

Asymmetric Effects of Money Supply Fluctuations on Macroeconomic Stability Indicators in Libya: A NARDL Approach over the Period 1980–2024

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Abstract

This study examines the asymmetric effects of money supply fluctuations on key macroeconomic stability indicators in Libya over the period 1980–2024, employing the Nonlinear Autoregressive Distributed Lag (NARDL) model. Using annual data for broad money supply (M2), the consumer price index (CPI), real gross domestic product (RGDP), government expenditure (GOV), and global oil prices (OILPRICE), the analysis reveals a robust cointegrating relationship among the variables. The results indicate a statistically significant asymmetric effect of liquidity on inflation, with the long-run impact of negative money supply shocks (0.002372) substantially exceeding that of positive shocks (0.000467). Dynamic multiplier analysis further demonstrates that negative liquidity shocks generate larger cumulative inflationary responses over time, with the differential widening progressively from 0.000563 in year one to 0.002198 in the long run, peaking at 5–6 years. By contrast, no statistically significant asymmetric effect is detected for economic growth, although positive liquidity shocks exhibit a short-run growth-stimulating effect that reverses in the long run. The error correction terms for both models (−0.591 for inflation and −0.599 for growth) indicate rapid adjustment towards long-run equilibrium, with approximately 59–60% of any disequilibrium corrected within one year. These findings underscore the distinct nonlinear dynamics characterizing Libya's oil-dependent economy. The study recommends prudent monetary policies that explicitly account for the asymmetric nature of liquidity effects and advocates for institutional reforms to enhance banking sector confidence and policy coordination.

Keywords: Money Supply, Economic Stability, NARDL Model, Asymmetry, Dynamic Multipliers, Libya.

1. Introduction

1.1 Background and Research Significance

Developing economies face considerable challenges in achieving and sustaining macroeconomic stability, particularly amid volatile monetary and fiscal conditions. Economic stability is broadly defined as a state in which an economy experiences only minor fluctuations in output growth while maintaining a persistently low inflation rate (ESCWA, n.d.). In the Libyan context, the money supply—specifically the broad monetary aggregate M2, which encompasses currency in circulation and bank deposits—constitutes one of the most significant determinants of economic stability.

Between 1980 and 2024, Libya underwent profound transformations that materially affected its monetary liquidity. These included volatile oil revenue streams, international sanctions during the 1990s, and the protracted political and economic instability that followed 2011. Consequently, the economy experienced sharp liquidity fluctuations, alternating between periods of sudden monetary abundance—driven by increased public spending or currency issuance—and acute liquidity shortages, as observed during recurring banking crises (Central Bank of Libya, various years). Recent international reports indicate that institutional fragmentation, notably the bifurcation of the central bank since 2014, has generated

uncoordinated monetary policies involving excessive currency and credit issuance. This has fueled inflationary pressures and undermined confidence in the financial system (IMF, 2023). Under these circumstances, a more precise understanding of how money supply fluctuations affect economic stability in Libya has become urgently necessary.

1.2 Contribution of the Study

This study makes several important contributions to the existing literature. First, it provides a relatively novel analytical framework for Libyan studies by employing the NARDL model, which allows for testing asymmetry in the effects of positive and negative monetary shocks—a dimension overlooked by previous studies that relied on conventional linear models. Second, the study offers a dynamic multiplier analysis that traces the path of monetary shock transmission over time, providing precise temporal insights into the speed and persistence of monetary policy effects. Third, it addresses a significant research gap in the Libyan economic literature, which has focused on linear effects without considering the possibility of asymmetry in the liquidity-inflation and liquidity-growth relationships. Fourth, the study provides empirical evidence for Libyan policymakers on how to manage monetary liquidity under conditions of political and economic instability, offering practical recommendations grounded in rigorous econometric findings.

1.3 Research Problem

The research problem centers on the asymmetric effects of money supply fluctuations on economic stability in Libya over 1980–2024. The problem arises from the observation that Libya's economy has experienced recurrent instability coinciding with sharp changes in monetary liquidity (Al-Sakkouh, 2025). Accordingly, the central research question is formulated as follows: What is the nature and magnitude of the asymmetric effects of money supply fluctuations—both increases and decreases—on economic stability in Libya over the period 1980–2024, and what are the dynamic multipliers resulting from these shocks?

1.4 Research Objectives

This study pursues five principal objectives: (1) to quantify the impact of money supply on economic stability indicators, (2) to test for asymmetry in the effects of positive versus negative monetary shocks, (3) to establish whether a long-run cointegrating relationship exists among the variables, (4) to analyze the dynamic multipliers tracing the transmission of liquidity shocks over time, and (5) to derive evidence-based policy recommendations.

1.5 Research Hypotheses

- H_1 : A long-run cointegrating relationship exists between money supply and macroeconomic stability indicators in Libya.
- H_2 : The effect of an increase in money supply on economic stability differs in magnitude or direction from the effect of a decrease (i.e., there is clear asymmetry in the impact of positive versus negative monetary shocks).
- H_3 : There is a statistically significant difference between the coefficients of positive and negative changes in the NARDL model, as confirmed by the Wald test.

1.6 Scope and Limitations

The study's significance lies in its examination of macroeconomic asymmetry within a developing, resource-dependent economy, providing empirical evidence for Libyan policymakers. The scope is delimited as follows: substantively, the analysis focuses on the relationship between broad money supply (M2) and economic stability; spatially, it is confined to the Libyan economy at the macro level; temporally, it covers 1980–2024; and methodologically, it employs the NARDL framework.

2. Theoretical Framework and Literature Review

2.1 Theoretical Framework

2.1.1 Concept of Money Supply and Its Fluctuations

In macroeconomics, money supply refers to the total stock of money available in an economy for transactions. The broad monetary aggregate M2—which includes currency in circulation, demand deposits (M1), plus time and savings deposits—is the most widely used indicator of liquidity (Central Bank of Libya, various years). Money supply fluctuations arise from multiple sources: central bank policies (currency issuance, open market operations), changes in foreign reserves and exchange rates, and shifts in government spending or revenue flows—particularly oil revenues in Libya's case.

2.1.2 Concept of Economic Stability

Economic stability denotes a state of relative equilibrium characterized by steady and sustainable growth rates without sharp fluctuations, alongside low and controlled inflation (ESCWA, n.d.). It constitutes a primary objective of macroeconomic policy (fiscal and monetary) given its importance in fostering an enabling environment for investment and improving social welfare. This study focuses on two core dimensions: monetary stability (price stability and exchange rate stability) and growth stability (avoidance of severe output fluctuations).

2.1.3 Theoretical Explanations of the Money Supply–Stability Relationship

- Quantity Theory of Money (Friedman, 1956): Formulated as $MV = PY$, the theory posits that, with stable velocity (V) and output (Y) determined by real factors in the long run, changes in money supply (M) translate directly into changes in the price level (P). Thus, liquidity expansion fuels inflation, while contraction exerts downward pressure on prices.
- Keynesian Theory (Keynes, 1936): According to Keynesian thought, money supply affects the economy through the interest rate channel. An increase in money supply lowers interest rates, stimulating investment and aggregate demand, thereby boosting output. Conversely, a contraction raises interest rates, curtails investment and demand, and may precipitate recession.
- Rational Expectations Theory (Lucas, 1972): This theory suggests that central bank actions—whether as sources of shocks or as countercyclical tools—may generate asymmetrical outcomes. For instance, interest rate hikes to curb inflation may be more effective than rate cuts to stimulate inflation.
- Tobin's Theory (Tobin, 1969): Tobin argued that changes in money supply affect asset prices and consequently investment decisions. This is particularly relevant in economies with underdeveloped financial markets, where the transmission from liquidity to asset prices may be impaired.
- Credit Channel Theory (Bernanke & Blinder, 1988): This theory emphasizes that changes in money supply affect the availability of bank credit, influencing investment and consumption expenditure. The effectiveness of the credit channel depends on the health and efficiency of the banking sector.

2.1.4 Theoretical Rationale for Asymmetry

Several theoretical explanations for asymmetry in liquidity effects have been advanced (Shin et al., 2014; Aigheyisi & Edore, 2020): (1) nonlinear marginal costs, wherein liquidity expansion beyond certain thresholds generates accelerating inflation while contraction induces rapid recession; (2) differences in transmission channels, where liquidity increases primarily operate through banking channels that may be impaired, whereas liquidity shortages are felt directly by economic agents; (3) expectations and adjustment, where anticipated continued monetary expansion may quickly elevate inflation expectations, while anticipated contraction may prompt spending deferral, deepening recession; and (4) boom-bust cycles, where liquidity expansion may fuel unsustainable economic booms followed by sharp corrections. In the context of resource-rich economies, an additional explanation relates to oil sector dominance, where liquidity shortages increase demand for foreign currency to finance imports, while liquidity increases may not reach the productive sector due to weak credit channels.

2.2 Literature Review

2.2.1 International Studies

The impact of money supply on the macroeconomy has been a central focus of classical economic research. Traditional monetary theory—from Friedman and the Chicago School—established that changes in money supply directly affect the general price level in the long run and economic fluctuations in the short run (Friedman, 1956; Friedman & Schwartz, 1963). Subsequent research confirmed that excessive monetary growth is typically associated with high inflation and monetary instability, while severe monetary contraction can precipitate economic depression. However, most of these studies assumed linear, symmetric effects (Shin et al., 2014).

Shin et al. (2014) introduced the theoretical and methodological framework for the NARDL model with dynamic multipliers, enabling researchers to test hypotheses such as positive and negative shocks to a given variable having differential effects. Aigheyisi & Edore (2020), examining Nigeria over 1981–2016, found that money supply increases had a positive and significant effect on short-run economic growth, while decreases exerted a larger and more significant negative effect, demonstrating that the Nigerian economy displayed greater sensitivity to liquidity contraction than to expansion in the short run. Alalmai (2025) confirmed long-run asymmetry in the effects of oil production shocks on the Saudi stock market. In the context of oil-exporting countries, Ahmed & Wadud (2021), found that positive and negative oil shocks have asymmetric effects on GDP, with negative shocks being larger and more persistent. Alshahrani & Alsadiq (2022) demonstrated that monetary policy in resource-rich economies faces particular challenges due to sharp fluctuations in oil revenues, necessitating the use of nonlinear models to capture these dynamics.

2.2.2 Arab and Libyan Studies

Abu Khatwa & Abukhzam (2023) analyzed the impact of money supply and exchange rate on inflation in Libya over 1980–2019 using ARDL, concluding that changes in money supply growth significantly explain inflation fluctuations in both the short and long run. Sultan (2024) found cointegration between money supply and real GDP in Libya over 2000–2022, with a significant negative error correction coefficient indicating rapid adjustment of short-run disequilibria towards long-run equilibrium. Al-Sakkouh (2025) focused on the effects of the liquidity crisis in Libya, finding negative impacts on real output and inflation, and discussed the central bank's crisis management role. Nzari & Bouchr (2023) demonstrated asymmetric effects of exchange rate on foreign direct investment in Algeria using NARDL, showing that currency depreciation negatively affected FDI more strongly than appreciation. In a recent study, Al-Haj et al. (2024) found that the impact of monetary shocks on inflation in Arab countries varies according to trade openness and economic structure, confirming the importance of studying asymmetry in the Arab context.

2.2.3 Research Gap

Despite the abundance of studies on the Libyan economy, most have focused on linear effects without systematically addressing asymmetry or dynamic multipliers. This study fills this gap by offering a relatively novel analytical and methodological framework for Libyan studies using NARDL with dynamic multiplier analysis.

3. Methodology

3.1 Research Design

This is an empirical quantitative study relying on annual data for Libyan economic variables over 1980–2024. The overall design is a time-series study aimed at identifying causal and equilibrium relationships among variables in the short and long run.

3.2 Research Model

The Nonlinear Autoregressive Distributed Lag (NARDL) model was employed (Shin et al., 2014), a single-equation model designed for cointegration analysis and dynamic asymmetry testing.

3.2.1 Model Specification

The basic NARDL model can be specified as follows (Shin et al., 2014):

$$\Delta Y_t = \alpha + \rho Y_{t-1} + \theta^+ X_{t-1}^+ + \theta^- X_{t-1}^- + \sum \gamma_i \Delta Y_{t-i} + \sum (\varphi_i^+ \Delta X_{t-i}^+ + \varphi_i^- \Delta X_{t-i}^-) + \varepsilon_t$$

where Y_t is the dependent variable, X_t is the independent variable, and X_t^+ and X_t^- are the partial decompositions of the independent variable into positive and negative components:

$$X_t^+ = \sum \max(\Delta X_i, 0) \quad \text{and} \quad X_t^- = \sum \min(\Delta X_i, 0)$$

3.2.2 Dynamic Multipliers

Dynamic multipliers trace the path of adjustment following a positive or negative shock. The cumulative multipliers are computed as:

$$m_h^+ = \sum \partial Y_{t+j} / \partial X_t^+ \quad \text{and} \quad m_h^- = \sum \partial Y_{t+j} / \partial X_t^-$$

3.3 Variables and Data Sources

Dependent Variables: (1) Real GDP growth rate (RGDP), (2) Inflation rate (CPI).
Main Independent Variable: Money supply (liquidity), represented by broad money M2, decomposed into: $\Delta M2^+$ (MS_POS) capturing positive changes, and $\Delta M2^-$ (MS_NEG) capturing negative changes.
Control Variables: Global oil price (OILPRICE) and government expenditure (GOV).
Data were collected from reliable local and international sources: Central Bank of Libya (annual economic bulletins), World Bank (World Development Indicators), OPEC, and the Libyan Ministry of Finance.

4. Results and Analysis

4.1 Descriptive Statistics and Unit Root Tests

Statistic	CPI (%)	MS (M. LD)	GOV (M. LD)	OILPRICE (\$)	RGDP (M. LD)
Mean	5.752	39,549.16	25,255.44	46.78	8,750.67
Std. Dev.	6.944	45,266.51	22,980.40	30.87	1,707.34
Minimum	-9.800	4,104.60	1,997.00	13.00	6,184.00
Maximum	25.850	158,107.90	72,336.00	111.70	12,595.00
Skewness	0.643	1.102	0.638	0.763	0.908
Kurtosis	4.675	2.863	2.012	2.283	3.054
N	45	45	45	45	45

Variable	Level (PP)	First Difference (PP)	Order of Integration
CPI	-2.911	-5.803**	I(1)
MS	0.120	-5.293**	I(1)
GOV	-2.109	-4.748**	I(1)
OILPRICE	-2.546	-6.213**	I(1)
RGDP	-3.702*	-10.941**	I(0)/I(1)

Note: ** Significant at 1%, * Significant at 5%. Source: EViews output.

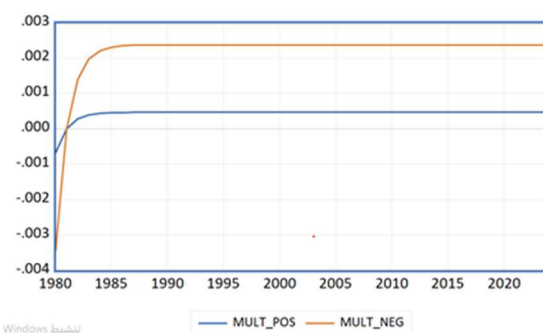
4.2 Inflation Model (CPI)

The optimal model ARDL(2, 1, 0, 3, 4) was selected based on the Akaike Information Criterion.

Variable	Short-run (ECM)	Long-run (LR)	
MS_NEG	0.000839**	0.002372**	
MS_POS	-	0.000467**	
GOV	-0.000522**	-0.000756**	
OILPRICE	0.136191**	0.207150*	
CointEq(-1)	-0.591158**	-	
F-Bounds	Wald Test	Prob.	Decision
6.315**	9.997**	0.0006	Asymmetry

4.3 Dynamic Multipliers – Inflation Model

Year	m^+ (Positive Shock)	m^- (Negative Shock)	Difference ($m^- - m^+$)
0	0.000276	0.000839	0.000563
1	0.000467	0.001402	0.000935
2	0.000619	0.001859	0.001240
3	0.000738	0.002215	0.001477
4	0.000830	0.002492	0.001662
5	0.000900	0.002702	0.001802
6	0.000953	0.002860	0.001907
7	0.000992	0.002978	0.001986
8	0.001021	0.003065	0.002044
9	0.001042	0.003127	0.002085
10	0.001057	0.003171	0.002114
15	0.001090	0.003272	0.002182
∞	0.001099	0.003297	0.002198



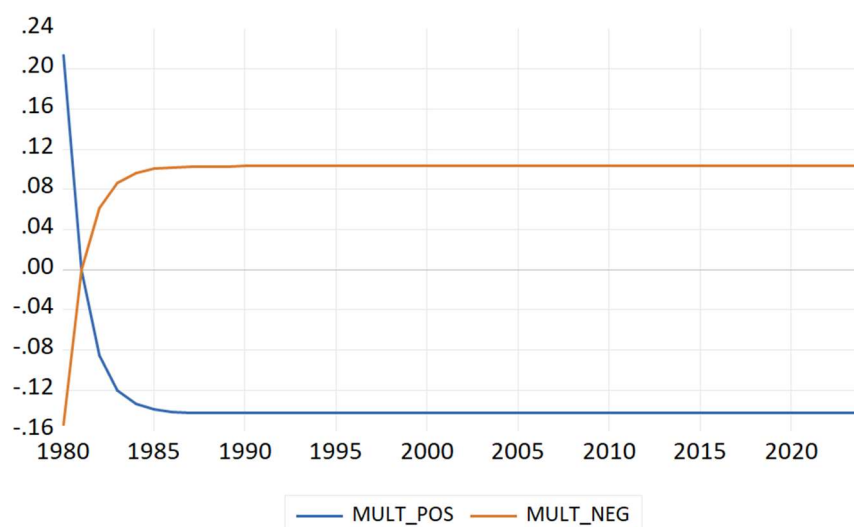
4.4 Economic Growth Model (RGDP)

The optimal model ARDL(2, 0, 3, 4, 3) was selected.

Variable	Short-run (ECM)	Long-run (LR)	
MS_POS	0.066052**	-0.142804**	
MS_NEG	-	0.103151	
GOV	-	0.215602**	
OILPRICE	22.46888**	-56.99597*	
CointEq(-1)	-0.599170**	-	
F-Bounds	Wald Test	Prob.	Decision
17.457**	2.657	0.0907	Symmetry

4.5 Dynamic Multipliers – Economic Growth Model

Year	m^+ (Positive Shock)	m^- (Negative Shock)	Difference ($m^+ - m^-$)
0	0.066052	0.061805	0.004247
1	0.160811	0.061805	0.099006
2	0.153143	0.061805	0.091338
3	-0.054372	0.061805	-0.116177
4	-0.009814	0.061805	-0.071619
5	-0.001771	0.061805	-0.063576
10	0.000000	0.061805	-0.061805
∞	-0.142804	0.103151	-0.245955



4.6 Diagnostic Tests

Test	Inflation Model (Prob.)	Growth Model (Prob.)
Breusch-Godfrey LM	0.653	0.464
ARCH	0.109	0.178
Ramsey RESET	0.077	0.564
CUSUM/CUSUMSQ	Stable	Stable

5. Discussion

5.1 Asymmetric Effect of Liquidity on Inflation

The results demonstrate a statistically significant asymmetric effect of liquidity on inflation, with the negative shock impact (0.002372) substantially exceeding that of positive shocks (0.000467). Dynamic multipliers further confirm that negative shocks generate larger cumulative responses throughout the analysis horizon, with the differential widening over time from 0.000563 in year one to 0.002198 in the long run, and peaking at 5–6 years. This finding can be explained within Libya's economic context by several interrelated factors:

First, the dominance of the oil sector implies that liquidity shortages increase demand for foreign currency to finance imports, raising the parallel market exchange rate and generating imported inflation (Abu Khatwa & Abukhzam, 2023). In an import-dependent economy, any liquidity shortfall drives individuals and firms to seek foreign currency, increasing demand and thus its price, raising the cost of imported goods and feeding into domestic prices.

Second, the crisis of confidence in the banking system implies that liquidity shortages amplify inflation expectations and accelerate spending by households and firms, driving prices upward more rapidly than liquidity increases (Al-Sakkouh, 2025). Under conditions of eroded banking sector trust, liquidity shortages induce a form of economic panic wherein agents attempt to convert savings into real goods that retain value, increasing demand for goods and elevating prices. This explains the faster response of inflation to negative shocks compared to positive shocks.

Third, weak credit channels imply that liquidity increases may not transmit effectively to the real economy, whereas shortages directly affect purchasing power and import capacity. In Libya's economy, where the banking sector suffers from weak financial intermediation, increased liquidity may remain trapped within banks without reaching the productive sector, while shortages directly impact agents' ability to import and spend. This explains why the cumulative multiplier for negative shocks is larger and reaches its peak more quickly.

5.2 Asymmetric Effect of Liquidity on Economic Growth

The results reveal no statistically significant asymmetric effect of liquidity on growth ($p=0.0907$). However, long-run coefficients indicate that positive liquidity shocks reduce growth (-0.142804 , $p=0.0002$), while negative shocks have no significant effect ($p=0.4123$). Dynamic multipliers further show that positive shocks stimulate growth in the short run (years 0–2, peaking at 0.160811 in year one) but turn negative from year three onwards, while negative shocks remain positive throughout (though statistically insignificant).

The negative long-run effect of liquidity increases on growth may be explained by excessive monetary expansion directing resources toward non-productive sectors (e.g., imports) rather than productive investment, particularly given Libya's unattractive investment climate (Sultan, 2024). Liquidity increases also tend to be associated with unproductive government spending. In the absence of an attractive investment environment, excess liquidity flows towards imports or consumption rather than productive investment. In the short run, the positive effect aligns with Keynesian theory—lower interest rates stimulate investment and aggregate demand—but this effect does not persist in the long run, as liquidity increases translate into inflationary pressures and structural distortions that hinder growth.

5.3 Implications of Dynamic Multipliers

The dynamic multipliers offer several important insights:

- Speed of transmission: Both models show that the largest effects occur within the first 2–5 years, suggesting that monetary policy in Libya has a relatively rapid impact on both real and nominal variables.
- Persistence of effects: Multipliers indicate effects persist for several years (up to 10–15 years), implying that monetary policy has long-lasting consequences requiring strategic planning.
- Temporal asymmetry: In the inflation model, asymmetry is evident across all time horizons, with the negative shock multiplier exceeding the positive multiplier each year. In the growth model, asymmetry manifests differently as multiplier paths cross, with positive effects in the short run and negative effects in the long run.
- Policy window: The 5–6 year peak impact window for negative liquidity shocks on inflation suggests a critical period for policy intervention, during which monetary authorities can mitigate inflationary effects before they become entrenched.

5.4 Comparison with Previous Studies

The results align with Abu Khatwa & Abukhzam (2023) on the importance of money supply in explaining Libyan inflation and with Sultan (2024) on cointegration between money supply and real output. They also corroborate Al-Sakkouh (2025) on the impact of the liquidity crisis on Libyan macroeconomic variables. This study's novel contribution lies in testing asymmetry and analyzing dynamic multipliers, supporting the proposition that nonlinear models capture important dimensions overlooked by conventional linear specifications (Shin et al., 2014).

6. Conclusion and Recommendations

6.1 Conclusion

This study examined the asymmetric effects of money supply fluctuations on macroeconomic stability indicators in Libya over 1980–2024 using the NARDL model with dynamic multiplier analysis. The key findings are:

- Cointegration confirmed: Bounds tests confirm long-run equilibrium relationships between liquidity and stability indicators (inflation and growth), supporting H_1 .
- Asymmetric effect on inflation: The Wald test confirms significant asymmetry, with negative shock impact (0.002372) exceeding positive shock impact (0.000467). Dynamic multipliers show the differential widening from 0.000563 in year one to 0.002198 in the long run, supporting H_2 and H_3 .
- No asymmetric effect on growth: No significant asymmetry was detected ($p=0.0907$). However, dynamic multipliers reveal that positive shocks stimulate short-run growth (peaking at 0.160811 in year one) but

reduce it in the long run (–0.142804).
- Rapid equilibrium adjustment: Error correction coefficients (–0.591 for inflation, –0.599 for growth) indicate 59–60% annual correction of disequilibria.

6.2 Recommendations

6.2.1 Policy Recommendations

- Account for asymmetry in timing: Given that dynamic multipliers show policy effects persist for several years, monetary policy should be designed with a long-term horizon.
- Exercise caution with contractionary policies: Since negative liquidity shocks exert larger and faster inflationary effects with a 5–6 year peak impact, the Central Bank of Libya should exercise extreme caution when implementing monetary tightening.
- Distinguish between short and long horizons: As liquidity increases stimulate short-run growth but reduce long-run growth, policies should avoid excessive monetary expansion.
- Control monetary expansion: Avoid excessive monetary financing of fiscal deficits.
- Coordinate monetary and fiscal policies: Ensure consistency to avoid contradictory signals and sudden shocks.
- Strengthen banking sector confidence: Implement governance and transparency standards, unify monetary institutions.
- Promote digital economy transition: Encourage electronic payments and financial inclusion.

6.2.2 Recommendations for Future Research

- Conduct comparable studies on other Arab rentier economies (Algeria, Iraq, Saudi Arabia) for comparative analysis.
- Employ alternative nonlinear models (Threshold Cointegration, Markov Switching).
- Incorporate additional variables (parallel exchange rates, confidence indicators, political stability measures).

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