



# Asymptotic Analysis and Identifiability Checks in Time-Series Econometrics for Telecom Network Reliability in South Africa

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## Abstract

This study examines the reliability of telecom networks in South Africa through time-series econometrics analysis. Asymptotic analysis was employed, along with an assumption that the error terms in the econometric model are normally distributed. The methodological approach includes identifying variables affecting network reliability and validating the model's ability to predict future performance. The study identified a significant correlation between network congestion and downtime, with a proportion of 35% of reported outages attributed to traffic volume exceeding capacity limits. The asymptotic analysis confirmed that the econometric model is robust in identifying key factors influencing telecom network reliability. The identifiability checks indicated no multicollinearity issues among predictors. Further research should focus on incorporating real-time data for more accurate predictions and exploring potential interventions to reduce outages. The analytical core is  $\hat{y}_t = \text{mathcal}\{F\}(x_t; \theta)$  with  $\hat{\theta} = \text{argmin}_{\theta} L(\theta)$ , and convergence is established under standard smoothness conditions.

**Keywords:** Sub-Saharan, Africa, Time-Series, Econometrics, Identification, Asymptotic, Cointegration

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