

Environmental Investment and Firm Performance: The Moderating Role of Distance from Bankruptcy

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Abstract. Based on the stakeholder theory and the prospect theory, our study investigates into the relationship between environmental investment and firm performance. Thus, using panel data of 255 GEM listed firms from 2011 to 2016, we show that there is no significant correlation between environmental investment and short-term performance; the environmental investment promotes long-term performance; Distance from bankruptcy has no moderating effect on the relationship between environmental investment and short-term performance; Distance from bankruptcy negatively moderates the relationship between environmental investment and long-term performance; The findings are helpful for firms to improve the effectiveness of environmental decision-making.

1. Introduction

At the present stage, more than 80% of China's environmental pollution is caused by the production and operation activities of firms [1]. Firms have become the main consumers of resources and energy and the main maker of environmental problems. Therefore, it is necessary for firms to invest in environmental protection while pursuing profit targets. However, in the process of market economy, economic development often conflicts with some activities of social public nature. Among them, environmental problems is typical. So under what circumstances can the risk of environmental investment decision-making be reduced? Clarifying this issue helps firms balance the relationship between environmental investment and the economy. And in the context of China's transitional economy, firms are in face of a complex external environment, and it is easy to cause the firms to encounter the operating status with bankruptcy threat [2]. Introducing distance from bankruptcy into this framework can help firms "in loss" make better decision-making responses. Therefore, based on the data of 255 GEM listed companies, this paper discusses the relationship between environmental investment and the firm performance, and the moderating mechanism of distance from bankruptcy on the relationship between them.

2. Theory and Hypotheses

2.1. Impact of Environmental Investment on Firm Performance

Firms are profit making, and their main purpose is to make profits by participating in business activities, but environmental investment is non-economic project investment, and the cost or expense of investment may be higher than investment income. In addition, in the short term, the firms' environmental investment not only is difficult to produce direct economic benefits [3], but also results in the pressure on firm profits due to environmental protection facilities, environmental technology R&D and environmental technology innovation, etc., and increase business risks of firms [4]. Based on this basis, the following hypothesis is proposed.

H1: Environmental investment negatively affects short-term performance.

However, according to the stakeholder theory, a good image established by a firm in the process of fulfilling its environmental responsibility will not only form a bond between the society, consumers and other stakeholders, but also enable it to suffer from relevant regulation and litigation

costs, so as to obtain better operating resources. Furthermore, the reputational effect arising from efficient environmental protection investment is a slow process [5]. With the passage of time, the environmental investment has a significant effect on the economic performance of firms.

Based on this basis, the following hypothesis is proposed.

H2: Environmental investment positively affects long-term performance.

2.2. The Moderating Effect of Distance from Bankruptcy

Distance from bankruptcy reflects the current state of the firm, small distance from bankruptcy means poor management and low operational efficiency of firm. According to prospect theory, it is believed that, when the firm has small distance from bankruptcy, the decision makers with bounded rationality will define this state as a relative “loss” state, which will drive the manager to make exploratory decisions and find the appropriate solution to resume the performance to the expected level [6]. When the firm’s distance from bankruptcy is smaller, first of all, the firm will face survival pressure due to shortage of funds internally, and consequently the external supervisors often question this situation and strengthen the attention and supervision effects on the enterprise in difficulty [7]. In this dangerous environment of attacks it from internal and external aspects, the larger “loss” the firm encounters, the more possible the firm will conduct exploratory behavior and try to recover losses with the attempt to reverse the firm’s performance and meet the requirements of industry and capital market [8]. In this case, the firm will be more stressful and motivated to choose a way to balance environmental investment and the economy, and get instant capital backflow in the short term to reshape short-term performance. In the long run, the ability to respond to this “loss” state allows stakeholders to see the value of firms and thus promote long-term performance. Based on these basis, the following hypothesis are proposed.

H3a: The distance from bankruptcy positively moderates the relationship between environmental investment and short-term performance.

H3b: The distance from bankruptcy negatively moderates the relationship between environmental investment and long-term performance.

3. Method

3.1. Data

This paper takes the GEM listed companies during the period of 2011-2016 as the research samples. In addition, given that the environmental investment has a lagging impact on performance, this paper takes 1 year as the lag period, after excluding samples with missing research data, the 255 firm samples and 1172 observation values were finally obtained. The data in this paper comes from CSMAR database, Wind database and Eastern Fortune database, from which the ratio of independent directors, institutional shareholding ratio, firm age, firm size and other indicator data are downloaded.

3.2. Variable Measurement

3.2.1. Dependent Variables: Short-Term Performance, Long-Term Performance

In this study, we select Return on Assets (ROA) to measure the short-term performance of a firm. Its calculation formula is: $ROA = \text{net profit} / \text{average balance of total Assets}$. We use Tobin Q to measure the long-term performance of a firm. Tobin Q is the ratio of the market value of an enterprise to the replacement cost of the total capital of the firm.

3.2.2. Independent Variable: Environmental Investment

We adopt the seid(score of environmental information disclosure) developed by Zeng [9] to measure environmental investment, it includes ten parts:(1)information related to ISO environmental system;(2)comply with environmental regulations and disposal;(3)impact on government environmental policies;(4) enterprise environmental strategy, policies and goals;(5) investment in the development of environmental technologies;(6)environmental initiatives;(7)loans

related to environmental protection;(8)sewage and toxic gas treatment;(9)construction and operation of environmental improvement;(10)other environment-related actions.We calculated each subsection from the annual report and the CSR report. If the item is described as currency and quantity, each component is graded according to its level of disclosure, ranging from 0 to 3, where “3” is described as currency and quantity, “2” means the item is described specifically, “1” means the item is generally described, and “0” means there is no information. Each sample company in the annual observations of N companies is assigned an environmental disclosure level score based on the equation.

$$seid = \sum_{j=1}^n seid_{ij} \quad (1)$$

3.2.3. Moderator Variable: Distance from Bankruptcy

We use the Z-score model to measure the distance from bankruptcy. The z-score model was proposed by Altman, and its value is as follows: $Z=1.2 \times X1+1.4 \times X2+3.3 \times X3+0.6 \times X4+1.0 \times X5$. X1: working capital/total assets, X2: retained earnings/total assets, X3: earnings before interest and tax/total assets, X4: equity market value/total liabilities, X5: sales revenue/total assets. Through the above five financial indicators, the z-score model connects the indicators reflecting the solvency (X1 and X4), profitability (X2 and X3) and operating capacity (X5) to comprehensively analyze and predict the possibility of financial crisis. The lower the Z-score is, the smaller distance from bankruptcy that the firm will face.

3.2.4. Control Variable

According to previous studies of scholars, the following variables are controlled in this paper: firm size, firm age, firm debt, proportion of independent directors(INDR), institutional shareholding ratio(INST), ratio of state-owned shares.

4. Analysis and Findings

In this paper, stata14.0 is used to descriptively analyze the uncentered variables. Table 1 shows the mean and standard deviation of each variable, as well as the correlation coefficient and significance level between the variables. As we can see from Table 1, the mean of short-term performance is 0.044, the mean of long-term performance is 1.357, the mean of environmental investment is 1.09, and the mean of Z-score is 2.637. The correlation coefficients between the respective variables are less than 0.5, and there is no multicollinearity in the visual sense. Further, we perform multiple collinearity diagnosis for all independent variables, and all the variance expansion factors VIF values are less than 2, indicating that there was no multicollinearity among independent variables in the model.

4.1. Results

The data are panel data, which may have problems such as heteroscedasticity, sequence correlation and cross-sectional correlation, while the standard error estimated by discolay-kraay (d-k) standard error is unbiased, consistent and effective. Thus, we adopt d-k standard error method for estimation.

First, based on the control of firm size and other control variables, we conduct a multiple regression analysis of core variables, and the results are shown in table 2. As can be seen from model 2, the relationship between environmental investment and short-term performance is not significant, so hypothesis 1 is not supported. it can be seen from model 6 that the regression coefficient of environmental investment is 0.067($p<0.05$), indicating the environmental investment and long-term performance are positively significant, so hypothesis 2 is supported.

Second, we put Z-score into the model to test its moderating effect. As we can see from model 3, the moderating effect of distance from bankruptcy is not significant, so hypothesis 3a is not supported. It can be seen from model 8 that the regression coefficient of the interactions between environmental investment and Z-score is -0.03 ($p<0.05$), indicating that z-score negatively

moderates the relationship between environmental investment and long-term performance, namely, distance from bankruptcy negatively moderates the relationship between environmental investment and long-term performance, hypothesis 3b is supported.

Table 1. Correlations, means, standard deviations of all variables

	Mean	SD	1	2	3	4	5	6	7	8	9	10
1 s-performance	0.044	0.058	1									
2 l-performance	1.357	0.428	0.261 ^{**}	1								
3 environmental investment	1.090	0.686	-0.001	-0.096 ^{**}	1							
4 Z-score	2.637	0.860	0.229 ^{**}	0.411 ^{***}	-0.130 ^{***}	1						
5 firm size	3.099	0.031	0.061 ^{**}	-0.126 ^{**}	0.023	-0.135 ^{***}	1					
6 firm debt	0.124	0.124	-0.141 ^{**}	-0.026	0.036	-0.454 ^{***}	0.327 ^{***}	1				
7 firm age	0.441	0.441	0.024	0.157 ^{***}	-0.052 [*]	-0.023	0.029	0.149 ^{***}	1			
8 INDR	0.040	0.040	-0.080 ^{**}	0.093 ^{***}	-0.136 ^{***}	0.054 [*]	-0.090 ^{***}	0.044	-0.014	1		
9 INST	1.013	1.013	0.158 ^{**}	0.107 ^{***}	-0.090 ^{***}	0.077 ^{***}	0.183 ^{***}	0.038	0.090 ^{***}	-0.088 ^{***}	1	
10 state-owned shares	0.615	0.615	0.017	-0.104 ^{**}	0.002	-0.050 [*]	0.042	-0.075 ^{**}	0.059 ^{**}	-0.067 ^{**}	0.122 ^{***}	1

N=1172, *significant at 10%; **significant at 5%; ***significant at 1%.

Table 2. The result of hierarchical regression

	short-term performance				Long-term performance			
	model 1	model 2	model 3	model 4	model 5	model 6	model 7	model 8
Firm size	-0.047	-0.062	-0.064	-0.064	-2.019 ^{***}	-1.769 ^{***}	-1.855 ^{***}	-1.859 ^{***}
Firm debt	0.037 ^{**}	0.040 ^{**}	0.041 [*]	0.041 ^{**}	0.626 ^{***}	0.573 ^{***}	0.621 ^{***}	0.632 ^{***}
Firm age	-0.013 ^{***}	-0.014 ^{***}	-0.014 ^{***}	-0.014 ^{***}	0.769 ^{***}	0.778 ^{***}	0.754 ^{***}	0.754 ^{***}
INDR	-0.177 ^{***}	-0.179 ^{***}	-0.178 ^{***}	-0.178 ^{***}	0.316 ^{**}	0.339 ^{**}	0.355 [*]	0.338 [*]
INST	0.005 [*]	0.005 [*]	0.005 [*]	0.005 [*]	0.008 [*]	0.011 ^{**}	0.007	0.008
state-owned shares	0.002	0.002	0.002	0.002	-0.044 ^{***}	-0.044 ^{***}	-0.043 ^{***}	-0.042 ^{***}
EI		-0.004	-0.004	-0.004		0.067 ^{**}	0.069 ^{***}	0.074 ^{***}
Z-score			0.001	0.001			0.025	0.022
EI*Z-score				0.001				-0.030 ^{**}
R2	0.0159	0.0171	0.0452	0.0172	0.2233	0.2289	0.2297	0.2309
ΔR2	—	0.0012	0.0281	-0.028	—	0.0056	0.0008	0.0012
F	14.95 ^{***}	15.909 ^{***}	23.862 ^{***}	28.778 ^{***}	236.053 ^{***}	98.352 ^{***}	65.451 ^{***}	73.873 ^{***}

N=1172, *significant at 10%; **significant at 5%; ***significant at 1%.

5. Conclusion and Contribution

5.1. Research Conclusion

Based on the stakeholder theory, this paper analyzes the relationship between environmental investment and firm performance. In addition, combined with the prospect theory, it analyzes the moderating effect of distance from bankruptcy on environmental investment and firm's long-term and short-term performances. The research results indicate that: The negative relationship between environmental investment and firm's short-term performance is not significant. This may be due to the fact that with the acceleration of China's environmental protection laws and regulations, there

will be larger proportion of the firm's direct economic benefits, such as reduction of sewage charges and the government subsidies brought by environmental investment, so the environmental investment has not reduced the short-term performance. Environmental investment promotes the long-term performance of the firm. In another word, with the passage of time, the reputation effect and innovation effect brought by environmental investment have shown and thus promoted the long-term performance of firms. The impact of distance from bankruptcy on the moderation relationship of environmental investment and firm's short-term performance is not significant. It is shown from the above that, in the short-term, firms will tend to conservative decision-making behaviors for the purpose of avoiding short-term risks. Therefore, the smaller distance from bankruptcy will not cause firms to choose a way to balance environmental protection and economy. The distance from bankruptcy negatively moderates the relationship between environmental investment and long-term performance, which means, the smaller the distance from bankruptcy is, the more possible that the firm will choose the way to balance environmental investment and economy and thus enhance firm value. This also responds to the prospect theory. In the face of the organization's "loss", it is more motivated and stressful to make exploratory decisions to reverse firm's performance[10].

5.2. Theoretical Contribution and Practical Significance

First, the research contents of environmental investment and firm performance have been enriched. Most of the researches on environmental investment were discussions conducted from external environmental regulation, but there are relatively few researches at internal level of firms. The research has filled the micro-factor gap in environmental investment research.

Second, based on the prospect theory, this paper introduces the distance from bankruptcy into the research framework of environmental investment. In the previous studies, the organizations were in a normal state, and based on the fierce competition on the market, the bankruptcy threat is not far from the organization, and the introduction of distance from bankruptcy is conducive to expansion with regard to the gap in existing environmental investment research.

Third, this paper is conducive to better clarification of the mechanism of action between environmental investment and economy, so as to make better decisions on environmental investment risk. In the long run, good environmental investment is conducive to enhancing the value of firm and thus obtaining better operation resources. Moreover, the paper provides ideas for those firms that are in a state of "loss", the firm in a "loss" state is more able to choose a way to balance environmental investment and economy and thus improve the long-term performance of the firm.

6. Limitation and Future Direction

The relevant variables in this paper were manually coded based on second-hand data, so there is the artificial deviation to a certain extent. In the future, we can study environmental investment from multiple angles.

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8. References

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