Advances in Social Science, Education and Humanities Research, volume 291
International Conference on Management, Economics, Education, Arts and Humanities (MEEAH 2018)

Research on the Relationship of China's Regional Credit Expansion, FDI and Environmental Pollution

Lin Sun[1, a]

[1] People's Bank of China, Jinan Branch, Jinan, China

[a] E-mail:sunlinsdu@gmail.com

Keywords: Credit Expansion; FDI; Environmental Pollution; Spatial Dynamic Panel Data Model.
Abstract. Industrial SO_2 and industrial wastewater were selected as the main environmental pollution indicators. Based on the spatial correlation of the environmental pollution, the spatial dynamic panel data models were constructed to study the impact of credit expansion and foreign direct investment (FDI) on the environmental pollution. The results indicate there exist obvious differences of the impacts of the bank loans and FDI for different types of pollution emissions. The bank loans suppress the industrial SO_2 emissions. However, FDI has no obvious impact on the industrial SO_2 emissions; FDI has a significant positive impact on industrial wastewater emission, while bank loans have no significant impact on industrial wastewater emissons.

Introduction

In recent years, affected by the global financial crisis, the international market has continued to slump, the contradiction between supply and demand mismatch in some industries has become increasingly prominent. As the economic work conference of China's government declare "de-capacity" as a structural reform task, China's green development and sustainable investment have begun to attract wide attention[1,2], and some researchers focused on the carbon emission in China[3].

China's green finance research has gradually became a hot research topic[4]. In this paper we concern the correlation of the green finance and environmental pollution by spatial dynamic panel data models, the industrial SO_2 emissions and industrial wastewater emissions are selected as the indicators to measure the impacts to environmental pollution, and the bank loans and FDI are selected as the indicators of green finance. As far as we know, such method has not been used to do empirical analysis for the problem.

Empirical Analysis

In order to explore the spatial correlation of environmental pollution in China, we select the industrial SO_2 and the industrial wastewater emissions in various cities and municipalities to indicate the degree of environmental pollution. Therefore, In order to analyze the factors affecting the degree of the environmental pollution of credit expansion and foreign investment, we select the emissions of industrial SO_2 and industrial wastewater of various cities and municipalities as the explained variables, select bank loans and FDI as the explanatory variables, select bank deposits, exports, imports, per capita GDP, and urban construction land area as the control variables.

Spatial Correlation Test

In this paper, the panel data of 287 prefecture-level cities in China selected for analysis from 2004 to 2015 were mainly from the CEIC database and the National Bureau of Statistics website and were calculated by Matlab 2010b and Elhorst space panel measurement package. Consider the spread of contaminant is related to the distance, the spatial weight matrix is constructed by queen space matrix, and the spatial correlation is tested by Moran's I index. The results are shown in Table 1 and Figure 1. It can be seen from Table 1 and Figure 1 that the Moran's I of SO_2 and wastewater emission are both greater than 0, and all of them have passed the 1% significance level test, so we need to consider the spatial correlation.

Table 1 Moran's I of SO_2 and Wastewater Eimssions in 2004-2015

Year	SO_2 Moran's I	Wastewater Moran's I	Year	SO_2 Moran's I	Wastewater Moran's I
2004	0.13***	0.14***	2010	0.15***	0.24***
2005	0.16***	0.15***	2011	0.21***	0.30***
2006	0.13***	0.19***	2012	0.21***	0.33***
2007	0.13***	0.18***	2013	0.22***	0.34***
2008	0.14***	0.20***	2014	0.22***	0.31***
2009	0.13***	0.20***	2015	0.19***	0.32***

*significance level of p<0.1; **significance level of p<0.05; ***significance level of p<0.01

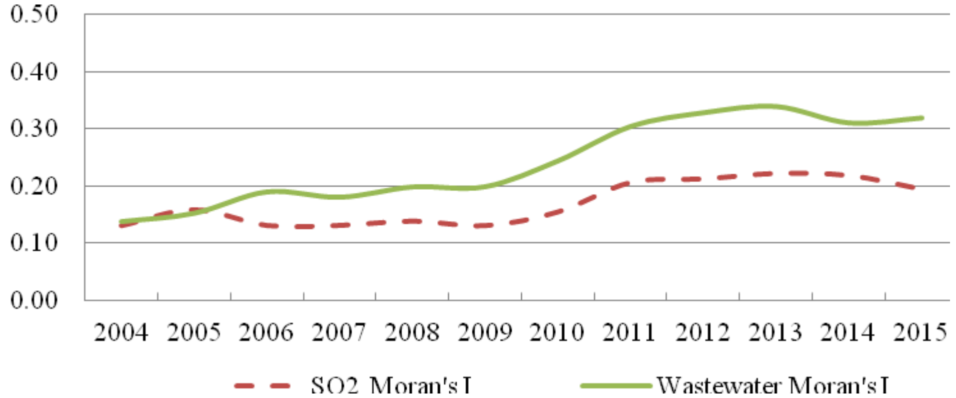

Figure 1 Trends of Moran's I of SO_2 and Wastewater Emissions, 2004-2015

Spatial Dynamic Panel Data Models of Industrial SO2 Emission

For the econometric model of industrial SO_2 emission, construct the spatial lag model (1) and error lag model (2) as shown below:

$$\begin{aligned}\ln(SO_2-Pollution_{i,t}) = {} & r\ln(SO_2-Pollution_{i-1,t}) + l\sum_{j=1,j\neq i}^{287} w_{i,j}\ln(SO_2-Pollution_{j,t}) \\ & + a_1\ln(loan_{i,t}) + a_2\ln(fdi_{i,t}) + b_1\ln(deposit_{i,t}) + b_2\ln(export_{i,t}) \\ & + b_3\ln(import_{i,t}) + b_4\ln(construction_{i,t}) + b_5\ln(perGDP_{i,t}) + u_i + v_t + e_{i,t}\end{aligned} \tag{1}$$

$$\begin{aligned}\ln(SO_2-Pollution_{i,t}) = {} & r\ln(SO_2-Pollution_{i-1,t}) + a_1\ln(loan_{i,t}) + a_2\ln(fdi_{i,t}) \\ & + b_1\ln(deposit_{i,t}) + b_2\ln(export_{i,t}) + b_3\ln(import_{i,t}) \\ & + b_4\ln(construction_{i,t}) + b_5\ln(perGDP_{i,t}) + u_i + v_t + e_{i,t}\end{aligned} \tag{2}$$

$$u_i = l\sum_{j=1,j\neq i}^{287} w_{i,j}u_{j,t} + h_{i,t}$$

where the $w_{i,j}$ is the spatial weight matrix. The spatial fixed effect, the time fixed effect, the double fixed effects of the above model are estimated and results are shown in Table 2. The impact of loan scale on industrial SO_2 emissions is significantly negative, indicating that industrial SO_2 emissions decreases with the increase of loan scale, which may be due to the impact of different industries loan scale further affecting pollution emissions, it also shows that the China's de-capacity effect in the financial sector is obvious. The impact of FDI on industrial SO_2 emissions is not obvious, probably due to the fact that FDI inflows and industries with relatively concentrated SO_2 emissions are less relevant.

Table 2 Results of empirical analysis of factors affecting Industrial SO_2 Emissions in prefecture-level cities in China from 2004 to 2015

Variables	Spatial lag models			Error lag models		
	Space fixed effects	Time fixed effects	Double fixed effects	Space fixed effects	Time fixed effects	Double fixed effects
loan	-0.0044** (-2.2487)	-0.0057*** (-2.9279)	-0.0040** (-2.0125)	-0.0040** (-2.0125)	-0.0053*** (-2.7215)	-0.0051*** (-2.6014)
deposit	0.0013 (0.4286)	0.0038 (1.2723)	0.0010 (0.3409)	0.0010 (0.3409)	0.0036 (1.1952)	0.0033 (1.0932)
export	-0.0056* (-1.7540)	-0.0041 (-1.2927)	-0.0064** (-1.9844)	-0.0064** (-1.9844)	-0.0051 (-1.6220)	-0.0049 (-1.5797)
import	0.0097** (2.2665)	0.0088** (2.1080)	0.0089** (2.0655)	0.0089** (2.0655)	0.0084** (2.0139)	0.0075*** (1.7794)
FDI	0.0227 (0.6125)	0.0016 (0.0434)	0.0341 (0.9093)	0.0341 (0.9093)	0.0124 (0.3356)	0.0022 (0.0588)
Per GDP	0.0003*** (-3.5089)	-0.0001* (-1.6762)	-0.0003*** (-3.1628)	-0.0003*** (-3.1628)	-0.0001 (-1.2167)	-0.0001 (-1.2199)
Urban Construction	0.0073** (2.5091)	0.0058** (2.0453)	0.0077*** (2.6111)	0.0077*** (2.6111)	0.0055* (1.9502)	0.0062** (2.1979)
dynamic lag	0.9121*** (143.3908)	0.9128*** (161.3667)	0.9371*** (171.8504)	0.9371*** (171.8504)	0.9322*** (186.1839)	0.9306*** (186.5049)
Spatial correlation	0.0600*** (7.4158)	0.0410*** (5.3440)	0.0120 (0.4847)	0.0120 (0.4847)	-0.0049 (-0.1984)	0.0070 (0.2820)
R^2	0.9241	0.9179	0.9228	0.9228	0.9172	0.9239

The value in parentheses is the t statistic, *significance level of p<0.1; **significance level of p<0.05; ***significance level of p<0.01

Spatial Dynamic Panel Data Models of Industrial Wastewater Emission

For the econometric model of industrial wastewater emission model, construct the spatial lag model (3) and error lag model (4) as shown below:

$$\begin{aligned}\ln(Water-Pollution_{i,t}) = r\ln(Water-Pollution_{i-1,t}) + l\sum_{j=1,j\neq i}^{287} w_{i,j}\ln(Water-Pollution_{j,t}) \\ +a_1\ln(loan_{i,t}) + a_2\ln(fdi_{i,t}) + b_1\ln(deposit_{i,t}) + b_2\ln(export_{i,t}) \\ +b_3\ln(import_{i,t}) + b_4\ln(construction_{i,t}) + b_5\ln(perGDP_{i,t}) + u_i + v_t + e_{i,t}\end{aligned} \quad (3)$$

$$\ln(Water-Pollution_{i,t}) = r\ \ln(Water-Pollution_{i-1,t}) + a_1 \ln(loan_{i,t}) + a_2 \ln(fdi_{i,t}) + b_1 \ln(deposit_{i,t}) + b_2 \ln(export_{i,t}) + b_3 \ln(import_{i,t}) + b_4 \ln(construction_{i,t}) + b_5 \ln(perGDP_{i,t}) + u_i + v_t + e_{i,t} \quad (4)$$

$$u_i = l \sum_{j=1, j\neq i}^{287} w_{i,j} u_{j,t} + h_{i,t}$$

Then the spatial fixed effect, the time fixed effect, the double fixed effects of the above model are estimated. The specific estimation results are shown in Table 3. The impact of FDI on industrial wastewater emission is significantly positive, indicating the industrial wastewater emissions increase with the increase of FDI. It may be that FDI has expanded scale the related industry of the wastewater emissions by financing, and produce more wastewater emissions. The impact of loans on industrial wastewater emission is not obvious, probably because there are fewer related industries in the industries where loans and wastewater emission are relatively concentrated.

Table 3 Results of empirical analysis of factors affecting industrial industrial wastewater in prefecture-level cities in China from 2004 to 2015

Variables	Spatial lag models			Error lag models		
	Space fixed effects	Time fixed effects	Double fixed effects	Space fixed effects	Time fixed effects	Double fixed effects
loan	0.0017 （0.4981）	0.0017 （0.4935）	0.0015 （0.4455）	0.0031 （0.9442）	0.0031 （0.9529）	0.0030 （0.9193）
deposit	-0.0076 （-1.4271）	-0.0063 （-1.1914）	-0.0062 （-1.1818）	-0.0102** （-2.0538）	-0.0088* （-1.7936）	-0.0088* （-1.7930）
export	0.0164*** （2.8639）	0.0178*** （3.1492）	0.0178*** （3.1576）	0.0172*** （3.3374）	0.0185*** （3.6153）	0.0184*** （3.6196）
import	0.0024 （0.3158）	0.0005 （0.0712）	0.0009 （0.1210）	0.0005 （0.0686）	-0.0016 （-0.2271）	-0.0011 （-0.1511）
FDI	0.1999*** （3.0039）	0.1747*** （2.6340）	0.1596** （2.4044）	0.2094*** （3.5396）	0.1849*** （3.1145）	0.1736*** （2.9315）
Per GDP	-0.0004** （-2.3560）	-0.0003* （-1.8760）	-0.0003** （-1.9772）	-0.0002 （-1.3859）	-0.0001 （-0.9712）	-0.0001 （-1.0608）
Urban Construction	0.0013 （0.2671）	-0.0019 （-0.4048）	-0.0004 （-0.0841）	0.0008 （0.1922）	-0.0020 （-0.4563）	-0.0008 （-0.1970）
dynamic lag	0.9051*** （129.5436）	0.9009*** （133.0315）	0.9040*** （134.8854）	0.9292*** （173.3100）	0.9264*** （172.2532）	0.9298*** （175.2722）
Spatial correlation	0.0300*** （3.3579）	0.0310*** （3.6025）	0.0320*** （3.7710）	-0.2680*** （-10.4472）	-0.2610*** （-10.1738）	-0.2620*** （-10.2124）
R^2	0.9122	0.9044	0.9123	0.9156	0.9079	0.9155

The value in parentheses is the t statistic, *significance level of p<0.1; **significance level of p<0.05; ***significance level of p<0.01

Conclusions

In general, there exist obvious differences of the impacts of the bank loans and FDI for different types of pollution emissions. The bank loans suppress the industrial SO_2 emissions. However, FDI has no obvious impact on the industrial SO_2 emissions, mainly due to the increase in bank loans and the suppression of industrial SO_2 emissions. However, FDI has no obvious impact on industrial SO_2 emissions; FDI has a significant positive impact on industrial wastewater emission, while bank loans have no significant impact on industrial wastewater emisson. SO_2 emissions are mainly from the steel, construction and other industries, of which the foreign investment is relatively small, so the impact is not obvious. With the implementation of the tightening of China's environmental protection policy, banks loans are limited to financing the high-emissions industries and significantly reduce SO_2 emissions. While the wastewater emissions are mainly from the papermaking textiles, chemical raw materials, etc. The proportion of the foreign investment in such industries is relatively high, so the impact of which is significant.

References

[1] G.M.Grossman, A.B.Kruger. Quarterly Journal of Economics, Vol.110(1995): p.353-377.

[2] M.A.Cole,. Ecological Economics, Vol.48(2004): p.71-81.

[3] Du L, Wei C, Cai S.. China Economic Review, Vol.23(2012): p.371-384.

[4]Force G F T.. *Final Report of the Green Finance Task Force*, Research Bureau of the People’s Bank of China and UNEP Inquiry into the Design of a Sustainable Financial System(2015)