Journal of Business Studies, Volume VIII, 2016, (ISSN: 0975-0150)

Environment Performance and Stock Market Valuation: Evidence from Indian Firms

Shivananda Shetty*

Abstract

The objective of this paper is to examine the relationship of a firm's environmental performance with its financial performance in a developing economy wherein the traditional command and control mechanism is predominant and the enforcement is weak. The study focuses on the firms in steel, power and cement sectors in India which are not only key contributor to the economic growth but also categorised as highly polluting sectors. The environment performance is represented by an index covering the regulated pollutants and the unregulated resources which proxies the firms environmental performance. We find a nonlinear negative relationship between the firm's market value and its pollution and resource utilization index respectively. The magnitude of market impacts are small as compared to the overall market value of the firms due to the lack of enforcement and low probability of being penalised.

1. Introduction

Environmental performance, encompassing the control of pollution and stewardship of natural resources, is of growing concern in both advanced and developing economies (Esty and Porter 2002). The Twelfth Five Year Plan has recommended various measures to strengthen the existing command and control mechanism and additionally use of market based policy mechanism like tax, voluntary disclosure etc. to encourage the firms to voluntarily improve their environmental performance. The implementation of command and control for regulated and unregulated pollutants are administratively difficult, slow and costly (Khanna, 2002). Similarly implementation of market mechanism like pollutant tax, trading mechanism takes time and is complex (Stoeckl, 2004). Hence encouraging the firm to voluntarily reduce the pollutants is seen as less expensive and efficient instrument. The key assumption for encouraging the voluntary programs is that it allows the firm to choose the least cost method to improve their environment performance which improves the profitability due to the reduced cost of input material usage, reduced cost due to less waste disposal, reduced regulatory scrutiny, less public and community pressure and increased product value and firm competitiveness due to consumer demand for green product (Arora and Cason, 1994). Moreover, the poor environmental performance has significant negative effect on the intangible value of the publicly traded firm (Konar and Cohen, 2001). Hence investigating the relationship between the environmental and financial performance of the firms in a developing country context will enable the regulators to effectively use the voluntary disclosure policy mechanism which is relatively less expensive and easy to implement.

Though India has extensive regulations for environmental compliance; the lack of enforcement has resulted in increasing pollution from the industries (Kumar and Managi, 2009). The noncompliance has been attributed to high cost of mitigation, the over ambitious law which results in high marginal abatement cost and the

Keywords:

Environment Performance, stock market, Tobin Q, Pollution Index, Market Valuation,

**Research Scholar, Department of Business Economics, South Campus, University of Delhi.*
Email : s.shetty01@gmail.com

probability of being caught is so low that the firms prefer to stay non-compliant. Alternative policy options are much needed which are not only simple, effective but also economically less burdensome on the regulators. The government of India has initiated several market based program focussed on particulate matter, energy efficiency and renewable energy which has been delayed to due various reasons and we are yet to see any tangible outcome. One of the key policy mechanism which has not used in India is to leverage on the use of the capital market by sharing the firm level information to all the stakeholders. The efficient market theory assumes that the market considers all the information into the valuation through various signals. Therefore, it is important to test the relationship between the firm's environmental performance and its market valuation. Several studies has been done to theoretically and statistically establish link between the environment and economic performance in developed countries however no similar study has been conducted, to our knowledge, in India.

The previous study in this regards in India has used the ISO 14000 as the proxy for environmental performance, the ISO 14000 represents the efforts by the firm and not the outcome while we use the actual quantity of pollutants and the input resource like water and energy which is the outcome which ultimately what is the key objective of the regulator. This paper contributes in understanding the relationship between the environment and the financial performance in a developing economy like India wherein the stakeholder dynamics' are evolving. This study will provide valuable insight to the regulators for choosing appropriate policy mechanism for sustainable growth. Secondly this paper uses regulated pollutants and resource utilisation index to represent the environmental performance which reflects the environmental sustainability practises followed by firm and as per our understanding this approach has been very limited in the past studies. Thirdly, this study also uses a nonlinear model to study the relationship as majority of the similar studies earlier uses a linear model.

Rest of the paper is organised as follows: Section 2 reviews the related literature. Conceptual framework followed in the study has been described in Section 3. Data used in the study has been discussed in Section 4. Section 5 presents the analysis of empirical results and the paper closes in Section 6 with some concluding remarks.

2. Related Literature

The relationship between firms environmental and its financial performance has been an area of research for more than forty years. There has been divergent views on the relationship as some researchers have argued that reduction of pollution causes incremental cost to the firm without any financial benefits (Cordeiro and Sarkis 1997, Jaggi and Freedman 1992, Stanwick and Stanwick 1998) or positive relationship (Cohen et al. 1997, Earnhart and Lízal 2007a, Rassier and Earnhart 2010, Wagner 2005, Okada and Iwata 2011) whilst the others have suggested that the reduction in the pollution helps the firm to reduce its operational cost and improve its productivity which enhances the firm's competitiveness in the market place (Porter and Van der Linde 1995, KOCSIS 2012, Portney 1997, Biondi 1998, Belz 1997, Khanna 1998, Sunderland 1995, Baylis 1998, Johnson 1997, Borkey and Nadai 1996). With the enhancement of regulatory enforcement the non-compliant firm has been considered to be risky as they can attract harsh penalty impacting their profitability and in some cases the business continuity. Firm which over complies with the mandatory regulation is not only considered profitable but also less risky than the non-complying firms hence the stock market provides them a higher intangible valuation (Konar and Cohen, 2001, Hart and Ahuja, 1996).

Following the traditional approach one assumes that the pollution is a by-product of the production process and hence by imposing a limit on the emission will result in incremental cost which will reduce the profitability of the firm. Rassier and Earnhart (2010) using a panel data of chemical manufacturing industries studied the impact of the clean water act on the future financial performance of the firm and reported a negative impact on Tobin Q wherein the market value and the replacement cost has been adversely impacted with a larger impact on market value, which implies that investors revise their expectations of the discounted present value of future profits in response to changes in Clean Water Act regulation.

Okada, and Iwata (2011) examined the impact of the environmental performance of the Japanese manufacturing firms using data from 2004-2008 wherein they proxied environmental performance by the quantity of waste and the greenhouse emissions respectively. Manufacturing firms were divided into clean and dirty

industries and it was reported that overall the waste emission had no significant impact on the financial performance on the clean and the dirty firms. The greenhouse gases had significant impact on the Tobin q of the overall firms and the clean firms but had no significant impact on the dirty firms.

Michael Porter (1990) and his co-author Class van der Linde (Porter and Van der Linde 1995) suggested that pollution is waste of resources and reduction in pollution will lead to an improvement in productivity through optimization of resource utilization. There have been several studies carried out towards validating the Porter hypothesis. Implementation of EMS helps in reducing waste, conserving energy, reduction in cost of operations and input materials by improving productivity (Patney, 1997, Biondi, 1998, Belz, 1997, Khanna, 1999, Sunderland 1995, Baylis, 1998, Johnson 1997, Borkey, and Nadai A 1996). An EMS provides a structured framework for identifying risks and implementing actions to mitigate the same. This results in fever fine and other regulatory issues which results in increase in cost to the organisation (Sunderland, 1996; Gleckman and Krut, 1996; Johnson, 1997; Belz, 1997; IISD, 1996; Khanna, 1998; Gelber, 1996). Reduced insurance cost: (Sunderland, 1996; Pringle, 1998; Patney, 1997; Kinsella; Johnson, 1997)

Schaltegger and Figge (1997) have shown that financial performance margins and long term shareholder value can be enhanced by progressive environmental management which lowers the resource consumption and other operational costs. EMS provides a consistent way to manage the organization away from constraints imposed by future regulations, material shortages, community complaints and other issues (Khanna, 1999). Konar and Cohen (2001) noted that legally emitted toxic chemicals have a significant impact on the intangible asset value of the publically traded companies.

Guenster et al (2005) has reported a positive but non-linear relationship between corporate environmental performances and firms Tobin's q, they further added that the relationship has strengthened over a period of time. This study has used a comprehensive eco-efficiency index which uses over twenty quantitative and qualitative parameters wherein each has been given different weight age considering the relevance and converted to relative score based on the sectors.

Most of the above studies have been done in developed economies and very few are focussed on developing economies. There is significant difference in the stakeholder pressure on the firm in a developing country wherein the enforcement is weak and the stakeholder aren't aware of the firm level environmental performance. In a developing economy the benefits to a firm from a proactive sustainability strategy is not clear as the environmental and social regulations are lacking or poorly enforced and the demand for the greener product is non existing (Blackman 2010).

3. Conceptual Framework and Empirical Strategy

The objective of this research is to investigate the relationship between the environmental and market valuation of the firm in a developing country. The empirical focus here is on three major sectors - Cement, Power and Power which are key to economic development of an economy. As per the literature review the firm's environmental performance is due to the various efforts undertaken by the firm which results in the reduction of the pollutant and optimal utilisation of the natural resources. These initiatives taken by the firm to reduce the pollutants provides it with tangible and intangible benefits. The tangible benefits help the firm to improve its profitability by providing incremental revenue and reduction of operational cost while the intangible benefits creates a positive image of the firm which enables it to create greater value for the firm at the market place as presented in Table 1.

The environmental performance provides both tangible and intangible benefits to the firm which has a positive impact on its financial performance. The improvement in environmental performance will provide the firm with financial benefit until it reaches a stage where all the means are exhausted and the marginal benefits starts declining and any further improvement will results in economic loss to the firm which impacts its market valuation adversely (Schaltegger & Wagner, 2011). Hence we consider the relationship between the environmental performance and the market valuation as nonlinear and is inverted U shaped wherein the initial efforts will yield incremental economic benefit which starts declining after some time. As the environmental performance encompasses regulated pollutants as well management of the natural resources we use both the pollutants as well as the resources like water and energy to represent the firm's environmental performance. Our study covers three major pollutants Sulphur dioxide, Nitrous oxide, particulate matter and two input resources which is indexed to a single variable representing the pollution and

conservation index of the firm. The study is particularly focused on testing the following hypotheses.

Hypothesis 1: The relationship between the environmental performance represented by the pollution index and the market valuation of the firm is nonlinear.

Hypothesis 2: The relationship between the environmental performance represented by the resource use index and the market valuation of the firm is nonlinear.

To measure the relationship between environmental/ resource use index and market valuation we use the function form suggested by Konar and Cohen (2001)

$$ln(q) = a + \sum\beta X + \varepsilon \quad (1)$$

ln(q) is the natural log of Tobin q and X is the matrix containing the explanatory (pollution index/resource use index) and control variable.

We test the hypothesis using the above functional wherein we use *ln(q)* to represent the market valuation of the firm. We have used control variables like MNC status, age of the assets, sales growth, capital intensity, debt equity ratio. The MNC firms have a better access to knowledge and technology on abating the environmental impact during the production process which provides them with tangible and intangible financial benefits. The firm that employs latest technology will be more efficient and profitable and average age of the assets proxies the vintage of the technology. The firms with older assets will have less financial and market benefits. The firms with a better sales growth will have a positive relationship with the financial and market performance of the firm as the firm with better sales growth is assumed to give better and long term profit to the stakeholders. The debt equity ratio represents the firm financial leverage which indicates how much debt a company is using to finance its assets relative to value of its shareholders equity. A highly leveraged firm is seen to be more risky then its peers because they are unable to generate enough profit to fund their operations and hence will have a negative relationship with the firm's intangible valuation. The capital intensity represents the cash the firm has to utilize during its operations and firm which is more capital intensive than its peers will have a negative relationship financial and market performance.

4. Data

For estimating our empirical model we have constructed a data base of firms in the steel, cement and power sectors in India that are listed in stock market. We have collected the firm level environmental, financial and other information like MNC status, NGO pressure etc. to enable us to test the hypothesis. We have tested the hypothesis in a developing country using three major sectors which contribute significantly to the economic growth and are considered to be highly polluting that majorly contributes to the industrial pollution. The firm level environmental data include the major pollutants emitted by the firms like Sulphur dioxide, oxides of nitrogen particulate matter that are regulated by the pollution control board and two input resources like water and heat which are not regulated directly

The polluting sectors are mandated under the Environmental Protection Act (EPA) to annually report to the local pollution boards about the status of environmental pollutants generated by the respective firms. The information has to be provided in a standard format known as annual statement. The local state pollution control boards file the statement in their archives. We had contacted the central pollution control board (CPCB) to get the information submitted by the firms however the CPCB directed us to the state pollution control boards. We were informed by the state pollution boards that such data cannot be divulged to a third party hence we filed a request under the right to information (RTI) act which mandates the timely response to the citizen request for government information. We had filed the request separately with 24 state pollution control boards requesting for the environmental data for industries in 8 major sectors across India covering Aluminium, Cement, Chloralkali, Chemical and Fertiliser, Paper, Power plant, Steel and Textile. The respective state PCB had further forwarded the request to their zonal offices. We had requested data for 477 facilities across India covering the sectors listed above. The pollution control boards could provide us information for 199 facilities for the year 2012 which is about 42% of the requested information. We could get 130 facility level information covering steel, cement and power sector. After checking for the completeness of the information we obtained 108 facility level information which was used for our study. The 108 facility level data across steel, power and cement sector representing 49 firms listed on the stock exchange was considered for our study.

Despite the fact that the EPA clearly specifies the units to be reported in the format, we have found several gaps in the same which we tried to fill by directly contacting the respective firms. To construct the pollution index or the resource use index, the firms which has the highest

emission in the respective sector was considered as the reference point wherein other firms emission was divided by the reference such that the firm with highest emission was 1. Such index was done for each pollutant (SO_2, NO_x, and PM) for the firms across the sectors. The pollution index is the geometric mean of the three individual pollutants indexes and it was prepared at the firm level. Similar approach was followed for the creation of resource conservation index of water and energy.

The financial data that was used as dependent and the control variables were taken from the database provided by Ace equity which publishes the data reported to the stock exchange by the respective firms. The Tobin's q ratio of the firm was calculated by dividing the total market value of the firm by its asset value. If q (representing equilibrium) is greater than one ($q > 1$), additional investment in the firm would make sense because the profits generated would exceed the cost of firm's assets. If q is less than one ($q < 1$), the firm would be better off selling its assets instead of trying to put them to use. The ideal state is where q is approximately equal to one denoting that the firm is in equilibrium. The facility which has been listed in the Centre for Science and Environment sector rating report was considered as a 1 which means that the facility is under the pressure of the environmental NGO who share the information with other stakeholders thereby creating pressure on the firm.

The other financial variables like debt equity ratio, sales growth, capital intensity sales asset ratio were used as control variables as their relationship with dependant financial variable is established. The MNC status of the firm represents the firm's international parentage wherein it has a majority shareholding; this information was collected from the company website. The descriptive statistics of the variables used in the study is given in Tables 2 and 3.

5. Results and discussion

For the sake of robustness, we have tested the hypotheses using both linear and nonlinear regression model for overall market value (Tobin q) and intangible market value (Tobin q-1) value. The regression results are presented in Table 4 (Data generated during the course is given in Appendix end of the paper). We find a significantly negative relationship between the pollution index and resource utilisation index with the market valuation of the firm for all the models. This shows that the level pollution generated by the firm and the quantity of the resource consumed has negative impact on the firm's market valuation. Highly polluting firms are considered to be risky and are more likely to be penalised by the regulators which can impact their bottom line in the future. Fama (1970) stated that stock prices fully reflect all public and private information, she contends that market, non-market and inside information is all factored into security prices. Hence considering the significance of the environmental impact on the profitability of the firm and the business continuity risk it has on the firm the market includes this information in the valuation of the firm. When the market doesn't have clear information on the firm level environmental performance data, it uses the signal provide by the ratings provided by NGO as we find a negative relationship with the firm value and the NGO pressure. The direction of the relationship between the environmental and market value is in line with the studies conducted earlier, Konar and Cohen (2001), Hart and Ahuja (1996) wherein the bad environmental performance is negatively correlated with the intangible asset value of the firm represented by Tobin q-1. The above studies have used a linear model however we have used a nonlinear model as we assume that the relationship between the environmental and financial performance is dynamic and it changes over period of time. Similarly Guenster et al. (2005) have reported a positive but non-linear relationship between corporate environmental performance and firm's Tobin q for European firms. Okada and Iwata (2011) studied the impact of the environmental performance on the firm valuation of Japanese firms and have reported significant negative impact of the greenhouse gases on the Tobin q however they reported no impact of the waste on the Tobin Q. The authors explained that the waste has been regulated for a long time and hence all the firms are the same level in terms of waste output while the greenhouse gas is yet to be regulated which is why each firms are at different level of performance. Rassier and Earnhart (2010), using a panel data of chemical manufacturing industries, study the impact of the Clean Water Act on the future financial performance of the firm and report a negative impact on Tobin q.

We find a positive relationship between the market value and the MNC status of the firm, which is due to the fact that MNC firms have access to technology, expertise, brand name and knowledge, which enables them to keep their operation more efficient and they are more competitive in the market. Most of the MNC also have advantage of the brand equity which also provides them a better market valuation as compared to the local firms. The firm which has higher sales growth which is used as

a control variable is significantly positively related with the market value which is in line with the expectation as the firm with better sales are considered to be stable and more profitable. Similarly we see a positive relationship of the market value of the firm with its sales to asset ratio which means that the firm which generates more revenue from a given asset is more efficient and profitable than the peers and hence such firms have better market valuation as compared to their peers.

The firms which are more capital intensive have a negative relationship with the market value which is in line with the expectation as such firms will be more leveraged and hence will have less market valuation as compared to the other firms.

The adverse relationship is statistically significant but its impact in terms of overall market valuation is less than 0.1% (Table 5). The lowest impact is on the cement sector for both pollution and resource use index and the highest is for the steel sector. This can be attributed to the fact that the firms face much lower financial and business continuity risk from the regulators due to the weak enforcement and also low probability of the firm being penalised for the noncompliance. Hence the market doesn't place a significant value the risk due to environmental noncompliance which results to lower impact on the market valuation.

6. Conclusions

The study aimed at investigating the relationship between the environmental performance and the market valuation of the firm using Tobin q and Tobin q-1 to proxy the overall and intangible market value. The environmental performance is represented by the pollution index and the resource use index which represent the compliance and the sustainability aspect of the firm. The study confirms the negative and non-linear relationship between the pollution index and resource conservation index with its overall and intangible market valuation. However the impact of the environmental performance on the firm valuation is low due the low financial risk on the firm due to the weaker enforcement and low probability of being penalised. Hence a dual approach of strengthening the enforcement followed by disclosure of the firm level information will lead to the market revaluating the environmental risk in their firm valuation. This will create an incentive for the firm to improve its environmental performance voluntarily to achieve better market valuation for itself. We find the firm level environment information is provided through the NGO rating only and there is no process for the firm level environmental information to be available to all the stakeholders. Therefore, the regulator should consider disclosure as a policy mechanism to influence the firm to improve their environmental performance due to the pressure from the stakeholder including the stock market, which will include the information in the stock price. The enforcement also has to be strengthened simultaneously as the non-compliant firm should be severely penalised which will directly create pressure on the firms and indirectly the impact of the penalty will be reflected in firms market valuation.

References

- Alberini, Anna and Kathleen Segerson. Assessing Voluntary Programs to Improve Environmental Quality, Environmental & Resource Economics, 2002, vol. 22, issue 1, pages 157-184
- Arora, S., and T. N. Cason. 1995. "An Experiment in Voluntary Environmental Regulation:Participation in EPA's 33/50 Program." Journal of Environmental Economics and Management 28 (3): 271-86
- Baylis, R., Connell, L. and Flynn, A. (1998), Company size, environmental regulation and ecological modernization: further analysis at the level of the firm. Bus. Strat. Env., 7: 285–296. doi: 10.1002/(SICI)1099-0836(199811)7:5<285::AID-BSE166>3.0.CO;2-U
- Belz, F. , Strannegard, L. et al., *International Business Environmental Barometer 1997*, Cappelen akademisk forlag, Oslo 1997.
- Biondi, V., Frey, M. and Iraldo, F., Environmental management system implementation by SME: EU experience and perspectives, paper presented at 7th international conference on greening of industry network- Partnership and Leadership-Building alliance for sustainable future, Rome , November,1998.
- Blackman A (2010). Alternative pollution control policies in developing countries. Review of Environmental Economics and Policy, 4(2): 234–253
- Borky. P., and Nadai. A., The economics and law of voluntary approaches in environmental policy, FEEM newsletter number 3,1996
- Calderon. P. (2012) Environmental Performance and Firm value: Evidence from Dow Jones Sustainability Europe, Int. J. Environ. Res., 6(4):1007-1014, Autumn 2012.

- Cohen, M. A., Fenn, S. A. & Konar, S. (1997). "Environmental and Financial Performance: Are They Related?," Working Paper Vanderbilt University, 1-40.
  Publisher - Google Scholar
- Cordeiro, J.J., Sarkis, J., 1997. Environmental pro-activism and firm performance: evidence from security analyst earnings forecasts. Business Strategy and the Environment 6 (2), 104–114.
- Esty, Daniel C and Michael E Porter 2000. "Measuring National Environmental Performance and its Determinants. "*The Global Competitiveness Report 2000.* Oxford University Press
- Earnhart Dietrich and Kizal Lubomir, Effect of ownership and financial performance on the firm environmental performance, Association of comparative Economics studies, http://dx.doi.org/10.1016/j.jce.2005.11.007
- Fama. E., (1970) "Efficient Capital Markets: A review of theory and empirical work" The Journal of Finance, Vol 25, No.2
- Figge, F. & Schaltegger, S. (2000): What is "Stakeholder Value"? Developing a catchphrase into a benchmarking tool. Lüneburg: Center for Sustainability Management (CSM) and Bank Pictet & Cie in association with UNEP.
- Guenster, N., Bauer, R., Derwall, J. and Koedijk, K. (2011), The Economic Value of Corporate Eco-Efficiency. European Financial Management, 17: 679–704. doi: 10.1111/j.1468-036X.2009.00532.x
- Gelber, M., Hanf. B. and Huther, S., "EMS Implementation at Hipp in Germany" Greener Management International, Issue 14, April 1996.
- Gleckman, H., and R. Krut. 1996. Neither International nor Standard: The Limits of ISO 14001 as an Instrument of Global Corporate Environmental Management. Greener Management International 14: 111–124
- Hart, S.L., Ahuja, G., 1996. Does it pay to be green? An empirical examination of the relationship between emission reduction and firm performance, Business Strategy and the Environment 5 (1), 30–37.
- Hart, Stuart and Gautam Ahuja, Does it pays to be Green? : An Empirical Examination of the relationship between Pollution Prevention and Firm Performance," paper, University of Michigan, 1994.
- Jaggi, B. and Freedman, M. (1992), An Examination of the Impact of Pollution Performance on Economic and Market Performance: Pulp and Paper Firms, Journal of Business Finance & Accounting, 19: 697–713. doi: 10.1111/j.1468-5957.1992.tb00652.x
- John Paul Jewell, Corporate environment performance in India, working paper, Centre for development finance, Institute of financial management and research.
- Johnson, P.,The business managers complete guide to environment management, Wiley Quality Management, John Wiley and Sons, Inc 1997
- King, A., Lenox, M., 2002. Exploring the locus of profitable pollution reduction. Management Science 48 (2), 289–299.
- Kinsella,J.,"ISO 14000 stands for environment management" paper presented at Armozacion del Comercico, International y medio Ambiente, Buenos Aires, Argentina, Septtember 7-9 1994.
- KOCSIS Timea, BEM Judit "Has environmental management system always a cost reducing benefit for adopting firm" International scientific conference on sustainable development and ecological footprint, March 26-27 2012
- Konar, S., Cohen, M.A., 2001. Does the market value environmental performance? Review of Economics and Statistics 83 (2), 281–289.
- Koku, P. S., A. Akhigbe, and T. M. Springer, 1997, "The Financial Impact of Boycotts and Threats of Boycott," Journal of Business Research, 40(1), 15–20.
- Kumar, S. and Managi, S. 2009 "The Economics of Sustainable Development: The Case of India." Springer-Verlag, New York, USA.
- Khanna, M and W. R. Q. Anton, 2002a, "Corporate environmental management: Regulatory and market-based pressures," Land Economics. 78:539-558
- Khanna, M. and W. R. Q. Anton, 2002b, "What is driving corporate environmentalism: Opportunity or threat?" Corporate Environmental Strategy, 9(4): 409 – 417
- Khanna, M., and L. Damon, 1999, "EPA's Voluntary 33/50 Program: Impact on Toxic Releases and Economic Performance of Firms," Land Economics, vol. 78(4): 539-558.
- Khanna, N. and Vidovic, M. "Re-evaluating the success of EPA's 33/50 program: Evidence from the facility participation" http://mpra.ub.uni-muenchen.de/25037/
- Lenox, M., Eesley C., 2009, Private environmental activism and the selection and response of firms target, Journal of Economics & Management Strategy, Volume 18, Number 1, Spring 2009, 45–73
- Okada, K and Iwata, H (2011) How does environmental performance affect the financial performance? Evidence from Japanese manufacturing firms. Ecological Economics 70 (2011) 1691–1700
- Planning Commission 2011, Government of India. Report on the working group on "Effectively integrating industrial growth

and environment sustainability" Twelfth Five Year Plan (2012-2017)

- Porter, M.E., van der Linde, C., 1995. Toward a new conception of the environment competitiveness relationship. Journal of Economic Perspectives 9 (4), 97–118.
- Priyadarshini, Keren 2003. Compliance of Environmental Regulations: The Indian Context. International Journal of Business and Economics, Vol. 2, No.1, 9-26
- Pruitt, S.W. and M. Friedman, 1986. "Determining the Effectiveness of Consumer Boycotts: A Stock Price Analysis of Their Impact on Corporate Targets," Journal of Consumer Policy, 9(4), 375–387.
- Rassier, D., Earnhart D., 2009, Does the porter hypothesis explain expected future financial performance? The effect of clean water regulation on the chemical manufacturing firms., Environment and Resource Economics , March 2010, Volume 45, Issue 3, pp 353-377
- Russo, M.V., Fouts, P.A., 1997. A resource-based perspective on corporate environmental performance and profitability. Academy of Management Journal 40 (3), 534–559.
- Schaltegger, S. & Figge, F. (1997): Umwelt und Shareholder Value. WWZ/Sarasin & Cie-Studie Nr. 54, 12. Auflage. Basel: WWZ/Sarasin & Cie.
- Schaltegger, S. and Wagner, M. (2011), Sustainable entrepreneurship and sustainability innovation: categories and interactions. Bus. Strat. Env., 20: 222–237. doi: 10.1002/bse.682
- Stanwick Peter., Stanwick Sarah, The relationship between corporate social performance and organisational size, financial performance and environmental performance: An empirical examination. Journal of business ethics 195-204, 1998
- Stoeckl, N. (2004), The private costs and benefits of environmental self-regulation: which firms have most to gain?, Business Strategy and the Environment, 13: 135–155.
- Sunderland, T.J.,"Environment management standard and certifications: Do they add value? Green Management International, Issue 14,April 1996"
- Wagner, Marcus (2005) How to reconcile environmental and economic performance to improve corporate sustainability: corporate environmental strategies in European paper industry, Journal of Environment Management 76(2005) 105-118
- World Bank 2013, An Analysis of physical and monetary losses of environment health and natural resources, Volume 1. Disaster management and Climate Change unit, Sustainable development department, South Asia region.

Appendix

Table 1: Determinants of the relationship between environmental and financial performance.

Firm Level Environmental Performance	**Firm Level Benefit**	**Financial performance**
- 1. Low emission of regulated pollutants like SO2, NOx and particulate matter. 2. Optimal utilization of input resources like water, energy.	**Tangible** 1. Sales growth 2. Operating Income 3. Low input cost 4. Better price 5. Low cost of finance 6. Low risk due to regulatory enforcement. 7. Competitive 8. Market access 9. Efficiency **Intangible** 1. Green image. 2. Innovative 3. Low risk 4. Product differentiation. 5. Stakeholder relations	**Market Valuation** Tobin q

Table 2: Descriptive Statistics of Environmental and Resource Conservation Performance

	SPM/Output	SO_2/Output	NO_x/Output	Water/Output	Heat/ Output	Pollution Index	Resource Conservation Index
Cement							
Obs	17	17	17	17	16	17	17
Mean	0.029	0.016	0.584	0.546	0.092	0.155	0.311
Std. Dev.	0.021	0.022	0.986	0.612	0.014	0.094	0.127
Min	0.010	0.001	0.062	0.010	0.078	0.065	0.095
Max	0.077	0.069	4.385	2.490	0.132	0.441	0.664
Power							
Obs	10	10	10	7	10	10	10
Mean	1154	5740	4154	1237	2499	0.505	0.581
Std. Dev.	490	3533	3357	934	393	0.339	0.235
Min	503	60	210	344	2047	0.041	0.199
Max	1921	10372	8591	2441	3182	0.961	0.936
Steel							
Obs	21	21	21	18	21	21	21
Mean	0.365	0.288	0.214	35.492	0.698	0.326	0.345
Std. Dev.	0.314	0.230	0.146	101.740	0.403	0.236	0.222
Min	0.023	0.030	0.020	0.050	0.060	0.032	0.032
Max	1.150	0.860	0.553	437.000	1.861	0.940	0.969
All							
Obs	48	48	48	42	47	48	48
Mean	240.543	1195.933	865.759	221.527	531.961	0.303	0.382
Std. Dev.	519.823	2817.556	2250.261	585.963	1047.949	0.256	0.219
Min	0.01	0.0013	0.02	0.01	0.06	0.032	0.032
Max	1921	10372	8591	2441	3182	0.961	0.969

Table 3: Descriptive Statistics of Non-Environmental Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Cement					
Market	17	48020.39	62871.41	54.36	170681
Tobin q	16	0.94	0.79	0.08	2.51
ROA	16	1.36	13.48	-44.51	13.05
ROCE	16	12.80	9.81	-5.49	23.26
ROE	16	7.26	14.17	-34.37	26.21
EPS	16	16.02	55.84	-83.02	177.53
MNC/Indian Corporate	17	0.12	0.33	0.00	1.00
Total assets	17	9856.33	18976.04	125.50	79276.20
Sales growth	16	637.74	2451.81	-19.51	9831.50
Debt equity ratio	17	0.98	1.90	-3.48	5.21
Average age	16	12.73	8.05	6.09	30.00
CDM project	17	0.29	0.47	0.00	1.00
NGO pressure	17	0.59	0.51	0.00	1.00
Gross sales	17	5725.82	6000.12	220.62	21513.30
Total Output	17	6941196	1.08E+07	263346	3.80E+07
Capital intensity	17	0.0029	0.0047	0.0001	0.0174
Power					
Market	11	17118.21	10739.69	3238.7	32562.19
Tobin q	10	0.46	0.33	0.09	1.13
ROA	10	2.72	4.55	-2.18	10.21
ROCE	10	8.87	6.54	1.96	20.86
ROE	10	5.40	12.75	-14.41	24.84
EPS	10	15.54	21.82	-4.58	60.34
MNC/Indian Corporate	11	0	0	0	0
Total assets	10	53612.63	43046.45	13922.9	164025
Sales growth	10	37.23	23.51	13.76	91.65
Debt equity ratio	10	2.65	2.31	0.77	6.73
Average age	10	8.41	4.96	3.65	17.58
CDM project	11	1	0	1	1
NGO pressure	11	0.82	0.40	0.00	1.00
Gross sales	10	18168.22	18841.56	4092.16	66365.90
Total Output	10	14889.7	37219.54	1003	120681
Capital intensity	9	13.35	13.54	1.11	37.17
Steel					
Market	16	9640.45	8893.57	2537.23	25854.46
Tobin q	20	0.30	0.25	0.05	1.13
ROA	19	2.39	3.80	-7.27	9.87
ROCE	19	9.52	5.68	-2.36	21.00

ROE	19	3.99	15.76	-40.09	24.84
EPS	19	11.68	24.37	-44.32	55.49
MNC/Indian Corporate	21	0	0	0	0
Total assets	20	18749.11	36044.33	63.0403	147196
Sales growth	19	21.97	27.08	-8.68	84.89
Debt equity ratio	19	1.83	1.69	0.08	6.86
Average age	19	9.54	6.56	3.39	24.65
CDM project	21	0.95	0.22	0.00	1.00
NGO pressure	21	0.62	0.50	0.00	1.00
Gross sales	20	13235.09	31199.94	170.97	135976
Total Output	21	1353014	3002870	23256	1.30E+07
Capital intensity	20	0.033	0.049	0.001	0.159
All					
Market	46	12580.79	23496.77	54.36	134153.6
Tobin q	46	0.56	0.58	0.05	2.51
ROA	45	2.10	8.51	-44.51	13.05
ROCE	45	10.54	7.59	-5.49	23.26
ROE	45	5.46	14.33	-40.09	26.21
EPS	45	14.08	37.52	-83.02	177.53
MNC/Indian Corporate	49	0.04	0.20	0.00	1.00
Total assets	47	22950.34	36053.27	63.040	164025
Sales growth	45	244.30	1461.89	-19.51	9831.50
Debt equity ratio	46	1.69	1.98	-3.48	6.86
Average age	45	10.43	6.92	3.39	30.00
CDM project	49	0.73	0.45	0.00	1.00
NGO pressure	49	0.65	0.48	0.00	1.00
Gross sales	47	11568.57	22524.28	170.97	135976.
Capital intensity	46	2.63	7.82	0.00	37.17

Table 4: Determinants of Financial Performance

	(1)	(2)	(3)	(4)
	ln(Tobin q)	Tobin q - 1	*ln*(Tobin q)	Tobin q - 1
Pollution index	-2.661*	-1.873**	-8.886**	-4.745*
	(-1.93)	(-2.19)	(-3.12)	(-2.38)
Pollution index ^{2}			7.529**	3.524*
			(2.4)	(1.73)
Resource utilisation index	2.577	1.861**	8.637***	4.815**
	(1.64)	(2.08)	(3.15)	(2.38)
Resource utilisation index^2			-6.835**	-3.363*
			(-2.18)	(-1.72)
Debt equity ratio	-0.195*	-0.0712*	-0.213*	-0.0800**
	(-1.75)	(-1.86)	(-2.03)	(-2.24)
Average age	-0.0194	-0.0102	-0.00676	-0.004
	(-0.77)	(-1.09)	(-0.25)	(-0.38)
MNC or Indian corporate	1.388***	1.578***	0.991***	1.393***
	(5.11)	(7.11)	(4.41)	(5.99)
NGO rating	-0.791**	-0.440**	-0.353	-0.236
	(-2.32)	(-2.13)	(-0.91)	(-0.92)
Capital intensity	-0.00769	-0.00853	0.000006	-0.000002
	(-0.66)	(-1.33)	(0.12)	(-0.08)
Sales growth	0.000051	0.00002	0.134	0.261
	(1.04)	(0.86)	(0.36)	(1.32)
CDM project	-0.0713	0.164	0.61	0.266
	(-0.21)	(0.92)	(1.25)	(1.17)
Sales/Assets	0.841*	0.379*	0.25	0.113
	(1.93)	(1.86)	(1.64)	(1.37)
ln(Assets)	0.362**	0.165**	-0.0179	-0.0135**
	(2.49)	(2.18)	(-1.67)	(-2.16)
Constant	-4.026***	-2.007***	-3.635***	-1.846**
	(-3.02)	(-2.92)	(-2.91)	(-2.76)
R^2	0.6102	0.7218	0.66	0.75
RMSE	0.687	0.373	0.662	0.367
N	41	41	41	41

t statistics in parentheses generated using robust standard errors.

* $p < 0.05$, ** $p < 0.025$, *** $p < 0.005$

Table 5: Estimated impact of the pollution index and resource utilisation index on the market value of the firm in INR crore (INR 10 million)

	Pollution Index		Resource Consumption index	
	INR	%	INR	%
All	1.521	0.012	1.260	0.010
Cement	0.953	0.002	1.142	0.002
Power	1.756	0.010	1.305	0.008
Steel	1.579	0.016	1.205	0.013