

Impact and spatial spillover effect of digital industry agglomeration on regional carbon emission intensity: Evidence from China

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Author: Kexin Liu

Co-Authors: Hongxia ZHANG, Zhaotin Guo

China faces the challenge of balancing economic growth with environmental protection. This paper investigates the impact and spatial spillover effects of digital industry agglomeration on regional carbon emission intensity in China. Based on balanced panel data for 30 provinces from 2007 to 2021, the study reveals an inverted U-shaped relationship between digital industry agglomeration and regional carbon emission intensity, with a turning point value of 1.464, and as of 2021, only a few provinces have reached the carbon-reduction stage of digital industry agglomeration. Furthermore, heterogeneity analysis shows that the carbon-reduction effect is more pronounced in regions with developed digital economies and non-resource-based provinces, while policy pilot areas exhibit varying impacts over time. Additionally, mechanism analysis indicates that digital industry agglomeration promotes regional industrial upgrading and has an inverted U-shaped effect on regional energy intensity, thereby influencing carbon emission intensity. Moreover, using a spatial Durbin model (SDM), this study explores the spatial spillover effects of digital industry agglomeration and finds a positive U-shaped nonlinear spatial spillover effect, where digital industry agglomeration initially suppresses but later enhances the carbon emission intensity of neighboring regions. This study offers several innovations as it incorporates industrial agglomeration into the digital economy-carbon nexus, refines measurements of digital industry agglomeration using data from the Chinese multi-regional input-output table, and comprehensively examines spatial spillover effects. The findings underscore the need for region-specific policies to enhance the positive externalities of digital industry agglomeration while mitigating its adverse spillover effects, providing valuable policy implications for achieving coordinated economic and environmental development.