The impact of Environmental regulation on corporate environmental investment of Computer Industry

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Abstract. In this paper environmental regulation intensity is built. Panel regression model and Grouping regression are used to verify impact of environmental regulation on corporate environmental investment of computer industry. Panel regression results show there is a negative correlation between environmental regulation intensity and environmental investment of computer industry. Grouping regression results show that environmental regulation has a "Threshold Effect" on environmental investment of computer industry.

Introduction

At present there are two opposite views on the relationship between the computer and environmental protection. First the division of labor and specialization of modern society is the root of all evil, human should return to the original simple life. Computer culture conditioned by the nature, so rarely respond to environmental issues. Because of short production cycle computer manufacturers pay little attention to reduce waste and pollution from each of these steps. Second, the computer is the progress of human civilization, it not only brings to the human life a lot of convenience, and alleviate the pollution caused by crazy plundering of resources.

Since the 1960 s, the environmental pollution and ecological destruction is increasingly serious. At present, environmental deterioration trend has not been fundamentally curbed and environmental contradictions; pressure continues to increase in China. Environmental issues gradually draw public concern. The government pledges to slow growth to make room for environmental protection.

Enterprises as the largest body of social production cause more and more severe damage to ecological environment. Enterprises should focus on their own economic benefit and the profit maximization goal, at the same time: undertake corresponding social responsibility and environmental responsibility.

Previous Empirical Research: An Overview

All investment decisions, including the selection of production technology, pollution control equipment purchase, investment capital configuration, etc., will be affected by the intensity of environmental regulation. Leiter et al [1] believed that three kinds of hypothesis could explain environmental regulation effect on enterprise investment decision: the pollution haven hypothesis, hypothesis of factor endowments and Potter hypothesis. All three hypotheses did not agree on how environmental regulation affects corporate investment behavior. But they show that strict environmental standards, environmental regulation will pose important and complicated influence on enterprises investment behavior. Based on this, this paper puts forward the research hypothesis:

Hypothesis 1: there is a correlative relationship between the government environmental regulation intensity and the scale of investment in environmental protection enterprises.

In the loose government environmental regulation policy and law enforcement, the corporate environmental investment is often higher than environmental taxes and fees and fines. They prefer to pay less for reducing environmental protection investment environmental taxes and fees and fines. Without the government's environmental regulation policy and economic stimulus measures, polluters usually do not take the initiative to pollution control, even if some enterprise voluntary environmental protection investment, also tend to decrease the cost of environment comply with

intentions [2].However, as the environmental regulation is to continue to strengthen and achieve a certain degree (i.e., the critical value, the turning points), enterprise for environmental protection investment are far less than environmental taxes and fees and fines, so enterprises have to take own environmental management and environmental investment [3]. The above analysis shows that the government environmental regulation impact on enterprise environmental protection investment behavior exist "threshold effect". Based on this, this paper puts forward the following hypothesis:

Hypothesis 2: the government environmental regulation intensity and the corporate environmental investment is "U" shaped relationship.

The Empirical Framework

To estimate the impact of environmental regulation on corporate environmental investment we use a panel regression model as follow.

$$EI_{it} = \alpha_1 ER_{it} + \alpha_2 STATE + Controls_{it} + \mu_i + \varepsilon_{it} \quad (i=1,\ldots,n，t=1,\ldots,T) \tag{1}$$

EI represents corporate environmental investment; ER represents environmental regulation; *I* is a dummy variable. Value of I is 1, when value of ER is greater than q(value of turning point). Otherwise the value of *I* is 0.Controls include *TQ*, *FLOW*, *LEVERAGE*, *STATE* and *INDUSTRY*, which represent investment opportunities, operating cash flow, financial leverage, property rights and industry attribute respectively.

Empirical Results

The following table 1 respectively shows results of mixed regression, fixed effects regression and random effects regression

Table 1. Estimation results of panel regression

Variables	OLS	RE	FE
ER	-2.4736	-5.9865***	-6.0455***
STATE	0.0247**	0.0462*	—
LEVERAGE	0.0203	0.0034	0.0011

ROE	0.0216	0.0064	0.0062
FLOW	-0.0500	-0.0252	-0.0243
INDUSTRY	0.0129	0.0206	—
MIDDLE	-0.0309	-0.0748**	—
EAST	-0.0382**	-0.0914***	—
TQ	0.0006	0.0012	0.0013
_cons	0.0273	0.0827**	0.0273***
N	414	414	414
R-squared	0.0375	0.064	0.0383
Prob	0.0767	0.0145	0.0931

Notes:*,**,and ***indicate 10%, 5% and 1% levels of significance.

Environmental regulation intensity coefficients is negative, three empirical models show that here is a negative correlation relationship between the intensity of environmental regulation and enterprise environmental protection investment scale. The result shows that the strength of the overall environmental regulation and enterprise environmental protection investment has significant negative correlation. That means government environmental regulation in China does not play a role in promoting enterprises increase investment in environmental protection. Guo-ping Tang[4] pointed out that environmental regulation in China is at a low level; Enterprises lack of willingness to carry out environmental protection investments, consistent with the results of this study; When environmental regulation is at a low level, for reasons of business performance, enterprise are more inclined to pay the fine environment, rather than the environmental protection investment. Although the intuitive impression is that environmental regulation intensity enhances enterprise's environmental protection investment, the empirical results do not support it. China's current environmental regulation intensity does not prompt companies to increase the scale of investment in environmental protection.

To verify the suitability of mixed OLS model fixed effect model and random effect model of, this paper made the following two tests: Individual Effect Inspection and Hausman Test. The results show random effect model applies the most to the study.

Companies holding nature virtual variable was positively associated with environmental protection investment. That means non-state-owned listed companies pay more in terms of environmental protection investment than state-owned listed companies[5]. According to the random

effects model, enterprise nature of industry, profitability financial leverage investment opportunities and enterprise environmental protection investment levels were positively correlated[6]. Heavy pollution enterprise with stronger the profitability or more investment opportunities conducted more environmental investment. The cash flow level is negatively related to the level of enterprise environmental investment. This coefficient is not significant at the 10% level; Position of enterprises is negatively related to the level of environmental investment and is significant at the 5% level. Enterprise in the west invested more than enterprise in the middle or east. 70% of enterprises in the western region belong to heavy pollution industry[7].

The following table 2 shows results of grouping regression.

Table 2. Estimation results of grouping regression

Variables	10%	20%	30%	40%	50%	60%	70%	80%	90%
ER	-0.70	-4.57	-4.89	-3.14	-4.92	-6.80	-7.64	-9.40	-13.9*
STATE	-1.68	1.85	2.08	0.55	2.00	3.49	4.19	5.84	14.7***
LEVERAGE	0.02**	0.02**	0.02**	0.02**	0.04**	0.02**	0.02**	0.02**	0.01**
ROE	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
FLOW	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
INDUSTRY	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.06
MIDDLE	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
EAST	-0.03*	-0.03*	-0.03*	-0.03*	-0.03*	-0.02*	-0.02*	-0.03	-0.02
Q	-0.04*	-0.04*	-0.04*	-0.04*	-0.04*	-0.04*	-0.04*	-0.03*	-0.04*
_cons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	414.00	414.00	414.00	414.00	414.00	414.00	414.00	414.00	414.00
R-squared	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.04	0.01
Prob	0.08	0.08	0.08	0.08	0.08	0.04	0.04	0.04	0.05

Notes:*,**,and ***indicate 10%, 5% and 1% levels of significance.

To verify threshold effect validation there are three methods, including adding square term, grouping regression and Bootstrap method (the Bootstrap) designed by Hansen for searching structure change point. Adding square item in the model will cause serious multicollinearity. While Hansen's method requires balanced panel data, considering some of the data from 2010 to 2014 is lost, this paper selects the grouping regression method to verify hypothesis 2.

By examining nine regression results, it can be seen that with 90% corresponding environmental regulation percentile as structure change point , P values (Prob > F) is 0.013, which means model as a whole is very significant. The result that corresponding coefficient of variable ER is 13.9387 and p

value is 0.056 represents coefficient is significant. The result that corresponding coefficient of variable ERI is 14.6952 and p value is 0.010 means the coefficient is significant. As the regression results show, government environmental regulation cannot prompt companies to invest more in terms of environmental protection before the intensity of environmental regulation has not reached 0.0042. When environmental regulation intensity is greater than 0.0042, the government's environmental regulation has played an important role in prompting companies increasing environmental investment. The hypothesis 2 is verified.

Above results also illustrate the current environmental regulation in most provinces below structure change, cannot have the effect of prompting companies increasing environmental investment. Enterprise environmental regulation cost accounts for just a small part of enterprise income. That reflects the enterprise response ability against environmental regulation. Corporate executives should take active attitude to deal with the government's environmental protection measures [8]. At the same time in order to avoid administrative penalties due to environment pollution by environmental protection departments, enterprises should pay attention to the change of the environmental policy in China in a timely manner. Government guidance for the environmental protection management system of construction enterprises, improve enterprise voluntary environmental management consciousness. At present in China most enterprises invest in environmental protection because of government regulation. They are "passive" to participate in environmental protection [9]. The Chinese enterprises' environmental responsibility consciousness is still weak [10]. Therefore, the government should step up to the enterprise for the propaganda of environmental protection, and provide the corresponding environmental management certification counseling and training, and summarize and promote environmental technology and successful management experience, and give financial and technical support to enterprises who are voluntary to participate in environmental management, in order to promote enterprises to participate in voluntary environmental management.

Conclusions

Panel regression results show environmental regulation intensity and enterprise investment level of environmental protection had significant negative correlation relationship. At present government environmental regulation couldn't encourage companies of computer industry to expand the scale of environmental investment.

Grouping regression results show that the environmental regulation had a "Threshold Effect" on enterprise's environmental investment. When environmental regulation intensity exceeded structure change point, environmental regulation had played an important role in prompting companies increase environmental investment.

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