RESEARCH ON THE IMPACTS OF IMPLEMENTATION OF ENVIRONMENTAL RESPONSIBILITY ON CORPORATE VALUE - TAKE CHINA'S LISTED IRON AND STEEL CORPORATIONS AS AN EXAMPLE

[1]Wenlong YAO, [1]Radim LENORT, [2]Martin ČECH

[1]*VSB - Technical University of Ostrava, Ostrava, Czech Republic, EU, marcoe@163.com*

[2]*Lovegistics.eu, Ostrava, Czech Republic, EU, martin.cech@lovegistics.eu*

https://doi.org/10.37904/metal.2022.4519

Abstract

This paper takes China's listed iron and steel corporations from 2016 to 2020 as samples to discuss the relationship between corporate environmental responsibility and corporate value. Then, analyzes the moderating effects of corporate ownership and industry concentration on the above relationship by establishing econometric models based on the resource dependence theory. This study found that iron and steel corporate actively fulfilling environmental responsibility could improve corporate value in the context of cutting overcapacity and green transformation of China's iron and steel industry.

Keywords: Steel, industry, ownership, environmental responsibility, corporate value

1. INTRODUCTION

The rapid and extensive development model of China's iron and steel industry creates many problems, such as environmental pollution, low industry concentration, disorderly competition, and production overcapacity. Therefore, since the beginning of the 11th Five-Year Plan for China's economic development, the iron and steel industry has been implementing structural reforms based on the supply side. The reform goals include cutting production overcapacity, improving industry concentration, and promoting steel production transition to green and low-carbon. Improving industrial environmental performance has become an essential aim of the ecological governance of China government which is facing increasingly severe environmental problems and societal pressure [1]. In China's transition from administrative to economic governance, the private corporation is different from the state-owned corporation in organizational structure, operating decisions, and management models. The heterogeneity of corporate ownership may affect its competitive advantage in the market, resulting in different emphases of corporations on environmental management [2]. China's iron and steel corporations have begun to balance environmental responsibilities and economic performance based on the consideration of corporate development strategies and changes in the concentration of China's iron and steel industry. Whether the corporate implementation of environmental responsibility can truly enhance corporate value or not has become an urgent concern for corporate decision-makers. Therefore, this paper presents the following questions:

- In the context of the supply-side reform of China's iron and steel industry, what impacts does the corporate implement environmental responsibility have on corporate value?
- What impact does the private corporation implement environmental responsibility have on corporate value?

Based on sustainable development theory, stakeholder theory and resource dependence theory, this paper takes market competition as the background, comprehensively considers industry concentration and corporate

ownership as moderator variables, and establishes econometric models to theoretically analyzes and empirically test the impacts of corporate environmental responsibility on corporate value.

2. LITERATURE REVIEW AND RESEARCH HYPOTHESES

At present, one of the mainstream opinions in the research on corporate environmental responsibility is "profit-driven", but there have several competing thoughts on how environmental responsibility affects corporate value. Palmer et al. believe that corporate reducing pollution and improving the environment will correspondingly reduce the marginal income [3]. Lankoski found an inverted U-shaped relationship between corporate environmental performance and corporate value [4]. McWilliams and Siegel believe that there has a neutral relationship between environmental responsibility and corporate value [5]. Overall, there is still much room for research on the relationship between environmental responsibility and corporate value.

2.1. Environmental responsibility and corporate value

The traditional corporate theory holds that the implementation of corporate social responsibility is entirely to serve the interests of shareholders. However, with the increasing demand for corporate social responsibility from all sectors of society in recent years, implementing social responsibility has become one kind of the effective means for corporations to gain legitimacy [6]. Moreover, after the corporation obtains this legitimacy, it will affect its subsequent economic performance. This opinion is supported by stakeholder theory and some latest corporate social responsibility literature that corporations can view environmental responsibilities as a strategic means to gain competitive advantages [7,8]. Although the government controls the critical resources to develop corporate needs, corporate often implements political strategies to obtain relevant resources which include not only direct means such as lobbying and rent-seeking but also corporate support and response to government policies [9,10]. Due to the particularity of the iron and steel industry being a heavily polluting industry, the government has become more and more strict with its environmental regulations, and financial support and tax incentives are biased towards corporations that focus on environmental protection. On the contrary, if a corporation with poor environmental performance conveys blind expansion and self-serving strategic policies to society, the government may impose corresponding penalties, and penalties will cause the public to lose confidence in the corporation. Ultimately, it will affect corporate profitability and damage the corporate economic value. Based on the above analysis, this paper proposes the following hypothesis.

Hypothesis 1 Implementation of environmental responsibility could help corporations to improve their corporate value.

2.2. The moderating effect of the nature of corporate property rights on the relationship between "Environmental responsibility — Corporate value"

He xiaogang et al. believe that there are significant differences in the costs and motivations of establishing political relations between corporations with different ownerships in China [11]. Although private corporations have more autonomy and flexibility in their strategies and decision-making than state-owned corporations, there are still certain disadvantages in obtaining some critical resources from public departments. Therefore, the private corporation has more motivation to engage in socially beneficial activities, and through this kind of means to establish friendly relations with the government to overcome the disadvantages in obtaining critical resources [10]. Gao Honggui took private corporations as the research objects and used the game theory to analyze the promoting role of mechanism in the corporate decision of whether to implement environmental responsibility. The result shows that rewarding good and punishing bad is an advantageous solution which means government intervention is essential [12]. Especially iron and steel corporations belong to the heavy pollution industry, the public and government pay more attention to their environmental performance than other industries. So, if the private corporate implement environmental responsibility as an altruistic behavior of caring about people's livelihood and serving the society, allows the private entrepreneur to obtain political status by

good reputation by gaining public support and respect. The entrepreneur could help the private corporate keep further strengthening relationships with the government to remedy resource disadvantages, and improve private corporate economic performance. Based on the above analysis, this proposes the following hypothesis.

Hypothesis 2 Compared with corporations with other kinds of property rights, private corporations' implementation of environmental responsibilities is more conducive to improving their corporate value.

2.3. The moderating effect of changes in industry concentration on the relationship between "Environmental responsibility — Corporate value"

According to the statistics data of the China Iron and Steel Industry Yearbook, in 1992, there were only 1,744 iron and steel corporations in China, but in 2013, the number of iron and steel corporations in China reached 14,523. The rapid growth of iron and steel corporations led to intensified competition within the iron and steel industry, the iron and steel industry's capacity utilization rate and industry concentration became lower, and increasingly severe environmental pollution problems [13]. The Chinese government has formulated shutdown policies for outdated production capacity in the iron and steel industry since 2011 and requires to eliminate all production capacity with high energy consumption, serious pollution of the environment and backward technological conditions. And require iron and steel corporations to increase energy conservation and emission reduction efforts and actively implement their environmental responsibilities. Xu and Zhou found that when the market is immature in the early stage of industry development, the market prospect is relatively certain, but the market demand has high uncertainty, and the market concentration and capacity utilization rate are low; while as the industry matures gradually and the uncertainty decreases, the dominant corporations will continue to expand the scale, gradually eliminate inferior corporations, and finally form a more reasonable market structure and capacity utilization rate [14]. Therefore, in this context of cutting production overcapacity and energy conservation and emission reduction in the iron and steel industry, as the competition intensifies in the market, products and services are gradually developing towards homogeneity. The increase in supply may lead to insufficient customer loyalty, coupled with the competitors, and the operating costs of the entire industry will rise. At this time, corporations implement their environmental responsibilities, which can get higher recognition from customers and society and meet the requirements of policy guidelines to gain more market share and improve corporate value. Based on the above analysis, this paper proposes the following hypothesis.

Hypothesis 3 The industry concentration is higher, and the positive effect of corporate green responsibility on corporate value is greater.

2.4. The strengthening effect of industry concentration on the moderating effect between the nature of corporate property rights and corporate value

The state-owned corporation has more substantial impacts on regional economic development and employment than the private corporation, which is easier to get government support. Therefore, the financing channels and capital of state-owned corporations are relatively sufficient, which can minimize the risk of delisting due to sustained losses [15]. However, the private corporation must pay more attention to long-term survival and development. Furthermore, changes in industry concentration will aggravate the sensitivity of the private corporation to survival pressure due to the private corporation don't have the "innate advantages" relationship with local governments. Therefore, the private corporation must more actively implement its environmental responsibility to obtain critical resources and better government support to grab more market share and improve the corporate value through seeking breakthroughs in R&D and innovation and introducing green technologies [12]. Based on the above analysis, this paper proposes the following hypothesis.

Hypothesis 4 The positive effect of environmental responsibility on corporate value is more significant for private corporations when the industry concentration becomes higher.

3. RESEARCH DESIGN

3.1. Design of variables

In this part, the variables involved in this paper will be clearly defined and introduce the measurement methods. The dependent variable is the corporate value.

Corporate value – *CV*. The current literature mainly uses ROA, ROE, ROS or Tobin's Q to reflect the profitability of corporations. ROA reflects the profitability and development strength of a corporation [16], which is more convincing in measuring the value of a corporation. This paper chooses the ROA to measure the corporate value.

Corporate environmental responsibility – *CER*. Considering the limited quantity and quality of social responsibility reports released by Chinese corporations, the scoring method that relies on annual and social responsibility reports may be more authoritative and comprehensive [10]. This paper refers to the method of Jia and Liu, which will use the corporate social responsibility score published by Hexun to measure the green responsibility of coporations [17].

Industry concentration – *HHI*. The Herfindahl-Hirschman Index (HHI) measures the degree of market competition in the industry in which a corporation operates.

Corporate ownership – *OWS*. Whether the corporation's controlling shareholder includes the state-owned department or institution is the standard to define whether the private corporation or not. Set to 1 if not included, and 0 is included.

Company size - *SIZE*. Measure by the logarithm of the number of employees in the corporation.

Asset-liability ratio - *DEB*. The percentage of long-term liabilities to the corporation's total assets.

Age of listed - *AGE*. The number of years the corporation has been listed.

Corporate R&D and Investment – *CRD*. The corporate R&D investment is divided by total assets.

Capital intensity – *CI*. Annual operating income divided by total assets.

Corporate operational efficiency – *CRR*. The Cost Revenue Ratio.

Level of regional development – *LRD*. The GDP of the region where the corporate location as percentages of the government budget

3.2. Model design

This paper sets the following models to test the hypotheses proposed:

$$CV = \alpha_0 + \alpha_1 CER + \alpha_2 X + \varepsilon_i \quad (1)$$

$$CV = \alpha_0 + \alpha_1 CER + \alpha_2 OWS + \alpha_3 CER \cdot OWS + \alpha_4 X + \varepsilon_i \quad (2)$$

$$CV = \alpha_0 + \alpha_1 CER + \alpha_2 HHI + \alpha_3 CER \cdot HHI + \alpha_4 X + \varepsilon_i \quad (3)$$

$$CV = \alpha_0 + \alpha_1 CER + \alpha_2 OWS + \alpha_3 HHI + \alpha_4 CER \cdot HHI + \alpha_5 CER \cdot OWS + \alpha_6 OWS \cdot HHI + \alpha_7 CER \cdot HHI \cdot OWS + \alpha_8 X + \varepsilon_i \quad (4)$$

where:

α_i - variable coefficient

CV - the dependent variable, Corporate value

CER - the independent variable, Corporate environmental responsibility

HHI - the moderating variable, Concentration ratio.

OWS - the moderating variable, Corporate ownership.

X - control variables

ε_i - random disturbance term

3.3. Sample selection and data sources

This paper selects the iron and steel corporations listed on the Shanghai and Shenzhen stock exchanges from 2016 to 2020 as the base samples. The sample corporations' operational and financial data will select from the WIND database, the CCER database, the CHOICE database, and the CSMAR database. Iron and steel industry data and regional economic data select from China Steel Industry Yearbook and China Regional Economic Yearbook from 2016 to 2020.

4. EMPIRICAL ANALYSIS AND RESULTS

4.1. Descriptive statistics and correlation analysis

Descriptive statistical analysis was performed on each variable before regression analysis. The correlation coefficient between *CER* and *CV* is 0.326 (p<0.01), which passed the significance test and preliminarily verified Hypothesis 1. This paper also conducts VIF analysis. The fluctuation interval of VIF value is less than 10, so it can be determined that there has no serious multicollinearity between variables.

4.2. Regression analysis

In **Table 1**, M1 is the test results including all control variables, M2 is the test results by the model (1), M3 is the test results by the model (2), M4 is the test results by the model (3), M5 is the test results by the model (4).

Table 1 Test results of the relationship between environmental responsibility and corporate value

Variable	M1	M2	M3	M4	M5
CER		0.0476***	0.0523***	0.0467***	0.0405***
CER×OWS			0.0332***		-0.1566*
CER×HHI				0.0243***	0.0238***
OWS×HHI					-0.3654
CER×OWS×HHI					0.0362**
Cons	6.9246**	4.9846*	5.3946*	5.3246*	5.9246**
Adjusted R^2	0.0492	0.0591	0.0597	0.0608	0.0625
F	31.5493	42.8791	39.9273	41.6676	34.5552
N	1595	1595	1595	1595	1595

Notes. *, ** and ***, respectively, denote significance at 10%, 5% and 1%.

The test results of M2 in **Table 1** show that the regression coefficient of environmental responsibility is 0.0476 (p<0.01), which has passed the significance test. It shows that corporate implementation of environmental responsibility can significantly enhance corporate value. Hypothesis 1 has been verified. In M3, the interaction coefficient of the nature of corporate ownership and environmental responsibility was 0.0332 (p<0.01), which passed the significance test. It shows that compared with other nature of corporate ownership, private corporation implementation of environmental responsibility can be more conducive improve corporate value. Hypothesis 2 has been verified. In M4, the interaction coefficient of industry concentration and environmental responsibility is 0.0243 (p<0.01). It shows that the higher the industry concentration, the more significant

corporate value promotion by corporates implement environmental responsibility. Hypothesis 3 has been verified. In M5, the interaction coefficient of industry concentration, corporate ownership and environmental responsibility is 0.0362 ($p<0.05$), which passed the significance test. It proved the nature of corporate ownership could strengthen the positive moderating effect of the relationship between "environmental responsibility and corporate value". And it shows that when the industry concentration is higher and privately-owned corporations, the positive effect of environmental responsibility on corporate value is more significant. Hypothesis 4 has been verified.

4.3. Robustness test

4.3.1. Alternative dependent variable

Different indicators substitute corporate value may affect the test results of the models. Therefore, this paper refers to the method of Wang and Qian, which uses Tobin's Q ratio as an alternative indicator of corporate value, and re-tests the above models [16]. With the same statistical method as above, the test results are shown in **Table 2**.

Table 2 Robustness test

Variable	M1	M2	M3	M4	M5
CER		0.0047***	0.0006	0.0025	0.0037*
CER×OWS			0.0061***		-0.0095**
CER×HHI				0.0048***	0.0047***
OWS×HHI					0.0239
CER×OWS×HHI					0.0216***
Cons	0.9568	0.3413	0.3988	0.3732	0.4231
Adjusted R^2	0.0281	0.0256	0.0261	0.0267	0.0277
F	16.8121	14.7644	14.1609	14.6763	13.7182
N	1595	1595	1595	1595	1595

Notes. *, ** and ***, respectively, denote significance at 10%, 5% and 1%.

The test results of M2 in **Table 2** show that the regression coefficient of *CER* is 0.0047<0.01), which is passed the robustness test. In M3, the interaction coefficient of the *OWS* and *CER* is 0.0061 ($p<0.01$), which is passed the robustness test. In M4, the interaction coefficient of *HHI* and *CER* is 0.0048 ($p<0.01$), which is passed the robustness test. In M5, the interaction coefficient among *HHI*, *OWS* and *CER* is 0.0216 ($p<0.01$), which passed the robustness test. The analysis results of this paper still have strong robustness when substituted indicators of corporate value.

4.3.2. Radom sample

Different sample volumes may affect the robustness of the results. Therefore, this paper randomly selects 80% of the subsamples for testing. The results as shown in **Table 3.**

The test results of M2 in **Table 3** show that the regression coefficient of *CER* is 0.0363<0.01), which is passed the robustness test. In M3, the interaction coefficient of the *OWS* and *CER* is 0.0271 ($p<0.01$), which is passed the robustness test. In M4, the interaction coefficient of *HHI* and *CER* is 0.0144 ($p<0.01$), which is passed the robustness test. In M5, the interaction coefficient among *HHI*, *OWS* and *CER* is 0.0384 ($p<0.01$), which passed the robustness test. The analysis results of this paper still have strong robustness after randomly selecting 80% of the sub-samples.

Table 3 Robustness test

Variable	M1	M2	M3	M4	M5
CER		0.0363***	0.0368***	0.0381***	0.0298***
CER×OWS			0.0271***		0.2547**
CER×HHI				0.0144***	0.0246***
OWS×HHI					-0.2012
CER×OWS×HHI					0.0384**
Cons	6.9772**	5.2402*	5.4126*	5.3655*	6.4340**
Adjusted R^2	0.0421	0.0498	0.0500	0.0513	0.0541
F	29.2953	37.3246	34.5416	36.4237	30.5951
N	1286	1286	1286	1286	1286

Notes. *, ** and ***, respectively, denote significance at 10%, 5% and 1%.

5. CONCLUSION

Combining the actual development situation of China's iron and steel industry and relevant theories, this paper discusses the impacts of environmental responsibility on corporate value, and analyzed the moderating effects of industry concentration and corporate ownership on the above relationship. By analyzed the data of China's listed iron and steel corporations from 2016 to 2020, the conclusions of this paper are as follows:

- Implementation of environmental responsibility has a significant positive effect on enhancing corporate value.
- The nature of corporate ownership plays a significant role in regulating the relationship between "Environmental responsibility and Corporate value". Compared with other types of corporations, private corporations' implementation of environmental responsibility plays a more significant role in the later value enhancement.
- In the context of China's steel industry cutting overcapacity, industry concentration has played a significant positive moderating role between "environmental responsibility and corporate value".
- Industry concentration has a significant secondary moderating effect between the nature of corporate ownership and the relationship between "Environmental responsibility and Corporate value". In the context of Intensified competition in the iron and steel industry, private corporations need to actively implement their environmental responsibilities to protect and gain market share to increase their market value.

REFERENCES

[1] LIANG, D., LIU, T. Does environmental management capability of Chinese industrial firms improve the contribution of corporate environmental performance to economic performance? evidence from 2010 to 2015. *Journal of Cleaner Production.* 2017. vol. 142, pp. 2985-2998.

[2] WU, H., LV, K., LIANG, L. Measuring performance of sustainable manufacturing with recyclable wastes：a case from China's iron and steel industry. *Omega.* 2017, vol. 66, pp. 38-47.

[3] PALMER, K., OATES, W. E., PORTNEY, P. R. Tightening environmental standards: The benefit-cost or the no-cost paradigm?. *Journal of Economic Perspectives*. vol. 9, no. 4, pp. 119-132.

[4] LANKOSIKI, L. *Determinants of environmental profit: An analysis of the firm-level relationship between environmental performance and economic performance*. Espoo, 2000. Dissertation. Finland: Helsinki University of Technology.

[5] MCWILLIAMS, A., SIEGEL, D. Corporate social responsibility: A theory of the firm perspective. *Academy of Management Review.* 2001, vol. 26, no. 1, pp. 117-127.

[6] BANSAL, P., CLELLAND, I. Talking trash: Legitimacy, impression management, and unsystematic risk in the context of the natural environment. *Academy of Management Journal.* 2004, vol. 47, no. 1, pp. 93-103.

[7] GODFREY, P. C. The relationship between corporate philanthropy and shareholder wealth: a risk management perspective. *Academy of Management Review*. 2005, vol. 30, no. 4, pp. 777-798.

[8] BERRONE, P., GOMEZ-MEJIA, L. R. Environmental performance and executive compensation: An integrated agency-institutional perspective. *Academy of Management Journal*. 2009, vol. 52, no. 1, pp. 103-126.

[9] SHEN, Y., FU, L.L., ZHAO, J.M. The impact of municipal party secetaries' turnover on enterprise rentseeking: an empirical study. *China Industrial Economics*. 2015, no. 9, pp. 37-52.

[10] MARQUIS, C., QIAN, C. Corporate social responsibility reporting in China: Symbol or substance? *Organization Science*. 2013, vol. 25, no. 1, pp. 127-148.

[11] HE, X.G., ZHANG, Y.F., LIAN, Y.L., et, al. Political ties and fire value — an empirical study in China. China Industrial Economics. 2013, no. 1, pp. 103-115.

[12] GAO, H.G. Research on institutional promotion mechanism of private enterprises fulfilling environmental responsibility. *Fujian Tribune*. 2011, no. 11, pp. 11-15.

[13] YANG, L.X, XIANG, Y.N. 2020, Research on the relationship between concentration and capacity utilization rate of China's iron and steel industry. *Statistics & Decision.* vol. 36, no. 20, pp. 110-114.

[14] XU, C.Y., ZHOU, N.L. The endogenous change of market structure and the harnessing of excessive production capacity. *Economic Research Journal*. 2015, vol. 50, no. 02, pp. 75-87.

[15] DENG, C., SUN, J.J. QFII's shareholding, nature of property rights and corporate financing constraints. *Management World.* 2014, no. 05, pp. 180-181.

[16] WANG, H.L., QIAN, C.L. Corporate philanthropy and corporate financial performance: The roles of stakeholder response and political access. *Academy of Management Journal*. 2011, vol. 54, no. 6, pp.1159-1181.

[17] JIA, X.P., LIU, Y. Extenal environment, internal resource, and corporate social responsibility.*Nankai Business Review*. 2014, vol. 17, no. 06, pp. 13-18+52.