Do Corporate Global Environmental Standards Create or Destroy Market Value?

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Arguments can be made on both sides of the question of whether a stringent global corporate environmental standard represents a competitive asset or liability for multinational enterprises (MNEs) investing in emerging and developing markets. Analyzing the global environmental standards of a sample of U.S.-based MNEs in relation to their stock market performance, we find that firms adopting a single stringent global environmental standard have much higher market values, as measured by Tobin's q, than firms defaulting to less stringent, or poorly enforced host country standards. Thus, developing countries that use lax environmental regulations to attract foreign direct investment may end up attracting poorer quality, and perhaps less competitive, firms. Our results also suggest that externalities are incorporated to a significant extent in firm valuation. We discuss plausible reasons for this observation.

(*Direct Investment in Developing Countries*; *Firm Value*; *Firm-Level Environmental Policy*)

1. Introduction

Global companies have become major players on the world stage. There are now in excess of 40,000 multinational enterprises (MNEs) with some 250,000 foreign affiliates, investing more than $200 billion abroad each year (UNCTAD 1995). About 40% of world trade consists of intrafirm transfers of materials and components within MNEs (Greider 1997). The 10 largest MNEs have annual sales in excess of the gross national products of the 100 smallest countries in the world (Hawken 1993, p. 92). Foreign direct investment (FDI) now exceeds official development assistance by a factor of five, whereas five years ago it was less than half (Wolfensohn 1997).

MNEs create, leverage, and arbitrage capabilities on a world scale. They are known to make positive contributions in economic efficiency (see, e.g., Caves 1996, Ch. 7) and serve as a conduit for the globalization of economies. However, MNEs have also proven elusive of public policy controls because of their economic power and ability to shift resources and production across borders. Questions have been raised concerning MNEs' social and environmental performance (e.g., in regard to their pollution record and labor practices, etc.) Social critics have argued that MNEs, in seeking to reduce costs, play employees and countries against one another, creating downward pressure on wages and social standards on a worldwide basis (Gladwin et al. 1995, Greider 1997).

Our focus is on the environmental aspect. Led by MNEs, the affluent societies of the developed world account for more than 75% of the world's energy and

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resource consumption and create the bulk of the industrial, toxic, and consumer waste (Hart 1997). Environmentalists contend that MNEs are now engaging in flight to "pollution havens" by moving dirty operations to countries where regulatory standards are less stringent (Daly 1994). Through flight to pollution havens, MNEs can avoid expensive pollution controls, cut costs by recapitalizing old equipment, and continue to make products that are no longer considered environmentally acceptable in the more highly regulated markets of the developed world (Vernon 1992). Over time, it is claimed that these practices lead to a "race to the bottom" as poor nations and localities vie for plants and facilities that seek only to minimize cost and externalize environmental responsibility (Korten 1995).

While some MNEs clearly utilize such practices, it is unclear whether there is systematic advantage in racing to the bottom. There appear to be forces that encourage MNEs to integrate and standardize their environmental practices globally. Indeed, it may make business sense in some cases to adopt global standards that exceed those required by some local laws or regulations, especially when environmental laws and regulations become more stringent as an economy grows. By investing in state-of-the-art technology and processes in developing countries, MNE facilities may be able to achieve simultaneously world-class cost, quality, and environmental performance. In addition, MNE's may reap standardization benefits and other intangible advantages like positive reputation effects.

In this paper, we therefore seek an empirical answer to an intriguing and important question: Is firm value linked to an MNE's corporate environmental policy? Specifically, we examine whether adopting a single stringent corporate environmental standard enhances firm value compared to those MNEs defaulting to less stringent or poorly enforced host country standards. We find that firms adopting a stringent global environmental standard have higher market values, as measured by Tobin's q (market value over replacement costs of tangible assets). Our results have strong implications: "Better firms" appear to adopt higher environmental standards and pollute less. However, we cannot identify with our data any causal (time series) relationships between either past changes in environmental standards and current change in firm value, or past change in firm value and current change in environmental standards.

In the next section, we describe prior research linked to the current work that is helpful in interpreting our results. In the third section, we discuss theory and propose our research questions. We present our methodology in §4 and results in §5. Discussion of the results and conclusions are contained in §6 and 7, respectively.

2. Prior Research

A growing body of literature ties superior environmental performance to financial performance (e.g. Porter and van der Linde 1995, Hart 1995). For example, three recent studies link proactive environmental management to superior stock performance: Hamilton (1995), White (1995), and Klassen and McLaughlin (1996) all use event study methodology to demonstrate that (1) news of high levels of toxic emissions results in significant negative abnormal returns; (2) firms with strong environmental management practices have better stock price returns than firms with poor practices after a major environmental disaster, such as the Exxon Valdez accident; and (3) environmental performance awards result in significant positive abnormal returns. The first and second results indicate that investors expect that firms incur nontrivial costs for environmental cleanup and that these costs are lower for firms with better environmental records. The third result suggests that recognition of environmental performance has a positive reputation effect which possibly augments firm value.[1]

Feldman et al. (1996) analyze a sample of 300 large public companies in the United States to see if investments in environmental management lead to reduced risk, and if such risk reduction is valued by financial markets. Their findings suggest that investments in environmental management lead to substantial reduction in perceived risk of a firm, with an accompanying

[1] The positive reputation effect may include not just investors' impressions of a firm's environmental performance; it may also include investors' impressions of a firm's management quality.

increase in a public company's stock price, of perhaps five percent.

Other scholars have examined the relationship between environmental and profit performance. Cohen et al. (1995), for example, demonstrate a strong correlation between environmental performance and firm profitability. Similarly, Hart and Ahuja (1996) present evidence indicating that efforts to prevent pollution and reduce emissions are positively associated with the "bottom line" (as measured by return on sales and return on assets) within one to two years of initiation, and that those firms with the highest emission levels stand to gain the most. Russo and Fouts (1997), in their study of 243 firms, find that environmental performance and return on assets (ROA) are positively linked, and that industry growth moderates this relationship, with returns to environmental performance higher for high-growth industries. Finally, Nehrt (1996) examines the relationship between timing and intensity of investment in pollution prevention and growth in profits within a sample of 50 pulp and paper companies. His results indicate a positive relationship between early movers in pollution prevention and profit growth.

While results are generally convergent, most empirical work to date has been restricted to MNEs in the United States or Western Europe where data are more available regarding environmental performance (e.g., Kennelly 1996). There has been some conceptual and case study treatment of MNE environmental performance in foreign contexts and developing countries (e.g., Korten 1995, Hart 1997), but little empirical research on this dimension has been conducted. The limited empirical work that has been done suggests that MNEs are more environmentally responsible than their local competitors in developing countries (Eskeland and Harrison 1997), but the evidence regarding MNE social performance is mixed (e.g., Zahra et al. 1993, Johnson and Greening 1994). We were unable to find any published empirical research focusing specifically on the question of how MNE international environmental standards, particularly their behavior in developing countries, affect firm market value. It is to that question that we now turn our attention.

3. Theory

Arguments can be made on both sides of the question of whether a stringent global corporate environmental standard represents a competitive asset or liability for MNEs. Below, we articulate the major theoretical lenses on either side of the argument.

Global Environmental Standards as Altruistic Liability

Conventional economic logic suggests that, *ceteris paribus*, in countries where environmental regulation is either lax or not enforced, it is cheaper to operate than in countries where strict environmental regulations result in fines, liabilities, and administrative or legal action against polluters (Stewart 1993). For example, the annual cost of complying with environmental regulation in the United States now exceeds $125 billion, or about 2.1% of GDP. In most developing countries, environmental spending represents only a fraction of 1% of GDP (Jaffe et al. 1995).

Evidence also suggests that strict pollution control regulations in the United States may have an adverse impact on productivity (Gray and Shadbegian 1993), perhaps by forcing companies to commit resources and manpower to nonproductive uses such as environmental auditing, waste treatment, and litigation (Haveman and Christiansen 1981). Hence, when operating in countries with less stringent or poorly enforced environmental regulations, defaulting to local standards reduces costs.

Furthermore, by defaulting to local standards in countries with lax regulation or enforcement, companies may be able to recapitalize old equipment that is no longer acceptable in more regulated markets, thereby lowering costs even further. Companies can also market products in such countries that may be discouraged or even banned for environmental reasons in more regulated markets, thereby extending product life cycles and revenue streams (Vernon 1992, Korten 1995).

In short, there may be considerable financial penalties associated with overly general or constraining environmental policies in response to standardized criteria when it is not really needed or justified (Rondinelli and Vastag 1996). Overall, the presumption is that defaulting to local standards is cost-saving, and

that adhering to more stringent environmental standards where they are not required or enforced is wasteful. Firms that are altruistic in their attempts to achieve higher environmental standards when investing in low-standard countries are not serving their shareholders. The behavior hurts market value and may be a reflection of managerial idiosyncrasies.

Global Environmental Standards as Value-Adding Asset

A competing logic suggests that value-seeking investors may view defaulting to lower or poorly enforced local environmental standards as counterproductive to long-term profit performance. First, the cost savings associated with lower environmental standards may be exaggerated and may not even exist: MNEs often find that they have to pay for the remediation of environmental damages even if they are in full compliance with local regulations and requirements, often due to pressures from environmental interest groups or international organizations (e.g., World Bank). Such cleanup costs can be significant.

Second, in making new investments, a firm may find that moving downward from accustomed higher standards violates established corporate routines and is actually more costly than adhering to the higher standards, even in the absence of regulation. By specifying a single corporate standard, performance monitoring and evaluation costs might be reduced because a single set of values, specifications, and procedures can be deployed throughout the world, without the need to consider local deviations from the norm. Global standardization will also mean that production improvements made in one location can readily be transferred to all subsidiaries. Global strategies leverage the return on investment in improvements made in high environmental standard regions across all geographic locations (Prahalad and Doz 1987, Bartlett and Ghoshal 1989). Thus, adopting a single stringent environmental standard is consistent with pursuit of global competitive strategies by MNEs (Christmann 1998).

Third, while adequate environmental standards may not yet exist in many developing countries, it can be argued that in the not-too-distant future, standards will rise as income increases and people become more sensitive toward and concerned about environmental deterioration. This pattern of environmental regulation following GDP growth has already been observed among newly industrialized nations such as Taiwan, Korea, and Singapore (Grossman and Krueger 1995). In other words, there may be an important future benefit to adopting a single global standard if the productive life of capital extends beyond the period of lax or poorly enforced regulation.

When the environmental standards in developing countries improve with increases in per capita income, firms performing above current requirements will not need additional investment, while firms defaulting to the current minimums will need to reinvest to conform to the heightened requirements. A foresighted firm could take advantage of this by adopting higher environmental standards than are dictated by current regulations. MNEs are especially well-positioned in this regard: They can actually use the environment as a strategic competitive advantage by speeding up the process (e.g., by lobbying for tighter environmental regulations) and thus outcompete local firms with lesser financial means, knowledge, and capability.

Fourth, the presumption that polluting lowers production cost can be challenged. Putting aside the issue of regulatory stringency, there are other ways in which environmental standards may affect competitiveness. Specifically, not all environmental regulations affect firms' behavior in the same manner, and the form of environmental regulation can be an important determinant of business impact. For example, U.S. environmental regulations often mandate specific control or treatment technologies. These so-called "command and control" style regulations dictate that specific pollution control technologies be used, often at an exorbitant cost (Porter and van der Linde 1995).

However, in many cases, it is possible to reduce or eliminate pollution by making changes in the manufacturing or production process, rather than capturing pollutants for treatment or disposal at the "end-of-the-pipe." Pollution and waste are reduced at the outset by a conscious effort to heighten resource efficiency. Many state-of-the-art technologies have high resource productivity. Such "eco-efficiency" can actually lower

operating costs, rather than raise them (Porter and van der Linde 1995, Hart and Ahuja 1996).

Finally, there may be fringe benefits associated with adhering to higher environmental standards. By committing to standards that exceed those of the host country, the company might benefit from heightened employee morale and thus productivity (Romm 1993). Adopting an internal corporate environmental standard ahead of legal requirements avoids special interest group pressures and may result in positive reputation effects for the firm, improving its public image relative to competitors.

These considerations suggest that a firm defaulting to lower or poorly enforced local environmental standards may be overlooking both tangible and intangible benefits associated with conforming to a higher global standard. Firms conforming to a higher global environmental standard may find that the strategy enhances value.

Value Creation or Destruction?

The conflicting nature of the above arguments suggests that the relationship between corporate environmental standards and firm value is an empirical question. We therefore investigate two questions:

1. Are MNEs which exceed local environment standards (those adopting higher global standards) higher- or lower-value firms? Is adhering to higher global environmental standards associated with higher market value or does it represent a nonproductive use of assets and a drag on market value?

2. Is there a detectable lead-lag relationship between firm value and environmental standards? In other words, do changes in environmental standards cause changes in market value or visa versa?

4. Methods

Sample

The sample of firms for this study was drawn from the U.S. Standard and Poor's 500 list of corporations. Although this population of firms is clearly biased towards the largest firms, this was not deemed to be a problem because MNEs were our target sample and the S&P 500 contains largely MNEs. Our sample period was from 1994 to 1997. This is the period in which we have data on both firm environmental standards and market value. Although the data source for our environmental standards, Investor Responsibility Research Center's (IRRC) Corporate Environmental Profile, collected data prior to 1994, the survey item that we draw upon changed in 1994, making comparison with prior years' data inappropriate.

Two screens were applied in selecting firms. First, only those MNEs involved in manufacturing or mining (SIC codes between 2000 and 3999) were selected because the main research variable, corporate environmental standards, was most salient to these firms. Second, only those MNEs with production operations in countries with GDP per capita below $8,000 (1985 dollars) were included in the study. Evidence suggests that concern for and activity in environmental regulation decreases dramatically for countries with per capita income levels below $8,000 (Grossman and Krueger 1995). Sampling on this dimension therefore allows us to insure that there is a difference between those firms that default to local standards and those that adopt a global standard. After applying these two screens to the population, we ended up with eighty-nine firms, which were drawn from fifteen two-digit SIC codes.

Dependent Variable

The key dependent variable (*Tobin's q*) is defined as firm market value per dollar of replacement costs of tangible assets. Tobin's q is widely used as an indicator of intangible value in economics research (e.g., Lindenberg and Ross 1981) and in the international business literature (e.g., Morck and Yeung 1991). We proxied for firm market value by summing *Compustat*-reported firm equity value (outstanding shares times share price), book value of long-term debt, and net current liabilities. We proxied for replacement costs of tangible assets by summing book value of inventory and net value of physical plant and equipment.[2]

[2] A more elaborate estimate for Tobin's q (e.g., Lindenberg and Ross 1981) and the current simplified estimate often yield qualitatively similar results. The key is whether the use of book—instead of market—value of debts, of inventory, and of plant and equipment introduces any systematic biases. Such biases are likely to be linked to industry and firm size. We incorporate industry effects in our statistical analyses in case there are any systematic biases linked to

Independent Variables

The focal information for our independent variable was derived from the Investor Responsibility Research Center's (IRRC) Corporate Environmental Profile. This data set describes each corporation's posture with regard to international environmental policy from 1994 to 1997. Each firm is allowed to check any of the following three categories "1," "2," or "3" in each year:

(1) local—the corporation adheres to local standards only;

(2) U.S.—the corporation applies U.S. environmental standards wherever it does business; and

(3) stringent global—the corporation has its own internal environmental standard that exceeds any national standard.

We first used this information to code a firm's environmental standards in year t ($ENV\ STD_t$) as "1," "2," and "3" accordingly. Next, we created two dummy variables. The first, ED_t, indicates that a firm's environmental standard in year t was not "local" (i.e., the firm did not adopt "1" in the above scheme). The second dummy, $ED2_t$, indicates that a firm's environmental standard in year t was "stringent global" (i.e., the firm adopted "3" in the above scheme).

The implicit assumption is that firms declaring a lower category of environmental standard pollute more. This assumption requires validation. Full-scale validation is difficult, however, because consistent and reliable pollution data on a global scale do not exist, especially in developing countries (the presumed "pollution havens"). We therefore resorted to validating the assumption based on each firm's U.S. "Toxic Release Inventory" (TRI) data. As expected, we found that firms adhering to "local standards" polluted the most, while firms applying "an internal global standard that exceeds any national standard" polluted the least. Firms applying U.S. standards overseas were in between these two extremes. The difference between the first and the third group is most statistically significant. Details on the validating effort are reported in the Appendix.

industries. We control for firm size by using the logarithm of the firm's assets in a given year.

To avoid the missing variable problem, we needed to include controls known to affect Tobin's q that are also plausibly related to a firm's choice of environmental standards. Tobin's q is known to be related to capital structure, intangibles like R&D and advertising expenditures, and multinationality (e.g., Morck and Yeung 1991). Hence, we included in our regression analyses the following control variables: R&D intensity (R&D/dollars of total assets), advertising intensity (ADV/dollars of total assets), leverage (long-term debt/dollars of total assets), and multinationality (percent of foreign assets/dollars of total assets).[3] We also included firm size (defined as the log of total dollars of assets) to control for the possibility that firm size is related with Tobin's q.[4] All data were obtained from Compustat for the years 1994–1997, except multinationality, which was obtained from Worldscope.

These control variables are possibly correlated with a firm's choice of environmental standards. For example, large and more internationally oriented firms are likely to be highly conscious of their public image because of the large scale and scope of any negative ramification from bad publicity. Highly leveraged firms may be less able to afford the investment required to implement more stringent global environmental standards.

[3] We also used the percentage of foreign sales as an alternative specification of multinationality. The results were in all cases not significantly different from those obtained using the percentage of foreign assets.

[4] There are other variables that are known to affect Tobin's q. First, there may be industry-level effects like competitive structure and growth potential. We filter these out by using two-digit SIC industry dummies to capture fixed industry effects. There are also other known firm-level effects that affect Tobin's q. One of these is growth trends. However, one runs the risk of double counting the growth effect if investment in intangibles is already incorporated. Product diversification can also affect Tobin's q. Product diversification is highly correlated with geographic diversification. Excluding either does not, however, affect the behavior of the other, as the comparison between Morck and Yeung (1998, Table 2) and Morck and Yeung (1991, Tables 4 and 5) illustrates. To conserve degrees of freedom and to avoid collinearity, we do not include these extra explanatory variables. Following a referee's suggestion, we include the log of size (total dollars of assets) as an independent variable.

Data Analysis

We used both bivariate and multivariate analyses to address the research questions. With regard to the first question, we identified the statistical relationship between firm value and level of corporate environmental standard using t-tests and multiple regression. We recognize that using the panel data entails counting firms with unchanged environmental standard multiple times, which exaggerates sample size and thus the t-statistics. We corrected for this by replacing the firm-year data with firm-average data when we conducted bivariate analyses (i.e., simple correlations). When we conducted multivariate regression analysis, we used the firm-average data to run "group mean" regressions. We also ran random firm effects regressions that utilize all available data points in our cross-sectional panel.[5]

To create the firm-average data, we averaged the dependent and independent variables for each year in which the firm reported a consistent environmental standard. Thus, a firm that used host country standards in every year would have one observation in the averaged firm-year data, while a firm that changed from host to U.S. standards would have two observations—one for each of the environmental standards. Out of our 89 firms, 72 never changed their environmental standards, 16 did so once and one did so twice.[6] Out of the 18 total changes, 12 were "positive" (upgrading environmental standards) while 6 were "negative" (downgrading environmental standards). Hence, there are 107 (89 + 12 + 6) firm-average observations. There were 6 missing "environmental standards" data points in our sample period. Out of these 107 observations, 30 adopted "local environmental standards," 18 adopted "U.S. standards" and 59 adopted "stringent global standards."

[5] In conducting multivariate regression analyses on the relationship between Tobin's q and environmental standards, we did not introduce firm fixed effects because for a very large proportion of our sample firms the focal independent variable (environmental standard) does not have much variation.

[6] We are not able to tell whether the changes reported by the firm are real or due to reporting errors. As a conservative robustness check, we repeated our analyses excluding the firm. Our results remained intact.

With regard to the second question, we used the Granger causality method which involves regressing, in turn, a) firm value on its own lags and past environmental standard; and b) environmental standard on its own lags and past firm value. When we performed the causality tests, we used the full panel data, rather than the firm-average data. When past changes in environmental standards predict current changes in market value, but past changes in market value do not explain current changes in environmental standards, we can conclude that adopting a higher environmental standard causes market value increase. When the reverse is true, we can conclude that higher firm value causes adoption of more stringent global environmental standards.

5. Results

Table 1 presents means, standard deviations, and simple correlations for the variables based on firm-average data in our study. As expected, we find a positive correlation between a firm's Tobin's q and its levels of research and development and advertising, and its multinationality. Likewise, a negative correlation is found between the Tobin's q value and the leverage of the firm. We now turn to consideration of our two research questions.

Are Stringent Environmental Standards and Market Value Compatible?

The key result in Table 1 is that firms that do not adopt local environmental standards have higher market values. The dummy variable ED[7] allows us to compare firms that do not adopt local environmental standards to those that do. ED2 allows us to compare firms that adopt a stringent global environmental standard to those that do not. Both ED and ED2 are positively and significantly correlated with Tobin's q. These observations provide preliminary evidence that those companies that go beyond local environmental standards have higher market values. Furthermore, companies adopting their own "internal environmental standard" have the highest Tobin's q values.

To better understand the differences in the charac-

[7] Because the data is firm-average, the time subscript for ED and ED2 is unnecessary.

Table 1 Means and Correlations for the Dependent and Independent Variables

	Mean (std dev)	ED	ED2	R&D	Adv.	Leverage	%Foreign	Log(Size)
Tobin's *q*	3.53	0.3043	0.3680	0.4643	0.4290	−0.2107	0.0953	−0.0068
	(2.72)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0792)	(0.9000)
ED	0.73		0.7175	0.2886	0.1627	−0.2293	−0.0146	0.1122
	(0.44)		(0.0001)	(0.0001)	(0.0027)	(0.0001)	(0.7884)	(0.0392)
ED2	0.58			0.2477	0.1911	−0.0178	0.1253	0.2995
	(0.49)			(0.0001)	(0.0004)	(0.7440)	(0.0212)	(0.0001)
R&D	0.04				0.0418	−0.3887	0.2734	−0.0650
	(0.04)				(0.4440)	(0.0001)	(0.0001)	0.2332
Adv.	0.02					−0.0439	0.1349	−0.0467
	(0.04)					(0.4213)	(0.0131)	(0.3921)
Leverage	0.17						−0.1478	0.04351
	(0.09)						(0.0078)	(0.4335)
% Foreign	0.33							0.0896
	(0.15)							(0.1000)
Log(assets)	9.14							
	(1.24)							

Note. Numbers in parentheses are *p*-values.

Table 2 *t*-tests Comparing Means at Different Environmental Standards

Standard	*N*	Tobin's *Q*	R&D	Advertising	Leverage	% Foreign	Log(assets)
Host	30	2.1986	0.0249	0.0119	0.1870	0.3418	8.9421
		(0.8874)	(0.0280)	(0.0234)	(0.0844)	(0.1585)	(1.0523)
U.S.	18	2.5317	0.0407	0.0154	0.1142***	0.2703	8.4871
		(1.2917)	(0.0396)	(0.0346)	(0.0724)	(0.1376)	(1.1890)
Internal	59	4.113**	0.045	0.025	0.1562**	0.349*	9.437***
		(2.729)	(0.041)	(0.038)	(0.088)	(0.154)	(1.268)

Note. The values in parentheses are standard deviations.

*, **, *** denote significantly different from the mean for the preceding category at 0.10, 0.05, and 0.01, respectively.

teristics of the firm types, we present, in Table 2, the results of *t*-tests for the differences between the means of Tobin's *q*, R&D, advertising, leverage, and multinationality at the three levels of environmental standards (see Table 2). The first interesting observation in Table 2 is that defaulting to local environmental standards is by no means the most common practice (only 30 out of 107 fit this description). Rather, the most common strategy in this sample is to adopt a stringent internal standard that is applied globally (59 out of 107 observations).

The *t*-tests reveal that those companies which use U.S. standards worldwide have *insignificantly* higher Tobin's *q* values than those companies which use the standards of the various host countries in which they operate. (The *t* statistic is at best marginally significant at the 10% level, 1-tail.) However, the firms that employ their own internal standard around the world have *significantly* higher Tobin's *q* values than those that use U.S. standards. The remaining *t*-tests in Table 2 indicate that the firms that use host, U.S., or internal environmental standards have roughly equal levels of R&D and advertising. However, firms using host country environmental standards are most leveraged,

while firms using internal environmental standards are the largest and attain the highest level of multinationality.

Of course, the analyses presented thus far do not control for factors that may be driving the observed relationships (e.g., spending on intangibles, firm size, leverage, and multinationality, etc.). In particular, there could be industry effects present. For example, some industries (e.g., pharmaceuticals, where firms have generally high Tobin's q values) utilize highly toxic chemicals and materials, making such firms more likely to adopt higher environmental standards. Therefore, we conduct multivariate analyses that control for these effects.[8]

Table 3 reports piecewise regressions which compare firms adopting the different types of environmental standards using the ED and ED2 dummy variables described above. Here, the base case in the regressions is the Tobin's q of firms adopting local standards. The regression coefficient for ED reveals the difference in Tobin's q between firms adopting U.S. standards worldwide and firms adopting local standards. The regression coefficient for ED2 reveals the difference in Tobin's q between firms adopting a stringent internal standard and firm adopting U.S. standards worldwide. The difference in Tobin's q between firms adopting a stringent internal standard and firms adopting local standards is the sum of the regression coefficients for ED and ED2.[9]

Regressions 3-a and 3-b are group mean regressions based on firm-average data that we used in Tables 1 and 2. Regressions 3-c and 3-d are random firm effects regressions that utilize all available firm-year observations. In 3-a and 3-c we do not include industry dummies, while in 3-b and 3-d we do. The results in all regression models are very consistent across all regression specifications: similar in sign, magnitude, and statistical significance.

Table 3 Piece-Wise Linear Regression of Tobin's q on Environmental Standards and Control Variables

	Group Mean Regressions		Random Firm Effects Regressions	
Variable	(3-a)	(3-b)	(3-c)	(3-d)
Intercept	2.719*		0.762	
	(1.318)		(1.599)	
R&D	26.036***	20.472***	27.316***	18.291***
	(4.911)	(6.432)	(5.004)	6.288
Adv	29.944***	25.368***	26.747***	17.892***
	(4.915)	(6.425)	(5.020)	5.854
Leverage	−1.658	−2.878	−1.242	−1.798
	(2.084)	(2.401)	(1.743)	1.705
% Foreign	−1.931*	−2.072	−0.414	1.008
	(1.142)	(1.362)	(1.202)	1.332
Log(assets)	−0.0620	−0.089	0.110	0.240**
	(0.141)	(0.177)	(0.168)	(0.116)
ED	−0.471	−0.350	−0.335	−0.140
	(0.4817)	(0.557)	(0.487)	0.467
ED2	1.467***	1.205**	1.216***	1.002***
	(0.4817)	(0.523)	(0.421)	(0.399)
Industry Dummies	No	Yes	No	Yes
N	107	107	338	338
R^2	0.516	0.588	0.454	0.503

Note. Numbers in parentheses are standard errors.

*, **, *** Significant at 10%, 5%, and 1%, respectively.

ED = 1 if corporate environmental standard is "U.S. standards" or "internal standards that exceeds any national standards"; 0 elsewhere.

ED2 = 1 if corporate environmental standard is "internal standards that exceeds any national standards"; 0 elsewhere.

The ED coefficients in all regression models are negative but insignificant, indicating that companies that use U.S. standards overseas and companies that use the standards of the host countries have similar market value. The ED2 coefficients are positive and highly significant in all models, indicating that firms using internal global standards overseas have higher Tobin's q values than those using U.S. standards. An F-test reveals that the sum of the ED and ED2 coefficients is significantly above zero, indicating that firms using a stringent internal environmental standard globally have statistically higher Tobin's q than those using host country standards. Table 3 results thus

[8] To control for industry fixed effects, we use two-digit SIC industry dummies. It is possible to use three-digit SIC industry dummies and doing so does not change our results. However, there are some three-digit SIC industries with very few firms (some have only one). To avoid this potential problem, we opt to report results based on two-digit SIC industry dummies.

[9] We also conducted regressions using the *ENV STD* variable. The results are consistent with what we report in Table 3, but less revealing. These results are available upon request.

confirm that adopting a stringent internally defined global standard is positively associated with a firm's stock market value.

We checked the robustness of our results. We first conducted residual diagnostics. We found no outliers whose deletion materially affects the results of our regression analyses. Heteroskedasticity is a concern with our data, especially in our group mean regressions in which we analyzed firm-average observations, where the number of observations from which the firm-averages are derived is not fixed. Accordingly, we conducted White's (1980) specification test, and determined that heteroskedasticity is not affecting our results. Finally, to be very conservative (but sacrificing statistical efficiency), we repeated regressions 3-a and 3-b using year-by-year data, one year's worth of data per run. We found qualitatively similar results.

Based on the above statistical analyses, we conclude that there is a reliable positive and significant relationship between the use of a single global environmental standard and a firm's Tobin's q.

Do Higher Environmental Standards Cause Increases in Market Value?

Our next step is to explore causality in this relationship using the original time series panel data. Does upgrading the firm's environmental standards lead to higher firm value (higher Tobin's q)? Or, is it the case that increases in a firm's Tobin's q result in higher environmental standards?

To address this question, we first regress Tobin's q on the five control variables used in earlier regression runs. We then do the same for our environmental standards variable ($ENV\ STD_t$) as defined in §4. We use this variable because it has more variation than either ED or ED2. The residuals from these regression runs comprise the portion of Tobin's q and environmental standards respectively not explained by R&D, advertising, leverage, total assets, and multinationality. We then regress Tobin's q residuals for a given firm on the lagged values of the Tobin's q residual and the lagged values of the environmental standards' residual. We do not know what time length, if any, will be appropriate for the lagged effect to be noticeable, so we present one, two, and three-year lags. These results are reported in Table 4a, columns 4a-1 to 4a-3. We repeat the analysis replacing $ENV\ STD_t$ by $ED2_t$. These results are reported in columns 4a-4 to 4a-6.[10] All specifications reveal consistent results.

The results in Table 4a indicate that the previous years' environmental standards are not significant predictors of current Tobin's q values.[11] We tried several alternative specifications for assessing whether a change in environmental standards led to a change in Tobin's q in future years. All results consistently showed that there is no lagged reaction to environmental standards on the part of the market. One interpretation is that our sample data have too few changes in environmental standards (only 17 firms out of 89 firms did so) to be able to generate statistically reliable results. Another plausible speculation is that the stock market upgrades a firm's market value within an annual time window once the firm adopts a higher environmental standard.[12]

Using the same analytical approach, we also looked to see whether firms that had changes in market valuations altered their environmental standards in subsequent years, but there was no evidence that such a link existed (see Table 4b).

In summary, we have found a significant and positive relationship between the market value of a company (as measured by Tobin's q) and the level of environmental standard it uses. This effect remains even after we have controlled for industry effects as well as other factors known to affect Tobin's q. Furthermore, our results suggest that a firm's mar-

[10] Regressions 4a-4 to 4a-6 were suggested by a referee.

[11] We recognize that the "unit root" problem may be present in our results in Table 5a and 5b, because in each case, the coefficient on the one-year lagged values of the dependent variable are not significantly different from 1.0. We attempted a first-difference analysis in order to correct for this potential problem, but this leaves us with only 42 observations in one year and may thus have the usual small sample difficulties. The results of the first-difference analysis do not contradict our reported findings.

[12] As long as firm valuation is based on expectations, our result is not inconsistent with results obtained by, e.g., Hart and Ahuja (1996) which show that efforts to prevent pollution and reduce emissions leads to an increase in return on sales and assets after one or two years.

Table 4a **Residual for Tobin's q Regressed on Lagged Residuals of Tobin's q and of Environmental Standards.**

	Environmental Standard = 1, 2, 3			Environmental Standard = ED2 (=1 if adopting a stringent global standard)		
	4a-1	4a-2	4a-3	4a-4	4a-5	4a-6
Residual of Tobin's q (t-1)	1.228***	1.246***	1.352***	1.227***	1.247***	1.356***
	(0.070)	(0.108)	(0.121)	(0.035)	(0.099)	(0.138)
Residual of Tobin's q (t-2)		0.002	0.257		0.004	0.243
		(0.157)	(0.221)		(0.137)	(0.234)
Residual of Tobin's q (t-3)			−0.733***			−0.728***
			(0.179)			(0.191)
Residual of Env Std (t-1)	−0.0914	−0.189	−0.203	−0.124	−0.343	−0.378
	(0.090)	(0.125)	(0.169)	(0.208)	(0.423)	(0.591)
Residual of Env Std (t-2)		0.155	−0.133		0.259	−0.039
		(0.115)	(0.174)		(0.413)	(0.714)
Residual of Env Std (t-3)			0.055			0.034
			(0.197)			(0.615)
N	252	162	72	252	162	72
R^2	0.886	0.901	0.938	0.885	0.901	0.937

Note. Numbers in parentheses are standard errors.

*, **, *** Significant at 10%, 5%, and 1%, respectively.

In all regressions, industry effects are controlled for. In models 4a-1, to 4a-3, "environmental standards" is defined as "1 (local)," 2 (U.S. standards)," and "3 (global)." In models 4a-4 to 4a-6, "environment standards" is defined as ED2, a dummy indicating the employment of a stringent global standard environmental policy.

ket value appreciates quickly once a firm adopts a higher environmental standard. However, past changes in market value do not predict whether a firm will adopt higher environmental standards in the future.

6. Discussion

Our finding that adopting stringent global environmental standards is positively associated with a higher firm value is open to several possible interpretations. First, it may be that private valuations internalize environmental externalities: The less negative externalities a firm imposes, the higher the firm value. Second, it is possible that adopting stringent environmental standards is actually more profitable than defaulting to lower or poorly enforced local environmental standards. Finally, poorly managed and less competitive firms may tend to adopt lower environmental standards. In this section, we discuss each of these interpretations.

Internalization of Externalities

The first interpretation is based not only on our data, but also on the results of other studies (e.g., Hamilton 1995, White 1995, Klassen and McLaughlin 1996). All these results suggest that investors incorporate potential environmental problems and liabilities into their pricing of companies. In developed economies with strong regulatory regimes, the mechanism exists to support this observation: The institutional and legal systems support the public's rights to a clean environment so that polluters have to pay for their environmental damage. Hence, firms that have higher potential environmental liabilities realize lower market values.

The focus of this study (developing countries), however, involves locations where environmental regulations are lax or property rights to a clean environment are poorly enforced. In these contexts, other mechanisms must be at work. One possible mechanism for the internalization of externalities under these circumstances is as follows: Interest

Table 4b Residual for Environmental Standards Regressed on Lagged Residuals of Tobin's *q* and of Environmental Standards.

	Environmental Standard = 1, 2, 3			Environmental Standard = ED2 (=1 If Adopting a Stringent Global Standard)		
	IVb-1	IVb-2	IVb-3	Ivb-4	IVb-5	IVb-6
Residual of Tobin's *q* (*t*-1)	0.006	0.016	−0.012	0.002	0.010	−0.007
	(0.008)	(0.022)	(0.017)	(0.007)	(0.018)	(0.024)
Residual of Tobin's *q* (*t*-2)		−0.024	−0.027		−0.016	−0.014
		(0.029)	(0.037)		(0.025)	(0.041)
Residual of Tobin's *q* (*t*-3)			0.023			0.013
			(0.041)			(0.033)
Residual of Env Std (*t*-1)	0.767***	0.639***	0.713***	0.765***	0.708***	0.731*
	(0.050)	(0.117)	(0.151)	(0.042)	(0.078)	(0.103)
Residual of Env Std (*t*-2)		0.188*	0.113		0.082	0.099
		(0.106)	(0.121)		(0.077)	(0.124)
Residual of Env Std (*t*-3)			−0.028			−0.051
			(0.071)			(0.107)
N	252	162	72	252	162	72
R^2	0.679	0.726	0.7947	0.707	0.723	0.769

Note. Numbers in parentheses are standard errors.

*, **, *** Significant at 10%, 5%, and 1%, respectively.

In all regressions, industry effects are controlled for. In models 4b-1, to 4b-3, "environmental standards" is defined as "1 (local)," 2 (U.S. standards)," and "3 (global)." In models 4b-4 to 4b-6, "environment standards" is defined as a dummy indicating the employment of a stringent global standard environmental policy.

groups and nongovernmental organizations expose unsound corporate environmental practices, raise consumer awareness, and put pressure on governments to discipline polluters even if the pollution is in overseas locations. Through these means poor environmental performance is translated into bad public image, lower consumer goodwill, and ultimately, lower firm value.[13] Aware of this disciplinary effect, far-sighted managers conscious of firm value opt to maintain a high level of environmental practice, even where regulations do not require it.

Bottom-line Benefits

There appear to be economic implications of adopting high environmental standards that extend beyond the negative or "disciplinary" effects associated with poor environmental performance discussed above. In fact, the smallest coefficient for ED2 (Table 3, regression 3-d) indicates that firms adopting their own stringent global environmental standards have a Tobin's *q* that is approximately 1.002 higher than those using U.S. standards abroad. Given the mean value of firm tangible assets in our sample, 1.002 represents more than $8.6 billion per firm. If we use the average of the regression coefficients for ED2 in Table 4, the number increases to $10.4 billion per firm. Even company

[13] For example, *The Economist* (July 20, 1996; "The fun of being a multinational") reported that:

> In Malaysia, a $5.5 billion hydroelectric dam to be built by a consortium including ABB Aseá Brown Boveri, a Swiss-based multinational, is being attacked by local people and western environmental groups for destroying rainforest. The average oil baron or mining boss might once have shrugged off such events as little local difficulties. Some even relished a brawl. Nowadays, they recognise that the stakes are higher. It is not only the prospect of consumer boycotts that worries them. In addition, staff morale can suffer (many Shell employees opposed the sinking of the Brent Spar), political contacts can be upset (Nelson Mandela denounced Shell's behaviour in Nigeria) and worst of all sanctions can be imposed (the state of Massachusetts recently banned contracts with firms doing business in Myanmar).

estimates of the cost (including punitive damages) of the largest environmental cleanup in history (the Exxon Valdez accident) are less than $8 billion (*The Lamp* 1999). The magnitude of the value increase associated with higher environmental standards thus represents more than just the monetarization of negative externalities.

We therefore advance our second interpretation: Adopting stringent environmental standards is more profitable than defaulting to lower or poorly enforced local environmental standards. This interpretation is consistent with other studies (e.g., Cohen et al. 1995, Hart and Ahuja 1996, Russo and Fouts 1997), all of which suggest a higher level of profitability associated with better environmental practices and efforts to reduce emissions and waste.

We need to be careful, however, in explaining how stringent environmental standards might raise profit performance. Two possible mechanisms apply. First, it may be that adopting the latest technologies and equipment increases productivity, and that is what makes the investment worthwhile. Better environmental practices are embedded in the latest technologies as a result of pressures from interest groups and governments in developed countries. From this perspective, the contribution of high environmental standards to bottom-line performance is "coincidental": The effect would not be present were it not for societal pressures to develop more environmentally friendly technologies and equipment. One would expect early movers to see the biggest gains from such investments, as Nehrt (1996) reports. Over time, companies not able to keep up with the investments would evidence erosion in bottom-line performance and firm value.[14]

A second, internally driven mechanism may also be at work, however. Firms that adopt high environmental standards are those that strive for eco-efficient production systems. The conscious policy to pursue technologies and processes that increase the *resource* productivity of their operations has a positive result for the bottom line.[15]

Low Performers Race to the Bottom

Tobin's q can be interpreted as a measure of firm "quality" (e.g., better-managed firms are higher-value firms). One can therefore interpret our results as suggesting that "quality" firms adopt high environmental standards independent of local requirements, and generate less pollution, while lower-quality firms engage in a "race to the bottom," as a means of gaining short term financial advantage. High "quality" firms are typically more focused on corporate goals and competitive position. The application of a stringent global environmental standard may be indicative of a desire to build organizational awareness amongst all affiliates, of company policies and practices. It may also be an indicator that a company, as an industry leader, aims to stay on top in all aspects of its business.

There are still other possible explanations for the linkage between firm quality and firm environmental standard. For example, it is possible that better firms have the foresight to plan for the future: They see the importance of applying high environmental standards even where not required because the standards will increase as a region grows and develops. It is also possible that higher-quality firms simply have the resources to invest in higher environment standards. They use environmental performance as a competitive weapon against other firms with fewer resources or means to keep up.

7. Conclusion

This paper refutes the idea that adoption of global environmental standards by MNEs constitutes a liability that depresses market value. On the contrary, the evidence from our analysis indicates that positive market valuation is associated with the adoption of a

[14] However, this is not a typical "equilibrium" perspective. At equilibrium, the value of the above investment should reflect the value of cash flow and thus should not affect Tobin's q.

[15] An extension of our argument is that developing countries offer particularly attractive locations to experiment with such "clean technology" because they are not subject to the same level of costly "command and control" regulation that is found in developed economies such as the United States. Indeed, under these circumstances, it may be possible for firms to jointly optimize cost, quality, and environmental performance.

single stringent environmental standard around the world.

Our results imply that private valuations may incorporate negative environmental externalities, even if the externalities take place in countries with lax environmental regulations and poorly protected environmental property rights. In addition, adopting stringent environmental standards may actually be more profitable than defaulting to lower local environmental standards. This may be a by-product of pressures in the developed world to make new technologies and equipment more environmentally friendly. It may also be that environmentally conscious firms are more diligent in reducing waste and improving resource productivity.

The notion that MNE's, as a group, pursue the lowest environmental standards and create a "race to the bottom" among developing countries desperate for foreign investments is not substantiated by the data. The most common corporate environmental practice in our sample is the opposite: adopting a stringent internal standard globally. We do not, however, suggest that the race to the bottom does not exist. In fact, our findings also suggest that companies with lower market values tend to pursue lower environmental standards. Perhaps these companies opt to default to host country standards because they lack the means to make the investment in environmentally superior technology worldwide. They may also be less well-run companies focusing on short-term cost savings. This might include, but is certainly not limited to, strategies such as recapitalizing old production assets, extending obsolete product life cycles, and exploiting low labor costs.

From a public policy standpoint, then, there are clear implications regarding these results: Developing countries may indeed attract foreign investment by lowering environmental standards, but the type of companies they attract by doing so will be weaker (and more pollution-intensive) firms not investing in state-of-the-art plants and equipment. After a temporary presence marked by the exploitation of the lower or poorly enforced host country standards, these companies may well end up fodder for those globally competitive firms which have adopted worldwide environmental standards and are reaping the competitive and market benefits of that policy. Thus, developing countries may be best served by promoting aggressive environmental objectives combined with a willingness to work collaboratively with the world's leading MNEs to define and implement policies that facilitate "win-win" environmental solutions.

The most important conclusion suggested by our results is that higher "quality" firms (as measured by Tobin's q) appear to pollute less. Future research should examine this relationship in greater depth. Two future directions appear evident. First, our study was constrained by data availability. Future research should supplement the current data with more variables, including firm reputation, more detailed information on firms' actual environmental practices and performance, and a longer time series. Second, future work should aim to identify why firms adopt higher environmental standards. While we have proposed several plausible explanations here, examination of their validity awaits further research.[16]

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Appendix: Validation of IRRC Environmental Standard Measure

In this study, the focal independent variables are derived from the Investor Responsibility Research Center's (IRRC) Corporate Environmental Profile. The IRRC contains a record of each corporation's declared stance regarding its international environmental standard: (1) the corporation adheres to local standards only; (2) the corporation applies U.S. environmental standards wherever it does business; and (3) the corporation has its own internal environmental standard that exceeds any national standards. The assumption is that firms declaring a lower category of environmental standard are poorer environmental performers.

This assumption requires validation. Full-scale validation is difficult because consistent and reliable pollution data at the plant level on a global scale do not exist, especially in developing countries. We therefore resorted to validating this assumption based on each firm's U.S. "Toxic Release Inventory" (TRI) data, as reported in

Table A1 Means and *t*-test for Relative Emissions

Delcared environmental standard	Default to Host standards	Apply U.S. standard	Apply an internal stringent global standard
Relative Emissions			
Mean (standard error of the mean)	0.010 (0.1297)	−0.2691 (0.2033)	−0.4269*** (0.1375)
t- and prob-value when comparing to "default to host country standards"	—	−1.578 (0.125)	−2.368** (0.021)
t- and prob-value when compared to "applying U.S. standard"	—	—	−0.167 (0.868)

*, **, *** denote significance at the 0.10, 0.05 and 0.01 level, respectively. In the first row, the results indicate whether the sample mean differs significantly from 0.

1995.[17] The IRRC (Investor Responsibility Research Center) tracks U.S. plants' toxic releases (by weight) and reports for each company its ratio of toxic releases to sales and industry average. We created a variable, "relative emissions," which is the difference between a firm's U.S. toxic release/sales and industry average. We then examined how "relative emissions" varies with a company's declared environmental standard. To determine the robustness of our results, we trimmed outliers that had student residuals greater than or equal to three.

Table A1 reports the mean "relative emissions" by each declared class of environmental standard. The result is consistent with our expectation: Firms defaulting to "local standards" (Group 1) have the highest relative emissions, while firms applying "an internal global standard that exceeds any national standard" (Group 3) have the lowest relative emissions. Firms applying U.S. standards overseas (Group 2) were in between these two extremes.

We also conducted a regression analysis. Notice that we did not need to control for industrywide effects because the pollution measure has been standardized by industry average. We controlled for firm size (log of total dollars of assets) because of possible economies (or diseconomies) of scale in "polluting." The regression analysis is reported in Table A2. The results are consistent with those in Table A1: (i) firms that "default to local environmental standards" pollute statistically significantly more than firms that apply "an internal global standard;" (ii) firms that "default to local environmental standards" pollute more than firms that apply "U.S. standards," but the difference is not statistically significant; and (iii) firms that apply "U.S. standards" pollute more than firms that apply "an internal global standard," but the difference is not statistically significant.

[17] We have data for both 1994 and 1995. Using 1994 data generates similar results that are slightly less significant but still acceptable. We chose to use the 1995 data because our records on corporate environmental standards for 1995 are more complete.

Table A2 Regression of Relative Emissions in 1995 on Environmental Standard and on Dummies Indicating U.S. Standards and Global Standards

Intercept	U.S. Standards Overseas	Internal Global Standards	Log(assets)	*N*	*R*-square (Adjusted)
−1.857** (0.723)	−0.418 (0.307)	−0.687*** (0.224)	0.223*** (0.08)	82	0.123

*, **, *** Significant at 10%, 5% and 1%, respectively.
The overall model is significant at the 5% level (*F*-value = 2.728)
Numbers in parentheses are standard errors.

While the tests are relatively simple, they provide evidence that our Environmental Standard variable is valid and meaningful: Companies using a global environmental standard are relatively cleaner in the United States than those companies defaulting to host country standards abroad. This is especially significant because companies that default to host country standards can, by definition, export their dirtiest processes to lax jurisdictions, an option that is not open to companies using a single global standard.

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