African Volcanology and Geochemistry (Earth Science)

Methodological Evaluation of Smallholder Farm Systems in Uganda Using Panel Data Estimation to Measure Efficiency Gains

Kizza Mugerwa[1,2], **Namugenyi Onyango**[3,4], **Musoke Nabwepa**[2]

[1] Department of Research, Mbarara University of Science and Technology

[2] Medical Research Council (MRC)/UVRI and LSHTM Uganda Research Unit

[3] Mbarara University of Science and Technology

[4] Department of Interdisciplinary Studies, Medical Research Council (MRC)/UVRI and LSHTM Uganda Research Unit

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Correspondence: kmugerwa@hotmail.com

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Author notes

Kizza Mugerwa is affiliated with Department of Research, Mbarara University of Science and Technology and focuses on Environmental Science research in Africa.

Namugenyi Onyango is affiliated with Mbarara University of Science and Technology and focuses on Environmental Science research in Africa.

Musoke Nabwepa is affiliated with Medical Research Council (MRC)/UVRI and LSHTM Uganda Research Unit and focuses on Environmental Science research in Africa.

Abstract

Smallholder farms in Uganda are a significant component of the country's agricultural sector, contributing to food security and economic development. Panel data analysis will be employed to examine the performance of smallholder farms. The model includes fixed effects for individual farms and random effects for time-invariant characteristics. A preliminary analysis suggests that input use efficiency varies significantly across farms, with some showing substantial gains in output per unit input. The study confirms the utility of panel data methods for assessing farm efficiency, revealing potential areas for improvement through targeted interventions. Recommendation is to implement training programmes focused on efficient resource utilization and market access strategies tailored to specific farming practices. The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African agroecology, smallholder farming, panel data analysis, econometrics, productivity enhancement, resource management, sustainable agriculture*

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