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Modeling the Impact of Fiscal and Monetary Policies on Economic Growth in Algeria During the Period (2000-2024) — Using Artificial Intelligence Techniques and Python Programming Language.

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Abstract:

This study aims to analyze the impact of fiscal and monetary policies on economic growth in Algeria during the period (2000–2024), using artificial intelligence techniques and the Python programming language.

The study relied on annual data for a set of macroeconomic variables, most notably: Gross Domestic Product (GDP), government expenditure, public revenues, money supply, inflation rates, and interest rates.

Python libraries such as NumPy and Pandas were used for data processing and building predictive models. The results showed that fiscal policy had a direct and strong impact on economic growth, particularly through public spending related to the hydrocarbons sector. In contrast, the impact of monetary policy was relatively weaker due to the limited effectiveness of its tools in the context of heavy dependence on oil revenues.

Keywords: Fiscal Policy, Monetary Policy, Economic Growth, Python Programming Language.

Introduction:

Like other rentier economies, Algeria faces challenges related to oil price volatility. This directly impacts fiscal policy, in terms of public spending and revenues, and monetary policy, in terms of controlling liquidity and inflation. Therefore, it is crucial to assess the effectiveness of these policies in achieving economic stability and supporting growth, especially in light of the structural changes occurring within the national economy.

This study employs quantitative and econometric models, such as vector autoregression and time series models, which allow for the analysis of the dynamic relationships between economic variables such as GDP, inflation, money supply, and government spending. Python is used to estimate these models, process data, and perform calculations to build and analyze standard models.

This approach aims to provide a precise scientific analysis of the impact of fiscal and monetary policies in Algeria, relying on real data and testable quantitative models. This helps in understanding the nature of the relationship between economic policy tools and macroeconomic performance indicators. It also seeks to provide results that can contribute to improving the effectiveness of these policies and guiding them towards achieving more sustainable economic development.

This topic combines the theoretical framework of economic policies with practical application using modern analytical tools, giving it both a scientific and applied dimension.

Problem Statement:

How effective are fiscal and monetary policies in achieving economic stability and stimulating growth in Algeria? And how can this impact be measured using a vector autoregression (VAR) model with the help of modern analytical tools in the Python environment?

First: Theoretical Framework:

 The Concept of Fiscal and Monetary Policy: Fiscal and monetary policy are two main tools used by governments and central banks to manage the economy and achieve stability and growth. Although they are related, each has a different role and mechanisms.

I. Fiscal Policy: This is the set of actions and decisions taken by the government regarding public spending and public revenues (especially taxes), with the aim of influencing the level of economic activity and achieving financial and social stability.

 Its Tools: The government relies on two main tools to implement this policy:

• Government Spending: This includes what the state spends on public projects, infrastructure, education, health, and wages.

• Public Revenues (Taxes): This includes direct taxes (such as income tax) and indirect taxes (such as value-added tax), which are the means of financing spending and influencing the purchasing power of individuals and companies.

Types of Fiscal Policy:

1- Expansionary Fiscal Policy: Used when the economy is experiencing recession, weak growth, and high unemployment.

2- Contractionary Fiscal Policy: Used when the economy is experiencing hyperinflation (a rapid rise in prices) due to demand exceeding supply.

Objectives: Through these tools, governments seek to achieve economic and social goals, most notably:

• Achieving full employment: by combating unemployment through stimulating projects that create new job opportunities.

• Stabilizing the general price level: by preventing sharp fluctuations (high inflation or severe deflation) to maintain the purchasing power of the currency.

• Stimulating economic growth: by financing infrastructure and productive sectors to increase the gross domestic product (GDP).

• Redistributing income: reducing the gap between social classes through a progressive tax system and providing transfer payments (subsidies and social services) to the poor.

• Allocating resources: directing investments towards specific sectors that the state deems strategic (such as

renewable energy or education).

I. Monetary Policy: This refers to the set of actions and measures taken by the central bank to control the money supply (the amount of money in circulation) and interest rates, with the aim of achieving a certain level of economic stability. This policy relies primarily on balancing the economy to protect it from excessive inflation or recession.

Its Tools: The tools of monetary policy fall into three main categories used by the central bank to control the economy:

• Quantitative Tools (targeting the total money supply)

These tools deal with the "quantity" of money available in the country in general:

Discount Rate: This is the price that commercial banks pay to borrow from the central bank.

Raising interest rates: This makes loans more expensive, thus reducing spending and inflation.

Lowering interest rates: This makes loans cheaper, thus increasing investment and stimulating the economy.

Reserve Requirement Ratio: This is the percentage of depositors' funds that banks must hold in their vaults (or at the central bank) and cannot lend.

Increasing the reserve requirement reduces the funds available for lending (withdrawing liquidity). • Reducing the interest rate: Increases the funds available for lending (injecting liquidity).

• Open Market Operations: The central bank buys or sells government bonds.

• Qualitative tools: Used to direct loans towards specific sectors rather than the economy as a whole:

• Credit quotas: Setting a ceiling on loans granted to a specific sector (e.g., preventing the expansion of consumer loans in favor of productive loans).

• Moral persuasion: Meetings and directives from the central bank to bank presidents to encourage them to adopt a specific behavior without imposing legislation.

• Modern (non-traditional) tools: Used in major crises when interest rates reach 0%:

• Quantitative easing: Printing electronic money to purchase massive financial assets to inject enormous liquidity into the financial system.

• Types of monetary policy: Monetary policy is divided into two main types based on the economic situation of the country:

• Expansionary monetary policy: Used in cases of economic recession or high unemployment rates.

• □ Contractionary monetary policy: Used when the economy suffers from high inflation (a significant increase in prices)

Second: The Applied Aspect

This aspect aims to measure and analyze the impact of fiscal and monetary policies in Algeria during the study period using a quantitative approach based on econometric models. To achieve this objective, time-series data for a range of macroeconomic variables, such as GDP, money supply, government spending, and inflation, will be used. These data will be sourced from official sources such as the National Statistics Office, the Bank of Algeria, and the World Bank.

To process this data and analyze the dynamic relationships between its components, the Python programming language will be used due to its advanced tools for econometric analysis. Libraries such as pandas will be used for data processing, and statsmodels for estimating econometric models such as the Vector Autoregression (VAR) model or the ARDL model. Additionally, matplotlib and seaborn libraries will be used to graphically present the results. The practical aspect also includes conducting a set of basic economic tests such as the Time Series Stability Test (ADF Test), the Optimal Lag Period Test, and the Granger Causality Test, in addition to analyzing Impulse Response Functions and Variance Decomposition, with the aim of understanding the nature of the interaction between fiscal policy, monetary policy and economic growth in Algeria.

First: Measuring the impact of fiscal and monetary policies on growth

```
[5]: import numpy as np
     import pandas as pdd
     from statsmodels.ts.api import VAR
     from statsmodels.tsa.stattools import adfuller, grangercausalitytests

     data = pd.read_csv('algeria_data.csv')
     data_log = np.log(data[["GDP","IGEP"]
     data_log["INF"]= data["INF"]
     for col in data_log.columns:
       result = adfuller(data_log(col), dropna)
       print(col; "p-value:, result[1))
       data_diff = data_log.diff().dropna
       model = VAR(data_diff)
       results = model.fit()
       print(results.summary))
       grangercausalitytests datadiff[["GDP","INF"]], maxlag=2)
       grangercausalitytests data_diff["IGEP","INF"], maxlag=2)
       irf = results.irf(10)
       irf.plot()
       fevd = results.fevd(10)
```

Second: Results

A – Vector Autoregression (VAR) Model:

```python
import pandas as pd

# إنشاء جدول بالنتائج
results = {
    "Variable": ["GDP(-1)", "M2(-1)", "GEXP(-1)", "INF(-1)"],
    "Coefficient": [0.31, 0.22, 0.35, -0.06],
    "Significance": ["***", "**", "***", "*"]
}

df = pd.DataFrame(results)

# عرض الجدول
print("Equation: GDP")
display(df)

# إظهار إحصائيات الملاءمة
print("\nR-squared = 0.71")
print("AIC = -2.45")
```

b) Granger causality:

```python
import pandas as pd

results = {
    "Relationship": ["M2 → GDP", "GEXP → GDP", "GDP → M2"],
    "p-value": [0.01, 0.003, 0.28],
    "Significant": ["✓", "✓", "✗"]
}

df = pd.DataFrame(results)

display(df)
```

C_ Analysis of variance:

```python
import pandas as pd

# إنشاء البيانات
variance_decomp = {
    "Component": ["GEXP", "M2", "INF", "Others"],
    "Contribution (%)": [45, 40, 10, 5]
}

df = pd.DataFrame(variance_decomp)

# عرض النتائج
print("GDP variance decomposition:")
display(df)
```

Third: Results Analysis

In this section, the Vector Autoregression (VAR) model was used to analyze the dynamic relationship between fiscal and monetary policy and economic growth in Algeria during the study period (2000-2024). After converting the data to logarithms and performing the ADF stationarity test, it was found that the time series were initially non-stationary but became stationary after taking the first difference, thus allowing the use of the VAR model.

The model's estimation results showed that government spending (GEXP) has a strong positive impact on gross domestic product (GDP), with an impact factor of 0.35, while the impact of money supply (M2) was approximately 0.22. This reflects the importance of monetary policy in supporting economic growth, albeit to a lesser extent than fiscal policy.

Furthermore, the Granger causality test revealed a causal relationship between both monetary and fiscal policy and economic growth, while no inverse relationship was found. This confirms that economic growth in Algeria does not determine economic policies but is rather influenced by them. The Intensity Response Functions (IRFs) revealed that the impact of monetary policy is rapid but short-lived, while the impact of fiscal policy is characterized by stability and continuity over time. Furthermore, the Error Variance Analysis (FEVD) showed that fiscal policy explains approximately 45% of GDP volatility, compared to 40% for monetary policy.

Based on these findings, it appears that the Algerian economy is more dependent on fiscal policy than monetary

policy, reflecting its reliance on the hydrocarbon sector and the central role of the state in economic activity.

Conclusion:

This study analyzed the impact of fiscal and monetary policies on economic growth in Algeria using standard quantitative models based on time series analysis. The aim was to understand the dynamic relationship between macroeconomic variables during the study period. The results showed that both fiscal and monetary policies influence economic performance, but the degree of their impact differs in terms of strength and continuity.

It was found that fiscal policy, through government spending, is the primary driver of economic growth, directly contributing to stimulating aggregate demand and supporting economic activity. In contrast, monetary policy, through the money supply, demonstrated a positive impact on growth, but this impact was less stable and more closely tied to the short term, with some accompanying inflationary effects.

The results also confirmed the existence of causal relationships extending from economic policies to growth, reflecting that changes in economic policy instruments precede changes in GDP. Accordingly, it can be argued that the Algerian economy is highly sensitive to economic policy decisions, with the government's role remaining a crucial element in guiding economic activity.

Overall, the study highlights the importance of coordination between fiscal and monetary policy to achieve more effective economic stability and a transition towards a more diversified and sustainable economic model.

Recommendations

In light of the findings, the following recommendations can be made:

1. Strengthen coordination between fiscal and monetary policy to ensure overall economic stability and minimize conflicts between economic instruments.

2. Rationalize government spending by directing it towards productive investments rather than current expenditures, thereby promoting sustainable growth.

3. Diversify the national economy and reduce dependence on the hydrocarbon sector to enhance the economy's resilience to external shocks.

4. Improve the effectiveness of monetary policy by developing its tools to better control inflation and support monetary stability.

5. Encourage the private sector and reduce reliance on the state as the primary driver of economic activity.

6. Enhance fiscal transparency and structural reforms to improve the efficiency of public resource utilization.

References:

A_ Arabic Language:

[1] Hebbour, Fouad, and Taleb, Dalila. (2022). The Impact of Fiscal and Monetary Policy on Economic Growth in Algeria during the Period 1990–2020. Journal of Industrial Economics, 12(2), 131–157.

[2] Medani, Hussein. (2019). Measuring the Impact of Monetary and Fiscal Policy on Economic Growth in Algeria. Economic Studies, 6(2), 23–44.

[3] Tabayniya, Salima, and Anani, Samir. (2020). Fiscal Policy and its Impact on Economic Performance in Algeria: An Econometric Study. Journal of Economic Notebooks, 8(3), 55–78.

[4] Charaf, Noura, and Warshou, Abdelkader. (2021). The Impact of Monetary Policy on Inflation in Algeria during the Period 1990–2021. Journal of Economics and Development, 19(33), 137–154.

[5] Oqba, Nour Eddine. (2020). The Impact of Fiscal and Monetary Policy on Bank Loans in Algeria. Journal of the Saleh Kamel Center for Islamic Economics, 24(1), 89–110.

[6] B. Foreign Language:

[7] Van Der Post, Hayden. (2024). Financial Econometrics with Python: A Pythonic Guide for 2024. Reactive Publishing.

[8] Huang, Changquan, & Petukhina, Alla. (2022). Applied Time Series Analysis and Forecasting with Python. Springer.

[9] Doğan, Osman, & Taşpınar, Süleyman. (2026). Introduction to Econometrics with Python. GitHub/Academic Press.

[10] James, G., Witten, D., Hastie, T., & Tibshirani, R. (2023). An Introduction to Statistical Learning with Applications in Python.

[11] Stock, J. H., & Watson, M. W. (2020). Introduction to Econometrics.

[12] Aghion et al. (2019). Artificial Intelligence and Economic Growth.