Corporate Social Responsibility and the Pollution Haven Hypothesis: Evidence from Multinationals' Investment Decision in China

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Abstract: This paper tests the pollution haven hypothesis by examining the relationship between environmental regulation and foreign investment with consideration of the role of corporate social responsibility, which has so far been neglected. Using multinationals' investment data from China, our results in general support the pollution haven hypothesis that less stringent environmental regulation is more attractive for multinationals to invest in China, but high social responsibility can counteract attractiveness of weak environmental regulation.

Keywords: pollution haven hypothesis, corporate social responsibility, foreign direct investment, environmental regulation, China

JEL Classification: F18; Q56; O53

1. Introduction

Since the beginning of the open-door policy, China has successfully attracted a high amount of foreign direct investment, which significantly contributes to the high economic growth rates in the past three decades (Tian and Yu, 2012). According to the latest World Development Indicators, China received an amount of 0.43 billion US dollars of foreign direct investment in 1982, and this amount increased dramatically to 185.1 billion in 2010. In tandem with the increasing foreign investment and rapid economic growth, China has experienced severe environmental deterioration. For

instance, about 90% of rivers close to cities are so severely polluted that they are unfit for drinking and fishing[1]; and the air pollution in Chinese cities is so severe that breathing it can result in serious health consequences (Yu and Abler, 2010). Is the coexistence of increasing foreign investment and environmental deterioration a coincidence, or is there some causal effect?

Regarding the relationship, there is a so-called pollution haven hypothesis which states that multinationals are more likely to transfer the intensely pollutive side of production to developing countries with relative low environmental standards (Sanna-Randaccio and Sestini, 2011; Sanna-Randaccio, 2012). According to the hypothesis, less stringent environmental regulations can be economically advantageous for developing countries, though it is of detriment to their environment. In order to compete with each other for foreign investment, developing countries are encouraged to race to the bottom level of environmental standards in order to stay in the game (Copeland and Taylor, 2003).

The core of the pollution haven hypothesis is that whether multinationals are attracted by weak environmental regulations. Research has provided evidence of a negative correlation between environmental regulation and the location choice of foreign investment (Xing and Kolstad, 2002; Zhang and Fu, 2008). It implies that less stringent environmental regulation could increase the possibility of foreign investment in some cases, which is consistent with the pollution haven hypothesis. While some

[1] Source: http://www.globescan.com/pdf/WaterViews_GlobalWaterPoll_GlobeScan.pdf.

other literature could not find strong supportive evidence that the multinationals prefer investing in regions with less stringent environmental regulation (Javorcik and Wei, 2005). Erkeland and Harrison (2003) suggest that the evidence of the pollution haven hypothesis might depend on the pollutants and industries. The mixed findings demand that more research should be done to complete the debate with consideration of more factors (Chao and Yu, 2004).

One possible reason for the inconsistencies in the findings could be the ignorance of the heterogeneity of multinationals, as most research puts more emphasis on the possible competition among developing countries. Different firms may have different philosophies towards environmental protection. For instance, Clarkson et al. (2008) find environmental performance is positively correlated with the level of discretionary environmental disclosures at the firm level. It is undeniable that some multinationals put the position of profitability above their environmental responsibility. For instance, according to an investigation by the Institute of Public & Environmental Affairs, around one hundred multinationals have been violating environmental regulations in China[2]. On the contrary, for some multinationals environmental responsibility occupies priority, and they never lower their environmental standards in pursuit of a higher profit rate. A good example is Swedish furniture giant IKEA, which has set up eight environmental requirements for Chinese suppliers, and any supplier who fails to comply with these requirements faces exclusion[3].

[2] Source: "Multinationals Blacklisted for Pollution", *China Daily* August 21, 2007.

[3] Source: http://www.tex-asia.com/html/news/domestic/2009/8/09810165545JB.html.

Considering the heterogeneities of firms as mentioned above, the amount of existing research on the pollution haven hypothesis is insufficient, and the environmental responsibility for a firm should be included. This paper will take the lead in introducing corporate social responsibility of the environment to the debate of the pollution haven hypothesis to fill in the gap in the current literature. It can be expected that multinationals with high social responsibility are less likely to be attracted by weak environmental regulations, as Porter's hypothesis suggested, these multinationals can obtain a premium from the capital market and maintain a competitive advantage by establishing a high environmental standard (Porter and Linde, 1995; Wagner, 2006; 2011). However, weak environmental regulations may provide incentives for the multinationals with low social responsibility and attract them to locate their plants there.

In order to fill in the literature gap, this paper attempts to examine the relationship between local environmental regulation and the location choices of foreign firms, specifically taking into account the role of corporate social responsibility, by using a conditional logit model and foreign firm data in China. Our results generally support the pollution haven hypothesis that less stringent environmental regulation is more attractive for multinationals to invest in China. However, corporate social responsibility also plays important roles in the hypothesis.

The remainder of the paper continues with Section 2, which provides a short literature review; Section 3 which presents the methodology and the data sources; Section 4 which gives the empirical results and discussions, and finally, Section 5

which concludes the paper.

2. Literature review

The debate over the Pollution Haven Hypothesis has attracted a great deal of attention from researchers in this field. There are two main strands of research which vary according to the data used. We first review the literature using macro-level data, and then review the literature using micro-level data. In the end of this section, the possible reasons for the mixed results are discussed.

At the macro-level, Xing and Kolstad (2002) find a negative relationship between US investment and the stringency of environmental regulation in host countries, by using the aggregated data from six highly pollutive US industries, they propose that lax environmental policy tends to attract more capital inflow of highly pollutive industries from the US. Using a five-year panel dataset for 30 Chinese provinces, Zhang and Fu (2008) find stringent environmental regulations deter foreign investment in China. Both the findings of Xing and Kolstad (2002) and Zhang and Fu (2008) support the pollution haven hypothesis.

In contrast, Eskeland and Harrison (2003) find no robust correlation between environmental regulation and foreign investment in developing countries. The evidence supporting the argument that foreign investors prefer regions with poor environmental regulation is weak. They argue that the relationship between investment and environmental regulation depends on a number of factors, such as industries and pollutants. In addition, they find foreign investment tends to use less

energy and adopts cleaner forms of production compared with their counterparts in the host countries. The view is confirmed by Bu et al. (2011).

Brunnermeier (2004) points out a disadvantage of the macro-level data that the aggregated data often confounds different environmental standards. On one hand, jurisdictions that attract more polluting firms will have higher abatement costs than those with a cleaner industrial composition, even if the environmental standard faced by individual firms is identical across jurisdictions. On the other hand, the newer firms have to comply with more stringent environmental standards than the existing ones. Thus, the jurisdictions with relatively newer plants may report higher compliance costs than jurisdictions with older plants even if their regulations are the same. One would need to adjust the reported pollution abatement costs to capture the difference in the industrial composition of the jurisdiction itself. The adjustment will introduce great challenges, which can be avoided through the use of micro-level data.

Using the micro-level data from the US, Arik (1996) examines the effect of state environmental regulations on new manufacturing plant locations, and only finds weak evidence which supports stringent environmental regulation to deter new firms from setting up pollutive plants. Javorcik and Wei (2005) find no evidence that supports the argument that highly pollutive foreign investors are attracted by weak environmental regulation for 25 economies in Eastern Europe and the former Soviet Union. Neither Arik (1996) nor Javorcik and Wei (2005) support the pollution haven hypothesis. On the contrary, List and Co (2000) use the US data but find that the relationship between environmental stringency and the possibility of attracting foreign investment is

significantly negative. Ben Kheder and Zugravu (2012) find that French manufacturing firms prefer investing in foreign regions with weak environmental regulations. In addition, Kirkpatrick and Shimamoto (2008) provide another interesting finding, which suggests that Japanese FDI appears to have been attracted to countries with higher environmental standards and they accordingly do not support the pollution haven hypothesis.

Except for a few exceptions, very few studies have used micro-level data for the studies in China. Di (2007) examines whether potential savings of pollution abatement cost influence the location choices of FDI, using data from four Chinese industries, and indicates that that the pollution-intensive FDI firms are sensitive to higher pollution levy charges, while non-polluting FDI firms are not. It suggests the existence of domestic pollution havens in China. Dean et al. (2009) examine pollution haven behavior by estimating the determinants of location choice for equity joint ventures (EJVs) in China, and their results indicate that weak environmental standards attract EJVs in highly pollutive industries funded through ethnically Chinese sources such as Hong Kong, Macao, and Taiwan, while they do not significantly attract EJVs funded from non-ethnically Chinese sources regardless of the intensity of the pollution produced by the industry.

Regarding the methodological issues, Brunnermeier (2004), and Jeppesen and Folmer (2001) review the literature on the subject and discuss the reasons for the mixed findings. They highlight two factors that should not be ignored. First, reverse causality may hold between environmental regulations and foreign investments. For

example, if greater foreign investments lead to a higher income, and a higher income could in turn lead to a greater demand for environmental quality, this could result in more stringent environmental regulations. That is, the environmental regulations could be a function of foreign investments. Second, the stringency of environmental regulation has been proxied in various ways in the literature. Some measures have obvious flaws. It is suggested that the measurement based on objective and quantitative data from pollution costs will be more convincing.

In addition to the methodological problems, another possible reason is the ignorance of the firm's heterogeneity, and overemphasis of the possible competition among the developing countries. Rondinelli and Berry (2000) suggest that the accountable multinationals usually adopt strictly self-regulated activities to achieve sustainable development. However, not all multinationals behave in this way. We should shed light on firms' environmental behavior with consideration of their heterogeneities in social responsibilities. So far, little is known about whether weak environmental regulations could attract more foreign investment if taking into account the corporate social responsibility. Considering the concerns above, this study takes the lead in introducing the perspective of corporate social responsibility to the debate over the pollution haven hypothesis, and an attempt at filling in the gaps in the literature.

3. Methodology and data

3.1 Methodology

This study uses a conditional logit model proposed by McFadden (1974) to estimate the location choice of multinationals. The model is well grounded in microeconomic utility/profit maximization and is feasible for rich empirical specifications. Unlike aggregate methodologies, the discrete-choice models empower researchers to reveal each individual's preference, while some micro-level characteristics may be lost in the aggregate methodologies by the aggregation process of discrete data.

Our conditional logit model assumes that multinational company i would choose province j for its new plant only if this province could maximize its profits. We ignore the characteristics of the plant which is standardized and captured by fixed effects, and assume the expected profit only depends on the observable characteristics of each province. Mathematically, the profit of multinational i in province j can be specified as:

$$\pi_{ij} = X_{ij}\beta + \alpha_i + \varepsilon_{ij} \qquad (1)$$

Where X_{ij} denotes the vector of observable location characteristics of province j; β is the vector of estimated coefficients which is identical across different multinationals; α_i captures the heterogeneities of multinationals; ε_{ij} is a random term capturing unobserved characteristics of each alternative and is assumed to be the independently and identically distributed (IID) extreme value. Therefore, a province j is selected by a multinational company i if and only if:

$$\pi_{ij} > \pi_{is}, \text{ for } \quad j \neq s \qquad (2)$$

The probability of a multinational i choosing a particular province j out of S potential provinces (alternatives) can be mathematically expressed as follows. The estimation of β can be obtained from the maximum likelihood method.

$$\Pr(j) = \frac{\exp(X_{ij}\beta + \alpha_i)}{\sum_{s=1}^{S} \exp(X_{is}\beta + \alpha_i)} \qquad (3)$$

Diverging from the original model of McFadden (1974), which specifies different β's for different alternatives, we assume the coefficient for independent variables is identical for different alternatives, while the heterogeneities across different alternatives are captured by α_i. In light of this, the model is often called the fixed-effects logit model (Greene, 2008). An advantage of this specification is the simplification of the assumption of Independence of Irrelevant Alternatives (IIA) in the original model of McFadden (1974).

The IIA property specifies that for any investor, the probability ratio of any two alternatives depends only on the attributes of the two alternatives and is independent of other available alternatives. Violation of the IIA assumptions results in inconsistent estimators. To detect the potential violations of the IIA assumption, Hausman and McFadden (1984) and Small and Hsiao (1985) proposed different statistical tests. In order to test the IIA assumption, we will drop the location of Beijing to compare differences between the results by the test of Hausman and McFadden (1984).

3.2 data

According to the current literature, the ideal data used should cover three sets of

information: First, a series of variables capturing regional characteristics, such as environmental regulation and so on; Second, the location choice of multinational investment in China; and Third, the measurement of corporate social responsibility of the multinationals. Only the successfully merged data can serve for the purpose of this study.

3.2.1 The dependent variable

Our data on multinational's location choice is sourced from the Fortune Global 500 Company investment database (1998-2007), provided by China's Ministry of Commerce. The database contains detailed information on each branch company of the Fortune Global 500 in China. Until 2007, there have been 284 Fortune Global 500 companies, which have made direct investment in China, excluding China's domestic companies in the Fortune Global 500. The total number of branch companies is 3553. The top four locations for branch companies are shanghai (579), Beijing (350), Guangdong (322), and Jiangsu (259), nearly half of the total number. In addition, the list of Fortune Global 500 also includes some multinationals in the financial sector. Their location choice is much less affected by environmental regulation, so that we drop these types of multinational too. Finally, after merging with the database of corporate social responsibility, we are able to get a full sample of 217 multinationals and 6510 observations (217*30). Within the sample, if province i is selected by multinational j for direct investment, the dependent variable equals 1. Otherwise, it equals 0.

3.2.3 Environmental regulation

As mentioned before, the measurement of environmental regulatory stringency is crucial for the research. Environmental regulation reflects one jurisdiction's restriction imposed on emissions and usually makes firms within the jurisdiction increase their pollution disposal costs. Adapting techniques learned from the literature, we employ three measures. The direct measure is generated from the change of the pollution disposal cost. Dasgupta, et al. (1997) show that the pollution levying system is the most widely developed mechanism in the Chinese pollution control regime. Among Chinese regions, the stringency of pollution levy varies substantially. Therefore, we use the sum of pollution discharge fees normalized by the added value of corresponding regional manufacturing sector, as the first measure for environmental regulation variable (ER1). The reason for normalization is that the economic sizes of Chinese regions are quite different.

The second measure of environmental regulation is based primarily on the effort of environmental protection devoted to different government jurisdictions. Similar to the method of Zhang and Fu (2008), we use the sum of investment towards pollution abatement projects normalized by the added value of the corresponding regional manufacturing sector, as the second measure for the environmental regulation variable (ER2). The investment in pollution abatement projects consists of the investment by enterprises for construction and installation projects, and the purchase of equipment and instruments required for the pollution harnessing projects for the treatment of wastewater, waste gas, solid wastes, noise pollution and other pollution, so it can reflect the government's juridical efforts in environmental protection.

The third measure is based on the capability of environmental enforcement and monitoring, as they generate substantial deterrence to corporate incompliance (Shimshack, 2007). China has already enacted lots of environmental laws and regulations at different governmental levels. However, the enforcement is still relatively weak. One possible reason is due to lack of professional staffs. For instance, the number of staff members in the Environmental Protection Agency (EPA) of the US is several times larger than that in China's counterpart, Ministry of Environmental Protection (MEP)[4]. Considering that the capacity of environmental enforcement and monitoring heavily relies on the size of local environmental protection agency, which varies substantially across different regions in China, we hereby use the number of public servants of local environmental protection agency normalized by the number of enterprises in each region as the third measure (ER3)[5].

In addition, as environmental data are mostly inaccessible in Tibet during the sampling period, Tibet is excluded from this study. The data of all three measures are all taken from *the Chinese Environmental Statistical Yearbook* (various editions).

3.2.3 CSR and Interaction terms (ER*CSR)

Our CSR data are sourced from the CSRHUB, which provides social, environmental, community and governance ratings on around 5,000 companies in 65

[4] MEP has 2935 full-time employee in 2011, according to their website: http://gcs.mep.gov.cn/zhxx/201204/t20120424_226666.htm. While, EPA has approximately 17,000 full-time employees and engages many more people on a contractual basis, according to Joseph Kahn and Jim Yardley (August 26, 2007). "As China Roars, Pollution Reaches Deadly Extremes". The New York Times. (http://www.nytimes.com/2007/08/26/world/asia/26china.html.)

[5] The enterprises are all state-owned and non-state owned enterprises above a certain level, which refers to enterprises with an annual sales of over 5 million RMB (about US $ 0.8 million).

countries. CSRHUB is the first one combining data from five of the premier socially responsible investment (SRI) analysis firms (also known as Environment, Social, Governance- ESG), and over 120 influential NGOs. Using a proprietary system for mapping and normalizing this broad range of information, CSRHUB provides consistent ratings for the sampled companies with a range between 0 and 100[6]. The higher the rating, the better the performance of corporate social responsibility is. Considering our research purpose, the environmental CSR rating is specifically adopted here.

Because we use the fixed-effects logit model, CSR cannot be included as an independent variable separately; otherwise it will be dropped out. Multiplying the rating of corporate social responsibility and the level of environmental regulation, we can get an interaction term of the two variables (ER*CSR) which is also included in the empirical model, and it avoids the problem of dropping-out. A merit of such a treatment can capture the interaction between environmental regulation and cooperative social responsibility. Then equation (1) can be rewritten as

$$\pi_{ij} = \gamma_1 * ER_j + \gamma_2 * ER_j * CSR_i + \hat{X}_{ij}\hat{\beta} + \alpha_i + \varepsilon_{ij} \qquad (4)$$

Where $\hat{X}_{ij}$ denotes a vector of other control variables, and $\hat{\beta}$ is the related coefficient vector; γ_1 and γ_2 are coefficients to be estimated as well.

If we assume CSR is given for a company, the relationship between location decision (Profit) and ER is hence given as

[6] The detailed methodology of the rating is available on the website: http://www.csrhub.com/content/csrhub-ratings-methodology.

$$\frac{\partial \pi}{\partial ER} = \gamma_1 + \gamma_2 * CSR \qquad (5)$$

$\frac{\partial \pi}{\partial ER}$ denotes the marginal impact of environmental regulation on the company profit. Suppose $\gamma_2 > 0$. Equation (5) indicates that a positive relationship between ER and location decision ($\frac{\partial \pi}{\partial ER} > 0$) requires $CSR > -\frac{\gamma_1}{\gamma_2}$, which in this case does not support the Pollution Haven Hypothesis; otherwise, $CSR < -\frac{\gamma_1}{\gamma_2}$ which is implicitly consistent with the Pollution Haven Hypothesis. $-\frac{\gamma_1}{\gamma_2}$ is a bifurcation point for the relationship.

3.2.4 Other provincial features

A few control variables cannot be ignored in the regression model in order to capture the provincial characteristics. The two most common factors determining the location choice of foreign investments are: potential market size and human capital (Shatz and Venables, 2000). We use per capital GDP as an indicator for the potential market size (Ben Kheder and Zugravu, 2012)[7]. The expected sign of the coefficient is positive. As for human capital, it is necessary to reflect the ratio of skilled labor forces against unskilled labor forces. Following Coughlin and Segev (2000), we use the share of population which has received high school or higher education, as an indicator for human capital. Moreover, we include the share of population aged from 15 to 64 to measure the potential labor size. One can speculate that more labor forces

[7] One anonymous reviewer suggested that employment costs might affect the location choice for FDI. We tried to include the variable of average wage, which is an important indicator for employment costs, in the regression. Unfortunately, it caused multicollinearity problem with per capita GDP. We had to drop it in the final results.

or higher level of human capital could be more attractive for foreign investment. The expected signs of the coefficients for the two variables both would be positive. The data for provincial characteristics are sourced from *China's Statistical Yearbooks*.

The third important control variable is the aggregation of foreign investment. Liang (2003) has shown that the effect of the aggregation effect is becoming the most important factor that affects foreign investment location choice. We conjecture that one region becomes more attractive if it has received lots of foreign investment. The amount of inward foreign investment, sourced from the database of China's Ministry of Commerce, is taken as an indicator of the aggregation of foreign investment.

The choice of location for foreign investment may be affected by corruption (Javorcik and Wei, 2005). Environmental regulation is closely related to government corruption. On one hand, if weak environmental regulation attracts foreign investment and we fail to control corruption, the empirical results cannot rule out another possible explanation: it is not the weak environmental regulation but corruption that attracts foreign investment. On the other hand, in the most corrupted regions, investment is very risky and multinationals may tend to avoid these places. As suggested by Wu and Zhu (2011), we measure the corruption level by using the number of corruption crime cases normalized by the population. Greater the value, more corrupt the region is. The source of the data containing white collar crime statistics is taken from China's Procuratorial Yearbooks.

The geographical disadvantages may also be significant for the decision of multinationals' location choices. Following the approach of Wei and Wu (2001), we

use the distance to the main ports to capture this. If the distance is greater, it is expected that the possibility of attracting foreign investment will be weaker. The expected sign of the coefficient of the port variable would be negative. In addition, local infrastructure could affect location decision for foreign investment. We include the lengths of road and railway, and telecommunication infrastructure in the regression, which are normalized by the province's area. The data of infrastructure variables are taken from China Economic Information Network (CEIN).

Note that we take logs for the continuous variables in order to control for possible non-linear relationships, which include per capita GDP, aggregated foreign investment, distance to the major ports, length of road, length of railway, and telecommunication infrastructure. The statistical summary of all the independent variables is presented in Table 1.

[Insert Table 1 here]

4. Results

4.1 Regression Results

Regression results are shown in Table 2, which consists of three models adopting different measurement of environmental regulation. Comparing the results of the three models, we find that results are quite consistent regardless of different measures for environmental regulation. We will discuss the results respectively in the following section.

Model 1 adopts the first measure of environmental regulation (ER1): the pollution

discharge fee normalized by the regional added value of manufacturing. The coefficient for environmental regulation variable is -0.0978and statistically significant, while the coefficient for the interaction term between environmental regulation and corporate social responsibility is 0.0014 and also statistically significant.

By Equation (5) we have the bifurcation point $-\frac{\gamma_1}{\gamma_2} = 68$. It implies that the multinationals with CSR higher than 68 possess a positive relationship between the likelihood of investment and the stringency of environmental investment; while those multinationals with CSR lower than the number have a negative relationship. However, the descriptive statistics in Table 1 show that the maximum CSR score for the multinationals in our sample is 76, which is a little above the bifurcation point. Therefore, our result in general supports the pollution haven hypothesis that less stringent environmental regulation is more attractive for multinationals to invest in China particularly for the multinationls with CSR lower than 68. In other words, corporate social responsibility plays significant roles here: The multinationals with higher social responsibility are less likely to be attracted by weak environmental regulation. Particularly, if the CSR higher than 68, the attractiveness of weak environmental regulation disappears. It implies that high social responsibility can counteract attractiveness of less stringency of environmental regulation.

In terms of control variables, such as per capital GDP, labor share, and foreign investment aggregation, the coefficients are all positive and statistically significant, consistent with our expectation. The coefficient of human capital is also positive. However, it is not significant. The coefficient of regional corruption level is negative

and statistically significant, which indicates that high levels of corruption will reduce the possibility of attracting foreign investment. The coefficient of port and railway infrastructure variable are insignificant, while that of road and telecommunication infrastructure variable are positive and significant, which implies that foreign investment does favor regions with better quality of road and telecommunication infrastructure.

[Insert Table 2 here]

Model 2 and Model 3 of Table 2 adopt the second and third measure of environmental regulation: the sum of pollution abatement investment normalized by the added value of manufacturing sectors, and the number of public servants of local environmental protection agency normalized by the number of enterprises in each region.. In Model 2, the coefficient for environmental regulation is -.0365 and statistically significant, while the coefficient for the interaction term of environmental regulation and social responsibility is 0.000423 and statistically significant as well, which remains consistent with Table 2. The bifurcation point is 86, which is higher than the maximum CSR score. It sufficiently supports our conclusions that the pollution haven hypothesis generally holds in China, and the multinationals with higher social responsibility are less likely to be attracted by weak environmental regulation. In Model 3, the coefficient for environmental regulation is -2.614 and statistically significant, while the interaction term of environmental regulation and social responsibility is 0.0387 and statistically significant as well. The bifurcation point is 67.5, which is slightly lower than the maximum CSR score. It still sufficiently

supports our conclusions that the pollution haven hypothesis generally holds in China but corporation social responsibility plays very important roles. The weak environmental regulation can only attract the multinationals with low social responsibility. The multinationals with higher social responsibility are less likely to be attracted by weak environmental regulation. In terms of control variables, the sign and significant level of the coefficients in Model 2 and Model 3 are similar to those of Model 1 in Table2, which support the previous findings.

4.2 Robustness check

For political concerns, multinationals could prefer investment in Beijing, the capital of China, which is more influential than other Chinese regions. In this way, the choice of investment in Beijing might be different from choices of investment in other regions. Given this consideration, the regression models are estimated again without the samples in Beijing, which at the same time can verify the IIA assumption. The results are shown in Table 3.The same as Table 2, model 1, model 2 and model 3 adopts different measure of environmental regulation: ER1, ER2 and ER3 respectively. In all models, the coefficients for the environmental regulation variable are negative and statistically significant. Meanwhile, the interactions of environmental regulation and corporate social responsibility are positive and mainly statistically significant. The results of all control variables are similar to those in the full sample. As a whole, the subsample estimation is consistent with the full sample.

Table 3 also reports the Hausman tests for IIA assumption. The tests can not reject the null hypothesis of IIA assumption for each of the three models. The results

indicate that our estimation is consistent and legitimate.

[Insert Table 3 here]

Considering the limitation of samples in this study, we adopt the bootstrap method, proposed by Efron (1979). The use of bootstrap can avoid the reliance on the current sample, if the population distribution is unknown and the sample size is limited. The results from 50 bootstraps show that the coefficient of the environmental regulation variable is negative and statistically significant, while the interaction of environmental regulation and corporate social responsibility is still positive and statistically significant, which again confirms our previous findings[8].

5. Conclusion

Given the heated debate on the pollution haven hypothesis, the paper takes the lead in examining the relationship between environmental regulation and foreign investment by taking into account the role of corporate social responsibility, with use of conditional logit models and multinational investment data from China. Our results generally support the pollution haven hypothesis that less stringent environmental regulation is more attractive for multinationals to invest in China. However, corporate social responsibility also plays important roles. Particularly, the multinationals with higher social responsibility are less likely to be attracted by weak environmental regulation. Our conclusions are quite robust and consistent, regardless of different measurements of environmental regulation, and different model specifications.

[8] Results are available on request.

The contribution of this paper is that it sheds new light on the study of the pollution haven hypothesis by introducing the perspective of corporate social responsibility. Previous studies pay considerable attention to the possible competition among developing countries, while the heterogeneity of multinationals has been largely ignored. Taking into account the corporate social responsibility, even though the pollution haven hypothesis generally holds, corporate social responsibility plays significant roles in the relationship between multinationals' location decision and local environmental regulation stringency. High corporate social responsibility usually can counteract the attractiveness of less stringent environmental regulation. Considering the tremendous impact of multinationals in China, we suggest that China should selectively attract multinationals in order to produce less environmental damage. If the multinationals are environmentally responsible, they will stimulate China's domestic colleagues to imitate their actions. If, however, China aligns itself with multinationals with poor corporate social responsibility records, its environment is highly likely to suffer as a result.

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Table 1：Statistical summary

Variables	Observation	mean	SD	Min	Max	Definition
ER1	6510	28.23	10.62	9.98	54.22	Normalized pollution discharge fees
ER2	6510	73.23	33.98	23.70	197.57	Normalized sum of pollution abatement investment
ER3	6510	0.87	0.46	0.11	1.81	Normalized number of public servants for local environmental protection
CSR	6510	62.41	7.92	36.00	76.00	Corporate social responsibility
Log of per capita GDP	6510	9.30	0.53	8.30	10.63	Log of per capital regional gross domestic product
Share of labor forces	6510	0.68	0.03	0.64	0.75	Share of population for the age from 15 to 64
Share of high school education or higher	6510	2.33	0.65	1.21	4.32	Share of population received high school or higher education
Log of foreign investment	6510	2.07	1.56	-0.83	4.79	Log of aggregated foreign investment
Number of corruption cases	6510	28.81	7.53	13.36	45.35	Normalized number of corruption cases
Log of distance to the nearest port	6510	2.52	0.79	0.00	3.73	Log of distance to the nearest port (Shanghai or Hongkong)
Log of total length of highways	6510	-0.84	0.75	-2.98	0.07	Log of total length of highways/land area
Log of total length of railways	6510	-0.01	0.88	-2.50	1.88	Log of total length of railways/land area
Log of telecommunication transactions	6510	5.68	0.82	3.49	7.62	Log of telecommunication service transactions

Table 2：Conditional logit model results (full sample)

	(1)	(2)	(3)
ER1	-0.0978**		
	(0.0401)		
ER1*CSR	0.00143**		
	(0.000615)		
ER2		-0.0365**	
		(0.0170)	
ER2*CSR		0.000423*	
		(0.000256)	
ER3			-2.614**
			(1.120)
ER3*CSR			0.0387**
			(0.0170)
Log of per capita GDP	1.067***	1.242***	1.048***
	(0.238)	(0.224)	(0.253)
Share of labor forces	4.986**	3.937*	4.852**
	(1.992)	(2.019)	(1.987)
Share of high school education or higher	0.175	0.0687	0.176
	(0.142)	(0.140)	(0.143)
Log of foreign investment	0.485***	0.433***	0.489***
	(0.0832)	(0.0844)	(0.0841)
Number of corruption cases	-0.0352***	-0.0398***	-0.0342***
	(0.00714)	(0.00716)	(0.00740)
Log of distance to the nearest port	0.0231	0.186**	0.0106
	(0.0711)	(0.0844)	(0.0711)
Log of total length of highways	1.196***	1.176***	1.202***
	(0.104)	(0.104)	(0.107)
Log of total length of railways	0.0303	0.171*	0.0363
	(0.0900)	(0.0953)	(0.0905)
Log of telecommunication transactions	0.347***	0.350***	0.322***
	(0.108)	(0.103)	(0.106)
Sample size	6,510	6,510	6,510

Notes: 1, The dependent variable equals 1 if the province is selected by the multinational i. Otherwise the dependent variable equals 0.

2, We use three indices to measure environmental regulation: ER1, ER2, and ER3 respectively denote pollution discharge fees, pollution abatement investment and the number of public servants for local environmental protection agency.

3,Standard errors are in parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Table 3：Conditional logit model results (sample without Beijing)

	(1)	(2)	(3)
ER1	-0.101**		
	(0.0404)		
ER1*CSR	0.00148**		
	(0.000618)		
ER2		-0.0376**	
		(0.0180)	
ER2*CSR		0.000434	
		(0.000271)	
ER3			-2.768**
			(1.132)
ER3*CSR			0.0412**
			(0.0171)
Log of per capita GDP	1.087***	1.301***	1.079***
	(0.248)	(0.233)	(0.270)
Share of labor forces	5.017**	3.993**	4.896**
	(2.002)	(2.028)	(1.996)
Share of high school education or higher	0.184	0.100	0.186
	(0.148)	(0.146)	(0.148)
Log of foreign investment	0.479***	0.412***	0.483***
	(0.0869)	(0.0887)	(0.0877)
Number of corruption cases	-0.0361***	-0.0431***	-0.0355***
	(0.00819)	(0.00825)	(0.00870)
Log of distance to the nearest port	0.0253	0.212**	0.0166
	(0.0791)	(0.0927)	(0.0805)
Log of total length of highways	1.203***	1.185***	1.211***
	(0.105)	(0.104)	(0.107)
Log of total length of railways	0.0338	0.184*	0.0404
	(0.0908)	(0.0965)	(0.0914)
Log of telecommunication transactions	0.357***	0.382***	0.335***
	(0.114)	(0.110)	(0.113)
Sample size	5,829	5,829	5,829
Hausman test for IIA	Chi2(10)=1.94	Chi2(10)=1.85	Chi2(11)=2.39

Notes: 1, The dependent variable equals 1 if the province is selected by the multinational i. Otherwise the dependent variable equals 0.

2, We use three indices to measure environmental regulation: ER1, ER2, and ER3 respectively denote pollution discharge fees, pollution abatement investment and the number of public servants for local environmental protection agency.

3,Standard errors are in parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.