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The Impact of Monetary Policy and Fiscal Policy on Economic Growth in the Maghreb Countries

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Abstract---This research investigates how fiscal and monetary policies influence economic growth across Maghreb countries — namely Algeria, Morocco, and Tunisia — during the period from 1991 to 2024. Using a panel data regression framework, the Hausman and Fisher tests indicated that the fixed-effects specification best fits the data, suggesting that each country retains distinctive structural and institutional features. After confirming the reliability of the model and the absence of econometric issues in the residual terms, the empirical findings show that fiscal policy exerts a **positive but relatively modest** and **statistically significant** influence on economic growth within the region. Conversely, monetary policy — proxied by the broad money supply — demonstrates **no statistically significant relationship** with economic growth. The estimates suggest that a 1% rise in government expenditure is associated with an approximately **0.0742% increase in GDP growth**.

Keywords---Fiscal policy, monetary policy, economic growth, panel time series regression models.

1. Introduction

Achieving high economic growth is the best way to eliminate poverty and achieve a better standard of living for individuals. Its increase creates job opportunities that lead to increased output, improving the levels of education and health provided to individuals. Therefore, countries seek to achieve high levels of it by following economic policies. The Maghreb countries strive to achieve high economic growth and maintain sustainable growth by applying fiscal policy. Their spending and support for certain sectors raise the income rates and welfare of their people. They also implement monetary policy

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through their central banks by lowering the interest rate on commercial banks, which leads to a reduction in the interest rate for customers, encouraging increased investment, which raises employment and income.

1.1 Study Problem

Based on the above, the study problem is:

What is the impact of fiscal and monetary policies on economic growth in the Maghreb countries?

The main question branches into the following questions:

* Is there an appropriate model that measures the impact of these sources on economic growth in the Maghreb countries?
* Is there a relationship between fiscal and monetary policies and economic growth in the Maghreb countries?

1.2 Study Hypotheses:

* The appropriate model to measure the impact of the sources on economic growth is one of the panel models.
* There is a positive relationship between fiscal and monetary policies and economic growth in the Maghreb countries.

3.1 Study Objectives and Methodology

The study derives its importance from addressing the topic of the impact of monetary and fiscal policy (as essential tools to stimulate economic growth to increase it) on economic growth in the Maghreb. We followed the descriptive approach by presenting economic growth models, and the inductive approach by using econometric measurement.

1.4 Previous Studies

Several studies have been conducted to measure the impact of economic policies on economic growth, including:

- Study (Bouamara and Ben Abdel Fattah, 2019): This study aimed to measure the impact of monetary policy and fiscal policy on economic growth in Arab countries during the period (1995-2016), to determine the extent of their contribution to driving economic growth. This was done using econometric measurement models through static panel models. The study found a positive relationship between the state's general budget balance and economic growth, and the government expenditure from the fiscal policy side was not significant. Regarding monetary policy, an increase in the exchange rate of local currencies in the sample countries had a negative effect on growth rates, while the money supply had no significant effect.
- Study (Dheimi and Belkacemi, 2019): This study aimed to measure the impact of public expenditures (operating expenses and capital expenditures) on the GDP in Algeria during the period 2000-2017. To address the issue, the researchers used the autoregressive distributed lag methodology. Using the augmented Dickey-Fuller test, the researchers found that the time series: logarithm of GDP growth rate (Lgdp), logarithm of operating expenses (Ldges), and logarithm of capital expenditures (Ldequ) are integrated of order one. The bounds testing approach (Wold test) indicated the possibility of a long-term equilibrium relationship. After estimating the error correction model, the existence of this relationship was confirmed through the negativity and significance of the error correction term coefficient. The researchers also found a positive and significant effect of operating expenses on GDP in the long term, where a 1% increase in (Ldges) leads to a 1.08% increase in (Lgdp), and a negative and significant effect of capital expenditures on GDP, And an increase in (Ldequ) by 1% leads to a decrease in (Lgdp) by 1.19%.
- Study (Jamal, 2018): The researcher studied the effect of fiscal and monetary policy on economic growth in Arab countries in the short and medium term, by applying Vector Auto Regression (VAR) and impulse response function, to identify the effect of shocks on the current and future values of

economic growth, along with variance decomposition analysis to measure the relative importance of variables in explaining the variance of forecast errors of the variables included in the model. In the Kingdom of Morocco, the researcher concluded that a positive shock of one standard deviation in the money supply has a positive effect on economic growth in the short and medium term, and a positive shock of one standard deviation in capital expenditure leads to an increase in GDP growth starting from the first year by about 1%, then declines after the third year, and then rises again from the fourth year at a weak rate.

2. Theoretical Framework of the Study.

The (1956 Solow, Robert) model is considered the foundation of models explaining the sources of economic growth, and it relied in its analysis on the (Cobb-Douglas) function and several assumptions including (Maki, 2019, p. 148):

* The existence of a single homogeneous produced good consumed by all countries.
* The economy is closed and its markets are perfectly competitive; the technological factor is an exogenous variable increasing at a constant rate.

At the beginning of the 1980s, what is called modern growth models appeared, including those that explained the relationship between government spending and economic growth (Barro model), and also those that explained the relationship between monetary policy and economic growth (St. Louis model).

Robert Barro Model 1990 (0199, Robert Barro Model).

Barro based his analysis of the role of government spending in economic growth on the Cobb-Douglas production function with constant returns to scale, highlighting the role of the government through its public expenditures on basic facilities and infrastructure in driving economic growth for the better, as it increases the productivity of private capital.

At the beginning of his analysis, he considered expenditures as investments in social goods, and the production function for each firm (i) is given as follows (Far, 2018, p. 131):

= …….(1)

Where:

Y, K, N represent output, private capital stock, and labor for firm i, respectively.

A: represents the level of technological progress and is constant, (1-α) is the output elasticity.

Assuming that all institutions are identical, the aggregate production function takes the form:

= ……...(2)

Government expenditures on infrastructure through paving roads, building dams, airports, and ports, as well as expenditures on health and education, increase private capital (Khashni, 2018, p. 33), thereby increasing projects and employment, and consequently increasing aggregate demand and production. On the other hand, spending on education and health positively affects economic growth by creating educated and innovative human capital. Government expenditures on airports, roads, ports, and hotels increase trade exchange with countries, thus boosting economic growth. As for government expenditures directed towards building dams, they facilitate irrigation, thereby increasing agricultural products to achieve self-sufficiency in food and thus increase economic growth.

The impact of public spending on economic growth in the Barro model occurs through two mechanisms (Al-Amrawi, 2017-2018, p. 87):

* The higher the public spending, the higher the economic activity and thus increased productivity.
* Spending on education, scientific research, and development accumulates knowledge and thus encourages economic growth to rise.

2.2. The St. Louis Model.

Confirming the critics' viewpoint regarding the importance of monetary policy over fiscal policy, St. Louis presented an econometric study to the U.S. Federal Reserve to measure the effect of increases in the narrow money supply and government spending on the gross national product for the period 1960-

1982 using quarterly data. The researcher (Al-Hiti and Ayoub, 2012, p. 27) concluded:
* That increases in the growth rate of the broad money supply and government spending explain 30% of the fluctuations in the gross national product.
When summing the coefficients of the monetary variables, while keeping the other variables constant, the increase in the growth rate of the money supply results in the same increase occurring in the nominal gross national product approximately within one year.

The Saint Louis model is as follows (Masoud and Al-Asfar, 2015, page 137):
= + + + …….(3) and:

: Gross National Product.
: Money Supply.
: Government Expenditure.
: Random variable (error term).
j and k: Number of time-lagged terms of the time series.
, , : The constant term and the effect of the money supply and government expenditure on respectively.

Methodology and Procedures Used in the Estimation.
To identify the impact of fiscal and monetary policy on economic growth in the Maghreb countries, we use an approach that combines time series data with cross-sectional data, which is the panel data methodology.

1.3 Presentation of Panel Data Regression Models.

Panel data consists of continuous data for multiple observations or phenomena over time periods, encompassing two dimensions: cross-sectional dimension (individuals, countries, sectors, etc.) and time dimension (time series).
These models differ from time series regression models in that they have several advantages, including:
* Improving the efficiency of estimators (parameters) by increasing degrees of freedom through a larger number of observations.
* Building more realistic behavioral hypotheses, comparing cross-sections with each other, and helping to prevent the problem of heteroscedasticity (Hsiao, 2014, p. 04).

The general form of panel models is as follows (Verbeek, 2004, p. 342):
= + + i = 1….N, t = 1….T ……..(4) and:
: The value of the dependent variable for individual i at time period t, : A vector of K explanatory variables corresponding to individual i at time period t, : The intercept of the model for individual i, : Measures the partial effects of at time t for unit i, : The random error term corresponding to observation i at time period t, the total number of observations in the model is N × T.
There are three models in panel data (Panel Data Models):
Polynomial Regression Model (PRM).

In this model, the intercept coefficients and slope coefficients are constant for all individuals (institutions, countries, etc.) and over time. In other words, the estimated coefficients in the basic model (4) are the same across all individuals (countries, sectors, etc.), and thus the model is written as follows (Greene, 2007, p. 185):
$Y = \alpha + \beta +$ ……..(5) and:
Y: vertical vector of dependent variables (1) × (T × N).
: matrix of independent variables.
: vertical vector of error terms (1 × K).
The PRM model is estimated using Ordinary Least Squares (OLS), assuming homogeneity of the variance of random error terms across individuals, with no autocorrelation between error terms among

individuals. That is, the pooled regression model satisfies all the standard assumptions of the multiple linear regression model.

2.1.3 Fixed Effects Model (FEM).

The presence of some unobserved variables across individuals (countries, institutions, etc.) that affect the dependent variable and do not change over time leads to differences between individuals. Through the pooled regression model, we cannot identify the behavior of each individual separately. Therefore, we allow the intercept parameter α to vary from one individual to another to determine whether each country has its own specific characteristics by adding dummy variables for each individual, thus reflecting the fixed effects of the individuals under study.

The fixed effects model is as follows (Verbeek, 2004, p. 348):

= + β+ i = j = 1...N t = …T… (6) and:

: The dummy variable specific to state i, where the peak of this variable equals one when j = i, and equals zero otherwise.

: The individual-specific intercept coefficient for individual i ( ).

The model (6) is estimated using the Ordinary Least Squares (OLS) method, assuming (V( )= , E( )=0).

3.1.3 Random Effects Model (REM)

Among the assumptions in the fixed effects model is the homogeneity of error variance for all cross-sectional observations, and the absence of autocorrelation among each set of cross-sectional observations within a specific time period, in order to ensure the validity and unbiasedness of the estimated parameters.

When one of the assumptions related to the estimation of the FEM model is violated, we then have what is called the random effects model, which treats the variation in behavior of each individual (state, institution, ...) separately as a random variable, making the intercept as follows (Dimitrios & Hall, 2007, p. 348):

(7) ..... i = 1…..N α + =

From this, the random effects model becomes:

= α + + + i = 1….N t = 1….T ……..(8) and:

: The individual-specific error term (state, sector, etc.) i, which is assumed to be constant in the model, reflecting the individual-specific independent variables not included in the model.

From observing the components of the REM model, it consists of two error terms (,), which satisfy the following assumptions:

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*E( ) = 0, E( ) = 0, V( ) = , V( ) = .

We set: + = *

We substitute equality (9) into (8), resulting in the (REM) model as follows:

= α + + i = 1….N t = 1….T …..(10) and:

*E( ) = E (+) = 0.

*V( ) = V(+) = + .

* + = COV( ).

Since the covariance between is not zero, the ordinary least squares method provides inefficient estimators, which affects the selection of parameters. To correctly estimate the (PEM) model under the violation of this assumption, we use the Generalized Least Squares method.

2.3 Comparison between panel data regression models.

When estimating panel data regression models, we compare them by conducting a Fischer test to choose between (PRM) and (FEM), and when the tests confirm the presence of unobserved effects between individuals, we use the Hausman test to choose between (FEM) and (REM).

1.2.3 Fischer Test (Test Fischer (F)).
This test allows us to determine whether there is a difference between the individual intercept parameters by comparing a model with an intercept parameter for each individual (FEM) and a model with a common intercept parameter for all individuals (PRM). The test is as follows (Baltagi, 2005, p. 13):
= and:
: Determination coefficient for (FEM), : Determination coefficient for (PRM), K: Number of parameters estimated in (PRM).
When we acknowledge that the pooled regression model (PRM) is appropriate, and when the appropriate model is the fixed effects model (FEM).

2.2.3 Hausman Test (1978).
The test is used to choose between the fixed effects model (FEM) and the random effects model (REM), to determine whether the unobserved effects among individuals are included in the intercept parameter or the random term, and whether there is a correlation between the explanatory variables and the unobserved effects.
The test is as follows (Johnston & Dinardo, 1997, p. 404):
H = and:
H follows a distribution
, are vectors of parameter estimates for the fixed effects model and the random effects model respectively.
: Inverse of the difference between the covariance matrices of the parameter estimates of the random effects model and the fixed effects model.
When: H we accept the null hypothesis and acknowledge that the estimator of the random effects model is efficient and consistent, and vice versa.
Estimation and Analysis of Results.

1.4 The Sample and Study Period.
The study sample consists of seven countries from the Middle East and North Africa: (Algeria, Morocco, Tunisia, Sudan, Jordan, Saudi Arabia, Egypt). These countries were selected from the Maghreb countries based on several criteria:

*Criterion One: Availability of data during the study period (1991-2024). In our study, we use medium-term time series for every 5 years, resulting in the number of observations (T×N=7*7=49).
*Criterion Two: According to the Development Index criterion, which measures the quality and standard of living among different countries, Egypt and Jordan are classified as countries with high human development. The same classification applies to the Maghreb countries (Algeria, Tunisia) (Development Report, 2019, page 22).

Saudi Arabia was chosen for the study sample because its revenues depend on the hydrocarbons sector, which aligns with the Algerian Republic. It also relies on tourism, which corresponds with Morocco and Tunisia.

4. The Used Model and Data Sources.
Based on the above and relying on studies that addressed the topic of determinants of economic growth, and according to the study's problem and sample, the standard model and study variables were chosen as follows:
= f ( ) ..... (11) and:
: The average annual growth rate of GDP per capita at constant 2015 prices, which is the dependent variable representing economic growth.
: The logarithm of real GDP per capita at the beginning of each sub-period. Within the framework of neoclassical theory, its coefficient measures the convergence degree of countries toward a steady-state,

and it is required that its coefficient be negative, as the economy approaches equilibrium in the long run, at the rate represented by this coefficient (Khashni, 2018, p. 119).
: The logarithm of the average annual growth rate of gross fixed capital formation at constant 2015 prices, which includes gross fixed capital formation such as land improvements (fences, ditches, etc.), purchase of factories, machinery, and equipment, construction of roads, railways, and the like, including the construction of schools, offices, hospitals, and private residential housing. According to the 1993 System of National Accounts, the acquisition of valuables is also considered capital formation.
Logarithm of the average human capital index, measured based on years of schooling and education expenditure. Researchers at the University of California calculate it using the "Barro-Lee" database, particularly the average years of schooling for the working-age population, adjusted to account for the quality of education (Al-Mustafa, 2020, p. 07). We calculated the average human capital for each sub-period and took the logarithm.
: The broad money supply ratio to GDP, calculated by dividing the money supply by the gross domestic product.
: Logarithm of the average annual growth rate of government final consumption expenditure at constant 2015 prices. Government final consumption expenditure consists of expenses incurred by the general government on all individual consumption goods and services, and collective consumption services.
: Error term.

Regarding data sources:
( ), ( ), ( ), and ( ) are from the Statistical Database of the Organization of Islamic Cooperation (SESRIC).
( ) is taken from the Penn World Table (PWT) database.
( ) is taken from the World Bank database.

3.4 Model Estimation:

Before estimating the appropriate model, it is necessary to determine whether there are unobserved effects between countries by comparing the three models for panel time series data.
Fisher Test.
The following table shows the test results:

Table No. (01): Fisher Test Results

Calculated statistic	Degrees of freedom (N-1, NT-K-N)	Tabulated statistic
$= \frac{(0.72006-424178)/6}{(1-0.424178)/37} = F_c$ 3,1686	DF (6 ,37)	$= 2{,}36 F_{(6,37)}$

Source: Prepared by the researchers based on the estimation results of (PRM) and (FEM) in Appendix No. (01).

From Table No. (1), we observe that: (= 2.36 = 3.1686), hence we reject the null hypothesis and accept that the Fixed Effects Model (FEM) is appropriate. We acknowledge the existence of unobserved effects between countries, and that each country has its own specific characteristics.
2.3.4 Hausman Test.
The following table shows the test results:

Table No. (02): Hausman Test Results

Calculated statistic	Degrees of freedom (K)	Probability of acceptance
X^2_5 =12,665538	DF = 5	P-Valeu = 0,0267

Source: Prepared by the researchers based on the results of Appendix No. (02).

We observe that (P-Value = 0.0267 < 0.05), hence we reject the null hypothesis and acknowledge that the estimators of the random effects model parameters are inconsistent and inefficient, and that the fixed effects model is appropriate.

3.3.4 Results of estimating the appropriate model (FEM):
Through Appendix No. (01), the results of estimating the fixed effects model (FEM) are as follows:

gdp=0,402-0.052lgdp+0,09Lk +0,07Lg+0.04lh+ 0.012 lM….(12)
Prop(0.001) (0,0003) (0,0008) (0,0179) (0,0001) (0,130)
$=8,6519\overline{R}^2$ =0,6368D_w=2,15F_c

Before starting the analysis of the estimation results, it is necessary to test the model's quality performance by checking for the presence or absence of econometric measurement problems in its residuals. The following table shows the results:

Table No. (03): Results of the tests for autocorrelation of errors (LM) and normal distribution of errors (J.B).

(Breuch-Bagan LM Test)		(Jarque-Bera Test)	
Calculated statistic	H_0	Calculated statistic	H_0ل
LM=32,4039	Prob = 0,0533	J.B= 0,5767	Prob= 1,1006

Source: Prepared by the researchers based on the results of Appendix No. (04).

From Table No. (03):
* Autocorrelation test of errors: We note that the value (P-Value=0.0533 > 0.05) for the Breusch-Pagan LM statistic is evidence that the calculated value is less than the tabulated value; therefore, we accept the null hypothesis as the test results indicate insignificance. Hence, we acknowledge the absence of autocorrelation of errors among the segments.
* Normal distribution test of errors (Jarque-Bera Test): We accept the null hypothesis and acknowledge that the model errors are normally distributed, with constant mean and variance over time, because P-Value=0.7473 is greater than 0.05.

Analysis of estimation results

Statistical Analysis of the Model
* All model parameters are statistically acceptable because the calculated t-student statistic is greater than the tabulated statistic, meaning they are all statistically significant at 5%.
* The value of ( ) indicates that representing the relationship between the independent variables (lk, lh, lg, mlgdp) and the dependent variable (gdpr) using the fixed effects model is considered effective. This means that 63.95% of the changes occurring in the dependent variable are caused by changes in the independent variables included in the model. The Fisher test (F) is significant at 1%, which confirms that the representation equation is good, and the obtained coefficient of determination value is objective and suitable to be used as a measure to estimate the effectiveness of representing the studied

regression equation. Since the model is free from the problem of autocorrelation and its residuals follow a normal distribution, we can say that the fixed effects model is statistically and statistically acceptable.

Economic Model Analysis

* The constant coefficient has a positive sign and is statistically significant, which is economically acceptable in economic growth models.
* The coefficient of the logarithm of per capita GDP at the beginning of each period is statistically significant and has a negative sign, indicating convergence among Maghreb countries towards equilibrium in the long term.
* There is a positive and statistically significant effect of gross fixed capital formation on economic growth.
* There is a positive and statistically significant effect of fiscal policy (represented by government spending) on economic growth, consistent with Keynesian economic theory.
* There is a positive and statistically significant effect of the human capital index on economic growth.
* There is a positive but statistically insignificant effect of monetary policy (represented by broad money supply) on economic growth.

Conclusion

The positive and statistically significant impact of government spending and money supply on economic growth in the Maghreb countries, as reached through the methodology of panel data regression models, is not sufficient to assert their effectiveness in boosting economic growth. An increase of 1% in lg leads to an increase in economic growth by 0.07422%, which is considered a weak effect given the government expenditures of these countries. Meanwhile, the increase in money supply is statistically insignificant. To improve the impact of the study variables on economic growth in the Maghreb countries, we propose the following:

* Activating the productive apparatus of the Maghreb countries by relying on and supporting local products to achieve self-sufficiency and reduce imports. This would improve the effectiveness of monetary and fiscal policies, as the latter require a flexible production system to perform well;
* Diversifying trade partnerships and not limiting them to the European Union only, to benefit from other foreign expertise in trade and to break the economic dependence on Europe;
* Developing and modernizing the banking sector and relying on digitization in domestic commercial transactions;
* Relying more on the agricultural sector, given the Maghreb countries' climatic qualifications, terrain, fertile lands, and young labor force, which make them among the largest exporters of agricultural products, thereby making their productive apparatus more flexible;
* Relying on and supporting human competencies, without marginalizing them, to benefit from their qualifications to advance the economy positively; also, activating a local supervisory body to investigate and hold banks accountable for how they grant government-supported investment loans, as well as the investors who receive these loans.

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