JOURNAL OF AL MAYADINE AL IKTISSADIA
VOL: 06, ISS: 01, 2023, Pages (487/508)
P-ISSN: 2716-7615 E-ISSN: 2716-8565

Predicting the impact of fiscal and monetary policy on economic growth in Algeria during the period 1980-2022

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Received: 11/09/2023 **Published: 01/01/2024**

Abstract:

This study aims to forecast the impact of the fiscal and monetary policies on the Algerian economic growth. In this study, we used the Vector Auto regression (VAR) model, which is considered a powerful analytical tool that allows for the analysis of causal relationships and interactions among financial and monetary variables, represented by government expenditure, money supply, and exchange rate. We also aimed to estimate the extent of the influence of fiscal and monetary policies on Algerian economic growth using available data from the World Development Indicators (WDI) published by the World Bank during the period (1980-2022). The obtained estimation results indicate that monetary policy has a higher impact on Algerian economic growth compared to fiscal policy. These estimates are in line with economic theory and empirical evidence, further supported by statistical analysis.

Keywords: Fiscal policy; monetary policy; economic growth; The (VAR) model.

JEL Classification Codes : F47, E5; **E62**

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Introduction

Achieving the economic growth and financial stability is the primary goal pursued by all nations. Algeria is among the countries that has undergone significant economic development over the years. Fiscal and monetary policy played a pivotal role in guiding the trajectory of this development **(Bailey. D, (2020, Mbilla. S *et al.* 2021), (Bongumusa. P and Kaseeram. I, 2022)**. The attainment of economic growth and stability unfolds within the framework of intricate economic and financial variables. In this context, fiscal and monetary policy plays a vital role in shaping and steering the economic trajectory, aiming to realize the desired economic objectives. The impact of these policies extends beyond the financial sector, affecting diverse facets of economic and societal life **(Petrevski. G *et al*. 2016), (Arestis. P and Sawyer. M, 2004).**

The impact of government expenditure, money supply, and exchange rate on economic growth represents a pivotal axis for shaping economic dynamics. Government expenditure is considered one of the key components of aggregate demand, and it can affect economic growth through several mechanisms. An increase in government spending on infrastructure, for instance, can stimulate economic activity by creating new job opportunities and boosting investments. Moreover, government spending can support vulnerable or affected economic sectors, contributing to mitigating economic slowdowns **(Boukhatem. C, 2021)**. Money supply affects the level of economic demand, interest rates, inflation, investment, and employment. Increasing the money supply can stimulate economic growth by boosting spending, lowering borrowing costs, and enhancing investment opportunities. However, it can also cause inflation if it exceeds the production growth, leading to higher prices and lower purchasing power. Therefore, money supply reflects the complex dynamics between demand and supply in the economy **(Dinh.D.V, 2019), (Nizhegorodtsev.R and Goridko.N, 2015)**. The exchange rate, or the value of a country's currency relative to another, is a key factor that also influences economic growth through various channels. It affects the competitiveness of exports and imports, the attractiveness of foreign direct investment, the inflation rate, the value of external debt, and the domestic consumption of imported goods. Depending on the direction and magnitude of exchange rate changes, these effects can be positive or negative for economic growth. Therefore, the exchange rate reflects the complex interplay between internal and external forces that shape a country's economy **(Habib, M. *et al*. 2017**). Indeed, The significance of the study lies in by understanding how fiscal and monetary policy influence economic growth, the government and the central bank can adapt their decisions to the objectives of development and stability **(Mehar, M. A, 2023**).

By concurrently exploring the impact of three pivotal variables, we enrich our understanding of intricate economic dynamics and potential interactions among these factors. Our current methodology, which integrates the effects of fiscal and monetary policies on economic growth within a unified model, represents a tangible departure from

numerous studies that examine the impact of each variable separately. This exceptional approach enables a comprehensive analysis of the 'compound effect' resulting from the interactions between government policies, monetary measures, and exchange rates on economic growth. Through this approach, we shed valuable light on the interconnectedness that shapes the broader economic landscape.

This study aims to analyze the impact of financial variables, such as the government expenditures, and monetary influences, such as the exchange rate and the money supply, on economic growth in Algeria. This analysis will be conducted using available financial and monetary data during the period (1980-2022)**,** employing the VAR model to estimate and illustrate the complex relationships and interactions among aggregate variables, as well as how financial and monetary decisions influence economic growth within this timeframe.

Importance of the study

The importance of the study is:

– Understanding Economic Interactions: This study contributes to providing a deeper understanding of the interactions and relationships between the fiscal policy, the monetary policy, and the economic growth in Algeria. Such insights can facilitate the simplification of economic decision interplays and enhance policy guidance with greater efficacy.

– Directing Economic Policies: By comprehending how fiscal and monetary policies impact economic growth, both the government and the central bank can base their decisions on accurate information regarding anticipated effects.

Objectives of the study

The objectives of the study are:

- Causal Relationship Analysis: The study seeks to analyze and understand the causal relationships between the fiscal policy, the monetary policy, and the economic growth in Algeria.
- Economic Policy Impact Prediction: The study aspires to predict the impact of the fiscal and monetary policies on the economic growth in Algeria.

In this context, we come to highlight the problem statement of our study, formulated within the framework of the following question:

'What is the impact of fiscal and monetary policy variables on the economic growth in Algeria during the period 1980-2022?.

To address this problem statement, we formulate it within the framework of the following sub-questions:

❖ How can causal relationships and interactions between the financial and monetary variables and the economic growth rates in Algeria be elucidated?

❖ How can the VAR model be employed to analyze the effects of fiscal and monetary policies on economic growth?

❖ What is the anticipated impact of fiscal and monetary policies on economic growth?

Study Hypotheses

In this study, we have relied on three fundamental hypotheses, as follows:

❖ The government expenditure policy has a greater impact on the economic growth rates in Algeria compared to the monetary supply policy.

❖ There is a varying impact of the fiscal and monetary policy variables on the economic growth rates in Algeria.

Research Methodology

The study employed both the deductive and inductive methodologies:

❖ Deductive Method: This method was employed in the theoretical treatment of the study, relying on the descriptive tools.

❖ Inductive Method: The inductive approach was used to conduct a quantitative analysis of the economy. The VAR model was employed to study the mutual effects among the study variables.

Scope of the Study

Considering the subject of our study, its scope has been divided into three sections**:**

- Objective Boundaries: The study focuses on analyzing the impact of the fiscal and monetary policy on the economic growth using the VAR model, without considering other fluctuations and variations.
- Spatial Boundaries: The spatial boundaries are confined to attempting the estimation of the VAR model in Algeria, utilizing Algerian economic statistics, employing available financial and monetary data.
- Temporal Boundaries: The temporal scope of the study extends from the year 1980 to 2022, a period marked by diverse changes.

Literature Review

Several studies have examined the impact of the government expenditure, the money supply, and the exchange rate on the economic growth using various standard estimation methods. We will provide a summary of some of these studies:

Government expenditure constitutes a fundamental element in the gross domestic product (GDP), and the issue of excessive spending is seen from the perspective of being inevitable and necessary. If government spending exceeds budget limits, it might indicate a failure to address the real factor that could affect productivity. Thus, **(M.Zulkifli *et al.* 2022)** conducted a study on the impact of government expenditure on economic growth in Malaysia from 1980 to 2020. They used the Vector Auto regression (VAR) model to examine the causal relationships and interactions between the government expenditure, money supply, and exchange rate variables and the economic growth rate variable. They found that government expenditure had a positive and significant effect on economic growth in both the short run and the long run, while money

supply and exchange rate had negative and insignificant effects. Authors also found that there was a unidirectional causality running from government expenditure to economic growth, but no causality between money supply, exchange rate, and economic growth. They concluded that government expenditure was an important determinant of economic growth in Malaysia and suggested that the government should prioritize productive spending that could enhance private sector productivity and competitiveness.

The effect of money supply on economic growth is a topic of great interest in monetary economics. A key issue is inflation, which means that prices go up and people can buy less with their money over time. Inflation is a vital monetary issue that differs across economies, especially in developing countries. Therefore, it is important to reexamine and reevaluate inflation, especially in the context of developing economies. Research presented by **(K.Santosh *et al*. 2023)**, examines how money supply and inflation affect economic growth from 1974 to 2020. Author's uses the "ARDL" model to check if there is a long-term relationship between the variables considering broad money supply and consumer prices as the independent variables, and gross domestic product as the dependent variable. The study shows a positive relationship between the consumer price index and economic growth. The results indicate that the consumer price index has a strong impact on economic growth in developing countries, such as Nepal. The paper suggests that monetary policy is an effective way to foster growth, and recommends that the government should keep a stable money supply and inflation rate, as well as a competitive exchange rate.

The exchange rate movement is a topic that has been studied by many economists and researchers. The study presented by **(Akpan *et al*. 2011)**, explores the effect of exchange rate movements on real output growth in Nigeria. Using the time series data from 1986 to 2010, this research paper investigates the possible direct and indirect link between exchange rates and gross domestic product (GDP) growth. The results show no significant evidence of a strong direct link between exchange rate variations and GDP growth. On the other hand, economic growth in Nigeria is directly affected by monetary variables. Therefore, we suggest that better exchange rate management is necessary, but not enough to boost the Nigerian economy.

Study Axes

The study encompasses the following two axes:

First Axis: The impact of fiscal and monetary policy on economic growth

In this section, we will discuss the impact of study variables on economic growth.

1. Impact of Government Expenditure on Economic Growth

Government expenditure is considered one of the key components of aggregate demand, and it can affect economic growth through several mechanisms:

- Demand Stimulation: Government spending increases the overall economic demand. This includes expenditure on infrastructure, public services, and social welfare programs. Such spending boosts both consumption and investment, driving production and economic growth. (**Arestis, P, *et al*. 2004**).
- Boosting Key Sectors: The government can direct spending to specific sectors like education, healthcare, and research and development. This can enhance workforce skills and innovation, ultimately leading to increased growth potential. **(Chekouri, A, *et al*. 2022).**
- Enhancing Employment Opportunities: Government spending on infrastructure projects and public services can generate increased labor demand, providing more employment opportunities. This improves unemployment rates, supports personal income, and enhances purchasing power. (**Dinh, D. V, 2019**).
- Infrastructure Development: Government spending on infrastructure development such as roads, bridges, and major projects can enhance the country's economic infrastructure. This not only improves the infrastructure itself but also enhances the economy's efficiency and productivity. **(Ayad, H, 2020**).
- Promoting Economic Stability: Investment-oriented government spending can contribute to economic stability by reducing fluctuations in economic activity and achieving sustainable long-term growth. **(Fekir H, 2022)**.

2. Impact of Money Supply on Economic Growth

Money supply represents the total amount of currency and financial liquidity available in the economy, and thus, it has a significant impact on economic growth through several mechanisms: **(Mehar, M. A. 2023)**.

- Effect on Economic Demand: Increasing the money supply can lead to an increase in economic demand, as there is a greater amount of money available for spending and investment. This effect can stimulate economic growth. **(Benazza, I, 2022**).
- Effect on Interest Rates: Increasing the money supply can lower interest rates, thus providing ample funds for borrowing, which in turn encourage investment and support economic growth. **(Hicham, E. A. 2023)**
- Effect on Inflation: Increasing the money supply by an amount greater than the growth in production can result in inflation. When the quantity of money rises without a

corresponding increase in production, it can boost overall demand, leading to higher prices. **(Habib, M. *et al*. 2017)**.

- Effect on Investment and Employment: Increasing the money supply can enhance the availability of funds for companies to invest and expand their operations. Consequently, this can lead to increased job opportunities and growth. **(Andreea. R, 2015)**.

3. Effect of Exchange Rate on Economic Growth

The exchange rate, or the value of a country's currency in relation to another, is a significant factor that greatly influences economic growth through several mechanisms:

- Effect on Exports and Imports: The exchange rate affects the cost of imported and exported goods and services. Depreciation of the national currency's value can make exported goods more competitive in foreign markets, stimulating exports and supporting growth. Conversely, an appreciating currency may raise import costs and reduce exports, potentially harming growth. **(Touitou, F. M. *et al*. 2019).**
- Effect on Foreign Direct Investment (FDI): The exchange rate affects a country's attractiveness for (FDI). Currency depreciation can make investments in the country more cost-effective, increasing the appeal for FDI and enhancing growth prospects. **(Sakli, H. *et al*. 2021)**.
- Effect on External Debt: The exchange rate can impact the value of external debt. An appreciating national currency can decrease the value of foreign-currency-denominated debts, alleviating pressure on the public budget and boosting economic growth. **(Bunescu, L. *et al*. 2014).**
- Effect on Domestic Consumption: Fluctuations in the exchange rate can affect individuals' purchasing power of imported goods. A stronger national currency against foreign currencies can increase consumers' buying power, thus boosting domestic consumption and contributing to economic growth. **(Louail, G. B .*et al*. 2020).**

Second Axis: Using the VAR Model to Forecast the Impact of Economic Policy on Algerian Economic Growth

To forecast the impact of monetary and fiscal policies, we estimated the VAR model for Algeria using macroeconomic data. The economic growth was one of the endogenous variables in the model**.**

1. Data Analysis

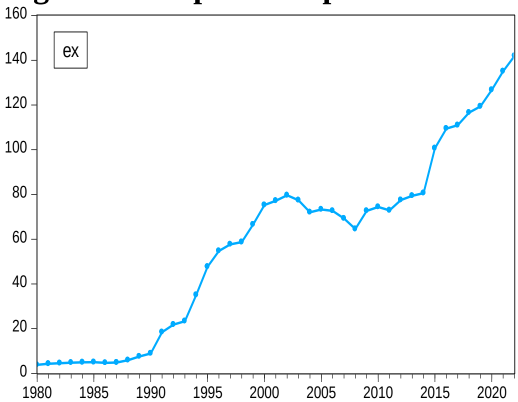
In this research paper, we have selected a set of aggregate variables that reflect the reality of Fiscal and Monetary Policies and their impact on economic growth in Algeria. These data cover the period from 1980 to 2022, sourced from the global development indicators (July 18**,** 2022) issued by the World Bank. To achieve optimal results, the logarithmically transformed variables have been analyzed using the Eviews version 9 software tool for the following variables:

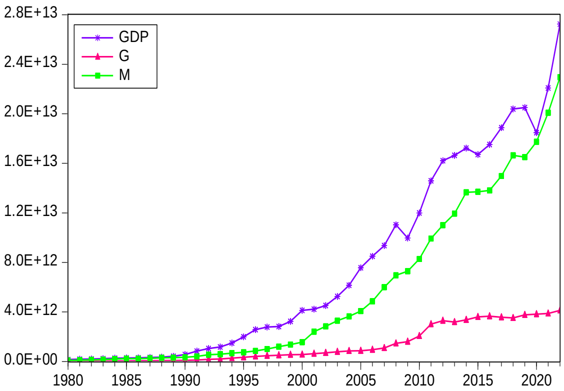
GDP: Gross Domestic Product (in current local currency prices)

EX: Official EXchange rate (local currency to US dollar, period average)

M: Broad money supply (in current local currency prices)
G: General government Final consumption expenditures (in current local currency prices)
Therefore, it is essential to graphically represent all the variables before studying their estimation method and testing (Figure.1).

Figure 1: Graphical Representation of the Study Variables





Source: Prepared by the researcher using Eviews 9 software.

2. Stability Testing, using the Augmented Dickey-Fuller (ADF) Test

The ADF test relies on a least squares of the following models to study the stationarity of time series data:

$$\begin{cases} \Delta y_t = \rho y_{t-1} - \sum_{j=2}^{P} \phi_j \Delta y_{t-j+1} + \varepsilon_t \text{..} (01) \\ \Delta y_t = \rho y_{t-1} - \sum_{j=2}^{P} \phi_j \Delta y_{t-j+1} + c + \varepsilon_t \text{.....................................} (02) \\ \Delta y_t = \rho y_{t-1} - \sum_{j=2}^{P} \phi_j \Delta y_{t-j+1} + c + bt + \varepsilon_t \text{...............................} (03) \end{cases}$$

The value of (ρ) is determined based on the lowest value of the AIC and SC criteria, Lagged differences are utilized to address the issue of the autocorrelation, and the subsequent table summarizes the results of the ADF tests.

Table 1: ADF Test at the 5% Significance Level

	Var	Model Type								
		Model(01)			Model(02)			Model(03)		
		τ	ϕ	Prob	τ	ϕ	Prob	τ	ϕ	Prob
The level	LogG	2.27	-1.95	0.99	-1.69	-2.94	0.42	-1.02	-3.52	0.93
	LogM	3.91	-1.95	0.99	-1.58	-2.94	0.48	-0.75	-3.52	0.96
	LogEX	1.44	-1.95	0.96	-1.55	-2.94	0.49	-1.16	-3.52	0.91
	LogGDP	3.05	-1.95	0.99	-1.39	-2.94	0.58	-1.01	-3.52	0.93
The first differences	LogG	-1.74	-1.95	0.08	-2.95	-2.94	0.05	-3.42	-3.53	0.63
	LogM	-1.66	-1.95	0.09	-3.97	-2.94	0.00	-4.18	-3.53	0.09
	LogEX	-2.45	-1.95	0.07	-3.09	-2.94	0.09	-3.31	-3.53	0.08
	LogGDP	-1.86	-1.95	0.06	-3.83	-2.94	0.06	-4.32	-3.53	0.00
The second differences	LogG	-7.16	-1.95	0.00	-7.07	-2.94	0.00	-6.99	-3.53	0.00
	LogM	-7.32	-1.95	0.00	-7.23	-2.94	0.00	-7.15	-3.53	0.00
	LogEX	-8.65	-1.95	00.0	-8.53	-2.94	0.00	-8.42	-3.53	0.00
	LogGDP	-6.87	-1.95	0.00	-6.77	-2.94	0.00	-6.66	-3.53	0.00

Source: Prepared by the researcher using Eviews 9 software.

3. Analysis of ADF Test Results

Based on the data from Table 1 and the ADF tests, we can arrive at the following conclusion: For each of the models (01), (02), and (03), the absolute values of the computed test statistics $(\tau)$are larger than the critical values (ϕ) at the 5% significance level, as well as at the 1% and 10% levels. Additionally, we observe that the p-values for all models are less than 5%, indicating that $(\Pr ob \prec 0.05)$. Consequently, following the unit root tests for the variables *LogGDP* , *LogG* , *LogM* , and *LogEX* , we found that they are non-stationary at the level but stationary at the second difference $I(2)$. Each variable is individually integrated of order, thus allowing us to suggest the potential existence of a long-term co-integrating relationship among the variables. To verify this hypothesis, estimating the regression relationship between the variables is necessary.

$$LogGDP_t = \alpha_t + \beta_1 LogG_t + \beta_2 LogM_t + \beta_3 LogEX_t + \xi_t \quad (04)$$

In other words:

$$\xi_t = LogGDP_t - \alpha_t - \beta_1 LogG_t - \beta_2 LogM_t - \beta_3 LogEX_t \quad (05)$$

Therefore, we need to ensure that the error term ξ_t is integrated of order zero (I(0)), meaning it is a stationary time series, Thus, after confirming that all time series are stationary and integrated of the same order (I(2)), and that the residuals are also stationary of order (I(0))**,** it can be inferred that a long-term cointegrating relationship exists between the independent variables and the dependent variable of the model. To verify this, we turn to the JOHANSEN test.

4. Johansen Cointegration Test

To study and estimate the long-term relationship among a set of variables integrated of the same order N, the Johansen test is employed. The test yielded the following results:

The calculated test statistic is $\lambda_{trace} = 41.93914$(see Appendix 01):, which is smaller than the critical value of 47.85613 at the 5% significance level, with a p-value of 0.1604 greater than 5%. Additionally, the matrix rank is (r=1), where (K-1≥r≥1) with (K=4).

Consequently, there is no long-term cointegrating relationship among the independent variables and the dependent variable of the model. The VAR model can be represented.

5. Steps for Estimating the Study Model

To estimate the VAR model, we follow the following steps:

5.1. Determining the Optimal Lag Order for the VAR Model

To determine the lag order of the VAR model, information criteria are employed. The method for selecting the lag order involves estimating each equation of the model for any order from 0 to ρ (where ρ is the maximum accepted number according to economic theory). In this study, we use the four criteria: (AIC), (HQ), (SC), and (FPE). We select the optimal lag that minimizes all the criteria. From Table 2, we find that the criteria AIC, SC, HQ, and FPE indicate the necessity of considering a lag of one time period for the VAR (1) model.

Table 2: Determining the Optimal Lag Length for VAR Model

VAR Lag Order Selection Criteria
Endogenous variables: LOGGDP LOGG OGM LOGEX
Exogenous variables: C
Included observations: 38

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-46.21110	NA	0.000165	2.642689	2.815067	2.704020
1	166.8892	370.1216*	5.19e-09*	-7.731010*	-6.869123*	-7.424357*
2	181.9614	23.00492	5.62e-09	-7.682178	-6.130781	-7.130203
3	196.4850	19.11008	6.57e-09	-7.604476	-5.363569	-6.807178
4	209.7031	14.60941	8.90e-09	-7.458057	-4.527640	-6.415437
5	229.5417	17.75037	9.66e-09	-7.660091	-4.040164	-6.372149

Source: Prepared by the researcher using Eviews 9 software.

5.2. Granger Causality Test

The Appendix 2 shows the results of the Granger causality tests for all possible pairs of variables, with a lag order of 8. The table shows that we can reject some of the null hypotheses H_0 at the 5% significance level, which means there is evidence of Granger causality between some pairs of variables. For examples, we have $F^* = 4.76693$ which is greater than the tabular value at a significance level of %5, as well as $prob: 0.0029 < 0.05$. This implies the rejection of H_0. On the other hand, we have $F^* = 11.3212$ which is

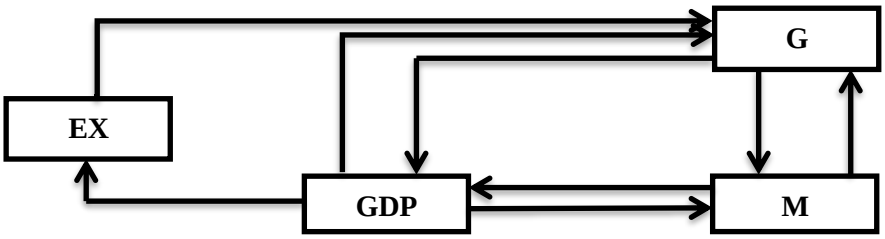
greater than the tabular value at a significance level of %5, as well as $prob: 1.E-05 < 0.05$. This also implies the rejection of H_0 . In other words, variable G causes variable GDP , and variable GDP causes variable G .

Furthermore, $F^* = 4.27932$ is greater than the tabular value at a significance level of %5, as well as $prob: 0.0050 < 0.05$. This implies the rejection of H_0 . On the other hand, we have $F^* = 2.70369$ which is greater than the tabular value of 2.11 at a significance level of %5, as well as $prob: 0.0380 < 0.05$. This also implies the rejection of H_0 and consequently this also means that G can be used to predict GDP in a time series. In other words, variable M causes variable GDP and variable GDP causes variable M .

Moreover, $F^* = 2.64564$ is greater than the tabular value at a significance level of %5, as well as $prob: 0.0412 < 0.05$. This signifies the rejection of H_0 . Furthermore, we have $F^* = 5.03946$ which is greater than the tabular value at a significance level of %5, as well as $prob: 0.0021 < 0.05$. This also signifies the rejection of H_0 . In other words, variable M causes variable G and variable G causes variable M .

In addition, $F^* = 3.16390$ is greater than the tabular value at a significance level of %5 , as well as $prob: 0.0202 < 0.05$. This implies the rejection of H_0 . Furthermore, we have $F^* = 3.92102$ which is greater than the tabular value at a significance level of %5, as well as $prob: 0.0077 < 0.05$. This also implies the rejection of H_0 . In other words, variable GDP causes variable EX and variable EX causes variable GDP .As for the remaining cases, F^* is smaller than the tabular value at a significance level of %5, as well as $prob = (0.2417 , 0.1849 , 0.7382 , 0.1708) > 0.05$. This indicates the non-rejection of H_0 . Hence, variable EX does not cause variable GDP , variable EX does not cause variable M , and variable M does not cause variable EX . The Figure.2 summarizes the results of the Granger test.

Figure (2): Causality Study among Variables



Source: Compiled by the researcher based on Granger causality test results.

5.3. Estimation of VAR Model

Results of estimating the VAR (1) model in matrix form with a lag of one time step are presented in Appendix 3:

$$\begin{bmatrix} LogGDP_t \\ LogG_t \\ LogM_t \\ LogEX_t \end{bmatrix} = \begin{bmatrix} 3.4689 \\ -0.6652 \\ -0.0143 \\ 0.2414 \end{bmatrix} + \begin{bmatrix} 0.7435 & 0.0139 & 0.1093 & 0.1558 \\ 0.2859 & 0.8253 & -0.0895 & -0.0547 \\ 0.2482 & -0.1528 & 0.8984 & -0.0003 \\ -0.1153 & 0.2938 & -0.1611 & 0.9429 \end{bmatrix} \begin{bmatrix} LogGDP_{t-1} \\ LogG_{t-1} \\ LogM_{t-1} \\ LogEX_{t-1} \end{bmatrix} \quad (06)$$

And thus, we can write the system of equations as follows:

$$\begin{cases} \text{LOGGDP} = 0.74\text{LOGGDP}_{t-1} + 0.01\text{LOGG}_{t-1} + 0.11\text{LOGM}_{t-1} + 0.16\text{LOGEX}_{t-1} + 3.47 \\ \text{LOGG} = 0.29\text{LOGGDP}_{t-1} + 0.83\text{LOGG}_{t-1} - 0.09\text{LOGM}_{t-1} - 0.06\text{LOGEX}_{t-1} - 0.67 \\ \text{LOGM} = 0.25\text{LOGGDP}_{t-1} - 0.15\text{LOGG}_{t-1} + 0.89\text{LOGM}_{t-1} - 0.0003\text{LOGE X}_{t-1} - 0.01 \\ \text{LOGEX} = -0.12\text{LOGGDP}_{t-1} + 0.29\text{LOGG}_{t-1} - 0.16\text{LOGM}_{t-1} + 0.94\text{LOGEX}_{t-1} + 0.24 \end{cases} \quad (07)$$

5.4. Analysis of Model Results

We analyze the model's results**,** from both statistical and economic perspectives, to evaluate the applicability of this model in practice.

1) Statistical Analysis of Results

The t-test results for the VAR (1) model show that the coefficients of the variables in the four equations are significant. The t-statistics are higher than the critical values at the 5%, 10**%,** and 1**%** significance levels for most of the variables. For the Gross Domestic Product equation, the coefficients of $LogGDP_{t-1}$, $LogEX_{t-1}$, and the intercept c are significant. The t-values are 4.50, 2.06, and 2.47, respectively, which exceed the critical value t_c at the degrees of freedom ($\upsilon = 38; \alpha/2$). For the Government Expenditure equation, the coefficients $LogGDP_{t-1}$ and $LogG_{t-1}$ are significant, with t-values of 1.94 and 8.86, respectively. For the Money Supply equation, the coefficients $LogGDP_{t-1}$, $LogG_{t-1}$, and $LogM_{t-1}$ are significant, with t-values of 2.27, 2.20, and 13.34, respectively. For the Exchange Rate equation, the coefficient $t_{cal} \succ t_{tab}$ is significant, as well as the lagged Government Expenditure coefficient $LogG_{t-1}$ and the lagged Exchange Rate coefficient $LogEX_{t-1}$. This indicates that a higher exchange rate enhances economic growth in the next year by reducing the cost of importing capital goods.

According to the F-test results for each equation $792.3988, 7138.004, 3668.385, 2836.632$, respectively, the F-statistic is higher than the critical value $F_{cal} \succ F_{tab}$ at the significance levels of 5%, 10%, and1% with degrees of freedom $(n-2, k) = (40, 4)$. This implies that the model is both statistically significant and valid. Additionally, the R-squared values for each equation $0.98, 0.99, 0.99, 0.99$, respectively, indicate the quality of estimation. This means that the explanatory variables

account for %0.99,%0.99 %0.98, %0.99, of the variations in GDP, government expenditure, money supply, and exchange rate, respectively, in each equation.

Moreover, the diagnostic tests for the model residuals confirm the robustness of the model and the absence of common problems. For the autocorrelation test Ljung-Box, we fail to reject the null hypothesis of no autocorrelation at the 5% significance level. For the normality test Jarque – Bera, we fail to reject the null hypothesis of normal distribution for the residuals of the first and second equations at the5%significance level. However, we reject the null hypothesis for the residuals of the third and fourth equations. (see Appendix 4).

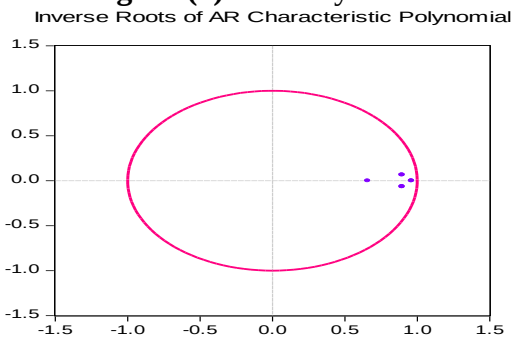
For the serial correlation test LM test at a lag of $h=9$, we fail to reject the null hypothesis based on the p-value, confirming no serial correlation in the residuals. For the homoscedasticity test, the p-value exceeds 0.05, leading to accepting the null hypothesis H_0, confirming homoscedasticity over the study period. The estimated coefficients of the model are stable throughout the study period, validated by the stability test. This is depicted in Figure (3).

Table (3): Stability test

Roots of Characteristic Polynomial
Endogenous variables: LOGGDP LOGG LOGM LOGEX
Exogenous variables: C
Lag specification: 1 1

Modulus	Root
0.961758	0.961758
0.897257	0.894857 - 0.065576i
0.897257	0.894857 + 0.065576i
0.658731	0.658731

Figure (3): Stability test



Source: Prepared by the researcher using Eviews 9 software

We can see from Figure (3) that the modulus of the largest eigenvalue of the coefficient matrix in the VAR(1) model is less than unity. This means that the model does not suffer from problems of multicollinearity or non-constant variance. Therefore, we can infer that the model is entirely stable.

2) Economic Interpretation of the Model

In the following, we present a summary of the results obtained from estimating the VAR (1) model (see Appendix 4).

- **Gross Domestic Product (GDP) Function**

It is evident that the GDP is a positive function of $LOGGDP_{t-1}$, $LOGG_{t-1}$, $LOGM_{t-1}$, $LOGEX_{t-1}$, and the intercept c, respectively. The coefficient of the lagged GDP is

estimated to be 0.7435, indicating that a 1% increase in the previous year's GDP increases by 0.7435**%** in the current year's GDP. Additionally, a 1% increase in $LOGG_{t-1}$ and $LOGM_{t-1}$ increases the current year's GDP by 0.0139% and 0.1093%, respectively. This implies that a higher government expenditure and money supply boost economic growth in the next year. We also find that the coefficient for the lagged exchange rate $LOGEX_{t-1}$ equals 0.1558, indicating that a higher exchange rate enhances economic growth in the next year by reducing the cost of importing capital goods. Therefore, the estimated parameters are consistent with economic theory.

- **Government Expenditure Function**

We observe that the coefficient of the lagged GDP and the lagged government expenditure are 1.9498 and 0.8253, respectively, in that order. This means that a one-unit increase in $LOGGDP_{t-1}$ and $LOGG_{t-1}$ increases government expenditure by 1.9498 and 0.8253 units of currency, respectively. Additionally, we find that government expenditure is a diminishing function of $LOGM_{t-1}$ and $LOGEX_{t-1}$, and the intercept c. This implies that a higher money supply in the previous year leads to lower government expenditure in the current year. Similarly**,** a higher exchange rate in the previous year reduces the total government expenditure in the current year. This is because of the heightened purchasing power of money.

- **Monetary Supply Function**

We note that the monetary supply is positively influenced by the variables $LOGGDP_{t-1}$ and LOGM_{t-1}, so the estimated parameters are consistent with economic theory. An increase of 1% in both the previous year's Gross Domestic Product and monetary supply leads to a rise in the total monetary supply for the current year by 227.68% and 89.84%, respectively, in that order. Additionally, there is a negative relationship between the current year's monetary supply LOGM_t and the previous year's government expenditure $LOGG_{t-1}$, attributed to the inflationary impact arising from increased spending. Also**,** there is a negative correlation between LOGM_t and $LOGEX_{t-1}$, respectively, where a 1% increase in $LOGEX_{t-1}$ results in a 0.003% decrease in LOGM_t, respectively. This indicates a very weak percentage change.

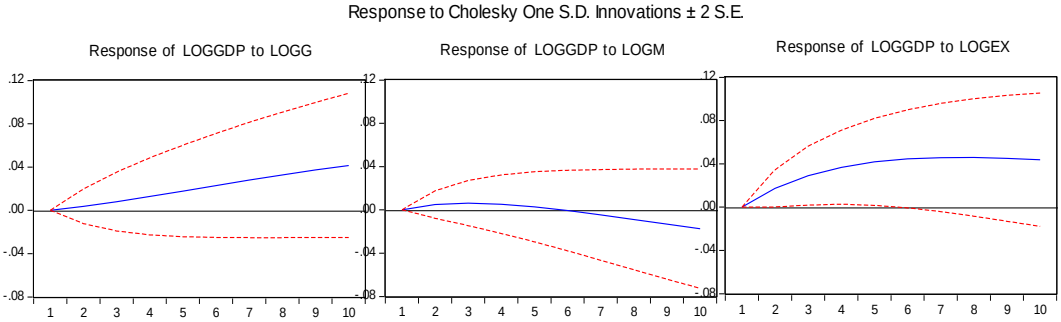
- **Exchange Rate Function**

We observe that the exchange rate depends on the variables $LOGGDP_{t-1}$, $LOGG_{t-1}$ LOGM_{t-1}, and $LOGEX_{t-1}$, respectively, which has a negative correlation with the total Gross Domestic Product of the previous year. However**,** which has a positive correlation with government expenditure and monetary supply, respectively,. This finding**,** contradicts economic theory.

3) Impulse Response Function

The Impulse Response Function is used to measure the dynamic response of a variable to a one-unit shock in another variable. It shows the effects of the shock on the variable of interest over time.

Figure (4): Instantaneous Response Functions of Variables $LOGG_t$, $LOGM_t$ and $LOGEX_t$



Source: Prepared by the researcher using Eviews 9 software

- **Impulse Response Function for Government Expenditure**

Figure (4) illustrates that a positive random shock in government expenditure $LOGG_t$ has a positive effect on Gross Domestic Product $LOGGDP_t$ in the first year, continuing to rise until the tenth year respectively. This outcome, suggests that government expenditure has a positive effect on GDP.

- **Impulse Response Function for Money Supply**

Figure (4) shows that a positive random shock in money supply $LOGM_t$ has a weak positive effect on Gross Domestic Product $LOGGDP_t$ in the first year, with the impact persisting until the fourth year, respectively. However, the effect diminishes and becomes negative in the sixth year, continuing to decline until the tenth year.

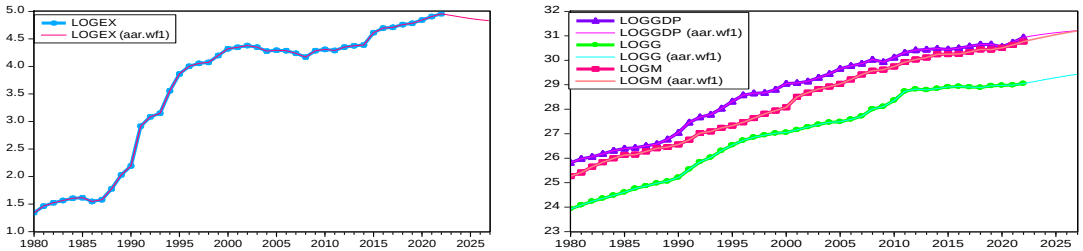
- **Impulse Response Function for Exchange Rate**

From Figure (4), we observe that a positive random shock in the exchange rate $LOGEX_t$ has a positive effect on the gross domestic product $LOGGDP_t$ in the first year, and this effect continues to rise until the tenth year, respectively**.** This implies that, the exchange rate has a positive impact on the overall gross domestic product, resulting from the reduction in the cost of importing raw materials and investment goods.

6. Forecasting

Using the estimated VAR (1) model, we forecast until the year 2027 as presented in the Figure (5). It is evident that the values of variables GDP_t, G_t, and M_t are projected to increase over the five-year forecasted period. As for the exchange rate values EX_t, we observe a decline from 2023 to 2027.

Figure (5): Forecasts for $LOGGDP_t$, $LOGG_t$, LOGM_t , $LOGEX_t$ values until the year 2027



Source: Prepared by the researcher using Eviews 9 software

Conclusion

In this study, we have examined the impact of fiscal and monetary policies on economic growth in Algeria using the VAR model during the period from 1980 to 2022. Based on a general problem statement, we addressed the main research question, **"**What is the effect of fiscal and monetary policy variables on economic growth in Algeria within the framework of applying the VAR model?**"**

Results

The results of our study have yielded several findings, as follows:

- There exists a significant positive impact of the lagged Gross Domestic Product $LOGGDP_{t-1}$ and the lagged exchange rate $LOGEX_{t-1}$ on the current-year $LOGGDP_t$. This implies that a 1% increase in $LOGGDP_{t-1}$ and $LOGEX_{t-1}$ leads to an approximate rise of $LOGGDP_t$ by about 74.35%, 15.58% respectively.
- There is a significant positive but weak impact of the lagged government expenditure $LOGG_{t-1}$ and the lagged money supply LOGM_{t-1} on the current-year $LOGGDP_t$. This signifies that a 1% increase in $LOGG_{t-1}$ and LOGM_{t-1} results in a rise of $LOGGDP_t$ by about 1.39%, 10.93% respectively.
- A strong and significant positive effect of the lagged $LOGGDP_{t-1}$ and the lagged government expenditure $LOGG_{t-1}$ on the current-year government expenditure $LOGG_t$ is present. This indicates that a 1% increase in $LOGGDP_{t-1}$ and $LOGG_{t-1}$ leads to an increase in $LOGG_t$ by approximately 28.59%, 82.53% respectively.
- A weak but significant negative impact of the lagged money supply LOGM_{t-1} and the lagged exchange rate $LOGEX_{t-1}$ on the current-year government expenditure $LOGG_t$ is evident. This means that a 1% increase in LOGM_{t-1} and $LOGEX_{t-1}$ leads to a decrease in $LOGG_t$ by around 8.95%, 5.47% respectively.
- A strong and significant positive impact of the lagged $LOGGDP_{t-1}$ and the lagged money supply LOGM_{t-1} on the current-year money supply LOGM_t is observed. This implies

that a 1% increase in $LOGGDP_{t-1}$ and $LOGM_{t-1}$ results in an increase in $LOGM_t$) by approximately (24.82%, 89.84%) respectively.

- A significant negative effect of the lagged government expenditure $LOGG_{t-1}$ on the current-year money supply $LOGM_t$ is evident. This indicates that a 1% increase in $LOGG_{t-1}$ leads to a decrease in $LOGM_t$ by about 15.28%.
- A weak but significant negative impact of the lagged exchange rate $LOGEX_{t-1}$ on the current-year money supply $LOGM_t$ is found. This means that a 1% increase in $LOGEX_{t-1}$ leads to a decrease in $LOGM_t$ by around 0.03%.
- A significant negative effect of the lagged $LOGGDP_{t-1}$ and the $LOGM_{t-1}$ on the current-year exchange rate $LOGEX_t$ is present. This signifies that a 1% increase in $LOGGDP_{t-1}$ and $LOGM_{t-1}$ results in a decrease in $LOGEX_t$ by approximately 11.53%, 16.11% respectively.
- A strong and significant positive impact of the lagged government expenditure $LOGG_{t-1}$ and the lagged exchange rate $LOGEX_{t-1}$ on the current-year exchange rate $LOGEX_t$ is observed. This implies that a 1% increase in $LOGG_{t-1}$ and $LOGEX_{t-1}$ leads to an increase in $LOGEX_t$ by approximately 29.38%, 94.29% respectively.
- An increase in the lagged money supply $LOGM_{t-1}$ raises the current-year $LOGGDP_t$ by a larger percentage compared to an increase in the $LOGG_{t-1}$. This difference is estimated at 11%. This can be attributed to the fact that an increase in the money supply leads to lower interest rates, stimulating investment and consumer spending, thus driving overall demand for goods and services, resulting in increased production and job creation.
- An increase in the $LOGEX_{t-1}$ raises the current-year $LOGGDP_t$ by a higher percentage than an increase in the $LOGG_{t-1}$ and the $LOGM_{t-1}$. This difference is estimated at 15.58%. This is due to the fact that an increase in the lagged exchange rate can enhance consumer purchasing power, leading to increased local consumption, thereby supporting economic growth.

Hypothesis Testing

❖ Monetary policy has a greater impact on Algerian economic growth than fiscal policy. This is because a monetary expansion leads to lower interest rates, stimulating investment and consumer spending, thereby driving overall demand for goods and services, which in turn promotes increased production and the creation of new jobs.

❖ There is a differential impact of fiscal and monetary policy variables on the rates of economic growth in Algeria. On the one hand**,** a lagged monetary expansion raises the current-year Gross Domestic Product GDP by a higher percentage compared to a lagged fiscal expansion. On the other hand, a lagged currency appreciation raises the current-

year GDP by a higher percentage compared to increases in both the lagged fiscal expansion and the lagged monetary expansion.

Recommendations

❖ Time element should be taken into consideration when interpreting the behavior of various economic variables.

❖ It is essential to study the magnitude of the impact of government expenditure and the money supply on economic growth. This is crucial for guiding increases made by the government and central bank, and understanding how these factors influence the economy. Determining the optimal context for directing these increases is also important.

❖ The central bank should consider the exchange rate when deciding to increase the money supply, given its significant effects on the economy as a whole and on foreign trade in particular.

Study Perspectives

In this realm, we propose some topics of no lesser importance than the current subject, including:

- Investigating the impact of economic transformation policies on economic growth.
- Analyzing the effects of tax policies and financial reforms on growth.

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Appendices

Appendix 1: Johansen Test Results

Series: LOGGDP LOGG LOGM LOGEX
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
At most 1	0.248162	22.40611	29.79707	0.2765
At most 2	0.171886	10.71152	15.49471	0.2299
At most 3	0.070076	2.978731	3.841466	0.0844

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.378995	19.53304	27.58434	0.3744
At most 1	0.248162	11.69458	21.13162	0.5780
At most 2	0.171886	7.732792	14.26460	0.4065
At most 3	0.070076	2.978731	3.841466	0.0844

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Prepared by the researcher using Eviews 9 software

Appendix 2: Granger Causality Test

Pairwise Granger Causality Tests- Lags: 8			
Null Hypothesis:	Obs	F-Statistic	Prob.
G does not Granger Cause GDP	35	4.76693	0.0029
GDP does not Granger Cause G		11.3212	1.E-05
M does not Granger Cause GDP	35	4.27932	0.0050
GDP does not Granger Cause M		2.70369	0.0380
EX does not Granger Cause GDP	35	1.45364	0.2417
GDP does not Granger Cause EX		3.16390	0.0202
M does not Granger Cause G	35	2.64564	0.0412
G does not Granger Cause M		5.03946	0.0021
EX does not Granger Cause G	35	3.92102	0.0077
G does not Granger Cause EX		1.63044	0.1849
EX does not Granger Cause M	35	1.49459	0.2272
M does not Granger Cause EX		1.68292	0.1708

Source: Prepared by the researcher using Eviews 9 software

Appendix 3: Estimated VAR Model Coefficients

Vector Autoregression Estimates				
	LOGGDP	LOGG	LOGM	LOGEX
LOGGDP(-1)	0.743504	0.285979	0.248274	-0.115351
	(0.16516)	(0.14667)	(0.10904)	(0.22778)
	[4.50184]	[1.94986]	[2.27681]	[-0.50642]
LOGG(-1)	0.013902	0.825351	-0.152839	0.293851
	(0.10488)	(0.09314)	(0.06925)	(0.14464)
	[0.13255]	[8.86173]	[-2.20719]	[2.03154]
LOGM(-1)	0.109341	-0.089529	0.898434	-0.161133
	(0.10193)	(0.09052)	(0.06730)	(0.14058)
	[1.07269]	[-0.98906]	[13.3496]	[-1.14619]
LOGEX(-1)	0.155881	-0.054785	-0.000364	0.942914
	(0.07541)	(0.06697)	(0.04979)	(0.10400)
	[2.06709]	[-0.81806]	[-0.00731]	[9.06608]
C	3.468949	-0.665244	-0.014391	0.241438
	(1.40399)	(1.24681)	(0.92699)	(1.93634)
	[2.47079]	[-0.53356]	[-0.01552]	[0.12469]
R-squared	0.996750	0.997485	0.998706	0.988461
Adj. R-squared	0.996398	0.997213	0.998566	0.987214
F-statistic	2836.632	3668.385	7138.004	792.3988

Source: Prepared by the researcher using Eviews 9 software

Appendix 4: Residual Test for VAR Model

(Homoscedasticity Test)

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Joint test:

Chi-sq	Df	Prob.
81.43277	80	0.4344

Individual components:

Dependent	R-squared	F(8,33)	Prob.	Chi-sq(8)	Prob
res1*es1	0.241	1.307	0.274	10.032	0.258
res2*res2	0.175	0.875	0.547	7.347	0.499
res3*res3	0.108	0.499	0.848	4.535	0.806
res4*res4	0.395	2.694	0.021	16.593	0.035
res2*res1	0.312	1.871	0.099	13.104	0.108
res3*res1	0.344	2.162	0.057	14.444	0.071
res3*res2	0.159	0.785	0.619	6.712	0.568
res4*res1	0.389	2.622	0.024	16.324	0.038
res4*res2	0.372	2.439	0.034	15.607	0.048
res4*res3	0.381	2.535	0.029	15.985	0.043

(Jarque-Bera Test)

VAR Residual Normality Tests
Null Hypothesis: residuals are multivariate normal

Component	Jarque-Bera	Df	Prob.
1	2.713841	2	0.2575
2	4.760289	2	0.0925
3	31.30631	2	0.0000
4	23.89466	2	0.0000
Joint	62.67510	8	0.0000

(Ljung-Box Test)

VAR Residual Portmanteau Tests for Atocorrelations
Null Hypothesis: no residual autocorrelations up to lag h

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	Df
1	19.57848	NA*	20.05600	NA*	NA*
2	37.30801	0.0019	38.67201	0.0012	16
3	52.84978	0.0116	55.40930	0.0063	32
4	61.50767	0.0911	64.97855	0.0517	48
5	74.86519	0.1663	80.14114	0.0839	64
6	86.12997	0.2997	93.28338	0.1471	80
7	98.66847	0.4056	108.3296	0.1835	96
8	112.0167	0.4818	124.8186	0.1922	112
9	133.0739	0.3615	151.6187	0.0756	128
10	170.0264	0.0683	200.1188	0.0014	144
11	181.2074	0.1202	215.2673	0.0023	160
12	187.6750	0.2597	224.3219	0.0081	176

(LM Test)

VAR Residual Serial Correlation LM Tests

Lags	LM-Stat	Prob
1	24.68548	0.0756
2	20.59043	0.1948
3	17.14809	0.3761
4	9.645831	0.8845
5	13.98039	0.6002
6	12.94680	0.6766
7	16.00163	0.4528
8	14.38588	0.5700
9	24.34571	0.0822

Source: Prepared by the researcher using Eviews 9 software