"Brave advance of torrent" :Dual institutional Embeddedness and the choice of environmental strategy of China's MNEs

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Abstract: With more attention paid to global environmental issues and the Chinese government's active demand for "carbon neutral" planning, the expectation and even pressure of environmental protection borne by Chinese multinational companies may be amplified. In the past, the research on the choice of environmental strategy of multinational enterprises is mainly based on the analysis of the three theoretical basis of industry, enterprise specific resources and institution logics. In recent years, the research on emerging market countries increasingly emphasizes the impact of institutional voids. This paper will combine theoretical analysis and moderating mediating effect model to explore the impact of unique institutional conditions faced by China's multinational corporations, and explain the choice of their environmental strategies. We assume that Chinese multinational corporations are influenced by the overall background of institutional voids and tend to adopt positive environmental strategies. At the same time, they are also influenced by the heterogeneity of domestic regional regulations.

Keyword : Corporate environmental strategy; Chinese multinationals; Environmental regulation; Institutional theory; Generalized structural equation model

1.Introduction

China has a very high influence on global environmental protection. According to the data of International Energy Agency (IEA) in 2020, China is still the first country in the world carbon emissions, and it is inevitably paid attention by the international community; Meanwhile, China, as the world's second largest economy, will have an important impact on the improvement of global climate environment by continuously promoting the low-carbon transformation of industry. Therefore, China has always insisted on improving the national independent contribution on the global environment. The "Carbon Neutral" propose would strive to achieve carbon summit before 2030. The impact of carbon neutralization on domestic enterprises will be significant, because whether the government's industrial policies or financial sector's fund orientation like green credit, will encourage enterprises to carry out environmental emission reduction and environmental protection innovation. In this context, Chinese multinational companies may have greater environmental pressure, because they are facing the influence of domestic system reform and the attention of overseas stakeholders for a long time.

In the field of international business (IB) research, the environmental strategies of multinational enterprises (MNEs) are often divided into two categories: positive and negative (Nippa, Patnaik, and Taussig, 2021). First of all, on the positive side, MNEs are regarded as the key to promote global environmental protection. Compared with domestic enterprises, MNEs have greater incentive mechanism and operation means to cope with the increasing pressure of environmental protection (Nippa, Patnaik, and Taussig, 2021), If MNEs innovate product technology and utilize international impact, global environmental protection will have a greater effect (Alan and Alain, 1998); On the other hand, due to the international impact and profit maximization orientation, MNEs are also regarded as the main sources of

pollution and carbon emissions (Clapp and Dauvergne, 2011). Because of their more flexible transferring ability, according to the pollution haven hypothesis, MNEs can transfer pollution sources to areas with less pressure of environmental regulation through business activities like outsourcing rather than internal innovation, which in a negative way it can also reduce its negative environmental impact domestically (Levinson and Taylor, 2008). Actually many scholars are still debating whether the environmental strategy choice of MNEs is positive or negative (Backman, Verbeke, and Schulz, 2017; Branger and Quirion, 2014; Bu and Wagner, 2016).

In firm's strategy view, positive environmental strategy has been proved to provide enterprises with sustainable competitive advantage, which is an important competitive field that leading enterprises pay attention to (Sharma and Vredenburg, 1998). However, the choice of environmental strategy depends on many factors, among which the influence of institution background has gradually attracted attention, especially when analyzing the MNEs in emerging market countries. Because MNEs are embedded in a variety of different institution environments, which have a significant impact on the company and its strategy (Marano, Tashman, and Kostova, 2017). There is gap between the institutions like environmental regulation in emerging market countries and developed countries. Emerging market MNEs may face the challenge of legalization in the views of stakeholders in developed host countries (Cazurra et al., 2014), which is known as the institutional voids, that is, the lack of institutional facilities, norms and regulations required by a well functioning economy (North, 1990). The problem of institutional voids can be considered in combination with facts. As a representative of emerging market countries, China's governance system is relatively perfect. But from a dynamic perspective, we have to admit that there are differences between China and other countries or regions with long-term development of environmental system, such as Europe. Figure 1 is a comparison timeline of carbon emission trading system based on ETS data of European Union, Nippa et.al's research in 2021 and public information collation (limited by space, we only reserve part of the countries). The black main axis is the time node of carbon emission trading system established by selected countries in the world, while the red axis is the process of intercepting the establishment of China's carbon emission trading system in part of the time, which directly reflects the disparity of development time. The carbon emission trading system in Europe and other regions has gone through three stages of development, which has an important impact on its internal enterprises and multinational companies (Nippa, Patnaik, and Taussig, 2021). Therefore, we can think that the institutional voids in the level of environmental regulation may have an impact on the choice of environmental strategy in the international activities of Chinese MNEs to a certain extent. Previous researches have witnessed that the impact of institutional voids often cause negative attribution of foreign stakeholders (Kostova et al., 2007), and MNEs need to take more positive actions to deal with the impact of negative attribution (Marano, Tashman, and Kostova, 2017). Corresponding to the choice mode of environmental strategy we discussed earlier, we assume that Chinese MNEs may adopt more positive environmental strategies, that is, to improve environmental performance through internal ways like innovation of environmental protection technology.
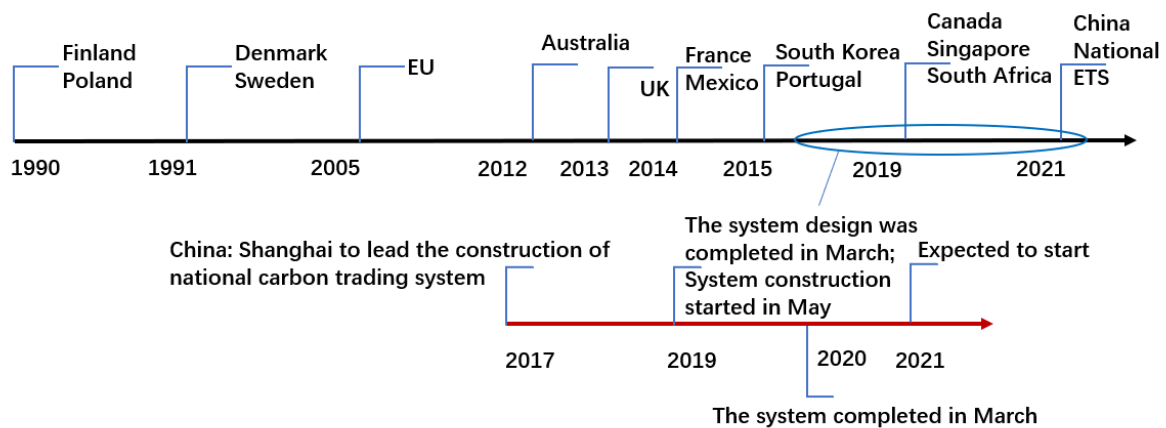
Figure 1   Time axis of carbon emission trading system establishment

Furthermore, in this research, the impact of institutional voids is the starting point of the choice of environmental strategy of Chinese multinational companies based on the analysis of the institutional logics. Because Chinese MNEs are the typical which in the background of dual embeddedness of iinsitutions in the home and host countries, we will analyze the heterogeneity of the impact of the differences of the domestic regional environmental regulations on the MNEs. The complete theoretical framework will be developed in the following part of theory background. This paper will try to integrate the theory of institution based view strategy, the strategic view under institutional voids, and the previous researches of the environmental strategy of MNEs. We try to put forward the theoretical framework of firm's environmental strategy and factors of institutional background, and carry out empirical test.

The empirical strategy of this paper is summarizing the influence of the dual institutional background and the choice of environmental strategy faced by Chinese MNEs into a model of mediating effect. We find that under the influence of the gap of environmental regulation, Chinese MNEs will choose to improve environmental performance through internal efforts like innovation investment while expanding their overseas activities. This path selection will be adjusted by the heterogeneity of domestic regional environmental regulations.

The main contributions of this paper are as follows: (1) To further summarize the theoretical application of integrated institutional theory and institution based corporate strategy in the choice of environmental strategy of MNEs, so as to improve its explanatory power. (2) The more prominent progress is taking the environmental strategy choice of Chinese MNEs as research object and make an empirical test, trying to make up for the research gaps in related fields. (3) We will decompose the role of institutions in a more detailed way, and more comprehensively discuss the institutional impact of Chinese multinational enterprises represented by emerging market countries under the background of dual institutional embeddedness.

2. Theory Background

2.1 Enterprise environmental strategy based on Institution

In the research of strategic management, there are three main theoretical bases, which are called "strategic tripod" ——industry, resources and institution view (Peng and Wang, 2008). The three theories have their historical development relations. In the 1980s, the role of industry structure in determining the corporates' performance differences among enterprises was highlighted, that is, Porter's view of enterprise

strategy based on industry held that different conditions in the industry largely determined the strategy and performance of the company (Porter, 1980). In the 1990s, a new dominant theory, resource-based view corporate strategy (RBV) emerged, which holds that resource differences drive strategic choice and performance (Barney, 1991). Because it's difficult for the industry-based view to explain the root causes of the differences presented by corporates, which is improved by the resource-based view. However, the resource-based view does not clearly solve how to balance the competitive pressure and institutional pressure of corporates, which is why sometimes corporate managers make decisions that are not the maximization of economic interests. This contradiction is particularly prominent in ESG issues, which leads to the research of strategic view based on institution. Research shows that if institutional issues are only used as the background of corporate strategy rather than a independent influencing variable, it will be difficult to deeply understand corporate strategic behaviors (Oliver, 1997), and the defect becomes more obvious in the analysis of emerging market countries (Narayanan and Fahey, 2005).

The most basic definition of institution is "the restriction of human interaction formed by human design" (North, 1990). A basic point of view of strategy based on institution is to regard institution as an independent variable, focus on the dynamic interaction between institution and organization, and regard strategic choice as the result of this interaction (Peng, 2002). It is even believed that institution directly determines the problems faced by corporates in making and implementing strategies and creating competitive advantages (Peng and Wang, 2008). Moreover, the institutional system is not uniform or coherent (Scott, 1995). Different types of institutions may have different effects. A basic classification is formal institutions (such as laws and regulations) and informal institutions (such as norms and cognition) (North, 1990).

Because the research of this paper is based on environmental regulation China MNEs faced, we will mainly focus on formal institution. We explore in more detail the different impact of different levels of institution that China MNEs faced on the strategic choice.

2.2 The identity of institutional voids and the heterogeneity of domestic environmental regulation

As mentioned in the previous introduction, institutional voids exist objectively in the comparison between emerging market countries and developed countries presently. China still has a gap with developed economies in the overall environmental regulations. Host country investors may think that the practice of companies in emerging market countries is often poor and not compliant, because the home country institution has no perfect supporting system (Cuervo, Cazurra and Ramamurti, 2014). This negative stakeholder attribution is considered a legitimacy challenge (Kostova et al., 2007). The problem of legitimacy is then as a negative attribution, which is not affected by the heterogeneity of the company's resources or strategic performance to a large extent and is uniformly "capped". And in the face of the systematic "discrimination" of the host country's stakeholders, it will also produce transaction costs (Sethi and Guisinger, 2002).

Before the implementation of the unified environmental regulation like carbon emission trading system, there are typical regional differences in China's environmental regulations. The heterogeneity mainly at the provincial level, which are reflected in the standards of emission fees or environmental taxes, the limits of pollutant emissions and the market access policy of industries. Different from the identity of institution voids problem, the influence of the environmental regulation in the region where the headquarters of the Chinese MNEs is located is necessarily heterogeneous. To make it clear, we refer to the practices of some scholars to measure the difference in the intensity of regional environmental regulations in China (Bu and Wagner, 2016). We define the intensity of environmental regulation as the total amount of

the annual pollution fees of each province and regions compared with the industrial GDP at the same year, so as to eliminate the impact of industrial scale. Figure 2 shows the matching of the regulation intensity value with the province. The deeper the color indicates that the higher the intensity value (the time is selected as 2017, the data is from the 2017 China Environmental Yearbook and the statistical yearbook of each province and regions with the blank is of missing data). Intuitively, the environment regulation in the northern regions is relatively more strict, and there are significant differences in different regions in China.

According to the existing theory, we assume that although MNEs headquartered in regions with more stringent environmental regulations are similarly faced with the legitimacy problem of institutional voids, their voids in environmental regulations with host countries may be relatively narrowed because they need to adapt to the more stringent environmental requirements domestically. Therefore, in the practice, there is less need to make more efforts to deal with the pressure of environmental institution, which will be further explained and empirically tested in the following.
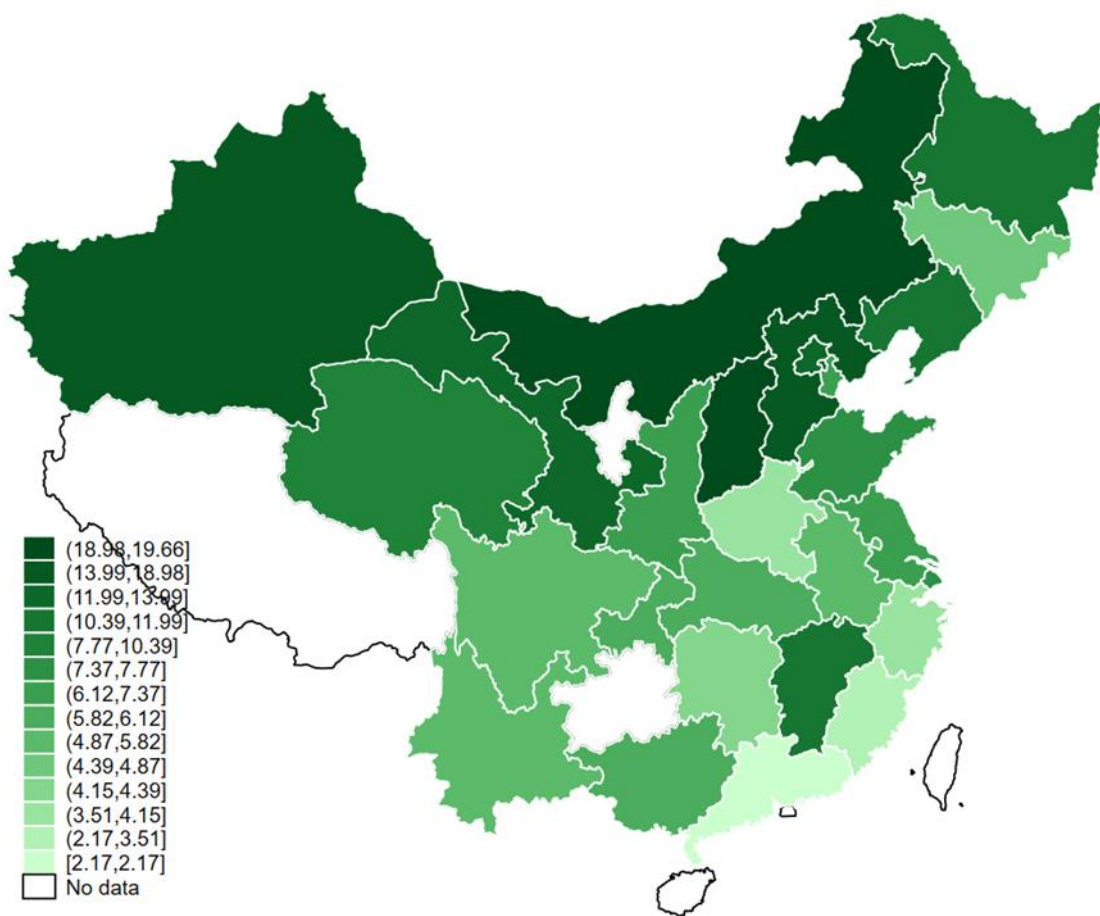
Figure 2 Map of regional differences in environmental regulation intensity at provincial level

To sum up, the theoretical framework discussed in this paper will be divided into institutional voids impact based on identity and regional environmental regulation difference based on heterogeneity. The two institutional effects will have different impacts, which are visually summarized as the logical block diagram shown in Figure 3. This decomposition based on the two functions of environmental institution will be the premise of this research.

Figure 3 Decomposition of the institution logics
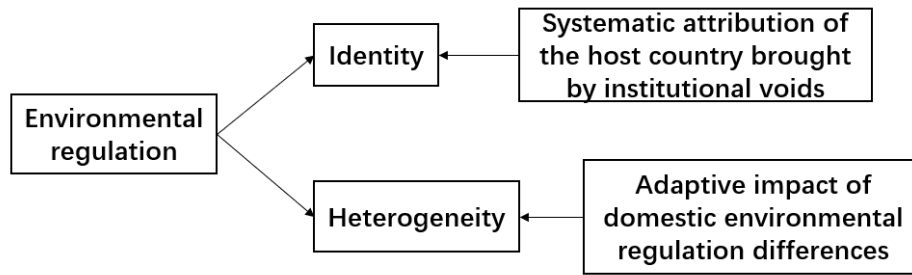
2.3 The environmental strategy choice of Chinese multinational companies under the influence of the double system embedding

In the introduction, based on the practical background, we preliminarily discuss the environmental strategy choice of MNEs. Based on theoretical analysis, the environmental strategy of MNEs is generally explained by FSA-CSA framework (Alan and Alain, 1998). FSA strategy refers to giving efforts to the specific advantages of enterprises in internal ways, also known as "race to top" (Bu and Wagner, 2016), that is, transforming the higher external environmental requirements into the internal advantages of the company, which is generally achieved by inducing innovation, such as innovating products or production processes to form the specific environmental capability endowment (Bu and Wagner, 2016); CSA strategy refers to utilizing the specific advantages of the country, also known as "race to bottom" (Bu and Wagner, 2016), that is, transferring business to countries with relatively loose regulations (i.e. "pollution refuges"), which does not substantially reduce the pollution emissions but only avoids the areas with more serious environmental pollution penalties. The MNEs adopting FSA strategy form the environmental advantage of internal innovation, which is encouraged by scholars; While, the MNEs adopting CSA strategy transfer pollution through offshore outsourcing is also known as "green washing", which has the risk of being criticized by stakeholders (Zhou and Wang, 2020).

What kind of environmental strategy MNEs should adopt is not a simple problem that can be judged by moral value. As discussed in the previous part of enterprise environmental strategy, this strategic choice is influenced by industries, enterprises features and especially institutions. In this research, we focus on the impact of the institution and control the other two strategic factors in the empirical test. Some studies believe that enterprises can obtain and maintain competitive advantage by overcoming, shaping and utilizing their strategies of institutional environment (Marquis and raynard, 2015). As for the legitimacy brought by the institution voids, the choice of corporate strategy will focus on how to overcome the negative attribution of stakeholders. Existing literature suggests that emerging market countries affected by institutional voids will be more motivated to implement global legalization practices, such as corporate social responsibility (Marano, Tashman, and Kostova, 2017), in order to overcome adverse attribution. Therefore, to a certain extent, we can assume that the environmental strategy of China MNEs affected by the institutional voids will focus on the choice of FSA strategy, that is, to improve environmental performance through interal ways like innovation; While the pollution transferring strategy represented by CSA is questioned and criticized a lot, which is more unlikely to be adopted by the companies that have been affected by institution voids.

As the previous analysis shows, Chinese MNEs are uniquely faced with the influence of identity and

heterogeneity. While they have the positive environmental strategy of focusing on FSA strategy brought about by the identity of institution voids, MNEs headquartered in different provinces may still have differences in the degree or practice of adopting FSA strategy. This point is not screened and quantitatively tested by the existing literature, so in need of being proved by facts. We visualize the difference of China MNEs' environmnetal performance at regional level by proportion of companies voluntarily disclosing sulfur dioxide in each province, shown in Figure 4. Comparing with the map of regional differences in environmental regulation intensity in Figure 2, we find that the proportion of companies that choose to disclose sulfur dioxide in provinces with stronger environmental regulations is not larger or less just in linear relationship. That enlighten us to test by more rigorous control in empirical analysis.

Through the above literature review and the establishment of theoretical framework, we can draw the following conclusions: (1) MNEs' choice of environmental strategy is affected by institutional variables, that is, MNEs' choice of FSA-CSA strategy can not be generalized, at least considering the institutional conditions of the region where MNEs are located, Especially the institution voids between home country and host country. (2) China MNEs are faced with a special institutional background. As the representatives of emerging market countries, they have the legitimacy problems caused by institution voids, and they also face the problems of large differences in domestic environmental regulations. (3) In the face of institution voids with identity impact, China MNEs may focus on adopting positive environmental strategies, that is, improving environmental performance through internal way like innovation. (4) Faced with the heterogeneity of regional environmental regulation differences, China MNEs from different provinces may need to pay different efforts in the way to improve environmental performance.
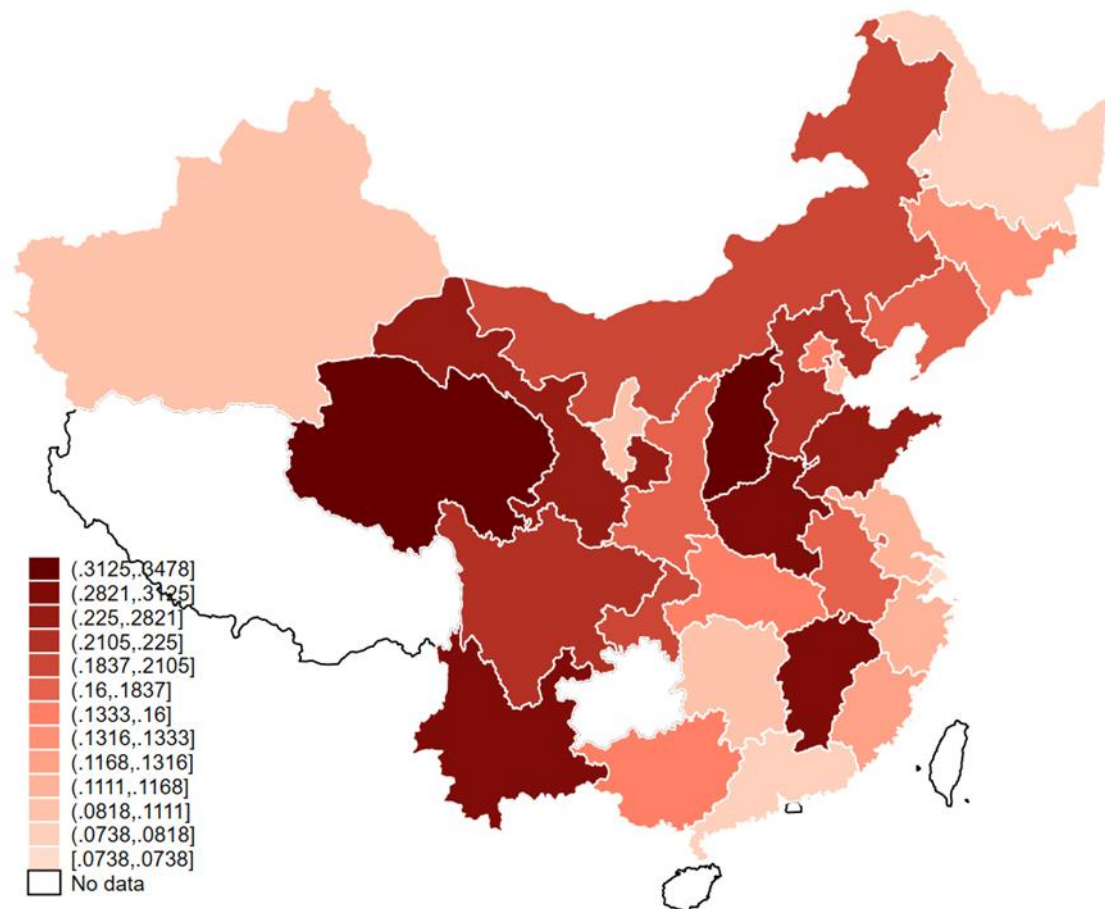

Figure 4 Map of differences in the degree of sulfur dioxide disclosure of multinational companies

3.Hypothesis Development

3.1 Identity: the impact of institutional voids and the environmental strategy of China's multinational corporations

Based on the theoretical analysis, the research believes that the domestic institution voids will promote emerging market enterprises to actively seek resources, markets and legitimacy abroad (Luo and Tung, 2007). We first conclude that under the increasing environmental pressure, the multinational companies with high overseas linkage will pay attention to improving the environmental performance of enterprises. Secondly, because the institution voids have been proved to be a driving force for MNEs to strengthen the activities of international cooperation (Marano, Tashman, and Kosova, 2017), we conclude that Chinese multinational companies will tend to adopt FSA environmental strategy, that is, China MNEs with high overseas linkage will pay attention to improve environmental performance through innovation investment. In order to strengthen the verification of FSA strategy selection, we set innovation investment as the mediating variable for Chinese multinational companies to improve environmental performance.

Environmental performance issues, not only include the pollution or carbon emissions of enterprises, but also whether the enterprises voluntarily disclose environmental information, because there are often no strict regulations that require enterprises to disclose the environmental information. First, the adoption of voluntary information disclosure strategy helps to narrow the information gap between investors and management and reduce agency costs (Lev, 1992). According to the theory of voluntary disclosure, companies with good environmental performance have the motivation to send signals of good environmental performance to the market through voluntary disclosure, which helps to improve the valuation of the company. Moreover, it is considered that the disclosure of environmental innovation enterprises is often much larger than that of non innovation enterprises (Radu and Francoeur, 2017). Therefore, the environmental information disclosure of the company is regarded as the agent variable of environmental performance in this research.

Based on relevant theories and literature, this paper holds that Chinese multinationals with high overseas linkage will pay attention to improving innovation investment at the same time; to a certain extent, it makes up for the blank of environmental strategy analysis of Chinese multinationals through theory and demonstration, that is, Chinese multinationals with high overseas linkage will pay attention to improving enterprise environmental performance at the same time, and tend to invest through innovation An intermediary path to improve environmental performance. To sum up, we propose hypothesis 1 and hypothesis 2:

Hypothesis 1: China MNEs with high overseas linkage will improve their environmental information disclosure.

Hypothesis 2: In the positive impact of China MNEs' overseas linkage and environmental information disclosure, innovation spend has an mediating effect.

3.2 Heterogeneity: the moderating effect of regional environmental regulation heterogeneity

In the institutional theory, some studies believe that MNEs are in the background of dual embeddedness of home country institution and host country institution (Pinkse and Kolk, 2012). We have analyzed the institution voids, which is the legitimacy problem caused by the gap between home country institution and host country institution (it can be regarded as the problem arising from the embeddedness of MNEs into host country institution). So it is also necessary to discuss the moderating effect of institutional heterogeneity of MNE headquarters embedded in the home country. The choice of corporate strategy in the face of embedded institution can be divided into three types (Cantwell, Dunning, and Lundan, 2009): (1)

institutional evasion, (2) institutional adaptation, (3) Coevolution. For the first way, the headquarters of China MNEs can not transfer their activities as freely as their subsidiaries, and we will choose the samples that control their headquarters from transferring; For the third way, the main way is that MNEs will participate in political activities to promote specific types of regulatory or market structure, and lobby the government to seek economic protection or support (Cantwell, Dunning, and Lundan, 2009). However, the China MNEs we analyzed have not reached this stage as a whole for changing formal institutions. Therefore, to control the above problems, we assume that the strategy of China MNEs facing the heterogeneity of provincial environmental regulation is mainly adaptive. However, MNEs with their headquarters in provinces with strict environmental regulations also face the legitimacy problem of institution voids and need to choose positive environmental strategies. However, because they adapt to the more stringent environmental requirements of the headquarters, the differences between their environmental regulations and the host countries may be relatively narrowed. Thus, the mediating path of improving environmental performance through innovation investment (we choose environmental information disclosure as an agent) may be negatively regulated. Therefore, we propose hypothesis 3:

Hypothesis 3: The heterogeneity of provincial environmental regulation plays a negative moderating role in the positive impact of overseas linkage on innovation spend for environment performance.

It should be noted that because we are based on the institutional background of China MNEs, it is difficult to measure the gap of institutional voids as a separate variable, because we have controlled a single home country, namely China. The relevant researches have a clear conclusion on the effect of institution voids, so the main work for us is to verify the path of China MNEs' positive environmental strategy choice in this context to get support (and we will control the other two elements, namely industry and enterprise specific resources); As for the regional environmental regulation differences, because of the lack of international and domestic research, we take the differences of environmental regulation of Chinese provinces as a separate variable into the hypothesis and model to complete our theoretical verification. So far, we have constructed a complete analytical framework based on the mediating effect model of regulation, emphasizing the different effects of the two roles of environmental regulation. We summarize the theoretical framework as shown in Figure 5:
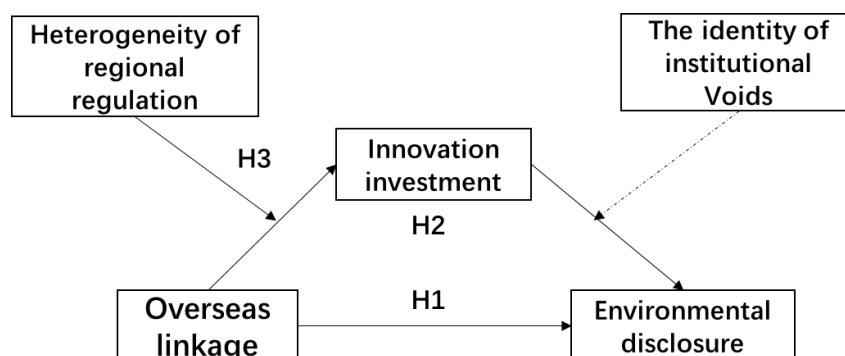

Figure 5 Theoretical framework

4. Data and research methology

4.1 Sample

In this paper, we only focus on the Chinese listed companies with overseas subsidiaries in manufacturing

industries. The environmental performance data at firm-level are manually collected from the company's annual reports or CSR reports. The data at provincial-level are from China Environmental Yearbook and the statistical yearbook at the provincial level. To alleviate the trouble of reverse causality, we consider the lag effect between variables, the environmental disclosure data is in 2019, the company's OFDI and financial performance data are lagged by one year, in 2018, while the regional environmental regulations lagged by one year on the basis of company's finance data, in 2017. To eliminate the influence of extreme values, select the upper and lower 1% tail reduction processing for the continuous variables in the sample. The samples with zero innovation spend are excluded. Excluding the samples of changes in the company's headquarters from 2017 to 2019.

4.2 Data and Variables

Dependent variable

Environmental information disclosure (Env). Because companies with good environmental performance are motivated to send signals about their good performance to the market through voluntary disclosure (Radu and Francoeur, 2017). This paper selects whether disclose the environmental information of multinational companies as the proxy variable of environmental performance. We collected the information from the annual reports. In terms of main effect, we focus on two main pollutants, including sulfur dioxide emission (Disso2) and carbon dioxide emission (Disco2). The variables are dummy variables, 1 for voluntary disclosure and 0 for non disclosure. Additional, to reduce the concerns of greenwashing instances, in robustness part we calculate the number of quantitative actions as an alternative dependent variable about the firm how to improve environmental performance or reduce pollution emissions. Similar to the measurement of previous studies (Wang, Wijen and Heugens, 2018), we obtain it by a content analysis of firms' CSR reports.

Independent variable

Oversea income as a proxy of firms'overseas linkage. The data of overseas income (Ovincome) are derived from CSMAR.

Mediating variable

R&D spend. Different from the data specially selected for environmental innovation, existing studies have confirmed the positive impact of R&D spend on environmental performance (Wang, Wang, and Qian, 2021). One of the purposes of this paper is to explain the choice of environmental strategy of Chinese multinational corporations. It is necessary to identify whether companies pay attention to innovation while expanding overseas participation, and whether this innovation supports the improvement of environmental performance. So we didn't only measure the relationship between environmental innovation and environmental performance. Therefore, this paper selects R&D spend as the mediating variable. The variable R&D spend was collected from firm's annual reports and was log-transformed..

Moderator variable

Environmental regulation intensity (Regulation). As the previous analysis shows, there are great differences in the development conditions of environmental regulation in China's provinces, but the pollution charge system is relatively perfect and generally implemented (Bu and Wagner, 2016). This paper defines the environmental regulation intensity as the normalization of the pollution charge of each province compared with the previous year's industrial GDP, so as to eliminate the impact of the scale problem of different province.

Control variables

a. Enterprise level control variables：

Return on assets (ROA) is an alternative indicator of profitability, because according to the theory of idle resources, companies with strong profitability can bear more additional costs and more resources are used to improve environmental performance (Aguilera caracuel, 2011); The ratio of assets and liabilities (Liability) reflects the debt situation of the company is also included in the model, because the high debt enterprises have higher financial constraints and risks, which affect the investment in environmental innovation; The ratio of intangible assets (Intangible), that is, the ratio of intangible assets to total assets, companies with high intangible assets may pay more attention to the improvement of environmental performance, such as reputation is an important part of intangible assets (mcwiliams & siege, 2000). The Tobin Q as the market value of enterprise assets and Return on Equity (ROE) to measure the efficiency of the company's use of its own capital are also included.

b. Regional level control variables:

At the regional level, in addition to discussing the intensity of environmental regulation, this paper also controls other regional differences (provincial level), such as economic development level (GDP) and regional total foreign investment (Foreign) to control the degree of regional foreign economic relevance.

4.2 Model

Because what this paper discusses is the mechanism with regulation and mediation path, and the explained variables are binary virtual variables, logit and probit regression are difficult to deal with the mediation effect. This paper uses the generalized structural equation model to test the mechanism.

5. Results

5.1 Descriptive statistics

Table 1 shows the descriptive statistics of the main variables. After tail reduction, the sample size was 469. Among them, the disclosure indicators of sulfur dioxide and carbon dioxide are low, and the average value is below 30%, but there are great differences between the two, indicating that different environmental disclosure indicators may be affected differently. Due to their different nature, carbon dioxide, as one of the main indicators for measuring carbon emissions, has a wide range of impact, which may be paid more attention by regulators and enterprises, Sulfur dioxide is a typical polluting gas, and its control may be more difficult; Regulation is the intensity of environmental regulation, with a maximum of 25.59 and a minimum of 2.17, reflecting the obvious heterogeneity of regional environmental regulation. The average of asset liability ratio is 47%, which is also reasonable. Table 2 shows all the correlation coefficients are under 0.7, which means multicollinearity is not a big concern in rules of thumb.

Table 1 Descriptive statistics of main variables

VARIABLES	(2) mean	(3) sd	(4) min	(5) max
ln(R&D spend)	18.85	1.570	12.75	23.49
Liability	0.470	0.205	0.0438	1.952
ROA	0.0205	0.0999	-0.690	0.331
Intangible	0.0476	0.0429	0.000613	0.379
TobinQ	1.057	0.872	0	10.17
ROE	0.0223	0.310	-4.320	1.726
Disco2	0.247	0.432	0	1

Disso2	0.120	0.325	0	1
Regulation	6.479	4.331	2.170	25.59
Ovincome	20.43	1.853	12.80	25.43
lnGDP	9.696	0.808	6.270	10.47
lnForeign	8.370	1.157	4.344	9.777

Table 2 Correlation coefficients of main variables

	Disco2	Disso2	Ovincome	R&D	Liability	ROA	Intangible	TobinQ	ROE	lnGDP	lnForeign	Regulation
Disco2	1											
Disso2	0.305	1										
Ovincome	0.139	0.271	1									
R&D	0.187	0.325	0.573	1								
Liability	0.019	0.133	0.263	0.241	1							
ROA	0.168	0.079	0.165	0.209	-0.392	1						
Intangible	0.098	0.090	-0.003	-0.024	0.079	-0.061	1					
TobinQ	-0.139	-0.119	-0.234	-0.210	-0.385	0.185	-0.089	1				
ROE	0.134	0.080	0.187	0.180	-0.274	0.667	0.012	0.119	1			
lnGDP	-0.104	-0.102	0.097	0.003	-0.036	-0.025	-0.157	0.078	0.019	1		
lnForeign	-0.230	-0.113	0.023	-0.032	-0.075	-0.063	-0.115	0.127	0.009	0.682	1	
Regulation	0.143	0.011	-0.088	-0.036	-0.043	0.083	0.078	-0.068	0.040	-0.634	-0.504	1

5.2 Basic model results

　　Table 3 shows the results of the generalized structural equation model (GSEM) for the disclosure of two main outcome variables, namely sulfur dioxide (Disso2) and carbon dioxide emissions (Disco2). The first line of the table is for classification of dependent variables. The following lines firstly show the summary statistics of the mechanism tested by GSEM. Follwing are the detailed results of regressions in the GSEM pathes, namely total effect of R&D and oversea income (Ovincome) on environmental disclosure, and the mediating effect of oversea income on R&D. In table 3, both for SO2 and CO2 show that oversea income has a positive effect on environment disclosure ($for\ SO2, \beta = 0.21,\ p < 0.05; for\ CO2,\ \beta = 0.006$). Thus, Hypothesis 1 is corroborated. The R&D spend also has a positive effect on environment disclosure ($for\ SO2, \beta = 0.05,\ p < 0.01; for\ CO2,\ \beta = 0.036,\ p < 0.05$). For the summary statistics, the propotion of mediating effect (R&D spend in the path from oversea income to disclosure) is 47.5% for SO2 and 73.7% for CO2, both are powerful (Hypothesis 2).

Table 3 GSEM results

	Env = Disso2		Env = Disco2	
Summary stats for each GSEM	Total effect	0.040	Total effect	0.019
		p=0.000		p=0.091
	Indirect effect	0.019	Indirect effect	0.014
		p=0.000		p=0.027
	Propotion of mediating effect = 47.5%		Propotion of mediating effect = 73.7%	
	Disso2	R&D spend	Disco2	R&D spend
R&D spend	0.050***		0.036**	
	(4.30)		(2.25)	
Ovincome	0.021**	0.382***	0.006	0.382***
	(2.27)	(11.65)	(0.43)	(11.65)
Liability	0.050	1.235***	-0.044	1.235***
	(0.60)	(3.80)	(-0.38)	(3.80)
ROA	0.056	2.900***	0.480*	2.900***
	(0.29)	(3.77)	(1.77)	(3.77)
Intangible	0.535*	-1.208	0.852**	-1.208
	(1.71)	(-0.97)	(1.97)	(-0.97)
Tobin Q	-0.007	-0.144*	-0.060**	-0.144*
	(-0.37)	(-1.82)	(-2.19)	(-1.82)
ROE	0.019	0.080	0.048	0.080
	(0.33)	(0.35)	(0.59)	(0.35)
GDP	-0.045*	-0.128	0.081**	-0.128
	(-1.66)	(-1.18)	(2.16)	(-1.18)
Foreign	-0.015	0.014	-0.093***	0.014
	(-0.96)	(0.21)	(-4.20)	(0.21)
Regulation	-0.006	-0.015	0.009	-0.015
	(-1.37)	(-0.90)	(1.56)	(-0.90)

Constant	-0.702**	11.920***	-0.575	11.920***
	(-2.20)	(10.39)	(-1.30)	(10.39)

In table 4, we include a two-way interaction (Ovin*Regulation) between oversea income and environment regulation (Regulation). The interactions in equation for SO2 and CO2 both have significant negative effects on R&D spend ($\beta = -0.683$, $p < 0.01$). Because our environmental regulation data is one year lagged, that means the stronger the previous environment regulation is, the less efforts the firms need to pay for improving environment performance by enhancing R&D spend statistically (Hypothesis 3).

Table 4 GSEM results with interaction

		Env = Disso2		Env = Disco2	
Summary stats for each GSEM	Total effect	0.042	Total effect	0.021	
		p=0.000		p=0.071	
	Indirect effect	0.021	Indirect effect	0.015	
		p=0.000		p=0.027	
	Propotion of mediating effect = 50%		Propotion of mediating effect = 71.4%		
	Disso2	R&D spend	Disco2	R&D spend	
R&D spend	0.050***		0.036**		
	(4.30)		(2.25)		
Ovincome	0.021**	0.420***	0.006	0.420***	
	(2.27)	(11.83)	(0.43)	(11.83)	
Liability	0.050	1.178***	-0.044	1.178***	
	(0.60)	(3.64)	(-0.38)	(3.64)	
ROA	0.056	2.924***	0.480*	2.924***	
	(0.29)	(3.83)	(1.77)	(3.83)	
Intangible	0.535*	-1.306	0.852**	-1.306	
	(1.71)	(-1.05)	(1.97)	(-1.05)	
Tobin Q	-0.007	-0.155**	-0.060**	-0.155**	
	(-0.37)	(-1.97)	(-2.19)	(-1.97)	
ROE	0.019	0.074	0.048	0.074	
	(0.33)	(0.32)	(0.59)	(0.32)	
GDP	-0.045*	-0.137	0.081**	-0.137	
	(-1.66)	(-1.27)	(2.16)	(-1.27)	
Foreign	-0.015	-0.038	-0.093***	-0.038	
	(-0.96)	(-0.57)	(-4.20)	(-0.57)	
Regulation	-0.006	0.071**	0.009	0.071**	
	(-1.37)	(1.98)	(1.56)	(1.98)	
Ovin*Regulation		-0.683***		-0.683***	
		(-2.67)		(-2.67)	
Constant	-0.702**	14.343***	-0.575	14.343***	
	(-2.20)	(9.85)	(-1.30)	(9.85)	

z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

5.3 How industries' pollution nature affects the mechanism

In terms of influencing factors of environmental strategy choice, enterprises in high pollution industries may be more restricted. According to the bulletin of the first China national census of pollution sources published in 2010, the industries of industrial enterprises are divided into heavy pollution intensive industries and non-heavy pollution intensive industries. The heavy pollution industries are identified as papermaking and paper products industry, textile industry, agricultural and sideline food processing industry, chemical raw materials and chemical products manufacturing industry, beverage manufacturing industry, agricultural and sideline food processing industry Food manufacturing and pharmaceutical manufacturing. We consider the effect of firm's nature of pollution intensity by divided our sample into two groups by this industry classification.

In table 5, we clearly find the divergence of results affected by industries' pollution intensity. The interactions Ovin*Regulation for both subsamples are still signifisant negative ($for\ heavy, \beta = -1.447$, $p < 0.05;\ for\ nonheavy,\ \beta = -0.49,\ p < 0.1$).But for R&D effect on the environment disclosure, only in non-heavy pollution industry we find consistency with basic model results. That shows non-heavy intensity industries have more flexibility to perform FSA strategy in our research, namely improving environment performance by own effort like R&D spend.

Table 5 GSEM results grouped by pollution intensity

	Heavy Pollution Industry (N=77)				Non-heavy Pollution Industry (N=392)			
	Env = Disso2		Env = Disco2		Env = Disso2		Env = Disco2	
Summary stats for each GSEM	Total effect 0 .014		Total effect 0.066		Total effect 0.046		Total effect 0.020	
	p=0.390		p=0.052		p=0.000		p=0.101	
	Indirect effect -0.008		Indirect effect 0.027		Indirect effect 0.026		Indirect effect 0.019	
	p=0.351		p=0.141		p=0.000		p=0.007	
	Propotion of mediating effect = -57.1%		Propotion of mediating effect = 40.9%		Propotion of mediating effect = 50%		Propotion of mediating effect = 95%	
	Disso2	R&D spend	Disco2	R&D spend	Disso2	R&D spend	Disco2	R&D spend
R&D spend	-0.021		0.068		0.062***		0.048***	
	(-0.96)		(1.59)		(4.58)		(2.79)	
Ovincome	0.023	0.401***	0.038	0.401***	0.021*	0.418***	-0.001	0.418***
	(1.30)	(3.84)	(1.11)	(3.84)	(1.94)	(11.34)	(-0.05)	(11.34)
Liability	-0.140	1.436	-0.645	1.436	0.070	1.056***	0.016	1.056***
	(-0.67)	(1.34)	(-1.56)	(1.34)	(0.79)	(3.22)	(0.14)	(3.22)
ROA	0.016	8.567*	-0.921	8.567*	0.074	2.828***	0.421	2.828***
	(0.02)	(1.90)	(-0.52)	(1.90)	(0.36)	(3.72)	(1.60)	(3.72)
Intangible	0.274	-1.571	-2.420	-1.571	0.534	-1.446	1.048**	-1.446
	(0.28)	(-0.31)	(-1.26)	(-0.31)	(1.61)	(-1.17)	(2.49)	(-1.17)
Tobin Q	-0.034	-0.739**	0.098	-0.739**	-0.006	-0.141*	-0.056**	-0.141*
	(-0.57)	(-2.47)	(0.84)	(-2.47)	(-0.28)	(-1.79)	(-2.08)	(-1.79)
ROE	0.023	-0.616	0.166	-0.616	0.017	0.085	0.048	0.085
	(0.06)	(-0.32)	(0.23)	(-0.32)	(0.29)	(0.38)	(0.63)	(0.38)
GDP	-0.029	0.174	0.342***	0.174	-0.041	-0.132	0.022	-0.132
	(-0.53)	(0.62)	(3.20)	(0.62)	(-1.33)	(-1.16)	(0.58)	(-1.16)

Foreign	-0.009	0.071	-0.172**	0.071	-0.018	-0.051	-0.073***	-0.051
	(-0.26)	(0.39)	(-2.52)	(0.39)	(-1.01)	(-0.72)	(-3.22)	(-0.72)
Regulation	-0.007	0.149	0.038**	0.149	-0.005	0.056	0.002	0.056
	(-0.96)	(1.59)	(2.47)	(1.59)	(-1.09)	(1.46)	(0.33)	(1.46)
Ovin*Regulation		-1.447**		-1.447**		-0.490*		-0.490*
		(-2.01)		(-2.01)		(-1.81)		(-1.81)
Constant	0.453	13.646***	-3.472***	13.646***	-0.951***	13.798***	-0.300	13.798***
	(0.69)	(3.60)	(-2.65)	(3.60)	(-2.68)	(8.97)	(-0.67)	(8.97)

z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

5.4 How regional heterogeneity affects the mechanism

To identify regional heterogeneity, we adopt the three main economic regions in China to group. In table 6, the results are only main variables that this research focus and divided into four parts by economic regions: the Beijing-Tianjin-Hebei Region, the Yangtze River Delta, the Pearl River Delta and the others. Only in the Beijing-Tianjin-Hebei Region, the result of R&D spend is negative. Which is consistent to the results in industries' pollution intensity, the Beijing-Tianjin-Hebei Region accumulates loads of heavy industry especially steel industry in Hebei. The three main regions have negative interaction between oversea income and regulation while other regions not, which may because less manufacturing multinational corporations centralize in other regions making the effect become misleading statistically.

Table 6 GSEM results grouped by regions

Region	Beijing-Tianjin-Hebei Region		Yangtze River Delta	
	Disso2	R&D spend	Disso2	R&D spend
R&D spend	-0.028		0.031	
	(-1.13)		(1.42)	
Ovincome	0.054**	1.272	-0.001	4.218***
	(2.09)	(0.53)	(-0.04)	(4.89)
Ovin*Regulation		-18.087		-77.081***
		(-0.38)		(-4.41)
	Pearl River Delta		Other Regions	
	Disso2	R&D spend	Disso2	R&D spend
R&D spend	0.101***		0.043*	
	(4.75)		(1.81)	
Ovincome	-0.002	1.005***	0.063***	0.505***
	(-0.12)	(3.29)	(2.87)	(6.52)
Ovin*Regulation		-13.278**		0.005
		(-2.24)		(0.01)

z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

5.5 Robustness

Firstly, to reduce the concerns of greenwashing, we replace the dependent variable by the number of quantitative actions of improving environmental performance and reducing pollution emission relevant to prevous research (Wang, Wijen and Heugens, 2018). The quantitative actions of improving environmental performance are defined like "The company saved 2 million sheets of paper this year", "Save 2 million kwh of electricity"; The quantitative actions of reducing pollution emission are like "Emission reduction of 120000 tons of carbon dioxide equivalent". The first replaced dependent variable (Disemission) only calculate actions of pollution emission (i.e. disclosure of environment liability), the second replaced dependent variable (Dise&p) contains both actions of environmental performance and emission. Because of the continuity of these two replaced dependent variables, we use linear fitted figure grouped by environment regulation. "Weak regulation" and "Strong regulation" are grouped by the average of the

intensity index of environment regulation (Regulation) at first. Figure 6 shows that both for actions of environmental performance and emission, the slope of sample with strong regulation is lower which is a visual proof of negative interaction.
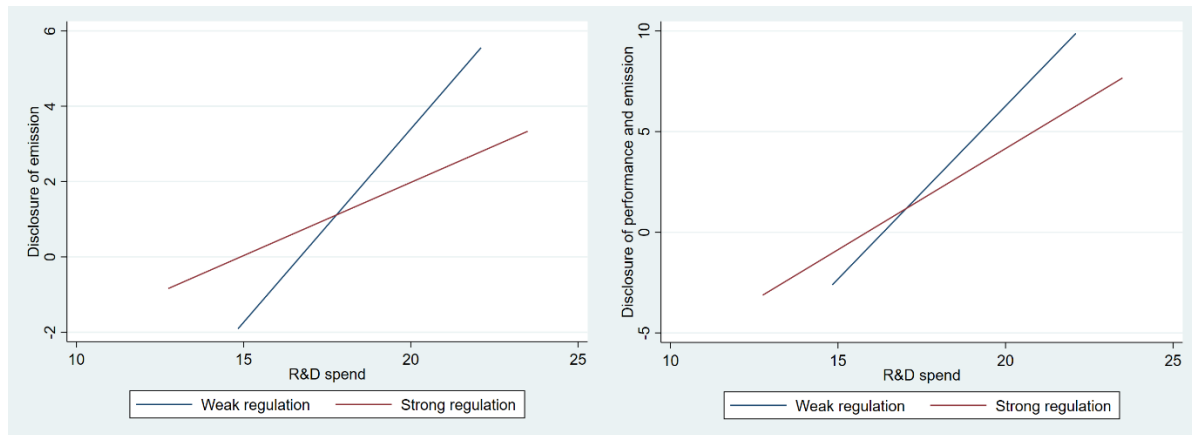

Figure 6 Moderating Effect of environment regulation

Secondly, to consider whether environmental information disclosure is effective as a substitute variable for environmental performance, we replace the dependent variable in the basic model with whether the company has passed ISO14001 environmental management system certification. Table 7 shows the results of three alternative dependent variables. For Disemission and Dise&p, the R&D spend still has significant positive effect, while Ovincome is still positive but not significant. For ISO14001, the coefficient of R&D spend is positive but not significant. The possible reason is that among many enterprises that have passed ISO14001 certification, the value of capability prediction brought by this certification is not completely clear (Bu and Wagner, 2016). The propotion of mediating effect is still obvious (59.7%, 67.1% and 61.1%).

Table 7 Robustness

	Env = Disemission		Env = Dise&p		Env = ISO14001	
Summary stats for each GSEM	Total	0.258 p=0.010	Total	0.589 p=0.001	Total	0.018 p=0.166
	Indirect	0.154 p=0.010	Indirect	0.395 p=0.000	Indirect	0.011 p=0.166
	Propotion of mediating effect = 59.7%		Propotion of mediating effect =67.1%		Propotion of mediating effect = 61.1%	
	Disemission	R&D spend	Dise&p	R&D spend	ISO14001	R&D spend
R&D spend	0.368***		0.942***		0.026	
	(2.64)		(3.80)		(1.39)	
Ovincome	0.104	0.420***	0.193	0.420***	0.007	0.420***
	(0.92)	(11.83)	(0.97)	(11.83)	(0.50)	(11.83)
Liability	0.016	1.178***	1.054	1.178***	0.056	1.178***
	(0.02)	(3.64)	(0.59)	(3.64)	(0.42)	(3.64)
ROA	1.702	2.924***	5.360	2.924***	-0.025	2.924***
	(0.72)	(3.83)	(1.28)	(3.83)	(-0.08)	(3.83)

Intangible	7.109*	-1.306	18.03***	-1.306	-0.075	-1.306
	(1.88)	(-1.05)	(2.69)	(-1.05)	(-0.15)	(-1.05)
Tobin Q	-0.101	-0.155**	-0.398	-0.155**	0.017	-0.155**
	(-0.42)	(-1.97)	(-0.94)	(-1.97)	(0.53)	(-1.97)
ROE	-0.267	0.074	-0.377	0.074	0.013	0.074
	(-0.38)	(0.32)	(-0.30)	(0.32)	(0.14)	(0.32)
GDP	0.298	-0.137	-0.185	-0.137	0.103**	-0.137
	(0.91)	(-1.27)	(-0.32)	(-1.27)	(2.38)	(-1.27)
Foreign	-0.464**	-0.038	-0.594*	-0.038	-0.033	-0.038
	(-2.39)	(-0.57)	(-1.72)	(-0.57)	(-1.26)	(-0.57)
Regulation	-0.004	0.071**	-0.058	0.071**	0.008	0.071**
	(-0.08)	(1.98)	(-0.66)	(1.98)	(1.27)	(1.98)
Ovin*Regulation		-0.683***		-0.683***		-0.683***
		(-2.67)		(-2.67)		(-2.67)
Constant	-6.797*	14.343***	-12.743*	14.343***	-1.122**	14.343***
	(-1.77)	(9.85)	(-1.87)	(9.85)	(-2.19)	(9.85)

z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

6. Conclusion and discussion

The purpose of this study is to further clarify the environmental strategy choice and its influencing factors of China MNEs on the basis of the relevant literature on institution voids. Based on the view of institutional theory, we further find that the choice of environmental strategy of China MNEs is not only affected by the industry and enterprise level factors, but also by the background of dual institutions embeddedness. Briefly we have two findings: (1) When faced with the institution voids as identity background, the choice of environmental strategy of China MNEs who tend to expand overseas linkage will improve environmental performance, and this improvement mechanism is mainly through internal innovation and R&D investment. (2) While China MNEs carry out their positive environmental strategies, they are also affected by the heterogeneity background of domestic regional environmental regulations. The stronger the original environmental regulations, the less efforts they need to make.

This paper still has the following limitations, which call for further study：

(1) In the theoretical setting, our classification of the role of the institution is mainly aimed at the institutional pressure that has been widely studied by exsisting studies. Under the background of China's institution, the heterogeneity of regional environmental regulation is a characteristic, and the positive policy of regional environmental subsidies by government is also a feature that needs to expand. We have not carried out further excavation, and the follow-up research can be further expanded.

(2) In the empirical test, this paper is limited by the availability of data and only uses cross-sectional data for analysis. Although the lagging effect treatment between variables is considered, it still lacks a comprehensive and dynamic perspective, because the choice of environmental strategy has the characteristics of long-term, continuous and dynamic adjustment. This problem needs in-depth research to further improve the theoretical and empirical framework.

(3) The selection of indicators is also limited by the availability of data. This paper can not obtain

detailed and objective environmental emission data of China MNEs in various host countries, but can only use whether to disclose as a substitute. As the motivation of information disclosure of enterprises is not only affected by performance, but also has the possibility of false disclosure, that is, the problem of green washing, follow-up research is needed to eliminate or show the factors of false disclosure.

Reference

[1] Aguilera-Caracuel, J., Arago´n-Correa, J. A., & Hurtado-Torres, N. E. 2011. Extending the literature on the environmental strategy of MNEs. Multinational Business Review, 19(4): 299–310

[2] Alan, M Rugman, and Verbeke Alain. 1998. "Corporate Strategy and International Environmental Policy." Journal of International Business Studies 29(4): 819.

[3] Backman, Charles A., Alain Verbeke, and Robert A. Schulz. 2017. "The Drivers of Corporate Climate Change Strategies and Public Policy: A New Resource-Based View Perspective." Business and Society 56(4): 545–75.

[4] Barney, Jay. 1991. "Firm Resources and Sustained Competitive Advantage." Journal of Management 17(1): 99–120.

[5] Branger, Frédéric, and Philippe Quirion. 2014. "Climate Policy and the 'carbon Haven' Effect." Wiley Interdisciplinary Reviews: Climate Change 5(1): 53–71.

[6] Bu, Maoliang, and Marcus Wagner. 2016. "Racing to the Bottom and Racing to the Top: The Crucial Role of Firm Characteristics in Foreign Direct Investment Choices." Journal of International Business Studies 47(9): 1032–57.

[7] Cantwell, John, John H Dunning, and Sarianna M Lundan. 2009. "An Evolutionary Approach to Understanding International Business Activity : The Co-Evolution of MNEs and the Institutional Environment." 41(4): 567–86.

[8] Cazurra, Alvaro Cuervo, Andrew Inkpen, Aldo Musacchio, and Kannan Ramaswamy. 2014. "Governments as Owners: State-Owned Multinational Companies." Journal of International Business Studies 45(8): 919–42.

[9] Clapp, J., & Dauvergne, P. 2011 Paths to a green world: The political economy of the global environment. Cambridge: MIT Press

[10] Lev B. 1992. Information disclosure strategy. California Management Review 34(4): 9–32.

[11] Luo, Y., & Tung, R. L. 2007. International expansion of emerging market enterprises: A springboard perspective. Journal of International Business

[12] Kostova, Tatiana, Srilata Zaheer, The Academy, and No Jan. 2007. "Multinational enterprise organizational legitmacy under conditions of complexity : The case of the mulitinational enterprise." Management 24(1): 64–81.

[13] Mackinnon, David P., and James H. Dwyer. 1993. "Estimating Mediated Effects in Prevention Studies." Evaluation Review 17(2): 144–58.

[14] Marano, Valentina, Peter Tashman, and Tatiana Kostova. 2017. "Escaping the Iron Cage: Liabilities of Origin and CSR Reporting of Emerging Market Multinational Enterprises." Journal of International Business Studies 48(3): 386–408.

[15] Marquis, Chris, and Mia Raynard. 2015. "Institutional Strategies in Emerging Markets." Academy of Management Annals 9(1): 291–335.

[16] McWilliams, A. & Siegel, D. 2000. Corporate social responsibility and financial performance: Correlation or misspecification? Strategic Management Journal, 21(5): 603–609

[17] Nippa, Michael, Sanjay Patnaik, and Markus Taussig. 2021. "MNE Responses to Carbon Pricing Regulations: Theory and Evidence." Journal of International Business Studies.

[18] North, D.C., 1990. Institutions, Institutional Change, and Economic Performance. Cambridge University Press, New York.

[19] Peng, Mike W, and Denis Y L Wang. 2008. "An Institution-Based View of International Business Strategy : A Focus on Emerging Economies." : 920–36.

[20] Peng, M. W. (2002). Towards an institution-based view of business strategy. Asia Pacific Journal of Management, 19(2/3), 251–267

[21] Pinkse, Jonatan, and Ans Kolk. 2012. "Multinational Enterprises and Climate Change: Exploring Institutional Failures

and Embeddedness." Journal of International Business Studies 43(3): 332–41.

[22] Porter, M. E. 1980. Competitive strategy. New York: Free Press.

[23] Radu, Camélia, and Claude Francoeur. 2017. "Does Innovation Drive Environmental Disclosure? A New Insight into Sustainable Development." Business Strategy and the Environment 26(7): 893–911.

[24] Scott, W.R. 1995. Institutions and organizations, Thousand Oaks, CA: Sage.

[25] Sethi, D., & Guisinger, S. 2002. Liability of foreignness to competitive advantage: How multinational enterprises cope with the international business environment. Journal of International Management, 8(3): 223–240

[26] Sharma, Sanjay, and Harrie Vredenburg. 1998. "Proactive Corporate Environmental Strategy and the Development of Competitively Valuable Organizational Capabilities." Strategic Management Journal 19(8): 729–53.

[27] Wang, Jian, Lisha Wang, and Xuepeng Qian. 2021. "Revisiting Firm Innovation and Environmental Performance: New Evidence from Japanese Firm-Level Data." Journal of Cleaner Production 281: 124446.

[28] Wang, Ruxi, Frank Wijen, and Pursey P.M.A.R. Heugens. 2018. "Government's Green Grip: Multifaceted State Influence on Corporate Environmental Actions in China." *Strategic Management Journal* 39(2): 403–28.

[29] Zhou, Nan, and Heli Wang. 2020. "Foreign Subsidiary CSR as a Buffer against Parent Firm Reputation Risk." Journal of International Business Studies 51(8): 1256–82.