The Impact of Trade Openness on The Atmospheric Environment in China

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1. Background and research objective

Since the reform and opening up from 1978, China's economy has seen a recovery, especially in the first decade of 21st century, when the China's economy grew at an average annual rate of more than 10% from 1.21 trillion dollars in 2000 to 5.88 trillion dollars in 2010 reaching the second highest total GDP in the world. China became the world's top goods exporter in 2009 with 1,201.61 billion dollars in exports and the world's top goods trader in 2013 with 4,158.99 billion dollars in total trade. Economic activities inevitably produce polluting emissions, the rise in economic level also awakened the demand for better environmental quality. Due to China's large population base and technological backwardness, environmental regulation is difficult in the beginning and growth stages of environmental protection.

Rapid industrialization and trade globalization put immense pressure on China's environment, particularly air pollution have reached hazardous levels in many areas, leading to significant health and ecological challenges. Based on the actual situation of China's participation in international trade, the panel data of 30 provinces in China are used as the basis of the study, and the impacts of foreign trade and other factors on air pollutant emissions are explored by constructing a theoretical model.

2. Data and research method

Panel data of 30 provinces in China during 2003-2020 (Only NO_x emission:2011-2020) were employed. Dependent variables (Atmospheric pollutants emission) including industrial SO_2, industrial NOx and Particulate Matters. And independent variables including export volume, import volume, share of exports in GDP (Trade openness), share of foreign-invested trade in total trade (Foreign-Invest Trade Dependence) and GDP per capita. All of data from China Statistic Yearbook and China Environment Statistic Yearbook (2004-2021)

In order to minimize and eliminate the effects of omitted variables, Time and Individual Fixed Effects Model was employed.

$$\mathrm{LnEm}_{it} = \alpha_0 + \alpha_1 \mathrm{O}_{it} + \alpha_2 \ln \mathrm{F}_{it} + \alpha_3 \mathrm{LnEx}_{it} + \alpha_4 \mathrm{LnIm}_{it} + \alpha_5 \ln \mathrm{G}_{it} + \varepsilon_{it}$$

Where Em refers to the atmospheric pollutant emission(industrial SO_2, industrial NO_x and Particulate Matters respectively), O refers to trade openness, F refers to foreign-invested trade dependence, Ex refers to export volume, Im refers to import volume, G refers to GDP per capita, ε refers to the error, i refers to the variables in i province or city, and t refers the variables at t year.

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3. Main findings

Trade openness and GDP per capita have significantly positive effect on the emissions of industrial SO_2 and PM. (When trade openness increased by 1%, industrial SO_2 emissions increased by 2.0688%, while PM emission grew up by 1.0344%. When GDP per capita rose by 1%, the industrial SO_2 and PM rose by 0.5768% and 0.2903% respectively.)

Due to the stricter environmental regulation started from 2015, there were some differences in the statistical approach to pollutant data. Year 2015 is a boundary to divide into two periods. Before 2015, traded openness and GDP per capita had a significantly positive effect on industrial SO_2 and industrial NO_x. After 2015, only trade openness had statistically significant impact on industrial SO_2.

For PM, separately, it is not significant at these two time periods, but it is significant overall. According to the literature, this could be due to the period is too short. The rate of economic growth and foreign trade slowed down and nearing saturation. And the main sources of PM are electricity generation, vehicle exhaust and winter heating by burning coal.

4. Conclusion

Trade openness and GDP per capita promote atmospheric pollutant emissions. Trade liberalization had a positive impact on industrial SO_2 emissions in all cases, the impact of trade liberalization on industrial SO_2 emissions was greater after the implementation of strict environmental policies in 2015.

Trade openness plays a positive role in industrial SO_2 emissions and PM in the whole country as well as in the high GDP group and medium GDP group in the sample. For low GDP group, trade openness and import have a negative effect on industrial SO_2 emission. Foreign-invest trade and export have a negative effect on PM emission.

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