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EVALUATING THE DISCREPANCY AND CONVERGENCE OF CHEMICAL FERTILIZER USE EFFICIENCY: A COMPARISON OF WHEAT, RICE, AND MAIZE IN CHINA

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Abstract

The use of chemical fertilizer has been a primary driver of China's grain yield growth. While playing a critical role in securing food security, it is also recognized as a major contributor to agricultural pollution and environmental degradation. Employing the Stochastic Frontier Analysis model (SFA) with provincial-level data from 1998 to 2020, this study assesses the discrepancy and convergence of chemical fertilizer use efficiency (FUE) in wheat, rice, and maize production, and discusses the policy implications for mitigating fertilizer overuse. First, the regional distribution analysis reveals average FUE scores of 0.31 for wheat, 0.56 for rice, and 0.40 for maize production. Second, the study employs three tests to assess the occurrence of σ-convergence and β-convergence in FUF, and to identify pathways to accelerate convergence. Results indicate the presence of technological spillovers and catch-up effects between different regions, with the improvement of FUE being pivotal for addressing these dual challenges. Finally, convergence tests further suggest that raising education attainment, optimizing compound fertilizer application ratios and reducing chemical fertilizer prices can help to achieve catch-up at the provincial level and mitigate fertilizer overuse.

Key words: chemical fertilizer use efficiency, convergence test, grain production, stochastic frontier analysis

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