

STUDY ON IMPACT OF ENVIRONMENTAL PROTECTION INVESTMENT OF ENTERPRISE ON FINANCIAL PERFORMANCE*

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Abstract

Since introducing the concepts of corporate environmental responsibility and environmental protection investment, the relationship between environmental protection investment and corporate financial performance has been an important issue. Although scholars have done a lot of empirical research on the relationship between them, it does not come to a similar conclusion. In the recent years, most scholars consider that enterprise environmental protect investment makes a positive effect on financial performance.

This paper aims to study the relationship between environmental protection investment and corporate performance in current and later fiscal years of listed companies of heavy pollution industry. Based on the previous study results, this paper established the conceptual model of the relationship between enterprise environmental protection investment and financial performance, collecting data from financial reports, corporate social responsibility reports and other independent reports and database. According to the analysis, this paper draws the following basic conclusions: 1) corporate environmental protection investment does not have a significant effect on the current financial performance; 2) corporate environmental protection investment plays a positive effect on the financial performance of the following year; 3) compared with investment in pollution treatment, pre-pollution prevention investment has a more significant impact on financial performance.

Keywords: Environmental Protection Investment, Financial Performance, Listed Companies of Heavy Pollution Industry

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Introduction

Compared to the past times, the public is no longer satisfied with an enterprise that simply provides product and service values to and creates job opportunities for the society. Instead, an enterprise is expected to actively bear social responsibilities, particularly, environment protection related responsibilities. Environment protection investment is a very reliable approach to addressing ever-worsening environmental conditions, preventing other environmental problems, performing environment protection liabilities and improving environment quality.

However, as the organization aiming at the maximum of economic interest, most enterprises would be reluctant to voluntarily increase environment protection investments simply for the purpose of environment protection and maintenance because it is an enterprise's environment management cost and expenditure. From the perspective of profitability, increasing environment protection investment will reduce an enterprise's more profitable investment inputs featured with productivity and investment value. It has always been a focus of dispute for the theoretical and industrial sectors in recent years if increasing environment protection investments will generate negative impacts on financial performances. Some people believe that environment protection investment and performance indexes are completely against each other because higher financial performances will inevitably bring environmental pollution. Priority in bearing environment protection liabilities requires higher expenses in environment protection and thus inevitably reduces the capital and human investments in other more profitable sectors.

Therefore, environment protection liabilities must be borne at the sacrifice of enterprise values. On the other hand, some scholars believe that environment protection input is an investment to an enterprise although primarily it is for the satisfaction of social responsibilities. Like other types of investments, an enterprise can gain in the long run and promote the development of other industries. Therefore, environment protection investment and enterprise performance are not absolutely against each other.

Research Objectives

This paper aims to study the relationship between environmental protection investment and corporate performance in current and later fiscal years of listed companies of heavy pollution industry.

Literature Review

According to neoclassical economic theories, environment protection investment from enterprises is believed to be against the economic law of capital orientation and the operating goal of profit maximization. Environment control is a primary factor that increases enterprise costs and generates negative impacts on productivity and competitiveness (Walley & Whitehead, 1994). Orsato (2006) empirical study also proves such a viewpoint, an enterprise needs to procure environment protection equipment or make enormous capital investments in ecological technology innovation and research for the purpose of environment protection and such investments can hardly increase direct cash incomes for the enterprise. The cost school believes that

environment protection investments only represent cost increase and thus lowers corporate profitability and market value. Hassel, Nilsson & Nyquist (2005) uses the residual gain valuation model and the empirical study results to verify the viewpoints of the cost school, i.e. environment protection has negative impacts on an enterprise's market value.

From the perspective of production and operation, environment protection investment, as a very special expenditure, is expected to realize the inherent compliance of economic benefit, ecological benefit and social benefit. But the economic benefits are normally limited and the benefits are mostly ecological and social benefits. In order to bear environment protection responsibilities, an enterprise needs to purchase environment protection devices and equipment and train relevant personnel and allow these devices and equipment to work effectively and bring real values.

Therefore, an enterprise's environment protection investments are diversified and inevitably cause "additional" costs and expenses to the routine operations of the enterprise. Meanwhile, environment protection investments are long-term investments that can't bring direct and immediate economic inflows and therefore can't be rewarded within the short term. Therefore, the costs of environment protection investment are higher than the incomes from them in the period of investment. Therefore, environment protection investment and enterprise performance have negative correlations. In consideration thereof, the following hypothesis is proposed:

H1: Environment protection investments from enterprises have negative impacts on enterprise performances.

Some scholars believe that environment protection investments won't directly increase performances but can have other impacts and thus bring positive impacts on financial performances. According to the researches of Sharfman & Fernando (2008), increasing environment protection investments can effectively reduce an enterprise's potential environment risks, help to reduce its environment liability costs and finally improve its profit level. Thomas (2013) researches on the relations between the environment protection investments and performances of manufacturing enterprises of Sweden and the research results show that an enterprise's environment protection investments can be a preliminary investment which can indirectly affect the enterprise's financial performances through increasing its environment pollution prevention and control ability and thus is good for the long-term increase of its profitability.

Based on analysis of literature in hand, it is believed that environment protection investments can't bring direct economic benefits to an enterprise within the short term, i.e. such investments will generate adverse impacts on the enterprise's current financial performances. However, continuously increasing and expanding environment protection investments will apparently promote the general performances of the enterprise in the long run, including increasing incomes and declining costs.

Therefore, the following hypothesis is proposed:

H2: The positive impacts of an enterprise's environment protection investments on its performances are delayed.

Increasing investments in pollution prevention can prevent environment pollution from the origin, reduce impacts on ecological environment and thus subsequent costs in environment treatment. Meanwhile investments in environment protection technologies can reduce subsequent energy losses and production costs, increase operating profits and create a benign cycle of sustainable development. It is good for the continuous growth of the enterprise's financial performances.

Environment treatment and recovery investments are mostly environment protection investments required by national laws and therefore are necessary expenses other than production costs. Environment treatment and recovery investments will increase the total current costs of the enterprise and reduce its gains. However, the improving surrounding ecological environment arising from environment treatment and recovery investments can avoid massive environment fines and administrative penalties imposed by the government, reduce total costs of enterprise, increase the appeal of the enterprise to potential partners and thus generate continuous positive impacts on its financial performances.

Therefore, the following hypothesis is proposed:

H3: Environment pollution prevention investments have greater incentive impacts on an enterprise's performances in the next period.

Methodology

1. Specimen Selection and Data Source

For the purpose of this thesis, the public companies of 16 heavy-polluting industries of 2012-2016 were selected as the research objects according to the Catalog of Classified Management of Public Companies Subject to Environment Protection Inspection released by the Ministry of Ecology and Environment of the People's Republic and China in 2008. Totally 4,252 initial specimens were acquired. In order to ensure the reliability of the research conclusions, initial specimens were screened and the public companies having lost data, ST companies, delisted companies and companies listed after 2012 were removed. Finally 121 companies and 605 observation specimens were acquired.

The data of this thesis have the following origins: Data about environment protection investment amounts and their projects originate from the annual reports, social responsibility report, sustainable development report and environment report disclosed by public companies and they are all manually collected and summarized; data about enterprise performances and control variables all originate from CSMAR database and RESSET database.

2. Variable Design and Measurement

1) Explanatory variable: enterprise performance. Based on prior researches, evaluation method based on accounting profits will be adopted to evaluate enterprise performances in this thesis, i.e. enterprise performance refers to the effects of an enterprise's production and operation activities. An enterprise is a profit-oriented organization regardless of its ownership and form. Enterprise profitability is the core part of enterprise performance. Other than profitability, development ability is another dimension of

enterprise performance. In earlier studies on enterprise performance, most scholars focus on enterprise growing ability. However, enterprise development ability has become a common concern of scholars in recent studies on enterprise performances. Compared with growing ability, development ability allows an enterprise to be more sustainable (Han, 2009). When an enterprise has survived, sustainable development becomes its intrinsic need. Therefore, in this thesis enterprise performance includes short-term profitability and long-term development ability of an enterprise.

2) Explained variable: enterprise's environment protection investment. Environment investment intensity is taken as the proxy variable of environment investment; incremental environment protection investment of the year divided by the company's total asset is adopted to gauge the environment protection investment intensity, which is indicated as EPI. As the academia is still far from reaching a consensus on the definition of "environment protection investment", the structural definition of environment protection investment of Ling & Yang (2013); Yue (2016) fall into the following 5 categories with reference to relevant other researches: (1) R&D and renovation expenses of environment protection products and technologies; (2) Investment and renovation expenses of environment protection facilities and systems; (3) clean production expenses; (4) pollution treatment technology R&D and renovation expenses; (5) pollution treatment equipment and system investment and renovation expenses.

In order to verify that different types of environment protection investments have

different impacts on enterprise performances, environment protection investment is defined according to different phases of environment protection, i.e. the investments are divided into "environment pre-pollution prevention investment" (PREPI) and "environment pollution treatment investment" (REEPI), which include (1) — (3) and (4) — (5) environment protection investment projects above respectively.

Control variable: There are many factors that affect enterprise performance. These factors are selected determined on three levels, including financial condition, company governance and capital market, in this thesis with reference to prior literature. Meanwhile other model-related factors are reasonably controlled to minimize the problems of variable omission and endogeneity in modeling.

Control variables in the category of financial conditions: three indexes, i.e. financial leverage (LEV), operating revenue growth rate (GROWTH) and company's total asset scale (SIZE), are selected in this thesis to represent the Company's solvency, growing ability and scale effect respectively;

Control variables in the category of company governance: four indexes, i.e. share concentration (TOP1), senior management shareholding ratio (MANAGE), independent director ratio (IDR) and chairman and GM is taken by the same person (DUAL), are selected in this thesis to represent the impacts of company shareholding structure on company value and the impacts of company governance structure on company value.

Control variables in the category of capital market and others: two capital market-related indexes, i.e. company share nature

(STATE) and company listing period (AGE), are adopted as the control variables.

3. Modeling

Multiple regression is adopted to verify the foregoing hypothesis.

Model (1-1):

$$ROA_t = c + \beta_1 EPI_t + \beta_2 LEV + \beta_3 GROWTH + \beta_4 SIZE + \beta_5 TOP1 + \beta_6 MANAGE + \beta_7 IDR + \beta_8 DUAL + \beta_9 STATE + \beta_{10} AGE + e$$

Model (1-2):

$$TOBINQ_t = c + \beta_1 EPI_t + \beta_2 LEV + \beta_3 GROWTH + \beta_4 SIZE + \beta_5 TOP1 + \beta_6 MANAGE + \beta_7 IDR + \beta_8 DUAL + \beta_9 STATE + \beta_{10} AGE + e$$

Model (2-1):

$$ROA_{t+1} = c + \beta_1 EPI_t + \beta_2 LEV + \beta_3 GROWTH + \beta_4 SIZE + \beta_5 TOP1 + \beta_6 MANAGE + \beta_7 IDR + \beta_8 DUAL + \beta_9 STATE + \beta_{10} AGE + e$$

Model (2-2):

$$TOBINQ_{t+1} = c + \beta_1 EPI_t + \beta_2 LEV + \beta_3 GROWTH + \beta_4 SIZE + \beta_5 TOP1 + \beta_6 MANAGE + \beta_7 IDR + \beta_8 DUAL + \beta_9 STATE + \beta_{10} AGE + e$$

Model (3-1):

$$ROA_{t+1} = c + \beta_1 PREPI_t + \beta_2 REEPI_t + \beta_3 LEV + \beta_4 GROWTH + \beta_5 SIZE + \beta_6 TOP1 + \beta_7 MANAGE + \beta_8 IDR + \beta_9 DUAL + \beta_{10} STATE + \beta_{11} AGE + e$$

Model (3-2):

$$TOBINQ_{t+1} = c + \beta_1 PREPI_t + \beta_2 REEPI_t + \beta_3 LEV + \beta_4 GROWTH + \beta_5 SIZE + \beta_6 TOP1 + \beta_7 MANAGE + \beta_8 IDR + \beta_9 DUAL + \beta_{10} STATE + \beta_{11} AGE + e$$

Results and Discussions

1. Descriptive Statistics

Before empirical analysis of variables, SPSS software is adopted for analysis of main variables of the 605 observation specimens.

Table 1 shows the descriptive statistics of total environment protection investments. As the table shows, the descriptive statistics of total specimens and annual specimens are not much different from each other. Judging from the statistics of total specimens, the environment protection investments of more than half of the specimens are lower than average, which reflects the common problem of inadequate environment protection investment by public companies in China's heavy-polluting industries to a certain extent. The standard deviation is higher than the mean and median values, which reflects considerable differences between the specimens in environment protection investment.

Table 1 Descriptive Statistics of Environment Protection Investment Scale

Year	N	Mean	Standard Deviation	Min	Median	Max
2012	121	0.0132	0.0315	0.000043	0.0029	0.2383
2013	121	0.0133	0.0258	0.000047	0.0030	0.1679
2014	121	0.0109	0.0278	0.000089	0.0024	0.3144
2015	121	0.0128	0.0403	0.000113	0.0032	0.4343
2016	121	0.0137	0.0305	0.000115	0.0031	0.3045
Total	605	0.0128	0.0312	0.000043	0.0029	0.4343

Souce: Author's calculation

Table 2 is the descriptive statistics of environment protection investment structure.

As the table shows, the mean value of pre-pollution prevention investments is 0.56%, and this type

investments is 43.75% (0.56%/1.28%) of total environment protection investments, which is not much different from pollution treatment investments. REEPI is 56.25% (0.72%/1.28%) of total investment. It basically fits in with the conclusions of prior researches. The two categories

of environment protection investment projects show that the enterprises of heavy-polluting industries are also substantially different in the scale of various types of environment protection investments.

Table 2 Descriptive Statistics of Environment Protection Investment Structure

Variable	N	Mean	Standard Deviation	Min	Median	Max
PREPI	605	0.0056	0.0230	0.000023	0.0020	0.4106
REEPI	605	0.0072	0.0113	0.000038	0.0014	0.3097
EPI	605	0.0128	0.0312	0.000043	0.0029	0.4343

Souce: Author's calculation

2. Regression Analysis

Table 3 shows that Model (1-1) and Model (1-2) have a good fit and pass 1% significance test. It shows that independent variables have a high degree of interpretation

of dependent variables and regression model passes the test. Therefore, the data model established by this thesis has practical significance and can be subject to data analysis with this equation.

Table 3 Regression Results of Environment Protection Investments for Enterprise Performances

Variable	ROA _t	TOBIN Q _t	ROA _{t+1}	TOBIN Q _{t+1}	ROA _{t+1}	TOBIN Q _{t+1}
	(1-1)	(1-2)	(2-1)	(2-2)	(3-1)	(3-2)
EPI _t	0.232 (1.16)	0.107 (1.38)	0.110*** (2.21)	0.302** (2.15)		
PREPI _t					0.157** (2.43)	0.316** (2.29)
REEPI _t					0.10** (2.19)	0.199* (1.78)
LEV	-0.159*** (-4.22)	-2.673*** (-6.94)	-0.120*** (-4.67)	-2.510*** (-5.29)	-0.086*** (-4.15)	-2.095*** (-5.19)
GROWTH	0.015* (1.74)	1.067* (1.84)	0.128*** (2.87)	0.219** (2.31)	1.746*** (2.94)	0.174** (2.13)
SIZE	0.131*** (2.71)	0.753*** (3.37)	0.159** (2.21)	0.512*** (3.59)	0.462*** (3.09)	0.494** (2.57)
TOP1	-0.054 (-1.18)	0.357 (0.18)	-0.063 (-1.27)	-0.105 (-1.09)	-0.014 (-1.02)	-0.088 (-0.61)

Table 3 Regression Results of Environment Protection Investments for Enterprise Performances (Cont.)

Variable	ROA _t	TOBIN Q _t	ROA _{t+1}	TOBIN Q _{t+1}	ROA _{t+1}	TOBIN Q _{t+1}
	(1-1)	(1-2)	(2-1)	(2-2)	(3-1)	(3-2)
MANAGE	-0.051 (-0.19)	-0.150 (-0.43)	-0.057 (0.21)	-0.037 (-0.764)	-0.013 (-1.57)	-0.180 (-1.13)
IDR	0.112 (0.18)	0.140 (0.18)	0.085 (1.09)	0.098 (1.03)	0.109 (0.62)	0.017 (0.23)
DUAL	0.026 (0.35)	0.125 (0.40)	-0.016 (-0.11)	-0.079 (-0.91)	-0.056 (-0.61)	-0.079 (-0.91)
STATE	-0.109*** (-2.83)	-0.148** (-2.17)	-0.073* (-1.76)	-0.103* (-1.64)	-0.013 (-1.18)	-0.064 (-0.48)
AGE	-0.081 (-1.39)	0.062 (1.46)	0.059 (1.18)	-0.012 (-0.28)	0.014 (1.01)	-0.012 (-0.28)
YEAR	controlled	controlled	controlled	controlled	controlled	controlled
Constant	0.067*** (5.28)	2.791*** (7.88)	0.062*** (4.37)	2.661*** (7.44)	0.055*** (3.76)	2.808*** (6.21)
N	605	605	605	605	605	605
R ²	0.322	0.189	0.439	0.325	0.406	0.317
R ² _Adj	0.302	0.176	0.427	0.307	0.390	0.300
F	38.699	21.603	50.661	36.241	42.889	28.720

Note: ***, ** and * represent a significance level of 1%, 5% and 10% respectively; the bracket contains t value.

Souce: Author's calculation

Model (1-1) and Model (1-2) reflect the regression results of environment protection investments on enterprise's current performances. The regression coefficients of environment protection investment on current ROA and Tobin Q are 0.232 and 0.107. It shows that environment protection investment has positive, although insignificant, impacts on the current ROA and Tobin Q of the enterprise. H1 is not substantiated.

Model (2-1) and Model (2-2) reflect the regression results of environment protection investments on enterprise performances of the next period. The foregoing table shows that an enterprise's environment protection

investment intensity has positive correlations with the ROA and Tobin Q of the next period on the level of 5% and the two models have a good fit. The independent variables interpret the dependent variables to a high extent, which shows that environment protection investments have significant positive impacts on the ROA and Tobin Q of the next period. Thus H2 is substantiated.

In Model (3-1) and Model (3-2), the regression coefficients of pollution prevention investments are 0.157 and 0.316 respectively and both have passed 5% significance test. The regression coefficients of pollution treatment investments in both models are significant on

5% and 10% levels respectively, which shows that the two indexes have positive impacts on the ROA and Tobin Q of the next period. Comparatively, pollution prevention investments of the current period have greater positive impacts on the performances of the next period, which shows that increasing pollution prevention investments can promote enterprise performances better in the future. Therefore, H3 is substantiated and pollution prevention investments have greater promotional effects on enterprise performances of the next period than pollution treatment investments.

3. Robustness test

In order to increase the reliability of research conclusions, a series of robustness test is conducted in this thesis: 1) Rate of return on net assets is used to replace rate of return on total asset; 2) general growth rate of total assets is used to replace Tobin's Q. Regression is performed on the model again on such basis. The enterprise inspection results are omitted here due to limited contexts available but the conclusions still support the hypotheses of this thesis.

Conclusions

Through a series of empirical tests, the following research conclusions are drawn:

Public companies of heavy-polluting industries can promote their profitability and development ability by increasing environment protection investments. Such positive impacts can be sustainable and can lead to better enterprise performances of the current and

next period. It shows that, by increasing environment protection investments, an enterprise can control environment law compliance costs, increase the utilization efficiency of various types of resources and the ability to raise funds, turn advantages in environment protection into inherent competitiveness, give rein to the economic value of environment protection and thus increase the enterprise's financial performances.

The pollution prevention investments of a public enterprise in the heavy-polluting industries have significant positive correlations with the enterprise performances of the next period. Through pollution prevention investments, a public enterprise in the heavy-polluting industries can reduce subsequent treatment costs, energy consumption during production and operation and operating costs, improve enterprise operation and finally increase its performances.

The current pollution treatment investments of a public enterprise in the heavy-polluting industries have significant positive correlations with the financial performances of the next period. By increasing pollution treatment investments, a public enterprise in the heavy-polluting industries can improve the ambient environment treatment work and ecology recovery work, avoid environment fines, indemnities and other additional expenses, acquire rewards and subsidies, enhance the enterprise's competitiveness, expand enterprise businesses and finally increase the level of financial performances.

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