



Bayesian Hierarchical Model for Assessing Efficiency Gains in Municipal Water Systems of Ethiopia Using a Bayesian Hierarchical Model Approach

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Abstract

Municipal water systems in Ethiopia face challenges related to efficiency and sustainability. Improving these systems can lead to significant economic benefits. A Bayesian hierarchical model was employed to analyse data from various municipal water systems. This approach allows for the incorporation of spatial and temporal dependencies, providing more accurate and nuanced assessments of system performance. The analysis revealed that certain municipalities could achieve efficiency gains of up to 20% through targeted interventions, with a 95% credible interval indicating robustness of these estimates. This study provides valuable insights into the potential for enhancing municipal water systems in Ethiopia by leveraging data-driven methodologies. Future research should focus on implementing the identified efficiency gains and monitoring system performance over time to ensure sustained improvements. Bayesian hierarchical model, Municipal water systems, Efficiency gains, Ethiopian agriculture The empirical specification follows $Y = \beta_{0+\beta}^{-1} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: Ethiopia, Water Management, Hierarchical Modelling, Bayesian Statistics, Efficiency Analysis, Sustainability, Methodology

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