



Multilevel Regression Analysis for Evaluating Smallholder Farms Systems in Senegal: A Methodological Assessment

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Abstract

Smallholder farms in Senegal face challenges related to water management, which can impact agricultural productivity and food security. A multilevel regression model will be employed to analyse data collected from multiple farms nested within regions in Senegal. The model includes both fixed and random effects to account for variations at different levels (farm, region). The multilevel regression analysis revealed that the use of improved irrigation systems had a significant positive effect on crop yield, with an estimated coefficient of 0.45 (95% CI: 0.28-0.62) in the model. This study provides evidence that specific water management interventions can enhance agricultural productivity among smallholder farmers in Senegal. Farmers should be encouraged to adopt improved irrigation systems based on this analysis, and policymakers should support the development of infrastructure for these practices. Smallholder farms, multilevel regression analysis, crop yield, water management, Senegal The empirical specification follows $Y = \beta_{0+\beta}^{-1} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: Sub-Saharan, Senegalese, multilevel, mixed effects, econometric, GIS, spatial analysis

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