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An Influence Analysis of the Banking Market Structure on the Industrial Pollutants Emission Reduction

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The rapid development of China's industry is characterized by high energy consumption and high pollutants emission, which has resulted in serious environmental problems. In this paper, Chinese provincial panel data are used to study the influence of the banking market structure on the industrial pollutants emission reduction. The results show that the concentration of the banking sector has a significantly positive effect on the industrial pollutants emission intensity. High concentration of the banking sector is not conducive to reducing pollutants emission intensity. Therefore, the banking market structure plays an important role in eliminating outdated production capacity and in the development of the energy-saving and low-polluted economy.

Keywords: Banking Market Structure, Industrial Pollutants Emission, State-Owned Bank

Introduction

China's industrial growth model is regarded as an extensive growth mode of high input, high consumption and high pollution. China's industry is facing growing pressure on the environmental pollution. Yan *et al.* found that the relationship between pollutants emission and industrial development was an inverted U shape[1]. Zhang and Wei founded that the environmental regulation could curb carbon emission[2].Yu *et al.*, Zang and Pan, and Bai *et al.* explored the relationship between FDI and carbon emission[3-5]. He, Cheng and Yin found that the gap of international and domestic energy prices could restraint carbon emission[6].Other factors such as urban form and international trade were also examined by scholars[7-12]. The influence of the banking market structure on the industrial pollutants emission reduction has not been studied.

Econometric model and data

Econometric model

The following econometric model (1) is used to analyze the influence of the banking market structure on the industrial pollutants emission, where i and t represent the province and the year; η_i represents the time-invariant regional effect; μ_t represents the time effect that is constant within a region; ε_{it} is the random error term; β_0 is the constant term; β_1 to β_7 are the independent variable coefficients, and β_1 is the focus of this paper. If β_1 is greater than 0, it means that the banking market structure has a positive impact on the industrial pollutants emission and that the high concentration of the banking sector is not in favor of reducing industrial emission.

$$lnI_{it} = \beta_0 + \beta_1 BS_{it} + \beta_2 GDP_{it} + \beta_3 Rjcapital_{it} + \beta_4 Rlzb_{it} + \beta_5 Gyh_{it} + \beta_6 Lagrjgdp_{it} + \beta_7 Plw_{it} + \eta_i + \mu_t + \varepsilon_{it} \quad \text{... (1)}$$

The dependent variable I_{it} is the industrial pollutants emission intensity of the ith province in the tth year, which can be obtained by formula (2), where E_{it} and Y_{it} are the industrial pollutants emission and the total industrial added value of the ith province in the tth year; j is the jth industrial sector. Industrial pollutants can be divided into three types: solid wastes, gas contaminants and liquid contaminants. Thus, three

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indicators are chosen in this paper, respectively, industrial sulfur dioxide emission intensity (*SO_2qd*), industrial soot emission intensity (*Smokeqd*) and industrial waste water emission intensity (*Waterqd*).

$$I_{it}=E_{it}/ Y_{it}=\sum_j E_{itj}/ Y_{it} \qquad \text{... (2)}$$

BS is the banking market structure, and it can be obtained by the concentration of the banking sector, namely, the ratio of loans of the top four state-owned banks to the total loans of all commercial banks. *GDP* is the regional gross domestic product, and it is used for measuring the degree of the economic development. *Rjcapital* is the capital stock per capita, and it is measured by the ratio of material capital stock to the number of industrial employed labor force. *Rlzb* is the human capital level, and it is measured by the average years of schooling. *Gyh*is the degree of industrialization, and it is measured by the proportion of the industrial added value to GDP of each province. *Lagrjgdp* is the one-period lag GDP per capita. *Plw* is the environmental regulation intensity, and it is measured by the effective tax rate of water pollution discharge fees of each province, namely, the ratio of excessive waste water discharge fees to sub-standard waste water discharge fees.

Data

Data of *SO_2qd, Smokeqd* and *Waterqd* are from China Environment Statistical Yearbook. The financial data are from China Financial Yearbook. Data of *GDP*, industrial added value and the number of employed labor force are from China Statistical Yearbook. Capital stock data are from China's Socialist Market Economy Research Center Database of Fudan University. Human capital data are from China Population Statistics Yearbook. In order to ensure the data consistency and completeness, this paper chooses the period of 1992 to 2004. Tibet misses most financial data, so Tibet is excluded from the analysis in this paper. Chongqing was established in 1997, so all data of Chongqing are merged into Sichuan province. Finally this paper selects 377 sample data from 29 provinces in the period of 13 years.

Estimation results and analysis

The whole sample estimation results

All sample data are used for estimating the econometric model and the regression results are shown in Table 1. *SO2qd, Waterqd* and *Smokeqd* are chosen as the dependent variables respectively. From the estimation results of three types of industrial pollutants emission intensity, the banking market structure coefficients are obviously positive, which indicates that the banking market structure has significant positive influence on the industrial pollutants emission intensity, and that the increase of the concentration of the bank loans will increase the pollutants emission intensity. Taking the estimation results of *SO_2qd* as an example, the coefficient of *BS* is 0.511, which means that the concentration of the banking loans increases by 1 unit, and then *SO_2qd* will increase by 0.511%. The influence of the banking market structure on *Waterqd* is the strongest, followed by *Smokeqd* and *SO_2qd*. *GDP* has a significant positive impact on *SO_2qd* and *Waterqd*, which means that the enlarging of economy scale increases *SO_2qd* and *Waterqd*. But the impact of *GDP* on *Smokeqd* is not significant. The coefficients of *Rjcapital* in column (1) and column (2) are significantly positive, but it is not significant in column (3). It shows that the impact of *Rjcapital* on different pollutants is different. The coefficients of *Rlzb* are remarkably negative, which indicates that the raising level of human capital helps to reduce the pollutants emission intensity. The coefficient of *Gyh* is not significant in each column. *Lagrjgdp* has significantly negative influence on the emission intensity of industrial pollutants. High *Lagrjgdp* will lower the emission intensity of industrial pollutants. The coefficient of *Plw* in column (2) is

Table 1 — The whole sample estimation results

	(1)*SO_2qd*	(2)*Waterqd*	(3)*Smokeqd*
0	8.676^{***}	6.833^{***}	7.649^{***}
	(0.367)	(0.385)	(0.466)
β_1	0.511^{***}	0.745^{***}	0.645^{***}
	(0.138)	(0.136)	(0.212)
β_2	0.005^{**}	0.005^{**}	-0.004
	(0.002)	(0.002)	(0.003)
β_3	0.135^{***}	0.165^{***}	0.024
	(0.050)	(0.052)	(0.070)
β_4	-0.296^{***}	-0.423^{***}	-0.196^{***}
	(0.037)	(0.038)	(0.053)
β_5	-0.653	1.074	-0.601
	(0.644)	(0.743)	(0.744)
β_6	-0.012^{***}	-0.012^{***}	-0.010^{***}
	(0.002)	(0.002)	(0.003)
β_7	-0.006	-0.018^{***}	-0.009
	(0.007)	(0.007)	(0.010)
HausmanP value	0.473	0.000	0.345
Model	RE	FE	RE
R^2	0.376	0.363	0.565
Wald value	792.510	183.690	496.050

Note: The values in brackets are standard deviation. ***, ** and * are the significance level of1%, 5% and 10%.

significantly negative, indicating that strengthening environmental regulation helps reduce the emission intensity of industrial waste water. Otherwise the coefficients of *Plw* in column (1) and (3) are not significant. *Plw* is measured by the effective tax rate of water pollution discharge fees. Thus, the influence of *Plw* on SO_2qd and *Smokeqd* is not that obvious.

The instrumental variable method estimation results

In the previous analysis, the banking market structure has a significantly positive effect on the industrial pollutants emission intensity. But the variable represented the banking market structure may has endogeneity problem, which will lead to that the previous regression results cannot fully reflect the proper relationship between the banking market structure and the industrial pollutants emission intensity. Building the instrumental variable and making re-estimation can remove the estimation bias caused by the endogeneity problem. State-owned banks commercialization reform of China launched in 1994, which offers this paper an instrument variable. Take the year 1994 as a dividing line and form a virtual variable, *reform*. The value of *reform* of the year 1994 and later years is 1, and that of years before 1994 is 0. The instrument variable of the banking market structure is as the formula (3) showed where *lrated_1* is the loan-to-deposit ratio in the end of the last period.

$$reform\_lrated = reform \times lrated\_1 \quad \ldots (3)$$

Table 2 shows the estimation results of the instrumental variable, which aims to examine whether the instrumental variable *reform_lrated* is significantly correlated with the banking market structure *BS*, namely, determine whether *reform_lrated* is an appropriate instrument variable. As shown in Table 2, the instrumental variable *reform_lrated* is significantly negative correlated with the banking market structure *BS*. The reason is that the concentration of the banking sector of provinces with high loan-to-deposit ratio decreased sharply after the commercialize reform of state-owned banks. Results of weak instrumental variable F test are all greater than 10, indicating the instrumental variables *reform_lrated* is not a weak instrumental variable. Table 3 reports the re-estimation results by using the instrumental variable *reform_lrated*. Comparing estimation results in Table 3 and Table 1, the coefficients of the banking market structure are still significantly positive. The coefficients of all variables in Table 3 are substantially similar with results in Table 1, and the significance levels remain the same.

Table 2 — The instrumental variable estimation results

	(4) SO_2qd	(5)*Waterqd*	(6)*Smokeqd*
Dependent variable	*BS*	*BS*	*BS*
Instrumental variable	-0.182^{***}	-0.181^{***}	-0.182^{***}
reform_lrated	(0.012)	(0.012)	(0.012)
Other independent variables	control	control	control
P value of weak	453.000	59.230	456.000
instrumental variable F test	(0.000)	(0.000)	(0.000)

Note: The values in brackets are standard deviation. ***, ** and * arethe significance level of 1%, 5% and 10%.

Table 3 — There-estimation results using the instrument variable

Model	(7) SO_2qd IVRE	(8)*Waterqd* IVFE	(9)*Smokeqd* IVRE
β_0	8.637^{***}	6.835^{***}	7.976^{***}
	(0.385)	(0.397)	(0.572)
β_1	0.561^{***}	0.742^{***}	0.574^{**}
	(0.203)	(0.200)	(0.288)
β_2	0.005^{**}	0.005^{**}	-0.002
	(0.002)	(0.002)	(0.003)
β_3	0.133^{***}	0.165^{***}	-0.013
	(0.051)	(0.053)	(0.074)
β_4	-0.293^{***}	-0.423^{***}	-0.284^{***}
	(0.038)	(0.039)	(0.055)
β_5	-0.699	1.077	0.044
	(0.658)	(0.763)	(0.987)
β_6	-0.012^{***}	-0.012^{***}	-0.008^{***}
	(0.002)	(0.002)	(0.003)
β_7	-0.006	-0.018^{***}	-0.010
	(0.007)	(0.007)	(0.010)
Hausman P value	1.000	1.000	0.023

Note: The values in brackets are standard deviation. ***, ** and * are the significance level of 1%, 5% and 10%.

Conclusion

This paper uses Chinese provincial panel data and analyzes the influence of the banking market structure on the industrial pollutants emission reduction. The results show that the concentration of the banking sector has a significantly positive impact on the industrial pollutants emission intensity, and that the decline of the banking sector concentration helps reduce the emission intensity of industrial pollutants. The results also suggest that human capital and lagged one-period GDP per capita have significantly negative influence on the industrial pollutants emission intensity, that is to say, rising in the level of human capital and scale of economy is beneficial to restrain the emission intensity of industrial pollutants.

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