



Time-Series Forecasting Model for Evaluating Cost-Effectiveness of Municipal Water Systems in Ethiopia

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Abstract

This study focuses on evaluating the cost-effectiveness of municipal water systems in Ethiopia by applying a time-series forecasting model. A time-series analysis was conducted using historical data from municipal water systems in Ethiopia. A dynamic linear regression (DLR) model was employed to forecast cost-effectiveness metrics such as total operational costs, capital investment, and user fees. The DLR model showed a significant positive correlation between the number of years since system inception and future operational costs, with an estimated increase rate of 5% per year. Confidence intervals for these projections were calculated to account for uncertainties in data and model assumptions. The study concluded that existing municipal water systems are financially sustainable over time but require periodic reassessment due to changing user needs and economic conditions. Regular monitoring of system performance is recommended, along with strategic planning for infrastructure upgrades and cost management strategies. The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Geographic, econometric, forecasting, sustainability, water resources, intervention studies, watershed management*

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