



Methodological Evaluation of Smallholder Farm Systems in Kenya Using Multilevel Regression Analysis to Measure Risk Reduction Risks

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Abstract

Smallholder farms in Kenya face significant challenges that threaten their productivity and sustainability. A multilevel regression analysis was employed, incorporating data from multiple years across various regions of Kenya. The model considered both farm-level and household-level variables to assess the impact of interventions aimed at reducing risks. Multilevel regression revealed that soil fertility management practices significantly reduced crop yield variability by an average of 20% across different farming systems in Kenya, indicating a positive effect on resilience. The study underscores the importance of integrating multilevel analysis into future research to better understand and mitigate risks faced by smallholder farmers. Farmers' organizations should be encouraged to adopt soil health improvement programmes as part of their risk reduction strategies, with a focus on training sessions and supply chain support for inputs such as organic fertilizers. The empirical specification follows $Y = \beta_{0+\beta}^{-1} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African agriculture, Smallholder farming systems, Multilevel analysis, Regression models, Risk assessment, Spatial econometrics, Geographic information systems*

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