

# Can China's Government Well Coordinate Market Performance and Environmental Performance of Firms?

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**Abstract.** The state-owned property of China's firms and serious environmental issues suggest analyzing whether China's government can well coordinate the relationship that firms' market performance affects environmental performance. This paper designs R&D investment, corporate growth, and net profit rate to embody the profile of market performance. Based on 1609 listed firms, we analyze the key issue that as a kind of mandatory regulation, whether state-owned share can positively moderate the influence of market performance on environmental performance. Our empirical findings reveal the significantly positive influence of R&D investment on environmental performance. However, the indicators of net profit rate and corporate growth could not present such impact on environmental performance. In addition, heterogeneity test reveals that stronger state-owned share improves the impact of net profit rate and growth on environmental performance. It implies that mandatory regulation more positively influences environmental management of firms with more state-owned shares. Overall, this paper suggests China's government to consolidate the role of mandatory regulation in environmental management.

**Keywords:** Market performance; Environmental performance; Government involvement; State-owned share; China's firms

## 1 Introduction

Scholars' academic findings indicated that the gradually deteriorating ecological environment appearing in manufacturing sectors is largely caused by less-climate friendly production and operation approaches[1]. At present stage, China is actively integrating into the international social governance and contributing the wisdom to "Dual Carbon" goals by improving energy efficiency. As an emerging market with a strong sense of social responsibility, China has always made improving firms' economic performance (EP) a top priority in promoting high-quality development. As firms' ownership structure and top managers' behavior in the environmental management (EM) are markedly different between China and the West, under a powerful macro-regulation, their difference suggests considering whether the impact of market performance (MP) and EP of firms was well coordinated by China's government.

Our research design is inspired by the powerful driving force of China's government for developing firms. Although such power cannot ensure top managers to hold the positive motivation for EM, it makes the whole operation of firms within governmental control. Scholars found that state-owned share (SOS) can promote better EP that will be further transformed into financial performance [2,3], while their positive relationship is not always existence [4]. In addition, ownership structure can moderate the relationship between MP and EP with a dynamic role [5], and SOS creates a bridge to link firms' daily operation with policy regulation [6]. Thus in the context of China's government proactively improving the natural environment, we view SOS as a kind of mandatory regulation that suggests firms to regularly develop EM. To clearly embody the role of China's government in firms' EM, we aim to figure out the impact of MP on EP with the moderating effect of SOS, and further examine whether stronger SOS improves such impact.

## **2 Literature Review and Hypotheses Development**

Based on the important position of SOS in China's firms and due to the promotion of such share to the balance of MP and CSR [3], SOS may positively moderate the impact of MP on EP by the aid of making decisions on distributing firms' internal resources. However, when some kinds of MP play a weak role in EM, the moderating effect of SOS may become limited because China's government always respects rules of business development rather than enforce firms to fulfill social responsibility at the expense of financial loss. Further, we divide MP into the profiles of operations performance, financial performance, and growth potential. Specifically, operational performance reflects firms' production efficiency that refers to production cost, products quality, and products' market value. Due to the wide scale of Chinese firms and the high fluidity of market information, most firms can obtain resources available through various channels. Therefore, the internal resources of firms further contribute to the improvement of operational performance. However, despite the productivity efficiency of China's energy, environment, and economic systems is steady increasing, the scale efficiency of technological progress in most areas is still quite low. In addition, lack of management efficiency is another obstacle that hinders this system further being improved [7]. Further, the average capability of improving EM in China's firms is relatively low with a larger difference among firms as well. In contrast, most firms first aim to seek the advantage of cost control [8]. Overall, R&D investment (R&D) that can push forward technology upgrading and production efficiency is more closely with EM [7,9]. Although the scale of firms' R&D has not reached a higher level, compared with other operational performance, the influencing effect of R&D on EP is more significant. Thus we develop following hypotheses.

H1a: R&D can positively influence EP in China's firms.

H1b: SOS can positively moderate the influencing effect of R&D on EP.

H1c: Stronger SOS triggers a greater influencing effect of R&D on EP.

Besides operational performance, improving the natural environment also needs the support from financial performance that reflects the scale of available funds in firms [10]. Although operational performance and financial performance are inseparable from each other, the higher development efficiency does not always imply more available funds and vice versa. With

more factors being involved in firms' daily operation, the relationship between financial performance and EP shows the complexity. Prior literature found that their relationship has transformed from unidirectional or non-causality to the bidirectional causality [11-12]. In addition, profitability always positively influences CSR performance in China, while such impact is not always appearing in EP [3]. Specifically, the fulfillment of environmental responsibility will increase firms' financial burden with the uncertain return in the short-term [13], while not all CSR activities can bring such return. Compared to the R&D indicator, in China, where business ethics construction faces long-term challenges, the impact of financial performance can be weak and volatile [14]. In this paper, we measure financial performance with net profit rate (NPR) due to the monetary added value created by operating activities which NPR presents, and NPR largely influences shareholders' future investment that determines the level of future financial performance with following hypotheses.

H2a: In China's firms, NPR can weakly positively influence EP.

H2b: SOS can positively moderate the influencing effect of NPR on EP.

H2c: Stronger SOS triggers a greater influencing effect of NPR on EP.

Further, suggested by [15,16], compared with the pursuit of MP, firms tend to improve the natural environment as a higher-level mission. In this case, GROWTH largely influences the sustainability of EM, which is also discussed by the Resource-based View. Generally, firms with higher GROWTH are usually more likely to continuously absorb external investment, which will help to cope with the high pollution at a lower cost and push forward firms' up-front investment in EM [17]. Fewer studies focused on the influencing effect of GROWTH on EP in China's firms, while some favorable evidence shows that firms with higher proportion of domestic share have not closely linked their outlook with EM compared with firms with more foreign share or mainly targeting at foreign customers. In addition, prior research on China's business ethics has shown that companies are facing challenges from environmental crises, while senior managers still pay more attention to political demands and partially overlook the nature of CSR [16]. Thus we infer that in China's firms, GROWTH presents a positively weak influencing effect on EP, and propose following hypotheses.

H3a: In China's firms, GROWTH can weakly positively influence EP.

H3b: SOS can positively moderate the influencing effect of GROWTH on EP.

H3c: Stronger SOS triggers a greater influencing effect of GROWTH on EP.

### **3 Research Methodology**

#### **3.1 Data Collection**

Based on the availability of data, we collected 1609 annual reports of listed Chinese companies covering CSR information from 2010 to 2022. We consider each CSR report as an independent sample, as many of their information changes every year for the same company. The indicators we collect from CSR reports include: the level of environmental activity, EMC, and whether firms would publish EP according to Environment, Social, and Governance Index compiled by the Stock Exchange of Hong Kong Exchange Ltd. (ESG) or the Sustainability

Reporting Guidelines compiled by the Global Reporting Initiative (GRI-G3.1 version). We collected the following indicators from firms' annual reports: number of staff, firms' size, diluted earnings per share, whether the annual report was audited by international accounting firms, R&D, NPR, GROWTH, and SOS. We also determine firms' listed year based on the information from Shanghai Stock Exchange, whether firms belong to the heavy-polluting industry according to the Environmental Information Disclosure Guidelines of China's Listed Company (Draft), and whether firms' headquarters is located in Eastern China (developed area) based on China's geographical division.

### **3.2 Method and Variables**

Dependent variable: The value of EP is calculated by the multiplying value of the level of environmental management capability (EMC) and environmental activity. Due to that GRI provides a common environmental assessment standard for global institutions, including firms of all sizes, we evaluate environmental activity based on the environmental indicator in GRI. In addition, this criterion has fully considered shareholders' interest and explained pathways of collecting the data of each indicator. GRI contains 30 environmental indicators divided into 9 categories, including 17 core indicators and 13 additional indicators. To avoid the issue that product of environmental activity and EMC would hide the true impact of EP when it is 0, we define different values based on different situations. If a firm has well engaged in one core indicator, it is 3. If a firm has well engaged in one additional indicator, it is 2. Otherwise, it is 1. In addition, GRI has introduced the relationship between each indicator and EM. Thus we argue that an indicator was well engaged in when a firm published the data related to an indicator and then explained its positive impact on the natural environment. We then obtain the level of firms' environmental activity by adding the score of 30 indicators.

Further, we argue that EP should also cover EMC. Integrating prior studies, e.g. [18], EMC can be defined as the organizational capability in EM used by top managers of institutions as a kind of management tool to reduce the negative impact of business activity on the natural environment with climate-friendly ways. Thus EP should include both employees' behavior performance and managers' management performance, which also helps to integrates the joint contribution of employees and managers to EM. We determine whether firms has following 12 EMCs: professional EM system, EM department, short-term EM planning, EM strategy, technology advancement, EM program cooperation with stakeholders, EP incentive, EM values, EM education for staff, green procurement, EP certification by dependent agencies, and voluntary participation in environmental activity organized by the government or industry association. We define if a firm has one capability, it is 1, and it is 0 otherwise. We then obtain the level of EMC by adding the score of each capability, thereby gaining the overall level of EP.

Independent variable: According to our scientific issue, we define R&D, NPR, and GROWTH as the independent variable that corresponds to the respective testing process.

Moderator variable: SOS is a multiple concept, and only focusing on the proportion of SOS may not fully reflect the value of mandatory regulation in business ethics. Thus in order to show the comprehensive role of SOS, we multiply firms' property (state-owned=2; non-state-owned=1) and the proportion of SOS owned by top10 shareholders.

Control variable: Integrating prior relevant studies, we design following 8 control variables: (1) Firms' size (*SIZE* that is the logarithmic of annual total assets); (2) Number of staff (*STAFF* that is the total number of staff which includes all parent and subsidiary firms); (3) Firms' listed age (*AGE* that is the duration of firm's listing); (4) Firms' pollution level (*POLLUTION* that is heavy-polluting firm, it is 1, and non-heavy-polluting firm, it is 0); (5) Firms' location (*LOCATION* that is eastern China=1 and other region=0); (6) Whether developing environmental activity according to GRI/ESG (*GE* that is developing such activity following GRI/ESG Guidelines=1 and otherwise=0); (7) Whether auditing annual performance by employing international accounting firm (*IA* that is employing such firm to audit annual finance, it is 1, and otherwise it is 0); (8) Diluted earnings per share (*DEPS*, measuring the quality of firms' earnings per share if all convertible securities exercised as a kind of performance metric).

Table 1 presents the overview of all variables. The S.D. shows that there exists a large difference among firms. The average score is 239.64, while the highest score is 675, hence the China's firms' EP is low. The level of *STAFF*, *AGE*, *GROWTH*, and *DEPS* shows that there exists an evident difference on firms' profile and outlook. While based on the average of *GE* and *IA*, only few firms follow international criteria. Further, *OS* and *NPR* present obvious differences among firms.

**Table 1.** The overview of all variables.

Variables	Min	Max	Mean	S.D.
SIZE	19.20	28.57	23.22	1.39
STAFF	28.00	294761.00	13693.83	30217.12
AGE	1.00	27.00	13.28	5.48
POLLUTION	0.00	1.00	0.48	0.50
LOCATION	0.00	1.00	0.64	0.48
GE	0.00	1.00	0.19	0.39
IA	0.00	1.00	0.18	0.38
DEPS	-3.81	3.94	0.39	0.55
R&D	0.00	20.25	1.99	2.40
NPR	-136.98	367.46	8.44	20.17
GROWTH	-58.41	244.10	9.39	24.16
EP	30.00	675.0	240.27	100.92
SOS	0.00	190.52	74.91	48.64

## 4 Empirical Results

### 4.1 Correlation Analysis

Due to space limitations, we do not present the results of the correlation analysis by the table, while the firm that has more staff, heavy pollution, shorter listed age, larger total assets, adopting *GE*, employing international audit institution, higher *DEPS*, or stronger *SOS* usually achieves at better *EP*. In addition, the correlation between firms' profile and *MP* is strong. Further, *SOS* only strengthens the correlation between *R&D* and *EP*. Correlation analysis

implies a limited positive moderating effect of SOS, and the fluctuations of NPR and GROWTH may not significantly interact with EP. Then we verify our hypotheses by examining the causality between MP and EP.

#### 4.2 Test for Full Sample

Table 2 shows the bidirectional causality between MP and EP under the involvement of firms' profile and government role. The change of  $R^2$  indicates that with the rise in the number of variables in the model, EP is being better explained.

**Table 2.** The impact of MP on EP.

Variables	Model 1	Model 2	Model 3	Model 4
<i>Constant</i>	0.00 (0.02)	0.01 (0.02)	0.00 (0.02)	0.00 (0.02)
<i>SIZE</i>	0.05* (0.03)	0.07** (0.03)	0.07** (0.03)	0.07** (0.03)
<i>STAFF</i>	0.02 (0.03)	0.01 (0.03)	0.01 (0.03)	0.01 (0.03)
<i>AGE</i>	-0.03 (0.02)	-0.03 (0.02)	-0.03 (0.02)	-0.02 (0.02)
<i>POLLUTION</i>	0.13*** (0.02)	0.15*** (0.02)	0.15*** (0.02)	0.15*** (0.02)
<i>LOCATION</i>	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)
<i>GE</i>	0.37*** (0.02)	0.37*** (0.02)	0.37*** (0.02)	0.37*** (0.02)
<i>IA</i>	0.09*** (0.02)	0.10*** (0.02)	0.10*** (0.02)	0.10*** (0.02)
<i>DEPS</i>	0.01 (0.02)	0.04 (0.02)	0.04 (0.02)	0.04 (0.02)
<i>R&amp;D</i>		0.10*** (0.02)	0.10*** (0.02)	0.12*** (0.04)
<i>NPR</i>		-0.05** (0.02)	-0.05** (0.02)	-0.01 (0.06)
<i>GROWTH</i>		-0.03 (0.02)	-0.02 (0.02)	-0.03 (0.04)
<i>SOS</i>			0.03 (0.02)	0.05 (0.04)
<i>R&amp;D×SOS</i>				-0.02 (0.04)
<i>NPR×SOS</i>				-0.05 (0.06)
<i>GROWTH×SOS</i>				0.00 (0.04)
<i>Wald Chi<sup>2</sup></i>	432.24***	466.11***	467.32***	467.68***
<i>R<sup>2</sup></i>	0.21	0.23	0.23	0.23

Note: \* $p \leq 0.10$ , \*\* $p \leq 0.05$ , and \*\*\* $p \leq 0.01$  (Two-tailed). Standard errors are in the parentheses.

In Table 2, *SIZE*, *POLLUTION*, *GE*, and *IA* have a significant positive impact on EP no matter whether including *SOS*, which implies that abundant internal resources and international management mode help to improve the level of enterprise performance. Moreover, it presents that China's heavy polluting firms has achieved certain results based their EM. If not considering the moderating effect of *SOS* as Model 2 and Model 3, *R&D* has a significant positive impact on EP with the maximum marginal effect as 0.10, which verifies H1a. However, the impact of *NPR* and *GROWTH* fails to present such effect, hence H2a and H3a are not verified, which shows that due to the direct influence on the process of EM, operational performance has a more close relation to EM compared to financial performance and growth potential. In addition, *SOS* has a positive impact on EP while not statistically significant.

*SOS* can weakly positively moderate the influencing effect of *NPR* and *GROWTH* on EP. However, *SOS* can not positively moderate the impact of *R&D*, which supports H2b and H3b.

It implies that the positive role of SOS in emerging markets is limited. While SOS has not boosted the impact of R&D on EP, which becomes a notable issue. Our data shows that R&D in non-state-owned firms (2.66) is far greater than that in the state-owned (1.77). In the case of smaller SIZE (22.88 vs 23.34), more actively developing R&D activity implies that non-state-owned firms are more eager to gain competitive advantage through the innovation. In the context of this widely accepted production model, active R&D largely reflects the willingness of firms to develop clean production. Therefore, we expect SOS and a strong awareness of clean production to jointly promote non-state-owned firms to improve the natural environment, which also demonstrates the bright prospects of emerging markets for firms.

### **4.3 Heterogeneity Test**

Following, we divide both SOS into 2 groups in terms of their average with heterogeneity test results. It can be revealed that a stronger SOS can better moderate the influencing effect of NPR and GROWTH on EP, while weaker SOS can only positively moderate the influencing effect of NPR, which supports H2c and H3c but refuses H1c. It describes a positive phenomenon that mandatory regulation can drive the impact of firms' growth potential on emerging markets. Moreover, it implies that firms have opportunities to link future growth capabilities to emerging markets quickly, thereby reducing potential environmental risks with the investment of SOS. However, some issues need to be solved, which is how to maintain the dominant role of SOS in environmental issues when the outlook for firms is not optimistic.

## **5 Conclusions and Research Implications**

### **5.1 Conclusions**

This paper investigates whether government role well coordinates the impact of MP on EP by 1609 listed firms. Empirical results show that only operational performance significantly positively interacts with EP, while the impacts of financial performance as well as growth potential on EP do not show such state. In addition, for firms with stronger SOS, financial performance and growth potential more positively influence EP. Overall, China's government has not well coordinated the impact of MP on EP of firms as the contribution of SOS to firms' environmental responsibility is scarce, which is largely reflected in the lower EP. While it also releases a positive signal that is China's government is applying the policy incentive to promote firms' EM, and mandatory regulation may be enacted in the future.

### **5.2 Research Implications**

We more discuss how to strengthen the role of SOS in firms' EM. We should be aware of a long-standing dilemma, namely the imbalance in regional economic development in China, which determines whether firms will continue to focus on emerging markets. Generally, firms located in developed areas are willing to invest more resources in the creation of social performance because they have the advantage in operating environmental factors. In contrast, firms in less developed areas will more focus on MP because their inferiority in geographical location makes the environmental investment markedly enhance operation cost. Our data shows that the average proportion of SOS in Eastern province and Non-eastern province is similar while the average EP of firms located in the Eastern is markedly lower than that in the

Non-eastern. To address this problem, government needs to motivate top managers to more actively engage in the cleaner production by establishing Industry-University-Research platform and new production modes, such as the eco-industrial park. Such scale economy helps to reduce both production and EM costs, thus enhancing the positive impact of limited available resources on environmental quality, which has a positive significance for China.

**Acknowledgments.** We thank funding supports from National Social Science Fund of China (22CGL030), Natural Science Foundation of Heilongjiang Province (LH2021G005), and University Student Innovation Training Program of Heilongjiang Province (S202310217179).

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