CHEMICAL ENGINEERING TRANSACTIONS
VOL. 59, 2017
A publication of AIDIC
The Italian Association of Chemical Engineering
Online at www.aidic.it/cet
Guest Editors: Zhuo Yang, Junjie Ba, Jing Pan

ISBN 978-88-95608- 49-5; **ISSN** 2283-9216
DOI: 10.3303/CET1759194

Study on the Environmental Effects of Electronic Information Industry in Anhui Province Based on Metering Model of Industrial Waste Gas, Wastewater and Waste

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The electronic information industry is the pillar industry of the national economy in Anhui province, and it plays an important role in economic development. However, in the production process, the electronic information industry has serious environmental problems, so we must attach importance to the environmental protection of electronic information industry. Based on the theory of environmental economics, industrial economics and international economics, the environmental pollution and the current situation of electronic information industry in Anhui province are analyzed. By referring to the previous research results, the new variables are introduced to construct the regression model, and the environmental effects of the electronic information industry in Anhui province are studied. The results show that the electronic information industry has a negative scale effect, positive technical effect and structural effect on the environment of Anhui province, and the scale effect is greater than the technical effect and the structural effect. At the same time, the typical case is further confirmed that the electronic information industry has a negative impact on the environment of Anhui province. Finally, this paper puts forward some countermeasures and suggestions from the perspective of regulations of the compensable use of environmental quality.

1. Introduction

The electronic information industry is not only the pillar industry of the national economy in Anhui province, but also the important industry of foreign direct investment, which plays an important role in the economic development of Anhui province (Ceballos and Dong, 2016). At present, the electronic information industry has been included in China's top ten industrial revitalization plan in Anhui province, and it will remain fast growth in the future (Gu et al., 2016). Through the form of waste water and waste residue, these substances will enter the surrounding environment to pollute the water and soil (Berkhout et al., 2016; Montanaro et al., 2017; Pirozzi et al., 2017; Sotgiu et al., 2017; Rossetti et al., 2017; Lozano et al., 2016; Zhang et al., 2016; Manna et al., 2016). According to statistics, a chip will produce 1.98m3/piece of waste water, 2087m3/piece of exhaust gas and 0.00573t/piece of solid waste. Through the investigation of domestic enterprises, it was found that the proportion of hazardous wastewater in the wastewater was 72.51%, 82.07% in the exhaust gas and 56.87% in the solid waste. Therefore, if we do not attach importance to the environmental protection of the electronic information industry, it will lead to very serious environmental pollution problems (Liu et al., 2016).
In order to promote the sustainable development of electronic information industry in Anhui province, this paper studies the environmental effect of electronic information industry, so as to provide reference for the healthy and healthy development of electronic information industry and environmental protection. In resolving the issue of external environment, the economical method can have the bigger benefit drive mechanism and the efficiency elasticity compared to the administrative method, and can internalize the environment exterior cost into the production cost. By analyzing the present situation and market share of the electronic information industry, the internal relationship between the electronic information industry and the environmental pollution is studied.

Please cite this article as: Songfei Wu, Jinhua Fan, 2017, Study on the environmental effects of electronic information industry in anhui province based on metering model of industrial waste gas, wastewater and waste, Chemical Engineering Transactions, 59, 1159-1164 DOI:10.3303/CET1759194

2. Literature review

Studdies on FDI and China's environment pollution problems done by domestic scholars are rarely seen. The present researches believed that FDI has negative effects on China's environment. The loose environment standards for our country are one of the essential factors that attract foreign investment. In 1999, Xia Youfu analyzed the enterprises numbers, gross industrial output value, and the proportion of employees in the foreign-funded enterprises and national pollution intensive industry indexes. The research showed that the foreign direct investment has an obvious pollution diversion tendency. Pan ShenBiao and Yu Miaozhi, based on the data of foreign investment and exhaust emission amount of Jiangsu, Zhejiang, and Shanghai three provinces, made a causality test on the foreign direct investment increase and environmental pollution exacerbating. The test results showed that there is a comparatively obvious cause and effect relationship between the foreign direct investment increase and environmental pollution exacerbating. It indicates that the foreign direct investment increase is one of the factors leading to the environmental pollution exacerbating. Sha Wenbing and Shi Tao made a metering of tte panel data during 1999-2004 of 30 provinces (cities and counties) in China (Li et al., 2016). And they found that FDI has apparent negative effects on the ecological environment. As for the general situation of the whole country, the total capital of three-capital industrial enterprise increases for 1% each time, industrial emissions increase 0.358%. The studies on the eastern, central, and western areas suggested that, the negative effects of foreign direct investment on China's ecological environment showed an obvious gradient feature with high in the east and low in the west.

Grossman and Krueger adopted the general balancing model to decompose the effects of FDI on China's environment into three aspects: scale effect, structure effect, and technology effect, and they established the basic framework of environment effect analysis. In addition, Amdreoni and Levinson point out for the technology effect that, the technology can results in no more increase of pollution and make it decrease with the increase of income (Li and Lo, 2016). On the one hand, technology effect promotes the economic growth mode transforming from epitaxial kind to connotative kind. And accompanied by such kind of transformation, the transformation coefficient between economic activities and investment is continuously improved. On the other hand, the technology effect improves the traditional production means, and the application of clean technologies will reduce the environment consumption in the unit investment and output, which is conductive for the improvement of environment quality.

3. Analysis of environmental effects of electronic information industry

The effect of scale effect on the environment may be positive or negative (Mangiaracina et al., 2016). The positive effect is that with the expansion of investment, the demand for environmental quality will increase. At the same time, the government will increase investment in the environment. The negative effect is that with the expansion of industrial scale, the loss of resources will increase. The relationship between pollution and development is called the environmental Kuznets curve. The current level of income in developing countries is still far from the inflection point, and pollution and resource-intensive production will continue for a long time.

As can be seen from Figure 1 to Figure 3, there is a positive correlation between the change trend of industrial added value and the change trend of wastewater, waste gas and solid waste emissions.

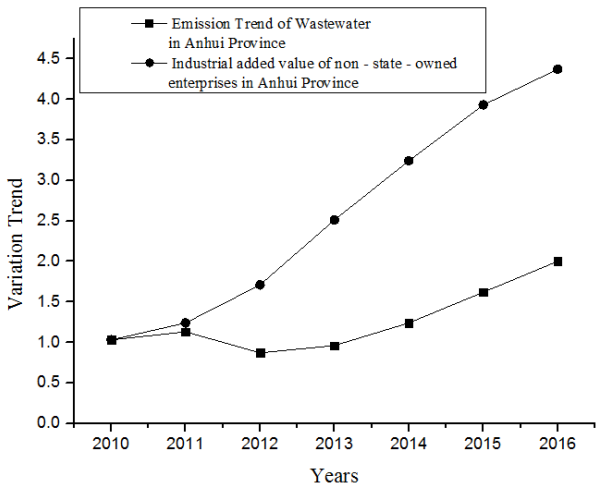

Figure 1: The trend of industrial added value and wastewater discharge of the "three capital" enterprises

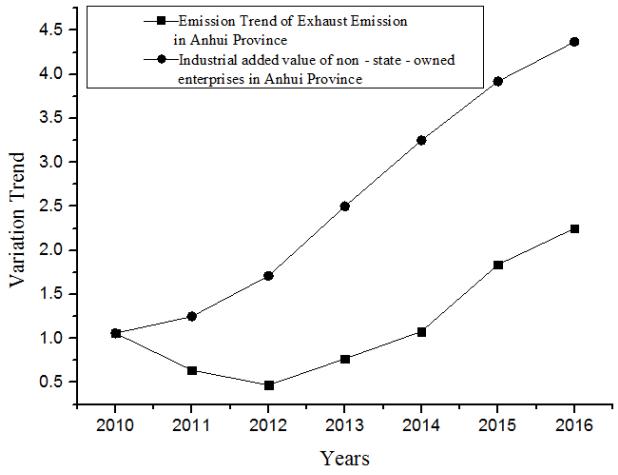

Figure 2: The trend of industrial added value and exhaust emission of the "three capital" enterprises

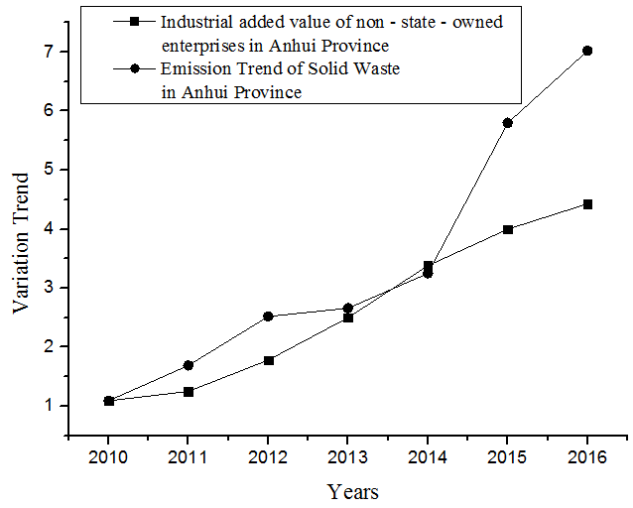

Figure 3: The trend of industrial added value and solid waste discharge of the "three capital" enterprises

4. An empirical analysis on the environmental effects of electronic information industry in Anhui

4.1 Analysis of regression model

In order to further study the environmental effect of the inflow of electronic information industry to Anhui, this paper adopts a function of characterizing the "three wastes" emission of electronic information industry and the related economic indicators of non-state electronic information enterprises and state-owned electronic information enterprises in Anhui province. W represents the "three wastes" emissions of Anhui electronic information industry, F represents the economic indicators of electronic information of non-state enterprises in Anhui province, and D represents the economic indicators of state-owned electronic information enterprises. The emissions from the electronic information industry can be expressed by the following functions:

$$W = f(F, D) \tag{1}$$

If $(\partial w/\partial F)>0$, it shows that there is a positive correlation between the electronic information industry and pollutant emissions, that is, the electronic information industry has a negative effect on the environment. If $(\partial w/\partial F)<x0$, it shows that the electronic information industry has a positive environmental effect on the environment.

This paper uses a function to characterize the technical and structural effects of state-owned enterprises and non-state enterprises in Anhui province on the emission of pollutants in China's electronic information industry, and establish a linear regression model.

$$\ln W_i / K_i = \alpha + \beta \ln D_i / DK_i + \gamma \ln F_i / FK_i + \zeta \quad (2)$$

i=1, 2, *L*, *I* represents the corresponding year, *lnW*$_i$ represents the natural logarithm of waste from the electronic information industry, ln*D*$_i$ represents the natural logarithm of industrial added value of state-owned electronic and communication equipment manufacturing industry in Anhui province, ln*F*$_i$ represents the natural logarithm of industrial added value of non-state-owned electronic and communication equipment manufacturing industry in Anhui Province, *DK*$_i$ represents the total assets of Anhui province state-owned electronic and communications equipment manufacturing industry, *FK*$_i$ represents the total assets of Anhui non-state-owned electronic and communications equipment manufacturing industry, *K*$_i$ represents the total amount of state-owned assets of non-state enterprises in Anhui province, ξi represents the amount of random error, α, β, γ represents the parameter to be estimated.

4.2 Analysis of regression results

Direction and intensity of the three waste discharges are measured. At a confidence level of 95%, the significance was examined.
The regression results of wastewater discharge are shown in table 1.

Table 1: The discharge of wastewater from electronic information industry and the industrial added value of state owned and non-state owned enterprises in Anhui

Year	Wastewater discharge	Industrial added value of state-owned enterprises (100 million yuan)	Total state-owned assets (100 million yuan)	Industrial added value of non-state owned enterprises (100 million yuan)	Total non-state owned enterprises (100 million yuan)
2010	1514	672	392	140	480
2011	1693	683	380	173	561
2012	1321	879	394	242	764
2013	1421	819	405	349	1051
2014	1874	760	397	455	1297
2015	2390	606	312	547	1460
2016	2962	705	355	606	1770

The regression results show that the explanatory variables ln*D/K* and ln*F/K* have passed the significance test. It shows that the state-owned and non-state-owned electronic information enterprises in Anhui have a significant impact on the discharge of electronic information industry wastewater. The statistic of *D-W* is 2.25, so there is no sequence autocorrelation. In the regression equation, β is -0.90. Under the condition that other conditions remain unchanged, the added value of the state-owned assets of the state-owned enterprises in Anhui is negatively related to the discharge of the unit assets. With each increase of 1%, industrial wastewater emissions will be reduced by 0.90%.γ is -3.52, this indicates that under the condition that other conditions remain unchanged, the value added of the assets of non-state-owned enterprises in Anhui province is negatively correlated with the amount of wastewater discharged from unit assets. With each increase of 1%, industrial wastewater emissions will be reduced by 3.52%. From the regression results, we can see that the effect of the technical and structural effects on the environment of the state-owned and non-state-owned electronic information enterprises in Anhui is positive, and the positive effects of the non-state owned enterprises are larger.
(2) The regression result of waste discharge in the production process are shown in table 2.
The regression results show that the explanatory variables ln*D/K* and ln*F/K* have passed the significance test. It shows that the state-owned and non-state-owned electronic information enterprises in Anhui have a significant impact on the exhaust emission of electronic information industry. The statistic of *D-W* is 1.78, so there is no sequence autocorrelation. In the regression equation, β is -1.99. Under the condition that other conditions remain unchanged, the added value of the assets of state-owned enterprises in Anhui province is negatively related to the emission of unit assets. With each increase of 1%, industrial wastewater emissions will be reduced by 1.99%.γ is -4.09, this indicates that under the condition that other conditions remain unchanged, the industrial added value of unit assets of Anhui non state owned enterprises is negatively related to the emission of unit assets. With each increase of 1%, industrial wastewater emissions will be

reduced by 4.99%. From the regression results, we can see that the effect of the technical and structural effects on the environment of the state-owned and non-state-owned electronic information enterprises in Anhui is positive, and the positive effects of the non-state owned enterprises are larger.

Table 2: The emission of electronic information industry in Anhui and the industrial added value of state owned and non-state owned enterprises

Year	Waste emissions during production (100 million cubic meters)	Added value of state-owned enterprises (100 million yuan)	Total state-owned assets (100 million yuan)	Industrial added value of non-state owned enterprises (100 million yuan)	Total assets of non-state owned enterprises (100 million yuan)
2010	101	67	392	140	480
2011	60	68	380	173	561
2012	44	87	394	242	746
2013	76	81	409	349	1015
2014	106	76	397	455	1297
2015	186	60	312	547	1460
2016	225	70	355	606	1770

5. Conclusions

The electronic information industry has negative effect on environment of Anhui province. There is a positive correlation between the industrial added value of the non-state owned electronic information enterprises in Anhui and the discharge of waste water, waste gas and solid waste. The scale effect of the electronic information industry is greater than the environmental externality caused by the technical effect and the structural effect. There is a negative correlation between the industrial added value of Anhui province owned electronic information enterprises and the discharge of waste water, waste gas and solid waste. The growth of state-owned enterprises is small, which mainly shows the positive externalities of the environment brought by technological progress. The environmental effect of non - state - owned enterprises in Anhui province is greater than that of state - owned enterprises. The scale effect of non - state - owned enterprises in Anhui province is higher than that of state - owned enterprises. From the perspective of total assets and industrial added value, the proportion of non-state-owned enterprises in the electronic information industry is greater than that of state-owned enterprises, and its growth rate is higher than that of state-owned enterprises. The technical effect of non-state-owned enterprises in Anhui province is higher than that of state-owned enterprises. The reason is that multinational companies in developed countries and regions rely on their development advantages, and constantly introduce new technologies and products and the development of standards, their technology is ahead of domestic technology. As a result, the non - state owned enterprises of Anhui province electronic information industry have more positive technical effects than state-owned enterprises.

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