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The impact of Monetary- Fiscal Policy on Economic growth: Empirical Evidence from Iraq 1970-2017

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Abstract

Most of the studies in the literature focused on the impact of monetary or fiscal policy on economic growth. However, this article combined the efficiency of both policies (fiscal and monetary) on economic growth in Iraq for the period 1970 to 2017 using the Autoregressive Distribution Lag (ARDL) model and Granger Causality techniques. The annual data included in the model were Gross Domestic Product (GDP) as a proxy of economic growth, government expenditure, and broad money as a proxy of fiscal-monetary policy and trade openness as a controlling variable. Results obtained from the analysis showed a positive long-run relationship between fiscal policy and economic growth in Iraq. At the same time, negative significant impacts were recorded from monetary policy to economic growth. Furthermore, the study discovered unidirectional causality from government expenditure to economic growth. Otherwise, there is no causality between money supply and economic growth.

Keywords: Monetary policy, Fiscal Policy, Economic Growth, ARDL approach, Iraq.

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Page : 10 – 24

Introduction

The key elements that the government and the central bank used to achieve economic and financial stability in the country are fiscal and monetary policy. Additionally, the government tries to use fiscal policy (Expenditure and Revenue) to capture aggregate demand and the price level of goods and services in the market by increasing or reducing spending and revenue. However, the central bank tries to use monetary policy (Money supply, interest rate, and exchange rate) to capture aggregate supply and the price level of goods and services in the market by increasing or reducing the amount of money and the velocity of money. The main reason for using both policies is the stability of the economics and coverage of the consequences of economic and financial crises.

The macroeconomic goals of fiscal and monetary policy in the country are reducing employment and poverty rates, price stability(exchange rate and interest rate), maintaining a balance of payments, declining a nation's debt, and improving livelihood and economic growth (Adeoye, Babasanya, & Adedeji, 2018; Agu, Okwo, Ugwunta, & Idike, 2015). Commonly, both fiscal and monetary policies pursue achieving macroeconomic stability. Economists, classics, and modernists have debated these two themes. Keynesian suggested that fiscal policy is more effective than monetary policy, while Milton Friedman believed that monetary policy is more effective than fiscal policy.

The main objective of this study is to describe the interdependence and overlap between monetary policy and fiscal policy with economic growth from the view of the impact of monetary policy and fiscal policy decisions and its tools on the assessment of predictable values of economic growth. Besides, this study tries to evaluate the impact of monetary policy and fiscal policy on gross domestic product (GDP) in Iraq because the efficiency of these two policies might differ by the government and central bank of Iraq.
Shortly, finding the relationship between fiscal policy and economic growth in Iraq is important. Although, the efficiency of monetary policy and economic growth. To capture these, the current article tries to answer the following questions:

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- What is the impact of fiscal policy on economic growth in Iraq?
- What is the efficiency of monetary policy on economic growth in Iraq?
- Which ingredient in these policies is more efficient in Iraq?
- Does the Iraqi government use monetary and/or fiscal policy as a key tool to develop the economic sector?

2. Literature Review

2.1 Theoretical framework

Monetary policy is a significant tool for influencing economic growth, with its main mechanism being interest rate manipulation. According to Iddrisu and Alagidede (2020), it impacts foreign and domestic goods and services markets. While some economists stress the independent role of a central bank in utilizing monetary policy for economic stabilization, others, like Hanif (2014), argue that fiscal policy also plays a vital role, especially in determining the price level.

The foundational theories for monetary policy can be classified into four main views: the Monetarist view led by Milton Friedman, the Keynesian theory, Irving Fisher's perspective, and lastly, the Radcliffe report. Friedman (1995) argued that monetary policy primarily affects the price level and is a source of inflation. He emphasized that while increasing the money supply could temporarily reduce unemployment, it could also lead to inflation. On the other hand, Keynesian theory suggests that money indirectly affects macroeconomic variables like price levels and real output (Khabo & Harmse, 2005). According to Keynes, monetary policy has ripple effects—increasing money supply spurs spending, employment, and overall economic growth. Keynesians also recommend a balanced approach that combines monetary and fiscal policies for effective economic management (Keynes, 1930).

One constraint on the effectiveness of monetary policy is the lag between its formulation and implementation. Moreover, it is generally accepted that monetary policy influences economic variables like investment, saving rates, and general price levels (Anyanwu, 1993). Overall, monetary policy is a complex tool with varying theoretical underpinnings and practical limitations, but it remains a cornerstone for managing economic growth.

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Irving Fisher's Quantity Theory of Money posits that changes in money supply directly influence economic output. In the short term, increasing money supply boosts aggregate demand and economic growth. However, Fisher notes that when the economy is at full employment in the long run, the theory mainly approximates money supply, price levels, and real GDP (Dimand, 2003).

The Radcliffe Theory expands upon Keynesian thought by distinguishing between the demand for money and liquidity. According to Radcliffe, these demands are not identical because people can easily convert interest-yielding substitutes to cash. This makes monetary policy less effective than anticipated, as people may hold onto interest-bearing assets instead of non-interest-yielding cash.

Fiscal policy is another tool affecting economic variables, and it has differing interpretations in Keynesian and Classical schools. Classical theory suggests that government spending and taxation do not significantly impact aggregate spending and employment levels but shift resources from the private to the public sector. Classical theorists argue that increased government spending will "crowd out" private spending, negating any short-term benefits (Farmer & Plotnikov, 2012; Sørensen & Whitta-Jacobsen, 2010).

Keynesian theory, on the other hand, argues that government can influence macroeconomic variables through fiscal policy, particularly through tax adjustments and government spending (Reem, 2009). Keynesians believe lower taxes and higher government spending generally stimulate economic growth. However, classical theorists argue that this approach may be unsustainable in the long run when prices adjust and the economy reaches its potential output.

In summary, monetary and fiscal policies have varying levels of effectiveness and importance based on different economic theories. While Fisher and Radcliffe focus on the nuances of monetary policy, Classical and Keynesian schools offer divergent views on the role and impact of fiscal policy on economic growth.

2.2 Empirical Literature

Several studies have examined the impact of monetary and fiscal policies on economic growth, offering varying conclusions. Andersen and Jordan (1968) found that monetary policy has a greater effect on economic growth and stabilization in the United States than fiscal policy. Contradicting this, Andersen and Jordan (1968) concluded that fiscal policy has a greater impact on economic activities. Batten and Hafer (1983) extended the analysis to five developed

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countries (Germany, France, the UK, Canada, and Japan) and found that monetary policy had a greater influence on economic growth than fiscal policy.

Chowdhury (1986), who analyzed data from Bangladesh using Ordinary Least Square (OLS), also found that monetary policy had a more significant impact on economic growth. Cardia (1991) discovered that both monetary and fiscal shocks played a small role in affecting the dynamics of a small open economy. Feridun (2005), in a study focused on Turkey, warned that poorly targeted monetary policy could yield negative results, especially affecting inflation and exchange rate stability.

Regarding fiscal policy, M'Amanja and Morrissey (2005) used data from Kenya for the period 1964-2002 and concluded that unproductive government spending and non-distortionary tax revenue had no impact on economic growth, while productive spending had a negative effect. Similar results were found by Braºoveanu and Braºoveanu (2008) in Romania, showing a negative causality between fiscal revenue and economic growth. Kukk (2007) indicated that the impact of fiscal policy on economic growth hinges on specific fiscal decisions, such as the allocation of increased revenue for current spending, savings, or public investment.

Overall, the studies demonstrate that the effectiveness of monetary and fiscal policies on economic growth varies by country, time frame, and methodological approach. While monetary policy appears to have a greater impact in some contexts, fiscal policy outcomes seem to depend on the nature of the expenditure and revenue decisions. Therefore, no single policy approach universally applies to all economic conditions.

The impact of monetary and fiscal policies on GDP has been explored in various countries, including Pakistan, Nigeria, and Iraq. Hameed (2010) studied the effect of monetary policy on GDP in Pakistan and found a minor relationship between interest rates and GDP but a significant impact from the money supply growth. Similarly, Onyeiwu (2012) analyzed Nigeria's economy and concluded that while the money supply positively impacts economic growth and the balance of payments, it negatively affects inflation rates.

Adeoye et al. (2018) argued for the coordinated and harmonized application of monetary and fiscal policies, especially when monetary policy adjusts passively to the government's expansionary fiscal operations. The situation in Iraq has also been examined. Zayer (2019) observed that Iraq achieved economic stability from 2011-2014 after gaining independence for its central bank. However, he also noted a lack of coordination between monetary and fiscal

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policies. Adnan (2017) assessed Iraq's fiscal policy after 2003, highlighting issues such as excessive public expenditure and the poor performance of the public sector.

Abu-Eideh (2015) explored the relationship between public spending and economic growth in Iraq from 2004 to 2015, finding a positive relationship between consumption expenditure and GDP growth. Salah and Daghr (2017) studied the impact of fiscal policy rules on the effectiveness of monetary policy in Iraq from 1990 to 2015. He found that increased government expenditure led to a budget deficit, price level increases, and a decline in the purchasing power of the Iraqi Dinar.

In summary, the studies across different nations reveal varying effects of monetary and fiscal policies on economic variables like GDP, inflation, and balance of payments. A common thread, however, is the call for better coordination between these policies for more effective economic management. Iraq, in particular, faces unique challenges that highlight the need for more effective and coordinated economic policies.

Table 1. Summarizing some empirical studies of the impact of fiscal-monetary policy on economic growth

Authors	Title	Time Frame	Method	Sample	fiscal policy on economic growth result	monetary policy on economic growth result
Otani and Villanueva (1990)	Long-Term Growth in Developing Countries and Its Determinants: An Empirical Analysis	1970-1985	Theoretical growth model	55 developing countries	Positive	
Easterly and Rebelo (1993)	Fiscal policy and economic growth: An empirical investigation	1870-1988	Simple regression	28 countries	Positive	
Abu-Bader and Abu-Qarn (2003)	Government Expenditures, Military Spending and Economic Growth: Causality Evidence from Egypt, Israel and Syria	Egypt (1975-1998), Israel (1967-1998), and Syria (1973-1998)	Granger Causality	3 countries	Negative	

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Landau (1986)	Government and economic growth in the less- developed countries: An empirical study for 1960-80	1960-1980	OLS	Less developed countries	Negative	
Jochumzen (2010)	Macroeconomic determinants of growth: Cross-country evidence.	1950-1977	Simple regression	47 countries	Not impact	
Baghebo and Stephen (2014)	Monetary policy and economic growth in Nigeria	1980-2011	ECT	Nigeria		Positive
Precious and Makhetha-Kosi (2014)	Impact of Monetary Policy on Economic Growth: A Case Study of South Africa	2000-2010	ECM	South African		Positive
Jarah, Auda, and Ibrahim (2019)	Impact of quantitative (indirect) instruments of monetary policy on some indicators of financial stability in Iraq	2003-2016	OLS	Iraq		Positive
Khalaf (2018)	A comparative study of the role of monetary policies in achieving economic growth in some oil and non-oil countries	1990-2017	Granger Causality	Oil and nonoil countries		Positive
Ubaid (2017)	The impact of monetary policy on the stability of economic variables in Iraq	1990-2017	VECM	Iraq		Positive

2.3 Monetary and fiscal policy in Iraq

Since 2003, Iraq has undergone two historic transitions: a political evolution from totalitarianism toward democracy and an economic transition from socialism toward free market systems. These transitions have required a fundamental change for the state, from

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controlling virtually all significant economic assets to providing public goods and facilitating a largely privately owned competitive economy. This change has required a significant modification and reorientation of public expenditure and a complete overhaul of tax policy and administration, as well as required a modified structure of money supply and change in the interest rate and exchange rate.

In addition, most of the national income of Iraq comes from oil exports. Table 2 shows the percentage of oil revenue and tax revenue of GDP from 2003 to 2019.

Table 2. The percentage of tax revenue of total revenue in Iraq 2003-2019

Year	Total revenue	Tax revenue M	The percentage of tax revenue on total revenue
2003	4596000	76500	0.258570095
2004	19258000	150000	0.281767612
2005	28775000	225000	0.305982575
2006	29645000	360701	0.377349845
2007	42064530	9456260	8.484312972
2008	50775018	5552870	3.536272851
2009	50408215	2837239	2.171896027
2010	61735312		0
2011	80934790	2372154	1.091513172
2012	102326898	2583186	1.016100309
2013	119296663	2743806	1.002898783
2014			0
2015	94048364	5416976	2.712343596
2016	81700803	5963030	2.92492025
2017	82069669	5266055	2.330162539
2018	91643667	8524371	9.301647652
2019	105569686	11828576	11.20451945

Sources:

1. Federal Budget Law - Ministry of Finance, Republic of Iraq
http://www.mof.gov.iq/pages/ar/federalbudgetlaw.aspx

2. Ministry of Planning
https://mop.gov.iq/en/

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Table 2 shows that the Iraqi government does not depend mainly on the financial instrument as a source of revenue. Therefore, the percentage of tax revenue increased very slowly. In 2003, tax revenue started at 0.25, which increased to 11.20 in total government revenue after sixteen years.

On the other hand, if we look at the role of monetary policy, we should compare the amount of money supplied and the economic growth in Iraq. After 2004, the (GDP) with the supply of money increased gradually. Especially in 2014, the money supply recorded the highest point, which related to monetary policy in the nation and the efficiency of the amount of money.

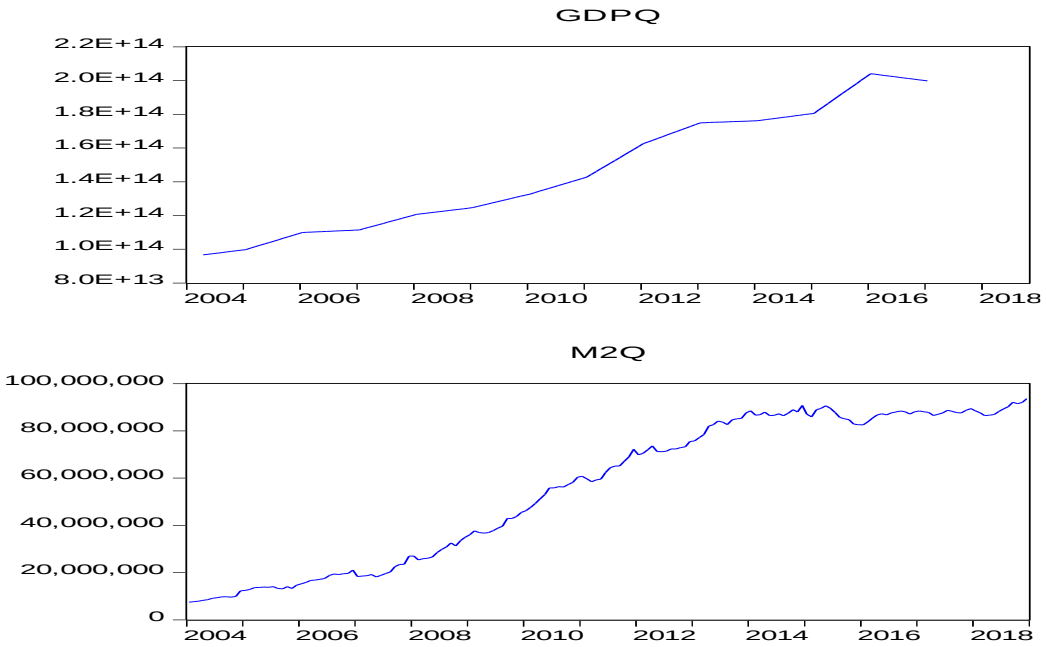

Figure 1. Money supply and economic growth in Iraq from 2004-2018

It is concluded that fiscal policy and monetary policy have a positive and negative impact on economic growth. However, the positive and negative impacts depend on the type of countries and the fiscal and monetary instruments as a proxy of these two policies. Moreover, this study tries to fill a gap in the literature: fiscal-monetary policy's impact on economic growth in Iraq.

3. Research Methodology and model specification

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Variance methods and models have been used in the literature to examine the impact of monetary-fiscal policy on economic growth. Some studies used panel data analysis (Benos, 2009; Hanusch, Chakraborty, & Khurana, 2017), and others used time series or cross-section analysis. This study adopted Gross Domestic Product (GDP), government expenditure, and money supply (M2) as a proxy of economic growth, fiscal policy, and monetary policy, respectively. Types of the data are annual time series obtained from (1970 to 2017). The source of the data is the Word Development Indicator (WDI). Description of series presented in Table 3:

Table 3. Description of variables

Variable	Description
GDP	Gross Domestic Product (current LCU)
GE	Final consumption expenditure (current LCU)
TO	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.
M2	Broad money (% of GDP)

Source: World Bank national accounts and OECD National Accounts data files.

Econometric methods were employed for the empirical estimation of the study. Johansen co-integration approach with the autoregressive distributed lag model (ARDL) and estimation of short-run and long-run co-integration among variables. The work used the co-integration approach according to the prerequisite of the nature of data stationary.

The model followed by Adefeso and Mobolaji (2010), who have regressed the specification of the model as follows:

$$Y_t = (GEXP, M2_t, OPPNESS_t) \quad (1)$$

Where:

Y: The GDP
GEXP: Government Expenditure
M2: Money supply (Broad Money)
OPPMESS: The degree of openness

Log-linear form for Eq.1 is derived as follows:

$$LnY_t = \beta_0 + \beta_1 LnGEXP_t + \beta_2 LnM2_i + \beta_3 LnOPNS_t + e_t \quad (2)$$

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Ln is the natural logarithm e_t, a normally distributed error term with zero mean and variance equal to zero. It is expected that $\beta_1, \beta_2, and \beta_3 > 0$.

This study added two dummy variables to the model because some other factors might affect the impact of fiscal-monetary policy on economic growth in Iraq, like war and crisis. Therefore, this study added two dummy variables to the model as follows:

$$LnY_t = \beta_0 + \beta_1 LnGEXP_t + \beta_2 LnM2_i + \beta_3 LnOPNS_t + D_1 + D_2 + e_t \quad (3)$$

Where:

D_1: is a dummy variable of crisis.
D_2 : is a dummy variable of war.

4. Findings and discussions

4.1 Unit root test

To test the null hypothesis of whether the variables have unit roots. This section investigates the stationarity of the data from 1970 to 2017. The problem of no stationarity of the data in the regression analysis is that the result might not be reliable or it is said to be spurious. Therefore, it should be stationary before using the data in a regression. Various methods have been used to test a unit root of the variables. This work adopted two common methods: Dickey and Fuller (1981). One advantage of the PP tests over the ADF tests is that the PP tests are robust to general forms of heteroscedasticity in the error term e_t . Another advantage is that the user cannot specify a lag length for the test regression.

The ADF test here consists of estimating the following regression:

$$\Delta Y_t = B_1 + B_2 t + \delta Y_{t-1} + \sum_{i-1}^{m} a_i \Delta Y_{t-i} + \varepsilon_t \quad (4)$$

Where ε_t is a pure white noise error term and $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2}), \Delta Y_{t-2} = (Y_{t-2} - Y_{t-3})$. The number of lagged difference terms to include is often determined empirically, the idea is to include enough terms so that the error term is serially uncorrelated.

The PP test here consists of estimating the following regression:

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$$Y_t = \partial + \rho Y_{t-1} + \varepsilon_t \quad (5)$$

Table 4 clarifies the unit root test results:

Table 4. Result of unit root test

Variable	Level and first difference	Augmented Dicky Fuller (ADF) ADF t-statistic	Critical value with the constant 1%	5%	Prob.*	Philips Perron (PP) pp-t-statistic	Critical value with the constant 1%	5%	Prob.*
LGDP	**Level**	-0.8976	-3.5847	-2.9281	0.7800	-0.8572	-3.5847	-2.9281	0.7926
	1st Difference	-4.8034	-3.5885	-2.9297	0.0003	-4.9099	-3.5885	-2.9297	0.0002
LGEP	**Level**	-0.6644	-35811	-2.9266	0.8454	-0.5239	-3.5777	-2.9251	0.8771
	1st Difference	-4.5304	-35811	-2.9266	0.0007	-4.5680	-3.5811	-2.9266	0.0006
LM2	**Level**	0.3736	-2.6173	-1.948	0.7881	0.6039	-2.615	-1.9479	0.8434
	1st Difference	-9.1828	-3.5847	-2.9281	0.0000	-26.663	-3.5811	-2.9266	0.0001
LOPNS	**Level**	-2.1961	-3.5777	-2.9251	0.2103	-2.1961	-3.5777	-2.9251	0.2103
	1st Difference	-5.7424	-3.5811	-2.9266	0.0000	-5.6609	-3.5811	-2.9266	0.0000

Null hypothesis: there is a unit root; alternative hypothesis: no unit root.

Source: The researcher based on data from 1970-2017 by using (Eviews9)

The ADF t-statistic of the LGDP at the level is equal to (-0.89), which is greater than the critical values at both the 1% (-3.58) and 5% (-2.92) significance levels, and the probability is more than 5%, which is (0.798). The value of the ADF t-statistics at the first difference form of the value of the LGDP is equal to (-4.80), which is also greater than both the 1% (-3.58) and 5% (-2.92). Also, the probability is (0.000) stationary and less than (5%) significance levels.

By the same, the PP t-statistic of the LGDP at the level is equal to (-0.85), which is more than the critical values at both the 1% (-3.58) and 5% (-2.92) significance levels, and the probability is more than 5%, which is (0.79). In addition, the value of the PP t-statistics at the first difference form of the value of the LGDP is equal to (-4.90), which is also greater than both

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the 1% (-3.58) and 5% (-2.92), also, the probability is (0.000) which is stationary and less than (5%) significance levels.

All previous results show that the LGDP is non-stationary at the level form in both tests (ADF and PP), and thus, there was a failure in rejecting the null hypothesis. Otherwise, by taking the first difference for this variable, the value of the ADF t-statistic and PP t-statistic became (-4.80 and -4.90), respectively. In both cases, these values are lower than the critical values with 1% (-3.58) and 5% (-2.92) significance levels, and the probability is less than 5%, which is (0.00).

Thus, these results show that the LGDP is stationary, and the null hypothesis can be rejected. Similarly, both tests' t-statistic values of the series LGXE, LLM2, and LOPNS have unit root problems at the level form, but their values are stationary after taking the first difference for them. It means all the variables are I (1), not I (0). Thus, this result supports that the variables could proceed to the co-integration test.

4.2 Johansen co-integration test

After completion of unit root testing on the study time series, to examine the null hypothesis of no co-integration among the variables. This study adopted the Johansen co-integration test. Table 5 shows the results:

Table 5. Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.781629	121.7174	47.85613	0.0000
At most 1 *	0.521994	54.76876	29.79707	0.0000
At most 2 *	0.374642	22.29099	15.49471	0.0041
At most 3	0.036500	1.636045	3.841466	0.2009

Trace test indicates 3 co-integrating equation(s) at the 0.05 level
** denotes rejection of the hypothesis at the 0.05 level*
***MacKinnon-Haug-Michelis (1999) p-values*

Table 6. Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.781629	66.94864	27.58434	0.0000
At most 1 *	0.521994	32.47778	21.13162	0.0009
At most 2 *	0.374642	20.65494	14.26460	0.0043

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At most 3	0.036500	1.636045	3.841466	0.2009

Max-eigenvalue test indicates 3 co-integrating equation(s) at the 0.05 level
** denotes rejection of the hypothesis at the 0.05 level*
***MacKinnon-Haug-Michelis (1999) p-values*

Tables 5 and 6 show that the trace statistics indicate at most three co-integrating equations at the (0.05) levels, which denotes a rejection of the hypothesis of no co-integration amongst the series at the (0.05) level by Mackinnon-Haug-Michelis (1999). In other words, there is co-integration amongst the GDP, GEXP, M2, and OPNS. Hence, this denotes rejecting the null hypothesis at the (0.05) level. After that, to investigate the impact of the independent variables on the dependent variable and the model estimation, this study uses the Ordinary Least Square (OLS) regression.

4.3 Ordinary Least Square (OLS)

One of the common methods in the literature to investigate the model estimation is Ordinary Least Square (OLS). This method has certain attractive statistical properties employed to ensure the fulfillment of assumptions. This model can be employed in this investigation with attention to the variance of the error term and the correlation between an independent variable and the error term. With this assumption, the error term is normally distributed, and no independent variable is a perfectly linear function of other explanatory variables. The result of the OLS estimation is as follows:

Table 7. OLS estimation of the LGDP as a dependent variable 1970-2017

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGE	0.988679	0.021883	45.18013	0.0000
LM2	-0.611610	0.336396	-1.818127	0.0765
LTO	-0.138260	0.042045	-3.288359	0.0021
D1	0.927228	0.216033	4.292060	0.0001
D2	0.003204	0.194560	0.016466	0.9869
C	3.439031	1.076566	3.194445	0.0027
index	**R^2**	**D.W**	**F-statistic**	**S.E. of regression**
Result	0.98	1.19	669.0494*	0.53

Source: Authors' computation

From Table 7. based on the applied estimation approaches and the LGDP as the dependent variable, the coefficients of LGE as the independent variables and (D1) as a dummy variable are positive and statistically significant at 5%. In contrast, the coefficients of the rest variables (LM2 and LTO) are negative and statistically significant at 1% and 10%.

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Page : 10 – 24

The results also show that a 1% increase in government expenditure increases the economy's growth by 0.98%. It means that the Iraqi government's expenditure is the source of economic growth. While increasing the money supply (M2) leads to a decrease in the GDP by 0.61%, this may be due to the increasing inflation rate because of increasing money supply without real increase of goods and services. Although for trade openness, increasing trade openness by 1% affects the Iraqi GDP to decline by 13%. This result also might be because of the Trade balance deficit caused by excessive import increases.

Table 7. also shows that the R^2 and adjusted R^2 are too high for the economic growth model. This finding shows that the model fits the data and has a correct specification.

4.4 Autoregressive Distribution Lag Model (ARDL)

Since the result of variables shows that all the variables are stationary at first differences in both (ADF and PP) tests. It means that all the series are (I_1). For this reason, this study could use (ARDL) model to investigate the variables' short- and long-run association. This model (ARDL) was developed and introduced by Pesaran (1997); Pesaran, Shin, and Smith (2001). More recent studies indicate that ARDL approach is preferable in estimating the co-integration relation to other methods (Engle & Granger, 1987; Gregory & Hansen, 1996; Johansen, 1988). Using this model, this study could simultaneously estimate the model's long- and short-run components.

The presence of an error-correction term among several co-integration factors infers that changes in the dependent variable are a function of both the level of disequilibrium within the co-integration relationship (presented by the ECM) and the changes in other explanatory variables. This shows that any deviation from the long-run equilibrium will feed back into the changes within the dependent variable in order to derive the movement toward the long-run equilibrium (Masih & Masih, 2002). Therefore, these co-integration methods are not appropriate and cannot be employed. Hence, we adopt the ARDL modeling approach for co-integration analysis in this study.

The ARDL framework for equation (2) is as follows:

$$\Delta LnY_t = \delta_0 + \sum_{i=1}^{p} \gamma_i \Delta LnY_{t-1} + \sum_{i=1}^{p} \theta_i LnGEXP_{t-i} + \sum_{i=1}^{p} \phi_i LnM2_{i-i} + \sum_{i=1}^{p} \varphi_i LnOPNS_{t-i} + \lambda_1 LnY_{t-1} + \lambda_2 LnGEXP_{t-i} + \lambda_3 LnM2_{i-i} + \lambda_4 LnOPNS_{t-i} + D_1 + D_2 + e_t \quad (6)$$

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SALAM: Islamic Economics Journal
Volume 5 No 1 (2024)
ISSN : 2723-5955 (ONLINE); 2745-7478 (CETAK)
Page : 10 – 24

In equation 6, the terms with the summation signs represent the error correction dynamics, while the second part (terms with λs) corresponds to the long-run relationship. The null hypothesis is λ1 = λ2 = λ3 = λ4 = λ5 =0, which indicates the non-existence of the long-run relationship.

The ARDL method estimates (p+1) k number of regressions to obtain the optimal lags for each variable, where p is the maximum number of lags to be used, and k is the number of variables in the equation. Since this study uses annual data, four lags are selected as the maximum lag (p). The optimal model can be selected using model selection criteria like Schwartz-Bayesian Criteria (SBC) and Akaike Information Criteria (AIC). In this study, the optimal model is selected based on their prediction power by comparing the prediction errors of the models. Diagnostic tests are conducted and reported after the estimation result section to ascertain the appropriateness of the ARDL model.

Table 8. ARDL Estimated: long-term coefficients and short-term error correction model

ARDL (3, 1, 2, 3, 4, 0) /Model ECM Results /Dependent Variable: ΔLGDP			
Variable	Coefficient	Std. Error	t-Statistic
D(LGDP(-1))	0.6811	0.3978	1.7121
D(LGDP(-2))	0.9187	0.3366	2.7294**
D(LGE)	-0.0046	0.4369	-0.0106
D(LM2)	-0.2904	0.3379	-0.8596
D(LM2(-1))	-0.6370	0.2948	-2.1604**
D(LTO)	-0.0515	0.0568	-0.9062
D(LTO(-1))	0.1029	0.0704	1.4597
D(LTO(-2))	-0.1293	0.0552	-2.3418**
D(D1)	0.8041	0.3022	2.6602**
D(D1(-1))	0.2268	0.2842	0.7979
D(D1(-2))	0.3894	0.2814	1.3836
D(D1(-3))	-0.8182	0.3099	-2.6403**
D(D2)	-0.0299	0.2013	-0.1488
ECM_{t-1}	**-0.8148**	**0.4178**	**-1.9501***
ARDL (3, 1, 2, 3, 4, 0) Model Long Run Results			
Variable	Coefficient	Std. Error	t-Statistic
LGE	0.9387	0.0460	20.37***
LM2	0.4655	0.8497	0.5478
LTO	-0.0189	0.0710	-0.2665
D1	1.5101	0.4852	3.1119***
D2	-0.0367	0.2509	-0.1465
C	0.3772	2.2519	0.1675
index	**R^2** **$AdjR^2$**	**S.E**	**F-statistic**	**D.W**

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Page : 10 – 24

Result	0.9958	0.9926	0.3708	308.3***	2.041

Note: *, **, and *** denote statistical significance at 10%, 5%, and 1%, respectively.

Table 8 shows the short and long-run dynamics association among the variables in the ARDL estimation. The lag in the model selected by AIC* is (3, 1, 2, 3, 4, 0). Generally, the coefficient of ECM_{t-1} is found to be minus amount and is statistically significant at 10%. The coefficient of the ECM term is -0.8148, which suggests a slow adjustment process. It demonstrates that there is a long-run relationship between the variables.

The coefficient of government expenditure (LGE) is 0.93, which is positive and statistically significant at the one-person level in the long run. It recommends that in the long run, an increase of one person in the government expenditure is associated with an increase in economic growth (LGDP) by 8.68* in Iraq. Unlike the short run, (GE) has a negative and insignificant impact on economic growth. However, money supply (LM2) has an insignificant and weak positive impact on economic growth in the long run but a negative impact in the long run. Furthermore, the last variable, which is trade openness (LTO), picked up a negative insignificant impact in both the short and long run, except the change in the lags of (LTO) like D [LTO (-1)] is positive and insignificant, but D[LTO(-2)] is negative and significant in the short run. Overall, the result clarified that fiscal policy is more effective than monetary policy in the short and long run in the case of Iraq, like the same result in OLS estimation.

The overall goodness of fit of the estimated equation, as shown in Table 8, is extremely high with $R^2 = 0.99$; the F-statistic measuring the joint significance of all repressors is statistically significant (p-value =.000). Hence, the value of Std. Error (SE) is (0.37), which is less than (0.53) in the OLS model. This means that the ARDL estimation is more accurate than the OLS estimation.

4.5 Granger causality test

The study further conducted the Granger causality test to analyze the cause-and-effect relationship between the variables and economic growth. The causality results are presented in Table 9.

Appendix (1) presents a table of the top 20 ARDL models from the Akakie Information Criterion (AIC).
* 8.68 is antilog of the value 0.9387.

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Page : 10 – 24

Table 9. Pairwise Granger Causality Tests

Null Hypothesis:	F-Statistic	Prob.	Decision
LGE does not Granger Cause LGDP	5.61310	0.0225	Reject null hypothesis
LGDP does not Granger Cause LGE	56.9765	2.9875	Accept null hypothesis
LM2 does not Granger Cause LGDP	0.01990	0.8885	Accept null hypothesis
LGDP does not Granger Cause LM2	1.00658	0.3215	Accept null hypothesis
LTO does not Granger Cause LGDP	7.15979	0.0106	Reject null hypothesis
LGDP does not Granger Cause LTO	0.14068	0.7095	Accept null hypothesis
LM2 does not Granger Cause LGE	8.52947	0.0055	Reject null hypothesis
LGE does not Granger Cause LM2	3.20284	0.0804	Reject null hypothesis
LTO does not Granger Cause LGE	18.1338	0.0001	Reject null hypothesis
LGE does not Granger Cause LTO	0.53316	0.4691	Accept null hypothesis
LTO does not Granger Cause LM2	0.00999	0.9209	Accept null hypothesis
LM2 does not Granger Cause LTO	4.35712	0.0427	Reject null hypothesis

The results in Table 9 clearly show that the causal relationship runs from government expenditure to economic growth. It means that unidirectional causality runs from government expenditure to economic growth. However, unidirectional causality was recorded among trade openness and economic growth. Moreover, there is bidirectional causality between money supply and economic growth. Finally, a broad money granger causes trade openness, and the probability is significant.

4.6 Diagnostic test

Diagnostic checks were performed to test the accurate model to analyze in this study and to confirm the model's goodness of fit. There are various techniques and tests to evaluate the model. However, this study tried to choose the most important techniques, such as the lagrange multiplier (LM) test for serial correlation, the Variance Inflation Factor test for Multicollinearity, the Ramsey test for Specification Error, the Breusch-Pagan-Godfrey test for Heteroscedasticity and Jarque-Bera test for normality. The results presented in Table 8 suggest that the model estimated is a good fit.

Table 10. Diagnostics tests results

Test for:	Test	P-value	Decision
Serial Correlation	LM	0.5335	Reject H_a
Multicollinearity	Variance Inflation Factor	4.7797	Accept H_a
Specification Error	Ramsey	0.8322	Reject H_a
Heteroscedasticity	Breusch-Pagan-Godfrey	0.5082	Reject H_a
Normality	Jarque-Bera	0.6947	Reject H_a

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Page : 10 – 24

Table 10 shows that the P-value is more than the 5% level. for all the tests used. However, for the Multicollinearity problem, equal 4.7797 is less than 10. The model passed these tests. The null hypothesis (H_0; the econometrics model does not exist) is accepted. Therefore, the ARDL models are correctly specified.

Additionally, the study used (CUSUM and CUSUMQ) to check the problem of structure change. There is no evidence of this problem, and it involves the existence of a stable relationship between variables. The relationship between variables is shown in Figure 2:

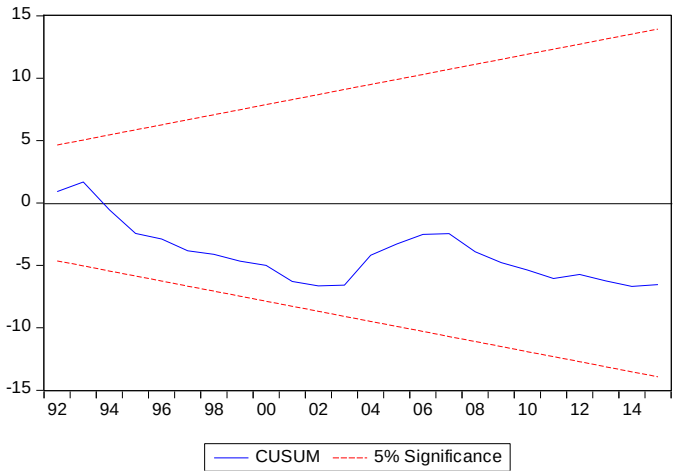

Figure 2. Stability test for Economic growth model for Iraq

Figure 2 illustrates the stability test of the Economic growth model for Iraq, employing various statistical methods to analyze the long-term consistency and reliability of the model. The graphical and numerical outputs suggest that the model is either stable or unstable over the defined time period, offering key insights into the efficacy of economic policies and strategies in Iraq.

5. Conclusion

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Page : 10 – 24

The comprehensive analysis in this study employs multiple econometric techniques to understand the dynamics of economic variables in Iraq, specifically focusing on GDP, GEXP, M2, and OPNS. The investigation begins with the Unit Root Test, including Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Initially, the data for the selected variables appear non-stationary. However, stationarity is achieved when first differenced, paving the way for further co-integration analysis.

After confirming stationarity, the Johansen Co-integration Test provides strong evidence for a long-term, stable equilibrium relationship among the variables. Trace and Maximum Eigenvalue tests convincingly reject the null hypothesis of no co-integration, supported further by MacKinnon-Haug-Michelis p-values well below the 0.05 threshold. These co-integration results validate the use of Ordinary Least Square (OLS) regression in later analyses.

OLS regression indicates that government expenditure positively impacts economic growth, with the model showing a strong goodness of fit. However, a more nuanced picture emerges when employing the Autoregressive Distribution Lag (ARDL) model, which reveals that while government expenditure positively affects long-term growth, its short-term impact is negligible. By contrast, monetary policy generally negatively and ineffectively influences economic growth.

The Granger causality test adds another layer of depth, identifying unidirectional causal effects from government expenditure and trade openness to economic growth. It also shows bidirectional causality between money supply and economic growth. Moreover, a broad money supply is found to Granger-cause trade openness. These causal relationships are invaluable for shaping fiscal and monetary policies.

Lastly, the study's diagnostic tests reinforce the robustness and reliability of the ARDL models used. Tests for serial correlation, multicollinearity, specification error, heteroscedasticity, and normality validate the model's goodness of fit. Specifically, p-values across these tests are above the 5% level, and additional stability tests, including CUSUM and CUSUMQ, reveal no evidence of structural changes.

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Page : 10 – 24

The study presents a multi-faceted, robust analysis of Iraq's economic variables. It reveals that fiscal policy, particularly government spending, is a more effective tool for economic growth than monetary policy. Importantly, the study confirms the reliability and validity of its models, ensuring that the insights gained are both statistically robust and economically meaningful.

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Appendix:

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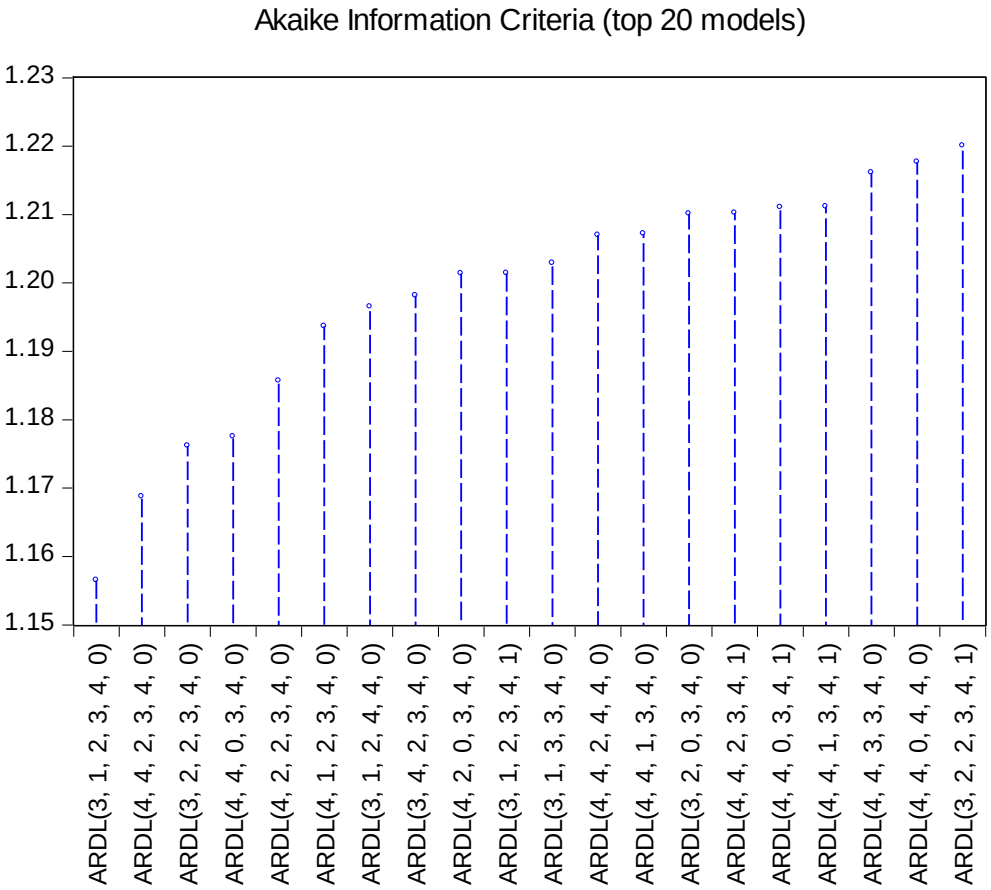

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