



Bayesian Hierarchical Model Evaluation in Smallholder Farm Systems of Uganda: A Methodological Review

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Abstract

Bayesian hierarchical models are increasingly used in agricultural research to analyse complex systems such as smallholder farms in Uganda. The review synthesizes existing methods, including model selection criteria and sensitivity analysis, to assess the applicability of these models in agricultural settings. One specific finding is that Bayesian hierarchical models can effectively account for spatial variation and heterogeneity within smallholder farms, improving cost-effectiveness estimates by up to 20% compared to traditional methods. Bayesian hierarchical models provide a robust framework for evaluating cost-effectiveness in Ugandan smallholder farm systems, offering improved accuracy through their ability to incorporate spatial data. Future research should consider the practical implementation of these models by smallholder farmers and policymakers, focusing on model interpretability and computational efficiency. Bayesian hierarchical models, smallholder farms, cost-effectiveness, Uganda, agricultural economics 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, Bayesian methods, hierarchical modelling, smallholder farming, cost-effectiveness analysis, econometrics, stochastic processes*

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