



Panel Data Estimation for Evaluating Municipal Water Systems Efficiency in Nigeria: A Methodological Assessment

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Abstract

Municipal water systems in Nigeria face significant challenges related to efficiency and sustainability, necessitating a methodological assessment to evaluate their performance. This research employs panel data analysis, utilising fixed effects models to evaluate the efficiency of municipal water systems across different regions in Nigeria. We use Stata software for data processing and empirical testing. Our findings indicate that panel data estimation reveals significant differences in system efficiency among urban centers in Nigeria, with some areas showing gains exceeding 20% after implementing intervention strategies. The study underscores the importance of adopting robust statistical methods to enhance the performance evaluation of municipal water systems in Nigeria. The identified inefficiencies suggest a need for targeted interventions and policy reforms. Based on our results, policymakers should prioritise resource allocation towards regions with lower efficiency scores, while also encouraging innovation and technological upgrades across all sectors. Model estimation used $\hat{\theta} = \operatorname{argmin}\{\theta\} \operatorname{sumiell}(y_i, f\theta(\xi)) + \lambda \sqrt{\theta} \sqrt{2^2}$, with performance evaluated using out-of-sample error.

Keywords: Nigerian, Metropolitan, Panel, Econometrics, Efficiency, Stochastic Frontier, Time-Series

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