

# Does environmental compliance pay?

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**This paper examines the relationship between the environmental compliance and financial performance of large US companies. The environmental performance is measured in penalties assessed for violations of environmental regulations. The financial performance is represented by the profit margins. The regression models developed in this paper suggest that the degrees of environmental compliance have a positive influence on the profit margins. Conventional economic wisdom is that regulations impose costs and restrictions and, therefore, put companies at a competitive disadvantage. However, this paper is consistent with the proponents of environmental regulations who argue that tough regulations force companies to be innovative and as a result make them more productive.**

*Keywords:* regulations; performance; competitive advantage

## Introduction

Over the last 25 years, unprecedented improvements in environmental quality have taken place in the US. The air most Americans breathe is pure, six in ten rivers and streams are suitable for fishing and swimming and most dangerous waste sites have been identified and are being cleaned. Although Americans are driving more miles, auto-emissions have been cut down significantly. According to the US Environmental Protection Agency (1994), total releases by industry had been cut down to 3.2 billion lb (approximately 1.5 billion kg) in 1992 from 4.9 billion (nearly 2.25 billion kg) in 1988. However, these improvements have been achieved at a very high cost. Americans pay approximately \$110 billion a year to reduce pollution and environmental degradation and this expenditure is rising. As a proportion of gross domestic product, US environmental spending is approximately 2.2% as compared with 1.6–1.8% for Germany and 1–1.5% for Japan. Command and control regulations have severely restricted industry's ability to decide on its production problems. This has resulted in suboptimal choices about technologies, product designs, product mixes and plant locations. Studies show that environmental regulations reduce productivity (Gray and Shadbegian, 1995). Environmental regulations are blamed for rising lay-offs. Companies argue that environmental regulations are putting them at a severe competitive disadvantage with companies operating in other countries

as those companies are not subjected to the same stringent regulations. In addition, they claim that stringent environmental regulations are driving new plants and jobs abroad.

The purpose of this paper is to examine whether non-compliance with environmental regulations provides any competitive advantage to companies. The question being addressed in this paper is whether lack of compliance creates an uneven playing field in a competitive market. The compliance with environmental regulations is measured in total amounts of penalties assessed under various environmental regulations normalized by domestic sales. The pay-off is measured in profit margins.

## Background

According to Abelson (1993), there is a 'pathological growth of regulations' in the US. The US Environmental Protection Agency answered to more than 90 committees and subcommittees in 1993 as compared to a mere 15 in the 1970s. The direct annual cost of complying with these requirements is more than \$500 billion. More than 125 000 federal bureaucrats are formulating more regulations. Besides the US Congress, states and towns are formulating their own laws of further compliance for companies. Rising threats of lawsuits are forcing companies to change operations to reduce the consequences of legal actions rather than to take advantage of the benefits of environmental planning. During the 1980s, on average approximately 100 were indicted for environmental crimes each year; seven in ten involved in criminal indictments were individuals, 12% were publicly traded stock companies, the median criminal fine for an organization was \$50 000 and was rising and approximately one in three individuals

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convicted along with their corporate employers was to serve 7 months in jail and more than one in two individuals convicted without a corporate defendant was to serve 18 months of jail time (Tietenberg, 1991). According to the US Department of Justice, criminal indictments rose from approximately 40 in 1983 to 174 in 1992. The federal fines collected in 1992 exceeded \$163 million. The value of federal environmental actions approached \$2 billion in 1992 (Council on Environmental Quality, 1993). Therefore, it is of no surprise that compliance with regulations is the top environmental concern of most business leaders according to a survey conducted by McKinsey & Company (1994).

There are two schools of thought on environmental regulations. According to opponents, environmental regulations reduce productivity, destroy jobs, waste resources and drive new plants and investments abroad. For example, Walley and Whitehead (1994) argued that highly profitable environmental projects have been identified and it will be hard for companies to come up with so called 'win-win' projects that will produce positive returns. They also argued that environmental regulations are destroying stock market values of corporations and, therefore, managers should consider shareholder values rather than compliance, emissions or costs when evaluating environmental issues. On the other hand, Porter and van der Linde (1995) argued that innovations and resource productivity caused by regulations will make companies more productive and competitive. Green processes will increase yields, improve utilization of by-products, reduce material handling costs, make work places safer and reduce waste disposal costs. Green products will reduce product costs, cut down packaging costs and improve product resale and scrap values.

Lower emissions should mean lower costs. The wastes discharged consist of materials, labour and equipment hours for which a company has paid. Waste management activities do not add value, instead they add costs of handling, transportation and disposal. Higher pollution typically means inefficient manufacturing processes. Lower pollution improves process yields, enhances the utilization of by-products, lowers energy consumption, makes work places safer and ultimately reduces product costs. The product with higher quality, lower packaging, easy disposal and higher safety secures higher market shares and premium prices. For example, chlorine-free papers secured an initial premium of approximately 25% and 'green' refrigerators 5–10%. Higher prices and lower costs should, therefore, offer higher profit margins to companies producing less pollution (see Figure 1).

#### Data sources

The *Corporate Environmental Profiles Directory* prepared by the Investor Responsibility Research Center (1993) is the major source of data for environmental compliance. This directory contains environmental performance data of large

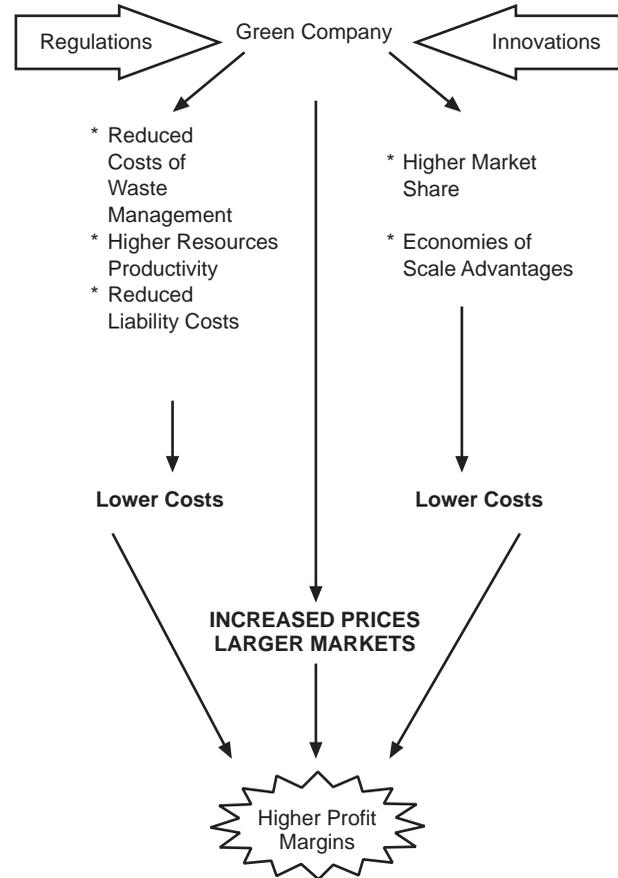


Fig. 1. Relationship between compliance and profit margins.

US companies belonging to the Standard and Poor 500 index. The compliance data is represented by the total value of penalties assessed under the Resource Recovery and Recovery Act (RCRA), Clean Air Act (CAA), Clean Water Act (CWA), Safe Drinking Water Act (SDWA), Toxic Substances Control Act and Federal Insecticide, Fungicide and Rodenticide Act (TSCA/FIFRA), Occupational Safety and Health Act (OSHA), Atomic Energy Act (AEA), Mining Safety and Health Act (MSHA) and Endangered Species Act (ESA). The penalties include all reported criminal, civil and administrative penalties assessed against companies for violating a particular environmental law. The penalties are adjusted by dividing the total penalties by domestic revenues for each year. The mean penalty per \$1 million of revenue is used as a measure for environmental compliance. A higher penalty per \$1 million of revenue represents a higher degree of non-compliance. The financial performance is measured in profit margins. The financial data is from the Compustat database.

#### Methodology

The objective of this paper is to analyse the impact of compliance on profit margins (sales less cost of goods sold).

It is assumed that the production function of a business can be represented by a Cobb–Douglas function. The inputs consist of assets and labour (employees). The production function can be written as profit margin = constant (assets)<sup>a<sub>1</sub></sup>(labour)<sup>a<sub>2</sub></sup>. Taking the logarithm of both sides of the equation and replacing log of the constant by a<sub>0</sub>, we obtain

$$\begin{aligned} \log \text{ profit margin} &= a_0 + a_1 \log \text{ assets} \\ &+ a_2 \log \text{ employees} + \text{error terms} \end{aligned} \quad (1)$$

The effects of research and development, advertisement expenses, age of the plant and degrees of environmental non-compliance are incorporated by rewriting Equation 1 as

$$\begin{aligned} \log \text{ profit margin} &= a_0 + a_1 \log \text{ assets} \\ &+ a_2 \log \text{ employees} + a_3 \log \text{ R\&D} \\ &+ a_4 \log \text{ advertisement} \\ &+ a_5 \text{ age} + a_6 \log (\text{penalties/sales}) + \text{error terms} \end{aligned} \quad (2)$$

Assets should have a positive influence on profit margins. When assets increase, the profit margins typically increase. Similarly, when the number of employees is increased, the profit margin should increase. Therefore, both *a*<sub>1</sub> and *a*<sub>2</sub> should be positive. Research and development spending should result in increased profit margins and therefore *a*<sub>3</sub> should also be positive. Since advertisement expenditure should positively affect profit margins, the sign of *a*<sub>4</sub> should be positive. Older plants typically have lower productivity and therefore should affect profit margins negatively. *a*<sub>5</sub>, therefore, should be negative.

It is also possible to rewrite Equation 2 by dividing penalties/sales by the industry mean of penalties/sales to account for industry effects:

$$\begin{aligned} \log \text{ profit margin} &= b_0 + b_1 \log \text{ assets} \\ &+ b_2 \log \text{ employees} + b_3 \log \text{ R\&D} \\ &+ b_4 \log \text{ advertisement} \\ &+ b_5 \text{ age} + b_6 \log (\text{penalties/sales normalized by} \\ &\quad \text{industry mean}) + \text{error terms} \end{aligned} \quad (3)$$

To remove any fixed effects for different companies, Equation 2 can be rewritten as

$$\begin{aligned} (\log \text{ profit margin}_{1990} - \log \text{ profit margin}_{1988}) & \\ &= c_1 (\log \text{ assets}_{1990} - \log \text{ assets}_{1988}) \\ &+ c_2 (\log \text{ employees}_{1990} - \log \text{ employees}_{1988}) \\ &+ c_3 (\log \text{ R\&D}_{1990} - \log \text{ R\&D}_{1988}) \\ &+ c_4 (\log \text{ advertisement}_{1990} - \log \text{ advertisement}_{1988}) \\ &+ c_5 \text{ age} + c_6 \log (\text{penalties/sales}) + \text{error terms} \end{aligned} \quad (4)$$

In Equation 4, the subscripts represent years.

The company data about assets, number of employees, research and development expenditures, advertisement expenditures, age of the plant and profit margins are from the Compustat database for the years 1987 and 1990. The compliance data for individual companies is the mean of the years 1988–1990. Various parameters can be computed by regressing logarithms of profit margins against logarithms of assets, number of employees, research and development expenditures, advertisement expenses and penalties and the age of the plant.

### Empirical results

The regression outputs using Equations 3–5 are given in Table 1. In model 1, profit margins are regressed against assets, employees, research and development expenses, advertisement expenses, age of the plant and penalties per \$1 million of revenue. The signs are as expected and are statistically significant at the 95% level. The *F* value indicates that the probability of all parameters being zero is very low. The *R*<sup>2</sup> value of 0.872 suggests that the variations in the dependent variables can explain approximately 87.42% of the variations in the profit margins. The sign for the penalties' parameter is negative, suggesting a negative relationship between environmental non-compliance and profit margins. This result is statistically significant at the 95% confidence level.

Model 1 can be modified by replacing penalties/sales by penalties/sales normalized by industry means. Penalties/sales of each company can be divided by industry mean penalties/sales. There is not much change in the regression results. The signs are as expected. The *F* value suggests that the probability that all parameters are zero is very low. The *R*<sup>2</sup> value of 0.8878 indicates that the independent variables explain approximately 89% of the variations in the dependent variable. The sign for the parameter of penalties/sales normalized by industry means is negative. This indicates that there is a negative relationship between non-compliance and profit margins. However, statistical significance suggests that there is only approximately 0.7278 confidence in this conclusion.

Model 3 removes any fixed effects different companies might have on profit margins. The data for 1988 and 1990 is used. Again the *F* statistic suggests that the probability that all parameters are zero is very low. The *R*<sup>2</sup> value of 0.8986 indicates that the significant variations in the dependent variable are explained by independent variables. The signs are as expected. The sign for a non-compliance term is negative suggesting negative relationships between non-compliance and profit margins. The statistical significance of this result is >0.95.

To sum up, based on the above results, it is possible to state confidently that non-compliance negatively influences the profit margins of companies. In other words, non-compliance does not create an uneven playing field and a

**Table 1.** Regression models for profit margins**Model 1**

log profit margin =  $a_0 + a_1 \log \text{assets} + a_2 \log \text{employees} + a_3 \log \text{R\&D} + a_4 \log \text{advertisement} + a_5 \text{age} + a_6 \log (\text{penalties/sales}) + \text{error terms}$

| $a_0$          | $a_1$          | $a_2$          | $a_3$          | $a_4$          | $a_5$           | $a_6$            |
|----------------|----------------|----------------|----------------|----------------|-----------------|------------------|
| 1.116 (0.0001) | 0.650 (0.0001) | 0.235 (0.0001) | 0.021 (0.0012) | 0.027 (0.0002) | -0.000 (0.0383) | -0.0361 (0.0381) |

Number of observations = 187

Prob >  $F = 0.0001$

$R^2 = 0.8742$

**Model 2**

log profit margin =  $b_0 + b_1 \log \text{assets} + b_2 \log \text{employees} + b_3 \log \text{R\&D} + b_4 \log \text{advertisement} + b_5 \text{age} + b_6 \log (\text{penalties/sales normalized by industry mean}) + \text{error terms}$

| $b_0$          | $b_1$          | $b_2$          | $b_3$          | $b_4$          | $b_5$           | $b_6$           |
|----------------|----------------|----------------|----------------|----------------|-----------------|-----------------|
| 1.085 (0.0001) | 0.644 (0.0001) | 0.250 (0.0001) | 0.022 (0.0004) | 0.032 (0.0001) | -0.000 (0.0284) | -0.021 (0.2728) |

Number of observations = 184

Prob >  $F = 0.0001$

$R^2 = 0.8878$

**Model 3**

(log profit margin<sub>1990</sub> - log profit margin<sub>1988</sub>) =  $c_1 (\log \text{assets}_{1990} - \log \text{assets}_{1988}) + c_2 (\log \text{employees}_{1990} - \log \text{employees}_{1988}) + c_3 (\log \text{R\&D}_{1990} - \log \text{R\&D}_{1988}) + c_4 (\log \text{advertisement}_{1990} - \log \text{advertisement}_{1988}) + c_5 \text{age} + c_6 \log (\text{penalties/sales}) + \text{error terms}$

| $c_0$           | $c_1$           | $c_2$           | $c_3$           | $c_4$           | $c_5$            | $c_6$            |
|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|
| 0.0476 (0.3647) | 0.6939 (0.0001) | 0.2013 (0.0002) | 0.1180 (0.0458) | 0.0338 (0.0458) | -0.0000 (0.0242) | -0.0447 (0.0394) |

Number of observations = 186

Prob >  $F = 0.0001$

$R^2 = 0.8986$

Numbers in parentheses represent the level of statistical significance.

company cannot generate superior financial results by ignoring environmental laws.

### Conclusions

The US spends more on pollution abatement as a proportion of gross domestic product than any other country in the world. Many policy makers fear that the US cannot afford the additional costs of stronger environmental regulations and, therefore, are demanding curtailment of environmental regulations at the federal level. This paper examines the relationship between the degrees of environmental compliance and profit margins of large US companies. A positive relationship between compliance and profitability is found based on the regression models. The analysis presented in this paper suggests that companies with higher degrees of compliance have greater profit margins. Contrary to the conventional wisdom that compliance reduces profitability, the analysis presented in this paper suggests that non-compliance does not bestow any competitive advantage on companies. According to Porter (1990), 'strict government regulations can promote competitive advantage by stimulating and upgrading domestic demand'. Tough product standards can force companies to respond to consumer demands. The relaxation of standards is counterproductive. The conclusion in the present paper is consistent with Porter (1990) hypothesis.

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