



# Spectral Methods and Condition-Number Analysis in Time-Series Econometrics for Epidemic Spread Modelling in Ethiopia

Mulu Gebru<sup>1</sup>

<sup>1</sup> Addis Ababa Science and Technology University (AASTU)

**Published:** 12 August 2007 | **Received:** 02 May 2007 | **Accepted:** 21 June 2007

**Correspondence:** [mgebru@hotmail.com](mailto:mgebru@hotmail.com)

**DOI:** [10.5281/zenodo.18848419](https://doi.org/10.5281/zenodo.18848419)

## Author notes

*Mulu Gebru is affiliated with Addis Ababa Science and Technology University (AASTU) and focuses on Mathematics research in Africa.*

## Abstract

This study examines the application of spectral methods in time-series econometrics for modelling epidemic spread in Ethiopia. Spectral decomposition techniques are utilised to estimate the eigenvalues and eigenvectors of the time-series data representing epidemic dynamics. The condition number of the covariance matrix is calculated to assess the sensitivity of the model predictions to changes in input parameters. The spectral analysis revealed that the dominant eigenvalue was significantly greater than one, indicating potential instability unless carefully managed through regularization techniques. Condition-number analysis showed a moderate level of numerical stability across different datasets from Ethiopia's health records. The methodology demonstrated effectiveness in predicting epidemic trends by identifying and mitigating model sensitivity issues. Further research should explore the impact of varying initial conditions on the spectral decomposition results, particularly for different types of epidemics. The analytical core is  $\hat{y}_t = \mathcal{F}(xt; \theta)$  with  $\hat{\theta} = \operatorname{argmin}_{\theta} L(\theta)$ , and convergence is established under standard smoothness conditions.

**Keywords:** *Ethiopia, Time-Series Analysis, Spectral Methods, Eigenvalues, Condition Number, Econometrics, Stability Analysis*

## ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

✉ **REQUEST FULL PAPER**

**Email:** [info@parj.africa](mailto:info@parj.africa)

Request your copy of the full paper today!

## SUBMIT YOUR RESEARCH

**Are you a researcher in Africa? We welcome your submissions!**

Join our community of African scholars and share your groundbreaking work.

**Submit at:** [app.parj.africa](http://app.parj.africa)



Scan to visit [app.parj.africa](http://app.parj.africa)

**Open Access Scholarship from PARJ**

Empowering African Research | Advancing Global Knowledge