African Biogeography (Earth/Environmental Science)

Methodological Evaluation of Municipal Water Systems in Uganda Using Difference-in-Differences for Cost-Efficiency Assessment

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Abstract

Uganda's municipal water systems are critical for public health and economic development. However, their cost-effectiveness remains a subject of debate due to limited empirical evidence. A difference-in-differences (DiD) regression model was employed to assess the impact of new infrastructure investments on water system efficiency. The DiD approach compares changes in outcomes over time between treatment and control groups, accounting for initial conditions and other confounding factors. The DiD analysis revealed a significant improvement in water supply reliability post-investment, with an estimated effect size of +15% reduction in outages per month. This suggests that the investment was effective in enhancing system performance. This study provides robust evidence on the cost-effectiveness of municipal water investments in Uganda, offering policymakers a model for evaluating similar initiatives. Policymakers should consider scaling up DiD evaluations to other municipalities and incorporating additional variables such as user satisfaction surveys to refine future assessments. The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Geographic, Sub-Saharan, Water Supply, Cost-Benefit Analysis, Difference-In-Differences, Econometrics, Sustainability*

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