UNIVERSITY OF
CAMBRIDGE

Department of Land Economy

Environmental Economy and Policy Research

Discussion Paper Series

Why do Manufacturing Plants Invest in Environmental Management?

by

María Teresa Ruiz-Tagle

2006

Number: 20.2006

Why do Manufacturing Plants Invest in Environmental Management?

María Teresa Ruiz-Tagle

Department of Land Economy, University of Cambridge

Abstract

While economic and contractual incentives encourage firms to respond to environmental issues, additional contributing factors also provide incentives for them to deal with corporate environmental issues. That is, formal regulation (government monitoring and enforcement) can promote firms' environmental improvements, but so can informal regulation (consumer pressure, shareholders, employees and local communities).

Environmental regulation, in the broadest sense, may affect firms' decision to implement an Environmental Plan and the attitude of firms towards the environment. However, other characteristics of plants and firms are also relevant elements when taking these decisions. But which are those factors, and how can we assess their impact? The purpose of this paper is to develop a framework that can be used to test empirically the importance of several possible sources of influence on the level of environmental responsiveness of a firm. This paper uses new data from a survey carried out in Chile in year 2001.

Keywords: Environmental Management, Formal Regulation, Informal Regulation, firm's responsiveness.

Address for correspondence

Dr. María Teresa Ruiz-Tagle
19 Silver St. CB3 9EP Cambridge UK
Tel: 44 1223 337147
Fax: 44 1223 337130
E-mail: mtr21@cam.ac.uk

Why Do Manufacturing Plants Invest in Environmental Management?

Dr. María Teresa Ruiz-Tagle
Research Associate, University of Cambridge
Email: mtr21@cam.ac.uk

1. Introduction and Background

Nowadays it is widely accepted that government environmental regulation is necessary, due to the existence of externalities or imperfect information. Externalities arise when social costs differ from private costs (like pollution damage), or social benefits differ from private benefits. In the case of imperfect information, workers, managers and consumers may only be partially aware of the environmental risks associated with various activities or consumer products. Therefore, they will be unable to trade off higher environmental risks for either higher wages or lower prices.

Firms would like to reduce their environmental risks or problems as well as to increase their profitability (see Gabel et al., 1993). While the second objective can be measured, there are fewer indicators to measure reductions in environmental risks. As a result, some companies are allocating resources to develop such indicators. The ISO 14.001 standards for Environmental Management System (EMS) were published in 1996, with the aim of providing guidance for environmental management measurements. Within the ISO 14.001 series, some standards are still under negotiation. However, the Environmental Management System standards have been finalised, and require organisations seeking certification to take several steps.[1] Although new, the ISO 14.001 is already having a significant impact on the environmental attitude of certain firms in both developed and developing countries.

While economic and contractual incentives encourage firms to respond to environmental issues, other contributing factors may also provide incentives for them to deal with corporate environmental issues. That is, formal regulation (government monitoring and enforcement) can promote firms' environmental improvements, but so can informal regulation (consumer pressure, shareholders [investors], employees, neighbourhood groups, local communities and industrial and trade associations among others).[2] Indeed, factors such as pressure group incentives are possible and likely influences on firms, and it is clear that firms have become more aware of the importance of environmental issues in the past decade (Khanna et al. 2002, Dasgupta et al. 2000b, Groenewegen et al. 1991, Henriques et al. 1996, Hunt et al. 1990 and Porter 1991 and 1990).

---

[1] The EMS standard require organizations seeking certification to take the following steps (Dasgupta et al. 2000, pp. 26):

1. "An initial review by management to identify environmental issues of concern (e.g. excessive use of polluting inputs; the potential for a serious environmental accident);
2. Establishment of priorities for action, taking into account factors such as local environmental regulations and potential costs;
3. Establishment of an environmental policy statement, to be signed by the CEO, which includes commitments to compliance with environmental regulations, pollution prevention and continuous improvement;
4. Development of performance targets based on the policy statement (e.g. reduction of emissions by a set amount over a defined period);
5. Implementation of the EMS, with defined procedures and responsibilities;
6. Implementation reviews, performance measurements, and management audits".

[2] See Afsah et al. 1996, Henriques et al. 1996, Pargal et al. 1996a, 1996b, Tietenberg et al. 1998, Tietenberg 1996).

Environmental regulation, in the broadest sense, is an important factor affecting the decision-making process in firms. Thus, it may affect firms' decision to implement an Environmental Plan and also the attitude of firms towards the environment. However, the financial position of the firm, as well as other characteristics of plants and firms, are also elements which are relevant when taking these decisions. The formulation of an Environmental Management System is a necessary condition towards managing the environment (see footnote 1), since it is an important way of communicating the company's position regarding environmental considerations to employees, managers, the general public, etc. Moreover, such a system may reduce the environmental risks faced by firms. An EMS involves much more than just compliance with government regulations; in fact, it also establishes the firm's position regarding environmental issues (e.g. willingness to reduce environmental risks by the implementation of an Environmental Plan).

From an economic point of view, rational firms with sufficient information about the costs of Environmental Plan projects will examine the benefits and costs of an activity, and will undertake it if, and only if, it is the best possible choice, given its net positive benefits. Therefore, in this scenario, a plant that implements at least one element of an environmental system must consider such benefits (both monetary and non-monetary), as the acquisition and/or maintenance of market share, potential efficiency gains, and an increase in reputation. The costs include those of implementing the environmental system, regulatory compliance costs, and the associated opportunity costs, which are defined as the benefits that would have been earned if the firm had chosen to invest in the next best activity.

But how can we make firms more environmentally responsive? First, it is necessary to define what it is meant by an environmentally responsive firm. We define a firm as environmentally responsive when it has formulated a plan for dealing with environmental issues. It is interesting to define which are the factors or sources that may influence the likelihood of a firm implementing an environmental system, and also try to assess their impact. It is required to define the sources of influences on environmental performance, as well as to determine how some of these variables relate to each other in a multivariate analysis. Thus, the purpose of this paper is to develop a framework that can be used to test empirically the importance of several possible sources of influence on the level of environmental responsiveness of a firm.

The paper is divided as follows. Section 2 defines and determines the different sources of influence on firms' environmental performance. Section 3 and 4 present the models and the results, respectively. Section 5 concludes.

2. Sources of Influence on the Environmental Performance of Firms

The factors that may influence the likelihood that a firm will implement an environmental system are summarised in this section (see also Khanna et al. 2002, Dasgupta et al. 2000b, Henriques et al. 1996 and Arora et al. 1995, among others). After that, each type of pressure is approximated by a set of variables. Some of these variables correspond directly to questions of an environmental survey carried out in Chile in the year 2001,[3] while others have been generated after some preliminary data analysis. Information about the economic characteristics of areas surrounding firms, as well as geographic characteristics of the location of the firms, were also incorporated in order to address other sources of influence.

2.1 Environmental Pressure

a) Formal Regulation

[3] The survey considered 700 manufacturing plants along Chile (15% of the total number of plants in the country).

In the presence of externalities, such as environmental pollution, it is accepted that the government should regulate the market in order to correct inefficiencies. In fact, formal regulation is an important source of environmental pressure, and it is believed that the higher the pressure the greater the likelihood of compliance with environmental regulation. Nonetheless, it would be interesting to test whether formal regulation has an impact on the likelihood of implementing an Environmental Management System by manufacturing plants in a developing country and try to measure its influence. Henriques et al (1996) did a similar analysis for Canada based on a survey undertaken in 1992.

The potential risks associated with the presence of regulators are non-compliance fines, product elimination or substitution, banning or restriction of raw materials and unacceptable process and product impacts, resulting in regulatory changes (Henriques et al. 1996). But, do regulators have a real impact on the level of implementation of an Environmental Plan? In this context, an Environmental Plan might act as a signal to regulators that something has been done to reduce such risks.

Environmental regulations and their costs differ among manufacturing industries, given the different types and levels of pollution. Regulations affecting the Basic metal industry are significantly more exigent than those affecting the Textile industry, for instance. Firms in more regulated industries are therefore more likely to consider environmental issues in their management strategies than those in less regulated industries, since the costs associated with non-compliance tend to be significantly higher. On the other hand, it is also believed that plants that belong to highly polluting industries will face more difficulties in trying to develop a more comprehensive EMS than a less polluting firm, due to their sector characteristics.

b) Informal Regulation

Government regulation is not the only source of environmental pressure. Indeed, another important source is informal regulation, which is constituted by consumers and investors, communities and NGO's (Pargal et al. 1996a, 1996b; Tietenberg 1996 and Tietenberg et al. 1998). Henriques et al. (1996) distinguish between external and internal pressure; external pressure consists of regulators, public-communities, contractors/suppliers, while internal pressure consists of investors, employees and management.

Consumers or the public-community (local communities and NGOs) can exert significant pressure through their buying power (consumer power), influence on the legislative process, third party and citizen suits and the boycotting of future developments. Contractors/suppliers may also represent a source of pressure. A firm may face the risk of hazardous waste liability and distributor boycotts. The implementation of an environmental system may work as a signal to all these groups, that something is being done in order to address potential environmental risks.

Internal pressure from investors arises as a result of dissatisfaction with environmental fines that reduce profits, difficulties in raising new capital or attracting new investors, or lack of progress toward environmental goals. Employees will exert pressure if they have to face environmental accidents due to a lack of training or awareness. Managers may be liable for environmental accidents arising from their inability to identify and remedy non-compliance or environmental risk problems. Therefore, one objective of an environmental system is to inform investors, managers and employees about the mechanisms that the firm can implement in order to reduce the potential environmental risks mentioned above, as well as to propose solutions which reduce those risks.

Besides, industries that are closer to final consumers may also be more keen to have an Environmental Plan than others. In fact, it is expected that plants which are closer to final consumers will care more about their environmental image and therefore will be more likely to invest in an EMS. Further, plants with more educated workers and more experienced and dedicated

environmental managers may be run more efficiently, and thus be in a better position to implement an Environmental Management System.

The type of ownership of the plant is also a possible influence on compliance and therefore also of the environmental responsiveness of firms. It may be hypothesised that the general public has better information about publicly traded firms than about family-owned or state ones. Thus, public preference for a cleaner environment may register more strongly on publicly traded firms, increasing the probability of having an EMS, or having a more developed EMS. The same may happen with markets which are linked to OECD countries. Foreign green consumerism may thus affect export-oriented firms, and green market signals begin to be relevant. Multinational firms may have greater sensitivity to environmental risks than domestic firms in LDCs. The first group may be more sensitive to their public image than their local counterparts. Besides, they usually have their headquarters in richer, more regulated economies, in which they have relatively low cost access to cleaner technologies and therefore they may develop an EMS more easily. In general, it is expected that the more environmental pressure a firm faces, the more likely it is that the firm will formulate an environmental system.

c) Indicators of Environmental Pressure Sources

To address the possible influence of the previous factors on plants' environmental responsiveness, manufacturing plants were asked various sorts of questions in the environmental survey. In particular they were asked the following:

What influence have the following factors had on your decisions to act regarding environmental improvements? *(Mark with an X)*

It does not influence ← → It influences a lot

A	Standards requirements and national environmental enforcement	1	2	3	4	5	6	7
B	Local neighbours and communities	1	2	3	4	5	6	7
C	National clients	1	2	3	4	5	6	7
D	Foreign clients	1	2	3	4	5	6	7
E	Suppliers	1	2	3	4	5	6	7
F	Industrial associations	1	2	3	4	5	6	7
G	Following what the competition has done	1	2	3	4	5	6	7
H	Free trade agreements	1	2	3	4	5	6	7
I	Company's internal policy	1	2	3	4	5	6	7
J	Internal economic issues of the company	1	2	3	4	5	6	7
K	Union	1	2	3	4	5	6	7
L	Fear of the press	1	2	3	4	5	6	7
M	Other (specify)………………………………………………	1	2	3	4	5	6	7

The analysis of this question shows that there is a high correlation between the different sources of pressure considered. Therefore, in order to solve the problem of multicollinearity, to maximise the elements included in this question, but with fewer and orthogonal variables, factor analysis methodology is applied.[4] The application of factor analysis suggests the extracting of four components:[5]

Component N°1: 'Responding to External Institutions'.
Component N°2: 'International Market'.
Component N°3: 'Productive Chain'.
Component N°4: 'Formal and Informal Regulation'.

Moreover, there are other sources of environmental pressure, apart from those listed in the previous question, that also constitute part of the informal pressure faced by firms. The type of ownership of the plant is relevant, as well as the linkages to OECD countries, the presence of multinational firms, the level of contact with final consumers and the level of education of the plants' employees (all

[4] For a detailed explanation of the Factor Analysis methodology see Kline 1994, Tacq 1997 and Hair et al. 1998.
[5] See Appendix N°1 for the results of the Factor Analysis.

issues addressed in different questions of the survey). Besides, to take account of differences in environmental regulation among manufacturing industries, industry dummy variables might also be included.

2.2 Financial Position of the Firm

The implementation of any environmental system may initially require a great deal of financial capital. Consequently, the greater the access of a firm to capital, the more likely it is that the firm will be able to afford the costs associated with implementing an environmental system, which may not just involve management measures but also technological changes. Therefore, the more financially restricted the plant, the less likely it will be to invest in an environmental system, unless it receives financial support.

Two measures of financial performance were included. Firms were asked to indicate the ratio between profits and debts (Profits/Debts) of the firm in 1999 in the environmental survey. This measure reflects the financial situation of the firm. A high ratio might mean that the company has some financial flexibility to invest in environmental management. Given that there is some trade off between the implementation of an Environmental Plan (short run consideration) and reducing coordination[6] costs related to environmental issues (long term consideration), firms should balance the costs and benefits of an Environmental Plan. Another indicator which measures the financial position of the plant is a self-assessment by the plants regarding their financial position in the year 2000 compared to the year 1995. It is expected that firms with more financial flexibility will be in a better position to invest in an EMS.

Besides, an indicator of the level of expenditure on environmental improvements in the period 1995-1999 is also considered (constructed from the questionnaire). It is expected that plants that spend more on environmental improvements are more likely be implementing some elements of an EMS.

2.3 Plant Size

A key role of management in organisations is to ensure coordination. Indeed, coordination is needed in order to ensure that the actions and efforts of the many subgroups of the organisations are focused on the same goals. The coordination costs are larger the bigger the organisation is (in terms of number of employees), as are the monitoring costs. Therefore, firms may prefer to invest in an environmental system in order to reduce the coordination costs in the organisation. On the other hand, it is believed that larger firms can achieve economies of scale while developing an environmental system, as is known to be the case for larger firms investing in R&D (Arora et al. 1995, 1996).

Plant size can be measured in various different ways. One is to consider the number of employees who work in the plant. A specific question asks about the number of employees in the plant. An alternative approach is to consider the multidivisional status of the plant (the number of plants that the firm has, issue also addressed in the survey.

[6] Coordination of the actions of the individuals and subgroups in an organization (see Milgrom and Roberts 1992, pp. 114). Coordination costs are directly related to plant size.

2.4 Visibility of the Plant

The visibility of the plant will also affect the likelihood of implementing an Environmental Plan by firms. Plants located in more densely populated areas are more easily scrutinised by local communities and neighbours. Therefore, they will have greater incentives to invest in an EMS, because that can affect their image and reputation. Moreover, the proportion of manufacturing employment in each community, compared with the total level of employment, may also represent a measure of the plant's visibility. The location of plants in areas with a high share of manufacturing employment may tend to increase the probability of their having an EMS because the visibility of the plant is higher than in other areas.[7]

Finally, plant size can also reflect the visibility of the firms. The larger the firm the more susceptible it may be to public scrutiny. Indeed, very often larger firms are called on by the public to act as industry leaders.

3. The Models

In order to analyse how the previous sources of influence may affect the level of plants' environmental performance, two models were considered and then estimated. The independent variables included in both models and their expected signs are next:

[7] The information required to assess this issue was not asked for in the survey, but was later attached to the survey. The data about population density and manufacturing employment was extracted from the CASEN survey (CASEN : National Economic Characterisation) for each district.

Table N°1

Independent Variables		
Variables' Name	**Description**	**Expected Sign**
Ext_inst	Continuous variable: Influence of external institutions (Union, other firms) on plants' environmental improvements (Component N°1).	+
Int_mkt	Continuous variable: Influence of international markets on plants' environmental improvements (Component N°2).	+
Prod_ch	Continuous variable: Influence of the productive chain on plants' environmental improvements (Component N°3)	+
F&I_reg	Continuous variable: Influence of environmental standards (formal regulation) and of neighbours and local communities (informal regulation) on plants' environmental improvements (Component N°4).	+
Ownership:		?
Plc	Dummy variable: The plant is a Plc (Public Liability Company). (note 1)	
Public_p	Dummy variable: the plant is Public (own by the State). (note 1)	
Other_pp	Dummy variable. The plant is private but not a Plc: Other type of private plant. (note 1)	
OECD	Continuous variable: Percentage of sales that are directed to OECD countries.	+
Owner_ki	Continuous variable: Percentage of firms' capital that belongs to foreign investors.	+
Cons_fin	Continuous variable: Percentage of sales that are directed to final consumers	+
Emp_ed	Categorical variable: Education level of general employees. The index ranks between 1: Primary school, 2: Secondary school, 3: Technician, 4: Professionally qualified, 5: Master level, 6: PhD. level. (note 2)	+
Env.Mg	Dummy variable: The plant has an Environmental Manager. (note 1)	+
EnvMg_ed	Categorical variable: Education level of the Environmental Manager (note 3). The index ranks between 1: Primary school, 2: Secondary school, 3: Technician, 4: Professionally qualified, 5: Master level, 6: PhD. level.	+
Env.Mg.w/IE	Dummy variable: the plant has an Environmental Manager with international experience. (note 1)	+
EnvMg_ti	Categorical variable: Time dedicated to environmental issues by the Environmental Manager. The index ranks between 0: Nothing to 7: 100%.	+
Pr_db	Continuous variable: Ratio between Profits and Debts in 1999.	+
Fin_perf	Categorical variable: firms' financial performance is better in year 2000 than in 1995. The index ranks between 1: Much Worse to 7: Much Better, in the questionnaire.	+
Inv95_99	Continuous variable: Expenditure in environmental improvements (period 1995-1999) over sales of 1999.	+
Size	Dummy variable for each size. N° of plant's employees: Small (10-49 employees), Medium (50-199 employees) and Large (200 or more employees). (note 1)	+
N°Plants	Dummy variable: 0: Single Plant, 1: Multidivisional status.	+
Sector	Dummy variable for each sector. SIC: Standard Industrial Classification index (Revision 2). Eight manufacturing industries: Food, Textile, Wood, Paper, Chemicals, Non metallic minerals, Basic metals, Metallic products. (note 1)	?
Pop_dens	Categorical variable: Population density. Small City (SC), Medium City (MC) and Large City (LC). Dummy variable for each city size (Source: INE).	+
IE_TE	Continuous variable: Share of manufacturing employment in total employment in each community (Source: CASEN survey 1998).	+

(1): When groups of dummy variables were included (type of ownership, environmental manager, plant size, industrial sector and city size), one in each group was kept out of the regression in order to avoid multicollinearity (e.i. Public sector firm, No Env.Mg., Small size, Textile industry and Small City are variables of the reference scenario).

(2): For the logit regression all categorical variables were re-scaled starting in "0".

(3): The variable EnvMg_ed is only considered in Appendix N°1, because its inclusion shrinks the sample into a sub-sample of only those firms that have an Env. Mg.

3.1 Dependent Variable

The dependent variables are based in the following question of the survey:

Has your plant implemented one or more of the following elements?

A	Formal management systems, with written procedures, addressing the most important environmental issues that your plant faces
B	A written environmental policy, signed by the company's CEO, which describes the company's commitment to the environment, environmental regulations, pollution prevention and continuous environmental improvements
C	A specific written environmental plan, with quantifiable goals and objectives, considering local environmental regulations and potential costs
D	Plans and procedures for environmental emergencies
E	Procedures for liasing with communities and neighbours regarding environmental issues relating to your plant
F	Procedures that include environmental aspects, beyond current legal standards
G	A management system to reduce releases/emissions through the use of internal procedures of your company
H	Indicators and environmental performance control, and management audits
I	An established environmental management system, with defined procedures and responsibilities
J	A Clean Production System, based on management steps (of low or negligible cost)
K	A Clean Production System, based on technological changes

Using these data it is possible to define two different dependent variables. One alternative is to consider a firm as environmentally committed if it has implemented at least one of the elements mentioned in the previous question. In such a case, the dependent variable is a dichotomous variable (Implement an Environmental Plan or do not implement one). A probabilistic model, in particular a logit model,[8] would be suggested. This methodology was used in Henriques et al. (1996) in their analysis of a survey carried out in Canada in 1992. Indeed, they chose this methodology because they did not want to impose any interpretation of what an Environmental Plan should look like. The regression method chosen to deal with this dichotomous variable (the plant has or has not an Environmental Plan) was a binary logit model.

Another alternative is to build up an index of Environmental Management (EM) that represents the level of environmental commitment of the different manufacturing plants. Such an index can be build using an endogenous approach; thus, it is suggested to apply factor analysis in all the elements of the previous question. While applying factor analysis to this question, initially three components were extracted. Unfortunately, this is not helpful in achieving a one-dimension result. The accounted variance of each of the components was rather different. It is still necessary to extract only one component that represents our index of Environmental Management. Thus, some variables that strongly determine the second and third components need to be omitted from the analysis. Just one combination of variables suggests extracting one component under the latent root criterion, as necessary, because only one eigenvalue is larger than the unit (see column 2 in Table N°1, Appendix N°2), while maximising the number of variables of interest to be considered. The subset of included variables is: statements A, B, C, D, F, G, H and I from the previous question. This single extracted component explains 44% of the variance of the variables under consideration. Therefore, with the exception of letter E, all the steps required to obtain ISO 14001 certification were somehow considered in the index of EM.

In what follows, both approaches will be analysed. The first will determine the variables that lead a manufacturing plant to initiate an Environmental Plan (Env_plan), while the second model will identify the factors that give the firm an incentive to move forward in the implementation of an EMS (index EM). Following is the description of the dependent variables included in the model:

[8] A good literature review for limited dependent variables is found in Long (1997) Chapters 3-5, Green (1995) Chapters 21-23, Greene (1997) Chapter 19 and Amemiya (1985).

Table N°2

Dependent variable (2 models)	
Env_plan	Dichotomy variable: Element of an Environmental Plan (1) or No Environmental Plan (0)
EM	Continuous variable: Index of Environmental Management (EM)

The complete function is the following:

1) Env_plan, 2) EM = f(Ext_inst, Int_mkt, Prod_ch, F&I_reg, Ownership [Plc, Other_pp, Public_p], OECD, Owner_ki, Cons_fin, Emp_ed, Env.Mg, Env. EnvMg_ed, Mg.w/IE, EnvMg_ti, Pr_db, Fin_perf, Inv95_99, Plant_size [Small, Medium, Large], N°Plants, Sector [Food, Textile, Wood, Paper, Chemicals, Non-metallic minerals, Basic Metals, Metallic products], Pop_dens [Small city, Medium city, Large city], IE_te)

4. Results

Tables N°3 and N°4 present the descriptive statistics concerning the variables used in the analysis. Table N°3 shows that 69% of the plants report having at least one element of an Environmental Plan (Env_plan). Nonetheless, when considering the index of Environmental Management (EM), we should note that the mean index is very low (0.16), which may be seen as a better representation of the level of implementation of environmental policies by Chilean enterprises.

Table N°4 illustrates the descriptive statistics for the independent variables. The first four variables (Ext_Inst, Int_Mkt, Prod_ch and F&I_reg) represent components derived from the factor analysis, and by construction they have a "0" mean, and a standard deviation of "1". Public sector firms represent only 1% of the plants, Plcs 5% and other types of private ownership (Other_pp) 94%. On average, only 4.6% of the sales are exported to OECD countries and most of the firms' sales are oriented to final consumers (on average 82%, but with a large standard deviation). Only 4.5% of the firms' capital is foreign owned (Owner_ki) on average, but the standard deviation is rather high (18%).

The mean level of education of general employees (Emp_ed) is Secondary school. 82% of the plants responded that they have an environmental manager (Env.Mg); but of these only 16% have international experience (Env.Mg.w/IE). The level of education of these managers (EnvMg_ed) falls between Technician and Professionally qualified, which is rather encouraging. However, the average time dedicated to environmental issues (Envmg_ti) is less than 25%.

The average ratio between profits and debts (Pr_db) is 13%, which reveals that plants do not have much financial excess. In average plants declare that their financial performance (Fin_perf) was worse of in the year 2000 than in 1995 (index 3.3 in the scale 1 to 7). The average level of expenditure on environmental improvements (Inv95_99) is US$240.

Medium size plants represent 22% of the cases, large plants 11% and small plants 67%. Only 23% of the plants belong to companies that have more than 1 plant (multiplants). The sectors with higher number of plants are the Food (33%) and Metallic product ones (19%). 19% of the plants are located in small cities (SC), 14% in medium size ones (MC) and (67%) in large cities (LC). Finally, the average proportion of manufacturing employment, over total employment, is 16%.

Table N°3

Descriptive Statistics for Y

Name	Mean	Std	Min	Max
EM	0.16	0.24	0	1
Env_plan	0.69	0.46	0	1

Table N°4

Descriptive statistics for X

Variable	*N (Count)*	*Mean*	*SD*	*Min*	*Max*
Ext_inst	4,222	0.00	1.00	-2	4
Int_mkt	4,222	0.00	1.00	-2	4
Prod_ch	4,222	0.00	1.00	-2	3
F&I_reg	4,222	0.00	1.00	-2	3
Public_p	4,222	0.01	0.09	0	1
Other_pp	4,222	0.94	0.23	0	1
PLC	4,222	0.05	0.22	0	1
OECD	4,222	4.61	16.74	0	99
Owner_ki	4,222	4.50	18.46	0	100
Cons_fin	4,222	81.68	33.44	0	100
Emp_ed	4,222	1.87	0.62	1	5
Env.Mg	4,222	0.82	0.38	0	1
Env.Mg.w/IE	4,222	0.16	0.37	0	1
EnvMg_ed	3,472	3.63	0.83	1	6
EnvMg_ti	4,222	2.03	1.32	0	7
Pr_db	4,222	13.60	24.85	-139	300
Fin_perf	4,222	3.39	1.82	1	7
Inv95_99	4,222	0.24	1.75	0	30
Small	4,222	0.67	0.47	0	1
Medium	4,222	0.22	0.42	0	1
Large	4,222	0.11	0.31	0	1
N°Plants	4,222	0.23	0.42	0	1
Food	4,222	0.33	0.47	0	1
Textile	4,222	0.14	0.35	0	1
Wood	4,222	0.14	0.34	0	1
Paper	4,222	0.06	0.23	0	1
Chemicals	4,222	0.10	0.30	0	1
Non-metallic min.	4,222	0.04	0.19	0	1
Basic Metals	4,222	0.01	0.08	0	1
Metallic Products	4,222	0.19	0.39	0	1
SC	4,222	0.19	0.39	0	1
MC	4,222	0.14	0.35	0	1
LC	4,222	0.67	0.47	0	1
IE_TE	4,222	0.16	0.06	0.05	0.33

Next, the multivariate results are presented in Tables N°5 to N°8. Different models will be developed. A logit model will be run initially, considering the dichotomous variable Env_Plan (whether the plant has implemented at least one element of an Environmental Plan). In Appendix N°3 an alternative logit model is presented, which considers only those plants that have an Env.Mg (3,742 cases) and then it includes the level of education of the manager (Env.Mg_ed) as an additional explanatory variable of the probability of having an Env_Plan in the plant. Then, a linear regression model considering the index of EM will be run. Again, the main model will consider the Env.Mg as an explanatory variable (it includes the 4,222 expanded data), and in Appendix N°3 (Table N°4) an alternative linear model is presented with the inclusion of Env.Mg_ed instead.

As is usual in the literature, for each of the different models previously suggested, two cases are run. The first considers all the variables under analysis (Model 1), and the second only those that are statistically significant (Model 2). In the following analysis, the first model will be explained in detail but references will also be made to the second model.

4.1 Logit Model of Dichotomous Variable Env_plan

The logit equation has a Cox and Snell R^2 of 0.41 and a Nagelkerke R^2 of 0.57 (Table N°5, model 1). Although these values are not very high, they are high for logit models. Moreover, the Chi-square statistic indicates that the model variables have significant explanatory power.

The sign of the coefficients are those expected in general, though there are some exceptions. For example, the model suggests that a higher ratio between profits and debts (Pr_db) will decrease the probability that a firm has an Environmental Plan, which goes against our initial hypothesis. The N° of Plants variable also has an unexpected negative sign; nonetheless the coefficient of this variable is not significant. Besides, there are other variables that are not statistically significant. A positive sign for the variable Owner_ki was expected; but the coefficient was not significant, suggesting that the level of international capital in the firm has no impact on the probability that the firm has an Environmental Plan. The same is true of variables Emp_ed, Env.Mg.w/IE and Env.Mg_ti; although positive signs, the coefficients are not statistically significant, implying that the general

level of education of employees does not affect the likelihood of an Env_plan, nor does the international experience of the environmental manager and the time dedicated by this manager to environmental issues. The coefficient of the Basic Metal industry is also not significant.

It is very interesting to note that all the components that represent environmental pressure (Ext_inst, Int_mkt, Prod_ch and F&I_reg) have a positive sign and are significant. That suggests that they do represent sources of pressure, as hypothesised, increasing the probability that the firm has an Environmental Plan. The positive coefficients of Other_pp and Plc support the hypothesis that private firms are more likely to have an Environmental Plan than public sector firms. Moreover, firms' environmental awareness and reputation regarding consumers is supported by positive and significant coefficients of OECD and Cons_fin coefficients. As expected, the presence of an Env.Mg has a positive impact on the probability of having an Environmental Plan.[9] Further, firms that declare that they are in a better financial position in the year 2000 compared with the year 1995, and/or have invested in environmental improvements in the last 5 years, are more likely to have an Env_plan. Likewise, the data supports the hypothesis that larger plants have a higher likelihood of having at least one element of an Environmental Plan than smaller plants.

Considering next the industrial sector variables, most of them are statistically significantly different from the Textile industry (base scenario); indeed only the Basic Metal industry is not. Moreover, with the exception of the Food industry, all the other sectors are significantly more likely to have an Env_plan than the Textile industry. It could thus be suggested that the more polluting industries tend more often to have at least one element of an Env_plan. The data also suggests that plants located in medium size cities (MC) or large ones (LC) are more likely to have an Environmental Plan than those situated in small cities (SC). Likewise, firms located in areas in which the share of manufacturing employment in total employment (IE_TE) is higher, will also tend to have an Environmental Plan. The above suggests that plant visibility does influence firms' environmental performance.

[9] If an alternative model is run considering only those plants that have an Env.Mg, and adding as an explanatory variable its level of education, it is found that the coefficient of Env.Mg_ed is positive and statistically significant (See Appendix N°3).

Table N°5

Logit Regression: "Env_plan" dependent variable										
Models	(1)					(2)				
Variable	*B*	*S.E.*	*Wald*	*Sig.*	*Exp(B)*	*B*	*S.E.*	*Wald*	*Sig.*	*Exp(B)*
Ext_inst	0.743	0.060	153.079	0.000	2.102	0.720	0.056	164.819	0.000	2.055
Int_mkt	0.471	0.078	36.556	0.000	1.602	0.495	0.076	42.252	0.000	1.640
Prod_ch	0.588	0.063	86.429	0.000	1.800	0.584	0.062	88.076	0.000	1.794
F&I_reg	0.991	0.059	279.578	0.000	2.694	0.998	0.059	284.624	0.000	2.714
Other_pp	4.691	0.874	28.793	0.000	108.995	4.078	0.758	28.924	0.000	59.052
PLC	4.380	0.907	23.294	0.000	79.827	3.860	0.794	23.634	0.000	47.489
OECD	0.012	0.003	12.620	0.000	1.012	0.011	0.003	13.537	0.000	1.011
Owner_ki	0.002	0.003	0.233	0.629	1.002					
Cons_fin	0.010	0.002	43.314	0.000	1.010	0.010	0.002	42.659	0.000	1.010
Emp_ed	0.067	0.081	0.687	0.407	1.069					
Env.Mg	1.733	0.195	79.127	0.000	5.658	1.768	0.126	196.178	0.000	5.858
Env.Mg.w/IE	0.205	0.147	1.947	0.163	1.227					
EnvMg_ti	0.010	0.064	0.024	0.877	1.010					
Pr_db	-0.009	0.002	17.960	0.000	0.991	-0.008	0.002	17.537	0.000	0.992
Fin_perf	0.243	0.028	74.045	0.000	1.276	0.246	0.028	78.621	0.000	1.278
Inv95_99	0.793	0.409	3.757	0.053	2.211	0.750	0.388	3.742	0.053	2.117
Medium	0.465	0.133	12.272	0.000	1.593	0.486	0.132	13.585	0.000	1.625
Large	1.395	0.267	27.376	0.000	4.035	1.430	0.260	30.237	0.000	4.180
N°Plants	-0.024	0.142	0.029	0.864	0.976					
Food	-0.922	0.175	27.931	0.000	0.398	-0.927	0.168	30.516	0.000	0.396
Wood	2.052	0.198	107.198	0.000	7.787	2.010	0.197	103.592	0.000	7.461
Paper	2.400	0.330	52.854	0.000	11.018	2.331	0.324	51.915	0.000	10.290
Chemicals	1.157	0.213	29.510	0.000	3.180	1.126	0.201	31.247	0.000	3.082
Non-metallic min.	0.833	0.294	8.035	0.005	2.301	0.828	0.291	8.095	0.004	2.288
Basic Metals	5.944	10.602	0.314	0.575	381.507					
Metallic Products	1.096	0.181	36.648	0.000	2.993	1.086	0.174	39.173	0.000	2.962
MC	0.578	0.186	9.686	0.002	1.782	0.544	0.176	9.537	0.002	1.724
LC	0.545	0.155	12.418	0.000	1.724	0.562	0.142	15.576	0.000	1.754
IE_TE	5.613	1.029	29.732	0.000	273.931	5.389	0.996	29.249	0.000	218.906
Constant	-8.119	0.936	75.295	0.000	0.000	-7.378	0.802	84.710	0.000	0.001
-2 Log likelihood	3000.90					3072.41				
Cox & Snell R Square	0.405					0.395				
Nagelkerke R Square	0.573					0.558				

Table N°6 presents the discrete changes of the probabilities associated with having an Environmental Plan, given a marginal and range change in the independent variables considered in models 1 and 2. Table N°7 presents the base values[10] from which the discrete changes are computed.

Among the significant variables, it is interesting to see which are the most influential in terms of a change in the likelihood of having an Env_plan. For that purpose, the marginal effect, range change[11] and discrete change of dummy variables from 0→1, of the different independent variables are taken into account. It should be remembered that such discrete changes are computed at the base values, and once you alter the base values the discrete changes also vary.

Among the most influential variables are some of the environmental pressure variables: External Institutions (7%)[12] and Formal and Informal regulation (5%). While the other two sources of environmental pressure have a lower impact, it is still worth pointing them out. Indeed, International Market (Int_mkt) pressure and the Production Chain (Prod_ch) will increase the probability of an Env_plan by only 2% each one.

Ownership of the plant has an important impact; a Plc firm will increase the probability of having an Env_plan by 22% compared to a Public Sector Firm (base scenario), Other Private Firms (Other_pp) will increase such a probability by 28%. It is interesting to note that while both types of private firm have a higher likelihood of an Environmental Plan, Other_pp shows a larger impact on

[10] The base scenario considers a Public sector firm, without Environmental manager, therefore No International Experience, Small size, Single plant, from the Textile industry, located in a Small city and all the other continuous variables in their means.

[11] A range change is a change in the variable from its minimum to its maximum value.

[12] A plant that faces the maximum pressure from this source, everything else being constant, will increase the likelihood of having an Env_plan by this percentage, compared to a plant that does not face that pressure at all.

the probability. The level of investment in environmental performance also has a large impact.[13] The existence of an Environmental Manager (Env.Mg) seems to affect by only 2% the likelihood of having an Env_plan. Moreover, the two industrial sectors that are more likely to have at least one element of an Environmental Plan than the Textile industry are Wood (2%)[14] and Paper (4%).

The rest of the variables have a lower impact on the probability of having an Env_plan. Indeed, selling most of their production to OECD countries only increases the probability of an Env_plan by 1%. The same happens with firms that have had a large improvement in their Financial Performance (Fin_perf). It is interesting to note that plants that have a large Profit-Debts ratio will decrease the probability of having an Env_Plan, only if such a ratio is really high, otherwise it will not affect the likelihood at all. Large plants seem to be slightly differentiated from Small ones; indeed Large plants have a 1% higher probability of an Env_plan compared to Small ones. On the other hand, the Multidivisional status of the plant (N°Plants) seems not to affect the probability. Moreover, if the Share of Local Manufacturing Employment (IE_TE) is very high, the probability of an Env_plan will also increase, but again only by 1%.

If the plant belongs to any of the following manufacturing sectors (Chemicals, Non-metallic minerals and Metallic products), the probability that the plant will implement an element of an Env_plan will increase by 1%.

Finally, the data suggests that the origin of the capital (Owner_ki), the final destination of sales (Fin_cons), the level of education of general employees (Emp_ed), the international experience of the environmental manager (Env.Mg.w/IE), and the time dedicated by this manager to environmental issues (Env.Mg_ti) have only a small impact on the likelihood of having an Env_plan. The same applies to the size of the city in which the plant is located (it will only affect it by almost 0.5% if the plant is located in a large city [LC]).

The impacts of each independent variable on the probability of having an Env_plan were computed under the base scenario. However, if one of the independent variables is allowed to vary along its possible values, we could expect that the impact of the other independent variables will also have a different effect on the likelihood of an Env_plan. For instance, the ownership variable will not have the same effect on the probability of an Env_plan if the plant faces strong Formal and Informal regulation (F&I_reg) compared to the case in which it does not. Figure N°1 considers the different possible levels of F&I_reg (x-variable). Then diverse discrete variables are considered in the model at the different levels of F&I_reg. What the graph shows is that while F&I_reg increases (towards the left), the impact of having a Plc versus a Public sector firm has a larger effect on the likelihood of an Env_plan. The same happens when a Large plant is considered instead of a Small one, the Paper industry rather than the Textile one, a Large city (LC) versus a Small one, a Multiplant versus a Single plant company and the presence of an Environmental Manager (Env.Mg) versus its absence. This suggests that when the level of F&I regulation increases, other independent variables have a larger impact on the likelihood of having an Environmental Plan. This also helps to explain why some variables had a small impact on that likelihood when the discrete changes were analysed at the base values, and how much they may vary if the base scenario is modified.

[13] The range change of Inv95_99 considers the total change in that variable, which should not be thought of as something very plausible for all firms.

[14] Probability increases by this percentage if the firm belongs to this industry rather than to the Textile sector.

Figure N°1
Predicted Probability of having an Environmental Plan

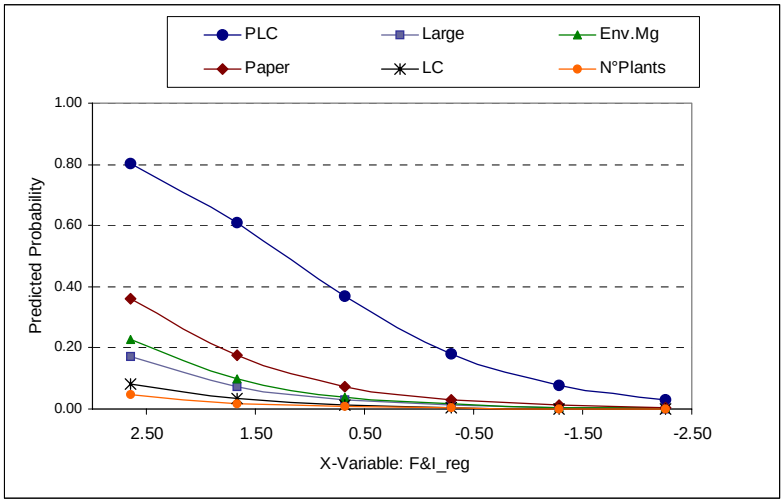

Table N°6

Discrete Change

Models			(1)					(2)		
Variable	*Marginal*	*Δ Range*	*0-->1*	*Centered Δ 1*	*Centered Δ σ*	*Marginal*	*Δ Range*	*0-->1*	*Centered Δ 1*	*Centered Δ σ*
Ext_inst	0.003	0.067	---	0.003	0.003	0.006	0.132	---	0.006	0.006
Int_mkt	0.002	0.020	---	0.002	0.002	0.004	0.049	---	0.004	0.004
Prod_ch	0.002	0.024	---	0.002	0.002	0.005	0.052	---	0.005	0.005
F&I_reg	0.004	0.049	---	0.004	0.004	0.009	0.109	---	0.009	0.009
Other_pp	0.017	0.285	0.285	---	---	0.035	0.331	0.331	---	---
PLC	0.016	0.226	0.226	---	---	0.033	0.284	0.284	---	---
OECD	0.000	0.007	---	0.000	0.001	0.000	0.016	---	0.000	0.002
Owner_ki	0.000	0.001	---	0.000	0.000					
Cons_fin	0.000	0.003	---	0.000	0.001	0.000	0.006	---	0.000	0.003
Emp_ed	0.000	0.001	---	0.000	0.000					
Env.Mg	0.006	0.017	0.017	---	---	0.015	0.040	0.040	---	---
Env.Mg.w/IE	0.001	0.001	0.001	---	---					
EnvMg_ti	0.000	0.000	---	0.000	0.000					
Pr_db	0.000	-0.013	---	0.000	-0.001	0.000	-0.029	---	0.000	-0.002
Fin_perf	0.001	0.007	---	0.001	0.002	0.002	0.012	---	0.002	0.004
Inv95_99	0.003	0.997	---	0.003	0.006	0.006	0.993	---	0.007	0.012
Medium	0.002	0.002	0.002	---	---	0.004	0.005	0.005	---	---
Large	0.005	0.011	0.011	---	---	0.012	0.026	0.026	---	---
N°Plants	0.000	0.000	0.000	---	---					
Food	-0.003	-0.002	-0.002	---	---	-0.008	-0.005	-0.005	---	---
Wood	0.008	0.025	0.025	---	---	0.017	0.052	0.052	---	---
Paper	0.009	0.036	0.036	---	---	0.020	0.074	0.074	---	---
Chemicals	0.004	0.008	0.008	---	---	0.010	0.017	0.017	---	---
Non-metallic min.	0.003	0.005	0.005	---	---	0.007	0.011	0.011	---	---
Basic Metals	0.022	0.584	0.584	---	---					
Metallic Products	0.004	0.007	0.007	---	---	0.009	0.016	0.016	---	---
MC	0.002	0.003	0.003	---	---	0.005	0.006	0.006	---	---
LC	0.002	0.003	0.003	---	---	0.005	0.006	0.006	---	---
IE_TE	0.021	0.008	---	0.058	0.001	0.046	0.017	---	0.113	0.003

Note: Marginal is the marginal change in each variable; Delta Range is change from the minimum to the maximum; 0-->1 is change from 0 to 1; Delta 1 is centered change of 1 around the mean; Delta SD is centered change of SD around the mean.

Table N°7

Base Values

Variable	*Values*
Ext_inst	0.00
Int_mkt	0.00
Prod_ch	0.00
F&I_reg	0.00
Other_pp	0.00
PLC	0.00
OECD	4.61
Owner_ki	4.50
Cons_fin	81.68
Emp_ed	0.87
Env.Mg	0.00
Env.Mg.w/IE	0.00
EnvMg_ti	2.03
Pr_db	13.60
Fin_perf	2.39
Inv95_99	0.24
Medium	0.00
Large	0.00
N°Plants	0.00
CIU_2_31	0.00
CIU_2_33	0.00
CIU_2_34	0.00
CIU_2_35	0.00
CIU_2_36	0.00
CIU_2_37	0.00
CIU_2_38	0.00
MC	0.00
LC	0.00
IE_TE	0.16

If the worst scenario is considered (this is a small public firm, with a single plant from the Textile industry, with medium Financial Performance, that has no Environmental Manager, located in a Small city and all other categorical variables are at their means), the probability that the plant has at least one element of an Env_plan is as low as 1%.[15] At the other extreme, considering the same industry, but this time a Plc, Large plant, with an Environmental Manager with international equivalent experience and a large amount of time dedicated to environmental issues, the probability that this plant has at least one element of an Environmental Plan will increase to 90%. If on top of that the regulator is able to implement and promote high Formal and Informal Environmental

[15] If the same worst scenario is analysed, but now considering only those plants that have an Environmental Manager and then taken into account its level of education (variable at its mean), the likelihood of an Env_plan increases to 41% (result from Appendix N°3).

Pressure (F&I_reg), such a probability will increase to 99%. Therefore, this suggests that there is an opportunity for policy makers to significantly increase the probability of plants having an Env_plan using different types of policies.

4.2 Linear Regression of Index EM

The linear regression model (second approach) used to estimate the index of Environmental Management (EM) has an R^2 of 0.40, and an adjusted R^2 of 0.39 (Table N°8, model 1). Although these values are not very high, the F statistic indicates that the model variables do have significant explanatory power.

The signs of the coefficients are generally as expected, but there are some exceptions. The data suggest that among the statistically significant industrial sectors, Food, Paper and Metallic products have on average a lower level of environmental management (negative coefficient) than the Textile industry (base scenario). This could be understandable in the sense that for the more polluting industries it is more difficult to have a more complete environmental management programme than for the less polluting ones. Nonetheless, the Basic Metals industry has a positive and statistically significant coefficient, which means that this industry tends to have a higher index of EM than the Textile industry. Moreover, there are other variables that also have an unexpected negative sign, but they are not statistically significant (these are Prod_ch, MC and LC).

It is interesting to point out that, with the exception of the Productive Chain (Prod_ch), all other components that represent environmental pressure (Ext_inst, Int_mkt and F&I_reg) have a positive sign and are all statistically significant. That supports the hypothesis that the previous factors promote the level of environmental commitment of the firm. The positive coefficients of Public sector firms and Plcs suggest these firms have a higher index of environmental management than Other_pp. This result differs from the one of the Logit model. When firms were asked if they have at least one element of environmental management, Plc and Other_pp were more likely to answer positively (logit model). When the level of environmental management implemented in the firm (EM index) was analysed, it was found that Plcs and Public Sector Firms have a larger index. This may suggest that Plcs are generally more aware of environmental issues than Other_pp and therefore they implement more measures of environmental management. Moreover, it seems that Public Sector Firms also implement more elaborate environmental management plans than Other Types of Private Property Firms (Other_pp). Besides, awareness and reputation with consumers seems not to matter very much. In fact the OECD variable is not significant, and while Cons_fin is significant, its coefficient is practically zero.

As expected, the level of education of the employees is associated with the level of the EM index. A plant that has more educated people will tend to have a higher index of EM. On the other hand, the variable Environmental Manager (Env.Mg) is not statistically significant.[16] However, the coefficients of the international experience of the Environmental Manager (Env.Mg.w/IE) and of the time dedicated by such a manager to environmental issues (EnvMg_ti) are also positive and statistically significant. All this suggests that more educated environmental managers, with some kind of international experience and with more dedication to environmental issues, have an important impact on the level of environmental management implemented by firms.

Besides, firms that declare that they were in a better financial position in the year 2000 compared to the year 1995 (Fin_perf), and/or have invested in environmental improvements in the last 5 years (Inv95_99), are more likely to have a higher index of EM. The variable Pr_db is also statistically

[16] If an alternative model is run, which considers only those plants that have an environmental manager, and therefore adding as an explanatory variable the level of education of such a manager, it is found that the coefficient of Env.Mg_ed is positive and statistically significant (See Appendix N°3).

significant; however, its coefficient is practically zero. A positive sign for the variable Owner_ki was expected, and this is supported by the data, although the coefficient is very low, suggesting a low impact of that variable in the EM index.

Likewise, the data support the hypothesis that larger plants do have a larger EM index than small plants, but the coefficient for medium size plants is not statistically different from that for small ones. The coefficient of the Number of plants variable is also positive, which suggests that multiplant firms tend to have a larger EM index. Finally, it is also observed that plants located in areas in which the share of manufacturing employment is high, tend to have a higher index of EM. The latter supports the hypothesis that a plant's visibility positively affects the level of environmental management. Indeed, it might suggest that manufacturer employees put some pressure on the firms to have a higher level of environmental management. Therefore, the regulator may target the areas in which the proportion of manufacturing employment is low.

Table N°8

Linear Regression: "EM" dependent variable

Models	(1)					(2)				
	Unstandardized		Standardized			Unstandardized		Standardized		
Variable	B	S.E.	B	t	Sig.	*B*	*S.E.*	*B*	*t*	*Sig.*
Ext_inst	0.033	0.003	0.142	10.913	0.000	0.032	0.003	0.137	10.825	0.000
Int_mkt	0.038	0.004	0.162	10.616	0.000	0.041	0.003	0.174	12.198	0.000
Prod_ch	-0.003	0.003	-0.014	-1.059	0.290					
F&I_reg	0.053	0.003	0.224	16.705	0.000	0.054	0.003	0.228	17.687	0.000
Public_p	0.099	0.039	0.037	2.527	0.012	0.106	0.039	0.039	2.727	0.006
PLC	0.070	0.014	0.064	4.816	0.000	0.072	0.014	0.066	4.977	0.000
OECD	0.000	0.000	0.016	1.122	0.262					
Owner_ki	0.001	0.000	0.100	7.612	0.000	0.001	0.000	0.102	7.873	0.000
Cons_fin	0.000	0.000	0.043	3.289	0.001	0.000	0.000	0.041	3.169	0.002
Emp_ed	0.096	0.005	0.249	18.615	0.000	0.095	0.005	0.247	18.834	0.000
Env.Mg	0.011	0.012	0.018	0.964	0.335					
Env.Mg.w/IE	0.053	0.008	0.082	6.268	0.000	0.055	0.008	0.085	6.714	0.000
EnvMg_ti	0.024	0.003	0.134	6.967	0.000	0.025	0.002	0.143	10.828	0.000
Pr_db	0.000	0.000	0.031	2.326	0.020	0.000	0.000	0.034	2.581	0.010
Fin_perf	0.005	0.002	0.040	3.078	0.002	0.006	0.002	0.044	3.513	0.000
Inv95_99	0.006	0.002	0.042	2.911	0.004	0.006	0.002	0.042	2.929	0.003
Medium	0.009	0.008	0.017	1.196	0.232					
Large	0.069	0.012	0.090	5.879	0.000	0.064	0.011	0.083	5.770	0.000
N°Plants	0.047	0.008	0.083	5.691	0.000	0.055	0.008	0.097	7.090	0.000
Food	-0.087	0.011	-0.173	-8.056	0.000	-0.084	0.007	-0.166	-11.284	0.000
Wood	-0.002	0.012	-0.003	-0.190	0.849					
Paper	-0.046	0.016	-0.045	-2.948	0.003	-0.049	0.014	-0.047	-3.572	0.000
Chemicals	0.014	0.013	0.018	1.099	0.272					
Non-metallic min.	-0.014	0.017	-0.011	-0.820	0.412					
Basic Metals	0.256	0.040	0.084	6.335	0.000	0.260	0.039	0.085	6.621	0.000
Metallic Products	-0.039	0.011	-0.066	-3.577	0.000	-0.041	0.008	-0.069	-4.860	0.000
MC	-0.008	0.011	-0.012	-0.736	0.462					
LC	-0.017	0.010	-0.033	-1.707	0.088					
IE_TE	0.308	0.061	0.078	5.029	0.000	0.291	0.055	0.074	5.283	0.000
(Constant)	-0.062	0.018	0.000	-3.467	0.001	-0.063	0.015	0.000	-4.084	0.000

R	0.630	Anova				R	0.628	Anova		
R^2	0.396	Sum of Squares	93.288			R^2	0.395	Sum of Squares	92.906	
Adjusted R^2	0.392	df	29.000			Adjusted R^2	0.392	df	20.000	
S.E.E.	0.184	Mean Square	3.217			S.E.E.	0.184	Mean Square	4.645	
R^2 Change	0.396	F	94.943			R^2 Change	0.395	F	137.030	
F Change	94.943	Sig.	0.000			F Change	137.030	Sig.	0.000	
df1	29.000					df1	20.000			
df2	4,191.000					df2	4,200.000			
Sig. F Change	0.000					Sig. F Change	0.000			

Among the significant variables, it is interesting to note which are the most influential in terms of an impact on the index of EM. This can be analysed by scrutinising the magnitude of the coefficients (unstandardised)[17] of the variables, which represent the elasticities between the dependent and independent variables in Table N°8. Among the explanatory variables that have the largest effect on the index of EM are some of the industrial sectors: Food, Paper, Basic Metals and Metallic products (-0.09, -0.05, 0.26, -0.04, respectively). Special attention should be given to the Basic Metals industry, which has a very large positive coefficient. Moreover, the Share of Manufacturing Employment in Total Employment in a particular area also significantly affects the level of the EM index (0.31).[18]

Besides this, the education level of employees, as well as the time dedicated by the environmental manager to environmental issues and his/her international experience also significantly affects the EM index (0.10, 0.02, 0.05, respectively). Among the environmental pressures, Formal and Informal Regulation has the larger impact (0.05), followed by International Market (0.04) and then by External Institutions (0.03) – this is confirmed if the standardised coefficients are compared.

The type of ownership of the plant has an important impact; a Plc firm has a higher EM index (+0.07) compared with Other Types of Private Property Firms (Other_pp), a Public Sector Firm also has a higher index than Other_pp (+0.10). If standardised coefficients are compared, Plcs have a larger positive impact than Public_p. Large plants are differentiated from Small ones, and even from Medium size ones. Indeed Large firms have a higher EM index (+0.07) compared with Small ones. Likewise, a Multiplant firm will have a higher EM index than a Single-plant firm (elasticity: 0.05). The rest of the variables have a lower impact on the level of the EM index.

[17] The standardised coefficients are the regression coefficients when all variables are expressed in standardized (z-score) form. Transforming the independent variables to standardized form makes the coefficients more comparable since they are all in the same units of measure. But in order to be able to compare variables they need to be variables that are comparable, which is rarely the case in this model.

[18] The scale of this variable should be taken under consideration.

5. Conclusions

The previous analysis may raise important policy implications for environmental regulators. It is clear which industrial sectors and plant sizes, among other characteristics of plants, are more likely to have an Environmental Plan or a higher index of environmental management. This may guide public efforts to direct resources or more instruments towards those specific sectors with a low probability of having an Environmental Plan or low levels of environmental management.

Moreover, it is also worth comparing the results of the two models and pointing out the differences in the determinant variables in each of them. The results suggest that investments in Formal and Informal Regulation (F&I_reg) can have a large impact on both a higher Environmental Management index (EM) and a higher likelihood of having an Environmental Plan (Env_plan). Empowering External Institutions should also be evaluated, as it considerably affects the likelihood of an Env_plan. Nonetheless, the costs associated with increased enforcement or the empowering of other agents should be taken into account.

The presence of an Environmental Manager has a strong impact on the likelihood of an Environmental Plan; though it seems not to affect the EM index. The level of education and international experience of the Environmental Manager have a large repercussion in both indicators (see Appendix N°3). Besides, the level of education of general employees particularly affects the index of environmental management. Therefore, empowering general employees (increasing the value of the education variable - Emp_ed) can be an effective mechanism to promote an Environmental Management System, while empowering environmental managers could affect both environmental performance indicators.

The firm's ownership also has an important effect on both environmental indicators. Plcs and other types of private property firms are more likely to have at least one element of an Environmental Plan. But Public Sectors Firms and Plcs tend to have a more complete Environmental Management System. The first suggests that private investors provide an additional indirect incentive to improve environmental performance. Consequently, disclosure information strategies that empower communities, NGOs, investors, etc. should be evaluated as effective policy instruments. It is also worth noting that while Public Sector Firms are less likely to have an Environmental Plan, once they do they tend to have a more comprehensive Environmental Management System.

The data suggests that plants that have invested in environmental improvements are in a better position to implement at least one element of an Environmental Plan. It seems that firms need to invest significant amounts of money in environmental improvements if they want to increase their index of EM (the impact of such investments is rather low; see coefficient of Inv95_99 in Table N°8). Therefore, if regulators want to encourage environmental performance by fostering investments in environmental improvements, they should foster really large investments. Moreover, regulators could also try to assist plants with financial difficulties to encourage them to improve their environmental performance.

Moreover, the data suggest that plants from the Wood and Paper industries are much more likely to have at least one element of an Environmental Plan than plants from the Textile industry (a less polluting sector). However, it also suggests that the most polluting sectors (Food, Paper, among others) are more likely to have an Environmental Management System that is less sophisticated than those of the less polluting industries. The exception is the Basic Metal industry that is inclined to have a larger EM index than the others, even though it is a high polluting sector. This is understandable, in the sense that the more polluting firms are more likely to have implemented at

least one element of an Environmental Plan (indeed that may be formally required), but they may be less able to implement a proper Environmental Management System, due to their pollution levels.

It is possible to appreciate that while some variables determine both the likelihood of an Environmental Plan and a higher index of Environmental Management, some others are more specific to each of these dependent variables. Indeed, it seems that the level of education of employees and the international experience of the Environmental Manager particularly encourage and support comprehensive programmes of environmental management. Instead, the presence and experience of the Environmental Manager particularly increases the likelihood of an Env_plan. This suggests that depending on the type of environmental management strategy regulators or environmental agencies would like to foster in manufacturing plants (one particular element versus a full programme of environmental management), they should look at the logit or the linear regression model and then concentrate on one set of variables or the other.

Finally, it is interesting to note that, with the exception of the industrial sector of the plants and the plant size, all the other variables (such as environmental pressure, environmental manager characteristics, investment in environmental improvements, etc.) are susceptible to the influence of the actions of the policy maker. Therefore, the regulator might attempt to affect them when trying to encourage improvements in the environmental performance of firms.

Bibliography

Afsah, S., Laplante, B. and Wheeler, D. (1996), "Controlling Industrial Pollution: a New Paradigm", Policy Research Department, World Bank, Working Paper Nº1672.

Arora, S., and Cason, N. (1995), "An experiment in Voluntary Environmental Regulation: The 33/50 Program", *Journal of Environmental Economics and Management 28*(3), pp. 271-286.

Arora, S., and Cason, N. (1996), "Why do Firms Volunteer to Exceed Environmental Regulations? Understanding Participation in EPA's 33/50 Program", *Land Economics 72* (4), pp. 413-432.

Amemiya, T. (1985), Advanced Econometrics, Cambridge: Harvard University Press.

Baumol W. and Oates W. (1988), The Theory of Environmental Policy, Cambridge University Press, Cambridge, U.K.

Dales J. (1968), Pollution, Property, and Prices, University Press, Toronto.

Dasgupta, S., Hettige, H. and Wheeler, D. (2000), "What Improves Environmental Performance? Evidence from Mexican Industry", *Journal of Environmental Economics and Management 39* (1), pp. 39-66.

Gabel, L. and Sinclair-Desgagné, B. (1993), "Managerial Incentives and Environmental Compliance", *Journal of Environmental Economics and Management 24*, pp. 229-240.

Greene, W. H. (1995), Limdep: Version 7.0, User's Manual, New York: Econometric Software.

Greene, W. H. (1997), Econometric Analysis, 3rd Edition, Prince Hall, Upper Saddle River, New Jersey.

Groenewegen, P. and Vergragt, P. (1991), "Environmental Issues as Threats and Opportunities for Technological Innovation", *Technology Analysis and Strategic Management* (3), pp. 43-55.

Hair, J., Anderson, R., Tatham, R. and Black, W. (1998), Multivariate Data Analysis, Upper Saddle River, N.J.: Prentice-Hall.

Henriques, I. and Sadorsky, P. (1996), "The Determinants of an Environmentally Responsive Firm: An Empirical Approach", *Journal of Environmental Economics and Management 30*, pp. 381-395.

Hoffman W. M., Frederick R. and Petry Jr. E.S. (1990), The Corporation, Ethics and the Environment, Quorum Books, New York.

Hunt, C. B. and Auster, E. R. (1990), "Proactive Environmental Management: Avoiding the Toxic Trap", *Sloan Management Review 31*, pp. 7-18.

Khanna, M. and Damon, L. (1997), "EPA's Voluntary 33/50 Program: Impact on Toxic Releases and Economic Performance of Firms", Environmental and Resource Economics Working Paper Nº8, Program in Environmental and Resource Economics, University of Illinois at Urbana-Champaign.

Kline, P. (1994), An Easy Guide to Factor Analysis, London: Routledge.

Kneese A. and Schultz C. (1975), "Pollution, Prices, and Public Policy." The Brookings Institute, Washington, DC.

Leibenstein H. (1976), Beyond Economic Man, Harvard University Press, Cambridge, MA.

Long, J. S. (1997), Regression Models for Categorical and Limited Dependent Variables, Advanced Quantitative Techniques in the Social Sciences, Thousand Oaks, CA: SAGE.

Naysnerski, W. and Tietenberg, T.H. (1992), "Private Enforcement", Innovation in Environmental Policy, Tietenberg, T.H. (ed.), Cheltenham, UK, Edward Elgar.

Milgrom, P. and Roberts J. (1992), Economics, Organization, and Management, Prentice-Hall, Englewood Cliffs, NJ.

Pargal, S, Wheeler, D. (1996b), "Informal Regulation of Industrial Pollution in Developing Countries: Evidence from Indonesia", *Journal of Political Economy 104*, pp.-1314-1337.

Pargal, S., Hettige, M., Singh, M. and Wheeler, D., (1996a), "Formal and Informal Regulation of Industrial pollution: Comparative Evidence from Indonesia and the U.S.", World Bank Policy Research Working Paper Nº1797.

Porter, M. E. and van der Linde, C. (1995), "Towards a New Conception of the Environment-Competitiveness Relationship", *Journal of Economics Perspectives* 9 (4), pp: 97-118.

Porter, M. E. (1991), "America's Green Strategy", *Scientific American* 264 (4), pp. 96.

Porter, M. E. (1990), Competitive Advantage of Nations, Basingstoke: Macmillan.

Tacq, J. (1997), Multivariate Analysis Techniques in Social Sciences Research: From Problem to Analysis, London: Sage.

Tietenberg, T. H., Wheeler, D., (1998), "Empowering the Community: Information Strategies for Pollution Control", Frontiers of Environmental Economics Conference, Airlie House, Virginia.

Tietenberg, T. H. (1996), "Private Enforcement of Environmental Regulations in Latin America and the Caribbean: an Effective Instrument for Environmental Management?" Washington: Inter-American Development Bank.

Appendix N°1 - Results of Factor Analysis: Influence of Factors on Environmental Improvements

TABLE N°1

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.804
Bartlett's Test of Sphericity	Approx. Chi-Square	16539.344
	df	66
	Sig.	.000

TABLE N°2

Communalities

	Initial	Extraction
P25_A	1.000	.493
P25_B	1.000	.724
P25_C	1.000	.624
P25_D	1.000	.736
P25_E	1.000	.793
P25_F	1.000	.579
P25_G	1.000	.675
P25_H	1.000	.809
P25_I	1.000	.600
P25_J	1.000	.613
P25_K	1.000	.689
P25_L	1.000	.565

Extraction Method: Principal Component Analysis.

TABLE N°3

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.363	36.360	36.360	4.363	36.360	36.360	2.114	17.614	17.614
2	1.344	11.197	47.556	1.344	11.197	47.556	2.091	17.425	35.039
3	1.163	9.689	57.245	1.163	9.689	57.245	2.000	16.663	51.702
4	1.031	8.592	65.837	1.031	8.592	65.837	1.696	14.135	65.837
5	.821	6.843	72.680						
6	.717	5.976	78.656						
7	.650	5.418	84.074						
8	.502	4.182	88.257						
9	.429	3.578	91.835						
10	.380	3.169	95.004						
11	.313	2.604	97.608						
12	.287	2.392	100.000						

Extraction Method: Principal Component Analysis.

TABLE N°4

Rotated Component Matrix [a]

	Component			
	1	2	3	4
P25_A	.20	-.02	.13	**.66**
P25_B	-.03	.17	.30	**.78**
P25_C	.08	.25	**.74**	.11
P25_D	.02	**.82**	.17	.17
P25_E	.07	-.06	**.87**	.15
P25_F	.30	.35	**.59**	.15
P25_G	**.69**	.28	.34	.05
P25_H	.22	**.86**	.15	.06
P25_I	.27	.44	-.10	**.57**
P25_J	**.60**	.18	.08	.46
P25_K	**.82**	-.07	-.03	.12
P25_L	**.58**	.40	.25	.12

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

Appendix N°2 - Results of Factor Analysis: Index of Environmental Management (EM)

TABLE N°1

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.513	43.914	43.914	3.513	43.914	43.914
2	.933	11.668	55.582			
3	.895	11.184	66.766			
4	.791	9.887	76.653			
5	.539	6.741	83.394			
6	.498	6.229	89.623			
7	.422	5.272	94.895			
8	.408	5.105	100.000			

Extraction Method: Principal Component Analysis.

TABLE N°2

Component Score Coefficient Matrix

	Component
	1
P14_A	.198
P14_B	.207
P14_C	.205
P14_D	.191
P14_F	.146
P14_G	.154
P14_H	.201
P14_I	.196

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Following are the weights of the Index of Environmental management "EM", after the component score coefficients were re-scaled:

	EM: Index of Environmental Management	**Weights**
A	Formal management systems, with written procedures, addressing the most important environmental issues that your plant faces	**0.13**
B	A written environmental policy, signed by the company's CEO, which describes the company's commitment to the environment, environmental regulations, pollution prevention and continuous environmental improvements	**0.14**
C	A specific written environmental plan, with quantifiable goals and objectives, considering local environmental regulations and potential costs	**0.14**
D	Plans and procedures for environmental emergencies	**0.13**
F	Procedures that include environmental aspects, beyond current legal standards	**0.10**
G	A management system to reduce releases/emissions through the use of internal procedures of your company	**0.10**
H	Indicators and environmental performance control, and management audits	**0.13**
I	An established environmental management system, with defined procedures and responsibilities	**0.13**
	Total	**1.00**

Appendix N°3 - Results of the Regressions: Logit and Linear Regression

Table N°1

Logit Regression: "Env_plan" dependent variable

Models										
	(1)					**(2)**				
Variable	*B*	*S.E.*	*Wald*	*Sig.*	*Exp(B)*	*B*	*S.E.*	*Wald*	*Sig.*	*Exp(B)*
Ext_inst	1.049	0.089	139.641	0.000	2.856	1.061	0.084	159.083	0.000	2.890
Int_mkt	0.449	0.093	23.467	0.000	1.567	0.482	0.084	32.607	0.000	1.619
Prod_ch	0.424	0.079	29.133	0.000	1.529	0.456	0.078	33.878	0.000	1.577
F&I_reg	1.492	0.093	257.868	0.000	4.445	1.482	0.087	287.110	0.000	4.404
Other_pp	6.664	1.034	41.564	0.000	783.717	5.940	0.860	47.647	0.000	379.769
PLC	5.580	1.072	27.107	0.000	265.191	5.235	0.920	32.378	0.000	187.804
OECD	0.017	0.004	19.028	0.000	1.017	0.014	0.003	19.626	0.000	1.015
Owner_ki	-0.015	0.004	14.512	0.000	0.985	-0.013	0.004	11.329	0.001	0.987
Cons_fin	0.024	0.002	147.286	0.000	1.024	0.024	0.002	159.853	0.000	1.024
Emp_ed	0.245	0.122	4.020	0.045	1.277	0.279	0.119	5.493	0.019	1.322
EnvMg_ed	0.798	0.085	87.478	0.000	2.222	0.735	0.081	83.205	0.000	2.086
Env.Mg.w/IE	0.039	0.186	0.043	0.835	1.039					
EnvMg_ti	-0.040	0.065	0.378	0.539	0.961					
Pr_db	-0.015	0.003	33.221	0.000	0.985	-0.015	0.003	30.643	0.000	0.986
Fin_perf	0.324	0.041	61.119	0.000	1.383	0.327	0.039	69.207	0.000	1.387
Inv95_99	10.932	2.168	25.425	0.000	55958	10.007	1.959	26.091	0.000	22,172
Medium	-0.117	0.171	0.468	0.494	0.890					
Large	0.524	0.329	2.532	0.112	1.689	0.560	0.302	3.440	0.064	1.750
N°Plants	0.112	0.201	0.308	0.579	1.118					
Food	-2.061	0.225	83.788	0.000	0.127	-2.280	0.179	161.424	0.000	0.102
Wood	0.308	0.286	1.163	0.281	1.361					
Paper	2.181	0.373	34.112	0.000	8.855	1.942	0.356	29.754	0.000	6.971
Chemicals	1.295	0.283	20.903	0.000	3.651	1.041	0.244	18.197	0.000	2.832
Non-metallic min.	-1.899	0.334	32.391	0.000	0.150	-2.295	0.295	60.350	0.000	0.101
Basic Metals	10.079	44.515	0.051	0.821	23836					
Metallic Products	0.809	0.246	10.805	0.001	2.246	0.563	0.215	6.849	0.009	1.755
MC	-0.413	0.280	2.173	0.140	0.662					
LC	-0.725	0.236	9.438	0.002	0.484	-0.631	0.169	13.930	0.000	0.532
IE_TE	4.776	1.492	10.246	0.001	118.595	5.458	1.399	15.230	0.000	234.716
Constant	-9.389	1.144	67.346	0.000	0.000	-8.675	0.939	85.356	0.000	0.000
-2 Log likelihood	1935.85					1952.79				
Cox & Snell R Square	0.424					0.421				
Nagelkerke R Square	0.633					0.629				

Table N°2

Discrete Change

Models										
	(1)					**(2)**				
Variable	*Marginal*	*Δ Range*	*0-->1*	*Centered Δ 1*	*Centered Δ σ*	*Marginal*	*Δ Range*	*0-->1*	*Centered Δ 1*	*Centered Δ σ*
Ext_inst	0.255	0.886	---	0.249	0.249	0.239	0.904	---	0.235	0.235
Int_mkt	0.109	0.550	---	0.109	0.109	0.108	0.578	---	0.108	0.108
Prod_ch	0.103	0.478	---	0.103	0.103	0.103	0.500	---	0.102	0.102
F&I_reg	0.362	0.950	---	0.347	0.347	0.334	0.946	---	0.323	0.323
Other_pp	1.617	0.584	0.584	---	---	1.336	0.653	0.653	---	---
PLC	1.354	0.581	0.581	---	---	1.178	0.648	0.648	---	---
OECD	0.004	0.382	---	0.004	0.069	0.003	0.342	---	0.003	0.054
Owner_ki	-0.004	-0.287	---	-0.004	-0.067	-0.003	-0.223	---	-0.003	-0.054
Cons_fin	0.006	0.429	---	0.006	0.190	0.005	0.376	---	0.005	0.178
Emp_ed	0.059	0.239	---	0.059	0.037	0.063	0.265	---	0.063	0.039
EnvMg_ed	0.194	0.641	---	0.191	0.159	0.165	0.678	---	0.164	0.136
Env.Mg.w/IE	0.009	0.009	0.009	---	---					
EnvMg_ti	-0.010	-0.066	---	-0.010	-0.013					
Pr_db	-0.004	-0.873	---	-0.004	-0.093	-0.003	-0.819	---	-0.003	-0.081
Fin_perf	0.079	0.449	---	0.078	0.142	0.074	0.437	---	0.073	0.133
Inv95_99	2.652	0.953	---	0.991	1.000	2.252	0.956	---	0.984	1.000
Medium	-0.028	-0.028	-0.028	---	---					
Large	0.127	0.130	0.130	---	---	0.126	0.134	0.134	---	---
N°Plants	0.027	0.027	0.027	---	---					
Food	-0.500	-0.331	-0.331	---	---	-0.513	-0.291	-0.291	---	---
Wood	0.075	0.076	0.076	---	---					
Paper	0.529	0.448	0.448	---	---	0.437	0.442	0.442	---	---
Chemicals	0.314	0.307	0.307	---	---	0.234	0.253	0.253	---	---
Non-metallic min.	-0.461	-0.318	-0.318	---	---	-0.516	-0.292	-0.292	---	---
Basic Metals	2.445	0.586	0.586	---	---					
Metallic Products	0.196	0.199	0.199	---	---	0.127	0.135	0.135	---	---
MC	-0.100	-0.095	-0.095	---	---					
LC	-0.176	-0.159	-0.159	---	---	-0.142	-0.125	-0.125	---	---
IE_TE	1.159	0.323	---	0.824	0.069	1.228	0.350	---	0.856	0.073

Table N°3

Base Values

Variable	*Values*
Ext_inst	0.00
Int_mkt	0.00
Prod_ch	0.00
F&I_reg	0.00
Other_pp	0.00
PLC	0.00
OECD	4.61
Owner_ki	4.50
Cons_fin	81.68
Emp_ed	0.87
Env.Mg	3.63
Env.Mg.w/IE	0.00
EnvMg_ti	0.00
Pr_db	13.60
Fin_perf	2.39
Inv95_99	0.24
Medium	0.00
Large	0.00
N°Plants	0.00
CIU_2_31	0.00
CIU_2_33	0.00
CIU_2_34	0.00
CIU_2_35	0.00
CIU_2_36	0.00
CIU_2_37	0.00
CIU_2_38	0.00
MC	0.00
LC	0.00
IE_TE	0.16

Table N°4

Linear Regression: "EM" dependent variable

Models	(1)					(2)				
	Unstandardized		Standardized			Unstandardized		Standardized		
Variable	B	S.E.	B	t	Sig.	*B*	*S.E.*	*B*	*t*	*Sig.*
Ext_inst	0.045	0.003	0.189	13.224	0.000	0.046	0.003	0.193	13.777	0.000
Int_mkt	0.037	0.004	0.160	9.329	0.000	0.039	0.004	0.167	10.434	0.000
Prod_ch	-0.004	0.004	-0.017	-1.158	0.247					
F&I_reg	0.070	0.004	0.264	19.015	0.000	0.070	0.004	0.266	19.398	0.000
Public_p	0.064	0.041	0.025	1.580	0.114					
PLC	0.064	0.016	0.058	4.010	0.000	0.064	0.016	0.058	4.076	0.000
OECD	0.000	0.000	0.022	1.404	0.160					
Owner_ki	0.001	0.000	0.094	6.601	0.000	0.001	0.000	0.097	6.851	0.000
Cons_fin	0.001	0.000	0.088	6.079	0.000	0.001	0.000	0.092	6.490	0.000
Emp_ed	0.106	0.006	0.277	18.238	0.000	0.105	0.006	0.275	18.342	0.000
Env.Mg_ed	0.020	0.005	0.066	4.267	0.000	0.021	0.004	0.069	4.668	0.000
Env.Mg.w/IE	0.040	0.009	0.064	4.479	0.000	0.042	0.009	0.068	4.786	0.000
EnvMg_ti	0.022	0.004	0.091	6.065	0.000	0.022	0.003	0.091	6.331	0.000
Pr_db	0.000	0.000	0.012	0.854	0.393					
Fin_perf	0.002	0.002	0.016	1.085	0.278					
Inv95_99	0.006	0.002	0.047	3.015	0.003	0.008	0.002	0.059	4.203	0.000
Medium	0.010	0.009	0.018	1.173	0.241					
Large	0.053	0.013	0.071	4.149	0.000	0.048	0.012	0.063	4.009	0.000
N°Plants	0.050	0.010	0.085	5.235	0.000	0.055	0.009	0.094	6.016	0.000
Food	-0.100	0.013	-0.192	-7.975	0.000	-0.104	0.010	-0.199	-10.610	0.000
Wood	-0.052	0.015	-0.065	-3.461	0.001	-0.058	0.013	-0.071	-4.470	0.000
Paper	-0.061	0.017	-0.062	-3.607	0.000	-0.066	0.014	-0.067	-4.621	0.000
Chemicals	0.009	0.015	0.012	0.629	0.529					
Non-metallic min.	-0.111	0.020	-0.086	-5.429	0.000	-0.127	0.019	-0.098	-6.835	0.000
Basic Metals	0.233	0.042	0.080	5.518	0.000	0.254	0.040	0.087	6.292	0.000
Metallic Products	-0.068	0.013	-0.107	-5.049	0.000	-0.074	0.011	-0.118	-6.816	0.000
MC	-0.023	0.013	-0.032	-1.786	0.074					
LC	-0.036	0.012	-0.066	-3.114	0.002	-0.030	0.009	-0.056	-3.189	0.001
IE_TE	0.243	0.076	0.056	3.194	0.001	0.248	0.073	0.057	3.410	0.001
(Constant)	-0.076	0.023	0.000	-3.321	0.001	(Constant)	-0.073	0.021	0.000	-3.409

R	0.650	Anova				R	0.649	Anova		
R^2	0.423	Sum of Squa	91.195			R^2	0.421	Sum of Squa	90.730	
Adjusted R^2	0.418	df	29.000			Adjusted R^2	0.417	df	21.000	
S.E.E.	0.190	Mean Square	3.145			S.E.E.	0.190	Mean Square	4.320	
R^2 Change	0.423	F	86.914			R^2 Change	0.421	F	119.245	
F Change	86.914	Sig.	0.000			F Change	119.245	Sig.	0.000	
df1	29.000					df1	21.000			
df2	3,442.000					df2	3,450.000			
Sig. F Change	0.000					Sig. F Chang	0.000			