

Environmental and financial performance:

Do industrial sectors differ in their ability to derive financial benefits from environmental actions?

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Abstract

This paper is based on our study (Darnall & Ytterhus 2005), which evaluates the link between facilities' environmental and financial performance and controls for endogeneity associated with improved environmental performance. These relationships were considered by relying on survey data from manufacturing facilities operating in Canada, France, Germany, Hungary, Japan, Norway and the United States (<http://www.oecd.org/env/eipc/resource/firm>). In addition to the "win-wins" analysis we also raised the question: Do industrial sectors differ in their ability to derive financial benefits from environmental actions? We made three types of comparisons:

- First we compared the financial performance of facilities operating within low polluting industries or "clean sectors" to facilities operating within high polluting industries or "dirty sectors".
- In the second stage of our sector analysis, we assessed whether facilities operating within two "dirty" sectors differed in their environmental performance and whether these differences were related to their financial performance (Hart & Ahuja 1996).
- Finally, we considered whether companies operating in "high growth" industries differed from companies operating in "low growth" sectors in whether they derived positive financial benefits from their environmental actions (Russo & Fouts 1997).

To assess the statistical relationship between facilities' financial and environmental performance among the sector comparisons, we relied on chi-square tests.

With respect to our sector analyses, facilities that operated in dirty and clean sectors, and in early mover and later mover sectors did not differ in whether or not they earned positive profits from their improved environmental performance. Low-growth sectors that accrued positive profits had more often reduced their use of natural resources and global pollutants than facilities in the same sector that did not accrue positive profits. However, these differences were modest, and for this reason, our overall conclusion therefore is that, based on the facilities in this sample: There is no empirical support to suggest that there are differences among industry sectors. These results are further corroborated by the lack of statistical significance found in our bivariate probit regression models when evaluating the links between firms' environmental and financial performance.

Background

The OECD project on 'Environmental Policy Design and Firm-level Management' (<http://www.oecd.org/env/eipc/resource/firm>) is exploring a number of issues at the interface between public and private environmental policy. Under the co-ordination of the OECD Environment Directorate, research teams collected data (2003) from approximately 4,200 firms from seven countries (Japan, Hungary, France, Germany, Norway, Canada and the United States) on issues such as environmental management and performance, as well as the public environmental policy context. The specific questions addressed in the project can be summarised as follows (Johnstone et al. 2005):

- How does the design of environmental policy frameworks affect management and decision-making within the firm?
- Does the application of different types of environmental policy instruments have different implications for firms' organisational and managerial responses?
- Do environmental management tools significantly improve the environmental performance of the firm?
- What public policy (and other factors) encourage the adoption of more innovative environmental practices?
- Does improved environmental performance generate commercial benefits (and what types of commercial benefits)?

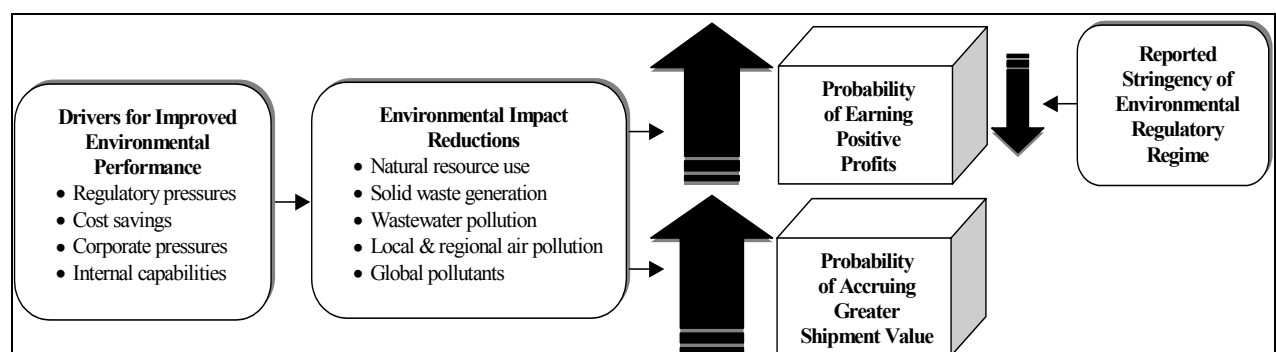
Our study (Darnall & Ytterhus 2005) evaluates the link between facilities' environmental and financial performance and controls for endogeneity associated with improved environmental performance. These relationships were considered by relying on survey data from manufacturing facilities operating in Canada, France, Germany, Hungary, Japan, Norway, and the United States and by utilizing simultaneous equation techniques. The findings indicate that facilities that reduced their environmental impacts increased the probability of earning positive profits (see figure 1). Moreover, in almost every instance, a facility's improved environmental performance also increased the probability of improving the value of its shipments. By contrast, the stringency of the environmental policy regime reduced a company's financial opportunities.

These findings offer evidence for the traditional economic view that that the current regulatory requirements constrain an organisation's financial opportunities (Friedman 1970; Christiansen & Haveman 1981; Conrad & Morrison 1989; Jaffe & Palmer 1997). However, these opportunities were recaptured if the facility took steps to reduce its impacts to the natural environment. That is, companies that improved their environmental performance experienced a net probability of earning positive profits.

Despite the fact that a more stringent regulatory regime reduced the probability that the facilities in our sample earned positive profits, pressure from regulators was an important motivator that encouraged companies to reduce their environmental impacts. As such, it appears that regulatory pressures are critical to achieving greater environmental improvements, and that while the stringency of the regulatory regime comes at a cost to the organization, these costs are compensated by the increased net probability that the organization will earn positive profits due to their environmental performance.

Our findings are illustrated in Figure 1:

Figure 1: Drivers, Environmental Performance and Probabilities for Improved Business Performance



Literature review

The results from prior research suggest that there appears to be a moderate positive relationship between a firm's environmental actions and its financial performance (see Table 1). These findings are not significant when evaluating short-run financial effects on stock market valuations, but are when taking a longer view (up to three years after the fact). While these results are encouraging, it is important to recognize that many estimation models used in previous studies did not consider that a firm's environmental performance is endogenous. That is, it is difficult to determine whether a firm's

environmental performance improved *because it was more efficient* at the onset, which in turn fueled their greater financial gains in the long run.

We therefore can be tempted to conclude that reducing a company's environmental impacts is very effective at improving its financial performance. However, this conclusion may be false. In fact, we do not know whether improved financial performance is due to environmental improvements, or due to the fact that the company already has good management practices prior to the reduction of its environmental impacts. As a result, studies undertaken which do not correct for endogeneity can cause misleading results. Therefore, the results of most prior studies must be interpreted with care and additional studies are needed to evaluate these relationships further. As of yet, none of the studies in table 1 have considered the environmental-financial performance among companies across different countries. This issue is particularly important since many more companies now operate globally.

Table 1: Summary of Prior Studies Evaluating the Link between Environmental and Financial Performance

Study	Financial Performance Measures	Environmental Performance Measures	Relationship	Endogeneity and/or Selection Bias Addressed?
Arora & Cason, 1995	ROA	33/50 TRI emissions	Positive relationship	No
Cormier et al., 1993	Intangible asset values	Water pollution discharges	Weak negative relationship	No
Hamilton, 1995	Stock price	TRI publication, TRI emissions	Negative relationship for TRI publication; no relationship for amount of emissions	Yes
Hart & Ahuja, 1996	ROS, ROA, ROE	TRI	Positive relationship in year 2	No
Khanna & Damon, 1999	ROI, Ratio of the valuation of intangible assets/sales	33/50 TRI emissions	Negative relationship with ROI; Positive relationship with intangible assets/sales	Yes
Konar & Cohen, 1997	Intangible asset values	TRI, Environmental lawsuits	Positive relationship for both measures	--
Laplante & Lanoie, 1994	Firms' equity value	Lawsuits, settlements, environmental incidents, investments in pollution abatement equipment	Negative relationship with settlements and investments	--
Levy, 1995	ROS, ROA, Growth	TRI	No relationship	No
Lanoie et al., 1998	Equity prices	Publication of non-compliers and heavy pollution emitters	No relationship, but sample was small	--
Rivera, 2002	Hotel room price and sales	Participation in voluntary environmental program	Positive relationship	Yes
Russo & Fouts, 1997	ROS	Compliance, abatement expenditures, support for NGOs	Positive relationship	No
Stanwick & Stanwick, 2000	Net income controlled by firm size	Formal environmental policy or description of environmental commitment	Positive relationship	No
Telle et al. 2004	ROS	Environmental plant level data from 1991 – 2001: Norwegian « polluting » industries (chemicals, basic metal, pulp and paper, other non-metallic minerals)	No significant relationship	Yes
Wagner et al. 2002	ROS, ROE and ROEC	Environmental data on emissions from European paper manufacturing firms	Negative relationship	Yes

-- = Relied on an event-history model and so endogeneity related to temporal ordering was not an issue.

Sectoral Analysis

In a complementary set of analyses about “win-wins”, we evaluated whether different sectors earned positive profits. We made three types of comparisons. First we compared the financial performance of facilities operating within low polluting industries or “clean sectors” to facilities operating within high polluting industries or “dirty sectors.” To classify facilities within these sectors, we relied on a taxonomy developed by the World Bank (Mani & Wheeler 1997) and Gallagher & Ackerman’s (2000) of manufacturing companies operating in the US.¹ “Clean” sectors were characterized as facilities operating within the fabricated metal products, industrial machinery, electronics, transportation equipment, instrumentation, and textile sectors (ISICs 17, 28, 29, 31, 33 and 35). “Dirty” sectors included pulp & paper, chemical, petroleum refining, primary metal and basic metal industries (ISICs 21, 24, 26 and 27). The environmental and financial performance of companies operating within these two types of manufacturing industries was then compared.

Hypothesis 1: Does the Environmental/Financial Performance Relationship Differ among “Dirty” and “Clean” Sectors?

In the second stage of our sector analysis, we assessed whether facilities operating within two “dirty” sectors differed in their environmental performance and whether these differences were related to their financial performance. More specifically, we compared whether facilities within the chemical industry that accrued positive profits and increased the value of their shipments also implemented different environmental practices and reduced their environmental impacts to a greater extent than companies operating in the pulp & paper sector. The chemical industry was selected because it has been seeking to voluntarily reduce its impacts to the environment since the 1980s in an effort to improve its overall environmental performance and public image (King & Lenox, 2001; Hart & Ahuja, 1996). For this reason, we classified the chemical industry as an “early environmental mover.” By contrast, the pulp and paper industry began later to consider voluntarily reduce its environmental impacts across the entire sector (Hart & Ahuja, 1996), making it a “late environmental mover.” The relationship between environmental and financial performance of companies operating within in these two sectors was then compared.

Hypothesis 2: Does the Environmental/Financial Performance Relationship Differ among “Early Movers” and “Late Movers”?

Finally, we considered whether companies operating in “high growth” industries differed from companies operating in “low growth” sectors in whether they derived positive financial benefits from their environmental actions. This last sector-level analysis was motivated by prior research suggesting that industry growth facilitates the financial benefits that an organization derives from its environmental improvements (Russo and Fouts, 1997). According to Russo & Fouts (1997), industry growth moderates the relationship between environmental and economic performance for several reasons. First industry growth accelerates the maturation of technologies within that industry and as a result, firms that invest in pollution prevention have a higher prospective return than firms in low-growth industries. The argument here is that the newness of the capital stock improves a company’s financial and environmental performance. Moreover, high-growth industries have a more organic (rather than bureaucratic) management style, and may therefore reap capture additional financial benefits by going beyond compliance because of their innovative culture. Finally, Russo and Fouts (1997) argue that is easier to create a reputation for environmental stewardship in a high-growth industry rather than a low-growth industry.

Hypothesis 3: Environmental / financial relationships differ among ‘low-growth’ and ‘high-growth’ industries

To determine which companies operated in high and low growth sectors, we asked respondents whether or not they experienced a change in the value of their shipments. We then sorted the companies based on the proportion of respondents within each sector that indicated they increased or significantly increased the value of their shipments in the last three years. Companies operating in sectors with the largest proportion of respondents indicating an increased value of shipments

¹ While relying on a classification of manufacturing companies in OECD countries would have been more appropriate, such a classification did not exist.

(electronics) were considered “high growth” industries, whereas companies operating in sectors with the lowest increased value of their shipments (food) were considered “low growth” industries.

To assess the statistical relationship between facilities’ financial and environmental performance among the sector comparisons, we relied on chi-square statistical tests.

Results

Hypothesis 1: Does the Environmental/Financial Performance Relationship Differ among “Dirty” and “Clean” Sectors?

In assessing the relationship between facilities’ environmental and financial performance across dirty and clean sectors, we hypothesized that larger financial benefits would accrue to facilities operating in dirtier industries and that also reduced their environmental impacts. Our rationale was that these companies could reduce their impacts to the natural environment at a lower cost because they have more “low hanging fruit” that can be picked more easily. However, achieving the same environmental improvements for companies operating in cleaner industrial sectors would cost significantly more. As a result, the positive profit for environmental actions taken by facilities operating in clean sectors was expected to be less.

Relying on Mani & Wheeler (1997) and Gallagher & Ackerman’s (2000) classification of “clean” and “dirty” manufacturing sectors, we assessed whether the relationship between environmental and financial performance differed. In evaluating environmental performance, we evaluated whether or not companies reduced their environmental impacts. Table 2 compares whether clean sectors differed from dirty sectors in their ability to earn positive profits. The results show that a greater proportion of more facilities that accrued positive profits operated in dirty sectors, as compared to the proportion of facilities that did not earn positive profits and operated in the same sectors. Approximately 4.4 percent more companies that earned positive profits operated in dirty sectors. By contrast, about 5 percent fewer companies earned positive profits and operated in cleaner sectors.

Table 2: Relationship between Financial Performance and Clean versus Dirty Sectors⁺

Facility Characteristic	Profit [†]
	positive/ break even or negative
Clean sector (n=3939; n=3966)	31.7%*** 36.8%
Dirty sector (n=3939; n=3966)	30.8%*** 26.4%

+ Clean sectors are ISICs 17, 28, 29, 31, 33, and 35. Dirty sectors are ISICs 21, 24, 26, and 27.

† Top values represent facilities that earned positive profits the past three years and that operated in a particular sector. Bottom values represent facilities that did not accrue positive profits and operated from the same sector.

* Statistically significant at $p \leq .10$; ** Statistically significant at $p \leq .05$; *** Statistically significant at $p \leq .01$

To consider these relationships further, we compared companies’ environmental practices to their financial performance. In comparing differences among the clean sectors and the dirty sectors, companies operating in dirty sectors reduced their environmental impacts proportionately to clean sector companies (see Table 3). For example, 54.3 percent of companies in dirty sectors that earned positive profits reported that they also had reduced their use of natural resources. Similarly, 54.5 percent of clean sector facilities that accrued positive profits also reduced their impacts to natural resources.

Table 3: Relationship between Clean/Dirty Sectors⁺ with Positive Financial Performance and Reduction in Environmental Impact

Reductions in	Facility Comparisons [†]	
	Profit in clean sectors positive/ break even or negative ¹	Profit in dirty sectors positive/ break even or negative ²
Use of natural resources (n = 1129, 1032)	54.5% 50.8%	54.3% 52.1%
Solid waste generation (n= 1151, 1044)	56.1% 55.3%	58.5%* 52.4%
Wastewater effluent (n= 1003, 949)	39.6% 38.4%	46.2% 43.0%
Local or regional air pollution (n= 850, 853)	39.8% 35.3%	46.4% 44.0%
Global pollutants (n= 684, 699)	35.7% 34.8%	36.1% 33.2%

⁺ Clean sectors are ISICs 17, 28, 29, 31, 33, and 35. Dirty sectors are ISICs 21, 24, 26, and 27.

[†] Top values represent facilities within the sector that earned positive profits during the past three years and that indicated they had reduced their environmental impacts. Bottom values represent facilities within the sector that had did not accrue positive during the past three years and that indicated they reduced their environmental impact.

* Statistically significant at $p \leq .10$; ** Statistically significant at $p \leq .05$; *** Statistically significant at $p \leq .01$

In comparing differences within the clean sectors and the dirty sectors, in only one instance did facilities that operated in dirty sectors, and that accrued positive profits, also reduced their impact to the natural environment. More specifically, 58.5 percent of companies in dirty sectors that earned positive profits reported that they also had reduced their solid waste generation. Clean sector facilities that earned positive profit did not reduce their impacts to natural resources, solid waste, wastewater, air pollution and global pollutants any more than facilities in the same sectors that did not accrue positive profits. In sum, our findings indicate that there was no statistically significant relationship between facilities' positive financial performance and their environmental performance in both the "dirtiest" and "cleanest" sectors over the last three years. It is important to note, however, that within dirty and clean sectors, there is likely to be differences in the extent to which these companies have reduced their environmental impacts. As such, high environmental performance may be pooled with low environmental performers within each sector. These differences may create the appearance that cleaner facilities do not benefit financially. For this reason, in addition to drawing comparisons across dirty and clean sectors, future research should study the extent to which companies differ within these sectors.

Hypothesis 2: Does the Environmental/Financial Performance Relationship Differ among "Early Movers" and "Late Movers"?

In comparing facilities that operated in "early environmental mover" sectors and "late environmental mover" sectors, we compared whether companies within the chemical industry derived greater financial benefits from their environmental actions than companies operating in the pulp & paper sector (Hart & Ahuja 1996). These sectors were chosen because the chemical industry has been participating in voluntary environmental programs since the 1980s to improve their overall environmental performance (Khanna & Damon 1999). We therefore defined these companies as "early movers" within the most polluting industries when it came to addressing their environmental impacts. By contrast, the pulp and paper industry began at a later time to consider voluntarily reducing its environmental impacts across the entire sector (Hart & Ahuja 1996). For this reason, we considered it a "late mover" among the most polluting manufacturing sectors when it came to reducing its environmental impacts. The environmental and financial performance of companies operating within these two sectors was then compared.

Our hypothesis was that late movers would derive more low-cost environmental improvements (Hart & Ahuja 1996) and therefore reap greater financial benefits than early movers. By contrast, "early movers" would have already collected the benefits of their low-cost environmental improvements. As a result, their "low hanging fruit" would have long since been picked, and they would be less likely to

derive a financial benefit from their environmental improvements. This hypothesis is based on the notion that there are diminishing returns on environmental actions.

The results of our chi-square analyses showed that there were no statistical differences among early or late movers and whether their reduced impacts to the natural environment were associated with earning positive profits (see Table 4). There also was no consistent pattern suggesting that late movers who accrued positive profits and reduced their environmental impacts did so more frequently than early movers. However, it is important to note, that this study evaluated facilities' activities for one point in time and would benefit from data that were collected at over multiple time periods. Time series panel data would allow us to compare facility responses longitudinally and determine the temporal ordering of specific events. Such information would offer more rigorous evidence for the relationships we have studied.

Table 4: Relationship between Early- /Late- Mover Sectors⁺ with Positive Financial Performance and Reduction in Environmental Impact

Reductions in	Facility Comparisons [†]	
	Profit for Early Movers positive/ break even or negative ¹	Profit for Late Movers positive/ break even or negative ²
Use of natural resources (n= 262, 126)	53.0% 50.6%	55.0% 67.4%
Solid waste generation (n= 266, 129)	54.9% 47.6%	59.2% 60.4%
Wastewater effluent (n= 250, 121)	46.8% 43.0%	52.6% 62.2%
Local or regional air pollution (n= 233, 110)	50.9% 50.0%	42.7% 50.0%
Global pollutants (n= 188, 95)	39.2% 28.6%	35.7% 43.6%

⁺ Early movers are chemical companies in ISIC 24. Late movers are pulp and paper companies in ISIC 21.

[†] Top values represent facilities within the sector that earned positive profits during the past three years and that indicated they had reduced their environmental impacts. Bottom values represent facilities within the sector that had did not accrue positive during the past three years and that indicated they reduced their environmental impact.

* Statistically significant at $p \leq .10$; ** Statistically significant at $p \leq .05$; *** Statistically significant at $p \leq .01$

Hypothesis 3: Environmental / financial relationships differ among 'low-growth' and 'high-growth' industries

In the final component of our sector analysis, we considered whether companies operating in "high growth" industries differed from companies operating in "low growth" sectors in whether they derived positive financial benefits from their environmental actions. This analysis was motivated by prior research suggesting that industry growth facilitates the financial benefits an organization derives from its environmental improvements (Russo & Fouts 1997).

According to Russo & Fouts (1997), industry growth moderates the relationship between environmental and economic performance for several reasons. First industry growth accelerates the maturation of technologies within that industry and as a result, firms that invest in pollution prevention have a higher prospective return than firms in low-growth industries. The argument is that the newness of the capital stock improves a company's financial and environmental performance. Moreover, high-growth industries have a more organic (rather than bureaucratic) management style, and may capture additional gains by going beyond compliance because of their innovative culture. Finally, it is easier to create a reputation for environmental stewardship in a high-growth industry rather than a low-growth industry.

To determine which companies operated in high and low growth sectors, we asked our survey respondents whether or not they experienced a change in the value of their shipments. Companies operating in sectors with the largest increase in the value of their shipments (electronics) were

considered “high growth” industries, whereas companies operating in sectors with the lowest change in the value of their shipments (food) were considered “low growth” industries.

Our results showed that companies operating in low growth sectors and that earned positive profits reduced their environmental impacts to natural resources and global pollutants more than companies in this same sector that did not earn positive profits (see Table 5). However, there were no statistical differences among low-growth and high-growth sectors and whether or not they reduced their solid waste, wastewater effluent, and local or regional air pollution.

Table 5: Relationship between Low- /High-growth Sectors⁺ with Positive Financial Performance and Reduction in Environmental Impact

Reductions in	Facility Comparisons [†]	
	Profit for Low-growth industry positive/ break even or negative ¹	Profit for High-growth industry positive/ break even or negative ²
Use of natural resources (n= 358, 126)	57.2%*** 39.5%	55.0% 67.4%
Solid waste generation (n= 349, 129)	48.2% 46.1%	59.3% 60.4%
Wastewater effluent (n= 355, 121)	44.4% 40.0%	52.6% 62.2%
Local or regional air pollution (n= 267, 110)	32.5% 36.1%	42.7% 50.0%
Global pollutants (n= 214, 95)	31.6%*** 19.2%	35.7% 43.6%

⁺ Low growth facilities are in food products (ISIC 15). High growth facilities are in electronics (ISIC 31).

[†] Top values represent facilities within the sector that earned positive profits during the past three years and that indicated they had reduced their environmental impacts. Bottom values represent facilities within the sector that had did not accrue positive during the past three years and that indicated they reduced their environmental impact.

* Statistically significant at $p \leq .10$; ** Statistically significant at $p \leq .05$; *** Statistically significant at $p \leq .01$

In sum, compared to our prior two sector comparisons, associations between environmental improvements and facilities’ financial performance existed, but were modest. For companies in the high growth sectors, the lack of a statistical relationship was especially obvious. However, unlike the comparison among clean and dirty sectors and early and late movers, some differences did exist among companies operating in low growth sectors. That is, low growth sector facilities that accrued positive profits reduced their environmental impacts to natural resources and global pollutants more than facilities in this same sector that did not accrue positive profits. Our findings therefore do not support the arguments put forward by Russo & Fouts (1997) suggesting that facilities in high growth sectors are more likely to derive positive financial benefits from their environmental actions.

The results of all our sector analysis are elaborated in Table 6. Overall, they indicate that facilities did not derive financial benefits as a result of facilities’ reductions in their environmental impacts in that only companies in low growth sectors that accrued positive profits also reduced their impacts to the natural environment. However, it is important to note that there are likely to be differences among companies within each of the sectors we compare. For example, facilities operating in clean sectors have a range of environmental performance, as do facilities operating in dirty sectors. By aggregating the facilities, and evaluating environmental performance at one point in time, we cannot account for these distinctions. Such differences may create the appearance that cleaner facilities within cleaner sectors do not benefit financially. For this reason, in addition to drawing comparisons across different sectors, future research should study the extent to which companies differ within the same sectors over time.

Table 6: Increased profits and Environmental Actions among Different Industrial Sectors

Comparison Group	Earned Positive Profits Associated with Reduced Impacts to the Environment
<ul style="list-style-type: none"> Facilities Operating in Clean versus Dirty Sectors 	No significant differences
<ul style="list-style-type: none"> Early versus Late Movers Operating in Dirty Sectors 	No significant differences
<ul style="list-style-type: none"> Facilities Operating in Low- versus High-growth Industries 	Modest differences—Low growth sector that accrued positive profits reduced their use of natural resources and global pollutants more than companies in the same sector that did not accrue positive profits.

Conclusions, limitations and future research

With respect to our sector analyses, facilities that operated in dirty and clean sectors, and in early mover and later mover sectors did not differ in whether or not they earned positive profits from their improved environmental performance. Low-growth sectors that accrued positive profits had more often reduced their use of natural resources and global pollutants than facilities in the same sector that did not accrue positive profits. However, these differences were modest, and for this reason, our overall conclusion therefore is that, based on the facilities in this sample: There is no empirical support to suggest that there are differences among industry sectors. These results are further corroborated by the lack of statistical significance found in our bivariate probit regression models when evaluating the links between firms' environmental and financial performance.

There are a couple limitations to our research design. First, our data were obtained using self-reported information rather than secondary sources. Many studies evaluating environmental performance have generally relied on the U.S. Toxic Release Inventory (TRI), because these data are widely available. However, international comparisons of facility-level environmental performance using these data are not possible because TRI data are not collected in all countries. Rather, environmental ministries use different metrics and indicators to assess environmental performance, which makes cross-country comparisons a challenge. Similarly, prior studies that evaluate the relationship between environmental strategy and business performance have relied on stock performance, pricing, sales, intangible assets, and return on sales, equity, investment and assets. However, these data are available only for publicly traded firms and therefore a facility-level study of both publicly traded and privately owned enterprises is not possible. By focusing on a broader population of organizations, we have sacrificed greater specificity in our analysis. Such a sacrifice, however, also strengthens our work because our results have broader applicability.

A second limitation of our research is that self-reported data may be biased in that environmental managers may have misrepresented their facility's environmental impacts and business performance. From the onset of this study, we believed that respondents would consist of facilities with more ambitious environmental strategies. We further believed that respondents would want to describe their environmental strategies as being more rigorous than they actually were. While our results suggest that facility managers were not reluctant to identify the shortcomings of their environmental and financial performance, the potential bias would tend to reduce the variance in our sample. As such, we would be less likely to find statistically significant relationships. However, by finding statistically significant relationships, additional evidence is offered about the strength of the relationship between the variables in our models (Hardin & Hilbe, 2001).

One way to increase the rigor of this research would be to do more country-specific analyses that draw on data from other sources. For example, in estimating a facility's financial performance, publicly available financial data could be gathered to supplement the OECD database. Similarly, combining the data used in this study with publicly available data related to facilities' environmental violations and fines, and toxic environmental releases would provide a more complete view of a company's environmental performance. These additional data would allow for analyses that would assess the

specific types of regulatory approaches (notices of violation, fines, information-based policies) that increase the probability that an organization will reduce its impacts to the natural environment and benefit financially.

Similarly, this research evaluated a panel of facilities for one point in time and would benefit from data that were collected longitudinally. Time series panel data would allow us to compare facility responses over multiple periods and determine the temporal ordering of specific events. Such information would offer more rigorous evidence for the relationships we have studied.

There is still much to learn about the relationship between environmental regulations, facilities' environmental performance, and the impact both factors have on an organization's financial performance. Our study offers evidence about the robustness of these relationships across seven countries. Such information is useful to policy makers, managers, and researchers alike in helping them understand the potential benefits facilities can accrue by undertaking ambitious environmental strategies.

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