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Panel Data Estimation for Cost-Effectiveness Analysis of Power-Distribution Equipment Systems in Ethiopia: A Methodological Assessment

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Abstract

The study focuses on the cost-effectiveness analysis of power distribution equipment systems in Ethiopia, addressing the critical need for efficient and sustainable energy infrastructure. A mixed-method approach combining statistical modelling with empirical analysis was employed. Panel data from various regions in Ethiopia were collected over a five-year period (-). A Generalized Method of Moments (GMM) regression model was used to estimate the cost-effectiveness, accounting for potential endogeneity issues. The estimated GMM coefficients indicate that investment in modern power distribution systems significantly reduces operational costs by approximately 15% compared to traditional methods. This reduction is particularly pronounced in rural areas where infrastructure is less developed. This study provides robust evidence on the cost-effectiveness of different power distribution equipment models, offering a new framework for policymakers and investors in Ethiopia's energy sector. Based on the findings, it is recommended that government bodies prioritise investments in advanced technology to ensure long-term sustainability and efficiency in power distribution systems across all regions. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Ethiopia, Panel Data, Cost-Effectiveness, Econometrics, Regression Analysis, Time-Series, Spatial Econometrics*

ABSTRACT-ONLY PUBLICATION

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