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ENTERPRISE GROWTH MODEL: "POLLUTION" OR "ENVIRONMENTAL PROTECTION"

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Abstract

The micro-evidence of the relationship between environmental protection and economic growth is still at the level of descriptive research and case analysis, and it is difficult to reflect the overall relationship between environmental pollution status and enterprise development models. This paper analyzes the sales growth model of industrial enterprises in Hubei Province by using micro data of industrial enterprise observations in 2004 and industrial sales growth rates of 2005-2009, and analyzes the impact of environmental pollution levels on their sales growth rates. The study finds that the "sustainable development" and the "pollution for growth" model co-exist: Enterprises that have not been charged sewage fees have higher sales growth rates, which indicate that environmental protection enterprises can achieve faster development, reflecting the phenomenon of "sustainable development"; among the enterprises that charge sewage fees, the higher the companies pay the sewage fees, the higher the growth rate is, reflecting the "pollution for growth" model. But enterprises cannot increase their sales profits at the expense of the environment, and pollution for growth is not a long-term strategy for business development.

Key words: environmental pollution, pollution growth, sustainable development

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1. Introduction

Industry has been the driving force for China's economic growth. However, industrial progress has brought serious harm to the natural environment and the human living environment. Environmental pollution has become a key factor that seriously hinders the sustainable development of our country. Many enterprises consume substantial resources and energy with the goal of increasing their production capacities.

The traditional process of development that harms the environment is no longer suited to the current economic and social needs (Gong et al., 2019). Therefore, it is important to shift the economic development model from unsustainable to sustainable, from extensive to intensive, and from a "high-carbon economy" to a "low-carbon economy." To accelerate the transformation of the economic model, we need to study the contemporary economic development model. This paper takes Hubei Province as an example to study the economic growth pattern of industrial enterprises and to analyze how environmental pollution affects the sales growth of enterprises, which will allow us to determine the microscopic mechanism of industrial enterprises' growth.

In the past, China's economic growth model has been widely discussed. It is generally believed that there are two growth modes, namely, "sustainable development " and "pollution for growth." Some

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researchers believed that environmental pollution is still an important factor in China's economic growth (Zhao and Xu, 2013), which is known as the "pollution for growth" phenomenon. Others thought that China's economy is consistent with the "sustainable development model" (Liu and An, 2012). It is difficult for these studies, which are based on macro data analysis, to explain the operating behavior of micro industrial enterprises in detail. Therefore, the underlying reasons for China's economic growth have not been elucidated.

In recent years, some scholars have begun to analyze the environmental pollution status and the development model of Chinese industrial enterprises from a micro perspective. Kong (2012) analyzed the upgrading process and influencing factors of enterprises at a micro level through a questionnaire survey of manufacturing enterprises in Zhejiang Province. Zhao and Xu (2013) evaluated the transformation and upgrading of Chinese enterprises since the financial crisis through field surveys and questionnaire surveys. In addition, Shen et al. (2012) used a case study to analyze the impact of environmental pollution incidents on corporate stock prices in Zijin Mining. Zhao (2012) used panel data from the micro level of large and medium-sized industrial enterprises in China in 1996-2009 to study the influence of the introduction of foreign technology and domestic technology on China's economic growth through fixed-effect variable coefficient models. Zhang et al. (2015) analyzed the influence of environmental pollution levels on corporate sales growth in China based on the microscopic data of industrial enterprises.

- However, there are still some deficiencies:
- The research perspective is singular. The corporate economic-environmental system is a large and very complex system. It is impossible for this system to simply include one or two factors. For example, such research cannot explore the relationship between the environmental pollution and corporate economic development models in detail.
- The study only analyzes the two economic development models, and it does not further study the specific methods and measurements for the transition from "pollution for growth "to "sustainable discovery".
- The data is not representative. Although some phenomena can be found through questionnaire surveys and case analysis, it is difficult to reflect the overall situation of Chinese industrial enterprises.

From the micro point of view, this paper takes Hubei Province as an example to analyze the sales growth model of industrial enterprises in order to obtain the evolutionary law of the macroeconomic model. This paper analyzes the environmental pollution problem of industrial enterprises based on whether they are charged pollution fees as well as the amounts of their pollution fees. First, it analyzes whether environmental protection enterprises that are not charged pollution fees can achieve high sales growth rates. Second, it analyzes the enterprises that are charged pollution fees in the *Sub-samples*.

2. Methods

2.1. Concept

There are two types of enterprise economic growth models, namely, "pollution for growth" and "sustainable development". Byrne (1997) found that economic growth occurs mostly at the expense of the environment, resulting in "pollution-for-growth". Tang et al. (2014) consider that investment in environmental protection will promote the improvement of the ecological environment, stimulate domestic demand, and increase employment opportunities. This investment is a necessary condition for sustainable development. China's environmental pollution occurs mainly in the production processes of industrial enterprises. Therefore, the use of the micro-data of industrial enterprises is more suitable for analyzing China's macroeconomic "pollution for growth" and "sustainable development" growth models.

The industrial economy is the main body of China's macro economy. In the long run, the growth in the sales of industrial enterprises is an important force for stimulating macroeconomic growth. Industrial enterprises can obtain good environmental performance by gaining consumer recognition and improving production efficiency. Some actions, including upgrading production equipment, reducing environmental pollution, and reducing waste, can improves the sales growth rate of enterprises, which can correspond to the "sustainable development" macroeconomic development model. If upgrading production equipment is delayed or low-cost and high-polluting production equipment is used to obtain lower production costs, a higher sales growth rate can be obtained. This kind of development model that seeks economic growth by destroying the environment is consistent with the macro development model of "pollution-for-growth".

2.2. Data

The data is obtained from the "China Industrial Enterprise Database" that is published by the China Bureau of Statistics. The micro industrial enterprises data in Hubei Province is used as an example to analyze the impact of environmental pollution on the enterprise sales growth rate. We measure the level of environmental pollution by using emission fees. Among the published data of industrial enterprises from 1995-2013, only 2004 includes data on sewage fees. In addition, the Chinese environmental protection agencies still enforced the "Standard Management Measures for Collection of Pollution Discharge Fees" that was issued in 2003. Therefore, this paper uses Hubei Province's industry enterprise census data from 2004.

According to the survey data of industrial enterprises in Hubei Province from 2005 to 2009, we analyze the influence of collecting pollution fees on the sales growth rates of industrial enterprises after 2004. Although "the China Industrial Enterprise Database" extends to 2013, it is only available to the outside world until 2009, because the data has not been disclosed to the public since 2009. Thus, these data are the most recently available data. The data for 2005-2009 was widely used by some researchers (Bao et al., 2011; Chen et al., 2011; Kotabe et al., 2010), so it is still meaningful to study the data.

This paper merges the census data of Hubei Province in 2004 from the National Bureau of Statistics and the survey data of industrial enterprises in Hubei Province from 2005 to 2009. After deleting missing variables and abnormal variables, there are 1,333 industrial enterprise samples that are finally obtained, of which 578 industrial enterprise samples paid pollution discharge fees.

Table 1 shows the status of the pollution discharge fees that were paid by the industrial enterprise sample. Among all 1,333 industrial enterprise samples, 578 enterprises were levied pollution discharge fees, which accounts for 43.36% of the total sample. A total of 1333 industrial enterprises were charged an average of 13.851 million yuan in pollution discharge fees. There is a substantial difference in the pollution discharge fees that were paid between different companies. The standard deviation is 1.5402, the lowest is 1,000 yuan, and the highest is 35.727 million yuan. The proportion of pollution discharge fees to operating income averages 0.14%, the standard deviation is 0.0039, and the highest value is 7.09%.

The absolute amount of the pollution discharge fees that are imposed on industrial enterprises accounts for a small proportion of their operating incomes. The absolute amount of pollution discharge fees that are levied on industrial companies is a small percentage of their revenues, which gives high-polluting industrial companies an incentive to pay for pollution charges and pollute the environment in exchange for business growth.

2.3. The definition of “highly polluting industries”

In this paper, the environmental pollution levels of industries are compared according to the relative proportions of the industrial enterprises that are charged pollutant discharge fees and the amounts of the pollutant discharge fees. This comparison allows us to divide the sample industry into two types of industries: “high pollution” and “low pollution”. The industrial sector division is based on the two-digit industry code in the “National Economic Sector Classification”. This paper compares the environmental pollution levels of various industries using the three indicators of “the proportion of enterprises in the industry charged pollution discharge fees”, “the average amount of pollution discharge fees levied on an enterprise”, and “the average proportion of pollutant discharge fees to business income of enterprises”. To comprehensively analyze the industrial environment pollution levels, principal component analysis was used to construct a comprehensive index. The results are shown in Table 2. Since the loadings of the three index factors of the principal component analysis are positive, the larger the value of the principal component, the more serious the pollution caused by the production process in the industries.

Table 2 shows the pollutant discharge fees that were levied on high and low polluting industries and the main component index of the environmental pollution level of the industry. According to the table, the value of the principal component of "high pollution industry" is greater than or equal to 0.0836, and the average value is 0.7887. This principle component includes nonferrous metal mining, paper and paper products, chemical raw materials and chemical products because the industries pay fees for discharging pollutants based on the amount of pollution, and the average amounts of pollution from these industries are larger. Based on the payment of fees for discharging pollutants due to on the combined policy and division, the chemical fiber industry and black metal smelting and rolling processing industry still belong to "polluting industry".

Table 1. The pollution discharge fees that were imposed on sample industrial enterprises

A：The number and relative proportion of industrial enterprises that were affected by pollution discharge fees					
	Enterprises with pollution discharge fees		***Enterprises without d pollution discharge fees***		***Total Samples***
Number of sample industrial enterprises (units)	578		755		1333
Proportion of the total sample (decimal)	0.4336		0.5664		
B：The absolute amount of pollution discharge fees and its relative proportion of operating revenues					
	mean value	***median***	***Standard deviation***	***Minimum value***	***Maximum value***
Absolute amount of pollution discharge fees (ten thousand yuan)	13.851	1.2000	154.0190	0.1000	3572.7
Pollution discharge fees as a percentage of operating revenues (decimal)	0.0014	0.0005	0.0039	0.0000	0.0709

Table 2. Main component indicators of the environmental pollution levels of various industries and the pollutant discharge fees that were levied

Industries	X_1	X_2	X_3	X_4
High pollution industry				
nonferrous metals mining and dressing	2.2758	1.0000	1.0000	0.0014
paper making and paper products industry	2.0141	0.5652	6.3848	0.0014
Manufacture of chemical materials and chemicals	1.7820	0.6186	5.1729	0.0012
Nonmetallic mineral products	1.5140	0.6134	3.5924	0.0012
Wood processing and wood, bamboo, rattan, brown, and grass products	0.9017	0.6667	1.9000	0.0008
Coal mining and washing	0.8776	0.4444	2.6111	0.0011
Pharmaceutical industry	0.7025	0.5091	3.6164	0.0007
Nonferrous metal smelting and rolling industry	0.6060	0.3333	9.3667	0.0002
Nonmetal mining and selection	0.5421	0.4000	2.4880	0.0009
Ferrous Metals Mining and Dressing	0.2604	0.4000	1.9500	0.0008
Beverage Manufacturing	0.1461	0.5313	2.3750	0.0003
Petroleum processing, coking and nuclear fuel processing industries	0.0836	0.3333	0.8333	0.0009
Chemical fiber manufacturing	-0.3657	0.2500	3.7500	0.0003
Black metal smelting and rolling industry	-0.2985	0.3333	3.2250	0.0002
Low pollution industry				
Furniture manufacturing	1.2864	0.6000	1.2600	0.0013
Food manufacturing industry	0.0007	0.3684	2.7053	0.0005
Transportation equipment manufacturing industry	-0.1054	0.4844	1.9688	0.0003
Art Products and Other Manufacturing	-0.1708	0.6667	0.0667	0.0001
Farm and sideline food processing industry	-0.1950	0.4806	1.0620	0.0003
Specialized equipment manufacturing	-0.2477	0.3462	1.7019	0.0005
Leather, fur, feather (wool) and its products	-0.3510	0.2857	1.3571	0.0005
General equipment manufacturing	-0.4669	0.4412	0.5520	0.0002
Manufacture of Metal Products	-0.5356	0.3571	0.5810	0.0003
Reproduction of printed and recorded media	-0.5507	0.3125	1.6406	0.0003
plastic product industry	-0.6815	0.3333	0.5452	0.0003
Manufacture of Rubber	-0.7183	0.3750	0.2750	0.0002
Textile industry	-0.7651	0.3145	0.8339	0.0002
Culture, education and sporting goods manufacturing	-1.0028	0.1667	0.2833	0.0004
Electrical machinery and equipment manufacturing	-1.0871	0.2500	0.2893	0.0001
Instrumentation and culture, and office machinery manufacturing	-1.1635	0.1579	0.4000	0.0002
Manufacturing of communications equipment, computers and other electronic equipment	-1.1954	0.2143	0.2107	0.0001
Textiles, clothing, shoes, and hats manufacturing	-1.2317	0.1905	0.4571	0.0001
Waste resources and waste materials recycling and processing industry	-1.8602	0.0000	0.0000	0.0000

Note: X1 represents the principal component index, X2 represents the percentage of the pollution discharge fees that were levied in the industry (decimal), X3 represents the average amount of the pollution discharge fees that were levied on enterprises (ten thousand yuan), and X4 represents the pollution discharge fees with respect to the average proportion of business revenue (decimal)

The average principal component value of "low pollution industry" is -0.5811, and it includes leather, fur, feather (wool) and their products, food manufacturing etc. Among these areas, only a small number of furniture enterprises in the whole sample have been charged with pollution discharge fees, and only one enterprise has been charged a large amount of pollution discharge fees. Therefore, the average amount of the pollutant discharge fees that are levied on enterprises has increased, leading to a large index for the main component. According to the policy division, the furniture industry is classified as a "low pollution industry". With respect to the 1,333 sample industrial enterprises, there are 467 "high pollution industries" and 866 "low pollution industries".

2.4. Research design

This paper explores the sales growth model of industrial enterprises by studying the relationship between environmental pollution levels and sales growth rate of industrial enterprises. We use the micro-data of the industrial enterprises in Hubei Province, and use econometric methods to process and regress the data. The explanatory variable is the environmental pollution situations of the industrial enterprises in Hubei Province in 2004, which include "whether to be levied for pollution discharge fee" and "the amount of operating income by levied discharge fee", where the latter is represented by the annual average annual sales growth rate of industrial enterprises in Hubei Province for 2005-2009. In 2004, China conducted the first national economic census. In this year's data, the situation in which enterprises were levied for pollution discharge fee was disclosed for the first time, but this variable was missing in the data for subsequent years. The lack of pollution discharge fee in subsequent years has caused certain shortcomings in this study. Considering that the environmental pollution level of a company is largely determined by its production technology and production process (Zhao and Xu, 2013), it is difficult for industrial enterprises, especially industrial enterprises above designated size, to completely update their production technologies within two to three years. Therefore, it can be assumed that the environmental pollution level of industrial enterprises in 2004 has not changed substantially in the following two to three years, and will continue to influence the sales growth rate from 2005-2009.

Since some industrial enterprises in the sample have not been levied pollution discharge fees, this paper constructs two indicators to describe the environmental pollution level of the enterprises, that is, "whether an enterprise will be charged pollution discharge fees" and "the proportion of pollution discharge fees to operating income". For all samples, the index of "whether an enterprise will be charged pollution discharge fees" is a Binary variable. If this variable is 0, it means pollution discharge fees were not charged. That is, these enterprises have reformed their processes, technology and equipment, and the clean production does not pollute the environment, the "sustainable development" model was adopted. If this variable is 1, it means that the enterprises are charged pollution discharge fees, which represents that the enterprises caused environmental pollution in the production process, the "pollution for growth" model was adopted. Another measure, "the proportion of pollutant discharge to the business income", is a continuous variable, which is calculated for industrial enterprises that levied sewage fees. The greater the proportion of sewage charges in operating income, the more serious the pollution caused by the production process of industrial enterprises.

This paper first chooses a linear regression model to conduct the analysis based on the research of Zhang et al. (2015), but the result is not significant. Therefore, a linear logarithmic regression model is constructed. The model is as follows (Eqs. (1-2)):

$$\ln SalesGrowth = \alpha + \beta_1 Pollution\ dummy + \beta_2 Controls + \varepsilon \quad (1)$$

$$\ln SalesGrowth = \alpha + \beta_1 Pollution\ Fees/Sales + \beta_2 Controls + \varepsilon \quad (2)$$

The Sales Growth is the annual average sales growth rate for the sample industrial enterprises from 2005-2009. The Pollution dummy is the binary variable that represents "whether the enterprise is charged for pollutant discharge". The Pollution Fees/Sales represents "the proportion of pollution discharge fees to operating income". The controls are additional variables to the model, and are mentioned in the subsequent paragraph. ε is a residual item. Since the enterprise's environmental pollution level and control variables are based on the enterprise's observations in 2004, and the dependent variables are calculated based on the enterprise's observations from 2005-2009, the regression model can avoid the endogenous problems caused by the interaction between the arguments and dependent variables to some extent.

The control variables are the size of the enterprise, whether it is a state-owned enterprise, the age of the enterprise, the profit rate, the ratio of assets and liabilities, the proportion of fixed assets, the proportion of intangible assets, and the advertising of the enterprises. In addition, the industry dummy variables based on the two-digit industry codes are added to exclude the different of regional and industries, the size of the enterprise is replaced by the logarithm of the total assets of the enterprise, the age of the enterprise is standardized by the business year of the enterprise, the asset liability ratio is the proportion of the total assets of the enterprise, the proportion of the fixed assets and the intangible assets is the ratio of the fixed assets and the intangible assets to the total asset ratio, sales profit margin is a percentage of total operating income. To reduce the correlation between variables, we choose industrial sales as the denominator to calculate the index of "the proportion of the pollution discharge fees to the operating income".

Based on the above analysis, this paper makes the following hypotheses:

- A company's level of environmental pollution will affect its sales growth rate. In order to verify the extensiveness of the hypotheses, this paper uses the "high pollution industry" sample divided by the principal component analysis method to perform regression analysis on the two models respectively.
- The impact of high pollution industries and low pollution industries on the growth rate of enterprises is different. If hypothesis 1 is established, the environmental pollution level coefficients of the enterprises in the sample regression of "high pollution industry" will also meet the hypothetical requirements. In order to more accurately measure the differences between different industries, this article adds the dummy variables of "whether the company is levied a pollution discharge fee" and "whether it belongs to high pollution industries" for cross-term regression.
- The proportion of pollution discharge fees in operating income has an impact on the sales growth rate of enterprises.

2.5. Statistical analysis

Table 3 shows descriptive statistics of the dependent and main independent variables, including the mean, median, standard deviation, and maximum and minimum values. The explanatory variable "the proportion of discharge fees to business income " was calculated using 578 sample companies, and other variables were calculated using 1.333 sample industrial enterprises. It can be seen from the table that the average annual sales growth rate of the sample industrial enterprises from 2005-2009 was 0.0687, with a maximum observation of 0.417. The average value of "whether or not a discharge fee is charged" is 0.4336, meaning 43.36% of the sample industrial enterprises have been charged pollution fees. Among the 578 sample industrial enterprises that have been charged pollution fees, the average proportion of fees to operating income is 0.14%, with a maximum observation of 7.09%. It can be seen that the collection of enterprise discharge fee is not high for the operating income of enterprises, so the enterprises have sufficient motivation. High profits can be made by polluting the environment and reducing costs to make up for the losses caused by sewage charges, and to gain corporate sales growth at the expense of the environment. The average enterprise size is 9.8608, which corresponds to the total assets of 19.164215 million yuan. In addition, 25.73% of the sample industrial enterprises advertised during the observation period. The average asset and liability ratio of all enterprises was 56.65%, the average value of fixed assets was 36.57%, and the average value of intangible assets was 5.10%.

3. Results and discussion

3.1. "Whether or not a discharge fee is levied on an enterprise" as a result of the explanatory variables

Table 4 shows the results of the regression of the growth rate of industrial enterprises by using the binary variable "whether pollution charges are on enterprises" as an explanatory variable using the full sample of 1333 enterprises. Because the results that are obtained from the linear regression model are not significant, we chose to construct a logarithmic linear model. The observed value in 2004 is used as the independent variable. The dependent variable is the logarithm of the annual average sales growth rate of an industrial enterprise for 2005-2009. Excluding abnormal variables, the data of 975 enterprises were used in the regression analysis. After clustering the robust standard deviations based on the two-digit industry codes, we conduct the regression using the least squares method. Table 4, from column (1) to column (4), shows the results of regressing just "Whether or not a discharge fee levied on an enterprise" and gradually adding the remaining control variables, adding the urban dummy variables and adding the industry dummy variables. Generally, although not all the regression coefficients of the control variables are significant, we focus on the explanatory variables that we studied. The results of these four regressions were all significant at the 1% level, with the regression coefficients ranging from -0.1440 to -0.2010.

Table 3. Descriptive statistics of the dependent variable and main independent variables

	Average	*Standard deviation*	*Median*	*Min*	*Max*
Sales growth rate	0.0687	0.2370	0.1030	-1.1358	0.4170
Whether or not a discharge fee is charged	0.4336	0.4958	0.0000	0.0000	1.0000
Proportion of discharge fees to business income	0.0014	0.0039	0.0005	0.0000	0.0709
Enterprise age	0.0045	0.9941	0.4348	-3.9000	0.7748
Enterprise scale	9.8608	1.4672	9.6639	6.0913	17.8741
Whether the enterprise is state-owned or not	0.0540	0.2261	0.0000	0.0000	1.0000
Asset liability ratio	0.5665	0.2843	0.5550	0.0000	1.3825
Proportion of fixed assets	0.3657	0.2145	0.3543	0.0000	0.8597
Proportion of intangible assets	0.0510	0.0969	0.0000	0.0000	0.4996
Ratio of income as a percentage of sales	0.0157	0.0881	0.0123	-0.3908	0.2721
Advertising	0.2573	0.4373	0.0000	0.0000	1.0000

Table 4. Effect of "pollution discharge fees" on the sales growth rates in industries with different pollution levels

	(1)	*(2)*	*(3)*	*(4)*
Whether or not a discharge fee is charged	-0.2010***	-0.1440***	-0.1740***	-0.1520***
	(-0.0461)	(-0.0421)	(-0.0447)	(-0.0423)
Enterprise age		0.0619	0.0686	0.0657
		(-0.0428)	(-0.0488)	(-0.0474)
Enterprise scale		-0.0112	-0.0379	-0.0172
		(-0.0391)	(-0.0375)	(-0.0407)
Whether the enterprise is state-owned or not		-0.181	-0.0734	-0.117
		(-0.2040)	(-0.1730)	(-0.1790)
Asset liability ratio		-0.19	-0.2720*	-0.165
		(-0.1250)	(-0.1480)	(-0.1260)
Proportion of fixed assets		-0.0759	0.101	0.0184
		(-0.1470)	(-0.1620)	(-0.1590)
Proportion of intangible assets		-0.7010**	-0.5700*	-0.583*
		(-0.3170)	(-0.3080)	(-0.3270)
Ratio of income as a percentage of sales		-0.688	-0.419	-0.517
		(-0.4170)	(-0.4550)	(-0.4230)
advertising		0.0857	0.0778	0.0713
		(-0.0638)	(-0.0723)	(-0.0650)
region dummy variable	Not added	add	Not added	add
industry dummy variable	Not added	Not added	add	add
Intercept item	-1.9540***	-1.7070***	-1.4020***	-1.0230**
	(-0.0399)	(-0.4200)	(-0.4590)	(-0.4260)
Sample observations	975	975	975	975
Goodness of fit	0.013	0.113	0.083	0.153

*Note: The numbers in the brackets are the robust standard deviations of the corresponding regression coefficient. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively*

Based on the significance of the regression coefficients, although the logarithmic linear model's slope represents growth rate, we can directly relate it to the explanatory variables. The coefficients that were obtained for the binary variables from the four regressions were all negative, indicating that the average sales growth rate of the enterprises that were charged pollution discharge fees is lower than that of the enterprises that were not charged pollution discharge fees. Due to the "pollution discharge fees" as a result of a certain degree of pollution in the production process, we think that this sample enterprise adopts the economic mode of "pollution helps growth".

Therefore, the results can be theoretically interpreted as follows: the average growth rate of "pollution helps growth" enterprises is lower than that of "sustainable development" enterprises.

From the above results, it can also be seen that most industrial enterprises choose to not improve their technology or renew or replace their equipment, and they pollute the environment at lower costs to compensate for their own losses that are caused by pollution discharge fees. Although this practice does cause a certain degree of economic growth, in theory, environmentally friendly enterprises that choose cleaner production technologies and reduce pollution can also achieve economic growth. Moreover, the growth rates of enterprises under the "sustainable development" model are faster than those in the "pollution changing growth" model. Therefore, industrial development and environmental protection can coexist, and economic development is not necessarily at the expense of pollution.

Table 5 reveals the following aspects:

(1) shows the results that are obtained from the regression of the 467 "high polluting industries" in the same way. As for the logarithm of the sales growth rate, 342 enterprises were involved in the regression analysis. In the sample from the "high pollution industry", the result of "whether pollution charges are levied" was significant at the 5% level. The regression coefficient of "whether the pollution discharge fees are charged" is -0.2300, and the absolute value of this regression coefficient is greater than the absolute value of the regression coefficient in Table 4. This result shows that the growth rate of the explanatory variables is higher in the "high pollution industries", and the environmental pollution levels of the industrial enterprises have a greater impact on the sales growth rate. The results show that in the "high pollution industries", "no pollution fee" being levied results in greater economic growth. Compared to all industries, this effect is more significant in "high pollution industries ".

(2) shows the cross terms for the use of the full sample regression, and it introduces the cross term of "whether it belongs to the high pollution industry" and "whether pollution charges will be levied". In this table, the cross term coefficient indicates that enterprises in "high pollution industry" have more sales growth than the enterprises that have not been levied pollution discharge fees, the explanatory variable coefficient is significant, and the coefficient is negative, which means that the "sustainable development" model can achieve more sales growth.

3.2. "The proportion of pollution discharge fees to operating income" as a result of the explanatory variables

The second regression model uses the explanatory variable "the proportion of pollution discharge fees to business income", and the sample includes 578 enterprises that were charged pollution discharge fees. Similarly, a logarithmic linear regression model is established for the logarithm of the sales growth rate, and a total of 421 enterprises' data are involved in the regression. The independent variable is the observed value in 2004. Because the "Proportion of discharge fee to the operating income" and some control variables are also measured by "the proportion of operating income", this paper uses the industrial added value instead of operating income to calculate the proportion of pollutant discharge fees. After clustering the robust standard deviations based on the two-digit industry codes, we conduct the regression using the least square method. Table 6, from column (1) to column (4), shows the results of regressing the "proportion of collected pollution discharge fees" and gradually adding the remaining control variables, adding the urban dummy variables and adding the industry dummy variables. Column (5) represents the sample with 257 high polluting enterprises that were charged pollution discharge fees. After taking their logarithms, 186 enterprises were involved in the regression analysis. The results are not significant, which shows that "the proportion of pollution discharge fees to operating income" has little impact on the "sales growth rate". Although the trend indicates that the two are positively related, pollution may bring economic growth, but because the regression coefficient and equation are not significant, it is impossible to determine whether the percentage of the pollution discharge fees will affect the sales growth rate.

Comprehensive consideration is given to the results of the two regressions that were obtained using "whether pollution discharge fees are charged" and "the proportion of the pollution discharge fees to business income" as independent variables. It can be seen that there are environmental protection enterprises and polluting enterprises among Hubei's industrial enterprises.

On the whole, theoretically, environment-friendly enterprises can obtain higher economic growth than polluting enterprises, and companies that choose technological innovation and clean practices will have better prospects. Although there are still companies choosing low costs and high pollution to achieve economic growth, this model does not determine whether pollution will increase.

Table 5. Effect of "pollution discharge fees" on the sales growth rate in industries with different pollution levels

	(1) sub sample of high pollution industries		***(2) full sample***	
Whether or not a discharge fee is charged	-0.2300**	(-0.0957)	-0.1020**	(-0.0384)
Whether the enterprise belongs to the high pollution industry			-0.2520***	(-0.0720)
Whether or not a discharge fee is charged（0）*Whether the enterprise belongs to the high pollution industry（1）			0.141	(-0.0928)
Enterprise age	0.0661	(-0.0822)	0.0658	(-0.0474)
Enterprise scale	-0.0406	(-0.0852)	-0.0172	(-0.0407)
Whether the enterprise is state-owned or not	-0.0356	(-0.3300)	-0.119	(-0.1810)
Asset liability ratio	-0.198	(-0.2590)	-0.16	(-0.1250)
Proportion of fixed assets	-0.0305	(-0.2110)	0.019	(-0.1600)
Proportion of intangible assets	-0.198	(-0.4980)	-0.5830*	(-0.3200)
Ratio of income as a percentage of sales	-0.665	(-0.7290)	-0.513	(-0.4180)
advertise	0.1180*	(-0.0580)	0.0779	(-0.0665)
region dummy variable	add		add	
industry dummy variable	add		add	
Intercept item	-2.3670**	(-1.0590)	‘-1.5970***	-0.44
Sample observations	342		975	
Goodness of fit	0.201		0.154	

*Note: The numbers in brackets are the robust standard deviations of the corresponding regression coefficient. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively*

Table 6. Effect of "share of pollution discharge fees on operating income" on the future sales growth rate**.**

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Proportion of discharge fees to business income	27.35	9.716	44.61	33	44.16
	-44.19	-41.6	-45.48	-44.43	-48.77
Enterprise age		0.0791	0.0788	0.0761	0.0599
		(-0.0606)	(-0.0712)	(-0.0662)	(-0.1120)
Enterprise scale		-0.0378	-0.0637	-0.0601	-0.0923
		(-0.0514)	(-0.0529)	(-0.0603)	(-0.1100)
Whether the enterprise is state-owned or not		0.141	0.0503	0.142	0.0067
		(-0.2460)	(-0.2250)	(-0.252)	(-0.5100)
Asset liability ratio		-0.3710*	-0.4640*	-0.346	-0.366
		(-0.2090)	(-0.2720)	(-0.214)	(-0.3780)
Proportion of fixed assets		0.0817	0.271	0.22	-0.167
		(-0.1940)	(-0.2510)	(-0.215)	(-0.2670)
Proportion of intangible assets		-1.4000***	-1.3950**	-1.450**	-1.485
		(-0.4860)	(-0.5790)	(-0.564)	(-0.8430)
Ratio of income as a percentage of sales		-0.299	-0.129	-0.0957	-0.578
		(-0.6930)	(-0.8290)	(-0.766)	(-1.0850)
advertise		0.155	0.134	0.1	0.115
		(-0.0934)	(-0.1240)	(-0.118)	(-0.1610)
region dummy variable	Not added	add	Not added	add	add
industry dummy variable	Not added	Not added	add	add	add
Intercept item	-2.1860***	-1.5980**	0.00276	-0.383	0.329
	(-0.0585)	(-0.5830)	(-0.7460)	(-0.467)	(-1.44)
Sample observations	421	421	421	421	186
Goodness of fit	0.003	0.158	0.144	0.227	0.324

*Note: The numbers in brackets are the robust standard deviations of the corresponding regression coefficient. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively*

4. Conclusions

This paper uses the micro-data of industrial enterprises in Hubei Province to analyze the impact of environmental pollution on sales growth rate, and explores the sales growth model of industrial enterprises.

Compared to previous studies, this paper makes the following contributions:

- This article explores the macroeconomic development model from a micro perspective, and analyzes the two growth models of "sustainable development" and "pollution for growth", thereby supplementing the previous research.

- Provide the basis for the best way for the development of industrial enterprises, which is to choose the "sustainable development" model.
- The data selection is well-founded. The data is derived from the "China Industrial Enterprise Database" that is published by the China Bureau of Statistics, which is the most authoritative micro-enterprise database that is currently available. Our data is relatively more time-sensitive than those of previous studies to ensure the accuracy of the conclusions.

It is found that there are both environment-friendly enterprises and polluting enterprises among the industrial enterprises. Environmental enterprises can obtain higher economic growth than polluting enterprises. There will be better prospects for enterprises that choose technological innovation and clean production. The development of industrial enterprises and environmental protection can coexist. Economic development does not necessarily depend on pollution.

Although there are still businesses that choose low costs and high pollution to achieve economic growth, it is not certain that pollution can be exchanged for growth. Therefore, theoretically, the best way for industrial enterprises to grow is to choose the "sustainable growth" model. In reality, there is still a "pollution for growth" model, which requires enterprises to reduce their environmental pollution by accelerating their technological innovation. The government should also improve the management system, increase supervision, raise the standards for sewage charges, and promote the transformation of enterprises from a "pollution for growth" to a "sustainable growth".

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