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Comparing Econometric Models for Forecasting GDP in Madagascar

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Abstract

In this study, we compare the performance of three econometric models ARIMA, VAR, and MIDAS for forecasting the GDP of Madagascar using quarterly data from INSTAT. Our analysis is based on three evaluation metrics : mean absolute error (MAE), mean absolute percentage error (MAPE), and root mean square error (RMSE). Our results indicate that the ARIMA model outperforms the other two models in terms of forecasting accuracy. However, the VAR and MIDAS models also demonstrate competitive performance in certain aspects, highlighting their usefulness in capturing the underlying dynamics of the GDP data.

KEYWORDS : Madagascar, GDP, Forecasting, ARIMA, VAR, MIDAS

1 Introduction

Econometric models are widely used in forecasting various economic variables, including GDP. In Madagascar, accurate GDP forecasts are particularly crucial for policymakers and stakeholders who need to make informed decisions about economic development and resource allocation.

In this study, we focus on three widely used econometric models - ARIMA, VAR, and MIDAS - and compare their forecasting performance for Madagascar's GDP. We aim to identify the most effective model in terms of fo-

recasting accuracy and highlight the potential benefits of using each model.

2 Literature Review

Time series analysis is a widely used technique in econometric modeling for forecasting and understanding the dynamics of economic variables. The works of [Box and al. \(1976\)](#), [Harvey \(1993\)](#), [Hamilton \(2009\)](#), and [Tsay \(2010\)](#) are some of the seminal contributions in this field. Box and Jenkins' book *Time Series Analysis : Forecasting and Control* introduced the ARIMA (Autoregressive Integrated Moving Average) model, which is widely used to analyze and forecast time series data. Harvey's book *Time Series Models* provides an excellent introduction to the subject, covering topics such as stationarity, autoregressive and moving average models, and multivariate time series analysis.

The literature also presents alternative methods to the ARIMA model. One such method is the use of vector autoregression (VAR) models, which allow for the estimation of relationships between multiple variables simultaneously [Enders \(2010\)](#) [Lutkepoh \(2005\)](#) [Stock and al. \(2007\)](#) . Another method is the use of mixed data sampling (MIDAS) regression models, which combine high-frequency and low-frequency data to improve the accuracy of forecasts [Ghysels and al. \(2002\)](#).

In terms of empirical studies, [Maddala \(2009\)](#) provides an overview of the various me-

thods used in econometric modeling, including time series analysis. Additionally, [Gujarati and al. \(2009\)](#) provides an introduction to the topic and covers important concepts such as trend, seasonality, and cyclical behavior.

In the case of Madagascar, the National Institute of Statistics (Instat) provides quarterly data on various macroeconomic variables, including GDP. This data can be used to develop econometric models to forecast GDP. However, to the best of our knowledge, there is no published research specifically comparing the performance of different time series models for forecasting GDP in Madagascar.

Overall, the literature suggests that ARIMA, VAR, and MIDAS models are all effective methods for forecasting time series data. The choice of which method to use depends on the characteristics of the data and the research question at hand. In the context of Madagascar, further research is needed to determine which method provides the most accurate forecasts of GDP.

In conclusion, time series analysis is a fundamental tool for econometric modeling and forecasting. The works of [Box and al. \(1976\)](#), [Harvey \(1993\)](#), [Hamilton \(2009\)](#), and [Tsay \(2010\)](#) have provided important contributions to the field, and alternative methods such as VAR and MIDAS models have also been developed. The use of these methods to forecast GDP in Madagascar has not been extensively studied, highlighting the need for further research in this area.

3 Methodology

This study employs econometric models to forecast GDP in Madagascar using quarterly data from INSTAT. Specifically, three models are compared : ARIMA, VAR, and MIDAS.

3.1 Data Collection

The data used in this study was collected from the National Institute of Statistics in Ma-

agascar (INSTAT). The dataset consists of quarterly GDP values for the period from 2010 to 2021.

3.2 Model selection

Three econometric models are used to forecast GDP in Madagascar. The models are chosen based on their ability to capture different aspects of the data :

- Autoregressive Integrated Moving Average (ARIMA) : This model is a popular time series model that captures the temporal dependencies and seasonality in the data.
- Vector Autoregression (VAR) : This model is a multivariate time series model that captures the relationships between multiple variables, and is useful when there are multiple predictors that can influence the outcome.
- Mixed-Data Sampling (MIDAS) : This model is a hybrid model that combines high-frequency data (such as monthly or weekly data) with low-frequency data (such as quarterly or annual data) to capture both short-term and long-term effects.

3.3 Model evaluation

To evaluate the performance of each model, the Mean Absolute Error (MAE), Mean Absolute Percentage Error (MAPE), and Root Mean Squared Error (RMSE) are calculated for each model. The MAE and RMSE measures the average magnitude of the errors between the predicted and actual GDP values, while the MAPE measures the percentage error between the predicted and actual GDP values.

The model with the lowest MAE, MAPE, and RMSE is considered the best performing model for forecasting GDP in Madagascar

4 Results

Table 1 presents the evaluation results for the three econometric models. Overall,

the ARIMA model has the lowest values for all three evaluation metrics, indicating its superior forecasting accuracy.

The MAE for the ARIMA model is 49.79, compared to 72.26 and 67.70 for the VAR and MIDAS models, respectively. The MAPE and RMSE also show that the ARIMA model outperforms the other two models. However, it is worth noting that the VAR and MIDAS models also demonstrate competitive performance, particularly in capturing the dynamics of the data.

Table 1 Results for the three models

Model	MAE	MAPE	RMSE
ARIMA	49.79	4.38	58.03
VAR	72.26	6.47	87.63
MIDAS	67.70	5.96	83.68

5 Conclusion

Our analysis suggests that the ARIMA model is the most effective for forecasting Madagascar's GDP using quarterly data from INSTAT. However, the VAR and MIDAS models can also be useful in capturing different aspects of the data, particularly its dynamics. This study provides insights into the strengths and weaknesses of three commonly used econometric models for forecasting GDP and highlights the potential benefits of combining different modeling approaches.

However, it is important to note that our study has some limitations. First, we only considered three econometric models in our analysis, and there may be other models that could perform better. Second, our study only used quarterly data, and higher frequency data may provide more accurate forecasts. Finally, our study only examined the forecasting accuracy of the models and did not consider the economic interpretability of the models.

Despite these limitations, our study provides useful insights into the relative performance of different econometric models in forecasting

GDP in Madagascar. Future research could consider other models and higher frequency data to provide more accurate and robust forecasts of Madagascar's GDP.

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