Development of an Integrated Macroeconomic Database and Automated Modelling Framework for Enhanced Policy Analysis Concept Note

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1 Introduction

Economic policy-making relies heavily on robust data management and macroeconomic modelling. On numerous occasions in developing countries, the approach is fragmented, leading to inefficiencies, inconsistent data handling, and limited collaboration. This concept note proposes the development of an Integrated Macroeconomic Database and Automated Modelling Framework that will centralize data management, automate model execution, and streamline policy analysis. By integrating macroeconomic datasets into a structured SQL-based database and linking them with predefined economic models in R and Python, this initiative aims to enhance data accessibility, improve forecasting accuracy, and allow economists to focus on policy interpretation rather than the technical execution of models.

When economic model building involves repetitive data handling, manual execution of diagnostic tests, and interpretation of results, the process consumes valuable time that should be devoted to economic analysis and policy formulation. The proposed system eliminates these inefficiencies by storing predefined models in a centralized database, allowing users to retrieve model outputs, forecasts, and diagnostics through an intuitive interface. By automating model execution, the system ensures consistency, reduces human error, and enhances collaboration across departments. Furthermore, integrating machine learning techniques and AI-driven analytics will enhance the predictive power of macroeconomic models and provide real-time insights for economic decision-making.

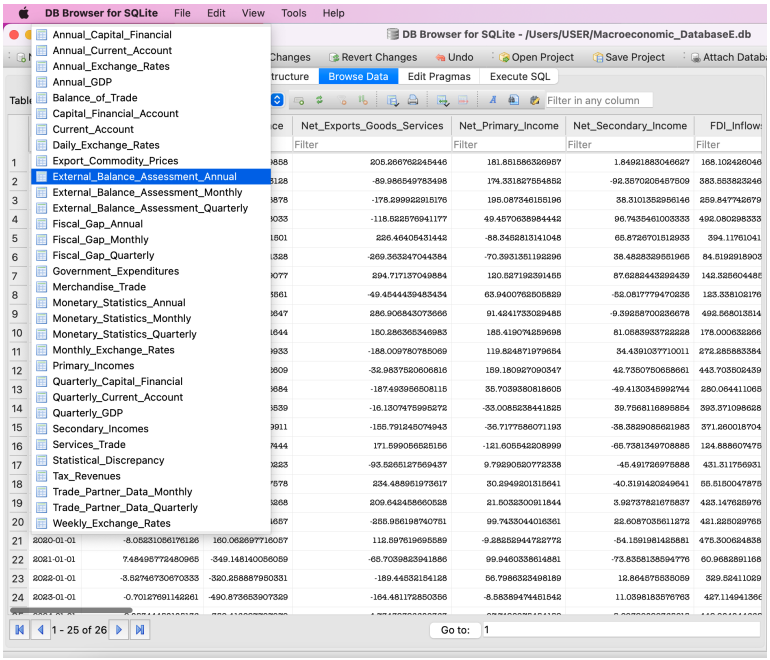
2 Objectives of the Integrated System

The core objective of this initiative is to develop a centralized database that enhances data integrity, efficiency, and policy analysis. This system will allow seamless retrieval and analysis of macroeconomic indicators, including GDP, monetary aggregates, fiscal data, external sector statistics, and exchange rate dynamics. Another key objective is to integrate predefined macroeconomic models within the system, enabling automated execution of diagnostics, forecasting, and policy simulations. By shifting the focus from model execution to economic interpretation, economists will be able to concentrate on evaluating economic conditions, identifying risks, and formulating policy recommendations. The system also aims to improve collaboration by providing multi-user access, where different departments can leverage the same database and models, ensuring a unified approach to economic research.

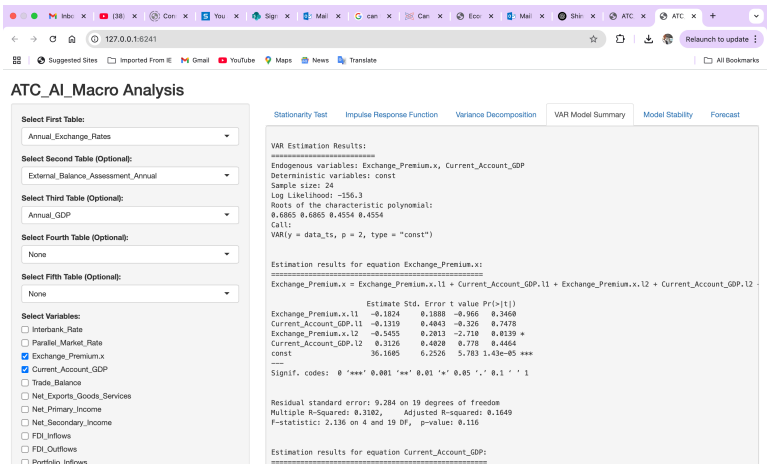
Additionally, this initiative will incorporate AI-powered forecasting techniques to complement traditional econometric models. Machine learning methods such as ARIMA, VAR, LSTM, and XGBoost will be deployed to improve macroeconomic projections. Furthermore, a natural language processing (NLP)-based chatbot will be integrated to facilitate real-time data queries, automating routine data retrieval tasks and generating instant policy reports. The implementation of this database-driven system will thus optimize decision-making processes, improve forecasting accuracy, and create an efficient workflow.

3 Milestones Achieved

Significant progress has already been made in the development of this system. A structured SQL database has been designed to store key macroeconomic variables, ensuring consistency and reliability in data management. The database includes well-defined tables for GDP, monetary and fiscal indicators, exchange rates, and trade statistics, with data frequencies standardized to accommodate monthly, quarterly, and annual time series. Below is a screenshot of the structure of the database and the proposed schema.



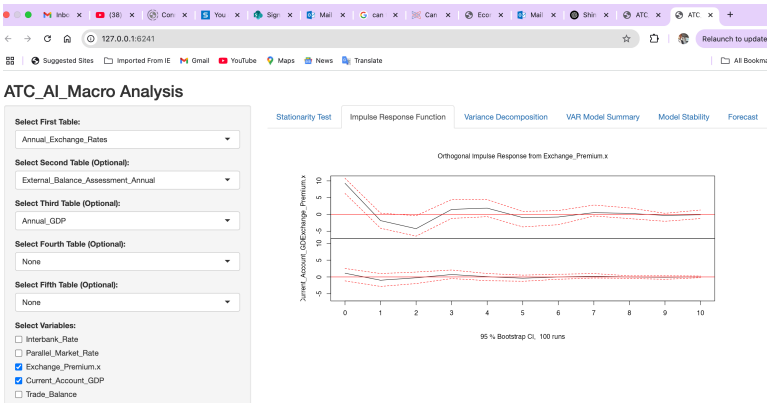
This database was developed in SQLite and will be migrated to MySQL to enhance scalability and allow multi-user access.



With the data infrastructure in place, the next milestone was integrating the database with economic modelling frameworks in R and Python. The system has been configured to execute predefined models in the background, automatically performing stationarity tests, cointegration analysis, and impulse response functions before presenting results to the user. This automation eliminates the need for manual model specification, allowing economists to directly access output diagnostics and forecasts through a user-friendly interface. Moreover, the system is equipped to store historical forecasts, enabling the evaluation of past model performance and refining predictive accuracy over time.

Below is a screenshot of the Graphic User Interface (GUI) which users across the departments with the Division can use to run the pre-defined AI and machine learning generated models

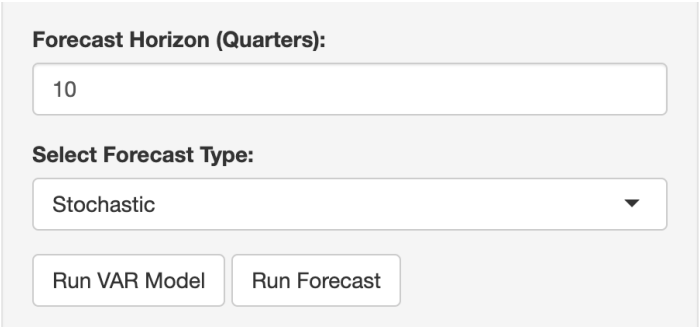
which are integrated in R and the Database.



The modelling framework underlying this project is robust and consistent with standard classical econometrics, making it ideal and plausible for use by individuals with or without a strong econometrics and modelling background. The Framework is also capable of generating standard IRF for policy analysis. The screenshot underneath is one such example using dummy data in the database.

The framework also provides options for stochastic or deterministic simulation and provides an automated reporting framework for policy analysis. Below is a dialog box showing the option for running standard VAR models for policy analysis, using data mined from the

database, and for forecasting.



4 The Need for Centralized Hosting on a Server

Hosting the database on a centralized MySQL server is critical for multi-user access, data security, and enhanced computational performance. A centralized system ensures that all economists within the Division can access updated macroeconomic data in real-time, eliminating redundancy and the risk of working with outdated information. It also enhances data security by implementing controlled access, encryption, and regular backups to prevent data loss or tampering.

5 Conclusion

The establishment of an integrated Macroeconomic Database and Automated Modelling Framework is paramount and may mark a significant advancement in economic research and policy analysis. By automating model execution and integrating AI-driven forecasting tools, this initiative will free up valuable time for economists to focus on interpretation and policy recommendations. Given its transformative potential, it is recommended that resources be allocated to support the full implementation of this system, ensuring that the Division remains at the forefront of modern macroeconomic research and policymaking.