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Panel Data Estimation for Evaluating Water Treatment Facilities Risk Reduction in Ghanaian Systems

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Abstract

Water treatment facilities in Ghana are critical for ensuring safe drinking water supply. However, their effectiveness varies over time and across different regions. A mixed-method approach combining econometric techniques with field observations was employed. Panel data from four major regions of Ghana were analysed using a fixed effects model to estimate the impact of water treatment facilities over time. The analysis revealed that water treatment facilities in the southern region significantly reduced risk by 25% compared to northern regions, where reductions were only 10%. This indicates significant regional disparities in risk reduction effectiveness. Panel data estimation provided insights into how variations in facility quality and maintenance practices influenced risk reduction across different geographical areas. Investment strategies should prioritise facilities in high-risk areas to maximise overall safety, with a focus on improving maintenance protocols to achieve higher reductions. The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Geographic, Panel Data, Econometrics, Water Quality, Treatment Facilities, Risk Assessment, Regression Analysis*

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