African Transport Economics (Economics/Engineering crossover)

Methodological Evaluation of Power-Distribution Equipment Systems in Ethiopia Using Quasi-Experimental Design for Cost-Efficiency Measurement

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Abstract

Power distribution equipment systems (PDES) play a crucial role in ensuring reliable electricity supply to households and businesses in Ethiopia. However, existing PDES often suffer from inefficiencies and high operational costs. The study employs a difference-in-differences (DID) regression model to analyse data from randomly selected communities with and without recent upgrades to their PDES. Uncertainty is quantified through robust standard errors. Recent upgrades significantly reduced electricity outages by 20% in treated areas compared to control regions, indicating a substantial improvement in cost-effectiveness. The quasi-experimental design demonstrates the effectiveness of targeted PDES upgrades in enhancing reliability and efficiency, providing actionable insights for policymakers. Policymakers should prioritise funding for infrastructure improvements in under-resourced areas to achieve broader benefits across the country. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African geography, power distribution systems, quasi-experimental design, econometrics, cost-benefit analysis, infrastructure assessment, performance metrics*

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