and the potential competitive advantages from environmental proactivity in markets with intense competition. At the aggregate level this will result in a faster diffusion of the EMS. Our second hypothesis establishes that:

H2: *The diffusion of ISO 14001 is higher in countries with strong market-supporting institutions than in countries with weak market-supporting institutions.*

3.2. The moderating role of market-supporting institutions in the relationship between uncertainty avoidance and ISO 14001

In contexts where formal institutions are weak, informal rules of behavior have a greater influence on driving the strategic choices of firms (Estrin & Prevezer, 2011; Peng and Heath, 1996; Peng, 2003; Peng et al., 2008, North, 1990). By contrast, when formal institutions are highly developed and economic exchanges are mainly governed by explicit rules, the effect of informal practices on strategic choices is less intense. In our framework, this means that uncertainty avoidance, which is an informal practice of society, may explain

the adoption of ISO 14001 to a lesser extent in countries with strong market-supporting institutions.

ISO 14001 may offer constancy and predictability in the absence of well-developed market-supporting institutions. It may compensate the uncertainty that results from a lack of formal institutions by facilitating coordination between buyers and sellers, providing information to stakeholders and supporting managers in the organization of their operations (Bansal & Bogner, 2002; Heras-Saizarbitoria & Boiral, 2013, King et al. 2005). This means that stakeholders and managers from countries where formal institutions fail to reduce uncertainty will attach more value to the capacity of ISO 14001 to lower their fear of the unknown. Conversely, in contexts where market-supporting institutions are strong, formal rules provide certainty (Fuentelsaz et. al, 2015). Our argument is that, when formal institutions satisfy the social needs of orderliness, consistency and structure to a greater extent, the added value of ISO 14001 in terms of reducing uncertainty is lower because the fear of the unknown is already reduced by formal mechanisms. In these contexts, the need for additional mechanisms that increase the predictability of human interactions is not so great because efficient markets are already highly predictable. As a consequence, stakeholders and managers from countries with strong market-supporting institutions will attach less value to the capacity of ISO 14001 to reduce uncertainty.

In our framework, this involves that the effect of uncertainty avoidance on the adoption of ISO 14001 will be overshadowed by market-supporting institutions. The appeal of ISO 14001 as a tool that provides formalization and certainty will be lower when market-supporting institutions already structure transactions and reduce uncertainty. Thus our last hypothesis proposes that:

H3: *The stronger the market-supporting institutions, the lower the influence of uncertainty avoidance on the diffusion of ISO 14001.*

4. EMPIRICAL ANALYSIS

4.1. Sample

We test our hypotheses with a panel of 49 countries from 2000 to 2014. Although ISO 14001 was launched in 1996, it was revised in 2000 to accommodate its features to early diffusion experiences (Delmas & Montes-Sancho, 2011). To avoid potential biases from the take-off period of the environmental standard, the period we analyze starts in 2000. Table 1 shows the countries that make up our sample and the average number of ISO 14001 certifications per country during the period analyzed. These countries represent 96 percent of the ISO 14001 certifications in 2014. It is important to note that the countries in our study belong to the five continents, which guarantees a high level of variation in the institutional contexts that we consider. Given this variability, it is safe to state that our sample is appropriate to study the effect of formal and informal institutions on the worldwide distribution of ISO 14001.

Table 1 to be inserted about here

We gathered information about the 49 countries from four publicly available data sources: the ISO Survey 2016 of the International Standard Organization,[2] the world development indicators of the World Bank,[3] the cultural dimensions data offered by the GLOBE project,[4] and the Index of Economic Freedom developed by the Heritage Foundation.[5] It should be noted that each of these databases offers information for more countries, but combining them only provide data for 2000–2014 for the countries in our sample.

[2] Available at https://www.iso.org/the-iso-survey.html
[3] Available at http://data.worldbank.org/data-catalog/world-development-indicators
[4] Available at http://globe.bus.sfu.ca/study_2004_2007#data
[5] Available at http://www.heritage.org/index/explore?view=by-region-country-year

4.2. Variables

Dependent variable. The dependent variable of our model, *ISO 14001 certifications*, measures the number of ISO 14001 certifications in a given country during each of the years of the period analyzed. This variable has been taken from the ISO Survey, which is published by the International Standard Organization on an annual basis.

Independent variables. We measure macro-level institutions through two variables: *uncertainty avoidance* and *market-supporting institutions.* The former proxies informal institutions and the latter formal institutions.

Uncertainty avoidance reflects the extent to which members of a society seek formalized procedures to cover situations in their daily lives and avoid unpredictable outcomes (House et al., 2004; Sully de Luque & Javidan, 2004). The data to measure uncertainty avoidance have been taken from the Global Leadership and Organizational Behavior Effectiveness project (GLOBE).[6] In this project, national cultures of 62 countries are examined through survey questionnaires that were collected from more than 17,000 middle managers across three industries: services, food processing, and telecommunications. From this information, the GLOBE project researchers created nine cultural dimensions encompassing both society practices ("as is") and values ("should be"). We focus on uncertainty avoidance as a practice because we are interested in measuring actual behaviors and trends in a particular society. This variable ranges from 1 to 7: the higher the value of the variable, the greater the aversion to unknown outcomes.

We use the GLOBE uncertainty avoidance dimension instead of that proposed by Hofstede for two main reasons. Firstly, in both cases, the cultural dimensions were measured only once. These dimensions have been assumed to be constant, since culture is long-lasting and relatively stable (McGrath et al., 1992). Although this assumption is widely accepted, we

[6] The GLOBE project provides within-country scores for Germany (former East and former West), South Africa (Black sample and White sample), and Switzerland (German and French-speaking). The empirical analysis considers the average value of these scores because the estimations are performed at the country level.

select GLOBE because its scores are closer to our research window. Whereas the dimensions of Hofstede were measured between 1967 and 1973, the dimensions of GLOBE were measured in the late 1990s. Secondly, several studies have highlighted that GLOBE and Hofstede capture different aspects of uncertainty avoidance (Veniak & Brewer, 2010). While the dimension of Hofstede ascribes more importance to the level of individuals' stress and perceived employment stability (Hofstede, 2006; Sully de Luque & Javidan, 2004), the GLOBE dimension mainly focuses on issues related to the efficient organization of a society such as order, rules, and laws (Tung & Verbeke, 2010; Veniak & Brewer, 2010). Given that the capacity of ISO 14001 to reduce uncertainty by providing formalization and information is a central issue in this study, we consider that the GLOBE measure is more consistent with our theoretical framework.

We use data from the Index of Economic Freedom (IEF) to define the variable *market-supporting institutions*. The IEF is provided yearly by the Heritage Foundation and it measures the extent to which a broad range of institutions support transactions. The index contains data about 50 independent variables, divided into 12 categories. We selected the five categories of the IEF that are most closely related to the notion of formal institutions assuring a market-based economy: business freedom, trade freedom, property rights, investment freedom, and financial freedom (Fuentelsaz et al., 2015; Meyer & Sinani, 2009; Meyer et al., 2009). These dimensions, by capturing institutions that directly support the efficiency of the market, allow us to proxy cross-country differences in information flows, the network of market intermediaries, and competitive pressures to which firms are subject. Our variable, *market-supporting institutions*, is calculated as the average of the five categories selected. This variable ranges from 0 to 100, values close to 0 meaning weak market-supporting institutions and values close to 100 meaning strong market-supporting institutions. High values of the variable denote greater information flows and transparency, a dense network of

market intermediaries and intense competitive pressure in the market. To provide statistical support for the internal consistency of this variable, we calculate Cronbach's alpha (Cronbach, 1951). This allows us to assess the reliability of the construct *market-supporting institutions* in our sample. The scale derived from the five items that the variable comprises is reasonable since the alpha coefficient for a test scale based on all items is 0.88. As this substantially exceeds the minimum level of 0.70 (Nunnally, 1978), the internal consistency of this variable is supported in our research setting[7].

Our independent variables are calculated with a one-year lag. Both variables are standardized to facilitate the interpretation of the results and reduce potential multicollinearity problems.

Control variables. Our empirical model controls for several factors that may contribute to the diffusion of ISO 14001 within a country. Firstly, we control for government commitment to the preservation of the environment through the inclusion of the dummy variable *Kyoto Protocol*. This variable takes the value 1 when this treaty officially came into force in each country; otherwise, it takes the value 0. Our contention is that firms will confront greater external pressures in countries whose governments voluntarily signed the international environmental agreement.

Secondly, we consider the coercive pressure that foreign multinational enterprises may exert on firms to pursue environmentally-friendly practices (Guler et al., 2002). Multinational enterprises are influential agents in the diffusion of new practices because of their bargaining power as purchasers of goods and services (Neumayer & Perkins, 2005). Empirically, we capture the presence of foreign multinational enterprises with the variable *FDI inflow*. This reflects foreign direct investments calculated as the sum of equity capital, reinvestment of

[7] We additionally test the reliability of the construct across the period 2000-2014. Cronbach's alpha coefficient ranges from 0.84 to 0.91, showing the internal consistency of the market-supporting institutions variable throughout the period of analysis.

earnings, and other capital in the reporting economy. This variable is expressed as a percentage of the annual GDP.

Thirdly, international trade has been identified as a key factor in the diffusion of ISO 14001 (Corbett & Kirsch, 2001). As this environmental standard facilitates coordination between buyers and sellers from different countries (Heras-Saizarbitoria & Boiral, 2013), attending to foreign consumers may be an important reason for adopting it. To control for the ecological pressure exerted by consumers from overseas, we include the variable *exports*, which reflects the value of exports in a given country expressed as a percentage of the annual GDP. We expect that diffusion of ISO 14001 will be higher in countries with a high level of exports.

Fourthly, since previous experience with the adoption of certified management standards may reduce the complexity of implementing new ones, we control for the number of *ISO 9001 certifications* adopted within each country (Albuquerque et al, 2007; King and Lenox, 2001). ISO 9001 is a quality management standard that was developed in 1986 by the International Organization for Standardization (ISO). ISO 14001 and ISO 9001 are developed by the same organization and based on the same principles. Their similarities may prompt more firms to get the environmental certification in those countries where the quality certification is more prevalent (Vastag, 2004).

Finally, we include the variable *clean energy*, which refers to non-carbohydrate energy that does not produce carbon dioxide when generated (as a percentage of the total). It includes hydropower and nuclear, geothermal, and solar power, among others. Clean energy is produced without the undesirable consequences of the burning of fossil fuels, such as high carbon dioxide emissions, which is considered to be the major contributing factor to global warming. We consider that high levels of *clean energy* in a given country may indicate a

higher awareness of the negative consequences of pollution and, therefore, greater environmental pressures from society.

We also consider several variables related to the economy of each country. First, our model considers the fact that countries may differ in the number of potential firms adopting ISO 14001. Thus, we control for the economic size of each country by including the variables *GDP per capita* and *labor force.* Whereas *GDP per capita* shows the sum of gross value added by all resident producers in the economy by population, *labor force* reflects the number of inhabitants that meet the International Labor Organization definition of the economically-active population expressed as a percentage of the total population. We consider that the number of potential adopters is higher in countries with high values of these two variables. Second, we proxy cross-country differences in the type of firms' activities by including the variable *Industry,* which comprises value added in sectors of industrial production of each economy expressed as a share of GDP.

Given the longitudinal nature of our data set, we include a set of *year dummies* to control for possible time influences. These variables allow controlling for country-wide common shocks, such as economic crises. Our model Table 2 presents the descriptive statistics and correlations between the variables included in the empirical analysis.

Table 2 to be inserted about here

4.3. Model

Our study measures the effect of macro-level institutions on the diffusion of ISO 14001. Our dependent variable is the number of ISO 14001 certifications in each of the countries analyzed. Given that this variable is discrete and non-negative, the classical linear model might be inappropriate. Instead, the use of a Poisson regression is broadly

recommended (Greene, 2008). Two basic assumptions must be fulfilled for this statistical technique to be used properly, namely, equidispersion and excess of zeros. As our sample does not meet these assumptions, we employ a negative binomial regression (generalized Poisson) because it is generally suggested as a more adequate option when the Poisson distribution assumptions are rejected (Audretsch & Lehmann, 2005; Guler et al., 2002). Our data include the two main features necessary to properly employ a negative binomial specification. Our dependent variable: i) is a non-negative and discrete count variable; and ii) exhibits overdispersion (the conditional variance exceeds the conditional mean).

It is also important to note that one of our theoretical variables is time invariant. The variable *uncertainty avoidance*, which is key in our first and third hypotheses, is constant throughout our observation window. Under these circumstances, the use of a fixed-effects specification is inappropriate to test our hypotheses because it eliminates any between-firm variation by mean-centering all the variables. As a consequence, we must use a random effects specification. This is in line with the existing literature that argues that, while time-invariant variables are interesting from a theoretical point of view, the random-effects specification is a more appropriate technique (Certo & Semadini, 2006; Fuentelsaz et al., 2015; Yu, Subramaniam, & Canella, 2013). Therefore, in our estimations, we use a random-effects negative binomial model with panel data.

5. RESULTS

The results of the negative binomial regression are presented in Table 3. To test our hypotheses, we estimated five models. Model 1 shows the results of the baseline model, which only includes the control variables. Model 2 and Model 3 consider the influence of uncertainty avoidance (Hypothesis 1) and market-supporting institutions (Hypothesis 2), respectively. Model 4 incorporates the joint effect of both institutional variables. Finally, to evaluate the potential interdependences between macro-level institutions, we multiply the

variables uncertainty avoidance and market-supporting institutions. The resultant interaction term is included in Model 5 (Hypothesis 3). The values of the Wald tests (shown at the bottom of Table 3) confirm that the full model is preferred to its simple counterparts. Therefore, we focus the discussion of our results on Model 5. As shown by the value of the chi squared, all the models are globally significant. Collinearity diagnostic confirms that multicollinearity is not a concern in our analysis since all variance inflation factors (VIF) are below the recommended threshold of 10 (Marquardt, 1970; Hair, Anderson, Tatham and Black, 1995). In particular, the mean VIF of the model is 2.77 and the range of VIF scores of the predictor variables oscillates between 5.10 and 1.25.

Table 3 to be inserted about here

Regarding Hypothesis 1, our results show that the direct effect of uncertainty avoidance is positive and significant (β=0.730, p=0.000). This means that the number of firms adopting ISO 14001 is higher in countries with greater levels of uncertainty avoidance and, therefore, supports Hypothesis 1. It seems that ISO 14001 is conceived as a tool that provides orderliness within the firm and allows managers to address stakeholders' concerns.

Hypothesis 2 proposes that strong market-supporting institutions enhance the diffusion of ISO 14001. The variable market-supporting institutions has a positive and significant coefficient (β=0.229, p=0.000), supporting Hypothesis 2. In accordance with our expectations, strong market-supporting institutions favor the adoption of ISO 14001 as they make it easier for stakeholders to exert pressure on firms to adopt sustainable practices, reduce the costs related to the implementation process and increase the value that managers attach to the capacity of the standard to improve operational efficiency and differentiate themselves from their competitors.

Regarding the interdependencies between formal and informal institutions, the coefficient of the interaction term between uncertainty avoidance and market-supporting institutions is negative and significant (β=-0.284, p=0.000). This result is consistent with the idea that the effect of uncertainty avoidance on the diffusion of ISO 14001 is less intense in countries with strong market-supporting institutions. Hence, the attractiveness of ISO 14001 to provide formalization and reduce ambiguity seems to be lower in societies with highly developed formal institutions. This result supports our Hypothesis 3.

To provide a more nuanced picture of the interdependencies between formal and informal institutions, Figure 1 offers a graphical illustration of their interactive effect (Dawson, 2014). To plot the interaction we focus on "high" and "low" levels of each independent variable. Following the standard approach, we operationalize "high" and "low" levels at one standard deviation above and below the mean, respectively (Aiken and West, 1991). As the variable market-supporting institutions varies over our observation window, we calculate its mean and standard deviation by considering the whole analyzed period. Whereas the solid line in Figure 1 depicts the effect of uncertainty avoidance on the diffusion of ISO 14001 when market-supporting institutions show a low level of development, the dotted line represents the influence of uncertainty avoidance on the diffusion of ISO 14001 when market-supporting institutions are highly developed. Overall, Figure 1 displays a positive relationship between the level of uncertainty avoidance and the number of ISO 14001 certifications within a country. In line with our expectations, this relationship is less intense when market-supporting institutions are highly developed. The dotted line of Figure 1 rises slower than the solid one. This means that the effect of an additional unit of uncertainty avoidance on the expected count of ISO 14001 is lower when market-supporting institutions are high. This graphical result supports our Hypothesis 3.

Figure 1 to be inserted about here

5.1. Robustness checks

We have carried out two additional analyses in order to provide robustness to our results. First, we measure informal institutions by using an alternative variable to approach uncertainty avoidance. As mentioned, the uncertainty avoidance dimension provided by GLOBE shows a great adjustment to our research goal, since it is focused on matters related to the organization of a society (Tung & Verbeke, 2010; Veniak & Brewer, 2010). However, we consider interesting to explore our model when uncertainty avoidance is measured through the dimension proposed by Hofstede (1991). It is important to point out that previous studies have shown that the uncertainty avoidance dimensions of GLOBE and Hofstede have opposite patterns. For instance, Koopman et al. (1999) found that whereas in the Hofstede project most of the Southern countries had higher uncertainty avoidance levels than the North and Western countries in Europe, in the GLOBE project the pattern was the opposite. Similarly, whereas Husted (1999) uses Hofstede to find that high levels of uncertainty avoidance are more likely to show corrupt behaviors, Parboteeah et al. (2005) reached the opposite conclusion using GLOBE. These contradictory results are explained by the fact that GLOBE and Hofstede capture different components of the uncertainty avoidance construct. Hofstede dimension is focused on the level on societal stress, whilst the GLOBE dimension reflects the extent to which a society values orderliness and lives in accordance with structured frameworks that help to prevent unexpected events (Veniak & Brewer, 2010). We

replicate our estimations with the dimension uncertainty avoidance of Hofstede. Accordingly, we use in our model the variable *Uncertainty avoidance Hofstede*[8].

Second, we measure formal institutions with an alternative approach. We focus on the Worldwide Governance Indicators (WGI), which have been shown to be suitable when evaluating the degree of formal institutional development of countries (Fuentelsaz et al., 2015). The WGI project offers aggregate indicators for over 200 countries over the period 1996–2016 for six dimensions of governance: voice and accountability; political stability and absence of violence; government effectiveness; regulatory quality; rule of law; and control of corruption. Given its similarity with our market-supporting institutions construct, we used the *Regulatory Quality index*[9]. This reflects "perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote the private sector". Therefore, this variable proxies, to some extent, the efficiency of the market.

Table 4 shows our robustness analyses. Column 1 and 2 measure the effect of uncertainty avoidance by using the dimension of Hofstede. Column 1 includes the direct effect of the variable *Uncertainty avoidance Hofstede* and Column 2 displays the full model specification. Columns 3 and 4 consider the effect of the variable *Regulatory Quality index*. Whereas Column 3 displays the direct effect of such variable, Column 4 presents the full model specification.

Table 4 to be inserted about here

Regarding our first robustness analysis, Column 1 and 2 of Table 4 show that the variable *Uncertainty avoidance Hofstede* has a negative and significant effect on the number

[8] The correlation between the uncertainty avoidance dimensions of GLOBE and Hofstede in our sample is -0.62. This negative correlation is in line with previous literature (see, for example, Garrido et al, 2014 and Veniak & Brewer, 2010).

[9] The Regulatory Quality index shows a correlation of 0.93 with our market-supporting institutions variable.

of ISO 14001 within a country (β=-0.177, p=0.018 in Column 1 and β=-0.195, p=0.011 in Column 2). By contrast, our main estimations display a positive and significant effect of the variable uncertainty avoidance when it is measured through the dimension of GLOBE. This contradictory finding, in line with previous literature, provides additional evidence of the fact that GLOBE and Hofstede measure different aspects of the uncertainty avoidance dimension.

With respect to our second robustness analysis, Columns 3 and 4 of Table 4 show that the effect of the variable *Regulatory Quality index* is positive and significant (β=0.619, p=0.000 in Column 3 and β=0.491, p=0.000 in Column 4). This supports the results of our main estimations. Formal institutions enhance the diffusion of ISO 14001 either when they are measured through the variable *Regulatory Quality index* or the variable *market-supporting institutions*. Likewise, the parameter of the interaction term of Column 4 is negative and significant (β=-0.312, p=0.000). This means that formal institutions reduce the effect of uncertainty avoidance on the diffusion of ISO 14001 regardless they will be measured through the variable *market-supporting institutions* or the variable *Regulatory Quality index*.

6. DISCUSSION

Our research explores the role that macro-level institutions play in the worldwide diffusion of ISO 14001. It finds that uncertainty avoidance and strong market-supporting institutions are important drivers for the adoption of this environmental standard. Moreover, it shows that both macro-level institutions are interrelated. Our results reveal that, in countries with strong market-supporting institutions, uncertainty avoidance exerts a lower effect on the diffusion of ISO 14001. These findings have several theoretical and policy implications.

From a theoretical perspective, this study refines our understanding about the factors that explain the uneven worldwide distribution of ISO 14001 (Delmas & Montes-Sancho, 2011; Delmas & Montiel, 2008; Delmas & Toffel, 2004; Neumayer & Perkins, 2004; Potoski & Prakash, 2004). It shows that macro-level institutions influence the diffusion of ISO 14001

by shaping both external pressures demanding its adoption and managers' assessments about its utility as a management tool that structures internal processes and signals environmental commitment. This enriches the institutional theory by proposing that the institutional context, in addition to comprising social actors that exert pressure on firms to adopt specific practices, may also determine the extent to which managers attach value to the endorsed practices (DiMaggio & Powell, 1983; Meyer & Rowan, 1977; Scott, 1995).

Our research also shows the importance of considering the interrelations between macro-level institutions when analyzing the diffusion of ISO 14001. It reveals that market-supporting institutions reduce the effect of uncertainty avoidance on the diffusion of the EMS. This is in line with prior studies that state that informal practices, such as uncertainty avoidance, are not relevant drivers of strategic choices when formal institutions are highly developed (Peng, 2003; Peng et al., 2008). We consider that the interactive nature of the drivers of the adoption of EMSs deserves further attention. This research explores interdependencies between macro-level institutions but future studies could analyze whether stakeholders that require environmental responsibility from firms have a substitutive or a complementary effect on the diffusion of ISO 14001. For instance, the impact of green customers on the implementation of environmentally-friendly activities might be higher in countries with a dense network of NGOs. NGOs like Greenpeace denounce the pollution caused by firms. By increasing social awareness of ecological problems, NGOs could strengthen the effectiveness of consumer pressure on the development of environmental behaviors by firms.

Regarding policy implications, it is important to notice that environmental standards are often used to complement legislation and to better address environmental issues within a country (Gilbert & Rasche, 2007). Our research, by identifying the institutional factors that stimulate the adoption of ISO 14001, may help governments to promote the diffusion of

environmental standards that support their environmental policies. As the capacity of ISO 14001 to reduce uncertainty seems to favor its diffusion, governments from countries with a great fear of the unknown might develop campaigns that describe the environmental standard as a tool that provides order and certainty in order to boost its adoption. Similarly, since the difficulties of implementing ISO 14001 may slow down its diffusion, governments might reinforce market institutions that favor its adoption and certification. For instance, governments could collaborate with certification bodies to facilitate the acquisition of the ISO 14001 certification. This will reduce the costs associated with the implementation of the environmental standard.

Our research is not without limitations. Firstly, our aim is to explain the diffusion of ISO 14001 by considering interdependences between formal and informal institutions. To do this, we focus on market-supporting institutions and a specific cultural trait: uncertainty avoidance. We contemplate this cultural trait because it is interrelated to market-supporting institutions. The need of avoiding uncertainty in a particular society may be satisfied by market-supporting institutions, as they provide certainty and reduce ambiguity in human interactions. This fact makes uncertainty avoidance the cultural trait that best fits with our theoretical approach. Despite this, we acknowledge that other cultural traits might also have an effect on the diffusion of the environmental standard. For instance, institutional collectivism, which reflects the extent to which members of a society stress good relationships with stakeholders (Waldman et al., 2006), may promote the adoption of ISO 14001. In countries with a high level of institutional collectivism, managers are more likely to adopt the environmental standard as a means to achieve cordial relationships with their stakeholders. Similarly, future orientation, which characterizes societies that emphasize working for long-term success (House et al., 2004), may boost the diffusion of ISO 14001. Institutional support and social acceptance increase the chances of firms' survival (DiMaggio & Powell, 1983;

Meyer & Rowan, 1977). As a consequence, managers oriented to the future have strong incentives to adopt the environmental standard to obtain external support, thereby securing the survival of their firms in the long term. Future research that only considers informal institutions affecting the diffusion of ISO 14001 could focus on the effect of these cultural dimensions.

Secondly, we focus on the analysis of the factors underpinning the diffusion of ISO 14001 without paying attention to the consequences of its implementation. We acknowledge that macro-level institutions may also affect the effectiveness with which the ISO 14001 is implemented and, therefore, determine its effect on firm performance. For instance, the reorganization of internal processes in accordance with ISO 14001 might be more effective in countries with strong market-supporting institutions where the information about its implementation process is highly accessible and a dense network of professionals may support firms in the training of employees and offer technical assistance. Future research should further our knowledge of the consequences of adopting ISO 14001 by exploring the moderating role of macro-level institutions in the implementation process. This would enrich previous literature that has identified several contingencies that determine the relationships between environmental management and firm performance (Christmann, 2000; Klassen and McLaughlin, 1996, Nehrt, 1996).

The third limitation of our study comes from the database that we use to test our hypotheses. Our results contribute to our understanding of the aggregated trend of diffusion of ISO 14001, which is sufficient to understand the influence of macro-level institutions on its uneven worldwide distribution. However, a multilevel study would provide a more detailed perspective of the phenomenon analyzed. Future research could gather information at the firm level, through surveys or personal interviews with managers, in order to comprehend micro-level aspects of the diffusion process.

Finally, our study focuses on ISO 14001, which is an environmental management standard with very specific features. This limits the generalization of our results. Future research would benefit from extending our analysis by considering the effect of macro-level institutions on the diffusion of other certified management standards such as ISO 9001, a quality management standard. The analysis of its international diffusion might involve considering other macro-level institutions as drivers of its adoption. For instance, in the case of culture, it may make more sense to focus on performance orientation than on uncertainty avoidance. Performance orientation reflects the extent to which individuals value material outcomes and the achievement of results (House et al., 2004). This cultural trait might have a direct effect on how managers assess the capacity of ISO 9001 to improve the performance of their firms through higher quality in their internal operations. Future research should investigate these ideas more deeply.

Overall, the current research identifies on the drivers of the international diffusion of ISO 14001. By looking at the reasons that determine the adoption of this environmental standard, we seek to increase our understanding of the factors that foster firms' development of ecological behaviors. This is useful to promote the preservation of the natural environment and to encourage firms to manage their resources in a sustainable way.

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Table 1: *ISO 14001 certifications for the period 2000-2014*

	Country	Mean	Std. Dev.
1	Albania	6.8	12.76
2	Argentina	730.6	430.89
3	Australia	1899.33	1208.44
4	Austria	716.93	325.13
5	Bolivia	27.2	17.90
6	Brazil	2033.8	1172.01
7	China	42712.8	41060.87
8	Colombia	832	1038.87
9	Costa Rica	63.4	27.58
10	Denmark	877.33	296.75
11	Ecuador	77.33	71.81
12	Egypt	388.2	235.00
13	El Salvador	6.8	5.70
14	Finland	1017.87	275.32
15	France	4193.47	2546.84
16	Georgia	5.47	14.46
17	Germany	5204.73	1762.44
18	Greece	392.13	302.2
19	Guatemala	10.87	7.85
20	Hong Kong	564.27	318.94
21	Hungary	1283.53	626.83
22	India	2763.6	1966.09
23	Indonesia	693.93	484.14
24	Ireland	413.07	182.74
25	Italy	11609.27	8500.99
26	Japan	23129.4	10206.22
27	Kazakhstan	83.27	86.07
28	Malaysia	1074.47	745.33
29	Mexico	682.47	361.81
30	Morocco	40.33	34.88
31	Namibia	6.53	3.52
32	Netherlands	1417.27	510.47
33	Nigeria	22.53	18.07
34	Philippines	406.8	235.21
35	Poland	1207.73	723.90
36	Portugal	607.93	420.94
37	Russian Federation	651.53	654.23
38	Singapore	870.87	527.32
39	Slovenia	339.87	127.35
40	South Africa	588.47	280.83
41	South Korea	5415	3675.70
42	Spain	11191.33	6369.78
43	Sweden	3475.07	931.45
44	Switzerland	1892.33	779.92
45	Thailand	1581.73	1025.19
46	Turkey	1164.4	805.06
47	United Kingdom	9248.33	5326.68
48	USA	4509.73	1609.08
49	Zambia	6.8	7.78

Table 2: *Descriptive statistics and correlations*

Variable	Obs.	Mean	Std. Dev.	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) ISO14001 certifications	686	3208.56	9606.57	0	117758	1.00										
(2) Labor force	686	0.47	0.07	0.30	0.60	0.25	1.00									
(3) GDP per capita	686	19152.20	19216.52	350.26	88002.61	0.11	0.53	1.00								
(4) Industry	686	30.04	7.01	6.84	48.53	0.11	-0.08	-0.45	1.00							
(5) Exports (% GDP)	686	43.78	37.99	9.04	230.27	-0.12	0.27	0.26	-0.16	1.00						
(6) FDI inflow (% GDP)	686	4.71	7.50	-16.07	87.44	-0.09	0.19	0.19	-0.23	0.57	1.00					
(7) Clean energy	686	11.26	11.91	0	50.73	-0.01	0.15	0.24	-0.19	-0.17	-0.14	1.00				
(8) Kyoto Protocol	686	0.68	0.47	0	1	0.14	0.05	0.11	0.11	-0.07	-0.02	0.07	1.00			
(9) ISO 9001 certifications	686	16194.83	38330.52	1	342800	0.90	0.25	0.10	0.13	-0.14	-0.08	-0.06	0.09	1.00		
(10) Uncertainty Avoidance	686	0.00	1.00	-1.76	2.10	0.15	0.33	0.65	-0.14	0.28	0.14	0.20	-0.02	0.16	1.00	
(11) Market-supporting institutions	686	-0.01	1.00	-1.94	1.83	-0.05	0.42	0.81	-0.57	0.39	0.29	0.20	-0.07	-0.08	0.53	1.00

***Table 3**: Effect of macro-level institutions on ISO 14001 diffusion*

	(1)	(2)	(3)	(4)	(5)
Uncertainty avoidance		0.616		0.520	0.730
		(0.000)		(0.000)	(0.000)
Market-supporting institutions			0.299	0.199	0.229
			(0.000)	(0.000)	(0.000)
Uncertainty avoidance* Market-supporting institutions					-0.284
					(0.000)
Labor force	-0.823	-0.361	-0.457	-0.179	0.0207
	(0.432)	(0.709)	(0.665)	(0.855)	(0.982)
GDP per capita	0.000000231	-0.0000156	-0.00000816	-0.0000191	-0.0000158
	(0.931)	(0.000)	(0.010)	(0.000)	(0.000)
Industry	0.00884	0.00759	0.0168	0.0139	0.0123
	(0.174)	(0.214)	(0.012)	(0.033)	(0.039)
Exports (% GDP)	0.00247	-0.00104	0.00105	-0.00162	-0.00253
	(0.044)	(0.431)	(0.399)	(0.222)	(0.043)
FDI inflow (% GDP)	0.000187	0.00165	0.00138	0.00192	0.00130
	(0.944)	(0.507)	(0.567)	(0.424)	(0.565)
Clean energy	0.00569	0.00620	0.00542	0.00571	0.0108
	(0.242)	(0.190)	(0.269)	(0.231)	(0.013)
Kyoto Protocol	0.0429	0.0288	-0.0228	-0.00742	-0.00880
	(0.625)	(0.746)	(0.784)	(0.931)	(0.914)
ISO 9001 certifications	0.00000757	0.00000671	0.00000810	0.00000709	0.00000666
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year dummies	Yes	Yes	Yes	Yes	Yes
Constant	0.772	1.116	0.552	0.910	0.999
	(0.147)	(0.031)	(0.304)	(0.085)	(0.046)
N	686	686	686	686	686
Chi2	2005.0	3136.7	2047.4	2908.6	4446.3
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Wald test vs model 1	.	55.58	29.36	70.50	124.98
		(0.000)	(0.000)	(0.000)	(0.000)
Wald test vs model 2	.	.	.	13.19	64.27
				(0.000)	(0.000)
Wald test vs model 3	.	.	.	36.08	107.69
				(0.000)	(0.000)
Wald test vs model 4	.	.	.	.	53.46
					(0.000)

Note: p-values in parentheses below regression coefficients.

***Table 4**: Robustness analyses*

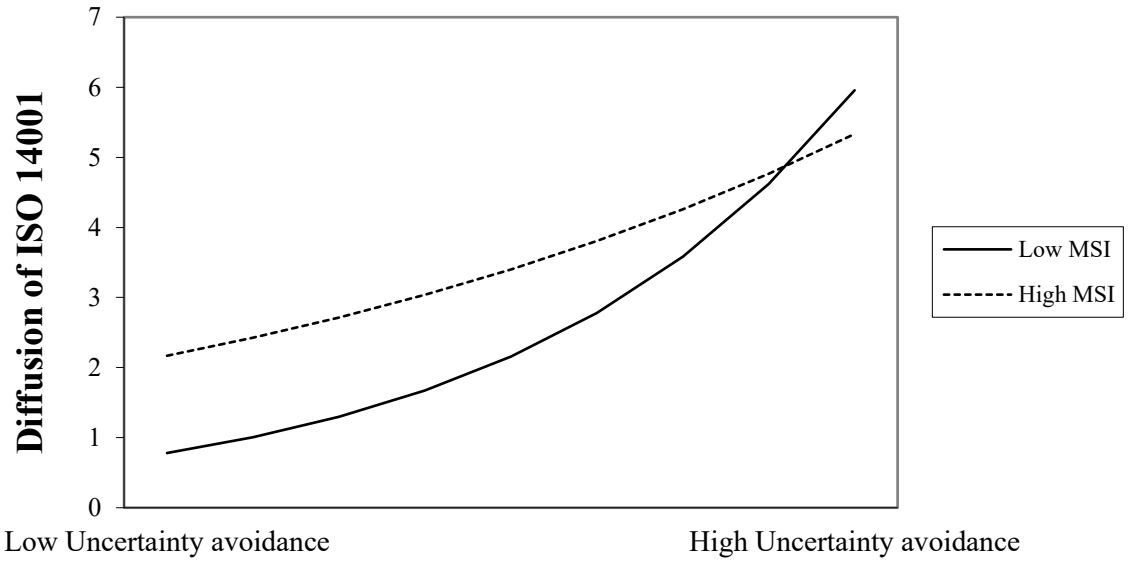
	(1)	(2)	(3)	(4)
Uncertainty avoidance Hofstede (UAH)	-0.177	-0.195		
	(0.018)	(0.011)		
Market-supporting institutions (MSI)		0.192		
		(0.001)		
UAH* MSI		0.0876		
		(0.049)		
Uncertainty avoidance GLOBE (UAG)				0.545
				(0.000)
Regulatory Quality index			0.619	0.491
			(0.000)	(0.000)
UAG*Regulatory Quality index				-0.312
				(0.000)
Labor force	1.951	1.989	-2.558	-1.277
	(0.047)	(0.044)	(0.021)	(0.202)
GDP per capita	-0.00000710	-0.0000106	-0.00000922	-0.0000143
	(0.009)	(0.001)	(0.007)	(0.000)
Industry	0.00650	0.00724	0.0154	0.0127
	(0.297)	(0.259)	(0.022)	(0.044)
Exports (% GDP)	0.00109	0.000411	-0.000604	-0.00259
	(0.370)	(0.746)	(0.628)	(0.056)
FDI inflow (% GDP)	0.00200	0.00229	0.00159	0.00160
	(0.403)	(0.307)	(0.473)	(0.456)
Clean energy	0.0107	0.0117	0.00320	0.0113
	(0.026)	(0.016)	(0.472)	(0.016)
Kyoto Protocol	-0.0314	-0.0558	0.00477	0.0403
	(0.718)	(0.506)	(0.955)	(0.632)
ISO 9001 certifications	0.00000729	0.00000753	0.00000766	0.00000636
	(0.000)	(0.000)	(0.000)	(0.000)
Year dummies	Yes	Yes	Yes	Yes
Constant	-0.0965	-0.0440	2.309	2.258
	(0.850)	(0.931)	(0.000)	(0.000)
N	644	644	588	588
Chi2	2680.5	2792.0	1430.6	2359.2
	(0.000)	(0.000)	(0.000)	(0.000)

Note 1: p-values in parentheses below regression coefficients.

Nota 2: Due to the availability of data in the Hofstede project, Columns 1 and 2 are performed in a sample of 46 countries. We exclude from the original sample Bolivia, Georgia and Kazakhstan because Hofstede project does not offer information about the cultural dimensions of these countries.

Note 3: Due to the availability of data for the Regulatory Quality index, Columns 3 and 4 are performed for the period 2002-2014.

Figure 1: *Interactive effect of market-supporting institutions and uncertainty avoidance on ISO14001 diffusion*



Note 1: The simple slope test shows that the relationship between uncertainty avoidance and the number of ISO 14001 certificates remains significant when the value of market-supporting institutions is high and low (β=0.450, p=0.000, for a high value of market-supporting institutions, and β=1.016, p=0.000, for a low value of market-supporting institutions).