Environmental Policy and Export Dynamics: A Firm-Level Analysis of China's Five-Year Plans

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1. Introduction

As economic development progresses and air pollution worsens, improving air quality has become a common goal for governments and the public alike. To this end, various air cleaning measures have been introduced by governments, including the phasing out of outdated equipment and the use of clean energy to reduce pollutant emissions. However, these measures often increase production costs for enterprises, leading pollution-intensive firms to relocate their production to countries with lower environmental standards, known as "pollution havens."

This paper utilizes data from China's 11th and 12th Five-Year environmental policies to investigate whether environmental regulation affects the exports of Chinese manufacturing firms. China formulates a five-year development plan every five years. In the 11th Five-Year Plan (2006-2010), China for the first time set a target to reduce sulfur dioxide emissions by 10%, assigning different reduction targets to each province. Subsequently, the 12th Five-Year Plan (2011-2015) implemented more stringent reduction targets in 19 key provinces: sulfur dioxide and nitrogen oxide emissions were to be reduced by 12% and 13%, respectively. Previous studies have found that environmental regulations can decrease the likelihood of firms exporting and reduce export volumes, but they focus on industry-level data and single environmental regulation policies.

By utilizing firm-level data, this study comprehensively analyzes the impact of two policies, exploring how continuous and varying stringency levels of environmental regulation affect firms' export behavior. This approach reveals the diversity and heterogeneity among firms within the same industry, as well as the differing responses to environmental regulation based on firm size, region, and market positioning. Consequently, the study provides a more comprehensive understanding of the relationship between environmental policy and international trade.

2. Methodology and Data

This study examines the effect of the two Five-Year environmental policies on the exports of Chinese manufacturing firms. The data were obtained from the National Bureau of Statistics of China (NBS), encompassing 41844 Chinese manufacturing companies from 2002 to 2014. A difference-in-differences-in-differences (DDD) model is specified as follows:

$$\ln(Export)_{c,t} = \alpha + \beta_1 Policy11_{cpt} + \beta_2 Policy12_{c,p,t} + X_{c,t} + \lambda_c + \eta_{p,t} + \delta_{i,t} + \varepsilon_{c,p,t}$$

where $\ln(Export)_{c,t}$ is the natural logrithm form of export value plus 0.001 for the case of 0 export value of company c in year t; $Policy11_{cpt}$ denotes the interaction term of Policy11: $Ln(Target)_p \times Post_{t1} \times Ln(SO2)_c$. $Policy12_{cpt}$ denotes the interaction term of Policy12: $KeyRegion_p \times Post_{t2} \times Ln(SO2)_c$. $Target_p$ is the pollution reduction target for province p under policy11; $KeyRegion_p$ is a dummy variable equal to 1 for provinces defined as key reduction regions under Policy12, and 0 otherwise. $Post_{t1}$ is a dummy variable equal to 0 for 2002-2005 and 1 for 2006-2009 for policy11, while $Post_{t2}$ is a dummy variable equal to 1 for 2011-2014 and 0 otherwise for policy12. $SO2_c$ represents the average sulfur dioxide (SO2) emissions from 2003 to 2005 for each company. We control for individual fixed effects (λ_c), province-by-year fixed effects ($\eta_{p,t}$) and industry-by-year fixed effects ($\delta_{i,t}$). $X_{c,t}$ includes a series of control variables for company c in year t.

Considering that policymakers might account for the export performance of high-pollution enterprises in each province, leading to potential endogeneity issues, this study adopts an instrumental variable (IV) strategy.

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Specifically, we use the ventilation coefficient as an instrumental variable to represent policy intensity, which measures the natural dispersion capacity of pollutants in the atmosphere, is correlated with the intensity of environmental regulations but not directly with firm-level export activities, satisfying the exclusion restriction.

3. Results and Conclusion

Table 1 shows the OLS regression results based on the specified model. For Policy11, the coefficients are -0.012 and -0.0173 in the first and second columns, respectively. For Policy12, the coefficients are -0.089 and -0.085 in the first and second columns, respectively, with the results for Policy12 being significant at the 1% level.

Table 2 presents the results using the instrumental variable (IV) approach. The instrumental variable for policy intensity proves to be a strong predictor. Specifically, we use two IVs: the ventilation coefficient as an instrument for Policy11 and the same for Policy12. The IV estimates indicate that both policies have a significant negative impact on firm exports, with Policy12 having a more substantial effect compared to Policy11.

The findings suggest that environmental regulations under both policies negatively impact the export of firms, with the effect of Policy12 being more pronounced. This analysis underscores the significant trade-offs between stringent environmental policies and international trade competitiveness for Chinese manufacturing firms.

Table 1. The impact of environmental regulations on firm exports (OLS estimates)

Dependent variable	**LnExport**	**LnExport**
$Policy11_{cpt}$	-0.012	-0.0173**
$Policy12_{cpt}$	-0.089***	-0.085***
Controls	No	Yes
Individual FE	Yes	Yes
Province×Year FE	Yes	Yes
Industry×Year FE	Yes	Yes
Observations	49,739	41740
R-squared	0.713	0.715

Table 2. The impact of environmental regulations on firm exports (IV estimates)

	Second Stage	**Second Stage**
Dependent variable	**LnExport**	**LnExport**
$Policy11_{cpt}$	-0.0135*	-0.0135*
$Policy12_{cpt}$	-0.1097***	-0.1092***
Controls	No	Yes
Observations	49739	49739

Notes: ***, ** and * indicate 1%, 5% and 10% significant level.

Reference:

1. Hering, Laura, and Sandra Poncet. "Environmental policy and exports: Evidence from Chinese cities." *Journal of Environmental Economics and Management* 68.2 (2014): 296-318.
2. Shi, Xinzheng, and Zhufeng Xu. "Environmental regulation and firm exports: Evidence from the eleventh Five-Year Plan in China." *Journal of Environmental Economics and Management* 89 (2018): 187-200.