

The Environmental Effect of Zhejiang's Foreign Trade Against the Background of Internet Plus ——An Empirical Analysis Based On Simultaneous Equation Models

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Abstract. Based on the perspective of Internet plus, this paper constructs a simultaneous equation model which includes e-commerce dependence degree for the external trade environment. The panel data of 11 major cities in Zhejiang Province from 2008 to 2015 are selected for empirical analysis. The research shows under the Internet plus, the three determining economic composed of the scale effect, composition effect and technique effect all have positive effects on the SO2 pollution emissions. The scale effect is significantly positive, indicating that the increase in SO2 emissions will be caused by the expansion of production scale and then affects the environment; on the contrary, the estimation of composition effect and technique effect are significantly negative, indicating that to some extent foreign trade helps to protect the environment and helps to reduce SO2 pollution emissions. In general, the development of cross-border e-commerce in Zhejiang Province promotes the traditional trade in bottleneck period to transform and upgrade, which helps to improve the environment.

1.INTRODUCTION

The "Silk Road" emphasizes that in the process of developing foreign trade, and it is necessary to highlight the concept of ecological civilization. Foreign trade and environmentally sustainable development have always been the hotspots of academic research. With the advent of the "Internet plus" era, the rapid development of cross-border e-commerce has promoted the transformation and upgrading of the traditional foreign trade industry. As the third batch of China's free trade zone, Zhejiang Province is a typical foreign trade province and also an e-commerce guide. In 2017, the total import and export volume of cross-border e-commerce in Zhejiang reached 60.39 billion yuan. Under the "Internet plus" background, the Internet not only has the function of collecting and transmitting information, but also a vital innovation factor for improving traditional trade management. It has the significance of transforming and upgrading the traditional trade structure, constraining international trade rules and expanding global market. How to deal with the opportunities and challenges of cross-border e-commerce and how to promote the development of foreign trade economy while taking into account the environment will be the main research direction of Zhejiang's future foreign trade. Based on the theories, this paper uses the simultaneous equation model to explore the relationship between Zhejiang's foreign trade and the environment



under the "internet plus" background.

At present, scholars believe there are two different views on trade and environmental relations.

Table 1: Basic views

Basic	representative literature	,main conclusion	
points			
Trade favorable	Anderson, Blaekhurst(1992), Bhagwati(1993), Stevens(1993), Selden, Song(1994), Beghin,	1.Free trade is conducive to emission reduction and can improve the efficiency of environmental resource allocation;	
theory	Potier(1997), Strutt, Anderson(1999), Hector	2.Free trade can reduce trade restrictions that are adverse to environmental protection;	
	R.Torres(1999), Lee and Roland-Holst(2000),	3.Free trade will promote the economy, raise welfare levels, and increase the capital of environmental protection;	
	Antweiler, Copeland, aylor(2001), Dean(2002)		
		4.Free trade pushes environmental protection	
		technology, and it can control and improve environmental problems	
Trade	Copeland and Barrett(1994), Daly, Goodland	1.Free trade has expanded the scale of economic activities, increased the use of non-renewable	
harmful	(1994), Ekins(1994), Chilchinliksy(1994),	resources, and also consumed too many renewable	
theory	Taylor (1994), Lopez(1994), Esty and	resources, causing environmental damage; 2.Free trade enables developing countries to lower	
	Geradin(1997), Dua, Esty(1997), Managi,	environmental standards and gain a comparative advantage, which is adverse to the environment ;	
	hibiki and Tsurumi(2009)	3.Free trade increases trade volume, accelerates	
		energy consumption and damages the environment.	

The above two views are one-sided and absolute. Grossman, Krueger (1993)^[1] and Panayotou (2000)^[2] further concluded that the relationship between the impact of free trade on the environment could not be unified because it is a common effect influenced by many aspects. Liminghong(2011)^[3] find that environment in China benefit from the trade liberalization regime and export-oriented strategy. However, Frankel and Jeffrey A.^[4] confirmed that trade likely to reduce three index of air pollution while not notable in other indexes ,and could not find evidence for the determination effect of the trade on environment. Most scholars believe that free trade will have a negative impact on production in the short term, but in the long run the relationship between them is positive.

Grossman, Krueger (1993) distinguishes the impact of free trade on the environment by three aspects: scale effect, composition effect and technology effect, constructing a basic analysis framework of environmental effect theory. In 1994, the OECD added the product effect to the environmental effect of international trade, which was divided into four aspects and extended the theory. Later, many scholars used the typical three-effect basic framework of scale, composition and technology to study the environmental effects of free trade. Dean (2002)^[5] adopted China's provincial water pollution data, based on the environmental three-effect simultaneous equations, which indicates that trade liberalization directly intensified the environment worsening. Jie He (2006)^[6] also analyzed the relationship between foreign direct investment and carbon emissions by using the industrial data of 29 provinces in China through the simultaneous equations. The results show that the impact on emissions is small, and the technical effect enhances the level of pollution control technology to reduce pollution emissions. The scale effects increase pollution emission, and structural effects are less affected.

In another example, xiaobo gao^[7] also takes advantage of the "environmental three effects" analysis framework, using the data of 30 provinces and cities in China. He constructs environmental pollution indicators and models, and believes that all three factors have an impact on the



environment, nevertheless the scale and technology on carbon emissions is more important. From the existing research literature, few scholars have included Internet elements as influencing factors in the model. With the changes of the Internet, the impact of cross-border e-commerce development on the scale and composition of Zhejiang's foreign trade cannot be ignored. Therefore, based on the Internet+ perspective, this paper draws on Dean (2002) simultaneous equations to construct a model for foreign trade environmental effects via quantitative tests.

2. RESAERCH DESIGN

(1) Model establishment and variable selection

This paper will draw on Dean's (2002) simultaneous equations, based on the analysis of "environmental three effects", adding e-commerce dependence to construct a simultaneous equation model. It describes the environment effect of foreign trade under "internet plus" background :

$$lnZ_t = C_{10} + C_{11}lnS_t + C_{12}ln\varphi_t + C_{13}lne_t + C_{14}lnT_t + C_{15}lnEEC_t + C_{16}lnFDI_t + \mu_t$$
(1)

$$lnS_t = C_{20} + C_{21}lnK_t + C_{22}lnL_t + C_{23}lnF_t + C_{24}lnZ_t + \mu_{2t}$$
(2)

$$ln\varphi_t = C_{30} + C_{31}ln(K_t/L_t) + C_{32}lnR_t + C_{33}lnT_t + C_{34}lnEEC_t + C_{35}lnFDI_t + \mu_{3t}$$
(3)

$$lne_{t} = C_{40} + C_{41}lnS_{t} + C_{42}lnT_{t} + C_{43}lnEEC_{t} + lnFDI_{t} + \mu_{4t}$$
(4)

(Note: t indicates a different year)

Equation (1) represents the pollution equation. According to Grossman and Kruger (1991) environmental effects theory, this paper divides the impact of foreign trade on the environment into four parts: scale effect (S_t), composition effect(φ_t), technical effect(e_t), pollution emission (Z_t), which is used to describe economic determinants of pollution emission under "internet plus" era. In addition, this paper adds three variables: e-commerce dependence(*EECt*), foreign direct investment

 (FDI_t) and foreign trade dependence (T_t) in order to response the degree of trade openness. The indicators measure the direct impact of foreign trade on the environment.

endogenous variables	Indicator name	
Z_t	pollution emission	
S_t	Scale effect	
$arphi_t$	Composition effect	
<u> </u>	technical effect	
exogenous variables	Indicator name	
T_t	Foreign trade dependence	
EEC_t	E-commerce dependence	
FDI_t	Foreign direct investment flow	
F_t	Foreign direct investment stock	
K_t	Domestic capital investment	
L_t	Labor input	
K_t/L_t	Capital labor ratio	
R_t	Government environmental regulation	

Table 2: variables

Equation (2) is the output equation of scale effect, using E-commerce, foreign capital and environmental factors in the traditional economic output model. The output equation mainly included foreign direct investment stock (F_t) and pollution emissions (Z_t) . The output function of this paper is domestic capital investment (K_t) , labor input (L_t) , foreign direct investment stock (F_t) and pollution emission (Z_t) .

Equation (3) is a composition equation, and the trade structural effect is related to the country's resource endowment. Foreign trade made exporting countries more specialized in their comparative

advantage parts, so that the allocation of resources among these countries can be maximized and have a positive effect structure. Therefore, in this composition equation, this paper introduces foreign trade dependence(T_t) and Foreign direct investment flow (FDI_t) to verify the impact of externalities on industrial structure, and the variable E-commerce dependence (EEC_t) was added. At the same time, the Government environmental regulation (R_t) in this the equation was to verify whether the differences in government policies would have a significant impact on industrial structure changes. The paper also selects the capital labor ratio (K_t/L_t) to reflect the changes in the industrial structure.

Equation (4) analyzes the technical effect in equation. Firstly, the economic growth factors (St), it will naturally increase people's requirements for environmental quality, thus forcing to improve environmental standards and strengthen environment regulations to develop a clean and healthy environment. Secondly, foreign trade dependence(Tt) will be positively related to the degree of liberalization in this country. Trade will indirectly affect the environment through economic growth, and will also use import trade to introduce advanced pollution control equipment and prevention technologies. Thirdly, foreign direct investment(FDI_t) has the technology spillover; on the other hand, the inflow of foreign capital will bring cleaner technology.

Finally,e-commerce dependence (EEC_t) , with the maturity of e-commerce platforms, the rise of cross-border e-commerce in recent years has had a significant impact on foreign trade. Between foreign trade process, it saves the cost of trade, improves production efficiency, and plays a promotion role in the trade structure, affecting the environment indirectly.

(2) Sample selection and data sources.

To obtain more accurate data, this paper uses the panel data of 11 major cities in Zhejiang Province from 2008 to 2015. "Zhejiang Natural Resources and Environment Statistical Yearbook", "Zhejiang Statistical Yearbook" and the "City Statistical Yearbook" are the main data sources.

The industrial SO₂ emissions of the sample cities in Zhejiang Province are expressed by $Z_j = \left[\frac{Y_i}{Y}\right]$. The emissions of each city are calculated by weighting the city's share of the province. The

gross industrial output of each city is used to measure the scale effect.

The composition effect of this paper by $\Omega_{jt} = \left|\frac{Y_{ijt}}{Y_{it}} \times \omega_{i,0}\right|$. The $Y_t J_t$ indicates that is in j province and i city in 11 cities' t-year GDP. $\omega_{i,0}$ indicates that the emission intensity of each of the 11 cities.

Considering the technical effect(e_t), there are many uncertain factors. This paper mainly uses the capital stock of the urban industrial sector invested in environmental governance from 2008 to 2015. E-commerce dependence(*EEC*_t), the proportion of e-commerce transactions account for each city the total import and export trade in Zhejiang Province to use in this paper.

3.EMPIRICAL ANALYSIS

The dynamic GMM method used in this paper includes endogenous variables, exogenous variables and lag terms of dependent variables. It estimates the simultaneous equation model used in this paper, which eliminates the possible fixed effects and sequence correlations in each city data. This method is the best choice for this article, both in terms of efficiency and scope of application. This paper also uses White's heteroscedastic covariance method to solve the heteroscedasticity problem. The model calculation uses Eviews8.0 software, and the results are as following:

variable	Pollution emission $(\ln Z_t)$	scale effect(lnS _t)	Composition effect $(\ln \varphi_t)$	Technical effect $(\ln e_t)$
lnZtLag term	-0.318** (5.876)	-	-	-
lnStLag term	-	0.522*** (9.768)	-	-
lnφt lag term	-	-	-0.326*** (3.736)	-
$\ln Z_t$	-	-	-	-0.438* (6.289)
$\ln S_t$	-	0.728 (2.378)	-	-
$\ln \varphi_t$	1.839*** (3.352)	-	-	0.462*** (5.215)
lne_t	-2.326*** (-2.125)	-	-	-
$\ln K_t$	-1.015*** (-1.735)	-	-	-
$\ln L_t$	-	0.167*** (3.836)	-	-
$\ln F_t$	-	0.183 (0.889)	-	-
$\ln K_t/L_t$	-	0.278*** (2.785)	-	-
$\ln R_t$	-	-	0.328*** (3.898)	-
ln <i>FDI</i> t	-	-	-0.052*** (-2.721)	-
$\ln T_t$	0.013*** (1.787)	-	-0.076*** (-3.697)	0.168*** (3.584)
ln <i>EEC</i> t	0.015*** (3.018)	-	-0.067** (-4.879)	0.235*** (4.375)
Autocorrelation	-0.012** (5.638)	-	-0.058** (-4.686)	0.098** (5.685)
$\ln Z_t$	-0.428** (8.76)	-7.217*** (8.71)	-0.605** (9.15)	-3.25*** (3.72)

Table3: Simultaneous equation model estimation resut

Note:(***, **, and * indicate the level of significance of 1%, 5%, and 10%, respectively, and the value of t in the brackets is the estimated coefficient)

From the estimation results in Table 3 have the goodness of fit. Under the "Internet plus", the three factors scale, composition, and technology decide that pollution SO₂ emissions are significant. The scale impact is significantly positive that the increase in SO₂ emissions will be caused by the expansion of production scale, which affects the environment; on the contrary, the composition effects and technical effects are significantly negative, indicating that foreign trade contributes to the protection of the environment, which is advantage to reduce SO₂ emissions. Foreign trade also has a direct impact on the environment. Foreign direct investment($lnFDI_t$) and foreign trade dependence(lnT_t) coefficient are positive , and these two indicators will increase So₂ emissions. It is known that for every 1% increase in foreign direct investment in Zhejiang Province, the total SO₂ emissions will increase by 0.013%. On the contrary, the coefficient of e-commerce dependence($lnEEC_t$) is significantly negative, indicating that for every 1% increase in e-commerce dependency, the total SO₂ emissions will reduce 0.012%.

The estimation results from equation (2) show that the increase of total industrial output under the Internet plus caused by foreign direct investment; the pollution emissions are significantly positively correlated, and the expansion of production scale will affect the environmental deterioration to some extent from the equation (3). The estimation results also show that the coefficient of e-commerce dependence ($\ln EEC_t$) is significantly negative, indicating that under the Internet plus, the development of cross-border e-commerce promotes the transformation and upgrading of traditional trade, thus improving the environment.

In addition, there is a significant negative correlation between foreign direct investment($\ln FDI_t$) and foreign trade dependence($\ln T_t$), indicating that trade division of labor: is conducive to the transformation on the industrial structure, thereby reducing emissions. There is a significant negative correlation between environmental regulations($\ln R_t$), which also indicates that stronger environmental regulations can help reduce pollution emissions and shift to a clean industrial

structure.

The estimation results from equation (4) show that, firstly, for every 1% increase in economic scale, technology investment will increase by 0.462%. The growth of economic scale is advantage to the improvement of environmental protection technology and pollution technology; Also, free trade has certain positive energy to technology, e-commerce Dependence and foreign direct investment. For example, foreign direct investment(ln*FDI*_t) increased by 1%, technical level increased by 0.168%; e-commerce dependence increased by 1%, technical effect increased by 0.098%; foreign trade dependence(ln*T*_t) increased by 1 %, the technical effect increased by 0.235%. In summary, the increase in technology investment in foreign trade in the context of Internet+ is conducive to the advancement of technology and the reduction of SO₂ emissions.

4. CONCLUSIONS AND RECOMMENDATIONS

(1)Main conclusions

Under the Internet plus background, this paper constructs a simultaneous equation model to explore the external trade environmental effects, and selects the data of 11 major cities in Zhejiang Province from 2008 to 2015 for empirical analysis. We have the following conclusions:

Firstly, under the background of Internet plus, the direct impact of foreign trade on SO_2 emissions are measured by foreign direct investment($lnFDI_t$), foreign trade dependence(lnT_t), and e-commerce dependence($lnEEC_t$). Among them, the coefficient of foreign direct investment and foreign trade is significantly positive, illustrating that the external trade and foreign direct investment will directly affect the expansion of domestic industry scale, then increasing SO_2 emissions; on the contrary, the coefficient of e-commerce dependence is significantly negative, and Internet plus is conducive to the transformation and upgrading of traditional trade at bottleneck. period, thus making the environment clean change.

Secondly, under the background of Internet plus, the indirect effects of three economic determinants to SO_2 emissions are all significant. The impact of scale is positive, illustrating that the growth of foreign trade has led to the growth of economic aggregates, the expansion of production scale, and increase in SO_2 emissions; on the contrary, the impact of technology and composition effects is negative, indicating that foreign trade will promote professional division system and benefit industrial structure, which can effectively reduce SO_2 emissions.

Thirdly, under the background of Internet plus, combining the direct and indirect effects of foreign trade on pollution emissions, we can conclude that the total effect of model analysis is positive. The rise of e-commerce and the development of cross-border e-commerce have prompted the transformation and upgrading of traditional industries, which can reduce SO_2 emissions and have a positive effect on the environment.

(2) Policy recommendations

Firstly, the government should accelerate the transformation and upgrading of Zhejiang's foreign trade and realize the new industrial status of "Internet plus". The development of "Internet plus" has promoted the rise of e-commerce and the change of foreign trade. Therefore cross-border e-commerce is the primary condition for the development of Zhejiang's foreign trade. Combination ZheJiang province industrial characteristics, we should vigorously promote the innovation of cross-border e-commerce, traditional retail industry, financial industry and traditional logistics industry. Foreign trade should improve the green technology content and open up a new era of cross-border e-commerce.

Secondly, improving the development norms of the foreign trade industry and encouraging

traditional enterprises can make full use of "Internet plus manufacturing". The development of foreign trade is based on the support of Zhejiang government policies and funds. For one, the government must establish a comprehensive trade supervision system to improve the management system, establish overseas warehouses, improve the logistics system, and create good cross-border e-commerce atmosphere. The china government can encourage enterprises to carry out cross-border e-commerce business through fund subsidies and tax incentives to guide enterprise innovation.

Thirdly, with the "Internet plus" development trend, the government should encourage enterprises to develop their brands. Under the "Internet plus" era, cross-border e-commerce has promoted Zhejiang's foreign trade to grow in size, increasing brand, quality, service and efficiency. If the enterprise has core technology or high-quality brands, it will be able to increase participation. The level and status of the international division of labor always increase the initiative.

Finally, the government should build an "Internet plus" education and training platform to strengthen the training of cross-border e-commerce talents. Constructing a school-enterprise cooperation platform and cultivating cross-border e-commerce merchants are an important basis for the green transformation and upgrading of Zhejiang's foreign trade.

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