[*THE IMPACTS OF CARBON REGULATION ON ENERGY TRANSITION IN CHINA*]

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Extended Summary

Mitigating climate change requires a fundamental shift from the current fossil fuel-based energy system to a low-carbon alternative. This transition involves gradually reducing reliance on high-carbon technologies while promoting green technological innovation. Such a shift entails complex social and technological changes that carry significant social implications. Therefore, accelerating low-carbon technological innovation is crucial for fostering new growth and promoting green development.

Developing green or low-carbon economic growth is essential for aligning with global sustainability goals. Green growth is related to several key areas, including affordable and clean energy, decent work and economic growth, industry, innovation and infrastructure, responsible consumption and production, and climate action. For many developing countries, green technology innovation is urgently needed to reduce dependence on fossil fuels, ensure green energy development, and address the global climate crisis.

In China, the National Development and Reform Commission (NDRC) has highlighted the need for enhanced regulatory measures to stimulate market-driven innovation in green technology. In December 2022, the NDRC and the Ministry of Science and Technology released an implementation plan to improve the market-oriented green technology innovation system by 2025. This plan outlines key tasks and initiatives focused on enhancing support for green technological innovation. It emphasizes the leadership of green technological innovation in nurturing leading green technology and low-carbon enterprises. The plan also encourages collaboration among actors in green technological innovation to boost innovation vitality and promote integration among stakeholders. Furthermore, it accelerates the transformation and application of green technology, enhances the green technology evaluation system, and provides fiscal, tax, and financial support to facilitate successful green technology transfer and application. The plan aims to optimize these aspects to ensure effective green technology utilization, with the goal of significantly improving China's market-oriented green technology innovation system by 2025.

However, policies designed to mitigate climate change and promote low-carbon development often exhibit inertia, making them slow to change. This is because the choices related to green technology innovation and the ensuing technological changes are influenced by non-linear increasing returns, making these changes path-dependent and vulnerable to "lock-in" effects. In a market dominated by traditional high-carbon production technologies, achieving a green transition requires overcoming the path dependency associated with high-carbon technologies. This involves cultivating green expectations to steer resources towards sustainable sectors, redefining the future growth potential and market value of green technologies, and motivating enterprises to engage in green technological innovation.

This paper examines the interplay between the path dependence of high-carbon technology and the green expectation of low-carbon paradigms, using China as an example. It addresses how path dependence on high-carbon technology arises during China's economic development, the impacts of high-carbon path dependency and low-carbon expectations on technological innovation models, and the regulatory frameworks essential for promoting economic growth while facilitating low-carbon innovation.

Using patent data from Chinese listed firms, the paper documents the path dependency of high-carbon innovation. It empirically assesses path dependence by examining the impact of existing patent stocks on patent application increments. The findings reveal that once brown technology establishes its sizable stock through first-mover advantages, it is likely to generate further increments, thereby reinforcing its dominance and impeding the transition towards green technologies. The paper also investigates how low-carbon transition regulatory policies mitigate the path dependence associated with high-carbon technologies. The results indicate that implementing carbon emission quotas in high-carbon sectors can diminish the advantages of existing high-carbon patent stocks, breaking the path dependence. Low-carbon policies foster positive expectations for green technology growth, reducing reliance on high-carbon technologies and enhancing low-carbon innovation.