

Firms' Environmental Performance: Does News Matter?

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Abstract

The empirical literature on environmental performance or compliance has followed two strands: one based on the impact of formal regulation as a means of inducing better environmental performance, and another centered on the role of informal regulation which mainly emphasizes the role of communities and capital markets. In this paper, we analyze the impact of environmental news in print media on firms' environmental performance. Using data from a survey of industrial facilities in South Korea, probit estimation results indicate that the publication of environmental news in print media *and* the firm's awareness of this publication are important predictors of a firm's environmental performance, more so than environmental laws, regulations, and environmental training. This paper thus reemphasizes the key role of media in influencing firms' environmental performance.

1. Introduction

A number of empirical studies have attempted to analyze the determinants of firms' environmental performance. Some of these studies have emphasized the role of monitoring and enforcement (formal regulation) as key determinants of environmental performance.¹ Formal regulation has, however, proven to be not always effective in solving environmental problems such as pollution, at least in a large number of developing countries. The failure typically ranges from weak monitoring capacity to insignificant fines or penalties. Hence, a limited number of authors have attempted to analyze the potential role and impact of other instruments that may either substitute or complement the formal regulatory framework. In this context, some studies have examined the potential role and impact of local communities² and of capital markets.³ These studies generally find that local communities do impact the environmental performance of firms where these are located, and that capital markets do react downward and upward to negative and positive environmental news, respectively. Dasgupta et al. (2001b, 2004) showed that such stock market reactions are significantly larger in Argentina, Chile, Mexico, the Philippines, and Korea than in Canada and the United States.

If a firm's market value is adversely impacted by the publication of negative environmental news, a key question of interest is whether this adverse impact then translates into an improvement in the firm's environmental performance. In other words,

¹ Dasgupta et al. (2001a), Gray and Deily (1996), Helland (1998), Laplante and Rilstone (1996), Magat and Viscusi (1990).

² Blackman and Bannister (1998), Pargal and Wheeler (1996).

³ Hamilton (1995), Lanoie and Laplante (1994), Lanoie et al. (1998), and Muoghalu (1990).

does environmental news impact the environmental performance of firms irrespective of the impact it may have on firms' market value? Hamilton (1995) found that firms with most adverse stock market reaction do experience improvements in environmental performance. On the other hand, Doonan et al. (2006) found that managers in the Canadian pulp and paper industry do not perceive capital markets to be an important source of pressure for environmental enhancement. The study showed instead government pressure (through its monitoring and enforcement activities) to be the key predictor of firms' environmental performance.

It is against this background that the present paper seeks to examine the impact of environmental news in the printed press on the environmental performance of publicly traded (stock market) firms. We do so in the context of a developing country. To our knowledge, no study in the context of a developing country has thus far attempted to assess whether or not changes in stock market values then induce an improvement in a firm's environmental performance. For this purpose, a survey was conducted in the Republic of Korea in 2005. The survey included only publicly traded firms with adverse environmental news printed in Korean newspapers. The study shows that the publication of environmental news in printed media (newspapers) *along with* the firm's awareness of this news publication is the key predictor of environmental performance, irrespective of the reaction of stock markets. Without neglecting the potential role of other determining factors, this finding reemphasizes the key role of information and of the media as conveyor of that information to enhance firms' environmental performance.

In the next section, we describe the data source. The methodology for data analysis is described in Section 3, and empirical results are presented in Section 4. We briefly conclude in Section 5.

2. Data source, description and preliminary analysis

The data used in this study were collected in a survey conducted in 2005 of firms operating in the Republic of Korea over the period 1990 – 2000. Given the purpose of this study, only firms traded on the stock market were included in the survey. In total, 49 firms were contacted by way of questionnaires. The latter were divided into two sets. The first set included firms whose names had been associated with adverse environmental news in the printed media, while the second set included firms whose names had not been publicly associated with such news. In both cases, questions were asked pertaining to ownership information, production, employees and sales information, environmental information (wastewater), environmental performance per se (overall environmental performance, environmental management), constraints, incentives and sources of pressure experienced by firms to improve environmental performance, and the impact of media reporting.

The model seeks to explain the determinants of the change in overall environmental performance over the period 1990 to 2000. This change in environmental performance was captured by the response to the question “How do you compare your overall environmental performance in 2000 relative to 1990?” Choices of answer to this

question ranged from much worse (1) to much better (5).⁴ This ordered variable was later transformed into a dummy variable, *Chenv*, with classes 4 and 5 ('better' and 'much better') having value 1 and 0 for the rest. In our dataset, 26.5 percent of firms did not report any change of environmental performance between 1990 and 2000, 53.1 percent reported a better environmental performance in 2000, and 20.4 percent reported a much better environmental performance.

One of the key explanatory variables of interest in this study is the media coverage of environmental incidents. This variable captures the extent to which a given environmental news is reported in the printed news media. The news media used in this study were Pusanubbo, Dongulbo, Seoul Shinmum and Hankoreh Shinmum. The variable coined *News* is a dummy variable with value 1 if the firm is in the news and 0 if it is not. However, it may be argued that for 'news' to have an impact on a firm's environmental performance, managers of the firm must be aware of this news publication. A related variable *Anews* thus aims to capture whether or not the managers of the firm are aware of the news publication. This variable is also constructed as a dummy variable with 1 if the firm is aware of news publication and 0 if not. An interaction variable was constructed to capture the simultaneity of "News" and "Awareness of news publication."

Table 1 contains summary statistics of the two variables of interest. In our dataset, 44.9 percent of firms were in the news over the period 1990 – 2000. Moreover, 67.3 percent of these firms have responded being aware of the news publication. A chi-squared test of independence of the pair of variables as well as between each variable and

⁴ 1 = much worse; 2 = somewhat worse; 3 = same; 4 = somewhat better; 5 = much better.

change in environmental performance variable is quite revealing. First, with a value of 8.702 and a P-value of 0.003, the chi-squared test points to the lack of independence between “news” and “awareness of news publication”. However, independence seems to be the outcome between “news” and “change in environmental performance” as well as between “awareness of news publication” and “change in environmental performance” as the relevant chi-squared test statistics indicate. In either case, the relevant testable hypotheses are the following. H1: ‘News in media’ does not affect change in environmental performance; H2: ‘Awareness of news publication’ does not affect change in environmental performance; H3: ‘News in media’ and ‘Awareness of news publication’ do not affect change in environmental performance.

Table 1
Summary statistics of ‘news’ and ‘awareness of news publication’

	Class	Frequency	Mean	Std
News in media (News)	0	27		
	1	22		
			0.449	0.502
Awareness of news publication (Anews)	0	16		
	1	33		
			0.673	0.474
χ^2 test for independence	Value	P-value		
News and Anews	8.702	0.003		
News and Chenv	1.462	0.232		
Anews and Chenv	0.738	0.390		

A host of other variables may have an impact on change in environmental performance. Following Doonan et al. (2006), different sources of pressure may impact a firm’s environmental performance including legal, economic, social, managerial, and

employees pressure. We describe these sources of pressure below as they were constructed and collected in the survey. Until otherwise said, the variables are ordered variables with 1 = much worse; 2 = somewhat worse; 3 = neutral; 4 = somewhat better and 5 = much better. A complete description of these variables is presented in Appendix 1.

The firm's environmental performance relative to Korean environmental laws, *Elaw*, is a self-assessment variable. Almost half the firms in the survey (49.9 percent) claimed the firm's performance to comply with Korean environmental laws; perhaps unsurprisingly, only one firm out of 49 believed its performance to be out of compliance.

The lack of environmental training, *Ltrai*, may be a contributor to environmental change. Here, 18.4 percent of firms pointed out that it is not that important, 44.9 percent believed it is neutral, and 26.5 percent thought it is important. As far as involvement of employees is concerned, *Lemp*, 12.2 percent judged that it is not that important, 49 percent of firms were convinced it is neutral, and 28.6 percent pointed out that it is important. The involvement from high managers, *Lmang*, can also have a bearing on change in environmental performance. In this connection, 44.9 percent firms considered the variable as neutral and 40.9 percent of firms assumed it is important. The lack of government control, *Lgc*, does in principle affect environmental performance. 55.1 percent of firms, however, believed it does not; 36.8 percent of firms felt it is important. Insufficient government assistance, *Iga*, could have some bearings on environmental performance. While 40.8 percent of firms considered its effect rather neutral, almost the same percentage believed it to be important. National government, *Nag*, as a potential

source of pressure recorded the agreement of 81.6 percent of firms. Local municipal government, *Lmg*, as another source of potential pressure was overwhelmingly accepted by firms (81.6 percent) as a predictive factor of environmental performance. Local residents, neighbor communities, *Lrc*, are expected to be a leading source of pressure for environmental change. Surprisingly, only 16.3 percent of the firms believed it is really important. Concerning consumers, *Consu*, 49 percent of firms considered its effect rather neutral and 40.8 percent deemed it important. Suppliers, *Spp*, as a source of potential pressure were acknowledged by 30.6 percent of firms, although 49 percent considered its effect rather neutral. Pressure originating from banks and investors, *Bip*, is well balanced in terms of perception. Indeed, 34.7 percent of firms were convinced that its effect is not that important, 44.9 percent thought it is rather neutral and 12.2 percent believed it is important. Environmental groups, *Eng*, as a source of pressure was acknowledged by many firms: 36.8 percent saw its effect being neutral and 40.8 percent felt that the group effect is important. Changes in the potential influence in national government, *Cing*, was measured by 1 if the influence has increased, 2 if it has decreased, and 3 if it has been neutral. In this connection, 44.9 percent of firms judged that the influence has increased and 49 percent thought it has not. Surveyed individuals were also asked if they thought the Korea's monthly violation reports had any impact on the stock market value of the firms.⁵ This variable, *Tri*, was only recorded by 10.2 percent of firms. This could indeed be interpreted as a surprisingly result, and may ultimately explain why reactions of stock

⁵ Since 1989, environmental authorities of South Korea have published on a monthly basis a list of enterprises violating the country's environmental rules and regulations. Over the period 1993 – 2001, in excess of 7,000 violation events have been recorded on these monthly violation lists, involving more than 3,400 different companies. See Dasgupta et al. (2004) for more details.

market to environmental news may not be a good predictor of a firm's environmental performance.

The total number of inspections in 2000, *Tinsp*, is a variable with 4 classes: 1 = 1 – 2 times; 2 = 3 – 6 times; 3 = 7 – 10 times; and 4 = 11 times or more. 14.3 of firms were in class 1, 32.7 percent in 2, 18.4 in 3 and 34.7 in 4. While the absolute number of inspections may not be a determinant of a firm's environmental performance, it may be argued that the change in the number of inspections between 1990 and 2000, *Cinsp*, could be an important explanatory variable (with an increase in inspections signaling increased regulatory scrutiny). In our sample, 42.9 percent of firms perceived an increase in the number of inspections, 16.3 percent thought it had decreased, and 38.8 percent believed it stayed relatively the same. Warnings from the Ministry of Environment in 2000, *Wme*, is a dummy variable with 1 if yes and 0 otherwise. 20.4 percent of firms have recorded some forms of warnings from the Ministry. The variable "Paid any fines or penalties related to the environment", *Fpe*, is a dummy variable with 1 if yes and 0 if not. 14.3 percent of firms revealed that they did pay some sorts of fines or penalties. Order to install pollution control equipment instrument in 2000, *Oipc*, is another dummy variable with 1 as yes and 0 as not. 14.3 percent of firms were summed to install pollution control instrument. Warning of violation of environmental regulations between 1990 and 2000, *Wver*, was captured by 1 if yes, 2 if not and 3 if the firm does not. 24.5 percent pointed out that they received warning(s), 53.1 percent claimed that they didn't and 22.4 percent were not sure. Another important variable is whether any fines or penalties were paid between 1990 and 2000. The variable captured by *Cfpe* contains 3 classes: 1 if yes; 2 if

not, and 3 if the respondent did not know. 22.4 percent of firms said yes, 53.1 percent said no and 24.5 percent were not sure. Order to install pollution control equipment instrument within the 1990-2000 period, *Coipc*, is a variable with 3 values: 1 if yes ; 2 if not, and 3 if the respondent did not know. 16.3 percent of firms acknowledged that order had been given to them to install pollution control instrument; 61.2 percent answered no, and 22.4 percent had no recollection.

3. Methodology

As indicated above, the model seeks to answer whether the publication of environmental news in news media as well as the awareness of such a publication explains changes in a firm's environmental performance. In order to avoid omitted variables biases, other important explanatory variables are also used in the model. The key assumption of the model is that although it is of cross section nature, it may have a hidden time dimension. In addition, the explanatory variables might be thought of as coming with a certain lag, thus making them predetermined variables. The model is thus constructed as a reduced form. The model is written as follows:

$$Chenv_i = \alpha + \beta_1 News_i + \beta_2 Anews_i + \beta_3 News * Anews_i + Z_i \gamma + u_i \quad (1)$$

where u represents the error term, $i = 1,2,3,4,\dots,49$ stands for firm, and other variables are defined as in Appendix 1. It is assumed that $u \sim IIN(0,1)$. Since *Chenv* is a dummy variable, model (1) is a probit model. It is estimated by maximum likelihood from which we obtain parameter estimates, marginal effects and elasticities.

As is well known, the parameters in (1) do not represent marginal effects. For sake of simplification, let us represent all variables by the matrix X . Then, for a given variable, for example $News$, the marginal effect is:

$$\frac{\Delta E(Chenv / X)}{\Delta News} = \frac{\Delta \Phi(.)}{\Delta News} = \beta_1 \Phi'(.) \quad (2)$$

where Φ is the standard cumulative distribution, Φ' is the density function, and Δ is the first difference operator if variables are dichotomous (which is replaced by ∂ if the variables of interest are continuous).

Note that (2) is evaluated at the means of variables. Perhaps of interest is the computation of interaction effect (see Ai and Norton, 2003, 124). At the outset, it is worth pointing out that $\beta_3 \Phi'(.)$ does not capture the full interaction effect of “*News*” and “*Awareness of news publication*”. This is only true if the model were to be linear. The full marginal effect is given by:

$$\frac{\Delta^2 \Phi(.)}{\Delta News \Delta Anews} = \beta_3 \Phi'(.) + (\beta_1 + \beta_3 Anews)(\beta_2 + \beta_3 News) \Phi''(.) \quad (3)$$

4. Empirical Results

As explained above, all variables do not appear in the final model. Table 2 contains the results of estimation of a parsimonious version of model (1) following the Hendry methodology and using a selection of variables defined in Appendix 1.

Table 2
Probit estimation of environmental performance model

Variable	Coefficient	Std. Error	z-Statistic	Prob.	Marginal effect	Elasticity
C	35.89301	17.32669	2.071544	0.0383	0.16D-08	
News	2.981974	1.628158	1.831502	0.0670	0.28D-07	0.13D-07
News*Anews	4.495794	2.751321	1.634049	0.1022	0.24D-08	0.49D-09
Cpp	-2.042458	1.038103	-1.967490	0.0491	-0.90D-10	-0.22D-09
Elaw	3.720739	1.690540	2.200918	0.0277	0.16D-09	0.59D-09
Edep	-6.209188	2.909432	-2.134158	0.0328	-0.28D-09	-0.34D-09
Tcn	-5.117058	2.236443	-2.288034	0.0221	-0.23D-09	-0.85D-09
Ltra	2.264934	1.251730	1.809443	0.0704	0.10D-09	0.31D-09
Lemp	-3.974566	1.824889	-2.177976	0.0294	-0.18D-09	-0.55D-09
Nag	6.624002	2.695507	2.457424	0.0140	-0.29D-09	0.11D-08
Lmg	-7.195410	2.976004	-2.417809	0.0156	-0.32D-09	-0.12D-08
Bip	0.467101	0.675796	0.691187	0.4894	0.21D-10	0.56D-10
Cing	1.313406	0.694233	1.891882	0.0585	0.58D-10	0.12D-09
Wver	-2.737378	1.287684	-2.125815	0.0335	-0.12D-09	-0.24D-09
Cfpe	-3.949580	1.962414	-2.012613	0.0442	-0.18D-09	-0.35D-09
Cipc	1.866535	1.381612	1.350984	0.1767	0.83D-10	0.17D-09
Mean dependent var	0.734694	S.D. dependent var	0.446071			
S.E. of regression	0.355976	Akaike info criterion	1.130634			
Sum squared resid	4.181727	Schwarz criterion	1.748371			
Log likelihood	-11.70053	Hannan-Quinn criter.	1.365003			
Restr. log likelihood	-28.34817	Avg. log likelihood	-0.238786			
LR statistic (15 df)	33.29527	McFadden R-squared	0.587256			
Probability(LR stat)	0.004272					
Obs with Dep=0	13	Total obs	49			
Obs with Dep=1	36					

Note: Model (1) is of interest. Variables are defined as in Table 3. Except for two parameters, all parameters are significant at the 10% level of significance. *D* stands for the number of zeroes after the dot. Marginal effects and elasticities are from Limdep 8.0.

As the *LR* statistic indicates the model passes the global test. *News* in media positively affects environmental performance. *News* matters the most if firms are indeed aware of its publication in media or others. While “*awareness of news publication*” did not appear directly in our final model because of problem of collinearity of covariance

matrix, it comes through the interaction term. “*News*” and “*awareness of news publication*” do on average positively affect environmental performance. There seems to be a negative relationship between concentration of pollutant’s wastewater between 1990 and 2000 and overall environmental performance. Concretely, the less the concentration of pollutant in the plant’s wastewater, the better is the overall environmental performance. There is a positive link between environmental law compliance and overall environmental performance. The presence of an environmental department does not seem to be a catalyst for environmental performance enhancement. This can be explained in several ways. Technological constraint is acknowledged as a serious bottleneck to environmental performance. Indeed, the bigger the technological impediment the lower the environmental performance. A positive relationship emerges between environmental training and environmental performance. Not surprisingly the lack of involvement from employees brings about a deterioration in environmental performance. The more the government appears as a serious source of pressure the better the environmental performance. This confirms the findings of Doonovan et al. (2006) who found this variable to be the most important predictor of environmental performance. Unquestionably, the prevalence of environmental warnings between 2000 and 1990 is an indication that environmental performance did not reach the level expected. This is reinforced by the negative relationship between fines/penalties and environmental performance. Orders to install pollution control equipment has been a catalyst for environmental performance enhancement.

Upon observing marginal effects and/or elasticities (columns 6 and 7 in Table 2), we notice that *News* per se has the biggest impact of all on environmental performance. It is followed by for the interaction term between ‘news’ and ‘awareness of news publication’. The next important sets of variables are local municipality and national government impacts. This ranking, with news impact as well as the interaction effect, seems to be consistent across all model specifications.

5. Conclusion

This paper has attempted to quantify the impact of environmental news publication in media as well as awareness of news publication on (change in) overall environmental performance of firms in the Republic of Korea between 1990 and 2000.

Using data from a survey of 49 firms traded in the market in the Republic of Korea and a probit estimation methodology, the study was able to make two contributions. First, it clearly showed that environmental news publication in media is the most important predictor of environmental performance, at least in the present context. Second, the use of an interaction term (environmental news publication in media and firms’ awareness of news publication) has added another dimension in the literature. Indeed, not only does environmental news publication in the media matter for environmental performance, but also firm’ awareness of the environmental news publication is an important add-on which reinforces the news effect (see Shanielle and Mamingi, 2004 for a similar argument in another context).

Summing up, while not dismissing the effects of other determining factors, this paper acknowledges that “media” has a very significant role to play in enhancing environmental performance.

The study has potential limitations that need to be discussed or addressed in the future. First, the fact that only firms which have been traded in the stock market were retained could induce some bias. If bias there is, it is, however, very small. Indeed, the results were not too different from the ones here when we included in the sample six firms which were not traded in the market. In fact, the rationale for dealing only with firms which were traded was to see whether those firms which registered market reaction also had environmental performance reaction. Unfortunately, there were too few of them to conduct a valid generalization. Second, the issue of endogeneity of some explanatory variables is a valid one. However, if we assume that our explanatory variables most reflecting the period 1990-2000 are lagged variables captured in the 2005 survey, then the issue fades away. In any case, in the future some test statistics need to be implemented to confirm or refute our hypothesis. Third, as the role of media is established here it is worth moving the debate forward by attempting to establish the link between media, environmental performance and financial performance or between media, financial performance and environmental performance.

References

- Ai, C. and E. C. Norton, 2003, "Interaction term in logit and probit models," *Economics Letters*, 80, 123–29.
- Blackman, A., and G. J. Bannister, 1998, "Community pressure and clean technology in the informal sector: An econometric analysis of the adoption of propane by traditional Mexican brick makers," *Journal of Environmental Economics and Management*, 35, 1–21.
- Dasgupta, S., J. H. Hong, B. Laplante, and N. Mamingi, 2006, "Disclosure of environmental violations and stock market in the Republic of Korea," forthcoming, *Ecological Economics*.
- Dasgupta, S., B. Laplante, N. Mamingi, and H. Wang, 2001a, "Inspection, pollution prices, and environmental performance: Evidence from China," *Ecological Economics*, 36, 487–98.
- Dasgupta, S., B. Laplante, and N. Mamingi, 2001b, "Pollution and capital markets in developing countries," *Journal of Environmental Economics and Management*, 42, 3, 310–35.
- Doonan, J., P. Lanoie, and B. Laplante, 2006, "Determinants of environmental performance: Views from the industry," forthcoming, *Ecological Economics*.
- Gray, W. B. and M. E. Deily, 1996, "Compliance and enforcement: Air pollution regulation in the U.S. steel industry," *Journal of Environmental Economics and Management*, 31, 96–111.
- Hamilton, T., 1995, "Pollution as news: Media and stock market reaction to the Toxics Release Inventory data," *Journal of Environmental Economics and Management*, 28, 98–113.
- Helland, E., 1998, "The enforcement of pollution control laws: Inspection, violations, and self-reporting," *The Review of Economics and Statistics*, 80, 1, 141–53.
- Konar, S. and M. A. Cohen, 1997, "Information as regulation: The effect of community right to know laws on toxic emission," *Journal of Environmental Economics and Management*, 32, 1, 109–24.
- Lanoie, P. and B. Laplante, 1994, "The market response to environmental incidents in Canada: A theoretical and empirical analysis," *Southern Economic Journal*, 60, 3, 657–72.
- Lanoie, P., B. Laplante, and M. Roy, 1998, "Can capital markets create incentives for pollution control?" *Ecological Economics*, 26, 31–41.

- Magat, W. and W.K. Viscussi, 1990, "Effectiveness of the EPA's regulatory enforcement: The case of industrial effluent standards," *Journal of Law and Economics*, 33, 331–60.
- Muoghalu, M.I., Robison, H. and J.L. Glascock, 1990, "Hazardous waste lawsuits, stockholder returns, and deterrence," *Southern Economic Journal*, 357–70.
- Pargal, S. and D. Wheeler, 1996, "Informal regulation of industrial pollution in developing countries: Evidence from Indonesia," *Journal of Political Economy*, 104, 1314–27.
- Small, S. and N. Mamingi , 2004, "Estimating the determinants of student performance: An exploratory study," *Asian-African Journal of Economics and Econometrics*, 42, 153–57.

Appendix 1
Variables of Interest

Variables	Description
<i>Chenv</i>	Change in environmental performance (2000 vs 1990). Dummy variable (DV). 1 = if yes 0 = same
<i>News</i>	News publication in media: DV: 1 = if firm is in News; 0 =: otherwise
<i>Anews</i>	DV: 1: aware of news publication in media; 0: if not
<i>News*Anews</i>	Interaction variable of “News” and ‘Anews’.
Z	Matrix of other explanatory variables: among others, the variables defined below.
<i>Bip</i>	Banks and investors as a source of potential pressure. Ordered variable (OV): 1: much worse; 2: somewhat worse; 3: same; 4: somewhat better; 5= much better.
<i>Cfpe</i>	Paid any fines or penalties between 1990 and 2000. 1 = yes; 2 = no; 3 = don’t know
<i>Cing</i>	Change in influence in national government. Classes: 1 = increased; 2 = decreased; 3 = same.
<i>Cinsp</i>	Change in the number of inspections (2000 vs 1990). Classes: 1 = increased; 2 = decreased; 3 = same.
<i>Cipc</i>	Ordered to install pollution control equipment. 1 = yes; 2 = no; 3 = don’t know
<i>Consu</i>	Consumers as a source of potential pressure. OV see <i>Bip</i>
<i>Cpp</i>	Concentration of pollutant in the plant’s wastewater b/w 1990 and 2000. 1 = increased; 2 = decreased; 3 = stayed relatively the same
<i>Cqw</i>	Change in quantity of wastewater b/w 1990 and 2000. 1 = increased; 2 = decreased; 3 = stayed relatively the same
<i>Edep</i>	Environment Department 1 = established; 2 = not established
<i>Elaw</i>	Environmental performance relative to environmental laws: Ordered variable (OV): 1: much worse; 2: somewhat worse; 3: same; 4: somewhat better; 5= much better
<i>Fpe</i>	Fines or penalties related to the environment in 2000. DV: 1 = yes; 0 = no.
<i>Iga</i>	Insufficient government aid. OV see above
<i>Lcg</i>	Lack of government control. OV see above
<i>Lcr</i>	Local residents, neighboring communities as a source of potential pressure. OV see above
<i>Lemp</i>	Lack of involvement of employees. OV see above
<i>Lmg</i>	Local municipality government as a source of potential pressure. OV see above
<i>Lmang</i>	Lack of involvement of high managers: OV see above
<i>Ltra</i>	Lack of environmental training. OV see above.
<i>Nag</i>	National government as source of potential pressure. OV

<i>Oipc</i>	Order to install pollution control equipment in 2000. DV: 1 = yes; 0 = no
<i>Sup</i>	Suppliers as a source of potential pressure. OV
<i>Tcn</i>	Technological constraint. OV see above
<i>Tinsp</i>	Total number of inspections in 2000. 1: 1 - 2 times; 2: 4 - 6 times; 3: 7 - 10 times 4Z: more than 11 times
<i>Tri</i>	Whether the stock market value is affected by monthly violation reports: DV: 1 = affected 2 = not
<i>Wme</i>	Warnings from The Ministry of Environment in 2000. DV: 1 = yes; 0 = no
<i>Wver</i>	Warning of violation of environmental regulations between 1990 and 2000. 1 = yes; 2 = no; 3 = don't know