

Inter-provincial population migration and carbon inequality in China

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(1) The research question

This paper focuses on exploring how China's large-scale inter-provincial population migration impacts carbon emissions. In recent years, a large number of people in China have migrated from less-developed regions to developed regions. Meanwhile, the Chinese government has committed to achieving carbon peak by 2030 and carbon neutrality by 2060. Against this backdrop, understanding the influence of population migration on carbon emissions is of great significance. Existing studies have limitations in the mechanism and quantitative assessment of the impact of population migration on carbon emissions. This paper aims to fill this research gap, deeply analyze the impact of population migration on carbon emissions, and provide a basis for formulating regionally coordinated carbon reduction policies.

(2) The method used

The paper adopts an integrated model framework. It utilizes the Geographically Weighted Regression (GWR) model to estimate the marginal effect of population migration on production-based carbon emissions, taking into account factors such as economic development and industrial structure. This model can reflect the spatial heterogeneity of sample marginal effects. The population migration matrix is employed to record population migration information, and the 2017 population migration data is approximated. The Environmentally Extended Multi-Regional Input-Output (EE-MRIO) model is used to calculate carbon emissions driven by consumption and investment, considering the environmental intensity in economic activities. Structural Path Analysis (SPA) is applied to track the embodied carbon emissions in critical supply chains. By comparing the results of factual and counterfactual scenarios, the quantitative impact of population migration on carbon emissions is quantified.

(3) The data used

The research mainly uses data from 2017. The data of independent variables in the GWR model are sourced from the China Statistical Yearbook and China Energy Statistical Yearbook. The population migration data comes from the China Population Statistical Yearbook. The carbon emissions inventory data and the 2017 MRIO table are obtained from China Emission Accounts and Datasets (<https://www.ceads.net/>). For the convenience of analysis, the carbon emissions inventory data is mapped into the MRIO table, and the 42 sectors in the MRIO table are re-integrated into 30 sectors. The research focuses on the economic linkages among provinces and does not consider import and export factors.

(4) The novelty of the research

The research is innovative in several aspects. Firstly, it innovates in the model framework by integrating the GWR model, population migration matrix, and EE-MRIO model. This integrated framework comprehensively assesses the impact of population migration on carbon emissions from the perspective of industrial linkages, covering direct carbon emissions driven by consumption and indirect carbon emissions driven by consumption and investment, thus making up for the limitations of previous studies that only focused on residential carbon emissions. Secondly, its research findings are novel. It reveals that although population migration increases the indirect carbon emissions of provinces with net in-migrants, it also transfers more carbon emissions to provinces with net out-migrants, exacerbating carbon emission inequality and increasing the carbon emission reduction barriers of net-out-migrant provinces. It also clarifies the impact of population migration on investment - driven indirect emissions. Thirdly, it has new discoveries at the level of industrial linkages and supply chains. It quantifies the impact of population migration on specific industries, identifies the key industries in net-out-migrant and net-in-migrant provinces where carbon emissions

increase due to population migration, and provides a basis for China to formulate hierarchical carbon emission reduction policies.

Keywords: Population migration; Carbon emissions; Multi-regional input-output analysis; Carbon inequality; China