Do Corporate Global Environmental Standards in Emerging Markets Create or Destroy Market Value

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DO CORPORATE GLOBAL ENVIRONMENTAL STANDARDS CREATE OR DESTROY MARKET VALUE?

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ABSTRACT

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. This paper seeks to answer this question by analyzing the global environmental standards of a large sample of US-based MNEs in relation to their market performance. We find that firms adopting a single, stringent global environmental standard have 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 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.

I. 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 ten 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 at 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. Social critics have argued that MNEs, in seeking to reduce costs, play off employees and countries against one another, creating downward pressure on wages and social standards on a worldwide basis (Gladwin, 1987, Gladwin, Kennelly and Krause 1995; Greider, 1997).

Our focus is on the environmental aspect. Environmentalists contend that MNEs are 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 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 environmental standard? We analyze the corporate environmental standards of a large sample of US-based MNEs in relation to their market performance. 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). However, we can not 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. This leads to another question: What drives firms to upgrade their environmental standards? The answer to this question awaits further investigation.

Our results have some important implications. First, the results in this study and others (e.g., Hamilton, 1995; White, 1995; and Klassen and McLaughlin, 1996) suggest that the market valuation of firms internalizes environmental externalities. It appears that investors attach a higher value to firms that aim to produce *fewer* environmental externalities. In fact, the increase in market value associated with adopting stringent global environmental standards is quite considerable. The magnitude of the increase would appear to reflect more than just lower environmental liabilities. Consistent with other studies (e.g., Hart and Ahuja, 1996; Russo and Fouts, 1997), the increase we observe indicates that adopting stringent global environmental standards is actually a more profitable strategy than "racing to the bottom."

These results question whether MNEs are systematically defaulting to lower environmental standards in a global context and whether there is any advantage in doing

so. On the contrary, our results suggest that poorer performing MNEs tend to default to less stringent environment standards. Thus, developing countries that use lax environmental regulations to attract foreign direct investment end up attracting poorer quality, and perhaps, less competitive firms.

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 Section IV and results in Section V. Discussion of the results and conclusions are contained in Sections VI and VII, respectively.

II. 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 result 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 non-trivial costs for environmental clean up 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[1] which possibly augments firm value.

Feldman, Soyka, and Ameer (1996) analyze a sample of 300 large public companies in the US 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

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

of a firm, with an accompanying increase in a public company's stock price, of perhaps five percent.

Other scholars have examined the relationship between environmental and operating 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 the most to gain. 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' environmental performance in the US 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. Gladwin, 1987; 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, Oviatt and Minyard, 1993; Johnson and Greening, 1994). We were unable to find any published empirical research relating specifically to 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.

III. 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 US 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 US may have an adverse impact on productivity (Gray and Shardbegian (1993), perhaps by forcing companies to commit resources and manpower to non-productive 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 re-capitalize 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 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 clean up 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 since 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 re-invest 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 out-compete 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, US 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 non-productive 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?

IV. METHODS

Sample

The sample of firms for this study was drawn from the US 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 since 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 both on 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 4000) 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 86 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]

Independent Variables

The focal independent variable, *Environmental Standard (ENV STD),* 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 performance. Each firm is allowed to check any of the following three categories: (1) the corporation adheres to local standards only; (2) the corporation

[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 linked to industry and firm size. We incorporate industry effects in our statistical analyses in case there are any systematic biases linked to industries. We control for firm size by using the logarithm of the firm's assets in a given year.

applies US environmental standards wherever it does business; and (3) the corporation has its own internal environmental standard that exceeds any national standard. Each firm was then coded as either category 1, 2, or 3 for each of the years 1994 to 1997.

The implicit assumption is that firms declaring a lower category of environmental standard pollute more. This assumption requires validation. Full scale validation is difficult because consistent and reliable pollution data on a global scale does not exist, especially in developing countries (the presumed "pollution havens"). We therefore resorted to validating the assumption based on each firm's US "Toxic Release Inventory" (TRI). The IRRC tracks US plants' TRI emissions (by weight) and reports for each company its ratio of toxic releases to sales and its industry average. We examined the difference between a firm's US toxic release/sales and its industry average. We found that firms that "adheres to local standards only" pollute more than the industry average while the opposite was true for companies that claim to apply "U.S. environmental standards" or their "own internal standard that exceeds any national standard." Firms that "adhere to local standards" pollute the most while firms that "apply an internal global standard that exceeds any national standard" pollute the least. The difference between the pollution by the first and the third group is most statistically significant. Details on the validating effort are reported in the appendix.

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

[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 out these industry level effects by running fixed effects models. There are also other known firm level effects that affect Tobin's q. One of these would be

were obtained from Compustat data tapes for the years 1994-1997, except multinationality, which was obtained from Worldscope.

It is expected that these control variables are 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. Firms engaged in extensive R&D are likely to be more aware of environmental problems and the likely course of future developments. Highly leveraged firms may be less able to afford the investment required to implement more stringent global environmental standards.

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 long-run firm value and level of corporate environmental standard using t-tests and multiple regression. In our analyses, we controlled for industry effects and relevant firm characteristics that are known to affect firm value. 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 have corrected for this by replacing the firm-year data with firm-period-average data.

To create the firm-period-average data, we averaged the dependent and independent variables for each year in which the firm reported a given environmental standard. Thus, a firm that used host country standards in every year would have one observation in the firm-period-average data, while a firm that changed from host to U.S. standards would have two observations — one for each of the environmental standards.[5]

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growth trends. However, one runs the risks 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 one is not going to affect the behavior of the other one, however, as the comparison between Morck and Yeung (1998, Table 2) and Morck and Yeung (1991, Tables 4 and 5) illustrates. To conserve the 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.

[5] In conducting regression analyses on the relationship between Tobin's q and environmental standards, another way to analyze the data would be to have all observations put into our regressions while controlling for firm fixed effects using a GLS approach. We opted not to do so because for a very large proportion of our sample firms the focal independent variable (environmental standard) does not have much variation. It is well known under such circumstances that the GLS approach does not significantly improve efficiency

Out of our 86 firms, 69 never changed their environmental standards while 17 made changes, including multiple changes. The total number of changes is 18, 12 were positive (upgrading environmental standards) while 6 were negative (downgrading environmental standards). Hence, there are 104 (86 + 12 + 6) firm-period-average observations. There were 6 missing "environmental standards" data in our sample period.

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 panel data, rather than the firm-period-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 increased market value. When the reverse is true, we can conclude that higher firm value causes adoption of more stringent global environmental standards.[6]

V. RESULTS

Table I presents means, standard deviations and correlations for the variables based on firm-period-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.

*** Insert Table I About Here ***

Are High Environmental Standards and Market Value Compatible?

The key result in Table I is that ENV STD is positively and significantly correlated with Tobin's q, as well as R&D, advertising, log (assets) and multinationality (only at the 10%

(see, e.g., Theil, 1971, Ch. 7).

[6] It is possible that the causality test may not be very effective because of the limited number of changes in corporate environmental standard. Our sample has for 86 firms four years worth of data with 6 missing readings. Therefore there are 252 (3x86 - 6) possible changes in corporate environmental standard. The

1-tail level), and negatively correlated with the indebtedness (leverage) of the firm. These data provide preliminary evidence that those companies adopting higher environmental standards globally also have higher levels of market value.

To better understand the differences in the characteristics of the firms, we present, in Table II, 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 II). The first interesting observation in Table II is that defaulting to local environmental standards is by no means the most common practice (only 30 out of 104 fit this description). Rather, the most common strategy in this sample is to adopt a stringent internal standard that is applied globally (56 out of 104 observations).

The t-tests reveal that those companies which use U.S. standards world-wide have *insignificantly* higher Tobin's q values than those companies which use the standards of the various host countries in which they operate. (But the t statistic is 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 II 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.

*** Insert Table II About Here ***

Of course, none of the analysis presented thus far controls for factors that may be driving the observed relationships. 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 so that firms in these industries are more likely to adopt higher environmental standards. In the multivariate analyses that follow, therefore, we control for industry effects.

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actual number of changes, however, is only 18.

Table III presents the results of multivariate regression analyses based on firm-period-average data. The dependent variable is the firm's Tobin-q. The models presented in the columns of Table III, respectively, control for no fixed effects and for industry fixed effects.[7] In each model, we control for the level of firm debt, R&D, advertising, and multinationality which all enter as the average for the past three years.

*** Insert Table III About Here ***

In both models, the control variables have the expected signs: Leverage has a negative but insignificant coefficient. "Research and development" and "advertising" each have a positive and significant effect on firm value. The degree of foreign market participation does not have a significant effect in any model. Given that our sample firms are all very large MNEs, the lack of significance of the multinationality variable is not surprising.

Our focal independent variable is the level of corporate environmental standard a firm employs (ENV STD). The results in Table III suggest that higher levels of ENV STD are strongly related to Tobin's q. The fact that the ENV STD coefficient remains positive and significant when we control for industry fixed effects indicates that the correlation between Tobin's q and ENV STD is not an artifact of industry (in fact, an F-test reveals that the industry effects are insignificant). Thus, we have evidence that intra-industry variation in environmental standards by itself has a positive influence on firm value.

In Table III, we have used the ENV STD variable with its original coding of 1, 2 or 3, representing host, U.S. and internal global standards respectively. Treating an ordinal variable in this manner forces the difference between a host and a U.S. standard to have the same impact on Tobin's q as the difference between a U.S. and internal standard. This is not necessarily the case, and in our next model specification, we use a piece-wise linear regression that allows us to relax this assumption.

[7] 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.

Table IV reports the piece-wise regression results. We used ENV STD to create two dummy variables. The first, ED1, took on a value of '1' if the original standards variable was above or equal to '2' (US standards), and the dummy was set to '0' if ENV STD was '1'. The second dummy (ED2) took on a value of '1' if the original standards variable was '3' (global standard) otherwise it was set to '0'. Hence, the impact of adopting an internal global standard (i.e. '3' on ENV STD) on Tobin's q is equal to the sum of the regression coefficients for ED1 and ED2. The impact of adopting a US standard (i.e. '2' on ENV STD) on Tobin's q is equal to the regression coefficient of ED1 only.

*** Insert Table IV About Here ***

The coefficient on ED1 indicates whether firms using U.S. standards overseas have higher Tobin's q values than those using host country standards. The coefficient is negative but not significant, indicating that those companies that use U.S. standards overseas do not have significantly higher market values than the companies that use the standards of the host countries.

The coefficient on ED2 indicates whether the firms using internal global standards overseas have higher values of Tobin's q than those using U.S. standards. The coefficient on ED2 is positive and significant (5%, 2 tails) in both models. An F-test reveals that the sum of the coefficient of ED1 and ED2 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. The results in Table IV thus indicate that the value generated by global environmental standards is driven by those firms that use a single, stringent internally-defined global standard, rather than the firms that use the U.S. standard overseas.

We checked the robustness of our results. We first conducted residual diagnostics of our regression results in both Tables III and IV. We found no outliers whose deletion materially affects the results of our regression analyses. Heteroskedasticity is a concern with our data, as we are analyzing firm-period means, where the number of observations from which the means are derived is not fixed. Accordingly, we conducted White's

(1980) specification test, and determined that heteroskedasticity is not affecting our results. Finally, instead of using sample average data, we repeated our statistical analyses using year by year data, one year's worth of data per run. We found qualitatively similar results.

Thus far, we have explored the relationship between firms' environmental standards and their market valuation as represented by Tobin's q. We have found that there is a reliable positive and significant relationship between the use of a single global environmental standard and 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 (Table Va). 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 these 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 lag effect to be noticeable, so we present one, two, and three year lags in Tables Va and Vb.

*** Insert Table Va about here ***

The results in Table Va indicate that the previous years' environmental standards are not significant predictors of current Tobin's q values.[8] We tried several alternative

[8] We recognize that the "unit root" problem may be present in our results in Table Va and Vb, 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

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 86 firms did so) to be able to generate statistically reliable results. Another interpretation is that the stock market upgrades a firm's market value within an annual time window once the firm adopts a higher environmental standard.[9] Thus, a change in environmental standard does not influence future firm value because firm value has already been increased in the year the higher environmental standard is adopted.

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 Vb).

*** Insert Table Vb about here ***

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 market 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.

VI. DISCUSSION

Our finding that higher global environmental standards augment 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

difficulties. The results of the first-difference analysis do not contradict our reported findings.

[9] 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.

actually more profitable than defaulting to lower or poorly enforced local environmental standards. Finally, firms with poorer financial performance 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; and 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 right 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 groups and non-governmental 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. For example, the *Economist* (1996) reported that:

> *"In Malaysia, a $5.5 billion hydroelectric dam to be built by a consortium including ABB Asea 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)."

Aware of this disciplinary effect, managers opt to maintain a high level of environmental practice, even where regulations do not require it.

Bottom line benefits

There appears 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 coefficient for ED2 (Table IV) indicates that firms using their own stringent global environmental standards have a Tobin's q that is approximately 1.17 higher than those using U.S. standards abroad. Given the mean value of firm tangible assets in our sample, 1.17 represents more than $10 billion per firm. Even company estimates of the cost (including punitive damages) of the largest environmental clean up 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; and 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 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, given 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 environmental 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.[10]

A second, internally-driven mechanism may also be at work, however. Firms that adopt high environmental standards strive to search 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.[11]

Low performers race to the bottom

Tobin's q can be interpreted as a measure of "firm quality." One can therefore interpret our results as suggesting that "quality" firms adopt high environmental standards independent of local requirements, while lower quality firms engage in a "race to the bottom," as a means of gaining short term financial advantage. High performing firms are typically more focused on corporate goals and competitive position. The application of a stringent, global environmental standard may thus 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 performing 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.

VII. CONCLUSION

[10] 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.

[11] 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 U.S. Indeed, under

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 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 world-wide. 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 firms not investing in state-of-the-art plant and equipment. After a temporary presence marked by the exploitation of the lower or poorly-enforced host country

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these circumstances, it may be possible for firms to jointly optimize cost, quality, and environmental performance.

standards, these companies may well end up fodder for those globally competitive firms which have adopted world-wide 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.

While our study answers many questions concerning the relationship between corporate environmental standards and firm value, there is still much work to be done on this topic. First, this study should be repeated with a longer time-frame to assess whether higher environmental standards do, in fact, lead to better cash flow down the road. Second, it would be desirable to seek a more fine-grained measure of companies' presence in developing countries. Currently, we have only a binary measure of this variable. This makes our tests overly conservative in that a company that has only one plant in a country with low environmental standards is treated the same as one that has substantially all of its production in such jurisdictions. We would not expect the market to treat these companies in the same way. Third, future research should seek to identify the motivation behind changes in environmental standards.

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Table I: Means and correlations for the dependent and independent variables

	Mean (std dev)	Env. Std.	R&D	Adv.	Leverage	%Foreign	Log(Size)
Tobin's q	3.5265 (2.7227)	0.36718 (0.0001)	0.46748 (0.0001)	0.44195 (0.0001)	-0.21117 (0.0001)	0.09618 (0.0792)	-0.00690 (0.9000)
Env. Std.	2.3144 (0.8733)		0.27956 (0.0001)	0.22858 (0.0001)	-0.12908 (0.0183)	0.07810 (0.1544)	0.23186 (0.0001)
R&D	0.0407 (0.0388)			0.07109 (0.0001)	-0.39491 (0.0001)	0.29115 (0.0001)	-0.06263 0.2537
Adv.	0.0205 (0.0345)				-0.03774 (0.4919)	0.11020 (0.0442)	-0.05412 (0.3241)
Leverage	0.1683 (0.0929)					-0.14529 (0.0078)	0.04351 (0.4281)
% Foreign	0.3280 (0.1531)						0.08728 (0.1113)
Log(assets)	9.1414 (1.2464)						

Note: Numbers in parentheses are p-values.

Table II: t-tests comparing means at different environmental standards

Standard	N	Tobin's Q	R&D	Advertising	Leverage	% Foreign	Log(assets)
Host	30	2.1986 (0.8874)	0.0249 (0.0280)	0.0119 (0.0234)	0.1870 (0.0844)	0.3418 (0.1585)	8.9421 (1.0523)
U.S.	18	2.5317 (1.2917)	0.0407 (0.0396)	0.0154 (0.0346)	0.1142*** (0.0724)	0.2703 (0.1376)	8.4871 (1.1890)
Internal	56	4.1475*** (2.7550)	0.0458 (0.0419)	0.0255 (0.0385)	0.1593* (0.0901)	0.3547** (0.1557)	9.2793** (1.0939)

Note: The values in parentheses are standard deviations.
*, **, *** significantly different from the mean for the preceding category at 0.10, 0.05 and 0.01 respectively.

Table III: Regressing Tobin's q on Environmental Standards and Control Variables (Environmental standards defined as 1, 2, 3)

	No fixed effects	Controlling industry fixed effects
Intercept	1.0501 (1.4391)	
R&D	27.046*** (4.8974)	21.7547*** (6.4408)
Adv	30.6467*** (4.9429)	26.0055*** (6.3677)
Leverage	-0.3386 (2.0266)	-2.2390 (2.3999)
% Foreign	-1.4577 (1.1423)	-1.4160 (1.3455)
Log(assets)	-0.0070 (0.1551)	-0.0178 (0.1981)
Environmental. Std	0.53485*** (0.1993)	0.4523** (0.2120)
N	104	104
R^2	0.5174	0.5953

Note: Numbers in parentheses are standard errors.
*, **, *** Significant at 10, 5 and 1% respectively

Table IV: Piece-wise linear regression of Tobin's q on Environmental Standards and Control Variables

	No fixed effects	Controlling industry fixed effects
Intercept	2.65871* (1.5040)	
R&D	26.6656*** (4.8638)	21.7786*** (6.3908)
Adv	30.3327*** (4.8180)	25.7406*** (6.3206)
Leverage	-1.5247 (2.0727)	-2.9432 (2.4260)
% Foreign	-1.8842 (0.1418)	-1.7561 (1.3537)
Log(assets)	-0.0620 (0.1548)	-0.0439 (0.1879)
ED 1 (U.S. vs. host country)	-0.4697 (0.4817)	-0.3215 (0.5516)
ED 2 (internal vs U.S. standard)	1.4497*** (0.4817)	1.1656** (0.5148)
N	104	104
R^2	0.5382	0.6063

Note: Numbers in parentheses are standard errors.
*, **, *** Significant at 10, 5 and 1% respectively
ED1 = 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.

Table Va: Residual for predicted Tobin's q regressed on lagged residuals of Tobin's q and Environmental Standards. In all regressions, industry and time fixed effects are controlled for.

	Model I	Model II	Model III
Residual of Tobin's q (t-1)	1.2276*** (0.0697)	1.2462*** (0.1084)	1.3516*** (0.1205)
Residual of Tobin's q (t-2)		0.0023 (0.1569)	0.2572 (0.2212)
Residual of Tobin's q (t-3)			-0.7325*** (0.1790)
Residual of Env Std (t-1)	-0.09054 (0.0903)	-0.1892 (0.1251)	-0.2026 (0.1691)
Residual of Env Std (t-2)		0.1554 (0.1150)	-0.1333 (0.1743)
Residual of Env Std (t-3)			0.0549 (0.1969)
N	252	162	72
R^2	.8856	.9011	.9375

Note: Numbers in parentheses are standard errors.
*, **, *** Significant at 10, 5 and 1% respectively

Table Vb: Residual for predicted Environmental Standards regressed on lagged residuals of Tobin's q and Environmental Standards. In all regressions, industry and time fixed effects are controlled for.

	Model I	Model II	Model III
Residual of Tobin's-q (t-1)	0.0058 (0.0078)	0.0159 (0.0223)	-0.0119 (0.0166)
Residual of Tobin's-q (t-2)		-0.0239 (0.0294)	-0.0271 (0.0374)
Residual of Tobin's-q (t-3)			0.0226 (0.0406)
Residual of Env Std (t-1)	0.7674*** (0.0501)	0.6391*** (0.1173)	0.7127*** (0.1511)
Residual of Env Std (t-2)		0.1875* (0.1059)	0.1129 (0.1206)
Residual of Env Std (t-3)			-0.0275 (0.0707)
N	252	162	72
R^2	0.6791	0.7264	0.7947

Note: Numbers in parentheses are standard errors.
*, **, *** Significant at 10, 5 and 1% respectively

Appendix A: Validation of IRRC Environmental Standard Measure

In this study, the focal independent variable *Environmental Standard (ENV STD)*, was derived from the Investor Responsibility Research Center's (IRRC) Corporate Environmental Profile. The variable is 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 US 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 does not exist, especially in developing countries. We therefore resorted to validating this assumption based on each firm's US "Toxic Release Inventory" (TRI), as reported in 1995[12]. The IRRC (Investor Responsibility Research Center) tracks US plants' TRI (in weight) and reports for each company its ratio of toxic releases to sales and industry averages. We first formed a variable, "relative emission," which is the difference between a firm's US toxic release/sales and industry average. We then examined how "relative emission" varies with a company's declared environmental standard. To ascertain that robustness in our results, we trim outliers that have student residual greater than or equal to three.

Table A1 reports the mean "relative emission" by each declared class of environmental standard. We find that firms that "default to local environmental standards" pollute more than an average firm in their industry, while the opposite is true for firms that claim to apply "US environmental standards" or an "internal stringent global standard," the last one being most statistically significant.

The ranking of the average "relative emission" follows our intuition. While the average "relative emission" of firms that apply the "US standards" seems to be the lowest, it is affected by one outlier. When the outlier is deleted, the average "relative emission" of the category retains only half of the reported magnitude. The ranking of the average

[12] We have data for both 1994 and 1995. Using 1994 data generates similarly results that are slightly less significant but are still acceptable at conventional level. We chose to use the 1995 data because our records on corporate environmental standard for 1995 are more complete.

"relative emission" then follow our intuition: firms that "default to host country environmental standards" have the highest relative emissions and firms that apply an "internal stringent global standard" have the lowest relative emissions. The average relative emission of firms that "default to local environmental standards" is statistically significantly higher than that of firms that apply "an internal stringent global standard," but not statistically significantly above those that apply "the US standard." The average "relative emission" of firms that apply the "US standard" is higher than the same average for firms that apply "an internal global standard."

We conducted a regression analysis. Notice that we did not need to control for industry wide effects because fixed industry effects have already been filtered out of the pollution measure by subtracting from it its industry mean. We controlled for firm size (log of total dollars of assets) because of possible economies (or diseconomies) of scale in "polluting". The regression results are 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 "US standards," but the difference is not statistically significant; and (iii) firms that apply "US standards" pollute more than firms that apply "an internal global standard," but the difference is not statistically significant.

While the tests are relatively simple, they provide evidence that the companies using a global environmental standard are relatively cleaner in the United States than those companies using host country standards abroad. Notice that the results only include U.S. data. Companies that use host country standards around the world can, by definition, export their dirtiest processes to lax jurisdictions, which is an option that is rejected by companies using a global standard. Thus, finding that the globally integrated strategy is associated with lower emissions in the U.S. supports our stance that the self-reported data are valid and meaningful.

Table A1: Means, correlation and t-test on Relative Emission

Declared environmental standard ---------- Relative Emission	Default to Host standards	Apply US standard	Apply an internal stringent global standard
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 (.125)	-2.368** (.021)
t- and prob-value when compared to "applying US standard"	--	--	.167 (.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.

Table A2 Regression of Relative Emissions in 1995 on Environmental Standard and on dummies indicating US standards and global standards

	A2-1	A2-2
Intercept	-1.588** (.666)	-1.857** (.723)
Environmental Standard (1,2 or 3)	-.342*** (0.111)	--
US Standards Overseas	--	-.418 (0.307)
Internal Global Standard	--	-.687*** (0.224)
Log (Assets)	.230*** (0.076)	.223*** (0.08)
N	82	82
R-square (Adjusted)	0.133	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.