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Corporate innovation and environmental investment: The moderating role of institutional environment

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Abstract

Corporate environmental investment helps improve corporate environmental performance, which, therefore, is an effective micro-level solution to mitigate environmental concerns generated by corporate excessive resource exploitation and energy use. Using Chinese listed firms within environment-related industries over the period 2011–2018 as the research setting, this study applies the panel data model to investigate the impact of corporate innovation on environmental investment, as well as the moderating effects of institutional factors. The results show that corporate innovation significantly improves firms' environmental investment with 1% Research & Development (R&D) investment ratio increase generating 2326 CNY (around 351 USD at 2018 exchange rate) increase in environmental investment; the moderating effect of environment policy is positive and significant while the moderating effect of internationalisation level is not significant, indicating that current environment policy implementation helps to strengthen the positive impact of corporate innovation on environmental investment while the role of internationalisation level in this nexus is not observed. From a micro-level perspective, the findings of this study shed light on mitigating environmental concerns through enhancing corporate innovation, and provide evidence that China's corporate internationalisation process awaits more regulatory controls.

Keywords: Corporate innovation; Environmental investment; Institutional environment; Emerging economy

1. Introduction

Since 2010, China has become the world second-largest economy (Gao, 2016). However, its rapid economic growth seems to be highly coupled with dysfunctional energy consumption and environmental deterioration (Zheng et al., 2019). Clearly, increasingly fast progress of China's industrialisation promotes economic growth but also generates sizable demand for

resources (Li et al., 2019). As an emerging economy, Chinese economic development pattern requires a balance between speed and quality: fast economic growth speed without compromising on excessive resource use and environmental deterioration.

Solutions to minimise the cost of environmental deterioration caused by rapid economic growth are encouraged at the macro level. The Chinese government plays a dominant role in the environmental restoration process (Sun et al., 2019). For example, China has promised to reach the peak level of carbon emissions prior to 2030, together with 60% decrease in carbon intensity (Mi et al., 2017). Energy conservation has been added to China's sustainable development plan and highlighted in the recent three Five-Year-Plans (Hu, 2016; Gao and Ge, 2020). To

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achieve these goals, appropriate and effective environmental regulations are required (Hu and Wang, 2020). In addition, central government shapes economic structure through substantial shareholdings of state-owned enterprises (SOE), which make great contributions to China's economy (Jin et al., 2019). Taken together, the institutional environment thus exerts critical influences on China's economic development mode (Gemmer et al., 2011) and hence environmental development mode (Zheng et al., 2018). As such, the role that institutional factors play in China's environmental restoration cannot be ignored.

Alternatively but importantly, micro-level solutions would also contribute to the healthy environmental development (Lü et al., 2015). Firms are the main carbon emission producer and energy consumer (Alam et al., 2019), and thus the way they manufacture and operate substantially affects national environmental protection and energy conservation. Making environmental investment, on the one hand, is likely to affect firms' operation as budgets are constrained (Wu et al., 2020); on the other hand, reduces costs by advanced technologies (Bierbaum et al., 2020) and builds up corporate reputation with sustainable operation (Aksak et al., 2016), creating an invaluable asset for firms (Guenther and Guenther, 2019) and improves firm performance (Pekovic et al., 2018). Accordingly, research on corporate environmental investment is of critical importance to modify not only China but also global environmental governance.

Limited scholarly attention, however, has been paid on the crucial role that firms act in mitigating environmental concerns. Braam et al. (2016) proposes that corporate environmental performance is increasingly accountable for the environment and encourages firms to become more responsible for their environmental performance. The propositions are supported and extended by subsequent studies. Liang and Liu (2017) confirms the positive influence of corporate environmental governance on economic development. From cross-country and single country perspectives respectively, Bhattacharyya (2019) and Gupta and Gupta (2020) reported that appropriate corporate environmental investment strategies generate reduced costs and risks and thereby enhance firms' sustainable development.

Further, from a perspective of firm-level driving forces, Abbas (2020) provides evidence that corporate total quality management has a positive and significant impact on corporate environmental investment. An interesting finding concerning the significant influences of location on corporate environmental responsibility is found in Liu and Anbumozhi (2009), indicating a regional heterogeneity in firm-level corporate environmental strategies.

Based on natural resource-based view, Alam et al. (2019) empirically documented that corporate Research & Development (R&D) investment improves firms' environmental performance. Bostian et al. (2016) concurs with the positive outcomes of corporate environmental investment and proposes that investment in new technology leads to lower energy use and hence fewer pollution emissions. The long-term benefits of environmental technology are also supported by other research (Murovec et al., 2012; Li, 2017; Tang et al., 2018). Accordingly, the impacts that corporate innovation is likely to exert on

firms' environmental investment are the least to be ignored. As can be summarised from prior studies, corporate green innovation helps improve energy efficiency, promote recycling, lower pollution, etc., in the long run. In other words, it is expected to accelerate production speed while simultaneously not increasing resource needs. Clearly, the long-term benefits through the impacts of corporate innovation on environmental investment are expected to make great contributions to mitigate environmental problems from a firm-level perspective.

Therefore, the picture of corporate environmental behaviour is distorted if corporate innovation is ignored. We take into account the important role of corporate innovation and use Chinese listed firms within environment-related industries as the research setting to investigate the impact of corporate innovation on firms' environmental investment. Given that prior research mainly concentrates on macro-level solutions, this study contributes to the existing environment literature by shedding light on a micro-level solution to mitigate environmental deterioration and dysfunctional energy use. Given the critical role that institutional factors play in China's environmental development, we also examine the moderating effects of environment policy implementation and internationalisation level in the relationship between corporate innovation and environmental investment. An integration of micro- and macro-level factors is expected to provide a more nuanced and complete understanding of the driving force of corporate environmental investment and how the institutional environment affects such driving impact in China.

2. Methodology

2.1. Sample

To examine the relationship between corporate innovation and environmental investment, as well as the moderating effects of environment policy and internationalisation level, we collected data of 2263 Chinese listed firms from 20 industries related to environment from 2011–2018. The 20 environment-related industries are selected based on Shen and Xu (2019) and the industry classification criteria issued by China's Securities Regulatory Commission. We removed firms with the following three characteristics: 1) having incomplete or unavailable data during sample period; 2) experienced significant changes in main business activities; 3) labelled as ST or *ST manifest in abnormal performance. Finally, we retained 275 sample firms (Table 1).

2.2. Measures

Corporate environmental investment (*Env*). Corporate environmental investment is the dependent variable, measured by the sum of current occurrence amounts on ongoing environmental projects, environmental governance, and pollution-mitigation fees (in 10,000 CNY, equivalent to approximately 1508 USD at 2018 exchange rate, applies hereafter) divided by total profits. As mentioned above, *Env* was manually collected from listed firms' annual report and corporate social responsibility report.

Table 1
Sample industry descriptions.

Industry	Number of firms
Electronics manufacturing & equipment	33
Real estate	7
Textiles & clothing manufacturing	5
Public sector unions	28
Chemical & related manufacturing	54
Communications/Electronics	20
Architectural ornament	3
Transportation	8
Metal	21
Agriculture	4
Car manufacturing	6
Light industry manufacturing	2
Equipment manufacturing	34
Food & beverage	13
Civil engineering and construction	12
Medical supplies	22
Miscellaneous manufacturing	3
Total	275

Corporate Innovation (*RD*). Corporate innovation is the key explanatory variable, measured by the research and development (R&D) investment divided by operation income. It measures a firm's expenditure on technology development and end product from R&D activities, reflecting the firm's innovation ability.

Internationalisation level (*Inter*) and environment policy (*Pol*). Institutional environment plays a dominant role in emerging economies (Sun et al., 2019). Therefore, we include internationalisation level and environment policy as moderators that affect the relationship between corporate innovation and environmental investment. Internationalisation level is defined as a dummy variable, with 1 representing the proportion of the firm's overseas business (assets) greater than 10% and 0 otherwise. *Pol* is also a dummy variable, with 1 representing the year the new Environmental Law implemented (2015) and 0 otherwise. The implementation of the new Environmental Law has largely affected firms' operation and management decisions, therefore, it was added in the regression modelling as a proxy for environment policy.

Control variables. Consistent with Jiang and Cui (2019), we controlled for firm-level factors that are likely to have an impact on corporate environmental investment, including growth ability (*Grow*), return on equity (*Roe*), financial constraints (*Cap*), financial leverage (*Fin*), firm size (*Size*), firm age (*Age*), ownership structure (*Owner*), year fixed effect (*Year*) and industry fixed effect (*Industry*). Table 2 displays the descriptions and measures of these variables. Year fixed effect (*Year*) and industry fixed effect (*Industry*) also controlled for firm-level. Year fixed effect represents time-invariant latent factors and industry fixed effect describes industry-specific common characteristics (Haveman et al., 2017).

There are in total 2200 (275×8) firm-year observations. In untabulated summary statistics, the proportion of environmental investment is 4.26% of total profits, with standard deviation of 10.2%, implying that corporate environmental investment varies largely across firms. A more worrying trend is the median environmental investment is less than 0.7%, suggesting a considerably low-level or less emphasis on environmental issues. Accordingly, identifying the key driver of corporate environmental investment is of vital importance. In addition, the R&D investment is also at a relatively low level (average of 3.11%), suggesting that firms are less motivated to develop advanced management and technology. This is likely due to the sizable financial support to state-owned enterprises (SOEs) by central and/or local government (Qian and Li, 2003; Xue et al., 2019). To be noted, the internationalisation level is high, with mean value of 35.14%. Large investment in foreign business does not necessarily secure high returns. The quality of investment and management matter a lot to corporate internationalisation process (Qian et al., 2013). Worryingly, its standard deviation is quite high at approximately 50%, raising a question about investment quality or performance.

2.3. Regression modelling

We investigate the impact of corporate innovation on firms' environmental investment using the following regression model:

Table 2
Variable descriptions.

Variable		Full name	Measure
Dependent variable	<i>Env</i>	Environmental investment	(Ongoing environmental projects investment + environmental governance + pollution mitigation)/total profits
Explanatory variables	<i>RD</i>	R&D investment	R&D investment/operation income
	<i>Inter</i>	Internationalisation level	1: Overseas business share greater than 10%; 0: otherwise
	<i>Pol</i>	Environment policy	1: Year 2015 (new Environmental Law implementation); 0: otherwise
Control variables	<i>Grow</i>	Growth ability	Year-over-year growth rate of operation income
	<i>Roe</i>	Return on equity	Return on equity
	<i>Cap</i>	Financial constraints	Net cashflow/total assets
	<i>Fin</i>	Financial leverage	Total debts/total assets
	<i>Size</i>	Firm size	Log of total assets
	<i>Age</i>	Firm age	Number of years since operated \times 10
	<i>Owner</i>	Ownership structure	Shareholding proportion of largest shareholder
Fixed Effects	<i>Year</i>	Year index	Year fixed effect
	<i>Industry</i>	Industry index	Industry fixed effect

$$Env = \beta_0 + \beta_1 RD + \beta_2 Grow + \beta_3 Roe + \beta_4 Cap + \beta_5 Fin + \beta_6 Size + \beta_7 Age + \beta_8 Owner + \beta_9 Year + \beta_{10} Industry + \varepsilon \quad (1)$$

In addition to the baseline model, we have also examined the moderating effects of internationalisation level and environment policy in the relationship between corporate innovation and environmental investment. Therefore, we introduce the following two moderation as baseline models:

$$Env = \beta_0 + \beta_1 RD + \beta_2 Pol + \beta_3 RD \cdot Pol + \beta_4 Grow + \beta_5 Roe + \beta_6 Cap + \beta_7 Fin + \beta_8 Size + \beta_9 Age + \beta_{10} Owner + \beta_{11} Year + \beta_{12} Industry + \varepsilon \quad (2)$$

$$Env = \beta_0 + \beta_1 RD + \beta_2 Inter + \beta_3 RD \cdot Inter + \beta_4 Grow + \beta_5 Roe + \beta_6 Cap + \beta_7 Fin + \beta_8 Size + \beta_9 Age + \beta_{10} Owner + \beta_{11} Year + \beta_{12} Industry + \varepsilon \quad (3)$$

where β_3 measures the moderation effects, with significant positive estimate representing observed positive moderation effects and negative representing observed negative effects, and unobserved moderation effects otherwise (insignificant).

We applied these panel data models to examine the impact of corporate innovation on firms' environmental investment, as well as the moderation effects of environmental policy implementation and internationalisation level. Hausman tests were implemented to select between fixed effects and random effects (Hausman, 1978). The test results show that all P -values are less than 0.001, therefore, the panel data model with fixed effects was applied in estimating regression models.

2.4. Data source

We collected archive data on corporate governance and accounting from China Stock Market & Accounting Research (CSMAR). The environmental investment data was collected from these listed firms' annual report and corporate social responsibility report, including investment in environmental and sustainable projects in the corporate social responsibility report, and current occurrence amounts on environmental

governance and related projects in the appendix of the annual report. Specifically, investment data in environmental and sustainable projects was sourced from corporate social responsibility report in CSMAR database and was manually collected and cleaned firm by firm; the remaining data was sourced from a widely-used website in finance, accounting, and management, business and many other research areas regarding Chinese listed firms (<http://www.cninfo.com.cn/new/index>) and was collected by web scraping technique performed in Python software. Data of other control variables were also collected from CSMAR database.

3. Results

3.1. Baseline results

The P -value of ΔF ,¹ in Table 3, clearly shows that the explanation power of Model 2 (with all controls added) has significantly improved compared to Model 1 (without controls), supporting the appropriate inclusion of control variables. The coefficient of RD is positive (0.2326) and statistically significant, suggesting that a significant and positive impact of corporate innovation on firms' environmental investment. Specifically, 1% increase in R&D investment ratio leads to 2326 CNY (about 351 USD) increment in corporate environmental investment.

3.2. Moderating effects of internationalisation level and environment policy

So far, we have provided empirical evidence for the positive impact of corporation innovation on firms' environmental investment. In China, a typical emerging and transition economy, institutional factors wield critical influences on corporate operations. Therefore, we take into account the impact of environment policy and internationalisation level, and examine their roles in the positive relationship between corporate innovation and firms' environmental investment. Table 4 demonstrates the results for moderation effects.

It is clear that Models 4 (testing Pol with all controls added) and 6 (testing $Inter$ with all controls added) have more significant explanatory powers than Models 3 (testing Pol without controls) and 5 (testing $Inter$ without controls), which again confirms the selection of these control variables. It is consistent across all these models that the impact of corporate innovation on environmental investment is positive and statistically significant. In addition, as shown in Model 4, the interaction between corporate innovation and environment policy implementation ($RD \cdot Pol$) is positive and statistically significant, suggesting that the implementation of the new Environmental Law helps improve the positive impact of corporate innovation on firms' environmental investment. In contrast, the coefficient of the interaction between corporate innovation and internationalisation level ($RD \cdot Inter$), as

Table 3
Baseline regression results.

Variable	Model 1 without control	Model 2 with all controls added
RD	0.2206* (0.0897)	0.2326* (0.0901)
$Grow$		-0.0098* (0.0033)
Roe		0.0031 (0.0052)
Cap		-0.0197 (0.0240)
Fin		0.0371* (0.0226)
$Size$		0.0070 (0.0063)
Age		-0.0004* (0.0001)
$Owner$		-0.0043 (0.0310)
Constant	0.0440* (0.0054)	-0.0742 (0.1279)
$Year$ fixed effect	Yes	Yes
$Industry$ fixed effect	Yes	Yes
P		0.0136*

Notes: * $P < 0.05$; Standard errors are given in parentheses.

¹ ΔF represents changes in F -statistic between two models.

Table 4
Results for moderating effects.

Variable	Model 3 testing moderator <i>Pol</i> without controls	Model 4 testing moderator <i>Pol</i> with all controls added	Model 5 testing moderator <i>Inter</i> without controls	Model 6 testing moderator <i>Inter</i> with all controls added
<i>RD</i>	0.1978* (0.0905)	0.2098* (0.0909)	0.1910* (0.0941)	0.2040* (0.0944)
<i>Pol</i>	0.0158* (0.0087)	0.0110 (0.0080)		
<i>RD-Pol</i>	0.2950* (0.1621)	0.2907* (0.1622)		
<i>Inter</i>			−0.0059 (0.0100)	−0.0061 (0.0100)
<i>RD-Inter</i>			0.1977 (0.1872)	0.1923 (0.1870)
<i>Grow</i>		−0.0099* (0.0033)		−0.0097* (0.0033)
<i>Roe</i>		0.0030 (0.0052)		0.0030 (0.0052)
<i>Cap</i>		−0.0166 (0.0241)		−0.0200 (0.0240)
<i>Fin</i>		0.0373* (0.0226)		0.0374* (0.0226)
<i>Size</i>		0.0073 (0.0063)		0.0070 (0.0063)
<i>Age</i>		−0.0004* (0.0001)		−0.0004* (0.0001)
<i>Owner</i>		−0.0043 (0.0309)		−0.0043 (0.0310)
Constant	0.0446* (0.0054)	−0.0805 (0.1279)	0.0450* (0.0060)	−0.0722 (0.1280)
Year fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
<i>P</i>		0.0079*		0.0226*

Notes: * $P < 0.05$; Standard errors are given in parentheses.

reported in Model 6, is statistically insignificant. This implies that the current internationalisation progress does not necessarily exert influences on the positive nexus between corporate innovation and environmental investment.

3.3. Robustness checks

The explanatory variable used in the regression modelling is measured by the proportion of corporate R&D investment to total operation income; therefore, there is likely an endogenous problem between corporate innovation and environmental investment. To mitigate such issue, we used an alternative measure to obtain the innovation index, which is proportion of technical employees (*PRD*, number of technical employees divided by total number of employees). Using the new corporate innovation measure, we re-examined the impact of corporate innovation on environmental investment, as well as the moderating effects of environment policy implementation and corporate internationalisation level (Table 5).

Model 7 is the baseline regression model for estimating the impact of corporate innovation on firms' environmental investment. The results are consistent with main findings that the effect for corporate innovation is positive and significant. Models 8 and 9 are testing for the moderation effects of environment policy and internationalisation level, respectively. The results again are consistent with our main findings, suggesting a positive moderating impact of environment policy implementation and an unobserved impact of corporate internationalisation level. Taken together, our main findings are reliable and robust to alternative measure.

4. Discussion

Empirical findings demonstrate a positive impact of corporate innovation on firms' environmental investment. This is encouraging because it provides a micro-level solution to mitigate long-term environmental deterioration and

dysfunctional energy use. Increased investment in corporate research and development activities helps advance firms' environmental technology, e.g. green technology (Tang et al., 2018). With refined or newly developed environmental technology, firms are more likely to improve energy efficiency, promote recycling, and lower pollution, etc. Specifically, improvement in green technology modifies product design and manufacturing activities (Tang et al., 2018), and hence reduces energy use, carbon emission, and minimises waste. For firms' own sake, advanced technology brings about reduced production and operation costs, which equip firms' with competitive advantages in increasing market share and outperforming competitors (Li, 2017). In addition, refined production processes are more likely to comply with environmental regulations, which thus reduces violation probability and survives compliance costs.

Accordingly, improving corporate investment in R&D is an effective way to increase corporate environmental performance, which further helps modify long-term environmental mitigation and sustainability. It is also beneficial for firms' long-term development because it will pay back the expenditure on innovation through reduced production and distribution costs by long-term technology advancement and functional management decisions. Therefore, improving corporate innovation investment is a win–win process and facilitates both corporate development and environmental restoration.

Another promising finding is the positive moderating impact of environmental policy. Empirical results imply that the implementation of the new Environment Law has begun to work and helps strengthen the positive effect of corporation innovation on environmental investment. The 2015 Environmental Law manifests in the micro-level environmental responsibility and obligation. Individuals are responsible for their environmental behaviour and local governments (county-level or above) were required to establish a public detection system of monitoring environmental pollution. Penalty for illegal environmental behaviour is immediate and corresponding environmental institutions are penalised by joint

Table 5
Results for robustness tests.

Variable	Model 7 baseline	Model 8 testing moderator <i>Pol</i>	Model 9 testing moderator <i>Inter</i>
<i>PRD</i>	0.0755* (0.0375)	0.0780 * (0.0379)	0.0719* (0.0319)
<i>Pol</i>		0.0679 (0.0427)	
<i>PRD-Pol</i>		0.0339* (0.0172)	
<i>Iner</i>			0.0001 (0.0116)
<i>PRD-Inter</i>			0.0109 (0.0591)
<i>Grow</i>	−0.0169* (0.0044)	−0.0169* (0.0044)	−0.0168* (0.0044)
<i>Roe</i>	−0.0204 (0.0408)	−0.0203 (0.0409)	−0.0202 (0.0408)
<i>Cap</i>	−0.0233 (0.0265)	−0.0232 (0.0265)	−0.0233 (0.0266)
<i>Fin</i>	0.0282 (0.0300)	0.0283 (0.0300)	0.0284 (0.0301)
<i>Size</i>	0.0053 (0.0084)	0.0052 (0.0084)	0.0052 (0.0084)
<i>Age</i>	0.0014 (0.0010)	0.0014 (0.0010)	0.0014 (0.0010)
<i>Owner</i>	0.0038 (0.0361)	0.0035 (0.0362)	0.0042 (0.0360)
Constant	−0.2433 (0.2404)	−0.2429 (0.2408)	−0.2396 (0.2424)
Year fixed effect	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes
<i>P</i>		0.0364*	0.0347*

Notes: * $P < 0.05$; Standard errors are given in parentheses.

liability. In addition, inter-regional joint protection system was highly encouraged. Therefore, within the current environment policy scheme, China, as an emerging economy, has stepped on the right track of mitigating environmental concerns. The micro-level spillover effects of corporate environmental investment should be strongly recommended.

Moreover, importantly but unfortunately, corporate internationalisation does not necessarily promote the positive nexus between corporation innovation and environmental investment; in other words, the impact of corporate internationalisation process is limited and less qualified. Although China's national internationalisation process has harvested great achievements with increasing importance in globalisation process, the micro-level internationalisation activities awaits improvement. In effect, this is consistent with the large standard deviation as described in Section 2.2 and renders the quality of Chinese firms' overseas investment questionable. The finding is important because there are more than 1/3 of corporate earnings investing in foreign countries, but its influences on domestic firm performance, especially environmental performance, are not observed. Within the context of The Belt and Road Initiative, Chinese government and enterprises make substantial investments in foreign businesses and infrastructure. Large amounts of investments are coupled with speculation and regulation risks. As evinced by this research, the positive effect of corporate internationalisation process is not observed. This raises concerns about overseas businesses' operations and managements. Taken together, regulations and monitoring on overseas investment should attract more administrative attention.

5. Conclusions

Using Chinese listed firms within environment-related industries over the period 2011–2018, we find that corporate innovation significantly improves firms' environmental investment, and the findings are robust to alternative measure of

corporate innovation. Specifically, 1% increase in R&D investment ratio leads to 2326 CNY (around 351 USD) increment in corporate environmental investment, which paves ways for micro-level environmental policy making. Corporate innovation is hence a sustainable investment for firms' long-term strategic development, both for the environment and for the firm.

Consider our sample industries and firms for example. In unablated descriptive results, civil engineering and construction industry ranks the top in environmental investment among the 20 sample industries, with an average investment value of approximately 309.15 million CNY (about 46.63 million USD) per annum. Within the largest industry in terms of environmental investment, Power Construction Corporation of China (PCCC, hereafter) sets an excellent example for other firms. During the sample period, PCCC's R&D investment rises from 7.42 million CNY (about 1.12 million USD) in 2011 to 9.26 billion CNY (about 1.40 billion USD) in 2018, and its environmental investment increases from 677 million CNY (about 102 million USD) to 1.01 billion CNY (about 152 million USD). Enormous innovation investment pays back, with its total assets rising from 163.22 billion CNY (about 24.62 billion USD) to 713.25 billion CNY (about 107.58 billion USD) over the period 2011–2018. In 2016, PCCC's investments in clean (or renewable) technology lead to substantial national-wide investments in construction technology innovation and paves ways for its future extensive international cooperation. In addition to total assets, PCCC also receives sound reputation and was awarded the outstanding energy-conservation enterprises in the 11th Five-Year-Plan. It is thus not surprising of its intensive engagement in The Belt and Road Initiative. Accordingly, the positive impact of corporate innovation on environmental investment demonstrates large spill-over effects and great sustainable potentials.

Moreover, our findings for the moderating role of institutional factors indicate that environment policy implementation

helps strengthen the positive impact of corporate innovation on environmental investment, while the role of corporate internationalisation level in this relationship is not observed, implying that China's current environment policy has begun to work but the internationalisation quality should be enhanced. Consideration for institutional factors is important because they play critical roles in emerging economies, like China. Accordingly, the 2015 Environmental Law is evinced to be appropriate and advantageous for solving environmental problems. Firms will gain benefits from the Environmental Law with proper manufacturing and operation strategies. In comply with the 2015 Environmental Law, PCCC's investment in clean technology makes considerable contributions to energy conservation and environmental protection, which in turn improves its strategic development. Compared to the positive moderation effect of environment policy, although a relatively large proportion of operation incomes has been invested in overseas business, the benefits and contributions of Chinese firms' overseas investment for addressing environmental concerns are not observed by our empirical analysis. Thus, regulations on overseas investment should be paid more administrative attention.

Declaration of Competing Interest

The authors declare no conflict of interest.

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