

Green Growth, Carbon Intensity Regulation, and Green Total Factor Productivity in China

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Huge primary energy consumption and coal-based energy consumption structure make China the world's largest emitter of CO₂. Instead of reducing the total amount of emissions, lowering CO₂ emissions per unit of GDP (CO₂ intensity) is set as an important CO₂ emissions control target by the Chinese government. Meanwhile, the CO₂ intensity constraint is used to act as a major policy tool for controlling CO₂ emissions. Compared with economic instruments such as carbon tax and carbon emissions trading, the carbon intensity standard, as a command-and-control instrument, is a relatively reliable tool under uncertainty condition, ensuring the smooth realization of an established emission control target, although its cost efficiency to achieve the target is relatively poor. However, considering the importance of total factor productivity to economic growth, the question is more about whether the CO₂ intensity constraint policy promotes the growth of China's green total factor productivity.

Based on the input-oriented Malmquist productivity index and parametric decomposition method, this paper measures the green total factor productivity and its growth sources using a dataset of input, output and CO₂ emissions of China mainland's 30 provinces (excluding Tibet) from 1997 to 2014, and assesses the impact of the carbon intensity regulation on China's green total factor productivity by using the two stage least squares approach.

When measuring the green total factor productivity under the input-oriented Malmquist productivity index framework, the output variables are values-added of primary industry, secondary industry, and tertiary industry, and the input variables include labor, capital, primary energy use, CO₂ emissions, and wastewater. When evaluating the effect of CO₂ intensity constraint on the green total factor productivity, the explanatory variables include dummy variable of CO₂ intensity policy, R&D intensity, FDI, foreign trade, industrial structure change, infrastructure, and government size.

The results show that the green TFP has been growing at a yearly averaged rate of -1.51% during this period. The results also indicate that the policy of CO₂ intensity regulation does not generate significant effect on the green total factor productivity of China's provinces when using the 2SLS estimator to control for the potential endogeneity biases. On the other hand, there exists significant heterogeneity in the effect of the CO₂ intensity regulation on the green TFP of China's provinces. Specifically, the CO₂ intensity regulation promotes the green development performance of provinces in the eastern area, while it does not generate obvious impacts on the green TFP of provinces in both central and western areas.

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