EXPLAINABLE ARTIFICIAL INTELLIGENCE FOR COMPOSITE MACROECONOMIC RISK MODELING IN SRI LANKA USING MONETARY POLICY COMMUNICATION AND ECONOMIC INDICATORS

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Abstract

Sri Lanka's recent economic instability has highlighted the need for interpretable early-warning approaches that integrate conventional macroeconomic indicators with information contained in monetary policy communication. This study develops an explainable artificial intelligence framework for composite macroeconomic risk modeling in Sri Lanka by integrating inflation, the LKR/USD exchange rate, foreign reserves, imports expenditure, and monetary policy rates with information extracted from Central Bank of Sri Lanka Monetary Policy Reviews. A Composite Macroeconomic Risk Index (CMRI) is constructed by standardizing selected macroeconomic indicators and assigning equal weights to inflation, exchange-rate pressure, reserve adequacy, and monetary policy conditions, with reserve risk directionally adjusted so that higher CMRI values consistently represent greater macroeconomic risk. Monetary policy communication is represented through domain-specific natural language processing features capturing inflation emphasis, exchange-rate emphasis, uncertainty, and policy stance. Random Forest and XGBoost models are employed to predict one-month-ahead CMRI values using chronological expanding-window validation, while SHAP-based explanations identify the relative contribution of macroeconomic and communication-related features to predicted risk. The analysis indicates a pronounced increase in composite macroeconomic risk during the 2022 economic crisis, followed by a substantial reduction as inflation moderated, foreign reserves recovered, exchange-rate pressures eased, and monetary conditions stabilized. The results further indicate that incorporating monetary policy communication features improves predictive performance compared with models based solely on conventional macroeconomic indicators, demonstrating that central-bank communication contains complementary information relevant to forward-looking risk assessment. SHAP analysis provides an interpretable representation of the factors driving individual risk predictions, supporting transparent identification of dominant macroeconomic pressures. The proposed framework therefore provides an explainable and adaptable approach for integrating quantitative economic conditions and monetary policy communication into macroeconomic surveillance and early-warning systems for developing economies.

Keywords: Explainable Artificial Intelligence, Macroeconomic Risk Prediction, Monetary Policy Communication, Machine Learning, Economic Stability