



Methodological Evaluation of Quasi-Experimental Design in Assessing Efficiency Gains Among Smallholder Farms Systems in Ethiopia

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Abstract

Smallholder farms in Ethiopia are pivotal to the country's agricultural economy but face challenges related to productivity and efficiency. A mixed-method approach combining field surveys with econometric analysis was employed. The study utilised a difference-in-differences (DiD) model to estimate treatment effects. The DiD model revealed significant efficiency gains among farms implementing the technology, with an estimated average increase of 12% in productivity compared to control groups over two years. Quasi-experimental designs provide robust methods for assessing technological interventions in smallholder farming systems, offering a nuanced understanding of their impact. The findings suggest that policymakers and development agencies should prioritise the dissemination of precision agriculture tools as part of broader agricultural support strategies. Smallholder farms, Ethiopia, Quasi-experimental design, Precision Agriculture, Efficiency gains Model estimation used $\hat{\theta} = \operatorname{argmin}\{\theta\} \operatorname{sumiell}(y_i, f\theta(\xi)) + \lambda lVert\theta rVert^2$, with performance evaluated using out-of-sample error.

Keywords: *African geography, Smallholder farming, Quasi-experimental design, Econometrics, Agricultural productivity, Resource allocation, Impact evaluation*

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