High-Speed Rail and Energy Productivity: Evidence from China

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The effects of high-speed rail (HSR) on the economy and productivity have received substantial attention from economists. However, no consensus has been reached about whether high-speed rail (HSR) is conducive to economic and productivity growth, especially in developing countries. Rail transport is more energy-efficient and emits less greenhouse gases (GHGs) than other traditional transportation modes. Therefore, the development of HSR is crucial for the energy transition. Existing studies focus on the economic and productivity effects of HSR. However, rare studies investigate the roles of HSR and HSR network accessibility in energy productivity, as well as the channels through which HSR affects energy productivity.

We attempt to gain insight into China’s energy productivity at the city level by using a unique dataset that was manually collected from official documents, websites, and reports. In order to ensure the accuracy of data and estimation results, the energy productivity indicators of Chinese cities are cross-checked. Using the difference-in-differences method combined with the propensity score matching, we identify the causal effect between HSR on energy productivity in China. Considering that HSR connections are unlikely to be randomly selected by the Chinese central government, an instrumental variable approach is adopted to address the potential endogeneity problem. Furthermore, we investigate the mechanism through which HSR affects energy productivity, as well as the heterogeneity of the impact across quantiles and distances.

The results show that HSR connection contributes to the improvement of energy productivity. This finding is consolidated after the potential endogeneity problem is addressed and a variety of potential confounders are controlled through a series of robustness checks. On average, the marginal impact of HSR on energy productivity is approximately 9%. Besides, HSR connection cannot be completely substituted by traditional railway and aviation in improving energy productivity. Heterogeneity analysis suggests that the positive energy productivity effect of HSR gradually decreases with an increasing distance to the nearest HSR station. Moreover, HSR network accessibility has a significant positive effect on energy productivity, while technological innovation mediates the relationship between HSR development and energy productivity.

The present study can provide some empirical references for the improvement of energy productivity via HSR network in other developing countries that are operating HSR like China. Information about how and to what extent HSR affects energy productivity is beneficial for both policymakers and practitioners to integrate transit-oriented development and ecology-oriented development modes. Policymakers should fully take advantage of the diffusion effect of HSR to reduce a spatial inequality between cities with and without HSR stations. To achieve green transformation and sustainable development goals, the development of HSR should not only consider its pollution reduction effects, but also its energy productivity effects.

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