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The Dynamic Effects of Monetary Policy on Unemployment in Algeria: An ARDL Investigation (2000–2024)

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Abstract

This study investigates the short- and long-run dynamics of the relationship between money supply, real interest rates, and unemployment in Algeria over the period 2000–2024. Given the significant role of monetary variables in shaping macroeconomic performance, the study aims to examine the extent to which monetary aggregates and real interest rates contribute to influencing unemployment levels in the Algerian economy. To achieve this objective, the study employs advanced econometric techniques, including the Augmented Dickey–Fuller (ADF) unit root test, the Autoregressive Distributed Lag (ARDL) bounds testing approach to cointegration, and the estimation of an ARDL model. These methods provide an empirical framework for examining the relationship between monetary policy variables and unemployment. The empirical findings confirm the existence of a long-run equilibrium relationship among the study variables. Moreover, the error correction term is negative and statistically significant at the 1% level, indicating an adjustment mechanism through which deviations from the long-run equilibrium are corrected following economic shocks. The results further reveal that the real interest rate has a positive short-run effect on

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unemployment, with an estimated coefficient of 0.09. In the long run, both money supply and the real interest rate exert positive effects on unemployment in Algeria.

Keywords: Unemployment; Monetary Policy; Money Supply; Real Interest Rate; Cointegration; Autoregressive Distributed Lag (ARDL) Model.

Introduction

Countries use monetary policy to achieve several objectives, foremost among which are promoting economic growth, reducing unemployment rates, and controlling inflation. Monetary policy plays a significant role in maintaining economic equilibrium through adjustments in the money supply and interest rates. Such adjustments contribute to achieving economic development, maintaining price stability, and addressing the challenges that may undermine macroeconomic stability.

Over the past years, Algeria has witnessed numerous economic developments resulting from the close interaction between its economy and various international economic variables. These developments have prompted the country to adopt a series of fiscal and monetary reforms aimed at achieving several economic objectives, particularly maintaining economic equilibrium, enhancing economic growth rates, and reducing unemployment and inflation.

Against this backdrop, the present study seeks to analyse the impact of monetary policy on unemployment rates in Algeria over the period 2000–2024, using the Autoregressive Distributed Lag (ARDL) model. Accordingly, the study addresses the following central research question:

To what extent has monetary policy affected unemployment rates in Algeria over the period 2000–2024? Furthermore, can an econometric model be developed to explain the long-run relationship between monetary policy variables, unemployment, and economic growth?

To address this research question, the following sub-questions are formulated:

- Has monetary policy contributed to reducing unemployment rates in Algeria during the period under study?
- Is there a long-run relationship between monetary policy indicators and unemployment rates, as estimated using the ARDL model?
- Does the Error Correction Model (ECM) reveal a dynamic adjustment mechanism through which short-run disequilibria are corrected and long-run equilibrium is restored?

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Research Methodology and Scope

This study adopts a descriptive approach, complemented by an inductive approach based on econometric tools, which enables the empirical testing of the research hypotheses using the study sample. In particular, the study employs the Autoregressive Distributed Lag (ARDL) approach, which is among the widely used econometric techniques for testing cointegration relationships and estimating short-run dynamics and long-run equilibrium adjustments.

Regarding the scope of the study, a specific geographical and temporal framework has been established. Geographically, the study focuses on Algeria, while its temporal scope covers the period from 2000 to 2024.

Objectives and Originality of the Study

This study seeks to address a fundamental gap in Algerian economic research, as empirical investigations into the relationship between monetary market variables and unemployment remain relatively limited. This scarcity may be attributed to Algeria's heavy reliance on hydrocarbon revenues, which has traditionally placed greater emphasis on fiscal policy at the expense of monetary policy. The study highlights the role that monetary policy can play in influencing and stabilising unemployment rates, thereby providing valuable insights for policymakers seeking to achieve macroeconomic balance.

The originality of this study lies in applying the Autoregressive Distributed Lag (ARDL) framework to monetary policy instruments over an extended period spanning more than two decades, characterised by structural reforms and global financial crises.

2. Previous Studies

- **Coglianese, Olsson and Patterson (2025), entitled "Monetary Policy and the Labor Market: A Quasi-experiment in Sweden".** This study aimed to examine the impact of monetary tightening on the Swedish labour market during the period 2010–2011. It found that an increase in interest rates led to a contraction in economic activity and a rise in the unemployment rate of approximately one to two percentage points. These findings highlight the adverse effects of monetary tightening on employment.

- **Berentsen, Menzio and Wright (2011), entitled "Inflation and Unemployment in the Long Run".** This study examined the long-run relationship between monetary variables, inflation or interest rates, and unemployment, drawing on a theoretical monetary economic model. It identified a positive relationship between monetary variables and unemployment over the long run. It also demonstrated that monetary factors may account for a substantial proportion of the increase in unemployment during periods of stagflation.

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- **Blanchard and Galí (2010), entitled "Labor Markets and Monetary Policy: A New Keynesian Model with Unemployment".** This study aimed to analyse the relationship between monetary policy and unemployment using a New Keynesian model incorporating wage and price rigidities as well as labour market frictions. Its findings indicate that real wage rigidities may generate inefficient fluctuations in unemployment. Furthermore, central banks face a trade-off between inflation stability and unemployment stability, depending on the structural characteristics of the labour market.

- **Singh, Suda and Zervou (2022), entitled "Monetary Policy, Labor Market, and Sectoral Heterogeneity".** This study investigated the effects of monetary policy on employment across different economic sectors and firm sizes. The findings revealed that employment responses to monetary tightening were stronger in the manufacturing and construction sectors than in the services sector. The study also highlighted differences in how small and large firms respond to monetary policy changes.

- **Corsello and Nispi Landi (2020), entitled "Labor Market and Financial Shocks: A Time-Varying Analysis".** This study examined the impact of financial shocks on the US labour market using a Time-Varying Parameter Vector Autoregressive (TVP-VAR) model. The findings showed that tighter financial conditions lead to higher unemployment, with the effects of adverse shocks being more pronounced during periods of financial stress and crises than during periods of economic expansion.

3. Econometric Analysis of the Impact of Monetary Policy on Unemployment Rates

3.1. Variable Specification and Stationarity Analysis

Variable Specification

This study uses annual data covering the period 2000–2024 for selected economic variables relating to the Algerian economy, obtained from the World Bank database. The Autoregressive Distributed Lag (ARDL) approach to cointegration is employed as one of the dynamic modelling techniques for examining cointegrating relationships. This approach allows lagged values of variables to be incorporated as explanatory variables in the model. It also combines autoregressive models and distributed lag models within a unified econometric framework.

The variables selected for the empirical analysis are based on the specifications adopted in several previous studies and are defined as follows:

- **CH:** Represents the unemployment indicator (dependent variable).

- **M:** Represents the money supply indicator.

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- **TRI:** Represents the real interest rate indicator.

The model to be estimated can therefore be expressed as follows:

$$CH=f(M,TRI,e_i)$$

Where (e_i) represents the stochastic error term.

Stationarity Analysis

A time series is considered stationary when its mean and variance remain constant over time and its covariance does not depend on time. Furthermore, a stationary series does not contain a deterministic trend, a seasonal component, or any other component whose behaviour changes over time.

Several tests can be used to determine whether a time series is stationary. One of the most widely used approaches is the unit root test developed by Dickey and Fuller. To examine the properties of the time series employed in this study and determine whether they are stationary, the Augmented Dickey–Fuller (ADF) test is applied separately to each variable.

The optimal lag length (p) is determined using the Akaike Information Criterion (AIC) and the Schwarz Information Criterion (SIC). Based on the appropriate specification selected from the estimated models, the results presented in Table (01) are obtained.

Table 1: Results of the Augmented Dickey–Fuller (ADF) Test

UNIT ROOT TEST TABLE (ADF)

		At Level		
		CH	M	TRI
With Const	t-Statistic	-3.9092	-2.5557	-4.6497
	Prob.	*0.0068*	*0.1169*	*0.0012*
		***	n0	***
With Const	t-Statistic	-2.2722	-5.2653	-4.6061
	Prob.	*0.4319*	*0.0016*	*0.0063*
		n0	***	***
Without Co	t-Statistic	-3.4688	-1.5440	-4.4622
	Prob.	*0.0013*	*0.1127*	*0.0001*
		***	n0	***
		At First Difference		
		d(CH)	d(M)	d(TRI)
With Const	t-Statistic	-1.9275	-5.2519	-5.8086
	Prob.	*0.3144*	*0.0004*	*0.0001*
		n0	***	***
With Const	t-Statistic	-4.3768	-5.1318	-5.5970
	Prob.	*0.0109*	*0.0024*	*0.0009*
		**	***	***
Without Co	t-Statistic	-3.2726	-5.3597	-5.9602
	Prob.	*0.0022*	*0.0000*	*0.0000*
		***	***	***

Source: Outputs of EViews 10 software.

Regarding the variables, the results indicate that all time series contain a unit root at level, as the calculated test statistics are greater than their corresponding critical values at the 1%, 5%, and 10% significance levels. Accordingly, the series are non-stationary at level. However, after

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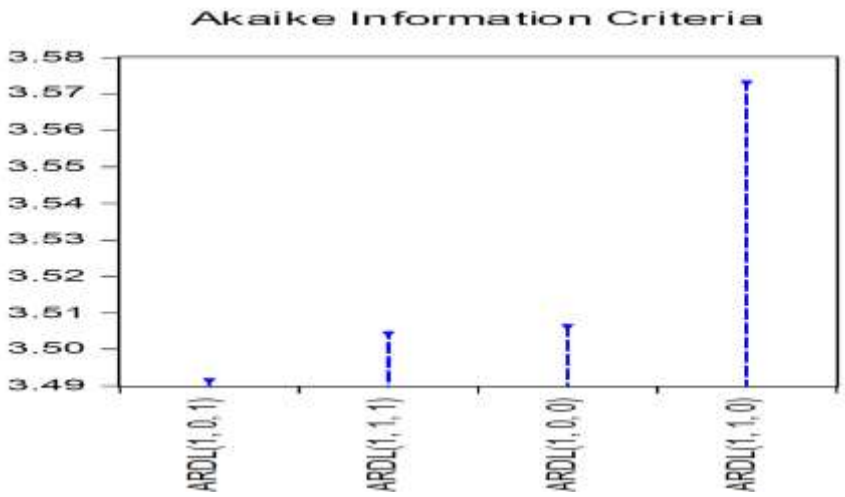
applying the same test to the first differences, the results show that all series become stationary, as the calculated test statistics are lower than their corresponding critical values at the 1%, 5%, and 10% significance levels. This indicates that all the variables are integrated of order one, I(1).

2.3. Cointegration Analysis

Determination of the Optimal Lag Length

The estimated parameters in both the short run and the long run are expected to be more consistent when the appropriate lag structure is selected. To determine the optimal lag length ((n)) of the distributed lag model, one of the two commonly used information criteria is generally employed: the Akaike Information Criterion (AIC) or the Schwarz Criterion (SC). In this study, the optimal lag length was selected based on the specification that minimises the AIC value, as illustrated in the following figure:

Figure 1: Optimal Lag Length



Source: Outputs of EViews 10 software.

According to the results obtained from these information criteria, the optimal model specification is identified as **ARDL (1,0,1)**.

Model Estimation

The estimation results of the **ARDL (1,0,1)** model are presented in Table (02).

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Table 2: Estimation Results of the ARDL (1,0,1) Model

Dependent Variable: CH
Method: ARDL
Date: 03/01/26 Time: 10:53
Sample (adjusted): 2001 2024
Included observations: 24 after adjustments
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): M TRI
Fixed regressors: C
Number of models evalulated: 4
Selected Model: ARDL(1, 0, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
CH(-1)	0.754966	0.056038	13.47249	0.0000
M	0.075129	0.034790	2.159524	0.0438
TRI	0.092253	0.039100	2.359435	0.0292
TRI(-1)	0.051514	0.036803	1.399710	0.1777
C	1.570388	0.734657	2.137582	0.0458

R-squared	0.946755	Mean dependent var	13.73112
Adjusted R-squared	0.935545	S.D. dependent var	4.983627
S.E. of regression	1.265241	Akaike info criterion	3.491455
Sum squared resid	30.41588	Schwarz criterion	3.736883
Log likelihood	-36.89746	Hannan-Quinn criter.	3.556567
F-statistic	84.45968	Durbin-Watson stat	2.175283
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Source: Outputs of EViews 10 software.

Preliminary results indicate that the model as a whole is statistically acceptable, as confirmed by the Fisher (F) test. Furthermore, the adjusted coefficient of determination (Adjusted R-squared) reaches 93%, indicating a strong explanatory power of the model.

Fisher Test (F-Bounds Test)

Based on the results presented in Table (04), the following conclusions can be drawn:

Table 3: Results of the ARDL Bounds Test

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	8.887680	10%	2.63	3.35
k	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5

Source: Outputs of EViews 10 software.

The results of this test indicate that the calculated F-statistic exceeds the upper critical bound of the ARDL bounds test. This allows us to reject the null hypothesis of no cointegration and accept the alternative hypothesis that a cointegrating relationship exists among the variables,

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indicating the presence of a long-run equilibrium relationship. This conclusion holds at the 10%, 5%, 2.5%, and 1% significance levels.

Estimation of the Long-Run Relationship

Having confirmed the existence of a long-run equilibrium relationship among the study variables, the long-run coefficients were subsequently estimated. The corresponding results are presented in the following table:

Table 4: Estimation Results of the Long-Run Relationship

Levels Equation Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
M	0.306606	0.116658	2.628236	0.0166
TRI	0.586723	0.253296	2.316348	0.0319
C	6.408849	2.157048	2.971120	0.0078

Source: Outputs of EViews 10 software.

The results presented above indicate that all estimated variable coefficients are statistically significant over the study period, suggesting that these variables have a significant influence on unemployment rates. These findings are consistent with the predictions of economic theory.

Estimation of the Error Correction Model (UECM)

The Error Correction Model (UECM) can be estimated based on the results presented in the following table:

Table 5: Estimation Results of the Short-Run Relationship (Unrestricted Error Correction Model – UECM)

ECM Regression Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TRI)	0.092253	0.027392	3.367872	0.0032
CointEq(-1)*	-0.245034	0.038192	-6.415917	0.0000

Source: Outputs of EViews 10 software.

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The results presented in the above table indicate that the error correction coefficient is negative and statistically significant at the 1% significance level. Its estimated value suggests a moderate speed of adjustment towards equilibrium following a shock to any of the explanatory variables.

3.3. Diagnostic Tests of the Model

- **Test for the Absence of Serial Correlation in the Error Terms:** The Breusch–Godfrey Serial Correlation LM Test was employed, and the results are presented in Table (06).

Table 6: Results of the LM Test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.100160	Prob. F(2,17)	0.9052
Obs*R-squared	0.279511	Prob. Chi-Square(2)	0.8696

Source: Outputs of EViews 10 software.

The p-value is found to be greater than 0.05. Accordingly, the null hypothesis of no serial correlation among the error terms is not rejected.

- **Heteroskedasticity Test:** The Breusch–Pagan–Godfrey test was employed to examine the homoscedasticity of the error terms. The results are presented in the following table:

Table 7: Results of the Breusch–Pagan–Godfrey Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.059939	Prob. F(4,19)	0.4033
Obs*R-squared	4.378452	Prob. Chi-Square(4)	0.3572
Scaled explained SS	1.381273	Prob. Chi-Square(4)	0.8474

Source: Outputs of EViews 10 software.

The results show that the p-value is greater than 0.05. Accordingly, the null hypothesis of homoscedasticity is not rejected.

- **White Noise Test (Residual Stability):** Based on the results presented in Table (08):

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Table 8: (LB) Test for the Residual Series

Correlogram of Residuals Squared

Date: 03/01/26 Time: 10:58
Sample: 2000 2024
Included observations: 24

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	-0.167	-0.167	0.7570	0.384
		2	0.321	0.302	3.6826	0.159
		3	-0.005	0.093	3.6835	0.298
		4	0.191	0.121	4.8246	0.306
		5	0.094	0.127	5.1130	0.402
		6	-0.067	-0.146	5.2692	0.510
		7	-0.103	-0.256	5.6597	0.580
		8	0.051	0.024	5.7602	0.674
		9	0.007	0.115	5.7621	0.763
		10	0.064	0.136	5.9419	0.820
		11	-0.104	-0.020	6.4627	0.841
		12	-0.116	-0.251	7.1566	0.847

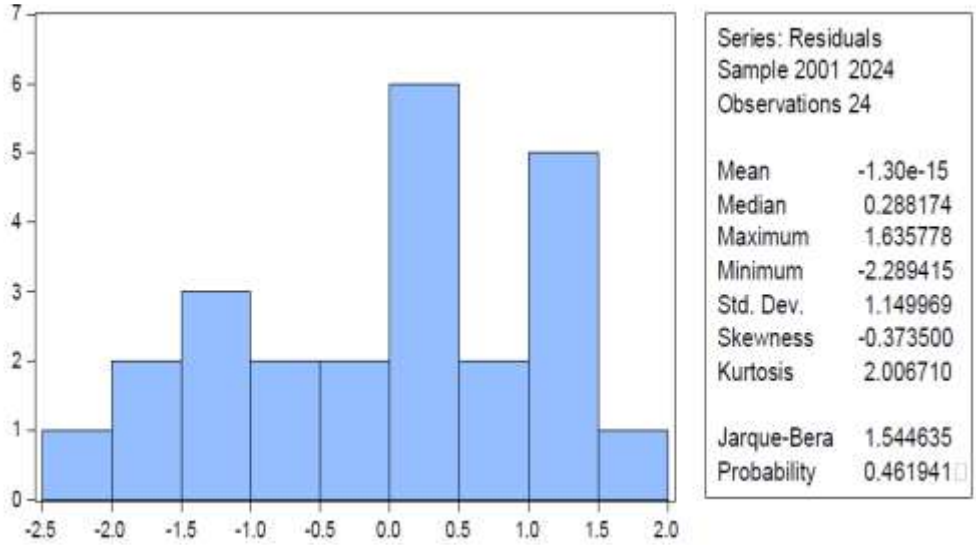
*Probabilities may not be valid for this equation specification.

Source: Outputs of EViews 10 software.

The Ljung–Box (LB) test results indicate that the p-value is greater than 0.05. Accordingly, the null hypothesis that all autocorrelation coefficients are equal to zero is not rejected. In other words, the residual series exhibits no statistically significant autocorrelation and can therefore be regarded as white noise.

- **Normality Test:** The results of this test are illustrated in Figure (02).

Figure 2: Normality Test of the Residual Series



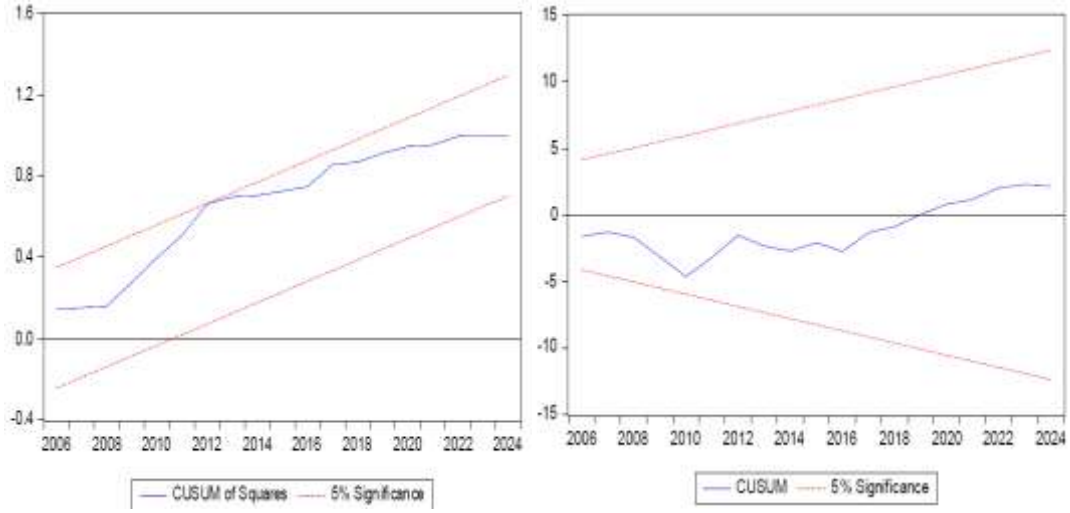
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The results show that the p-value is greater than 0.05 at the 5% significance level. Accordingly, the null hypothesis is not rejected, indicating that the residual series follows a normal distribution.

- **Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) Tests:** To ensure that the data used in this study are free from structural changes over time, the Cumulative Sum (CUSUM) test and the Cumulative Sum of Squares (CUSUMSQ) test are employed. The results of these tests are illustrated in the following figure.

Figure 3: Results of the CUSUM and CUSUMSQ Tests



Source: Outputs of EViews 10 software.

The results illustrated in the figure indicate that both the Cumulative Sum (CUSUM) curve and the Cumulative Sum of Squares (CUSUMSQ) curve remain entirely within the critical bounds at the 5% significance level. This indicates that the model parameters are stable and that no significant structural changes occurred during the study period. These findings confirm the stability of the model and the adequacy of its econometric specification.

Based on the results of the stability tests and diagnostic tests conducted on the estimated model, it can be concluded that the model exhibits a satisfactory degree of statistical fit. This justifies its use in estimating and analysing the long-run relationship among the study variables and enhances the reliability of the findings.

4. Conclusion

This study aimed to analyse the impact of monetary policy on unemployment rates in Algeria over the period 2000–2024, using the Autoregressive Distributed Lag (ARDL) model and the Error Correction Model (ECM). The findings revealed the existence of a long-run equilibrium relationship among the study variables, as confirmed by the results of the ARDL Bounds Test. Furthermore, the Error Correction Model revealed an effective mechanism for correcting disequilibria and restoring long-run equilibrium, with the error correction coefficient estimated at (-0.24), being negative and statistically significant at the 1% significance level.

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The short-run results also revealed a positive and statistically significant effect of the real interest rate on unemployment rates. In other words, the estimation results indicated a positive relationship between the real interest rate and the unemployment rate in the short run. This relationship can be explained through the cost-of-financing channel, whereby an increase in the real interest rate raises borrowing costs for businesses, potentially limiting their ability to finance investment and expansion projects. This, in turn, may reduce demand for investment and factors of production, particularly labour. Moreover, higher capital costs may lead firms to postpone projects or scale down their activities, thereby reducing their capacity to create new jobs and contributing to higher unemployment rates.

In the long run, the results revealed positive effects of both money supply and the real interest rate on unemployment rates. The positive relationship between money supply and unemployment can be explained by the fact that monetary expansion does not necessarily translate into higher productive investment and employment, as its effectiveness depends on how liquidity is allocated and on the responsiveness of the productive sector. Where the productive base is insufficiently diversified and certain sectors have limited capacity to absorb additional financing, an increase in money supply may instead lead to higher nominal demand and inflationary pressures, or finance activities that do not directly contribute to job creation, rather than generating genuine growth in output and employment. This interpretation is particularly relevant to the Algerian economy, given the specific characteristics of its productive structure, its reliance on the hydrocarbon sector, and the limited transmission of monetary policy effects to certain economic sectors.

From an econometric perspective, the diagnostic and stability tests confirmed the adequacy of the model and the reliability of its results, thereby supporting its use in explaining the relationship among the study variables.

Recommendations

In light of the findings, the following recommendations can be put forward:

1. There is a need to reconsider the transmission mechanisms of monetary policy to the real economy by strengthening the banking system's capacity to channel liquidity towards productive investment, rather than relying solely on quantitative monetary expansion.
2. The potential effects of changes in real interest rates on investment and employment decisions should be taken into account, while ensuring a stable financing environment that enables businesses to expand their productive activities.
3. Banking finance mechanisms for small and medium-sized enterprises should be developed, and their access to investment loans should be facilitated, given their role in job creation and economic diversification.
4. Financial and tax incentives should be directed towards labour-intensive economic sectors, particularly manufacturing, agriculture, and productive services, in order to expand the productive base and absorb unemployment.

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5. Efforts should be made to diversify the Algerian economy and reduce its dependence on the hydrocarbon sector, thereby enhancing the economy's capacity to respond to monetary policy measures and reducing the dependence of employment opportunities on external fluctuations.
6. Employment and unemployment indicators should be incorporated into the assessment of monetary policy effectiveness, alongside indicators of inflation, liquidity, and economic growth, in order to measure the extent to which monetary policy decisions affect the real economy.

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