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ABSTRACT

This paper analyzes the determinants of the cross-national adoption of the international Environmental Management System standard ISO 14001 using a panel of 102 countries from 1996 to 2000. I use new institutional economics to develop hypotheses on the impact of the institutional environment on the cost of adopting the management standard. I also develop hypotheses using the institutional sociology perspective to address the role of the institutional environment in affecting demand and legitimation processes related to the standard. The results of the statistical analysis show that both rationales of cost minimization and legitimation play a role in the adoption of the standard. Using both theories improves our understanding of institutional forces affecting the early adoption of emerging management standards.

INTRODUCTION

Organizational scholars and economists have long argued that national environments can significantly affect many aspects of organizations, especially through the distinct institutional, legal, political and cultural features of a country. However, they acknowledge the importance of the institutional environment on organizational choice through different avenues: on the one hand, institutional sociology puts the emphasis on norms and cognitive elements of the institutional environment as predictors of organizational change. It describes firms as driven by legitimation processes (Scott, 1995). On the other hand, new institutional economics emphasizes the impact of the institutional environment, defined as the "rules of the game" on organizational change, and proposes that firms adopt governance structures based on their comparative efficiency (North, 1990; Williamson, 1996). New institutional economics highlights differences in the efficiency of governance structures according to the institutional environment in which they are implemented. Although these two approaches are not necessarily incompatible, since organizations may adopt organizational change for different reasons, they are rarely both investigated at the same time.

I propose that both the institutional sociology and new institutional economics perspectives need to be considered together in order to understand the institutional mechanisms that drive the adoption of new management practices. This paper proposes, and tests empirically, a comprehensive approach to explaining the adoption of management practices, when firms are seeking both legitimation and efficiency. In this

paper, I analyze empirically the institutional factors that explain the early adoption of the international environmental management standard ISO 14001 in 102 countries.

The 1990s have been marked by the diffusion of international management standards such as the total quality management standard ISO 9000 and the international environmental management standard ISO 14001. Research has been conducted on the mechanisms of the international diffusion of the ISO 9000 standard (Casper and Hancke, 1999; Mendel, 2001; Guler, Guillen and MacPherson, 2002). However, because of the lack of data at the early stage of its adoption, the research on ISO 9000 has focused mainly on the later stages of diffusion, once the standard was adopted by a large number of companies in a large number of countries. Little is know about the factors that explain the adoption of an emerging management standard within a specific country, that is to say the factors that cause the adoption of the standard at its inception.

It is important to analyze the factors that explain the adoption of an international standard at its early stage, as they may differ from the factors that explain its later diffusion. Research has shown that imitation in the network of trade relations may play an important role in the adoption of management standards after several years (Guler, Guillen and MacPherson, 2002). I argue that in the early phase of adoption, the role of the institutional environment, including both its regulative and normative elements within each country, may play a more important role than forces related to trade. This is because of the initial small number of adopters in each country and the need to set-up the "infrastructure" to facilitate the initial adoption of the standard within a country. Furthermore, it is essential to understand the factors that explain the early adoption of a

standard within a particular country as the development of more international standards is being considered.

The ISO 14001 standard, released in 1996, is a standard for a certified Environmental Management System (EMS). An Environmental Management System is one of the tools an organization can use to implement an environmental policy. It consists of "a number of interrelated elements that function together to help a company manage, measure, and improve the environmental aspects of its operations" (Welford, 1996). In 2000, 22,900 firms had adopted ISO 14001 in 98 countries. However, the level of adoption of ISO 14001 differs greatly across countries (see Figure 1.). In 2000, 48 percent of the worldwide ISO 14001 certified facilities were located in Western Europe and 34 percent in the Far East, while U.S. certified facilities accounted for only 4.5 percent of ISO 14001 certified facilities (ISO, 2000) (see Figure 2.). Because ISO 14001 is a very recent standard and because we have information on the number of ISO 14001 certifications in the first five years of the life of the standard, it provides an ideal setting for the analysis of the factors driving or hampering the adoption of an emerging standard.

I argue that in the case of the early adoption of ISO 14001, both efficiency rationales and legitimation processes play a role in favoring or hampering the adoption of the standard. ISO 14001 is a process standard where firms implement an environmental management system. The aim of ISO 14001 is to improve the management of environmental issues within the firm. The actual impact of ISO 14001 on environmental performance is not guaranteed. The standard does not establish absolute requirements for environmental performance other than a commitment to compliance with applicable regulations, and it does not identify environmental performance as a factor in the actual certification

process.[1] According to institutional sociology theory, faced with uncertainty of the tangible benefits of an organizational practice, firms will rely on their routines, that is to say on what they have done in the past, or do what is perceived as appropriate within the institutional context in which they operate. Managers may form their opinions by observing which companies around them are adopting the standard. Or they may be subject to the coercive action of powerful actors, such as states and multinational companies, who require the standard (Guler, Guillen and McPherson, 2002).

Institutional factors may also impact the costs of adoption of the standard. Since environmental issues are heavily regulated, the regulatory aspect of the institutional environment plays an important role for an environmental standard such as ISO 14001. Specifically, firms might identify regulatory violations during the implementation of the environmental certification. The adoption of the standard may thus be associated with high transaction costs if regulatory agencies or other stakeholders were to use such information against firms. Firms may be reluctant to adopt a standard that involves high transaction costs. On the other hand, if regulatory agencies are committed to increasing the stringency of their environmental regulations, the adoption of the ISO 14001 standard facilitate firms' adaptation to more stringent regulation and reduce the cost of complying with these.

In this paper, I integrate the new institutional economics perspective with the institutional sociology perspective. I first propose a comprehensive institutional framework that takes into account the rules of the game as well as social norms, to explain the costs and benefits of adopting a management standard in a specific national context. I subsequently

test the proposed framework by analyzing the adoption of ISO 14001 since its creation in 1996.

DESCRIPTION OF ISO 14001

Formally adopted in 1996 by the International Organization for Standardization, ISO 14001 represents a new standard, and approach to improved environmental management practices. ISO 14001 shares many common traits with its predecessor ISO 9000, the international standard for quality management. Like ISO 9000, ISO 14001 does not focus on outcomes, such as pollution, but focuses on processes. Also like its predecessor, ISO 14001 involves a possible audit by a third party. The ISO 14001 standard describes the basic elements of an effective Environmental Management System (EMS). These elements include creating an environmental policy, setting objectives and targets, implementing a program to achieve those objectives, monitoring and measuring its effectiveness, correcting problems, and reviewing the system to improve both the program and overall environmental performance (Delmas, 2002).

To acquire ISO 14001 certification, an organization must undertake an initial audit and complete five surveillance visits during the three-year validity of the certificate (Adams, 1999). The costs of certification can vary widely, depending on the size of the company, the nature of its operation, and the environmental system already in place. Estimates range from less than $50,000 for small firms to greater than $200,000 for larger firms (Watkins and Gutzwiller, 1999). These estimations concern the certification process only and do not take into account the cost of organizational changes that firms may have to carry out to attain the ISO 14001 standard.

As ISO 14001 is based on the same approach that managers have successfully used to identify and eliminate quality defects with ISO 9000, it can help to identify and correct process defects that result in pollution. Therefore, organizations that set out to manage environmental matters systematically can be expected to learn about production processes that result in pollution, take action against these and perform better than firms that do not (Coglianese and Nash, 2001). However, even if improvement in environmental performance is expected of ISO 14001 certified firms, the standard does not require firms to provide information to the public on their environmental performance. Nor does it require improvement beyond regulatory compliance.

In addition to improving environmental performance, ISO 14001 is said to have the potential to provide economic benefits to certified companies, notably in terms of competitive advantage (Corbett and Kirsch, 2001; Delmas, 2001). Companies may experience direct financial benefits: a decrease in the cost of regulatory fines, as well as a decrease in environmental liabilities. By involving employees in the design and implementation of the standard, ISO 14001 can potentially lead to operational efficiencies. ISO 14001 can also indicate to external stakeholders, such as customers, communities, media, investment and insurance groups, and regulatory agencies, that the company has an environmental management system in place. In brief, ISO 14001 can be used to send a signal to the institutional world that the firm conforms to a specific norm (Russo, 2002).

INSTITUTIONAL ENVIRONMENT AND ADOPTION OF ISO 14001

New institutional economics and institutional sociology offer seemingly contradictory interpretations of organizational phenomena. According to Granovetter (1985) new

institutional economics provides an undersocialized account whereas institutional sociology offers an oversocialized perspective. In this part, I argue that new institutional economics and institutional sociology should be integrated to understand the institutional mechanisms that drive the adoption of emerging governance structures.

New institutional economics is defined in opposition to the "old institutional economics" pioneered by Thorstein Veblen, John Commons and Wesley Michell. The old institutional school argued that institutions were a key factor in explaining and influencing economic behavior, but it operated outside neo-classical economics and there was no quantitative theory from which reliable generalization could be derived or sound policy choices made. In contrast, new institutional economics acknowledges the important role of institutions, but argues that one can analyze institutions within the framework of neoclassical economics. More specifically, new institutional economics focuses on how the institutional environment impacts the transaction costs associated with governance structures. Transaction costs include all search and information costs, as well as the costs of monitoring and enforcing contractual performance. Proponents of the new institutional economics approach assume that organizations face competitive pressures that drive them to efficiency frontiers. The new institutional economics framework defines the institutional environment as background constraints, or "rules of the game", that guide individuals' behavior. These can be both formal, explicit rules (constitutions, laws, property rights) and informal, often implicit rules (social conventions, norms) (North, 1990). [2] The institutional environment is also seen as a "set of parameters, changes which elicit shifts in the comparative costs of governance" (Williamson, 1996:112).

Institutional sociology adopts a broader notion of the institutional environment, which includes the "cognitive, normative and regulative structures and activities that provide stability and meaning to social activities" (Scott, 1995:33). The institutional sociology framework emphasizes the importance of regulatory, normative and cognitive factors that affect firms' decisions to adopt a specific organization practice beyond the technical efficiency of the practice. Institutional sociology places particular emphasis on legitimation processes and the tendency for institutionalized organizational structures and procedures to be taken for granted (Oliver, 1992:563), regardless of their efficiency implications. It captures the extent to which organizational designs adopted within organizational fields tend toward increased homogeneity over time. Isomorphism, which represents the adoption of similar organizational forms, is a central construct within institutional sociology (Meyer and Rowan, 1977).

The second main difference between institutional sociology and new institutional economics lies in the importance attributed to bounded rationality and uncertainty. Even though institutional economists have incorporated bounded rationality in their approach, they have paid little attention to the implications of bounded rationality at the design selection level (Dow, 1987). In the institutional sociology approach, bounded rationality implies limited searches among available alternatives. March and Simon (1958) recognized that decision makers operate under cognitive constraints and tend to conduct more or less limited searches among available alternatives to obtain satisficing solutions. When information is not available or when searching for information is too costly, organizations will rely on their routines and will adopt what is conceived as appropriate. Normative and cognitive elements of the institutional environment are more likely to play

a role in firms' decisions to adopt organizational practices under conditions of uncertainty, i.e. when the benefits from an organizational practice are poorly understood, and the efficiency benefits of adoption are not clear (DiMaggio and Powell, 1983).

The new institutional economics framework highlights an additional source of uncertainty which is not taken into account by the institutional sociology perspective, and which originates from opportunistic behavior. The opportunistic behavior of contractual parties such as firms or governments can increase the ex-post transaction costs linked to the adoption of a governance structure. Governments who are setting the rules of the game may be the source of uncertainty. A firm may adopt a governance structure to reduce such opportunism and its associated costs or, on the contrary, a firm may reject a governance structure because of the potential transaction costs that are associated with it. In this framework, managers are devising strategies to reduce uncertainty linked to opportunistic behavior.

It seems that both approaches shed light on two different sources of uncertainty: the first one resulting from bounded rationality and the second one from opportunistic behavior. These two sources of uncertainty can be both present at the same time and it is important to understand how firms could cope with these. Scott suggested, that "institutional arguments need no be formulated in opposition to rational or efficiency arguments but are better seen as complementary and contextualizing them" (Scott, 1987: 509). Baron and Hannan, in their review of the influence of economics on sociology, note that recent strands of economic sociology focus on the situational and structural forces that shape actors' options for pursuing their economic objectives (Baron and Hannan, 1994). Scott and Meyer argue that there is evidence of progress in reconciling the economics and the

sociological approaches (Scott and Meyer, 1994: 75). Roberts and Greenwood proposed to merge the two theoretical approaches and suggested a "constrained-efficiency" perspective (Roberts and Greenwood, 1997). Their approach introduces cognitive constraints and satisficing search behavior into an efficiency-based design adoption framework.

Building on this research trend, I propose that both the new institutional economics and institutional sociology approaches be integrated to understand the institutional mechanisms that drive the adoption of emerging governance structures. In this perspective, managers are boundedly rational because they do not have all the information on the technical efficiency of the innovation. They may therefore be subject to the pressure of powerful actors that provide them with information on the benefits of the emerging governance structure. The adoption of an emerging standard may also be associated with transaction costs. These costs include search and information costs as well as costs resulting from the opportunistic behavior of other firms and institutions. Firms are also considering these potential costs when adopting the standard. In that framework, the institutional environment is composed of coercive actors, de facto and de jure rules, and social norms that impact the costs (search, information, as well as transaction costs) and potential benefits of the adoption of the standard (increased legitimacy within the field). Firms will adopt the standard when the potential benefits of adoption are "perceived" as superior to the potential costs. Indeed there is little tangible evidence of the quality and effectiveness of the standard when it is first adopted and managers' decisions are driven more by their perceptions of the costs and benefits of the standard than by tangible facts.

The role of governments and the rules of the game

Both the new institutional economics and the institutional sociology perspectives regard national governments as important actors, facilitating or hampering the adoption of management practices. The institutional sociology approach explains how pressures originating from the state or from powerful companies are the most direct mechanism of institutional diffusion (DiMaggio and Powell, 1983). Coercive isomorphism refers to the homogeneity pressures stemming from political influence and the need to achieve legitimacy within a context. Governments may provide incentives or impose sanctions for organizational transformation. Numerous studies have reported the role of the government in influencing the adoption of a management practice (Tolber and Zucker, 1983; Kelley and Arora, 1996; Russo, 2001; Delmas and Terlaak, 2002).

Governments can play an important role in promoting the adoption of ISO 14001. Through their commitment to improve the natural environment and their threat of issuing more stringent regulations, governments can send a clear signal to firms that environmental concerns will be taken seriously in the future. Because ISO 14001 is a management system that goes beyond existing command and control regulations, firms would then consider ISO 14001 as a tool to prepare their organization for potentially more stringent regulations. Governments can also provide direct incentives to push firms to adopt the standard. For example they can grant les stringent monitoring of existing regulations or regulatory flexibility to firms that are certified ISO 14001. The commitment of the government toward the environment and the standard will therefore increase the demand for environmental management practices and environmental performance.

For example, in Europe the European Commission issued the Eco-Management and Audit Scheme (EMAS) in 1993. The European Commission originally intended to pursue mandatory participation, but business lobbying successfully prevented this. The European Commission did, however, retain the right to adopt compulsory registration in the future, adding power to the legislative impetus towards environmental audits (Ashford, 1994). Some firms in Europe considered ISO 14001 as a first step to get prepared to a potentially more stringent and mandatory EMAS (Delmas, 2002).

However, promises made by governments may not be promises kept. The credibility and effectiveness of a government's commitment to a specific policy vary with its political and social institutions. The effectiveness both of the regulatory framework and the institutions that hold governments accountable for their actions are two such examples of factors that impact government credibility (Levy and Spiller, 1994). The new institutional economics literature shows that policy uncertainty results in lower levels of investment and growth (Henisz, 2000). When firms confront uncertainty about government commitment to protecting their investment, they may decide to divest or protect themselves with governance structures that are appropriate. Government commitment in this case is measured as the extent to which a given political actor is constrained in his choices of futures policies (Henisz, 2000). When assessing the commitment of the government toward the environment, it is therefore crucial to control for the credibility of this commitment.

In the case of ISO 14001, the ability of the government to credibly commit to more stringent environmental policies can lead firms to adopt an EMS standard that helps them to cope with existing regulations and to get prepared to comply with more stringent

upcoming regulations. In brief, government credible commitment toward the environment can impact the adoption of ISO 14001 because firms can use ISO 14001 to reduce the potential uncertainty raised by future stringent regulations and also benefit from more flexibility in the implementation of existing regulations. I therefore hypothesize that:

> *H1: The greater the credible commitment of a government toward protecting the natural environment, the greater the number of ISO 14001 certificates within a country.*

Regulatory systems, as well as intellectual property regimes, tort laws, and antitrust laws, constitute the regulatory aspect of the institutional environment. They influence the set of organization structures that are possible within that context, and the agents' ability to efficiently contract with other agents. Two examples of the impact of the regulatory environment on firms' strategies include the impact of property rights systems on innovative strategies (Arrow, 1996; Merges and Nelson, 1994), and the influence of antitrust regulation on cooperative strategies (Shapiro and Willig, 1990). In the case of ISO 14001, the legal issue that could discourage some firms from considering the adoption of ISO 14001 is the potential discovery of previously unidentified or unresolved regulatory violations. Indeed, the identification of violations during the implementation phase or during self- or third-party audits can lead to potential liabilities. The violated regulations may involve strict liability (i.e. intent or negligence need not be shown) and/or a duty to disclose violations (Wilson, 1998). Regulatory agencies could potentially use ISO 14001 to take legal actions against non-complying firms (Orts and Murray, 1997).

Additionally, ISO 14001 requires companies to document the details of environmental aspects of their operations that are not related to regulatory compliance in order to track the effectiveness of the system. This may also cause a potential risk of legal liability. Audits conducted under ISO 14001 check these documents and may point out weaknesses in the company's handling of environmental matters, such as records of system failures and minor spills. These findings, while they may not be governed by any regulation, might still be used in legal proceedings as incriminating evidence. Thus, if a company adopts an EMS with a written policy statement on environmental matters, with specified targets and objectives, it may also be defining a standard under which it may be held accountable (Mostek, 1998).

There is evidence that fear of legal liability and uncertainty of government actions toward certified companies affect ISO 14001 adoption practices. A recent survey sent to 200 U.S. firms certified before 1999 asks about the level of constraints faced when seeking ISO 14001 certification. Sixty-two percent (62%) of surveyed firms considered "uncertainty with regulatory agencies' utilization of EMS audit information" as a constraint to the adoption of ISO 14001. Likewise, 60 percent indicated the "potential legal penalties from voluntary disclosure" to be a constraint to the adoption of ISO 14001 (Delmas, 2000: 24).[3]

In conclusion, information disclosed during the process of ISO 14001 certification may lead to legal liability and subsequent transaction costs. In a context where there is uncertainty concerning the potential litigation costs linked to ISO 14001, firms may be reluctant to acquire a certification that could lead to high transaction costs. Such uncertainty will be greater in countries marked by a high level of litigation and

adversarial relations between stakeholders. For example this will be the case of the United States, where methods of policy implementation and dispute resolution are mode adversarial and legalistic when compared with the systems of European countries (Kagan, 2001). I formalize my second proposition as:

H2: The higher the level of litigation within a country, the fewer the number of ISO 14001 certifications within that country.

In conclusion, governments can send mixed signals to firms concerning the adoption of ISO 14001. They may adopt increasingly stringent environmental regulations that make ISO 14001 adoption a more attractive option. However, firms may be reluctant to adopt the standard if the transaction costs of adopting ISO 14001 are potentially high because of litigation, which raises the probability of confidential information on environmental matters being used against firms.

Institutional and competitive isomorphism

In addition to the government, firms are a second influential type of organization that may cause coercive isomorphism and increase the demand for the standard. For example, multinationals are widely recognized as key agents in the diffusion of practices across national borders, through the transmission of organizational techniques to subsidiaries and to other organizations in the host country (Arias and Guillen, 1998). Institutional research has also argued that organizations are more likely to imitate the behavior of other organizations that are tied to them through networks (Westphal, Gulati and Shortell, 1997; Guler, Guillen and MacPherson, 2002). In the case of ISO 14001, some firms my require their suppliers to adopt the ISO 14001 standard. This is the case for Ford and also for General Motors, which requested their U.S. suppliers to be ISO 14001 compliant

(Sabatini, 2000). In such cases firms respond to the direct demand of their customers. Likewise, firms that are exporting to countries where an important number of local firms have adopted ISO 14001 may find ISO 14001 certification a barrier to entry. Firms will therefore adopt the standard to be able to trade with local firms. For example, in Japan the Ministry of International Trade and Industry has been promoting the ISO 14001 standard within Japanese industry to be able to access European markets that may require the standard (Roht-Arriaza, 1997). Guler, Guillen and MacPherson (2002), have shown that such behavior, which they call institutional mimicry, is observed in the case of ISO 9000. In the case of ISO 14001 this effect may be less important at first because of the initially low number of adopters in each country.

In addition, competitive bandwagon pressures may arise from a threat of lost competitive advantage. Firms may adopt the same practices because not doing so would disadvantage them relative to the competition and erode their edge in the market place. According to this argument, firms competing in countries that have a higher adoption rate of ISO 14001 should mimic their competitors' behavior and adopt ISO 14001. Because of the similarities between the ISO 9000 and ISO 14001 standards, I formalize the hypotheses on the impact of institutional and competitive mimicry on the adoption of ISO 14001 as follows:

> *H3a: The greater the number of ISO 14001 certifications in countries with which the focal country is trading, the greater the number of certificates in the focal country.*
>
> *H3b: The greater the number of ISO 14001 certifications in countries with which the focal country competes in third markets, the greater the number of certificates in the focal country.*

Norms and experience with process standards

Institutional sociology considers norms and cognitive aspects of the institutional environment as the principal driver of firms' behavior. In the institutional sociology perspective, the normative pillar of the institutional environment refers to sets of expectations, within particular organizational contexts, of what constitutes appropriate and legitimate behavior (Scott, 1995). In other words, Scott's normative pillar is grounded in what is appropriate, that is to say what is expected of organizations. Much of the writing on normative constraints emphasizes how the normative expectations assume a taken-for-granted form; the ways of organizing become unquestioned, and alternatives become unthinkable (Oliver, 1991). The cognitive aspects of the institutional environment refer to the cultural elements that govern choice often without receiving conscious thought (DiMaggio & Powell, 1983; Hoffman & Ventresca, 1999).

In some cultural contexts, management may be more focused on performance evaluation than on process evaluation. In this case, firms may be less likely to adopt ISO 14001 because it is a process-oriented rather than a performance-oriented standard. This cultural propensity to favor or dislike process standards can be proxied, as ISO 14001 is not the first international process standard. ISO 9000, the quality management standard, was adopted in 1987 and is therefore a precursor of ISO 14001.

Turning to the new institutional economics perspective, norms may have an impact on the cost of adopting the standard. In a context where there is a lot of information on how to implement the ISO 9000 standard, it is most likely that there will also be information available on how to implement ISO 14001, as both standards are very similar and ISO 9000 registrars and consultants can easily become ISO 14001 registrars. On the contrary,

in a context where there is little available information on how to reach the ISO 9000 or ISO 14001 standards and get certification, it is probable that firms will have to incur higher costs to access this information than they would in a context where the information is readily available. In this case it is difficult to disentangle the role of efficiency rationale and isomorphism. Both rationales are actually playing a role in favoring the adoption of ISO 14001 through norms. I therefore hypothesize that:

H4: The greater the number of existing ISO 9000 certificates within a country, the greater the number of ISO 14001certificates within that country.

In conclusion, since ISO 14001 is a voluntary standard, firms will implement ISO 14001 when the costs of adopting the standard are perceived as lower than the potential benefits of adoption. The following elements of the institutional environment increase the demand for the standard and its associated benefits: high government credible commitment toward the environment, institutional or competitive mimicry in the network of trade. The factors that increase the costs of adoption are: high levels of litigation and no previous investments in international process standards. The hypotheses and their expected signs are summarized in Table 1. The following section describes the methodology used to test the impact of institutional factors on the adoption of ISO 14001 in 102 countries.

[Insert tables 1 and 2 about here]

DATA AND METHOD

I have compiled a panel dataset of the total number of ISO 14001 certified facilities in 102 countries between 1996 and 2000 (see Table 2.). In my sample, 98 countries had at

least 1 certificate in the year 2000 and 4 countries have zero certificates in the year 2000. These 102 countries represent 95 percent of the total number of certifications worldwide in 2000.

Dependent variable

The dependent variable represents the number of facilities certified in each country for the period 1996-2000. The International Standardization Organization in Geneva provided the data on the number of certified facilities in each country. The reference month for the number of certificates was December of each year.

Independent variables

I obtained measures for the independent variables from other secondary data sources. I measured independent variables with a one-year lag when possible.

Governmental credible commitment to environmental issues. To measure governmental credible commitment toward the environment, I created a variable GOVC by combining two variables: a measure of the commitment of the government to environmental management (CAP-MAN) and a measure of government credible commitment to their policies (POLCON).

The first variable, CAP-MAN, represents the commitment of a country toward environmental issues. The source of this measure is the Environmental Sustainability Index (2001). The Environmental Sustainability Index measures overall progress toward environmental sustainability for 142 countries. Environmental sustainability is measured through 20 indicators, each of which combines two to eight variables, for a total of 68 variables. CAP-MAN combines four of the 68 variables.[4] These are: the stringency and

consistency of environmental regulations, the degree to which environmental regulations promote innovation, the percentage of land area under protected status and the number of sectoral Environmental Impact Assessment guidelines.[5]

The second variable represents the credibility of government commitment to its policies. Analyzing the credibility of the government's own promises regarding the future policy environment, by examining the feasibility of policy change, provides additional important information. The measure of credible commitment, POLCON was taken from Henisz' political hazards index (Henisz, 2000). This index quantifies the extent to which institutional actors within a country are constrained in their choices of policies in a given year. These institutional actors are, for example, the executive or a chamber of the legislature. To construct this index, Henisz used existing political science databases and identified the number of independent branches of government (executive, lower and upper legislative chambers, judiciary, and states or provinces) with veto power over policy change. First, each additional veto point (a branch of government that is both constitutionally effective and controlled by a party different from other branches) provides a negative but diminishing effect on the total level of hazards. Second, homogeneity (or heterogeneity) of party preferences within an opposed (or aligned) branch of government is negatively correlated with the level of hazards. Possible scores for the final measure of political hazards for a given country in a given year ranged from 0 (minimal hazards) to 1 (extremely hazardous) (for a detailed discussion of this measure see Henisz, 2000). I checked the consistency of Henisz index with the governance indicators developed by the World Bank, which focus on "inputs" required for the government to be able to produce and implement good policies. (Kaufman, Kraay and

Zoido-Lobaton, 1999).[6] Both indicators are highly correlated (correlation>0.8). [7] One of the advantages of Henisz's measure is that it is calculated for each year from 1995 to 1999 as compared to the World Bank indicators which are just available for the years 1998 and 2000.

To account for government credible commitment to environmental issues, I created a single factor based on the principal component analysis of CAP-MAN and POLCON. The first principal component explained 73.3 percent of the total variation between the two variables with an Eigenvalue of 1.5. The factor for governmental credibility can be thought of as the average effect of the credibility of a government and its commitment towards environmental issues. This first principal component was then treated as an independent variable called governmental commitment (GOVC).

Litigation. In a perfect world, there would be a variable measuring the number of environmental lawsuits across countries. To my knowledge, there is no existing international comparative measure of the level of litigation. As a proxy of the level of litigation, I created a variable measuring the number of environmental law firms per country. I divided the variable per capita. I assumed that the number of environmental law firms was correlated with the number of environmental lawsuits (i.e. if there is a supply of environmental law firms there must be a market for environmental lawsuits). The data for this variable were taken from the Martindale-Hubbell International Law Directory, 1996-2000. I expected that litigation negatively affected the decision of obtaining ISO 14001 only after a certain threshold level was reached. A very low number of environmental law firms per capita, as well as a very high number of environmental law firms per capita, should both have a negative effect on the likelihood of adoption. In

the first case, a low number of law firms represents a low level of environmental regulation and therefore a low level of litigation. This situation does not provide incentives for firms to adopt environmental management practices. In the second case, a high number of law firms represents a high level of litigation and may deter firms from adopting ISO 14001. I therefore integrated the variable litigation as a quadratic term in the equations. I recognize that there may be some bias in this Law Directory toward U.S. based companies because it is published by a U.S company. In the regression I checked the sensitivity of the results to excluding the U.S.

Institutional and competitive mimicry. In order to approximate institutional mimicry in the network of trade, I adapted the measure developed by Guler, Guillen and MacPherson (2002), which captures how strongly a country is tied to other countries through trade, and the extent to which ISO certificates have already diffused in these countries. However, unlike Guler, Guillen and MacPherson (2002) who used the number of ISO 9000 certifications, I used the number of ISO 14001 certifications. In a network model of trade, the impact of direct ties on diffusion for a given country *i* can be captured by the total strength of the trade ties between country *i* and all other countries (defined as country *i*'s trade with each country j as a proportion of country *i*'s total trade) weighted by the extent of diffusion in those countries. In other words, the cohesion effect is high if a country has strong trade ties with other countries that have a large number of certificates as of the previous year. Normally the institutional mimicry effect should only flow for countries that have a strong tie with the focal country. The strength of ties for each country was squared before being weighted by the number of certificates to avoid treating as equivalent those situations where country *i* has a weak tie with country *j*,

which has a large number of certificates, and those where country *i* has a strong tie with country *j*, which has a small number of certificates. Exports were used instead of total trade as I expected the imitation effect to flow through export ties. Indeed focal countries are more likely to be affected by the practices of those that they are exporting to, as these are the countries with which the focal country must establish legitimacy in order to export. Formally, the institutional mimicry measure for country *i* at time*t* is:

$$Institutional\ Mimicry_{it} = \sum_{j} ISO_{jt-1} \times \left(Exports_{ij} / Exports_{i}\right)^{2}$$

Where ISO_{jt-1} is the number of certificates for country j at time t-1, $Exports_{ij}$ is the exports from country *i* to country *j* averaged over 1995-1997, and $Exports_{i}$ is country *i*'s total exports during the same period. The data on export ties between each pair of countries come from Feenstra (2000).

I measured competitive mimicry in the network of world trade by an adjusted structural equivalence measure. Structural equivalence for each country *i* as of year t is measured by the Pearson rank correlation coefficient between the proportion of country *i*'s exports to all other countries (except j) and the proportion of country j's exports to all other countries (except *i*), weighted by the sum of certificates in all other countries j as of year t-1. It is a first-order measure because it only takes into account direct ties between pairs of countries. Formally, for each country *i*, the competitive mimicry measure is:

$$Competitive\ Mimicry_{it} = \sum_{j} ISO_{jt-1} \times Corr\left(Exports_{i}, Exports_{j}\right)$$

Where ISO_{jt-1} is the number of certificates for country j at time t-1, $Corr\left(Exports_{i}, Exports_{j}\right)$ is the Pearson correlation coefficient between the percentage of

country *i*'s exports with all other countries and the percentage of country *j*'s exports with all other countries for 1995-1997. Export ties that are not statistically significant (below 0.15) are treated as zeros. Because the number of ISO certification is low in the first years of adoption, the number of zero values for this variable is high. [8]

Experience with process standards. To represent existing experience with international management standards, I included a variable (ISO9) representing the number of ISO 9000 certifications in the focus country measured at a one-year lag and divided by the GDP of the focus country. This measure represents the level penetration of ISO 9000 within the economy. The International Standard Organization in Geneva provided information on the number of ISO 9000 certifications.

Control variables

I also included two control variables. The first one (FDI) is the presence of foreign multinationals. It is measured by the value of inward foreign direct investment (FDI) as a percentage of GDP. The second one is GDP as a measure of the size of the economy and the potential market for ISO 14001 certifications. This measure was constructed based on countries' GDP at Power Purchase Parity. These measures were obtained from the World Bank's World Development Indicators Database for the years 1995-1999.

[Insert table 3. about here]

All the variables and their components are summarized in Table 3. This study has several limitations. First, ISO 14001 is very recent and we are able to study only the five years

since adoption of the standard. Second, there is no information available yet on the adoption of ISO 14001 per sector.

Estimation

The dependent variable, which represents the number of ISO 14001 certificates per country is a count variable. I considered using Poisson regression which is specifically designed for count dependent variables (Greene, 1993). However, Poisson regression assumes that the mean and variance of the events counts are equal. When the variance is greater than the mean, the distribution is said to display overdispersion. The important feature of my dependent variable is the joint presence of many observations clustered at zero and several observations far in the right tail of the distribution, resulting in a variance higher than the mean and therefore overdispersion. Negative binomial regression is used to estimate count models when the Poisson estimation is inappropriate due to overdispersion. When individual counts are more dispersed than the Poisson model, the negative binomial model can be used because a random term reflecting unexplained between-subject differences is included in the regression model (Gardner, Mulvery, and Shaw, 1995). I therefore ran a negative binomial model using a panel dataset for country data pooled over the 1996-2000 period. The panel negative binomial model that I use is represented by the following equation:

$$\log \lambda_{i,t} = \mathrm{X}_{it}\beta + \sigma\varepsilon_i + \mu_i$$

Where $\Pr(y = r) = \frac{\lambda^r \varepsilon^r}{r!}$, where y is the observed count and r is an integer.

X is a vector of characteristics of the country i at time t, and σ is a correction for overdispersion. The model also includes μ_i, a time-invariant country i effect, which can be treated as either fixed or random. The negative binomial model is log-linear, so exponentiating a coefficient gives the estimated multiplier effect that a one-unit change in the covariate has on the expected number of certificates. I ran the model using the *xtnbreg* command in the Stata 7 statistical software with the fixed-effects and the random-effects options (see Stata, 2001: 393-394).

To account for unobserved heterogeneity, the possibility that observationally equivalent countries may differ on unmeasured characteristics, I first used the fixed effects overdispersion model approach. The fixed-effects overdispersion model applies to the distribution of the dispersion parameter. Fixed effects estimator for count data handle unobserved heterogeneity by computing within-country estimates of the coefficients. The dispersion is the same for all elements in the same country. In this approach, only the variation within a country across time is used to estimate the regression coefficients. Thus, unobserved variations between countries are not problematic because between-country variation is not used in the computations of the estimates. The fixed effects approach has two main disadvantages that are relevant to our study. First, the parameters of time-invariant covariates cannot be easily estimated. Second, when an individual has zeros or values that do not vary over time, his contribution to the log-likelihood is equal to zero. Therefore individuals with values that do not vary over time are not included in the total number of observations. In my sample there are several countries, which do not have adopted any ISO 14001 certificates in the period 1996-2000. They are therefore not

included in the fixed-effects model. The number of countries included in the fixed-effects model is 67.

In order to check whether the inclusion of additional countries with no ISO 14001 certificates would change the results, I ran a random-effects overdispersion model. In random-effects overdispersion models, the dispersion varies randomly from group to group such that the inverse of the dispersion has a Beta(r,s) distribution. In the random-effects model all 102 countries are included.

RESULTS

Table 4 presents the descriptive statistics and Table 5 the correlation coefficients. The results of the negative binomial for the pooled data over the 1996-2000 period are presented in Table 6 for the fixed-effects model and in Table 7 for the random-effects model. Model 1 includes the control variables only, models 2 to 7 include the independent variables individually. Model 8 is the full model. In model 9 and 10 the variables representing the number of ISO 9000 certificates and Foreign Direct Investment are removed. Model 11 includes high-income countries with GDP per capita > $9,200.

Since table 5 shows some relatively high correlations between GOVC, Lawfpop, ISO9 and GDP, I entered highly correlated variables individually and reported likelihood tests. Since multicollinearity does not affect model fit, likelihood ratio tests indicate whether the addition of a single variable into a model is significant.

Model 1 includes the control variables only. The year dummies exerted significant effects on the number of certificates. However, the size of the country, measured by the variable GDP is not significant in the fixed-effects model. This can be explained because there is

little variation over time in the GDP measured in purchasing power parity. In the random-effects model GDP is significant. Foreign Direct Investment is not significant either in both fixed-effect and random-effects models indicating that at the early stage of the adoption of ISO 14001 the presence of multinationals is not a driver of adoption.

[Insert tables 4 and 5 about here]

Hypothesis 1 states that the more credible the governmental commitment to the environment, the more the number of ISO 14001 certifications. Models 2 and 8 provide support for the importance of the credible commitment of the government to favor the adoption of ISO 14001. The coefficients estimates of government credibility are positive and significant ($p< 0.05$ and $p<0.01$).

Hypothesis 2 predicts that firms would be less likely to adopt ISO 14001 in a context where the risk of litigation is high. The sign of the quadratic term of variable representing the number of environmental law firms per capita within a country has a negative value and is significant ($p< 0.05$ and $p<0.01$) in model 3 and in the full models, suggesting that the higher the threat of litigation, the less likely the firms would adopt ISO 14001 certification.

Hypothesis 3 predicts that the number of certificates in the focal country should be positively related to the number of certificates in those countries to which the focal country is directly tied into the trade network. This hypothesis sought evidence for the impact of institutional mimicry on the process of diffusion. The coefficient estimate for

institutional mimicry is positive and significant in models 5 and 7 ($p< 0.05$ and $p<0.01$). However, it loses significance in the full fixed-effects model. Although it is significant in the random-effects model including 102 countries, it becomes insignificant if I limit the random-effect model to the 67 countries that are included in the fixed-effects model. These results show that the regulative aspect of the environment as well as the number of ISO 9000 certifications and the level of litigation are more important determinants to the adoption of ISO 14001 certificates than institutional mimicry when we include only the population of first adopters. The effect of competitive mimicry is not significant in any model. Since there are still very few ISO 14001 certificates adopted in the world because the standard was adopted recently, the effect of competitive mimicry is still too small to be significant.

Hypothesis 4 predicts that the more the experience with process standards such as ISO 9000 within a country, the more likely ISO 14001 would be adopted. The variable representing the number of ISO 9000 certifications is positive and significant ($p<0.01$) for model 4 and the full model. This finding confirms hypothesis 4.

To test whether the significance of credible commitment would hold for high-income countries, I ran the analysis including only countries with high income using the World Bank definition (i.e. countries with GDP per capita > $9,266). This limits the list of countries from 102 that were used in the original regression to 32 countries.[9] The results are reported in model 11 and are similar to the previous models. The variable Lawfpop representing the level of litigation is significant and negative when the quadratic term is removed suggesting that the role of litigation is strictly negative within countries which

have already reached a certain level of development and therefore a relatively high number of lawyers (results available upon request).

The case of high-income countries provides a good support for the hypotheses under investigation, sustaining the assertion that the more credible the governmental commitment to the environment and the greater the experience with process standards such as ISO 9000 within a country, the more likely the firms are to adopt certifications. Likewise, the more the risk of litigation in the country the less likely the firms are to adopt certifications.

DISCUSSION

My analysis shows the importance of the institutional environment defined as the "rules of the game", as well as a coercive actor that promotes or deters the adoption of management practices. In the case of ISO 14001, governments can provide the jump-start that allows the initial adoption of a management standard. For example, they can provide the resources and information that reduce the search cost linked to adopting the standard. They also can provide other incentives such as regulatory flexibility. Governments may also ensure that the rules of the game are compatible with the adoption of the standard. Although previous research had assessed the role of government as a coercive actor, it did not provide detailed measures of the impact of governments and regulation on the demand and costs of adopting a management standard. Furthermore, it is possible that the role of the government plays a more important role for ISO 14001 than for other management standards because the standard deals with environmental issues which are heavily regulated.

By focusing on how the regulatory environment impacts the costs and the demand for ISO 14001 as well as the importance of norms, I bring together two different but complementary institutional approaches. New institutional economics focuses on efficiency, whereas institutional sociology places particular emphasis on legitimation processes and the tendency for institutionalized organizational structures and procedures to be taken for granted regardless of their efficiency implications. This article adds to the institutional literature by using both of these research streams as a way of understanding organizational design adoption. This framework analyzes the adoption of ISO 14001 by viewing organizations as efficiency seeking under institutional constraints.

I also show that norms within an institutional context have an important bearing on the likelihood of adopting ISO 14001. Namely, the previous adoption of process standards such as ISO 9000 facilitates the adoption of ISO 14001. This finding was not included in previous studies analyzing the adoption of ISO 9000 because there was no previous process standard before the adoption of ISO 9000. My research therefore provides new insights on this issue by showing the link between two different standards in terms of their objective (quality management versus environmental management) but similar standards in terms of their prerequisites and organizational requirements.

The position of the country in the network of trade is not shown to be an important factor in explaining the adoption of ISO 14001 certificates. Trade is probably playing a role through ISO 9000 but not directly through ISO 14001 adoption in other countries. One could argue that since previous research showed the role of institutional mimicry and competitive mimicry through the network of trade on the adoption of ISO 9000, it is

possible that institutional and competitive mimicry play an indirect role on the adoption of ISO 14001 through its impact on ISO 9000.

The importance of institutional factors to the diffusion of ISO 14001 is linked to the incompleteness of the standard in dealing with the measurement of environmental performance. If the standard clearly defined a procedure for the assessment of environmental performance it would be possible for stakeholders to use ISO 14001 to compare firms' impact on environmental performance, both within a country and internationally. The benefits of the standard would therefore be unambiguous. Thus, I predict that a standard which clearly spelled out environmental measures would diffuse better on an international scale. Institutional factors would play a less important role in its adoption, since the adoption would be based mostly on comparing its tangible benefits.

CONCLUSION

There has been a lot of speculation on the drivers of firms' first adoption of management standards but there is still limited empirical evidence. In this paper I show the relationship between firms' decisions to adopt environmental management standards and institutional factors. Institutional theory emphasizes the importance of normative and cognitive factors that affect adoption decisions over and above the technical efficiency of the organizational practice. My analysis, based on the early adoption of the international standard ISO 14001 confirm the role of norms and legitimation processes as driving the demand for the standard. In particular, I show that the previous adoption of the international standard ISO 9000 is a clear driver of the adoption of the ISO 14001 standard. In addition, the analysis emphasizes the role of the regulatory environment as well as specific elements of the coercive action of the government. In the case of ISO

14001, the level of litigation within a country, as well as government credible commitment toward the environment, affect the probability of the adoption of ISO 14001. Whereas the level of litigation is a deterrent to the adoption of ISO 14001, the level for credible commitment of the government toward the environment positively impacts the adoption of ISO 14001. The transaction costs of adopting ISO 14001 vary with the level of litigation, and the demand for the standard varies with government credible commitment to the environment. These results show the importance of the regulatory environment as a predictor of the adoption of ISO 14001.

This study combines some of the propositions of institutional sociology, which emphasize the role of norms and legitimation processes with those of the new institutional economics approach, which suggest that the regulatory environment impacts the transaction costs of acquiring the standard.

When the data will be available, it will be exciting to compare the drivers of late adoption to those of early adoption. It will be also be interesting to analyze the role of specific industries as facilitators of the adoption of ISO 14001. Since ISO is gathering information on the adoption of ISO 14001 by industry and country for the post-2000 period, further research should yield more precise variables to measure the industry effects of the adoption of ISO 14001.

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Figure 1. Number of ISO 14001 certifications in Germany, Japan, United Kingdom and the United States

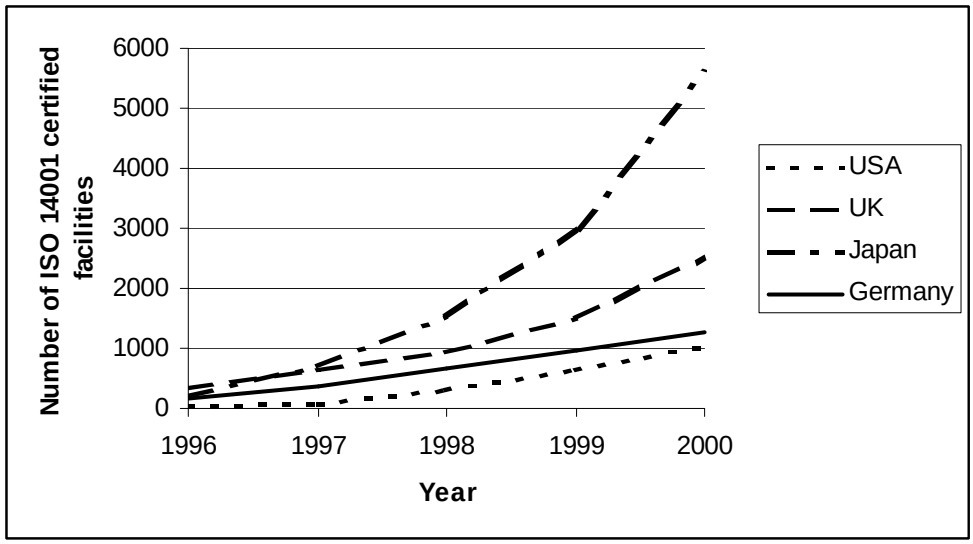

Figure 2. Regional Share of ISO 14001 certifications

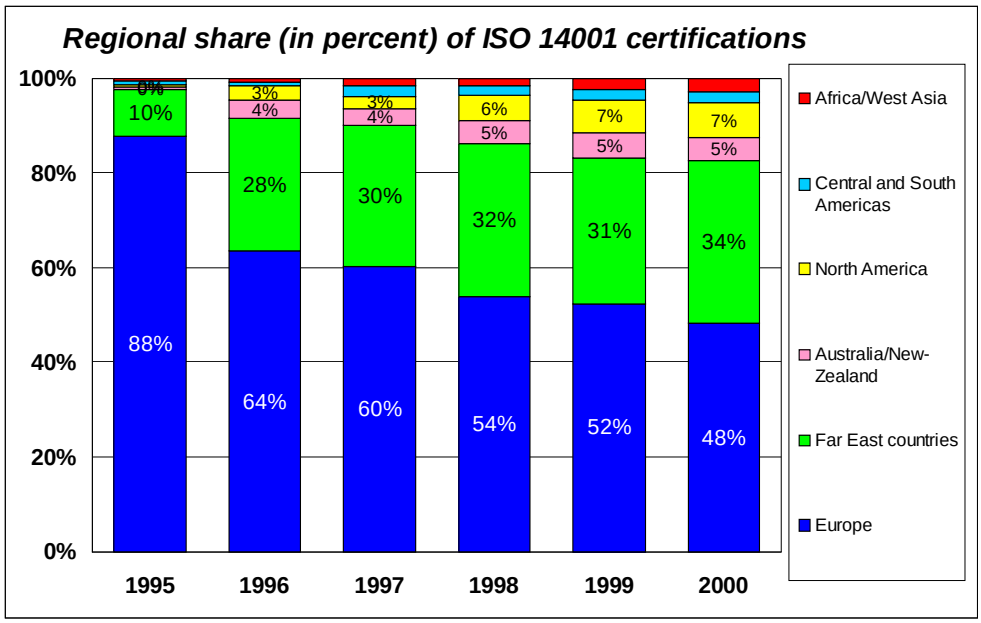

Table 1. Expected sign of the Hypotheses

		Expected sign
H1	Government Credible Commitment	+
H2	Litigation	-
H3a	Institutional Mimicry	+
H3b	Competitive Mimicry	+
H4	Norms	+

Table 2. Countries included in the analysis and number of ISO 14001 certificates

Country	Number of iso14001 certificates	Country	Number of iso14001 certificates	Country	Number of iso14001 certificates
Algeria	0	India	257	Tanzania	0
Argentina	114	Indonesia	77	Thailand	310
Australia	1049	Iran, Islamic Rep.	12	Togo	0
Austria	203	Ireland	163	Trinidad & Tob	1
Bangladesh	0	Israel	60	Tunisia	3
Barbados	3	Italy	521	Turkey	91
Belgium	130	Jamaica	0	Uganda	0
Bolivia	1	Japan	5556	Ukraine	0
Brazil	330	Jordan	16	United Kingdom	2534
Bulgaria	0	Kenya	2	United States	1042
Burundi	0	Korea, Rep.	544	Uruguay	22
Cambodia	0	Madagascar	0	Venezuela	7
Cameroon	0	Malawi	0	Vietnam	9
Canada	475	Malaysia	174	Yemen, Rep.	0
Central Afr Rep	0	Mali	0	Zambia	2
Chile	11	Mauritius	4	Zimbabwe	4
China	510	Mexico	159		
Colombia	21	Mongolia	0		
Comoros	0	Morocco	4		
Congo, Rep.	0	Mozambique	0		
Costa Rica	20	Netherlands	784		
Cote d'Ivoire	0	Nicaragua	0		
Cyprus	4	Pakistan	4		
Czech Republic	116	Panama	0		
Denmark	580	Papua New Guinea	0		
Dominican Republic	1	Paraguay	1		
Ecuador	1	Peru	13		
Egypt, Arab Rep.	78	Philippines	46		
El Salvador	0	Poland	66		
Fiji	0	Portugal	47		
Finland	508	Romania	5		
France	710	Russian Fed	3		
Gabon	0	Senegal	0		
Gambia, The	0	Sierra Leone	0		
Germany	1260	Singapore	100		
Ghana	0	Slovak Republic	36		
Guinea	0	South Africa	126		
Guinea-Bissau	0	Spain	600		
Guyana	0	Sri Lanka	2		
Honduras	2	Sweden	1370		
Hungary	164	Switzerland	690		
Iceland	2	Syrian Arab Rep	3		

Table 3. Variables Description

VARIABLES	DEFINITION	YEAR	SOURCE
GOVC- Credible Commitment of government toward the environment	Factor of CAP_MAN and POLECON:	1995-1999	
	CAP_MAN Environmental Regulation Capacity and Management	2000	Environmental Sustainability Index
	Commitment of country toward the environment		
	POLECON Credibility of Government commitment	1995- 1999	Henisz (2000)
LAWFPOP Law Litigation	Number of environmental law firms by country / population of the country)	1995-1999	Martindale-Hubbell International Law Directory.
IM Institutional Mimicry	$IM_{it} = \sum_{j} ISO_{jt-1} \times \left(Exports_{ij} / Exports_{i}\right)^{2}$	1996-2000	International Standard Organization Feenstra (2000)
CM Competitive Mimicry	$CM_{it} = \sum_{j} ISO_{jt-1} \times Corr\left(Exports_{i}, Exports_{j}\right)$	1996-2000	International Standard Organization Feenstra (2000)
ISO9	(Number of ISO 9000 certifications / GDP) $x10^{12}$	1995-1999	International Standard Organization (2000)
FDI	Inward Foreign Direct Investment as a % of GDP	1995-1999	World Bank Development Indicators (2001)
GDP	Gross Domestic Product at Power Purchasing Parity	1995-1999	World Bank Development Indicators (2001)

Table 4 Descriptive statistics

Variables	Obs	Mean	Std.Dev.	Min	Max
iso14000	614	79.267	326.263	0.000	5556.000
GOVC	614	0.289	0.959	-1.566	2.604
Log (Lawfpop)	614	0.048	0.124	0.000	0.993
Log(ISO9)	614	2.225	1.580	0.000	4.690
Log (IM)	614	1.210	0.636	0.000	3.030
Log(CM)	614	3.017	0.652	0.510	3.960
Log(FDI)	614	0.458	0.337	-0.810	2.160
Log(GDP)	614	10.605	0.910	8.570	12.950
y1997	614	0.202	0.402	0.000	1.000
y1998	614	0.204	0.403	0.000	1.000
y1999	614	0.202	0.402	0.000	1.000
y2000	614	0.191	0.393	0.000	1.000

Table 5. Correlations

	1	2	3	4	5	6	7	8	9	10	11	12
1. iso14000	1.0000											
2. GOVC	0.2930	1.0000										
3. Log (Lawfpop)	0.1604	0.4676	1.0000									
4. Log(ISO9)	0.2732	0.4654	0.3674	1.0000								
5. Log (IM)	0.1735	0.0806	0.1098	0.2533	1.0000							
6. Log(CM)	0.1738	0.0829	0.0692	0.2947	0.8793	1.0000						
7. Log(FDI)	0.0536	0.1460	0.1828	0.2159	0.1924	0.2060	1.0000					
8. Log(GDP)	0.3715	0.3575	0.2510	0.5865	0.0128	0.1366	0.0025	1.0000				
9. y1997	-0.0779	0.0071	-0.0192	-0.0800	-0.2205	-0.2137	-0.1010	-0.0087	1.0000			
10. y1998	-0.0318	0.0089	-0.0105	0.0134	0.0754	0.1630	-0.0089	0.0031	-0.2528	1.0000		
11. y1999	0.0548	0.0034	0.0230	0.1028	0.3383	0.3436	0.0933	0.0049	-0.2513	-0.2528	1.0000	
12. y2000	0.1752	0.0022	0.0256	0.1354	0.5311	0.5199	0.1280	0.0186	-0.2450	-0.2465	-0.2450	1.0000

Table 7. Negative binomial of the number of ISO 14001 certificates from 1996 to 2000 Fixed-effects model

FE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	iso14000	iso14000	iso14000	iso14000	iso14000	iso14000	iso14000	iso14000	iso14000	iso14000	iso14000
GOVC		0.262 (0.115)**						0.242 (0.115)**	0.266 (0.120)**	0.242 (0.115)**	0.433 (0.153)***
Lawfpop			2.002 (0.957)**					1.446 (0.881)*	1.916 (0.996)*	1.543 (0.880)*	1.264 (0.997)
Lawfpop2			-3.643 (1.353)***					-2.927 (1.166)**	-3.606 (1.343)***	-2.933 (1.165)**	-2.699 (1.199)**
ISO9				0.827 (0.158)***				0.757 (0.156)***		0.758 (0.155)***	0.795 (0.267)***
IM					0.500 (0.228)**		0.501 (0.219)**	0.182 (0.217)	0.422 (0.226)	0.183 (0.216)	0.111 (0.262)
CM						-0.643 (0.685)	-0.741 (0.669)				
FDI	-0.089 (0.135)	-0.134 (0.139)	-0.081 (0.136)	-0.063 (0.138)	-0.022 (0.135)	-0.096 (0.134)	-0.034 (0.134)	-0.009 (0.137)	-0.056 (0.137)		-0.014 (0.193)
GDP	0.367 (0.245)	0.286 (0.244)	0.254 (0.243)	0.341 (0.236)	0.404 (0.245)*	0.277 (0.271)	0.290 (0.276)	0.259 (0.235)	0.216 (0.242)	0.258 (0.235)	0.265 (0.303)
y1997	1.212 (0.142)***	1.193 (0.139)***	1.220 (0.138)***	1.039 (0.132)***	0.899 (0.199)***	1.697 (0.540)***	1.449 (0.540)***	0.943 (0.182)***	0.947 (0.190)***	0.943 (0.182)***	0.917 (0.220)***
y1998	1.881 (0.133)***	1.859 (0.130)***	1.850 (0.130)***	1.509 (0.135)***	1.388 (0.259)***	2.672 (0.856)***	2.285 (0.856)***	1.336 (0.246)***	1.420 (0.256)***	1.334 (0.244)***	1.320 (0.308)***
y1999	2.499 (0.129)***	2.487 (0.127)***	2.450 (0.129)***	2.000 (0.144)***	1.840 (0.326)***	3.447 (1.021)***	2.919 (1.033)***	1.785 (0.313)***	1.896 (0.328)***	1.782 (0.310)***	1.757 (0.392)***
y2000	2.964 (0.128)***	2.955 (0.126)***	2.909 (0.128)***	2.373 (0.153)***	2.179 (0.379)***	4.070 (1.188)***	3.440 (1.206)***	2.126 (0.361)***	2.255 (0.380)***	2.123 (0.357)***	2.115 (0.449)***
Constant	-3.829 (2.839)	-3.129 (2.816)	-2.489 (2.811)	-6.189 (2.780)*	-4.439 (2.831)	-1.438 (3.946)	-1.558 (4.015)	-5.265 (2.780)	-2.458 (2.793)	-5.269 (2.780)	-5.727 (3.820)
Observations	327	327	327	327	327	327	327	327	327	327	140
Number of countries	67	67	67	67	67	67	67	67	67	67	29
Log Likelihood	-799.143	-796.57	-793.949	-784.923	-796.869	-798.696	-796.237	-777.027	-789.053	-777.030	-498.551

Standard errors in parentheses *** p<0.01, ** p<0.05 ***p<0.10

Table 6. Negative binomial of the number of ISO 14001 certificates from 1996 to 2000 Random-effects model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	iso14000	iso14000	iso14000	iso14000	iso14000	iso14000	iso14000	iso14000	iso14000	iso14000	iso14000
GOVC		0.374 (0.111)***						0.222 (0.097)**	0.225 (0.097)**	0.383 (0.115)***	0.459 (0.130)***
Lawfpop			1.679 (0.937)*					1.167 (0.730)*	1.227 (0.728)*	1.518 (0.964)*	1.030 (0.858)
Lawfpop2			-3.080 (1.305)**					-2.207 (0.954)**	-2.190 (0.935)**	-2.951 (1.272)**	-2.017 (1.038)*
ISO9				1.623 (0.117)***				1.557 (0.117)***	1.539 (0.117)***		1.212 (0.207)***
IM					0.493 (0.191)***		0.496 (0.194)**	0.333 (0.145)**	0.332 (0.146)**	0.445 (0.194)**	0.213 (0.186)
CM						0.370 (0.535)	0.305 (0.516)				
FDI	-0.052 (0.131)	-0.121 (0.138)	-0.055 (0.134)	0.116 (0.141)	0.007 (0.130)	-0.050 (0.131)	0.011 (0.131)	0.126 (0.138)		-0.058 (0.137)	0.060 (0.194)
GDP	1.176 (0.232)***	1.069 (0.228)***	1.023 (0.244)***	1.630 (0.148)***	1.221 (0.233)***	1.213 (0.236)***	1.259 (0.240)***	1.594 (0.151)***	1.581 (0.151)***	0.987 (0.234)***	1.301 (0.188)***
y1997	1.161 (0.133)***	1.134 (0.130)***	1.166 (0.132)***	0.791 (0.110)***	0.859 (0.176)***	0.885 (0.420)*	0.631 (0.421)	0.568 (0.149)***	0.572 (0.149)***	0.875 (0.170)***	0.683 (0.179)***
y1998	1.869 (0.124)***	1.835 (0.121)***	1.841 (0.123)***	1.184 (0.106)***	1.375 (0.227)***	1.414 (0.667)*	1.002 (0.668)	0.814 (0.197)***	0.829 (0.197)***	1.369 (0.227)***	1.019 (0.240)***
y1999	2.497 (0.120)***	2.471 (0.118)***	2.450 (0.122)***	1.573 (0.112)***	1.839 (0.282)***	1.951 (0.796)*	1.390 (0.807)	1.108 (0.242)***	1.137 (0.242)***	1.844 (0.289)***	1.379 (0.295)***
y2000	2.972 (0.119)***	2.945 (0.117)***	2.918 (0.123)***	1.868 (0.117)***	2.188 (0.327)***	2.335 (0.925)*	1.664 (0.943)	1.337 (0.275)***	1.375 (0.274)***	2.202 (0.335)***	1.673 (0.334)***
Constant	-13.171 (2.699)***	-12.275 (2.632)***	-11.372 (2.819)***	-23.947 (1.801)***	-13.856 (2.701)***	-14.366 (3.151)***	-14.944 (3.233)***	-23.598 (1.854)***	-23.335 (1.846)***	-11.463 (2.701)***	-19.407 (2.387)***
Observations	498	498	498	498	498	498	498	498	498	498	144
Number of countries	102	102	102	102	102	102	102	102	102	102	32
Log likelihood	-1317.443	-1311.840	-1313.264	-1252.553	-1314.278	-1317.202	-1314.104	-1243.080	-1243.499	-1304.296	-733.198

Standard errors in parentheses *** p<0.01, ** p<0.05 ***p<0.10

[11] Section 4.5.1 of ISO 14001 requires an organization to have procedures to "monitor and measure, on a regular basis, the key characteristics of its operations and activities that can have a significant impact on the environment" as part of the checking and corrective action portion of its EMS. Although ISO 14001 requires an organization to measure and track its environmental performance, there are no adopted or commonly accepted Environmental Performance Indicators. ISO 14031 (*Guidelines on Environmental Performance Evaluation*) contains over 100 examples of measures and indicators, but it does not propose a core set of metrics for comparison and benchmarking of performance, nor does it establish performance levels.

[2] Institutional constraints include both what individuals are prohibited from doing and, sometimes, under what conditions some individuals are permitted to undertake certain activities…They are perfectly analogous to the rules of the game in a competitive team sport (North, 1990: 3-4). The institutional environment is defined as "the rules of the game that define the context in which economic activity takes place. The political, social and legal ground rules establish the basis for production, exchange, and distribution" (Williamson, 1996:378). North suggests that a country's institutional endowment is characterized by the legislative and executive institutions, judicial institutions, administrative capabilities, informal norms, and the character of the contending social interests (North, 1990).

[3] The responses where on a five-point scale ranged from "not a constraint" (1) to "a serious constraint" (5).

[4] CAP-MAN is calculated by taking the average of the underlying variables. The variables are presented in standardized form, as z-scores.

[5] Stringency and Consistency of Environmental Regulations and Degree to which Environmental Regulations Promote Innovation. Reference year 2000. Source: Michael E. Porter et al, *The Global Competitiveness Report 200*0, Oxford: Oxford University Press, 2000. Based on business survey responses.

Percentage of Land Area Under Protected Status. Reference year 1997. Source: World Resources Institute, *World Resources 2000-01*, Washington, DC: World Resources Institute, 2000.

Number of Sectoral EIA Guidelines. Reference Year 1998. Source: IIED, WRI and IUCN. *A Directory of Impact Assessment Guidelines (Second Edition), London: International Institute. for Environment and Development (IIED), 1998.*

For information on these variables including the scores for each country see the Environmental Sustainability Index (2001 annex 6: 41-44).

[6] The index measures the perception of the quality of public service provision, the quality of the bureaucracy, the competence of civil servants, the independence of the civil service from political pressure, and the credibility of governments' commitment.

[7] The correlations and regression results using the World Bank indicators are available upon request. The results using the World Bank indicators are quite similar to the ones presented here, although they do not allow us to use a fixed effect model because the variable credible commitment is constant over the years.

[8] I decided not to use a measure of equivalence in trade that would include equivalence of trade by sector because such a measure would include a higher number of zeros.

[9] Argentina, Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea Rep., Kuwait, Netherlands, New Zealand, Norway, Portugal, Singapore, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom, United States.