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An Empirical Study of Firm Environmental and Financial Performance: Evidence from Small and Medium Manufacturing Firms in Vietnam

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Abstract. There has been interest regarding the effects of environmental performance on financial performance over a given period. This paper studies the relationship between environmental and financial performance in Vietnam's small and medium manufacturing firms by using the World Bank 2005 data on "Productivity and the Investment Climate". Particularly, this research has investigated the relationship between ROA, accounting based measure of financial performance in the short term, and *inspected times*, an environmental variable measured by the number of times that a firm was inspected by the Environmental Agency. A firm that has incurred a high number of inspections has low environmental compliance. Based on a different level of environmental performance, this study constructs the "SME_high polluting" (SME_H) and "SME_low polluting" (SME_L) portfolio. The analytical results indicate that better pollution control neither improves nor undermines financial success. The SME_H group shows that high-inspected time, implying poor environmental performance has a statistically significant and positive impact on ROA implications for financial performance. The SME_L group, environmental and financial performances are not related statistically. Finally, several implications for SMEs, government sector, and researchers as well as future research direction are also provided.

Keywords: Environmental, financial, performance, SMEs.

1. Introduction

The Vietnamese modern economic era started in 1986 when the government launched the reforming policy known as "Doi moi" in order to change the system of a centralized management, based on state subsidies, to a multi-stakeholder, market oriented economy, including an important role for the private sector. Due to the reforming policy, the Vietnamese economy has increasingly developed and become one of the most rapidly growing economies among the world's poorest nations.

In Vietnam's economic development, small and medium-sized enterprises (SMEs) have emerged as a dynamic force. SMEs, especially the manufacturing SMEs, make a great contribution to creating employment and income generally in

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the world, and particularly in Vietnam (Rand et al, 2002; Berry, 2002). In 2004 the manufacturing SMEs sector accounted for 20.9 percent of the total number of SMEs in Vietnam (GSO, 2005), which makes it the second largest proportion after the trading SMEs sector.

However, the rapid growth of manufacturing SMEs in Vietnam goes together with environmental deterioration and puts pressure on natural resources. The general feature of Vietnamese SMEs is their distribution in the urban and rural residential areas with concentration in the traditional trade villages with handicraft technology, backward equipment, limited space, and low investment. Therefore, many small-scale enterprises cause environmental pollution in the surrounding residential areas (Phung, 2004). According to the assessment of environmental authorities, most SMEs are equipped with obsolete manufacturing technology and no environmental protection facilities. Their potential to renovate or change technology for improving production effectiveness and environmental protection are low and less motivated due to the possibly negative impact of environmental compliance by manufacturing SMEs on their financial performance.

For some time there has been interest regarding the effects of environmental performance on financial performance. However, no conclusive results have emerged so far. There are two schools of thought on this issue. According to one point of view, environmental performance has a negative link with financial performance, causes extra costs and reduces a firm's profitability. On the other hand, the Porter Hypothesis argues that improved environmental performance and the associated re-evaluation of production processes and adoption of innovative solutions increase resource productivity and competitive advantage - thereby creating opportunities for improving financial performance in technological solutions to environmental problems - especially clean technologies. This notion may be especially true as firms shift their focus away from end-of-pipe abatement measures and toward redesigning production methods so that sources of pollution are minimized or eliminated.

In Vietnam, there have, in fact, been many research projects by domestic and foreign organizations, but most of them have focused on general descriptions of the current situation of environmental issues in industrial zones, also suggesting policies or temporary support to create the most favorable conditions for environmental improvement. Although these researches have made great contributions to deal with environmental issues, it is necessary to have further research projects on environmental matters of SMEs, especially deep academic studies focusing on the relationship between the environmental and financial performance of SMEs. Such further studies would firstly be of benefit to academics by adding more empirical evidence as to which school of thought on the issue really exists in Vietnam. Secondly these kinds of studies would also be expected to contribute to practitioners and policy makers by supporting the appropriate integration of environmental matters into industrial and other economic oriented policies, ensuring the long-term existence of SMEs, and by providing indirect evidence to evaluate the efficient and effective implementation of existing environmental regulations in Vietnam.

Therefore, the main objective of this research is to investigate the relationship between the environmental and financial performance of Vietnam's small and medium manufacturing firms by using the World Bank 2004 data on "Productivity and the Investment Climate". Does a firm that strives to attain good environmental performance gain an increase in profitability or is environmental performance just an extra cost for this firm? Answers to these questions have important implications for the role that the government can be expected to play in encouraging firms to shift from pollution treatment to pollution prevention measure.

This paper is organized as follows; the next section briefly reviews previous research into the relationship between environmental performance

and financial performance, and develops hypotheses. Following that, the third section presents the data and samples as well as variables and their measurement. In the fourth section, analyses and results are reported. The fifth and sixth sections present a discussion of the findings and our limitations as well as directions for future studies.

2. Literature Review and Hypothesis Development

Two schools of thought on the relationship between firm's environmental and financial performance

The link between environmental and financial performance has been widely debated in the literature over the last ten to fifteen years. There are two schools of thought on the relationship between a firm's environmental and financial performance (details in Table 1). According to a *conventional neoclassical view*, there is a negative link between the two performances. Improved environmental performance mainly causes extra costs for the firm and reduces profitability. It is assumed that both environmental regulations and protection measures are hindrances to competitiveness because they require costly investments for waste treatment, such as conventional end of pipe (EoP) systems and the introduction of clean techniques, all of which increase the firm's fixed costs (Claver, 2006). It seems to be a reality that if firms have focused on EoP technologies as their major approach towards pollution control and improvement of environmental performance in general, environmental investments were often seen as an extra cost (Cohen et al. 1995).

Holding an opposing view, Porter (1995), in supporting a *revisionist view,* argued that improved environmental performance is a potential source for competitive advantage and following this are improvements in productivity, increased profitability and lower cost of compliance. Theoretical and empirical research has provided arguments for both positions but has not been conclusive to date (Schaltegger, 2002).

Table 1: Conventional neoclassical and revisionist view

View point	Performance attributes
Conventional neoclassical view	High environmental + low financial Or High financial + low environmental
Revisionist view	High financial + high environmental Or Low financial + low environmental

Source: Naimon et al., 1997.

The so-called Porter hypothesis (Porter, 1995) asserts that firms can benefit from environmental regulations. It argues that well-designed environmental regulations stimulate innovation that by enhancing productivity, increase the private benefits of firms. Consequently, environmental regulations would not only be good for society, they would also be good for firms. In addition, Prace (2005) noted that the nature of innovation and certain types of regulation are two important points in Porter hypothesis. These two points would spark innovative responses. Prace (2005) tried to define characteristics of efficient environmental regulation and differ between two broad categories of innovations. The first type of innovation minimizes the cost of coping with pollution. Once the pollution occurs, there should be innovative approaches with the intention of turning the resources embodied in the pollution into something valuable such as by recycling and utilization of waste products. The other kind of innovation is improving the resource productivity. The core idea is that pollution is costly and it is a form of economic waste. It is simply a sign of ineffective production. The goal is that sources should be used more efficiently by lowering energy consumption, material savings and reducing unnecessary packaging. Accordingly, costs can be decreased or even revenue can be enhanced. Porter regards this kind of innovation as more important in the competitiveness issues.

Previous empirical studies on the impact of environmental performance on financial performance

Empirical studies supporting the revisionist viewpoint

In the research of Hart and Ahuja (1996), pollution prevention and emission reduction initiatives have positive impacts on a firm's return on assets (ROA), return on sales (ROS) and return on equity (ROE). This research was realized over a period of two years, at 127 manufacturing, mining, and production firms drawn from the Standard and Poor's 500 list of Corporations. The results of this analysis showed that emission reductions enhance better operating financial performance. In addition, Russo and Fouts (1997) analyzed 243 firms that had been rated for environmental compliance by Franklin Research and Development Corporation (FRDC) over a two-year period (1991-92). The study determined that a firm's return on assets (ROA) improves as a firm's environmental performance improves. In addition, in the study of Konar and Cohen (2001), the authors researched the link between Toxic Release Inventory (TRI) emissions levels, environment-related litigation, and the intangible asset value of the Standard and Poor's 500 list of Corporations. This study demonstrated a significantly positive effect of these two environmental performances on a firm's intangible asset values. Another research of Cohen et al. (1995) examines the correlation between environmental and financial performance in order to address whether investing in companies that are environmental leaders in their industries reaps a higher return compared with a neutral investing strategy. By constructing "high-polluter" and "low-polluter" portfolios from Standard and Poor's 500 firms, based on nine environmental variables, the authors found that the "low-polluter" portfolio does as well as - and often better than - the "high-polluter" portfolio. Klassen and McLaughlin (1996) investigated the link between a firm's environmental performances - a total of 140 award announcements and 22 environmental crises - including oil spills, gas/chemical leaks and explosions. The financial impact of the awards or crises was measured by comparing the change in a firm's market valuation relative to its baseline valuation. The result determined that firms with strong environmental management, measured by environmental achievement awards, had increases in their market value, while firms with weak environmental management, measured by environmental crises, was followed by decreases in market value.

Empirical studies supporting Neoclassical

Wagner (2003) gave the argument brought forward firms with high impacts of environmental regulation. Those firms face a competitive disadvantage compared with other firms if stringent environmental regulation burdens them with higher environmental compliance costs. This study also highlighted the view of neo-classical environmental economics, which argues that the purpose of environmental regulation is to correct for negative externalities that diminish social welfare. Consequently, environmental regulation - in internalizing the costs of the negative externality, according to the polluter-pays-principle - will generally impose costs on the polluters. The result is that environmental compliance is costly, reducing firm profits through expenditures on pollution control. With profit as the motivation of firms, they prefer to invest as little as possible in environmental compliance to meet the legally required minimum standards. Environmental performance would seem to be negatively related to financial performance: the more profitable firms spend less on environmental controls (Limpaphayom, 2004).

The goal of the regulation is to internalize the externalities, which commonly means to impose additional costs on the pollution producers. Accordingly, regulation may increase a firm's total average costs in the short run, such as the extra cost of installing new equipment, costs of treatment for EoP methods dealing with hazardous waste and investing in R&D. Regulation is also likely to raise the costs of producing every extra unit of output (Prace, 2005). It means that firms spend more money when complying with environmental standards,

installing mandatory technologies, or at least technologies necessary to achieve compliance with pollution limits, and reporting their environmental impacts.

Following the same idea that there is an inverse relation between financial valuation and pollution, the study of King and Lenox (2001) reported that fixed characteristics of a firm (such as firm size and research and development intensity) could cause this negative relation. This study was realized with 652 US firms during the period 1987-96. Mathur and Mathur (2000) used an event study methodology to analyze stock price reactions to the green marketing strategies of 73 companies during the period 1989-95. They documented negative price reactions to announcements of green marketing strategies. They found, from a review of advertising literature, that consumers are often confused by a firms' promotional efforts, which in turn leads to negative effects on stock prices. However, announcements of green products, recycling efforts and appointment of environmental managers result in insignificant stock price reactions. Earnhart (2007) investigated the effect of pollution control on corporate financial performance in a transition economy. In particular, this study assesses whether better pollution control, as measured by lower air pollutant emissions, improves or undermines financial success, as defined by accounting-based measures of financial performance, e.g. profitability. For this assessment, this study analyzes the effect of air pollution control using a panel of Czech firms for the years 1996-1998. The analytical results indicate that better pollution control neither improves nor undermines financial success. These results provide no support for the hypothesis that pollution prevention, generated by improved production processes, leads to lower costs, and thus, greater profitability. To sum up, environmental regulation may facilitate a firm's competitiveness if it is able to stimulate sufficiently the innovation forces. However, the current prevailing presence of command and control regulation gives insufficient space for such innovation.

The actual situation in Vietnam supporting the Neoclassical view

Tran (2003) observed that in the Vietnamese situation, SMEs have limited capital and human capacity to install new production processes. Their possibilities to renovate or change technologies for improving production effectiveness and environment protection are low. Because of inadequate financial capacity and lack of strict enforcement by authorities, Vietnamese SMEs surveyed usually invest in a temporary treatment facility with insufficient capacity. Then, due to high operation and maintenance costs, most of the treatment facilities are only operated temporarily whenever authorities conduct inspections. Regarding financial limitation, Vietnamese SMEs rarely establish an EoP treatment system voluntarily, without external pressure. In addition, Vietnamese SMEs have limited capital and human capacity to install new production processes.

Generally, there are two schools of thought on the relationship between a firm's environmental and financial performance. Obviously, which school of thought is applied is based on different situations. In Vietnam's case, with the actual situation mentioned above, it is appropriate to hypothesize that environmental performance is likely to be negatively related to financial performance in Vietnam's small and medium manufacturing firms. Therefore, this study proposes a hypothesis as follows: *The lower environmental performance a firm has, the higher its financial performance is, in the short run.*

Previous studies on portfolio methodologies in environmental research

Molloy et al. (2002) pointed out that portfolio analysis is motivated by the interest in the relative profitability of "green" investing. This study compares the stock market returns of portfolios created using environmental performance criteria. Wagner (2003) reveals that research on (model) portfolios of firms with different environmental performances is based on the segregation of firms or equity portfolios into groups with different levels of environmental performance. The

portfolios created in this way can be industry-matched and can be matched for additional criteria such as firm size or export orientation. The idea is that firms with similar characteristics should show a similar economic performance. Portfolios can cover only one industry, several industries or all industries in a country – for example all manufacturing industries. Studies evaluating the relationship between environmental and economic performance examine the average returns for each portfolio, based on accounting profitability or stock market performance measures across all firms and/or all periods. Telle (2006) suggests that many research studies employed Ordinary Least Square methodology to find a linear relationship between the environmental and financial performance with the addition of control variables.

With regard to portfolio methodology, three studies used samples divided in different portfolios to examine the effect of environmental performance on financial performance in standard market economies. First, Cohen et al. (1995) examines both accounting-based measures of financial performance (e.g. return on assets) and market-based measures of financial performance (e.g. risk-adjusted shareholder total return). Their study divides a sample of US firms into two 'portfolios' according to whether each firm is above or below its industry median for one of nine environmental performance measures. They then test the differences in financial performance mean values across the two sub-samples. Second, Gottsman and Kessler (1998) compare the financial returns of Standard and Poor's 500 list of Corporations against three sub-samples based on four measures of environmental performance. In particular, they divide firms into the top 75%, top 50% and top 25% of environmental performers. Third, Filbeck and Gorman (2004) divide their sample of electric company firms into two portions - a 'less compliant' portfolio and a 'more compliant' portfolio - based on the magnitudes of imposed environmental penalties, and then test whether monthly total stockholder returns differ between these two portfolios.

Based on the popularity of the portfolio methodology in the environmental research, this paper is expected to apply this method in the Vietnamese case. The detailed description will be in the next parts.

Previous studies on researched variables

Following the hypothesis about the link between environmental and financial performance above, this section will review recent empirical research that measure specific variables of environment and finance, which may be applied in this paper related to the testing of Vietnamese data.

Environmental performance

Cohen, et al. (1995) used nine variables for environmental performance that differ in the extent to which they depend on recent actions following firm violation. Some variables, such as the number of environmental litigation proceedings, the number of noncompliance penalties, and the dollar value of noncompliance penalties, are more likely to be correlated with firm compliance efforts. The rest are the volume of toxic chemical releases, the number of oil spills, volume of oil spills, and the number of chemical spills.

King (2001) noted the environmental performance measures that empirical studies use. These measures are compiled and disclosed by competent and independent agencies, such as TRI emissions and environmental performance indexes, or measures constructed by the researcher, through the content analysis of corporate documents. These reported events include discharges or chemical leaks, lawsuits and environmental fines for non-compliance, environmental liabilities, environmental awards, and implementation or certification of environmental management. In addition, annual reports and financial statements or other corporate documents allow for an analysis of the type of environmental information reported by corporations.

Margolis (2007) - in a meta-analysis of empirical studies on the relationship between corporate social and financial performance, sorted the collection of research involving Corporate Social Performance into nine categories. These

categories were based on a total of 167 studies, with the first five categories representing specific dimensions of Corporate Social Performance and the last four categories representing different approaches for capturing Corporate Social Performance broadly. The first five categories were: Charitable contributions, Corporate policies, Revealed misdeeds, Environmental performances, and Transparency. The last four forms of broad appraisal include: Self-reported social performances, Observers' perceptions, Third-party audits, and Screened mutual-funds.

Revealed misdeeds include the public announcement of arrests, fines, guilty verdicts in lawsuits, involuntary recalls, and other actions that indicate socially irresponsible behavior. Revealed misdeeds will be relevant to, or be, an indicator of environmental performance if a misdeed involved environmental practices.

As can be seen above there are many indicators or constructs describing environmental performance. In this paper, revealed misdeeds will be used as only one indicator for environmental performance. The reason is that command and control approaches (CAC) have been adopted to provide incentives for polluters to introduce and operate pollution treatment facilities. Most of the environmental legislation in Vietnam places emphasis on end of pipe (EoP) solutions dealing with waste emission to meet the national environmental standards. Authorized agencies carry out environmental inspection activities under strict procedures for identifying cases related to violation of environmental laws and policies. Environmental inspection is a fundamental part of ensuring compliance with legal environmental requirements. Therefore, in order to evaluate the environmental performance of firms, inspection by authorized agencies is the most appropriate way.

Financial performance

Margolis (2007) listed the specific measures of financial performance examined by the original authors into two broad categories: accounting-based measures of financial returns (e.g., Return on Assets, Return on Equity) versus market-based measures of financial value (e.g., stock returns, market/book value ratio). The Cohen, et al. (1995) study used two accounting measures - ROA, ROE and one market measure - total risk-adjusted return to shareholders. Data on the financial variables used was taken from the Compustat database. Hart and Ahuja (1996) selected three financial performance data - ROS, ROA, and ROE - for each firm as the dependent variables within the period 1989-1992. These financial data were sourced from the Compustat database. Several control variables were also compiled for this period, both at the firm and industry level. King (2001) stated that in relation to financial performance measures, empirical studies typically use accounting-based measures, such as ROS, ROA, ROE and Tobin's q, and/or market-based measures, such as return and risk-adjusted measures.

Therefore, it can be said that ROA is the most widely used by market analysts as a measure of firm performance, as it measures the efficiency of assets in producing income. ROA will be utilized as only one financial performance indicator in this paper.

Control variables

These measures are generally thought to influence firm market value directly, as well as indirectly through profitability. In particular, the following are included as control variables: sales growth, research and development intensity, firm size, age of firm assets, capital intensity, firm financial leverage, and owner/manager's behavior and education. These control variables are discussed in more detail below .

Hart and Ahuja (1996) suggested some firm-level control variables when assessing influence on economic performance. These included research and development intensity, advertising intensity, capital intensity and leverage. Earnhart (2007) used several control variables for constructing the link between environmental performance and financial performance. Total assets, equity and sales are various measures for assessing firm size. Capital intensity of a firm is calculated by dividing capital expenditure by sales. Sales growth is calculated as the annual percentage change in sales for a particular firm-year observation. Zu (2008) noted the growing interest in investigating the perceptions of top

management toward corporate social responsibility, and more specifically on environmental performance. The study pointed to managerial abilities as the motivators of socially responsible behavior and stressed the management of stakeholder expectations as an integral part of the process. Besides, according to the study of Kotey (1997), financial performance depends on numerous factors that are both internal and external to the enterprise. Of these, the abilities and the personality characteristics of those who manage the enterprise are universally regarded as one of the most powerful sets of factors having either a positive or negative impact on the financial performance and ultimate success of the enterprise.

For this paper, the most popular control variables, including firm size, capital intensity and the owner's educational background will be used.

Analytical framework

To sum up, this part of this paper sets up an analytical framework summarizing and integrating all arguments from the literature review mentioned above. Specifically, the framework below describes the relationship between researched independent, dependent, and control variables.

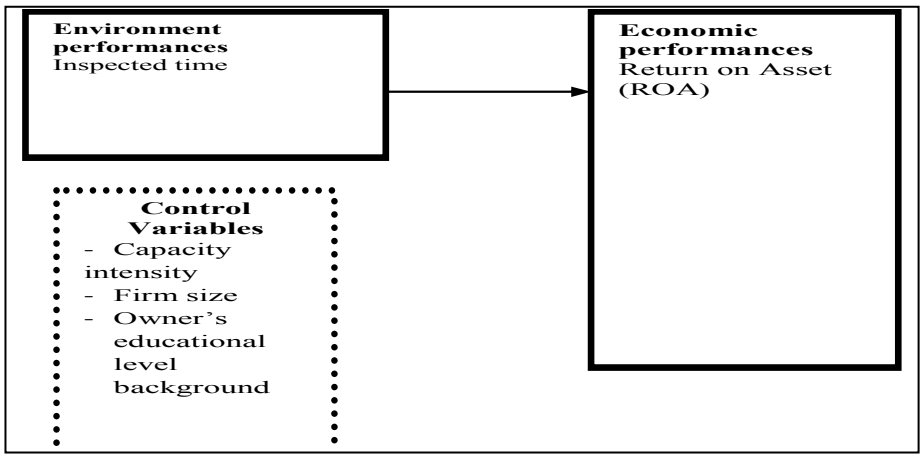

Figure 1: Analytical framework of the study
Source: Outlined by author.

3. Research Methodology

Data and sample, and different portfolios

This research uses the secondary database of the *Productivity and the Investment Climate Enterprise Survey* implemented by the World Bank in 2005 with the focus being on the data from 2002, 2003 and 2004 (three continuous year's data). The general purpose of the survey is to understand the investment climate in Vietnam and how it affects business performance. The questionnaire begins with items about the origin and shareholdings status of a business, including questions about the background of the manager. This information is useful to determine if and how the interaction between the investment climate and business performance varies by business types. It also addresses issues related to finance (examining financial constraints on production and expansion), government regulation, contract enforcement, labor relations, and business performance.

This survey was conducted in five main areas of Vietnam including the Red river delta, the Mekong river delta, and the Northern central, Southeast and Southern central coastal areas. The total number of observations is of 1,150 firms.

The definition of a small and medium scale firm follows the current definition of the World Bank as well as the Vietnamese Government. There are 837 firms considered as SMEs in the WB survey. To be suitable for this research, after removing the cases that have missing data and biased values, only 765 small and medium firms are used as the sample for analysis in this research.

As can be seen in Table 2 and Table 3, there are 16 main sectors that the 765 SMEs are engaged in. The majority of the SMEs are operating in the Food and Beverage sector with the Wood and Metal products sectors following. In addition, there are 240 SMEs in the Red River Delta region and 243 SMEs in the South East region, both of which account for the largest proportion of SMEs in the sample with 31.4 percent and 31.8 percent respectively. These two regions are the most developed in Vietnam. Hanoi, the capital, is located in the area of the Red River Delta. The biggest city, Ho Chi Minh City, is located in the Southeast. According to the national enterprise survey conducted by the General Statistical Office (GSO, 2005), establishments are mostly concentrated in Ho Chi Minh City (23%), and in Hanoi capital (15%).

Table 2: Distribution of the studied firms by industry in the World Bank's survey, 2005

Manufacturing industry	SMEs	Percent
1. Food and Beverage	122	15.90
2. Textiles	36	4.71
3. Apparel	28	3.66
4. Leather products	6	0.78
5. Wood and wood prod, incl.furniture	99	12.94
6. Paper	53	6.93
7. Chemicals and chemical products	45	5.88
8. Rubber and plastic products	50	6.54
9. Non-metalic mineral products	2	0.26
10. Basic metals	10	1.32
11. Metal products	92	12.00
12. Machinery and equipment	40	5.23
13. Electrical machinery	11	1.45
14. Electronics	15	1.96
15. Vehicles and other transport equipment	13	1.70
16. Construction materials	63	8.24
17. Other	80	10.50
Total	**765**	**100**

Source: Descriptive statistics by author using World Bank's survey, 2005.

Table 3: Distribution of studied firms by all regions

Manufacturing industry	SMEs	Percent
Red River Delta	240	31.4
North Central Coast	122	15.9
South Central Coast	93	12.2
South East	243	31.8
Mekong River Delta	67	8.7
WHOLE COUNTRY	**765**	**100**

Source: Descriptive statistics by author using World Bank's survey, 2005.

Research variables, measurement and regression model

Financial variable: The dependent variable for this analysis is financial performance measured by ROA in 2004, that is, the ratio of profit to assets, reflecting the asset utilization of each firm. ROA is an accounting based measure of financial performance in the short term.

Environment variable: Environment variable can be measured by the number of times that a firm was inspected by an environmental agency. This variable is relevant to "revealed misdeeds" indicating socially irresponsible behavior. Authorized agencies carry out environmental inspection activities to identify activities that violate environmental standards. Inspected times by an environmental agency implies the number of times a firm does not comply with

environmental regulations - meaning the firm's non-compliance times. This indicator indirectly tells us something about pollution levels to which the firm is exposed. In the broader thinking, inspected time can be understood as an action that indicates socially irresponsible behavior by the firm. A "low polluting firm" indicates it is a "good" environmental actor with a high environmental compliance or has relatively few non-environmental compliance times. A "high polluting firm" indicates the firm is a "bad" environmental actor or has many non-environmental compliance times. In that sense, inspected time by Environmental Agency is a negative indicator for environmental performance. A firm with high inspected times is a low compliance firm based on environmental performance.

Control variables: There are several variables used in the analysis of financial performance as controls including: 1) The capital intensity (KAINTENSITY) of a firm, calculated by dividing fixed asset expenditure by sale value 2) The firm's size (LOGSIZE) calculated as the natural log of the total number of the firm's employees 3) The owner's educational background (BACKGROUND) measured by ordinal numbers from 1 to 6, representing the education level of the owner from the lowest to the highest level: Did not complete high school; High school; Vocational training; Some college or university training; Graduate degree (BA, BSc etc.), and Post graduate degree (PhD, Masters). Details of all researched variables can be summarized in Table 4.

Table 4: Details of all researched variables

Variables	Description	Name
Independent variables	Number of inspected times by	INSPECTED
Environmental	Environmental Agency (from 0 to 10)	
compliance	Ratio of fixed assets to sales	KAINTENSITY
Control variables	Natural log of total number of	
Capital intensity	employees	
Firm size	Ordinal number for the educational level of owner (from 1 to 6)	LOGSIZE
Owner's educational background	Ratio of profit to assets	BACKGROUND
Dependent variables		ROA
Return on asset (ROA)		

Source: Summarized by author using World Bank's survey, 2005.

Analysis models

The main quantitative analysis method used in this research is Multiple Regression analysis. The relationship between independent and dependent variables is modeled in the following equation:

$Yi = a + bXi + e$

Where *Y* represents return on asset (ROA) in i^{th} SMEs, *Xi* represents four independent variables such as environmental performance (INSPECTED), capital intensity (KAINTENSITY), firm size (LOGSIZE), educational background (BACKGROUND), and *e* is error term.

The details of the relationship between variables are illustrated in the equation:

ROA = b0 + b1INSPECTED + b2KAINTENSITY + b3LOGSIZE + b4BACKGROUND + e

Moreover, based on the level of a firm's environmental performance and following the literature review of previous studies of portfolio methodology, this research divides the sample into two different model portfolios, following the different levels of environmental performance. For all portfolios, the mentioned multiple regression was used to estimate the model. Specifically, the first model focuses on small and medium manufacturing firms as a whole (765 firms). The other two models (sub-samples) are high polluting firms (from 2 to 12 inspected times by the

Environmental Agency) and low polluting firms (0 or 1 inspected times by the Environmental Agency). The details about each model portfolios in terms of the number of firms will be listed in Table 5.

Table 5: The number of firms in each model

Total small and medium firms **(Total_SME)**	765	Model 1
- High polluting firms **(SME_H)**	145	Model 2
- Low polluting firms **(SME_L)**	620	Model 3

Source: Descriptive statistics by author using World Bank's survey, 2005.

4. Analysis Results and Discussion

Descriptive Statistics

This part of this paper provides comprehensive descriptive statistics of all variables in the 3 models of this study (details in Table 6 below). The descriptive statistics tell us the distribution of variables, the spread of the distribution (minimum, maximum, and range), measures of central tendency (mean), and measures of variability around the mean (Std. Deviation).

Multiple Regression and analysis results

Table 6: Descriptive Statistics

	N	ROA	INSPECTED	KAINTENSITY	LOGSIZE	BACKGROUND
Model 1		**Small and medium firms (Total_SME)**				
N	**765**					
Mean		0.036526	0.7739	0.7142	1.7830	4.2340
Maximum		0.4348	12	11.82	2.48	6
Minimum		-0.3688	0	0	0.3	1
Std.Dev.		0.063943	1.45341	1.02028	0.42979	1.40172
Model 2						Small firms **(SME_H)**
N	**145**					
Mean		0.040148	3.0207	0.6844	1.8981	4.2759
Maximum		0.4348	12	6.33	2.48	6
Minimum		-0.2377	2	0.01	0.78	1
Std.Dev.		7.34828	2.03261	0.81256	0.39593	1.41167
Model 3						Small firms **(SME_L)**
N	**620**					
Mean		0.035679	0.2484	0.7212	1.7561	4.2242
Maximum		0.3221	1	11.82	2.48	6
Minimum		-0.3688	0	0	0.3	1
Std.Dev.		0.061534	0.43243	1.06347	0.43324	1.40034

Source: Calculated by author.

Table 7: Results of Total_SMEs

Return on Asset (ROA)					
Independent variables	Coefficient B	Standard coefficients Beta	T	Sig.	VIF
(Constant)	3.559		3.564	0.000	
INSPECTED	**0.349****	**0.079**	**2.371**	**0.018**	**1.018**
KAINTENSITY	-2.448***	-0.391	-11.652	0.000	1.024
LOGSIZE	0.281	0.019	0.523	0.601	1.188
BACKGROUND	0.253	0.055	1.561	0.119	1.151
R^2	0.166				
Adjusted R^2	0.162				
Durbin - Watson	2.067				
Sample size	765				
***, **, * statistically significant at 1%, 5% and 10% level respectively					

Source: Calculated by author.

Table 8: Result of SME_H

	Return on Asset (ROA)				
Independent variables	Coefficient B	Standard coefficients Beta	T	Sig.	VIF
(Constant)	8.354		2.824	0.005	
INSPECTED	**0.855*** **	**0.236**	**3.165**	**0.002**	**1.007**
KAINTENSITY	-3.587***	-0.397	-5.122	0.000	1.082
LOGSIZE	-4.332***	-0.233	-2.678	0.008	1.371
BACKGROUND	0.879*	0.169	1.954	0.053	1.347
R^2	0.224				
Adjusted R^2	0.202				
Durbin - Watson	2.222				
Sample size	145				

***, **, * statistically significant at 1%, 5% and 10% level respectively

Source: Calculated by author.

Table 9: Result of SME_L

	Return on Asset (ROA)				
Independent variables	Coefficient B	Standard coefficients Beta	T	Sig.	VIF
(Constant)	2.529		2.406	.016	
INSPECTED	**-0.479**	**-0.034**	**-0.916**	**0.360**	**1.010**
KAINTENSITY	-2.314***	-0.400	-10.831	0.000	1.020
LOGSIZE	1.174**	0.083	2.106	0.036	1.153
BACKGROUND	0.181	0.041	1.062	0.289	1.126
R^2	0.178				
Adjusted R^2	0.173				
Durbin – Watson	2.040				
Sample size	620				

***, **, * statistically significant at 1%, 5% and 10% level respectively

Source: Calculated by author.

Table 10: Summary of analysis results

	Model 1	**Model 2**	**Model 3**
	Total-_SME	**SME_H**	**SME_L**
(Constant)	3.559	8.354	2.529
INSPECTED	**0.349** **	**0.855*** **	**-0.479**
KAINTENSITY	-2.448***	-3.587***	-2.314***
LOGSIZE	0.281	-4.332***	1.174**
BACKGROUND	0.253	0.879*	0.181
R^2	0.166	0.224	0.178
Adjusted R^2	0.162	0.202	0.173
Durbin - Watson	2.067	2.222	2.040
Sample size	765	145	620

Source: Calculated by author.

From Tables 7 to 10, three models are interpreted as follows: by observing the multiple coefficient of determination, R^2 is considered as an optimistic estimate for the population value, with the highest value of 0.224 in SME_H model and the lowest value of 0.166 in Total_SMEs, indicating that 22.4% and 16.6% respectively of the variance in ROA is explained by environmental variables and three control variables. The next coefficient noticed is Adjusted R^2 considered as a better population estimate. This coefficient is always given along with R^2. So in these models the highest and lowest value of Adjusted R^2 is also shown in SME_H and Total_SMEs models.

The value of the Variance inflation factor (VIF) and coefficient of the Durbin-Watson indicate whether the model violates the assumption of no multicollinearity and no autocorrelation in a general linear regression model. Checking VIF shows that none of the variables in all three models exceeds 10. In term of the Durbin-Watson value, the model does not violate the assumption of this value. It falls in an acceptable range of 1.2-2.5. All Durbin Watson values are in the optimal position of the acceptable range, around 2.

For the regression coefficient and significant level of independent variable in each model, it can be found that the variable Inspected time (INSPECTED) has a positive impact on the ROA in the model of SME_H, and Total SMEs with coefficient of 0.855, 0.349; at a statistical significant level of 1% and 5% respectively. The SME_L model shows no statistically significant results between environmental and financial performance. The model SME_H got the highest R^2, highest Adjust R^2 and has an environmental variable with a statistical significant level of 1% (p value = 0.002).

The relationship between control variables and a firm's financial performance: From model 1 to 3, capital intensity is consistently a negative predictor of ROA. Whereas firm size only is significant in relation to ROA in the two models SME_H and SME_L, and is a negative factor in SME_H, it is a positive predictor in the SME_L model. Finally, the owner's background control is a positive indicator for financial performance in SME_H, while the two remaining models show no relationship.

Findings and discussion

From analysis of the results of multiple regressions, two models Total_SMEs and SME_H support the hypothesis, and the last model SME_L rejects the hypothesis.

The purpose of this paper examines the relationship between a firm's environmental and financial performance and identifies which group of Vietnamese SMEs is under this relationship. Based on these results, this paper mainly relies on the result of two models – SME_H and SME_L. Only SMEs_H has a statistical significance.

In SMEs_H, inspected times are statistically significant, having a positive effect on ROA. As explained, inspected time is a proxy environmental variable having a negative meaning. This shows that a SME with low environmental performance will gain high financial performance. For SMEs_L, environmental and economic performances are not related. Therefore, the SME_H group supports the hypothesis "The lower a firm's environmental performance, the higher its financial performance". The SME_L group rejects this hypothesis.

The results of SMEs_H shows that high inspected time implying poor environmental performance has a statistically significant positive impact on ROA standing for financial performance. This indicates that investors perceive environmental improvements as costly, unless investments are made in response to regulations and to avoid penalties.

For SME_H, the existing environmental regulation cannot work well because it has a negative impact on financial performance. If firms try to follow and obey this kind of innovation, their behavior will have negative impacts on their economic performance. Therefore, there is no incentive for firms to obey environmental innovation. The following reason may be offered. This study examines the environmental issues in 2004 when the EoP method was dominant in Vietnam. The EoP method helps a firm to comply

with the environmental standard. The firm, in response to this standard, has to install end of pipe methodology in order to comply with the environmental standard of the government, but this method is usually costly. If the company follows this approach, they will incur a high cost and this cost makes for an increase in the cost of the production process and total costs for the firm.

5. Conclusion

Concerning the whole SMEs, the analytical results indicate that better pollution control neither improves nor undermines financial success. SMEs_H shows that high inspected time implying poor environmental performance has a statistically significant and positive impact on the ROA implications for financial performance. This result supports the hypothesis "the lower environmental performance a firm has, the higher its financial performance". SMEs_L and environmental and financial performances are not related statistically. This indicates that SME_H perceives environmental improvements as costly, unless investments are made in response to regulations and to avoid penalties. This result also is in accord with Vietnamese conditions where there is an environmental perception that is reinforced by the policy of pushing EoP measures. This is specifically true in the case of high polluting SMEs whose capacity and willingness in complying with environmental requirements is not sufficient.

This study has implications for the SMEs, government sectors and researchers. For Government, the government should consider strong public intervention in the case of SME_H in order to attain environmental targets for the society. Compared with poor regulations based on command and control, which constrain the choice of technologies and stress EoP solutions. Pollution prevention methods can deliver the firm a win – win result. Government needs to support SME_H with environmental measures such as market incentives, tax exemptions or subsidies, to encourage SME_H to invest in an environmental prevention approach focusing on innovation and adoption of cleaner production methods. This can bring a favorable outcome with both environmental and financial benefits.

For SMEs, Vietnamese SMEs should pay greater attention to an environmental protection approach, such as cleaner production, in order to make their long-term development sustainable. This approach has contributed significantly to reducing pollution, improving environmental performance, raising profitability and enhancing competitiveness.

For academics, this study provides additional empirical evidence of what the school of thought on this issue really is in Vietnam. As suggested by the hypothesis, a neoclassical view is applied in Vietnam's case within the framework of the analysis sample used in this paper.

This paper has some limitations. As it just gives the empirical test in the year 2004, the paper doesn't show the long-term relationship between environmental and financial performance. The environmental variable is a proxy variable indirectly related to a firm's environmental performance. The data were taken from the Enterprise survey on "Productivity and investment climate" conducted by the World Bank, which had no real data on the environmental performance of firms. Control variables did not cover many aspects of financial performance.

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Nghiên cứu tác động của thực hiện môi trường đến kết quả hoạt động của các doanh nghiệp sản xuất vừa và nhỏ tại Việt Nam

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Tóm tắt. Nghiên cứu tác động của thực hiện môi trường đến kết quả tài chính đã thu hút được sự quan tâm của xã hội trong thời gian qua. Bài viết này nghiên cứu tác động của thực hiện môi trường và kết quả hoạt động của các doanh nghiệp sản xuất vừa và nhỏ tại Việt Nam (SME) thông qua sử dụng bộ số liệu của Ngân hàng Thế giới năm 2005 "Năng suất và môi trường đầu tư". Cụ thể, nghiên cứu này điều tra mối quan hệ giữa ROA, một thước đo về kết quả tài chính của công ty trong ngắn hạn và số lần mà doanh nghiệp bị các cơ quan môi trường kiểm tra, một biến số về thực hiện môi trường. Công ty nào có số lần bị kiểm tra nhiều có nghĩa là sự thực hiện môi trường thấp. Dựa trên các mức độ khác nhau về thực hiện môi trường (số lần bị kiểm tra), nghiên cứu này chia mẫu nghiên cứu làm hai nhóm "những SME có mức ô nhiễm môi trường cao" và "những SME có mức ô nhiễm môi trường thấp". Kết quả phân tích đã chỉ ra rằng kiểm soát môi trường tốt không làm tăng hay giảm kết quả tài chính. Với nhóm "ô nhiễm môi trường cao", nhóm có số lần bị kiểm tra nhiều, thì thực hiện môi trường không tốt lại có tác động tích cực quan trọng về mặt thống kê đối với ROA. Đối với nhóm "ô nhiễm môi trường thấp", thực hiện môi trường và kết quả hoạt động không có mối quan hệ quan trọng về mặt thống kê. Cuối cùng, dựa trên kết quả phân tích, nghiên cứu này đưa ra những khuyến nghị cho các SME, nhà làm luật và nhà nghiên cứu cũng như những gợi ý cho các nghiên cứu tiếp theo trong tương lai.