

Corporate Environmental Performance and the Choice of Export Mode – Based on the Theory of Heterogeneous Firm Trade

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Heterogeneous firm trade theory holds that firms' productivity is closely related to firms' export mode and Corporate Environmental Performance (CEP). CEP as one of the important elements associated with firms' productivity, has a significant impact on firms' export mode. The objective of the paper is to assess the enterprises with import and export business in Maoming City. Primary data was used to obtain data, while binary logistic regression analysis was used to analyse the data to determine the influence of CEP on export mode. The results show that the CEP has a positive impact on the export mode. Furthermore, results show that enterprises with better CEP are more inclined to choose the direct export mode, and vice versa. This result is consistent with the theory of heterogeneous firm trade. The study recommends that the Chinese government should give full consideration to the export mode of enterprises when making export policies and make full use of CEP's positive influence on the export mode to promote the internationalisation strategy of enterprises and realise the maximisation of enterprise value.

Keywords: *Heterogeneous, Theory, CEP, Export Mode, Hierarchy, Value*



1. INTRODUCTION

Heterogeneous firm trade theory holds that firms' productivity is closely related to their export mode. Firms with low productivity choose the indirect export mode, while those with high productivity choose the direct export mode. Firms in between choose a mixed export mode of both indirect and direct (Zhou, Wu & Liu, 2015). At present, the voice of environmental protection is rising day by day. As one of the important elements related to the productivity of enterprises, whether and how the Corporate Environment Performance (CEP) can affect the choice of export mode has become a new subject of theoretical research.

At present, the studies on CEP and export mode selection mainly focus on the following aspects: Firstly, the evaluation method of CEP. The evaluation methods of CEP mainly include the following: (i) to develop a standard system for CEP evaluation, such as the International Organization for Standardization (ISO) ISO14031 (ISO 1999) ; (ii) model construction for evaluation, such as data envelopment analysis (Zhu,2015; Li & Qiu,2013), Analytic Hierarchy Process (Li,2013), Fuzzy Comprehensive Evaluation (Tian, 2011) and Ecological Efficiency Model (Xie, 2012); (iii) to use relevant data directly for alternative evaluation, such as recycling percentage of waste (Al-Tuwaijri, Christensen, & Hughes, 2004) or Environmental Performance Index score of the US Council on Economic Priorities (Hughes, Anderson & Golden, 2001) to measure CEP.

Secondly, influencing factors and economic consequences of CEP. Existing studies on the influencing factors of CEP mainly include government pressure (Pang & Rao, 2019), market pressure (Shang & Zhu, 2018; Li, 2017), stakeholders (Tan & Wang,2019), firm characteristics (Yang, 2019; Yang & Xie, 2019; Alat, et al., 2019), corporate governance (Hoang, Abeysekera & Ma, 2016; Walls, Berrone & Phan, 2012; Liao & Yan, 2015) etc. Research on the economic consequences of CEP mainly focuses on the impact of environmental performance on financing capacity (Ye, 2015; Ma, 2014), financial performance (Hang, Geyer-Klingeberg, Rathgeber, & Stockl,2017; Hussain, Rigoni, & Cavezzali,2016; Hu, 2012) and the impact of productivity (Ambec, 2008).



Thirdly, Influencing factors of enterprise export mode. These scholars have diversified studies on the influencing factors of export model, including institutional and environmental factors (Blue Hailin et al., 2010), productivity (Ahn, Khandelwal, & Wei, 2011; Li Chunding, 2015), characteristics of management (Bo Bemhard Nielsen, Sabina Nielsen, 2011), financing ability factors (Yang & Xu, 2015), enterprise-scale, and innovation ability factors (Ma, 2014).

From the existing literature, the existing research results still have the following shortcomings: First, there is no unified CEP evaluation system in line with China's economic development level; Second, the research on the economic consequences of CEP mainly focuses on financing capacity and productivity, while the research on the influencing factors of export mode mostly focuses on enterprise productivity and scale, and few studies directly combine CEP with export mode choice.

Based on the above analysis, this paper, based on the heterogeneity trade theory, uses the productivity transmission mechanism to link the CEP with the choice of export mode directly. The specific objectives of this research are: To understand the current situation of the environmental performance of enterprises in China; To synthesise the effects of CEP on enterprise export model; Design the overall improvement of CEP, optimise the export mode of enterprises and enhance the international competitiveness of the countermeasures and suggestions.

This study tries to make contributions in the following aspects. From theory, this paper is on the enterprise environmental performance evaluation system and the study of the economic consequences. It is the study of factors affecting the export model, a combination of both the theory of environmental accounting and heterogeneity crossover study contents of trade theory that also help to improve the heterogeneity enterprise trade theory research on the applicability of Chinese enterprises. On the one hand, it can provide a basis for the policy formulation of relevant government departments from the perspective of management. A direct export is more advanced than that of indirect exports value realisation ways. In order to optimise the export model of enterprises, improve the international competitiveness of enterprises, to better promote the development of an international strategy to provide a scientific and reasonable platform, the government is in urgent need of the related studies that provide the basis for policymaking. This study can provide data basis for the policy making of government departments. On the other hand, by analysing the positive economic consequences of CEP's improvement, this paper provides a powerful support for China's export enterprises to actively improve CEP and expand direct exports to achieve higher returns of enterprise value.

2. THEORETICAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

So, what affects corporate productivity? Scholars believe that productivity is the result of firms' self-selection. If the productivity of an enterprise is the same at the beginning of its establishment, the enterprise can independently choose technology, labour force, capital, etc., and thus the differences in productivity levels between enterprises are generated (Jing, 2019). Similarly, firms are free to choose between environmentally friendly action or inaction and between high-quality action and low-level action, which affects their productivity. Under the concept of total factor productivity, productivity including physical factor productivity (such as capital, labour and land productivity of) and intangible factor productivity (productivity of technology innovation and management innovation) (Feng, 2016), enterprise environmental performance mainly affects intangible factor productivity:

(1) management innovation boosts productivity. Needs good CEP through the establishment of environment management skills, management systems and practices, and environmental management systems to optimise the environment of enterprise resource integration, reduce the probability of environmental accidents, thus reducing environmental compliance costs. This kind of environment management innovation allows the enterprise, in the face of environmental regulatory pressure, to form a unique competitive advantage.

On the other hand through good environmental management set up it can: develop a "green" image to improve the corporate reputation; improve employee satisfaction; improve employee satisfaction; get money at a lower cost in the capital markets; improve customer "loyalty" as the customer attaches great importance to the case of "green mark", this kind of "loyalty" is stronger.

(2) Technological innovation improves productivity. Enterprises' investment in environmental protection will bring the innovation of new products, new technologies and new processes. On the one hand, it can reduce the amount of energy used and improve the efficiency of using other resources. On the other hand, through clean technologies, it can reduce waste management costs and achieve energy conservation and emission reduction. CEP performance impacts enterprise productivity through the "dual-core" mode of management innovation and technological innovation.

Based on the above analysis, it can be seen that there is a causal logic relationship between CEP and export mode, and enterprise environmental management innovation and environmental technology innovation affecting enterprise productivity, which effects enterprise's choice of export mode. According to the Heterogeneous Firm Trade Theory, firm productivity is the key factor that determines the choice of export mode. If the firm's productivity is low, it can enter the international market through trade intermediaries; if productivity is high, it can choose to export directly to realise its value better. Accordingly, the hypotheses proposed in this paper are as follows:

H₁: Enterprises with higher CEP are more inclined to choose direct export mode; On the contrary, enterprises with lower CEP are more inclined to choose the indirect export mode.

3. METHODS

3.1 Variable Measurement and Definition

3.1.1 Enterprise Export Mode

This paper assesses the export enterprises in Maoming City as the object of investigation and analysis. According to the investigation, there are only two direct export and indirect export cases, and the number of mixed exports is minimal and unrepresentative. Therefore, this paper adopts two export modes, namely direct export and indirect export. We set a dichotomy dummy variable EM, where EM=0 indicates an indirect exit and EM=1 indicates a direct exit.

3.1.2 CEP

The disclosure of corporate environmental information, especially the disclosure of quantitative data, is seriously lacking in China, so it isn't easy to select proxy variables for corporate environmental performance. The variables selected by scholars are not uniform, which can be mainly divided into three categories: (i) single variable. For example, the discharge fee of unit operating income (Yang, 2019; Hu, 2012) and environmental strategy (Tang, 2019) as proxy variables of CEP; (ii) use multivariate as substitute variable. For example, the CEP is represented by whether it has been punished for excessive emissions and the type of punishment (NYU, 2011); whether it has passed the ISO140001 certification and received environmental punishment is taken as proxy variables (Wang, 2012); the environmental



protection level of the enterprise's products and the reputation of the society for the products are taken as proxy variables (Cheng, 2012). (iii) the comprehensive scoring results were used as proxy variables. For example, the environmental performance index is constructed from resource and material consumption, pollutant control and treatment, and environmental protection investment to comprehensively reflect the environmental performance level of enterprises (Chen & Chun, 2013).

The third point of view is adopted in this paper. Firstly, the index system of enterprise environmental performance evaluation is constructed from three aspects: enterprise environmental management innovation performance, enterprise environmental technology innovation performance and energy conservation and emission reduction performance. Then, weighting and scoring were given to each index, and the comprehensive scoring results were calculated. Finally, the comprehensive scoring results are used as proxy variables of corporate environmental performance.

The construction of specific enterprise environmental performance indicators is as follows:

(1) Environmental technology innovation indicators. For the whole enterprise, environmental investment is all the input index of its environmental performance, but it is directly related to enterprise environmental technology and environmental management innovation. In the environmental protection investment, investment in research and development is taken as the investment in environmental protection technology. The ratio of environmental protection technology investment to operating income is taken as the investment index of environmental protection technology innovation performance. The ratio of other environmental protection investment, excluding environmental protection technology investment to operating income is taken as the investment index of environmental management innovation performance. The direct output index of environmental technology innovation performance is reflected by environmental technology innovation achievements and environmental product research and development.

(2) Environmental management innovation indicators. The output indicators of environmental management innovation performance are mainly establishing the environmental management system, the training of environmental protection personnel and the construction of green industrial chain, etc. The negative output of environmental violation is the negative output.

(3) The spill over efficiency of environmental technology and management innovation. Environmental technology and environmental management activities on enterprises' production process, which will bring benefits of energy conservation and emission reduction. Therefore, the comprehensive utilisation rate of "three wastes", the operation rate of environmental protection equipment and the implementation of cleaner production is taken as the input indicators of energy conservation and emission reduction of enterprises. In terms of output indicators, the performance of energy conservation and emission reduction is mainly the reduction of energy consumption and resource usage and the reduction of "three wastes" emissions, including comprehensive energy consumption per ten thousand yuan of output value and "three wastes" emissions per ten thousand yuan of output value.

(4) The weighting of each index. The weighting methods include subjective weighting methods (such as analytic hierarchy process) and objective weighting methods (factor analysis method). Due to the short time of enterprise environmental performance implementation and lack of historical data, it is difficult to adopt an objective weighting method. The index system related to environmental performance is complex. Therefore, this paper adopts the analytic hierarchy process to weighting environmental performance indicators. The relative weight and final ranking value of each index calculated by the analytic hierarchy process software (YAHP version 0.6.0) are shown in Table 1 for their meanings and weights.

In accordance with relevant national laws and regulations, ISO14031 standard and relevant industry regulations, the CEP indicators are divided into four levels. We invited 16 experts, 7 professional teachers in colleges and universities and 9 senior managers in enterprises, to score according to the collected data combined with the scoring level. Finally, the specific score of each index was obtained by an arithmetic average score of each expert.

According to the specific score and weight of each index, the score of CEP can be calculated by the formula as follows:

$$CEP_i = \sum W_i P_i \quad (1)$$

Where W_i represents the weight of the i th index, and P_i represents the score of the i th index. The CEP score can be calculated from formula 1.

3.2 Model

According to the characteristics of variables, the export model of explained variables is measured by classification indicators. If the enterprise environmental performance is directly measured by scores, it is a continuous variable. Binary Logistic regression model is adopted. The model is constructed as follows:

$$\text{Logit}[p(\text{EM}_i=k)]=\ln[p(\text{EM}_i=k)/1-p(\text{EM}_i=k)]=\alpha+\beta_1\times\text{CEP}_i+\beta_2\text{Control} \quad (2)$$

Where k represents the export mode, with a value of 0,1. CEP_i represents the score of enterprise environmental performance, and Control represents the Control variable.

At the same time, in order to further verify the results of Equation (2) and to understand the more detailed impact of CEP on export mode, we divide the scores of CEP into four different groups to test the impact of CEP on export mode under different groups. We use CEP_0 , CEP_1 , CEP_2 and CEP_3 respectively CEP for "failed", "pass", "good" and "excellent". The grouping of the four groups of standard for CEP score less than 60 points, is greater than or equal to 60 points less than 70 points, is greater than or equal to 70 points is less than 80 points, and is greater than or equal to 80, the assignment of 0, 1, 2 and 3.

The model we built is as follows:

$$\text{Logit}[p(\text{EM}_i=k)]=\ln[p(\text{EM}_i=k)/1-p(\text{EM}_i=k)]=\alpha+\beta_1\times\text{CEP}_1+\beta_2\times\text{CEP}_2+\beta_3\times\text{CEP}_3+\beta_4\text{Control} \quad (3)$$

In the model, we take the enterprises with "failing" CEP as the reference, so CEP_0 is not included in the model test. If β_1 is greater than zero, it means that the enterprise environmental performance has a positive impact on the export mode, if $\beta_3>\beta_2>\beta_1$ indicates that enterprises with higher CEP are always more inclined to export directly than those with lower CEP.

3.3 Data Collection

This paper takes the import and export enterprises in Maoming City as samples, collects data from 327 enterprises by means of questionnaire survey and telephone interview, of which 13 enterprises have incomplete data, and the remaining 304 enterprises participate in data analysis.



According to the situation of enterprises, the export mode is divided into direct export and indirect export. We also collected information related to enterprise environmental performance and used analytic hierarchy process (AHP) to calculate enterprise environmental performance score.

4. RESULTS OF THE FINDINGS

4.1 Descriptive Statistics

From the enterprises' survey, of 304 enterprises surveyed, direct export account for 45.72% (139 companies) and indirect export account for 54.28% (165 companies). Among these 304 enterprises, only 5 enterprises scored more than 80 in CEP, accounting for only 1.64%. 109 enterprises (accounting for 35.86%) scored between 70 and 80. In comparison, 183 enterprises (accounting for 60.19% of all enterprises) scored between 60 and 70, indicating that the CEP of most enterprises in Maoming City has reached the pass level, but is not yet good. The minimum value of CEP score of enterprises is 55.42 points, and the maximum value is 85.63 points. There is a big difference between the maximum and minimum value, indicating that enterprises have a big difference in CEP.

Table 1 CEP Evaluation Index and Weight				
CEP	The secondary indicators	Specific indicators	Interpretation of indicators	Weight
	EEnvironmental Technology Innovation A ₁	Environmental technology investment ratio b ₁	Ratio of investment in environmental technology to revenue	0.1637
		Innovation achievements of environmental technology b ₂	Number of environmental technology innovations and inventions	0.0819
		Research and development number of environmental protection products b ₃	The number of green products that have been successfully developed by the enterprise is marked	0.0819
	Environmental Management Innovation A ₂	Proportion of investment in environmental management b ₄	The total amount of investment in environmental protection after deducting investment in environmental protection technology divided by the business income of the enterprise	0.1017
		Environmental management system b ₅	Establish environmental management system in accordance with ISO14031 standard and obtain certification	0.1541
		Environmental protection training hours b ₆	Enterprise environmental protection training hours per capita	0.0302
		Green industrial chain b ₇	Enterprises implement "green procurement", "green production", "green sales", "green logistics" and so on	0.0496
		Environmental violation b ₈	Number of environmental violations by enterprises	0.0770
		Cleaner Production Execution b ₉	System and implementation of cleaner production	0.0359

Environmental innovation benefit A ₃	Operation rate of environmental protection equipment b ₁₀	Ratio of environmental protection equipment running time to production starting time	0.0312
	Comprehensive utilisation rate of "three wastes" b ₁₁	Ratio of utilisation ratio of "three wastes" to emissions	0.0237
	Comprehensive energy consumption per ten thousand yuan of output value b ₁₂	The energy consumption of ten thousand yuan of output value is converted into standard coal	0.1051
	Emission of "three wastes" per ten thousand yuan of output value b ₁₃	Total discharge of wastewater, waste gas and solid waste of ten thousand yuan of output value	0.0640

Table2 Descriptive Statistics

Variables	Sample size	Minimum	Maximum	Mean	Standard Deviation
CEP	304	55.42	85.63	68.9786	4.35120
Export Model	304	0.00	1.00	0.4671	0.49974

4.2 Model Regression Results

According to Equation 2, when the CEP score of an enterprise is used as its proxy variable, the independent variable is a continuous variable. The results of testing the influence of the CEP on the export mode are shown in line 2 of Table 3. The B value and constant term value in column 1 are linear, which is convenient for us to test the significance. However, compared with linear regression, the coefficient of binary logistic is smaller. According to the binary Logit model, then

$$\text{Logit}[p(\text{EM}_i=k)] = -8.305 + 0.118 \times \text{CEP}_i \quad (4)$$

The results show that enterprises with better CEP are more inclined to choose direct export mode, and P value less than 0.05 indicates that the result is significant. Columns 3 to 6 reflect the test result of Equation 3, which is expressed linearly as:

$$\text{Logit}[p(\text{EM}_i=k)] = -1.792 + 1.404 \times \text{CEP}_{1i} + 2.103 \times \text{CEP}_{2i} + 3.178 \times \text{CEP}_{3i} \quad (5)$$

The above result has the same meaning as the result of Equation (4).

Table3	Binary Logistic Regression Results			
	B	Exp(B)	95%,C.I.for Exp(B)	
			Lower	Upper
CEP	0.118	1.126	-----	-----
Constant	-8.305	-----		
CEP (1)	1.404	4.073	0.480	34.535
CEP (2)	2.106	8.217	0.956	70.606
CEP (3)	3.178	24.000	1.140	505.193
Constant	-1.792	-----	-----	-----

However, in logistic regression, the coefficient in column Exp(B) is easier to explain. It reflects the change rate of Odds' occurrence ratio caused by the change of the independent variable by 1 unit. In the second line of Table 3, Exp(B) is 1.126, which indicates that when CEP changes by 1 unit, the Odds ratio will change by 1.126 unit, indicating that the higher the CEP is, the more inclined it is to export directly. This feature is even more evident when we use grouping variables for CEP. For example, see lines 4 through 5 in Table 3. CEP1 is CEPO as a reference object, the CEP Exp of (1) (B) a value of 4.073, says in the case of other conditions remaining unchanged, the occurrence ratio of direct export of enterprises with a CEP score of 60 to 70 is 4.073 times that of enterprises with a CEP score of less than 60. The Exp(B) value of CEP2 is 8.217, indicating that the occurrence ratio of direct export of enterprises with a CEP score of more than 70 and less than 80 is 8.217 times that of enterprises with a CEP score of less than 60. So, at a P value of 5%, $24 > 8.217 > 4.073$ indicates that compared with enterprises with "failing" environmental performance, enterprises with "passing", "good" and "excellent" environmental performance have an increasing tendency to choose the direct export mode. CEP enterprises with "excellent" environmental performance have the strongest tendency to choose direct exports, which is higher than other enterprises. Hypothesis 1 is true.

5. THE RESEARCH CONCLUSION AND POLICY MEANING

Enterprise environmental resources are one of the main heterogeneous resources of enterprises. Environmental resources can improve CEP and influence enterprise productivity through



management innovation and technology innovation, which is the enterprises' innovation value. According to the heterogeneity firm trade theory, firm productivity affects export mode choice, so foreign trade enterprises should choose the appropriate export mode according to their own CEP status to maximise the value of the enterprise. This paper analyses the relationship between CEP and export mode selection from micro-enterprises, takes foreign trade enterprises in Maoming City as the object, and constructs the CEP evaluation system by the analytic hierarchy process (AHP), and carries out the empirical test according to the score results of the evaluation system as the proxy variable of CEP. It is found that the higher the CEP of foreign trade in Maoming, the more inclined it is to choose the direct export mode, and the lower the CEP, the more inclined it is to choose the indirect export mode.

The conclusions of this paper has important implications for the government to formulate relevant policies. The higher the CEP, the more conducive it is to the transition from indirect export to direct export mode, so we should actively start from environmental technology and management innovation to improve environmental benefits to improve the overall CEP.

In April 2014, known as "the history of the most severe environmental law" of new environmental laws, a substantial increase in pollution enterprise's responsibility and penalties were introduced. The Environmental Protection Tax Law, which was formally implemented in 2018, is China's first tax law that specifically embodies the "green tax system" and vigorously promotes the construction of ecological civilization. The introduction of these two laws has further increased the environmental risks faced by enterprises and made it more costly for enterprises to violate environmental laws. This requires enterprises to strengthen environmental protection and environmental management strategy should be brought into the enterprise development strategy. Promoting an enterprise's environmental performance can achieve green development in an all-round way. On the other hand, the government departments in accordance with the law to strengthen the management of environment at the same time, also want to practice to improve the CEP, such as the preferential tax policy and the financial markets "green" loan ratio. In this way, enterprises can achieve higher CEP through the guidance and incentive of environmental policies, to better cope with the foreign green barriers, expand enterprise direct exports and get a high value return.

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