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DIGITAL ECONOMY DEVELOPMENT AND ITS ENVIRONMENTAL IMPACTS: EVIDENCE FROM CHINA'S CARBON EMISSIONS

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Abstract

China's digital economy is rapidly expanding and plays a dual role in the nation's low-carbon transition under the "dual-carbon" goals. This study examines how digitalization affects carbon emissions through multiple channels, focusing on industrial structure optimization, green technological innovation, energy mix transition, and industrial robot deployment. Using provincial panel data from 2012–2021 and a multiple mediation model, the results show that the digital economy significantly reduces carbon emissions by promoting industrial upgrading, advancing eco-innovation, and accelerating the shift to cleaner energy sources. However, greater penetration of industrial robots partially offsets these gains by increasing energy demand, particularly in highly industrialized eastern provinces. Heterogeneity analysis reveals that emission-reduction effects are strongest in eastern regions, high-emission provinces, areas with dense AI enterprises, non-pilot carbon trading regions, and provinces with stricter environmental regulations. These findings provide new evidence on the environmental consequences of digital transformation and offer policy insights for promoting regionally differentiated digital strategies, strengthening eco-innovation, and mitigating rebound effects to ensure alignment with carbon neutrality objectives.

Key words: carbon emissions, digital economy, transmission mechanisms

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