STUDIA UNIVERSITATIS ECONOMICS SERIES
"Vasile Goldiş" Western University of Arad
2026 - 36(2)
DOI: 10.2478/sues-2026-0010

ETHIOPIAN ECONOMIC GROWTH UNDER FISCAL AND MONETARY POLICY SHOCKS: EVIDENCE FROM A STRUCTURAL VAR MODEL

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(Received: April 2025; Accepted: July 2025; Published: April 2026)

Abstract: The impact of monetary and fiscal policy fluctuations on output has been a prominent area of macroeconomic policy and satiability of the economy. Thus, this study aimed to investigate the impact of monetary and fiscal policy shocks on affecting Ethiopian macroeconomic fluctuations using the annual time series data from 1991 to 2022. The study used a quantitative research approach, and the data were collected from annual reports of the National Bank of Ethiopia (NBE) for monetary policy variables and other control variables, and the Ministry of Finance and Economic Cooperation (MoFEC) for fiscal policy variables. To analyze the data, the study adopted a structural VAR model to compute variance decompositions and impulse response functions. The results of the unit root test show that all variables are stationary at 1st difference with trends, and trend and intercept at a 95% confidence level. The causality test results suggest that real GDP, exchange rate, and trade openness showed bidirectional causality, while Consumer Price Index, gross capital formation, government expenditure, interest rate, and tax revenue show unidirectional causality. The study concluded that the results of variance decompositions and impulsive response function displayed that although monetary policy shocks are relatively more important than fiscal policy shocks in affecting the economic growth of Ethiopia, both policies have an effective impact on economic growth (real GDP) determinations. Therefore, the study suggested that the government of Ethiopia should use an effective monetary and fiscal policy mix to reduce the rate of inflation and to bring stable economic growth to the country.

Keywords: Monetary policy; fiscal policy; economic growth; Structural VAR model; time series, Ethiopia.

JEL Codes: E62, E52, C32, O55.

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1. Introduction

The influence of fiscal and monetary policies on national economies has long been a central focus of macroeconomic analysis (Manedo, 2022). These policies are vital tools used to guide economic activity and support a country's growth and development. Economists and policymakers continue to examine how fiscal and monetary interventions affect economic stability. Their main objectives include maintaining low unemployment, boosting production, and ensuring price stability—responsibilities that fall primarily on monetary and fiscal authorities (Tilahun, 2022). Monetary policy involves a range of actions and regulatory measures taken by the central bank, including setting minimum deposit interest rates and the rediscount rate for commercial banks. It also plays a critical role in maintaining price and exchange rate stability while promoting sustainable economic growth, particularly in countries like Ethiopia (Ababa, 2009). On the other hand, fiscal policy relies on government spending and taxation to influence overall economic performance (Perotti & Kontopoulos, 2002).

Ethiopia is striving to achieve rapid and sustainable economic growth by stabilizing its macroeconomic conditions. Both monetary and fiscal policies play a vital role in this effort by helping to control inflation and manage public expenditure (Reda, 2021). The National Bank of Ethiopia is responsible for implementing monetary policy, which involves regulating the money supply and credit in the economy. This is done through the establishment of exchange rates and interest rates aimed at promoting economic growth and maintaining price stability (Hawitibo, 2023). Over the past nine years, Ethiopia's economy has experienced significant growth. According to the International Monetary Fund (IMF), the country recorded a growth rate of 6.1% and an inflation rate of approximately 22% for the 2021/22 fiscal year. These figures indicate that the money supply is expanding nearly three times faster than the real economy. High inflation, a concern not only in Ethiopia but globally, has prompted policymakers to implement responsive measures (Tadesse & Melaku, 2019; Takyi-Ofori, 2021).

The debate over macroeconomic policy has persisted since the 1960s, primarily between Keynesians and monetarists. Keynesians argue that fiscal policy has a greater influence on economic output, while monetarists maintain that monetary policy is more critical for managing economic activity (Birol & Gencer, 2014). According to Keynesians, monetary policy becomes ineffective during a liquidity trap, as interest rates are already at their lowest and cannot be reduced further by increasing the money supply. In such situations, substantial public investment is required to achieve full employment. When monetary policy fails to stimulate investment, fiscal policy can boost output through increased government spending

Studia Universitatis "Vasile Goldis" Arad. Economics Series Vol 36 Issue 2/2026
ISSN: 1584-2339; (online) ISSN: 2285 – 3065
Web: publicatii.uvvg.ro/index.php/studiaeconomia. Pages 99-128

(Havi & Enu, 2014). Researchers continue to debate the relative effectiveness of fiscal and monetary policies in fostering economic growth (Haile, 2020). The discussion remains inconclusive, with some scholars supporting the dominance of one policy over the other, while others question the effectiveness of both in addressing economic challenges.

A number of empirical studies on Ethiopia's economy have used different methodological approaches and reached varied conclusions. Some have focused on the role of monetary policy in influencing economic growth (Manedo, 2022; Mengesha & Berde, 2023; Abdulkadr et al., 2024), while others have examined the impact of fiscal policy (Gemechu, 2017; Tilahun, 2022; Ayana et al., 2023). Only a limited number of studies have looked at the combined effects of both fiscal and monetary policies (Tadesse & Melaku, 2019; Hawitibo, 2023). Importantly, none of these studies applied a Structural Vector Autoregression (SVAR) model to the period from 1991 to 2022. Previous research also shows some methodological shortcomings. Several studies used basic VAR models without structural identification, making it difficult to differentiate the effects of various policy shocks. For instance, Tesfay (2010) employed an unrestricted VAR model, which may not effectively separate the impacts of fiscal and monetary policies. Additionally, many studies treated government spending as a single unit, without distinguishing between capital and recurrent expenditures—an approach that overlooks the unique effects each type may have on economic growth.

This paper aims to fill these gaps by using the SVAR model with Cholesky decomposition, allowing for a clearer identification of fiscal and monetary policy shocks and their respective effects on Ethiopia's economic growth. The study also distinguishes between fiscal and monetary policies and disaggregates government spending into capital and recurrent components, providing a clearer understanding of each policy's impact and supporting the development of more targeted economic strategies. Overall, this approach offers a more detailed and balanced assessment of policy impacts, which can inform more effective fiscal and monetary strategies in the Ethiopian context.

2. Literature Review

2.1. Application of the SVAR Model

To assess how policy changes affect macroeconomic variables, economists frequently employ the Structural Vector Autoregression (SVAR) model. Unlike conventional VAR approaches that do not distinguish between types of shocks, SVAR incorporates theoretical constraints to identify the nature of each policy disturbance (Sims, 1980). With techniques like Cholesky decomposition, researchers can isolate and compare the effects of fiscal versus monetary shocks. In the Ethiopian

context, this model proves valuable for analyzing how various components of fiscal policy (e.g., taxation, public spending) and monetary policy (e.g., interest rates, liquidity levels) shape economic performance over time (Christiano et al., 1999). SVAR enables policymakers to understand these complex dynamics and design more effective interventions tailored to the country's unique economic conditions.

2.2. Keynesian Theory

Keynesian theory highlights the importance of active government involvement in regulating aggregate demand. Pigou (1936) posited that fiscal tools—namely, government expenditure and taxation—play a significant role in influencing economic performance, particularly during downturns marked by weak demand. In the context of a developing nation like Ethiopia, where infrastructure and market structures are still evolving, fiscal policy becomes an essential mechanism for boosting demand, lowering joblessness, and encouraging growth. Initiatives such as increased public investment in infrastructure and welfare programs are considered crucial measures for mitigating economic slowdowns (Arestis & Sawyer, 2004). Fiscal policy shocks, according to Keynesian theory, can have significant short-term effects on aggregate demand. The theory suggests that increased government spending can boost demand, leading to higher output and employment (Blanchard & Johnson, 2013). In Ethiopia, where fiscal policies have traditionally been used to support development projects and reduce poverty, such shocks are assumed to have a direct positive impact on growth.

2.3. Monetarist Theory

Monetarist theory, advanced by Milton Friedman, stresses the importance of controlling the money supply as a means of managing economic growth and inflation. Monetarists argue that inflation is always a monetary phenomenon and that monetary policy plays the central role in influencing economic activity (Friedman, 1968). Unlike Keynesians, who advocate for active fiscal policies, monetarists maintain that long-term growth is best achieved through stable and predictable monetary policies. In Ethiopia, where inflation has historically been volatile, the role of the central bank in controlling money supply and interest rates is crucial for stabilizing economic growth (Geda, 2009). Monetary policy shocks, according to monetarist theory, influence inflation and interest rates, which in turn affect investment and economic activity. By tightening or loosening the money supply, central banks can control inflation and influence real GDP growth (Lucas, 1972). In the Ethiopian context, the central bank's role in regulating inflation and ensuring price stability has become increasingly important as the economy opens up to more global interactions.

Studia Universitatis "Vasile Goldis" Arad. Economics Series Vol 36 Issue 2/2026
ISSN: 1584-2339; (online) ISSN: 2285 – 3065
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2.4. IS-LM Model

The IS-LM framework, introduced by Hicks (1937), provides a conceptual basis for analyzing how fiscal and monetary policies interact within an economy. The IS curve reflects equilibrium in the goods market by illustrating how output responds to varying interest rates, while the LM curve captures balance in the money market, linking income levels to interest rate movements. Within this structure, fiscal measures—such as changes in government spending or taxation—result in shifts in the IS curve, whereas alterations in the money supply or interest rates by monetary authorities shift the LM curve. As Mankiw (2016) notes, expansionary fiscal actions can raise aggregate demand, thereby pushing the IS curve outward. In contrast, monetary adjustments, as outlined by Mishkin (2015), impact liquidity conditions and borrowing costs, ultimately influencing both investment and consumer behavior through movements in the LM curve. In the Ethiopian context, where government spending plays a central role in driving development and monetary tools are increasingly utilized to curb inflation, the coordinated application of these policies is crucial for achieving balanced and sustainable economic growth.

2.5. New Classical and Real Business Cycle Perspectives

New Classical economics and Real Business Cycle (RBC) theory, developed by Lucas (1972), Kydland, and Prescott (1982), emphasize rational expectations and market-clearing behavior, suggesting that policy interventions have only short-term impacts. These theories argue that individuals anticipate policy moves, which limits the long-term effectiveness of such actions. While applicable in some developed contexts, these models face limitations in countries like Ethiopia, where economic structures often display rigidity, and capital markets remain underdeveloped (Barro, 2005). Given institutional inefficiencies and inflation volatility, fiscal and monetary interventions in Ethiopia tend to have more significant and lasting effects than the theories predict (Assefa, 2012).

Table 1. Summary of Economic Theories and Their Implications in the Ethiopian Context

Theory	Key Proponents	Main Argument	Policy Tool Emphasized	Expected Economic Impact	Relevance to Ethiopia
Keynesian Theory	Pigou (1936); Arestis & Sawer (2004); Blanchard	Active government spending can stabilize output during downturns	Fiscal policy (spending, tax)	Fiscal policy (spending, tax)	Fiscal policy (spending, tax)

	& Johnson (2013)				
Monetarist Theory	Friedman (1968); Lucas (1972); Geda (2009)	Money supply control is key to managing inflation and long-term growth	Monetary policy (money supply, interest rate)	Control inflation, influence investment, and support stable growth	High: Crucial for managing inflation and monetary stability
IS-LM Model	Hicks (1937); Mankiw (2016); Mishkin (2015)	The interaction of goods and money markets determines output and interest rates.	Both fiscal and monetary	Fiscal policy shifts the IS curve; monetary policy shifts the LM curve	High: Reflects coordinated use of policies in a developing economy
New Classical / RBC Theory	Lucas (1972); Kydland & Prescott (1982); Barro (2005)	Market-clearing and rational expectations limit long-term policy effects	Minimal intervention	Short-term impact only; market forces dominate	Limited: Structural rigidities and institutional inefficiencies weaken applicability.

3. Methodology and Empirical Data

3.1. Research Design

The study employed a quantitative method, motivated by the numerical nature of time series analysis and the quantitative representation of variables.

3.2. Data Types and Sources

Annual time series data were gathered covering the years from 1991 to 2022. The selection of the sample period is grounded in the significant economic and policy transformations that occurred in Ethiopia following the adoption of market-oriented reforms in the early 1990s. This period also marks a relatively stable phase in data availability, allowing for a consistent and comprehensive analysis of fiscal and monetary policy impacts. The secondary data was obtained from the annual reports of the National Bank of Ethiopia (NBE), which provided information on monetary

Studia Universitatis "Vasile Goldis" Arad. Economics Series Vol 36 Issue 2/2026
ISSN: 1584-2339; (online) ISSN: 2285 – 3065
Web: publicatii.uvvg.ro/index.php/studiaeconomia. Pages 99-128

policy and other control variables. Additionally, fiscal policy variables were sourced from the Ministry of Finance and Cooperation (MOFEC).

3.3. Method of Data Analysis

The econometric analysis employed a Structural Vector Autoregressive (SVAR) model to examine the statistical relationships between dependent and independent variables, as well as to assess the effects of fiscal and monetary policy on economic growth. The use of the SVAR model is justified by its ability to identify and isolate the effects of different policy shocks within a dynamic system. Unlike basic VAR models, the SVAR approach—especially when coupled with Cholesky decomposition—allows for a more accurate interpretation of causal relationships among variables, making it a suitable and robust tool for analyzing complex policy interactions in a developing economy like Ethiopia.

3.3.1. Model Specification and Justification

Sims (1980) introduced the vector autoregressive (VAR) model as a flexible tool to capture the dynamic interdependence among several economic indicators without the need for stringent theoretical assumptions. One major drawback of the standard VAR framework is its inability to account for simultaneous interactions among variables, which poses challenges in evaluating immediate responses to economic shocks (Oseni, 2015). To overcome this, economists frequently apply orthogonal impulse response techniques using a Cholesky decomposition of the error term covariance matrix—an approach that requires careful ordering of variables to yield meaningful results (Petrevski et al., 2016). As an alternative, structural VAR (SVAR) models have gained popularity due to their ability to incorporate contemporaneous relationships more explicitly (Bruneau & De Bandt, 1999). The SVAR method is less reliant on comprehensive economic modeling and imposes fewer theoretical constraints than traditional VARs. Additionally, it offers analytical tools such as impulse response analysis and variance decomposition, which help assess the transmission of shocks and the influence of policy measures (Van Aarle et al., 2003).

The SVAR model with a k-dimensional vector can be represented as follows:

$$AY_t = \beta + C_1Y_{t-1} + C_2Y_{t-2} + \cdots C_kY_{t-k} + B\varepsilon_t \qquad (1)$$

Where, β is n×1 vector of constant that includes all deterministic components, Y_t(i.e. Y_{1t} ….Y_{et}) is an n×1 vector of endogenous variables at time t, C_i is n x n coefficient matrix of the lagged endogenous variables in the SVAR model (i=1…k), A is n x n invertible coefficient matrix of contemporaneous relationships among the variables included in Y_t, ε_t is n x1 vector of structural shocks with $\varepsilon_t \sim N(O, BE\ (\varepsilon_t\varepsilon_t')B'$ that means the structural disturbance ε_t should be orthogonal

or should not be mutually correlated. Matrix B is n× n-dimensional matrix that measures the contemporaneous effect of innovations or shocks on the other endogenous variables in the model.

$$U_t = A^{-1}B\varepsilon_t \text{ and this can be rewrite as } AU_t = B\varepsilon_t \qquad (2)$$

Where U_t denotes the disturbances in their reduced form and ε_t is the structural shock. Therefore, equation (2) illustrates the connection between the reduced form disturbance U_t and the structural shocks ε_t. This representation of the structural VAR model is also known as the AB model according to Amisano et al. (1997).

$$\begin{bmatrix} 1 & a_{12} & a_{13} & a_{14} & a_{15} & a_{16} & a_{17} & a_{18} & a_{19} & a_{110} \\ a_{21} & 1 & a_{23} & a_{24} & a_{25} & a_{26} & a_{27} & a_{28} & a_{29} & a_{210} \\ a_{31} & a_{32} & 1 & a_{34} & a_{35} & a_{36} & a_{37} & a_{38} & a_{39} & a_{310} \\ a_{41} & a_{42} & a_{43} & 1 & a_{45} & a_{46} & a_{47} & a_{48} & a_{49} & a_{410} \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & a_{56} & a_{57} & a_{58} & a_{59} & a_{510} \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 & a_{67} & a_{68} & a_{69} & a_{610} \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & 1 & a_{78} & a_{79} & a_{710} \\ a_{81} & a_{82} & a_{83} & a_{84} & a_{85} & a_{86} & a_{87} & 1 & a_{89} & a_{810} \\ a_{91} & a_{92} & a_{93} & a_{94} & a_{95} & a_{96} & a_{97} & a_{98} & 1 & a_{910} \\ a_{101} & a_{102} & a_{103} & a_{104} & a_{105} & a_{106} & a_{107} & a_{108} & a_{109} & 1 \end{bmatrix} \begin{bmatrix} U_t^{RGDP_t} \\ U_t^{M_{2t}} \\ U_t^{GCF_t} \\ U_t^{OPEN_t} \\ U_t^{TLF_t} \\ U_t^{INTEREST_t} \\ U_t^{CPI_t} \\ U_t^{EXP_t} \\ U_t^{REER_t} \\ U_t^{TAX_t} \end{bmatrix}$$

$$= \begin{bmatrix} b_{11} & b_{12} & b_{13} & b_{14} & b_{15} & b_{16} & b_{17} & b_{18} & b_{19} & b_{110} \\ b_{21} & b_{22} & b_{23} & b_{24} & b_{25} & b_{26} & b_{27} & b_{28} & b_{29} & b_{210} \\ b_{31} & b_{32} & b_{33} & b_{34} & b_{35} & b_{36} & b_{37} & b_{38} & b_{39} & b_{310} \\ b_{41} & b_{42} & b_{43} & b_{44} & b_{45} & b_{46} & b_{47} & b_{48} & b_{49} & b_{410} \\ b_{51} & b_{52} & b_{53} & b_{54} & b_{55} & b_{56} & b_{57} & b_{58} & b_{59} & b_{510} \\ b_{61} & b_{62} & b_{63} & b_{64} & b_{65} & b_{66} & b_{67} & b_{68} & b_{69} & b_{610} \\ b_{71} & b_{72} & b_{73} & b_{74} & b_{75} & b_{76} & b_{77} & b_{78} & b_{79} & b_{710} \\ b_{81} & b_{82} & b_{83} & b_{84} & b_{85} & b_{86} & b_{87} & b_{88} & b_{89} & b_{810} \\ b_{91} & b_{92} & b_{93} & b_{94} & b_{95} & b_{96} & b_{97} & b_{98} & b_{99} & b_{910} \\ b_{101} & b_{102} & b_{103} & b_{104} & b_{105} & b_{106} & b_{107} & b_{108} & b_{109} & b_{1010} \end{bmatrix} \begin{bmatrix} \varepsilon_t^{RGDP_t} \\ \varepsilon_t^{M_{2t}} \\ \varepsilon_t^{GCF_t} \\ \varepsilon_t^{OPEN_t} \\ \varepsilon_t^{TLF_t} \\ \varepsilon_t^{INTEREST_t} \\ \varepsilon_t^{CPI_t} \\ \varepsilon_t^{EXP_t} \\ \varepsilon_t^{REER_t} \\ \varepsilon_t^{TAX_t} \end{bmatrix}$$

In this context, RGDP stands for Real Gross Domestic Product, M_2 refers to Money Supply, GCF is short for Gross Capital Formation, OPEN represents Trade Openness, TLF denotes Total Labour Force, INTEREST indicates the Lending

Studia Universitatis "Vasile Goldis" Arad. Economics Series Vol 36 Issue 2/2026
ISSN: 1584-2339; (online) ISSN: 2285 – 3065
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Interest Rate, CPI, which is used to assess Inflation, is the Consumer Price Index, EXP signifies Total Government Expenditure, RERR stands for Real Effective Exchange Rate, and TAX represents Tax Revenue. All variables have been log-transformed. The ordering of variables in the Cholesky decomposition is grounded in economic theory and the logical transmission mechanisms of fiscal and monetary policy in Ethiopia. Monetary policy variables like Money Supply and Lending Interest Rate are placed early, reflecting their exogeneity in the short term. Investment-related variables such as Gross Capital Formation and Trade Openness are ordered next, as they react to prior monetary conditions. Structural variables like Labour Force adjust slowly and precede inflation (CPI), which responds with a lag to policy shocks. Government Expenditure and Tax Revenue represent fiscal policy responses and are positioned later to capture their endogenous reaction to macroeconomic developments. Finally, the Real Effective Exchange Rate reflects the net outcome of monetary, trade, and price dynamics. This ordering aligns with theoretical expectations and ensures robustness in identifying fiscal and monetary shocks affecting Ethiopia's economic growth. These variables are essential for understanding the transmission mechanisms through which policy shocks affect economic performance.

Because reduced structural innovations (Ut) are linear combinations of structural shocks or innovations and do not have a direct economic interpretation, it is not possible to derive the structural shocks from the reduced form. Consequently, an impulse response function lacks a significant economic interpretation. To simultaneously identify the structural form parameters from a reduced VAR model while obtaining impulse response functions and variance decompositions with precise economic interpretations, it is essential to impose restrictions on the parameter matrices A and B. To determine the structural VAR model of a k-dimensional framework, it is essential to apply $\frac{k^2-k}{2}$ restrictions on the structural model to orthogonalize the shocks, resulting in a just-identified system (Van Aarle *et al*., 2003). In this study, there are ten variables; hence, the number of restrictions necessary to just identify the model is $\frac{10^2-10}{2} = 45$. The identification method employed to discern structural shocks is recursive, also known as triangulation or the Cholesky identification scheme, as proposed by Sims in 1980. To achieve the identification of fiscal and monetary policy shocks within the model, this study adhered to the recommendations of Robinson (1997), which stipulate that non-policy variables should be prioritized over policy variables based on their exogeneity and gradual response. Accordingly, variables in the reduced VAR are ordered as Y_t= (RGDP, M_2, GCF, OPEN, TLF, INTEREST, CPI, EXP, REER, TAX). The

identification of the structural parameters of the recursive short-run restriction by setting zero value restrictions on $AU_t = B\varepsilon_t$ was presented as follows:

$$\begin{bmatrix} U_t^{RGDP_t} \\ U_t^{M_{2t}} \\ U_t^{GCF_t} \\ U_t^{OPEN_t} \\ U_t^{TLF_t} \\ U_t^{INTEREST_t} \\ U_t^{CPI_t} \\ U_t^{EXP_t} \\ U_t^{REER_t} \\ U_t^{TAX_t} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{21} & b_{22} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{31} & b_{32} & b_{33} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{41} & b_{42} & b_{43} & b_{44} & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{51} & b_{52} & b_{53} & b_{54} & b_{55} & 0 & 0 & 0 & 0 & 0 \\ b_{61} & b_{62} & b_{63} & b_{64} & b_{65} & b_{66} & 0 & 0 & 0 & 0 \\ b_{71} & b_{72} & b_{73} & b_{74} & b_{75} & b_{76} & b_{77} & 0 & 0 & 0 \\ b_{81} & b_{82} & b_{83} & b_{84} & b_{85} & b_{86} & b_{87} & b_{88} & 0 & 0 \\ b_{91} & b_{92} & b_{93} & b_{94} & b_{95} & b_{96} & b_{97} & b_{98} & b_{99} & 0 \\ b_{101} & b_{102} & b_{103} & b_{104} & b_{105} & b_{106} & b_{107} & b_{108} & b_{109} & b_{1010} \end{bmatrix} \begin{bmatrix} \varepsilon_t^{RGDP_t} \\ \varepsilon_t^{M_{2t}} \\ \varepsilon_t^{GCF_t} \\ \varepsilon_t^{OPEN_t} \\ \varepsilon_t^{TLF_t} \\ \varepsilon_t^{INTEREST_t} \\ \varepsilon_t^{CPI_t} \\ \varepsilon_t^{EXP_t} \\ \varepsilon_t^{REER_t} \\ \varepsilon_t^{TAX_t} \end{bmatrix}$$

3.3.2. Diagnostic Tests

To make sure that the data fits the fundamental presumptions of the SVAR model, the study used pre-estimation tests such as the unit root test, co-integration test, and maximum lag length, as well as post-estimation tests such as autocorrelation, normality, stability, and variability tests.

3.3.3. Granger Causality Test

The Granger causality test is used to discover which way one variable influences another, or whether the movement of the x variable is influenced by the movement of the y variable (Diks & Panchenko, 2006). The Granger test is based on the assumption that if variables do not affect each other, the null hypothesis will be rejected when the calculated F statistic surpasses the theoretical value. A pairwise Granger causality test was employed to evaluate the causal relationship between the variables.

3.4. Variables

The economic growth, measured by Real Gross Domestic Product, functioned as the dependent variable in this research. Following a review of the relevant literature and the researcher's expertise, nine potential explanatory variables were identified as independent variables from a broader range of factors. These variables include government expenditure, broad money supply, gross capital formation, total labour force, trade openness, lending interest rate, real effective exchange rate, tax revenue, and consumer price index.

Studia Universitatis "Vasile Goldis" Arad. Economics Series Vol 36 Issue 2/2026
ISSN: 1584-2339; (online) ISSN: 2285 – 3065
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4. Results and Discussion

4.1. Results of Pre-Estimation Diagnostic Test

4.1.1. Unit Root Test Results

The research employs the Augmented Dickey-Fuller (ADF) test rigorously to determine the stationarity of the variables. The ADF statistic, as noted by Leybourne (1995), is represented as a negative value. A greater negativity in the results indicates a more robust rejection of the null hypothesis. The findings reveal that the ADF t-statistics surpassed the t-critical value at a 5% significance level for all variables when considering the first difference in both constant, trend, and intercept, as illustrated in Table 2. This suggests that all variables exhibit stationarity at the first difference.

Table 2. Augmented Dickey-Fuller (ADF) Unit Root Test

Variables	At Levels				At First Difference			
	Intercept (Constant)		Trend and Intercept		Intercept		Trend and Intercept	
	ADF t-statistics	t- critical value at 5%	ADF t-statistics	t- critical value at 5%	ADF t-statistics	t- critical value at 5%	ADF t-statistics	t- critical value at 5%
LNRGDP	0.888134	-2.963971	-1.690530	-3.568379	-4.856542	-2.963972	-4.938150	-3.568379
LNCPI	-0.396018	-2.960411	-1.848813	-3.562882	-8.806089	-2.963972	-9.977532	-3.568379
LNEXP	-7.643983	-2.963972	-1.751943	-3.562882	-7.643983	-2.963972	-7.662826	-3.568379
LNGCF	-2.803446	-2.976263	-3.722352	-3.562882	-3.223819	-2.976263	-4.117287	-3.587527
LNINTEREST	-0.786454	-2.960411	-4.393266	-3.587527	-8.494854	-2.963972	-8.315556	-3.568379
LNM_2	4.520227	-2.963972	-2.018351	-3.562882	-13.49677	-2.963972	-18.11234	-3.568379
LNOPEN	-3.078438	-2.960411	-3.132634	-3.562882	-13.85173	-2.963972	-15.23828	-3.568379
LNREER	-3.843220	-2.960411	-3.780172	-3.562882	-14.76808	-2.963972	-15.16788	-3.568379
LNTAX	0.098590	-2.963972	-2.932737	-3.587527	-3.538493	-2.963972	-3.446487	-3.568379
LNTLF	-0.802036	-2.960411	-1.576194	-3.562882	-5.506813	-2.963972	-5.446802	-3.568379

Source: Own computation based on E-views 12 output.

4.1.2. Maximum Lag Selection

The findings indicate that all information criteria select one (1) lag length. Following the basic estimation of the structural VAR model, it is standard practice to utilize the criterion with the lowest value for determining the lag length (Liew, 2004). Consequently, the estimation findings suggest that the SIC value is the lowest among

all (refer to Table 3). As a result, the suitable lag for the model estimation is a one VAR (1) model utilized for co-integration analysis. Narayan (2004) recommended using a maximum of 1 lag for annual data series of small sample observations.

Table 3. VAR Lag Order Selection Criteria

Lag	Log L	LR	FPE	AIC	SC	HQ
Zero	115.9047	NA	1.29e-12	-7.510667	-7.180630	-7.407303
One	338.6549	322.6038*	8.94e-18*	-19.49344*	-16.85315*	-18.66653*
Two	409.2438	68.15483	3. 95e-18	-20.98233	-16.03178	19.43188
Three	577.2016	81.08307	1. 32e-20	-29.18632	-21.92551	-26.91232

Note: The subscript * indicates the lag order selected by the criterion. LR stands for Sequential modification (each test at a 5% level), FPE is Final prediction error, AIC is Akaike information criterion, SC is Schwarz information criterion, and HQ is Hannan-Quinn information criterion.

4.1.3. Cointegrating Test

The outcome indicates the cointegration test conducted using Johansen's (1988) trace statistic and maximum eigenvalue statistic. The statistics from the Johansen test were more notable than the critical value at no cointegrating vectors (r = 0) for both the trace and maximum eigenvalue tests. This suggested that there was one cointegrating relationship present. Johansen's co-integration tests conducted on the series in an alternative form showed that both the Trace and Maximum Eigentest statistics rejected the null hypothesis of no cointegration at the usual 5% significance level. Consequently, both test statistics demonstrate five cointegrating relationships among the series at the 1% significance level (refer to Table 4).

Table 4. Unrestricted Co-integration Rank Test at first difference form

Hypothesized No. of CE(s)	Eigenvalues	**Trace (λ trace)**		**Maximum Eigenvalues**	
		Trace Statistics	Critical Value (5%)	Max-Eigen Statistics	Critical Value (5%)
None*	0.9318118	225.2225	125.6154	80.56658	46.23142
At most 1*	0.742434	144.6559	95.75366	40.69439	40.07757
At most 2*	0.692234	103.9815	69.81889	35.35245	33.87687
At most 3*	0.671489	68.60909	47.85613	33.39559	27.58434
At most 4*	0.571075	35.21350	29.79707	25.39420	21.13162
At most 5	0.248251	9.819297	15.49471	8.560598	14.26480
At most 6	0.041089	1.258699	3.841465	1.258699	3.841465

Note: * denotes rejection of the null hypothesis at a 5% level of significance
Source: Own estimation using E-view 12 (2023)

4.2. Results of Post-Estimation Diagnostic Test

4.2.1. Auto-Correlation Test

Pollitt et al. (2012) state that the covariance of the error terms across time is zero, which is the disturbance term. Stated otherwise, it is presumed that there is no correlation between the errors. The study employed the Autocorrelation LM test to determine whether autocorrelation existed to test this hypothesis. Since p-values are higher than a 5% significance level at the chosen lag, the finding does not refute the null hypothesis, which holds that there are no serial correlations (Table 5).

Table 5. VAR Residual Serial Correlation LM Tests

Lags	LM-Stat	Probability
1	53.97162	0.5979
2	75.52797	0.0964
3	48.33641	0.7681
4	58.76694	0.4465

Source: own Estimation using E-view 12 (2023)

4.2.2. Normality Tests

A residual test of Cholesky of Covariance (Lutkepohl) was employed to verify that the data was normal. As can be seen from Table 6, the residuals are multivariate and regularly distributed, indicating that the null hypothesis is accepted because the p-values are greater than the 5% significance level. The residuals have a normal distribution as a result. Normality in the residuals supports the use of classical inference techniques and affirms that the estimated model captures the underlying data-generating process effectively (Enders, 2015).

Table 6. VAR Residual Normality Tests

Component	Skewness	X^2	P-Value	Kurtosis	X^2	P-Value	Jarque-Bera	P-Value
1	0.764808	3.022143	0.0821	3.521795	0.351682	0.5532	3.373826	0.1851
2	-0.208977	0.225636	0.6348	2.919744	0.008320	0.9273	0.233955	0.8896
3	0.472453	1.153263	0.2829	2.187813	0.852046	0.3560	0.863968	0.6492
4	0.361682	0.675871	0.4110	2.523922	0.29275	0.5885	0.968628	0.6161
5	-0.344185	0.612061	0.4340	2.303177	0.627184	0.4284	1.239246	0.5381
6	-0.160551	0.133179	0.7152	2.928989	0.006513	0.9357	0.139693	0.9325
7	0.100274	0.051950	0.8197	3.621285	0.498577	0.4801	0.550527	0.7594
8	-0.196805	0.200117	0.6546	2.379743	0.496928	0.4809	0.697045	0.7057
9	0.138605	0.099259	0.7527	3.175188	0.039642	0.8422	0.138902	0.9329
10	-0.631604	2.061109	0.1511	4.368154	2.417800	0.1200	4.478909	0.1065
Joint		6.246510	0.4911		15.72341	0.1517	23.96992	0.3488

Source: Own computation based on E-views 12 output (2023).

3.2.3. Stability Test

The stability of VAR was examined using the inverse root of the AR characteristic polynomial. If every dot is inside the unit circle, the estimated VAR is stable (stationary) (Kommanaboyina & Rhodes, 1999). The null hypothesis (Ho=the model is stable at all conventional significance levels) is not rejected by the study (Figure 1).

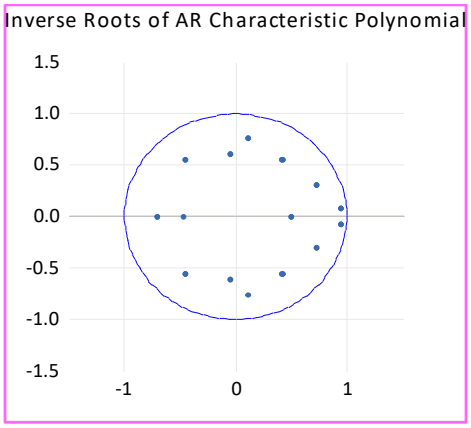

Figure 1. AR roots Graph

3.2.4. Heteroskedasticity Tests

The study used White Heteroskedasticity (no cross-term) to determine the presence of heteroskedasticity. The joint test shows no evidence of heteroskedasticity because the P value is greater than 0.05 (Table 7). Thus, the study does not reject the null hypothesis of constant variance (homoscedasticity). If the null hypothesis is not rejected, it suggests that there is no statistical evidence of heteroskedasticity in the model (Greene, 2018).

Table 7. VAR Residual Heteroskedasticity Tests (Levels and Squares)

Chi-sq	Df	Probability
507.5664	504	0.5471

Source: Researchers' Computation using E-view 12 (2023)

4.3. Structural VAR Estimation

4.3.1. Variance Decomposition Analysis

Variance decomposition isolates an endogenous variable's variation into its component shocks to the VAR. The variance decomposition for GDP indicates that

a significant portion of the forecast error variance in output growth is attributed to its shock throughout the entire forecasting period (Table 8). This suggests that real GDP reacts permanently to its shock; nonetheless, the impact of the shock diminishes as time goes on. In the short term, 100% of the forecast error variance in Real Gross Domestic Product is attributed to its values; Real Gross Domestic Product has a significant self-reinforcing effect, thus other variables in the model have minimal influence on it. Variables such as CPI, EXP, GCF, INTEREST, M2, OPEN, REER, TAX and TLF appear to exert significant external influences on RGDP, but their internal dynamics have relatively limited impact (Table 8). This implies that a variable with weak endogeneity is heavily influenced by external, exogenous factors. The endogenous influence of real GDP is diminishing from 100% by year one to 12.29% by year five, primarily due to the growing exogenous effects of other variables (Table 8). In the first period of the short run, CPI has no endogenous effects but is 100% influenced by exogenous factors.

The portion of monetary policy shock attributed to money supply variations accounts for approximately 1.78% of the real GDP variation in two years, whereas its explanatory influence rises substantially to 19.09% by the 10^{th} year, as illustrated in Table 8. This is similar to the findings of Misati & Nyamongo (2011) that it takes roughly 12 years for interest rates to adjust to monetary policy signals and for their effectiveness to become apparent. Fiscal policy shock, which is explained by government expenditure, accounts for approximately 6.95% of real GDP in the second year, and its innovative power diminishes to roughly 3.18% after a decade, as shown in Table 8. As government spending decreases, real GDP is also expected to decline correspondingly, reflecting a positive correlation between the two variables. The ability of innovation to explain variations in average lending interest rates, consumer price indices, and real effective exchange rates grows over the entire forecast period from 0.87%, 0.29%, and 0.03% in year two to 6.39%, 0.83%, and 29.56% in year ten of the variations in real GDP, respectively. Research findings indicate that fiscal policy has little impact on real GDP, whereas monetary policy can boost actual economic performance in the long term. Studies by Mgadmi & Chrigui (2015) for Bangladesh, Pham (2016) for Vietnam, and Idris (2019) for Nigeria all provide support for this outcome. The findings were comparable to those of studies conducted by Tesfay (2010), Beyene and Kotosz (2022), and Gizaw (2022) in Ethiopia. In the short term, fiscal policy has a more substantial impact on GDP (6.95% in period two), whereas monetary policy has a negligible effect (1.78% in period two). The outcome was in line with the research conducted by Woldesemayat (2020) and Tadesse & Melaku (2019).

Table 8. Variance Decomposition of RGDP Using Cholesky (d.f. adjusted) Factors

Period	S. E	LNRGDP	LNM_2	LNEXP	LNCPI	LNGCF	LNINTEREST	LNOPEN	LNREER	LNTAX	LNTLF
1	0.029738	100.00000	0.000000	0.000000	0.000000	0.0000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.037933	88.91420	1.778461	6.954176	0.291904	0.538818	0.873175	0.417637	0.034308	0.028493	0.168828
3	0.048678	60.81662	8.6718	13.69884	0.490513	0.345121	1.265138	8.105857	6.228259	0.101868	0.276933
4	0.075682	25.39262	18.76370	15.03506	0.290881	0.476785	3.392806	18.89118	17.09648	0.389038	0.271450
5	0.144622	12.29857	21.49464	10.01089	0.097041	0.593871	5.262582	23.95855	25.52246	0.614649	0.146753
6	0.295412	12.59294	20.72631	6.231585	0.231425	0.568396	6.003451	24.27624	28.66521	0.642205	0.062231
7	0.606840	14.60717	19.84283	4.405771	0.469887	0.502760	6.251851	23.78596	29.49993	0.609477	0.024366
8	1.240044	15.88761	19.37091	3.620469	0.660461	0.448678	6.342555	23.45228	29.63104	0.576585	0.009411
9	2.523561	16.48768	19.17012	3.302320	0.775739	0.413934	6.381355	23.30946	29.60021	0.555414	0.003776
10	5.125140	16.72213	19.09595	3.182839	0.834770	0.393947	6.399787	23.26639	29.55835	0.544154	0.001680

Source: Researchers' Computation using E-view 12 (2023)

Note: The numbers in the table are percentages of error variance. The period 1 to 10 implies the future 10 years.

Studia Universitatis "Vasile Goldis" Arad. Economics Series Vol 36 Issue 2/2026
ISSN: 1584-2339; (online) ISSN: 2285 – 3065
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Table 9. Variance Decomposition of RGDP Using Structural VAR Factors

Period	S.E	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8	Shock9	Shock10
1	0.029738	8.791611	31.11892	1.478826	0.950493	26.39735	5.740520	0.44387	2.062617	0.924801	22.09098
2	0.037933	6.925328	31.21584	8.939787	0.59618	21.44158	7.067791	3.332279	4.108739	1.565116	14.80736
3	0.048678	4.326641	21.23599	18.24210	0.526582	17.69144	13.27736	3.077884	6.805510	2.607411	12.20908
4	0.075682	5.07980	32.56772	18.96116	0.644024	9.238986	13.50305	1.981483	9.137609	2.729889	6.164099
5	0.144622	6.609057	54.07809	11.79499	0.712224	3.467422	9.632527	1.096615	8.601217	1.959780	2.048081
6	0.295412	7.334093	66.64077	6.598525	0.821465	1.410141	6.835639	0.764404	7.564244	1.429937	0.600781
7	0.606840	7.559514	72.07466	4.125680	0.959468	0.789411	5.516421	0.662703	6.933634	1.189378	0.189134
8	1.240044	7.613793	74.23417	3.060938	1.081601	0.598897	4.969410	0.632080	6.639817	1.094628	0.074672
9	2.523561	7.613174	75.04989	2.619266	1.167866	0.538233	4.762777	0.622386	6.522286	1.061759	0.042363
10	5.125140	7.596607	75.33789	2.443844	1.220127	0.518872	4.694573	0.619102	6.482999	1.052709	0.033271
Average		**6.94**	**53.36**	**7.83**	**0.87**	**8.21**	**7.60**	**1.32**	**6.49**	**1.56**	**5.83**

Source: Researchers' Computation using E-view 12 (2023)

Note: Shock 1 represents RGDP, Shock 2 is money supply, Shock 3 is government expenditure, Shock 4 is CPI, Shock 5 is GCF, Shock 6 is interest rate, Shock 7 is trade openness, Shock 8 is REER, Shock 9 is tax revenue, and Shock 10 is total labour force.

Since variance decomposition based on the Cholesky factor may change dramatically if the ordering of the variables in the VAR is altered, the researcher used structural VAR factors to check the robustness of the results. The actual gross domestic product variance decompositions, which account for almost 6.94% of the total variations on average, are endogenous and have a significant long-term impact on their own (Table 9). Aside from real GDP, the more significant differences are caused by the money supply (Shock 2) and gross capital formation (Shock 5). The more significant output fluctuations are caused by changes in the money supply, which average 53.36%, and gross capital formation, which average 8.21% (Table 9). Conversely, there is little output variation in the consumer price index (Shock 4), which averages 0.87%, and trade openness (Shock 7), which averages 1.32%. As a result, the researcher obtains identical outcomes from the structural VAR factors of variance decomposition analysis and the Cholesky factor. This finding suggested that fiscal policy has greater power to influence real GDP in the short run, whereas monetary policy has a significant impact in the long run. Although both policies are significant variations, financial shocks (53.36) are less than the financial policy (7.83) in affecting the profitable growth of Ethiopia. This result is supported by other literature similar to Senbet (2011), Olamide et al. (2022), and Manedo (2022).

4.3.2. Impulse Response Functions

A shock to the i^{th} variable influences not only the i^{th} variable itself but also propagates its effects to all other endogenous variables via the dynamic framework of the VAR. An impulse response function illustrates the impact of a one-time shock to one of the innovations on both the present and subsequent values of the endogenous variables. In this study, the response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 analytic asymptotic S.E.s was employed to estimate impulse response functions. This approach is preferable to using the inverse of the Cholesky factor of the residual covariance matrix, as the response can vary significantly with different variable orderings. In contrast, the response is likely to remain stable in Cholesky One S.D. (d.f. adjusted) Innovations.

Figure 2 depicts the impulse-response functions of factors' effects on Real GDP, numbered 2 through 10. Impulse responses are responses to specific shocks. GDP has a positive and strong, steady influence on itself for nearly ten years over the projection timeframe. This observation is consistent with those of Cyrus (2014). A response to shocks to the money supply, government spending, consumer price index, gross capital formation, interest rate, trade openness, REER, tax revenue, total labour force, and GDP itself is shown in Figure 2. The set of standard errors plotted against time in years is displayed on the vertical axis.

Studia Universitatis "Vasile Goldis" Arad. Economics Series Vol 36 Issue 2/2026
ISSN: 1584-2339; (online) ISSN: 2285 – 3065
Web: publicatii.uvvg.ro/index.php/studiaeconomia. Pages 99-128

A one standard deviation shock (innovation) to the money supply that affects RGDP is shown in Figure 2 of No. 2. In the short term, it has a statistically significant and positive natural effect on GDP output during the 1st to 2nd periods. In the long term, it exhibits a positive, gradual increase from the third period to the full 10-year horizon. Stated differently, a shock to the money supply of one standard deviation results in both short-term and long-term increases. Interest rates in the economy should decline as the money supply expands. When interest rates decline, more money becomes available for borrowing in the economy, which leads to more investment and an increase in the nation's GDP. In order to support and guarantee economic stability, the National Bank of Ethiopia's monetary policies should stabilise lending, inflation, and exchange rates appropriately. This will create a favourable investment climate. Studies by Adekunle (2021) in Nigeria and Sanusi (2010) in Ghana, along with Ahmad et al. (2022), Tadesse and Melaku (2019), Tilahun (2022), and Gizaw (2022) in Ethiopia, all found that money supply has a positive and statistically significant effect on economic growth. The outcome deviated from Indonesia's estimates by Suhendra and Anwar (2022).

Figure 2 from No. 3 indicates that government spending, which is the focal point of fiscal policy, has a notably positive impact on real GDP from the starting period through to year five. It indicates a steady positive decline from year six to year eight, followed by a negative shift between years nine and ten. This suggests that the reaction to the innovation diminishes after the six-year mark, and the standard error linked to the estimated response also shows a significant decrease. In the short term, a one standard deviation increase in government expenditure leads to a rise in real GDP, reflecting a demand-driven boost. However, this effect diminishes over time due to inefficient public spending, rising debt burdens, inflationary pressures, and the crowding out of private investment. These factors hinder productivity and undermine the sustainability of long-term economic growth. Even with a decrease in government spending over time, the initial shocks cause immediate reactions, highlighting the noticeable effects of these "announcement" impacts. It's important to note that the influence of changes in government expenditure is relatively small when compared to that of the money supply. These results align with those documented by Cyrus & Elias (2015) in Kenya, Akpan and Atan (2015) in Nigeria, and Manedo (2022) in Ethiopia.

The impact of interest rates exhibits a significant downward trend from the first year to the final year. The standard errors were reduced throughout all horizons, which indicates the estimated response over time emphasizes the degree of confidence associated with the estimated interest rate response to innovations. An unexpected rise in the interest rate (LNINTEREST) will lead to decreased outputs during the initial four periods. Following the fifth period, there will be a gradual increase in

output, although it remains negative across all time horizons. The data indicates a significant negative impact on GDP output over a span of ten years (as shown in Figure 2 of No. 4). When interest rates rise, the costs associated with investment and transactions also increase, which ultimately results in a slowdown of economic growth. Slight increases in interest rates can often be linked to indirect taxation, which raises the costs associated with loans and consequently influences interest rates (Ghazi, 2021). This finding aligns with the research conducted by Tesfay (2010), Chen et al. (2017), and Salik & Adamu (2021).

The consumer price index (CPI) is a statistical measure derived from the prices of a selected group of representative items, with their prices collected at regular intervals. We utilize the CPI with 2011 set as the base year (i.e., 2011=100), and the variable is transformed into a logarithmic form for incorporation into the empirical model of this study. An unexpected rise in consumer prices is set to boost economic growth from the first to the second period. Growth will stabilize from the third period to the sixth, but we'll see a gradual uptick from the seventh period onward (refer to Figure 2 of No. 5). It's worth noting that consumer prices tend to drop in response to structural revenue shocks, aligning with the findings of Munir and Riaz (2020). This outcome contrasts sharply with the predictions made by Chibi et al. (2019) regarding Algeria.

An unexpected rise in the exchange rate (LNREER) will initially boost output during the first three periods, followed by a decrease until the final period (see Figure 2 in No. 8). Between the fourth and tenth periods of 2019 to 2020, following the global financial crisis, Ethiopia faced significant challenges in maintaining its international competitiveness and trade balances, leading to a pattern of ongoing deficits. The influence of shocks in tax revenues on economic growth is notably positive, peaking at an impressive level after three periods. Following this peak, there is a consistent decline observed throughout the remaining period (see Figure 2 of No. 9). Initially, the reaction to changes in tax revenues intensifies, but from period four onward, this intensity significantly diminishes. An increase in tax revenue can lead to a decline in government spending. This aligns with the findings of Munir and Sultan (2018) and Munir & Riaz (2020), which suggest that higher tax revenue has a significant positive impact on GDP over the long term. The study concluded that, based on the analysis of impulse response functions, monetary policy shocks have a greater impact on key macroeconomic fluctuations compared to fiscal policy shocks. The results align with the findings of Dery & Serletis (2024), Manedo (2022), and Hasan et al. (2016). However, this study contradicts the conclusions drawn by Tadesse & Melaku (2019), Beyene & Kotosz (2022), Gizaw (2022), and Woldesemayat (2020),

Studia Universitatis "Vasile Goldis" Arad. Economics Series Vol 36 Issue 2/2026
ISSN: 1584-2339; (online) ISSN: 2285 – 3065
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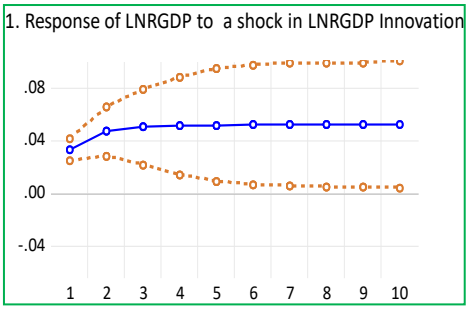
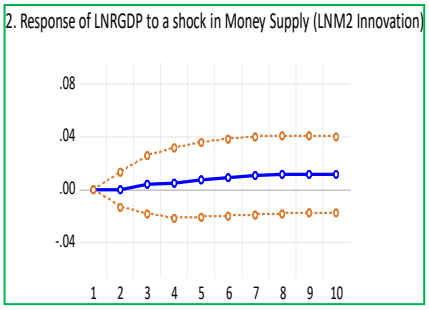
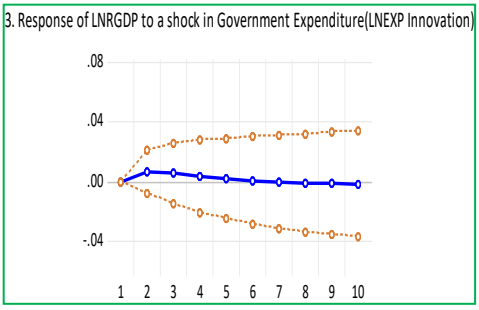
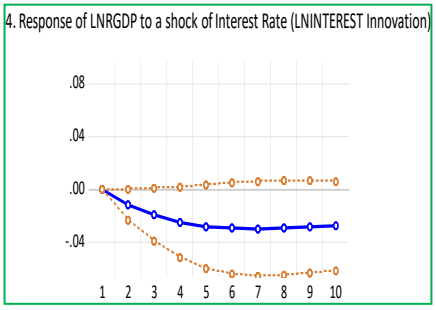
who argue that fiscal policy plays a more significant role than monetary policy in influencing economic growth (real GDP).

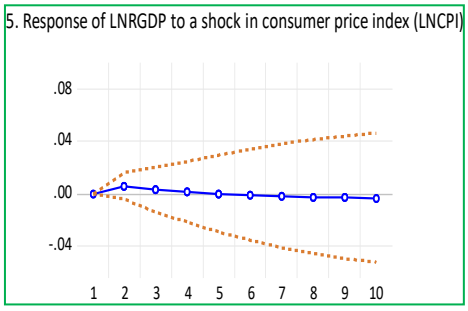
Response to Structural VAR Innovations ± 2 S.E

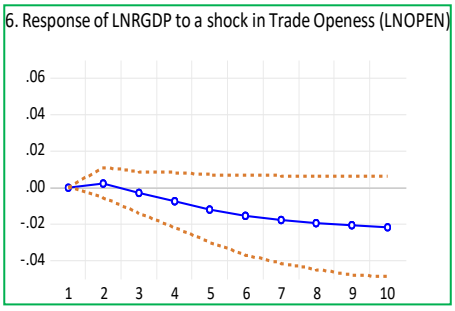












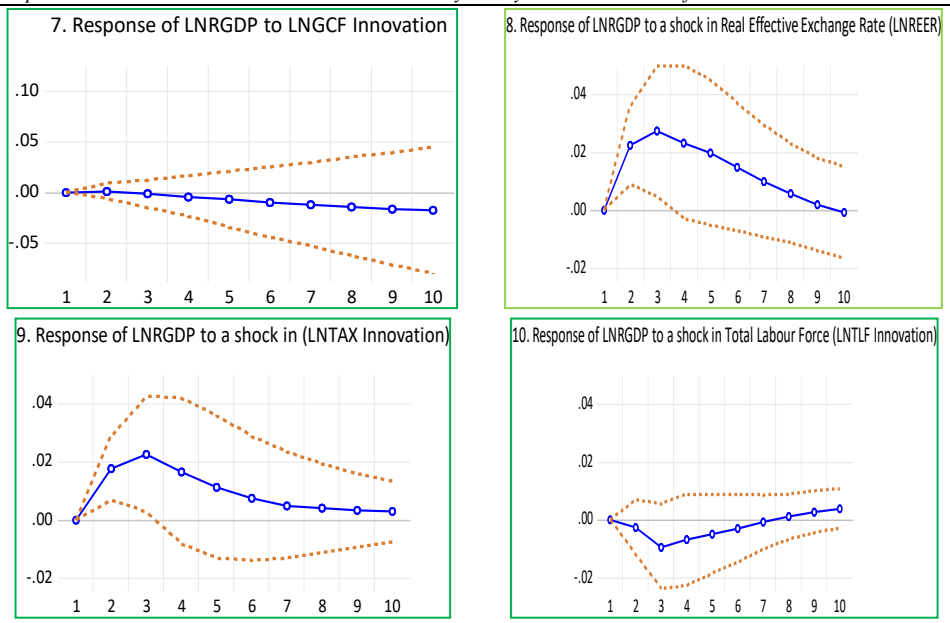


Figure 2. Impulse Response Functions

Note: The blue line represents the impulse response function, while the red line represents the standard error at 95% confidence intervals. The black line represents stationary points, while the numbers 1 to 10 in the left column are the years.

4.3.3.VAR Granger Causality Test

The researcher performs Granger-causality tests to support the impulse response function findings, aiming to explore the short-run dynamics and the direction of causality between endogenous and exogenous variables. Granger-causality tests establish whether the causal relationships between the series in VAR models are unidirectional or bidirectional. The Granger causality was examined in this study using the Block Exogeneity Wald Tests. The results of the causality test indicate that three variables (LNRGDP, LNREER, and LNOPEN) exhibited bidirectional causality at a significance level of 1%. This implies that changes in RGDP may lead to changes in REER & OPEN and vice versa. The other variables (LNCPI, LNGCF, LNEXP, LNINTEREST, and LNTAX) indicate a one-way causality rather than a reciprocal relationship (Table 10).

Studia Universitatis "Vasile Goldis" Arad. Economics Series Vol 36 Issue 2/2026
ISSN: 1584-2339; (online) ISSN: 2285 – 3065
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Table 10. Granger Causality using Block Exogeneity Wald Tests

Dependent Variable: LNRGDP

Excluded	Chi-square	df	P-Value
LNCPI	8.667008	1	0.0032***
LNGCF	0.033089	1	0.8557
LNEXP	8.013386	1	0.0046***
LNINTREST	2.467189	1	0.1162
LNM2	2.187887	1	0.1391
LNOPEN	9.537108	1	0.0020***
LNREER	14.02292	1	0.0002***
LNTAX	3.294701	1	0.0695
LNTLF	1.884199	1	101699
All	132.0515	9	0.0000

Dependent Variable: LNCPI

Excluded	Chi-square	Df	P-Value
LNRGDP	3.443925	1	0.0635
LNGCF	0.523735	1	0.4693
LNEXP	1.116268	1	0.2907
LNINTREST	0.190519	1	0.6625
LNM2	2.915236	1	0.0877
LNOPEN	0.064797	1	0.7991
LNREER	0.022621	1	0.8804
LNTAX	0.014375	1	0.9046
LNTLF	6.388232	1	0.0115***
All	32.33466	9	0.0002

Dependent Variable: LNGCF

Excluded	Chi-square	df	P-Value
LNRGDP	0.608260	1	0.4354
LNCPI	0.683331	1	0.4084
LNEXP	2.867742	1	0.0904
LNINTREST	0.933398	1	0.3340
LNM2	0.486157	1	0.4858
LNOPEN	0.014158	1	0.9053
LNREER	0.109192	1	0.7411
LNTAX	8.108880	1	0.0135***
LNTLF	1.215998	1	0.2701
All	193.3132	9	0.0000

Dependent Variable: LNEXP

Excluded	Chi-square	df	P-Value
LNRGDP	3.801866	1	0.0512**
LNCPI	1263650	1	0.0004***
LNGCF	1.202968	1	0.2727
LNINTREST	12.32452	1	0.004***
LNM2	0.015307	1	0.9015
LNOPEN	1.682338	1	0.1946
LNREER	0.778044	1	0.3777
LNTAX	0.555934	1	0.4559
LNTLF	0.103646	1	0.7475
All	112.9532	9	0.0000

Dependent Variable: LNINTEREST

Excluded	Chi-square	Df	P-Value
LNRGDP	3.35E-05	1	0.9954
LNGCF	1.540342	1	0.2146
LNGCF	0.620349	1	0.4309
LNEXP	0.004577	1	0.9451
LNM2	0.333551	1	0.5636
LNOPEN	1.584276	1	0.2081
LNREER	2.777169	1	0.0956
LNTAX	1.470435	1	0.2253
LNTLF	0.556669	1	0.4556
All	168.9542	9	

Dependent Variable: LNM2

Excluded	Chi-square	df	P-Value
LNRGDP	0.180547	1	0.6709
LNCPI	1.123546	1	0.2892
LNGCF	0.212066	1	0.6452
LNEXP	0.090556	1	0.7635
LNINTEREST	0.120798	1	0.7282
LNOPEN	37.526228	1	0.0000***
LNREER	38.88692	1	0.0000***
LNTAX	0.044027	1	0.8338
LNTLF	1.153272	1	0.2829
All	0.0000	9	0.0000

Dependent Variable: LNOPEN

Excluded	Chi-square	Df	P-Value
LNRGDP	8.280432	1	0.0040***
LNCPI	0.000132	1	0.9909
LNGCF	0.068627	1	0.7933
LNEXP	1.214745	1	0.2704
LNINTEREST	0.189020	1	0.6637
LNM2	0.010019	1	0.9203
LNREER	7.399056	1	0.0065***
LNTAX	0.912399	1	0.3395
LNTLF	4.463308	1	0.0346
All	146.0829	9	0.0000

Dependent Variable: LNREER

Excluded	Chi-square	df	P-Value
LNRGDP	6.633438	1	0.0100***
LNCPI	0.247452	1	0.6189
LNGCF	0.173951	1	0.6766
LNEXP	0.532240	1	0.4657
LNINTEREST	0.041303	1	0.8390
LNM2	0.258882	1	0.6109
LNOPEN	2.367582	1	0.1239
LNTAX	0.324353	1	0.3395
LNTLF	3.176145	1	0.0747
All	110.1652	9	0.0000

Dependent Variable: LNTAX

Excluded	Chi-square	Df	P-Value
LNRGDP	3.517294	1	0.0607
LNCPI	6.390715	1	0.0115***
LNGCF	0.003366	1	0.9537
LNEXP	0.004631	1	0.9457
LNINTEREST	0.006295	1	0.9368
LNM2	5.599880	1	0.0180**
LNOPEN	1.239973	1	0.2655
REER	0.912399	1	0.3395
LNTLF	0.408712	1	0.5226
All	32.99183	9	0.0001

Dependent Variable: LNTLF

Excluded	Chi-square	Df	P-Value
LNRGDP	1.062691	1	0.3026
LNCPI	0978736	1	0.3225
LNGCF	0.444038	1	0.5052
LNEXP	0.252345	1	0.6154
LNINTEREST	0.151993	1	0.6966
LNM2	0.142919	1	0.7054
LNOPEN	0.040265	1	0.8410
REER	0.163732	1	0.6857
LNTAX	0.408712	1	0.3756
All	11.86384	9	0.02211

Note: *, **, and *** represent significance levels of 10%, 5% and 1%, respectively. df(1) implies lag 1 is selected for VAR analysis.

5. Conclusions and Recommendations

The study investigated the impact of fiscal and monetary policy shocks on economic growth in Ethiopia, analyzing time series data from 1991 to 2022. The results of the Johansen trace and maximum eigenvalue statistics revealed five cointegrating relationships among the variables at the 1% significance level, indicating a long-term connection among the series. The causality tests indicated that real GDP, the real effective exchange rate, and trade openness exhibited bidirectional causality at a 1% significance level. This implies that changes in real GDP can influence exchange rates and trade openness, and the relationship may also work in the opposite direction. Several other variables, including the consumer price index, gross capital formation, total government expenditure, lending interest rates, and tax revenue, show a one-way causality without a reverse effect. Variance decomposition results reveal that monetary policy variables, such as money supply and interest rates, account for approximately 53.36% and 7.60% of the changes in real GDP over ten periods, respectively. In contrast, fiscal policy variables contribute, on average,

Studia Universitatis "Vasile Goldis" Arad. Economics Series Vol 36 Issue 2/2026
ISSN: 1584-2339; (online) ISSN: 2285 – 3065
Web: publicatii.uvvg.ro/index.php/studiaeconomia. Pages 99-128

7.83% of real GDP variations due to government expenditure and 1.56% from tax revenue over the same period. The impulsive response function indicates that changes in the money supply have a statistically significant and positive impact on economic growth in the short term, with a gradual positive increase observed over the long term. Conversely, government expenditure shows a significant positive effect initially but turns negative from the ninth to the tenth year. In summary, the results of variance decompositions and the impulsive response function showed that both monetary and fiscal policies significantly influence economic growth. However, the impact of monetary shocks is more pronounced than that of fiscal policy on the economic growth of Ethiopia.

Based on the findings, the study makes the following recommendations:

- The Ethiopian Ministry of Finance and Economic Cooperation (MoFEC) should focus on increasing the productivity of public spending by prioritizing capital investments with high growth potential, reducing wasteful expenditures, and improving the efficiency of public service delivery. Structural reforms aimed at enhancing public financial management and performance monitoring are essential.
- The National Bank of Ethiopia should expand the scope and depth of financial markets to improve the responsiveness of monetary instruments. The development of interbank markets, improved communication strategies, and gradual movement toward an inflation-targeting framework would enhance policy credibility and effectiveness.
- Boosting domestic revenue generation through tax base broadening, better tax compliance, and improved administration will reduce dependence on external borrowing. Reforming underperforming public enterprises to improve their efficiency and profitability can also ease the fiscal burden.
- Given the observed adverse effects of exchange rate depreciation, policymakers should pursue a cautious and gradual exchange rate adjustment strategy. This should be complemented by efforts to increase the domestic production of tradable and export-oriented goods to mitigate the inflationary consequences of devaluation and reduce import dependency.
- Technically, the country should explore the asymmetric and nonlinear effects of policy shocks to account for regime changes or structural breaks in the Ethiopian economy.
- Future research should incorporate external sector variables such as foreign aid, remittances, and global commodity prices to account for Ethiopia's external vulnerabilities.

- Other researchers from Ethiopia are encouraged to use advanced econometric methods, such as panel SVAR or time-varying parameter models, to enable comparative analysis across Sub-Saharan African economies and to evaluate how policy effectiveness has changed over different regimes and reform periods.

Acknowledgments
I would like to extend my sincere thanks to the National Bank of Ethiopia for providing the necessary data and information. The author also thanks the anonymous reviewers and the editor for their valuable contributions.

Funding
This research received no external funding.

Author Contributions
Tale Geddafa, the sole author, conceived the title, designed the study, collected the data, developed the methodology, performed the formal analysis, interpreted the data, drafted the original manuscript, reviewed and edited the content, created the visualizations, and wrote the paper—carrying out all aspects of the work.

Disclosure Statement
The authors declare no conflict of interest.

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