



Methodological Evaluation of Smallholder Farm Systems in Ghana Using Multilevel Regression Analysis to Measure Risk Reduction Effects

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Abstract

Smallholder farming systems in Ghana face significant challenges related to risk management, particularly climate-related risks such as drought and floods. A multilevel regression model was employed to analyse data collected from smallholder farms across different regions of Ghana. The model accounts for both farm-level and regional variability in risk exposure and management practices. The analysis revealed that implementing weather insurance schemes at the farm level significantly reduced perceived risks by approximately 25%, with a robustness standard error ranging from -3% to +4%. This finding underscores the effectiveness of targeted interventions in mitigating climate-related risks for smallholder farmers. This study provides evidence on how multilevel regression analysis can be effectively utilised to identify and measure risk reduction effects among smallholder farming systems. The findings have implications for policy development aimed at enhancing agricultural resilience in Ghana. Policy makers should consider incentivizing the adoption of weather insurance schemes as part of a comprehensive strategy to protect smallholder farmers from climate-induced risks. Additionally, further research is recommended to explore other effective risk management practices across different regions and contexts. The empirical specification follows $Y = \beta_{0+\beta}^{\vec{p}} X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Ghana, Smallholder Farms, Multilevel Regression, Risk Analysis, Agricultural Systems, Methodology, Quantitative Methods*

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