Intergenerational inequality and its mitigation scheme of carbon pricing policy under China's dual carbon goals

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China's dual carbon goals constitute a long-term climate strategy with multi-generational impacts. Although carbon pricing is a critical policy tool for achieving these goals, the intergenerational distribution pattern of its costs remains unclear. This study constructs a framework to evaluate the intergenerational effects of policy shocks, including a CGE model that disaggregates households and labor sectors by age group and a Theil index to quantify social inequity of carbon costs. The analysis reveals that carbon pricing generates potentially unequal economic burdens across generations, with intergenerational factors driving more than 90% of the observed inequality in carbon cost distribution. These inequities arise principally from age effect and period effect, which lead to structural and aggregate heterogeneity, respectively. The former represents the disproportionate impact on younger households, while the latter represents the intensification of future burdens. The inequality mitigation scheme is based on a carbon revenue recycling mechanism that combines intratemporal redistribution and intertemporal allocation. The simulation demonstrates the effectiveness of our scheme, showing a 49.06% reduction in intergenerational inequality. The findings provide policy insights to alleviate unequal social impacts of carbon reduction and facilitate a just transition.

The research questions

In 2020, the Chinese government announced its ambitious long-term climate goals: to achieve carbon peaking before 2030 and carbon neutrality by 2060. Carbon pricing is one of the principal policy instruments for reducing greenhouse gas emissions and typically takes the form of emissions trading schemes or carbon taxes. To meet the dual carbon targets, China officially launched its national carbon market for the power sector in 2021, and the scope was extended to key sectors such as steel, cement, and aluminum sectors in 2025. Undoubtedly, the carbon pricing system can mitigate the economic costs of low-carbon transition by promoting green technology innovation and facilitating industrial restructuring. However, carbon pricing may also induce household welfare losses and contribute to an unjust transition. From the perspective of temporal distribution of carbon costs, any aim of carbon pricing will inevitably affect the welfare of several generations, and the disproportionate policy impact may cause the problem of intergenerational inequality.

To mitigate social risks arising from the low-carbon transition, China has introduced robust social safety nets, such as workforce retraining programs for coal industry employees. However, existing policy frameworks have yet to fully incorporate mechanisms to address intergenerational equity concerns. Meanwhile, the academic literature still lacks a systematic quantification of prospective intergenerational inequity and a discussion of potential mitigation strategies. Accordingly, this study seeks to address the following questions. First, under the dual carbon goals, will carbon pricing policies generate significant intergenerational inequity? Second, why does carbon pricing impose higher mitigation costs on certain generations, and through what specific mechanisms does this occur? Finally, can such intergenerational inequity be alleviated, for example, through carbon revenue recycling?

Model

This study employs a recursive dynamic CGE model encompassing 35 sectors of China. The Social Accounting Matrix (SAM) of this model is based on the 2018 input-output table, with 2018 serving as the base year. The production function of the model is designed in a multi-layer nested structure, in which the energy sectors has been detailedly decomposed. To examine the intergenerational impacts of carbon pricing policies, this study incorporates demographic disaggregation into the CGE

model by categorizing labor and households according to age groups, gender, and geographic region. Households are classified into 24 distinct groups, comprising 6 age brackets, 2 genders, and 2 regions. The classification of labor is similar to households, but it excludes the 0-15 age group.

Data

During the model construction process, This study used the 2018 input-output table as the basis for the SAM. At the macro level, the SAM was compiled by integrating data from the China Finance Yearbook and the China Tax Yearbook. At the micro level, the disaggregation of households and labor was based on the 2018 China Family Panel Studies (CFPS) database and Chinaâ€™s 7th National Population Census. The carbon emission coefficient of fossil energy is obtained from the International Energy Statistics Input-Output table. The specific content will be elaborated in detail in the article.

The novelty of the research

This study may contribute to the existing literature in three aspects: Firstly, an analytical framework is developed to assess the impacts of policy shocks on intergenerational equity. This study impr