

Research on the Impact of Environmental Regulation on Corporate Financial Performance

-- Based on 16 Listed Enterprises in Wenzhou City, China

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Abstract: In recent years, with the deepening of the concept of sustainable development, China's government has been paying more and more attention to environmental protection, especially under the strategic objectives of carbon peak and carbon neutrality, and the government and relevant departments have been vigorously pursuing environmental regulatory policies. At the same time, some enterprises tend to avoid the environmental pollution and negative externalities caused by their production and operation process out of the pursuit of financial performance. This paper takes listed enterprises in Wenzhou City as the research object, uses the relevant data of 16 listed enterprises in Wenzhou City during 2010-2021, and adopts panel regression empirical analysis method to empirically study the impact of environmental regulation on the financial performance of listed enterprises, and verifies the intermediary effect of technological innovation on it, and the results of the study show that: environmental regulation has a significant positive impact on the financial performance of listed enterprises, and there is a complete intermediary effect of technological innovation. The results show that environmental regulation has a significant positive effect on the financial performance of listed enterprises, and there is a complete mediation effect of technological innovation. After comprehensively examining the relationship between environmental regulation and enterprise financial performance, this paper gives a series of effective improvement countermeasures for listed enterprises in Wenzhou City in terms of implementation by the government and fulfillment by enterprises.

Keywords: Environmental regulation, Financial performance, Technological innovation, Listed companies.

1. Introduction

With the acceleration of China's industrialization and urbanization, environmental pollution is not only a common concern of the current society, but also an important factor restricting the sustainable development of enterprises. According to China's "2021 China's ecological environment statistics annual report" data show that China's wastewater and exhaust emissions are still very high, such as chemical oxygen demand emissions of 25.310 million tons, sulfur dioxide emissions of 2.748 million tons. The problems of high energy consumption and high pollution still exist significantly in economic and social operation. [According to relevant research, the loss of China's economy caused by environmental pollution accounts for about 8% to 15% of GDP. It can be seen that environmental pollution is not only a serious threat to sustainable economic growth, but also a bottleneck for sustainable economic and social development.

Under the new normal, China's economic development has transformed from a stage of rapid growth to a stage of high-quality development, and a green and low-carbon development model that takes into account both economic growth and environmental improvement has become an important goal in the stage of high-quality economic development. On September 22, 2020, General Secretary Xi Jinping announced at the 75th United Nations General Assembly that "China will strive to peak its carbon dioxide emissions by 2030 and strive to achieve carbon neutrality by 2060," demonstrating China's determination to combat environmental pollution and build a resource-saving and environmentally friendly society. [Technological innovation is the main driving force and important driver to promote the transformation of enterprise industrial structure of high

quality and high quality, and it is the key factor to support and lead the high-quality development of China's economy. Wenzhou as the birthplace of the national private economy, how to seek a balance between the protection of the environment transformation and enterprise economic development, how to take advantage of the opportunity of environmental protection, to realize the greening of technology, innovation, so as to achieve the purpose of stimulating the growth of profits, for the majority of the country's enterprises has a significant reference significance.

2. Literature Review

For the study of environmental regulation, the vast majority of foreign scholars believe that the implementation of environmental regulation will have a positive impact on domestic enterprises, Boyd et al. (1999) defined environmental regulation as a means of economic regulation, and found that the implementation of environmental regulation can promote the performance of the manufacturing industry, and the two are positively correlated [1]. Behera et al. (2022) showed that the implementation of appropriate and effective environmental regulation policies, especially regarding foreign direct investment (FDI), helps domestic firms to obtain green technology spillovers [2]. Fahad Shah et al. (2022) argued that environmental regulatory policies are effective in promoting regional OFDI reverse technology spillovers with good robustness [3]. However, some scholars believe that the impact of environmental regulation on firms is not clear, or even has a negative impact, for example, Bigerna et al. (2021) found that the dynamics of the impact of market and environmental regulatory instruments on the environmental energy efficiency of the electricity sector in

European countries depends on the policy instruments used, i.e., different environmental regulatory instruments will have different impacts [4].

And related studies on financial performance focus on board diversity, intellectual capital, social responsibility fulfillment and managerial characteristics and corporate culture. Specifically, ArenasTorres Felipe et al. (2021), by studying the relationship between board composition diversity (gender, nationality, and age) and the financial performance of Chilean listed companies, found that the current boards of directors of Chilean listed companies have a low level of gender and nationality diversity, and that the diversity of the board composition contributes to the improvement of financial performance [5]. Gupta et al. (2022) used VAICTM and e-VAICTM models to compare the existence of a significant positive correlation between capital and financial performance in Chile with a sample of Indian listed pharmaceutical companies [6].

Research on the relationship between environmental regulation and corporate financial performance is divided into two major schools of thought in terms of theory as a whole, one supported by neoclassical economic theory and the other by Porter's hypothesis. For example, Lv Ling and Jiao Shuyan (2011) empirically found that there is a significant negative correlation between environmental disclosure and environmental performance, a significant positive correlation between environmental performance and financial performance, and no significant correlation between environmental disclosure and financial performance [7]. Yang Yu Di and Qi Yong (2021) found that environmental regulation will prompt industrial enterprises to increase environmental protection investment, which will increase their financial burden. At present, many scholars in China support the second view, that through the design of appropriate environmental regulation policy will be conducive to the improvement of corporate financial performance [8]. For example, Zhang Chao and Song Huasheng (2022) found that the promulgation of the new "Environmental Protection Law" significantly increased the financial asset allocation of enterprises, which led to the reduction of non-liquid financial assets and the increase of liquid financial assets, i.e., the environmental regulations optimize the structure of the financial asset allocation of the enterprise to improve its future financial performance [9]. Cheng Z et al. (2017) argued that the implementation of China's policies on energy conservation and emission reduction laws and regulations has greatly reduced the carbon emissions of Chinese enterprises, but the innovation ability of enterprises has not been significantly improved, and local environmental regulation policies can instead promote technological innovation by enterprises, but the effect on pollution control is not so significant [10]. Baran Michal et al. (2022) found a high correlation between environmental, social and corporate governance (ESG) scores on firms' financial performance (return on equity ROE, return on assets ROA, and return on sales ROS) for a sample of energy firms in Poland [11]. Kneller (2012) found that after the implementation of environmental regulation policies, firms' innovation activities decrease, firms' R&D investment funds cannot be secured, and part of the funds must be transferred to environmental governance [12]. Farza Khoulood et al. (2021) found that green innovation has a linear positive effect on different financial performance indicators (return on assets, return on invested capital, and price-to-book ratio), i.e., green

innovation contributes to the enhancement of corporate reputation and financial performance, by examining the relationship between green innovation and corporate financial performance in the German company HDAX [13].

According to the combing of the above literature, it can be seen that domestic and foreign scholars are still in the discussion stage of the relationship between environmental regulation on the relevant enterprises, has not yet formed a consistent answer, and lack of financial performance of the specific content of the discussion, and on the relationship between environmental regulation and corporate financial performance of the factors to be explored, the main known factors such as R & D investment, technological innovation, etc., most of which follow the theory of the Porter's Hypothesis.

3. Theoretical Analysis and Research Hypotheses

3.1. Environmental Regulation and Corporate Financial Performance

As an important livelihood need, the ecological environment has long been closely scrutinized by the government and its relevant departments, as well as by the public. The neoclassical economic theory in the study of the ecological environment to the static point of view cut, that let the enterprise in accordance with environmental regulatory measures to manage the ecological environment in a short period of time will increase their production costs, including the cost of pollution control and clean technology and R & D investment, naturally, it will also affect their profits, which will impede the enhancement of the total factor productivity of the green, which is the environmental regulation of the This is the "compliance cost" effect of environmental regulation. Therefore, in terms of the "compliance cost" effect, the implementation of environmental regulations does not bring profits to enterprises in the short term, but rather increases their production costs, and the profit margin of enterprises will be reduced as a result, leading to a reduction in the green total factor input of enterprises.

The revised view represented by the Porter's hypothesis theory and neoclassical economic theory is completely opposite, he cut from the dynamic point of view, that appropriate environmental regulation can drive producers to pay attention to the research and development of cleaner production technology, improve the level of production technology, but also conducive to the optimization of resource allocation, so that resource allocation is more scientific and reasonable, thus promoting the development of the whole enterprise, improve enterprise profits, which can partially or even completely offset the "compliance costs" of the implementation of the regulation, so as to achieve the protection of the environment at the same time can also improve enterprise profits. This can partially or even completely offset the "compliance cost" of implementing the regulation, thus realizing the protection of the environment while also increasing the profits of enterprises and promoting their economic growth.

At the same time, the government and its relevant departments have adopted positive green subsidies for some enterprises, and followed the mechanism of "whoever discharges pollutants pays" to flexibly formulate the environmental protection tax [24], which brings incentives for enterprises to fulfill their social responsibility for

environmental protection, and motivates enterprises to actively fulfill and actively cater to the relevant environmental regulatory policies, and then obtain more green financial support. financial support, stimulate enterprise cash flow, and then improve enterprise financial performance. From the perspective of the public, the public's environmental awareness has generally increased in recent years, stimulating consumers' preference for green and environmentally friendly products and driving consumer demand, which in turn stimulates the production of green and environmentally friendly products and the fulfillment of cleaner production methods on the one hand through the product market, and on the other hand, prompts the development of ESG investment, creates its own image, and improves the reputation and green competitiveness of the enterprise in order to win the favor of consumers and obtain higher profit returns. Accordingly, Hypothesis 1 is proposed.

H1: The implementation of environmental regulations has a negative impact on the financial performance of listed enterprises in Wenzhou in the short term and a positive impact in the long term.

3.2. The Mediating Role of Technological Innovation on Financial Performance

Technological innovation is an indispensable driving force in the process of enterprise development, and is the key to promoting the sustainable development of enterprises. Through technological innovation, it can bring about the creation of new processes, new materials, new machines and new forms of business, and consequently the innovation of new labor tools and labor skills.

On the other hand, according to the principle of political economy, the precondition for normal production of an enterprise is that the marginal benefit of the enterprise is greater than the marginal cost. At the primary stage of socialism, China insists on taking economic construction as the center, and all work is subordinate to and serves economic construction. Especially before the reform and opening up, enterprises tend to pursue profit maximization and lack of attention to environmental protection, while the government's exploration of environmental regulation has just begun and the implementation of environmental protection policies is poor, which makes enterprises tend to obtain greater economic benefits at the expense of the environment

At present, China's environmental regulation efforts continue to strengthen, in addition to the government environmental protection department, more and more members of the public began to spontaneously carry out pollution supervision of traditional enterprises, that is, voluntary participation in environmental regulation is becoming more and more common. To summarize, in the long run, the implementation of environmental regulation contributes to the improvement of corporate financial performance, and technological innovation which plays an intermediary role. Accordingly, hypothesis 2 is proposed.

H2: Technological innovation plays a mediating role in the process of environmental regulation affecting corporate financial performance.

4. Empirical Analysis

4.1. Data Description

Combined with the previous policy combing and the changes in the financial performance of some listed

enterprises in Wenzhou City before and after the government's green concern, Wenzhou Municipal Government has been focusing on the green transformation of enterprises since 2010, and it is reasonable for this paper to select the data of enterprises from 2010-2021. In order to further verify the impact of the government's green focus on the financial performance of listed enterprises in Wenzhou City, this paper takes part of the listed enterprises in Wenzhou City from 2010 to 2021 as the research object, and screens the samples as follows: exclude enterprises listed after 2010; exclude the samples with serious missing data, and use stochastic linear interpolation to make up the data of some of the data that is not seriously missing to reduce the error; After the above steps, the panel data of 16 sample companies are finally obtained.

The core explanatory variable of this study is environmental regulation, and the frequency of words related to environmental protection in the government's work report is used as an indicator of the intensity of local environmental regulation. The explanatory variables are firm performance, and the financial performance of the firms is used as a proxy variable using the net profit margin of total assets (FP), the net profit of the firms (PROFIT), and the price-earnings ratio of the firms (FP-1), respectively. Six control variables were selected from each dimension, in order to explore the role of environmental regulation on enterprise performance mechanism, the mediator variable was selected, the mediator variable is technological innovation (RDINVPER), this paper comprehensively consider the characteristics of Wenzhou listed enterprises, combined with the availability and completeness of the data, technological innovation is mainly through the use of the R & D investment as a proportion of operating income to measure. Explanation and description of variables, see table 1.

Table 1. Variable definitions and descriptions

Variables Type	Variables Name	Symbol
Explained Variables	Total Assets Net Margin	FP
	Corporate Net Profit	PROFIT
	P/E Ratio	FP-1
Explanatory variables	Environmental Regulation	ER
Mediating variable	Technological Innovation	RDINVPER
Control variable	Enterprise Growth	GROW
	Company Size	INSIZE
	Age of listing	AGE
	Shareholding ratio of the largest shareholder	EC
	Capital Intensity	CI
	Corporate Debt Ratio	LEV

4.2. Measurement Modeling

In order to examine the impact of environmental regulation on the financial performance of listed enterprises in Wenzhou City and to verify Hypothesis 1, the relevant model in this paper is set up with the financial performance of enterprises as the explanatory variable and environmental regulation as the explanatory variable, meanwhile, considering that there are many factors affecting the financial performance of enterprises, this paper selects the growth of enterprises, enterprise size, age of listing of the company, the proportion of the first largest shareholder's shareholding, the capital

intensity, and the enterprise's debt ratio as the control variables. In order to facilitate the comparative illustration, the enterprise size is treated in logarithmic form, and the basic measurement equation is:

$$FP_{it} = C + \beta_1 ER_{it} + \beta_2 Controls_{it} + \varepsilon_{it} \quad (1)$$

Meanwhile, in order to further test the mediating role of technological innovation in the environmental regulation on the financial performance of listed enterprises in Wenzhou City, the mediating effect test equation constructed in this paper with the financial performance of enterprises as the explanatory variable, environmental regulation as the explanatory variable, and technological innovation as the

mediating variable is as follows:

$$FP_{it} = a_0 + a_1 ER_{it} + a_2 Controls_{it} + \varepsilon_{it} \quad (2)$$

$$RDINVPER_{it} = b_0 + b_1 ER_{it} + b_2 Controls_{it} + \varepsilon_{it} \quad (3)$$

$$FP_{it} = c_0 + c_1 ER_{it} + c_2 RDINVPER_{it} + c_3 Controls_{it} + \varepsilon_{it} \quad (4)$$

4.3. Empirical Findings

4.3.1. Descriptive Statistics

Descriptive statistics were analyzed for all indicators and the descriptive statistics obtained are shown below, see table 2.

Table 2. Descriptive statistics

Variable	N	Mean	SD	Min	Max
FP	192	5.391	13.03	-113.8	40.60
FP-1	192	74.86	108.6	-35.27	695.7
ER	192	5.583	1.982	2	8
LEV	192	39.07	18.50	6.019	102.7
RDINVPER	192	3.302	1.729	-0.280	10.67
GROW	192	83000000	540000000	-0.659	6100000000
INSIZE	192	21.36	3.458	0	25.37
EC	192	34.55	18.14	0.961	113.5
AGE	192	6.984	5.444	-9	21
CI	192	1.834	1.312	-0.215	12.09
PROFIT	192	6.774	29.20	-268.2	100.4

Among them, INSIZE, which has a large absolute value of data, is logarithmized to obtain the maximum value, minimum value, average value and standard deviation of each variable, and the sample size is 192, which is sufficiently large and has strong representativeness. Overall, the distribution of data size among the indicators is relatively uniform, and the data preprocessing is reasonable for subsequent analysis.

4.3.2. Benchmark Regression

First, in order to reduce the problem of heteroskedasticity

and autocorrelation among variables, according to the results of Hausman test, this paper adopts the fixed effect model for the regression of equation (1), and the variables pass the VIF test, which indicates that there is no multicollinearity among the variables and the regression results are valid. Benchmark regression results of environmental regulation on enterprise performance, see Table 3.

Table 3. Benchmark regression results

	(1)	(2)	(3)	(4)	(5)	(6)
	FP	FP-1	PROFIT	PROFIT	FP 1	FP 1
ER	-0.824 (0.47)	-0.735** (0.327)	2.375** (0.970)	2.169** (1.049)	10.798* (5.883)	9.932*** (3.713)
LEV		-0.233 (0.146)		0.0024 (0.132)		0.486 (0.469)
GROW		0 (0.000)		0 (0.000)		0 (0.000)
INSIZE		0.121 (0.626)		-0.564 (0.997)		-5.112 (3.530)
EC		0.0691 (0.061)		-0.0276 (0.124)		1.366*** (0.441)
AGE		0.0061 (0.227)		0.104 (0.440)		-2.056 (1.558)
CI		-0.997 (1.277)		-0.00670 (1.659)		8.284 (5.871)
cons	9.99*** (2.624)	15.28 (12.732)	-6.486 (5.745)	6.922 (24.009)	14.57 (32.851)	63.90 (84.976)
N	192	192	192	192	192	192

Estimation results of the benchmark model. The estimation

results in column (2) of Table 4 show that the regression

coefficient of environmental regulation on firms' performance FP (Net Profit Margin on Total Assets) is significantly negative at 5% level of significance, which indicates that there is a negative impact of environmental regulation on firms' performance in the short run. Column (4) of Table 4 shows that the regression coefficient of environmental regulation on firms' net profit PROFIT is significantly positive at 5% level of significance. Column (6) of Table 4 shows that the regression coefficient of environmental regulation on corporate performance (P/E ratio) is significantly positive at the 1% significance level, using the P/E ratio as a comprehensive indicator, indicating that there is a significant positive relationship between environmental regulation and corporate performance, and verifying Hypothesis H1: The implementation of environmental regulation has a negative impact on the financial performance of Wenzhou listed companies in the short term, and a positive impact in the long term.

4.3.3. Mechanism Analysis

Based on the benchmark regression, Eqs. (2) and (3) are regressed by the mediation effect model to test the mediation effect of technological innovation. The regression results are shown in Table 5. First of all, model (2) in Table 5 is the regression result of environmental regulation on technological innovation of enterprises, the regression coefficient is -0.1499, and it is significant at 1% confidence level, which says that there is a significant negative relationship between environmental regulation and technological innovation. Model (4) in Table 4 is the regression result of enterprise technological innovation on enterprise performance, the regression coefficient is 1.6548, and it is significant at 1% confidence level, which indicates that there is a significant positive relationship between technological innovation and enterprise technology, that is to say, the improvement of technological innovation will, to a certain extent, promote the enhancement of enterprise performance.

Table 4. Mechanism Analysis

	(1)	(2)	(3)	(4)
	RDINVPER	RDINVPER	FP	FP
ER	0.0859 (0.0628)	0.1499*** (0.0572)		
RDINVPER			0.527 (0.5551)	1.6548*** (0.5956)
LEV		0.0117 (0.0072)		0.2618*** (0.0568)
GROW		0 (0.0000)		0 (0.0000)
INSIZE		0.1289** (0.0544)		0.449 (0.4196)
EC		0.00150 (0.0068)		0.0733 (0.0534)
AGE		0.0549** (0.0240)		0.123 (0.1899)
CI		0.5430*** (0.0904)		1.8350** (0.7866)
cons	3.7814*** (0.372)	5.7463*** (1.308)	3.6513* (2.049)	0.380 (9.368)
N	192	192	192	192

To summarize the quasi-experiment of 16 listed enterprises in Wenzhou, technological innovation in the environmental regulation and enterprise performance between the masking effect is stronger than the mediating effect, the implementation of environmental regulation will increase the compliance cost of enterprises, thus squeezing out the R & D investment, which directly leads to the enterprise in the green technological innovation of the investment is limited.

5. Conclusion

This paper focuses on the impact of environmental regulation on the financial performance of listed enterprises in Wenzhou City. Using a panel regression model, the relationship between environmental regulation and financial performance of listed enterprises in Wenzhou City is empirically examined by utilizing the relevant data of 16 listed enterprises in Wenzhou City during the period of 2010-2021, focusing on the influencing factors at the enterprise

level, and proving the mediating role of technological innovation. The main conclusions: First, environmental regulation has a negative impact on the financial performance of listed enterprises in Wenzhou City in the short term, but in the long term, the implementation of environmental regulation has a positive impact on the long-term development of enterprises; second, in the long term, the implementation of environmental regulation has a positive impact on the financial performance of listed enterprises in Wenzhou City, i.e., the implementation of environmental regulation policy can help to improve financial performance, and at the same time, there is a mediating effect of technological innovation. mediation effect. In summary, the following recommendations are proposed for listed enterprises in Wenzhou under the environment of environmental regulation:

5.1. Proactive Disclosure of Social Responsibility Reports to Improve ESG

For a long time, the business objectives of enterprises are mostly profit maximization, and the environmental pollution and negative externalities in the process of production and operation are generally avoided, however, with the deepening of the theory of social responsibility, it is generally agreed in the academic community that enterprises should not only maximize profits as the only goal, but also consider the impact on the consumers, communities and the ecological environment during the production process, and that the existence of the enterprise is not only to create economic benefits, but also to promote the development of the society. and also to promote the development of society. Therefore, listed enterprises in Wenzhou should change their overly profit-oriented mentality, avoid neglecting their social responsibilities due to economic benefits, and establish a long-term development vision to maintain the balanced development of economic and environmental benefits, and to maintain a long-term, stable business status.

5.2. Promoting Financial Performance with Green Technological Innovation

Technological innovation plays a complete intermediary effect in the impact of environmental regulations on financial performance of listed enterprises in Wenzhou City. Enterprises adopt green production process, which helps to continuously improve their production technology level, update production equipment to optimize the allocation of factors, and produce green products to reduce pollution emissions, thereby increasing the added value of products. By strengthening the behavior of environmental protection investment efforts to enhance the enterprise's innovation ability, that is, to play the "innovation advantage", thus improving the overall competitiveness of enterprises, enterprises in the production technology investment increases, but also able to improve the technical level of the enterprise, to help enterprises to better realize the sustainable development of the enterprise, contributing to the enterprise's financial performance.

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