Applied Mathematics & Information Sciences
An International Journal

http://dx.doi.org/10.18576/amis/190120

Analyzing the Relationship Between the Budget Deficit and Macroeconomics Variables

Khaled Mohammed Al-Sawaie[1,*], *Nidal Ali Abbas*[1], *Ahmad HabesAlmajali*[1], *Hamza Mahmoud Alrawashdeh*[1], *Mohammad Matroud Al-Smeiran*[1], *Fayez Haddad*[2], *Asokan Vasudevan*[3], *Suleiman Ibrahim Mohammad*[4,5], *and Wen Zhou*[6]

[1]Faculty of Economics and Administration Sciences, Zarqa University, 13110 Zarqa, Jordan
[2]Financial Technology Department, Hourani Center for Applied Scientific Research, Al-Ahliyya Amman University, Amman, Jordan
[3]Faculty of Business and Communications, INTI International University, Persiaran Perdana BBN Putra Nilai, 71800 Nilai, Negeri Sembilan, Malaysia
[4]Electronic Marketing and Social Media, Economic and Administrative Sciences Zarqa University, 13110 Zarqa, Jordan
[5]INTI International University, 71800 Negeri Sembilan, Malaysia
[6]Faculty of Liberal Arts, Shinawatra University, Thailand

Received: 30 Oct. 2024, Revised: 29 Nov. 2024, Accepted: 3 Dec. 2024
Published online: 1 Jan. 2025

Abstract: This study examines the relationship between budget deficit and selected macroeconomic variables in Jordan for the period 2008 to 2023. The research employs ARDL methodology, stationary analysis techniques, and bounds testing to investigate the long-term connection between the variables being studied. The integration bounds test showed that the variables are cointegrated, implying a long-term relationship. The ARDL estimation results revealed that there is a significant negative association between real GDP and the budget deficit, with all other variables showing positive relationships. The study suggests that Jordan's fiscal authorities should implement effective strategies for collecting taxes and managing public sector expenditures. Jordan has experienced a budget deficit since its formation, which has been linked to issues such as high debt, inflation, limited investment, and slow growth. The research added to the real-world discussion on how budget deficits impact macroeconomic factors by utilizing ARDL and Granger causality methods.

Keywords: Budget Deficit, Macroeconomic Variables, ARDL, Granger Causality, Cointegration, Jordan

1 Introduction

In recent years, budget deficits have garnered significant attention from policymakers due to their magnitude and the methods used to finance them. The rise in budget deficits, particularly in many developing nations, has raised concerns about their long-term sustainability. Persistent budget deficits in these countries often lead to an accumulation of government debt [1,2].

Different ways to cover the budget deficit include printing money, taking loans from domestic and international sources, and getting foreign aid from donors and governments. As the amount borrowed at present is combined with the existing deficit, interest payments from borrowing typically increase. This implies that more borrowing is required to cover interest payments and increase the primary deficit, impacting future borrowing rates. Truly, when the fiscal deficit is financed through borrowing from the national banking system, private borrowers will be pushed out due to increasing domestic interest rates [3,4,5]. The money supply and inflation rate rise in tandem with the monetisation of the deficit [6]. The budget deficit could lead to an increase in the exchange rate. An outflow of foreign cash due to a higher exchange rate could reduce the competitiveness of the nation's exports. The current account is thereby made worse by this. Less competitive exports cause resources to be diverted from the production of tradables to the production of non-tradables, as noted by [7] and [8].

Persistent budget deficits in the majority of low-income nations are caused by rising public spending, an inability to raise money, and rising debt levels [9,10]. These factors include a limited tax base, a lacklustre tax

* Corresponding author e-mail: ksawaie@zu.edu.jo

administration system, and the inability of low-income nations to raise enough money from both internal and external sources. Overspending on public debt has the potential to trigger a debt crisis and increase the amount of external debt owed by the nation [5,11]. Therefore, budget deficits have a significant impact on the economic, financial, and political stability of a country. Macroeconomic factors such as real GDP, money supply, inflation rate, real interest rate, and real exchange rate all play a role in determining the impact budget deficits have on the economy [12,13].

This research seeks to explore the factors causing Jordan's budget deficit and the link between budget deficit and macroeconomic indicators. Despite the increasing research on the topic, the Jordanian economy has had a budget deficit since the establishment of the emirate. The budget deficit is said to be caused by reasons like excessive debt, inflation, inadequate investment, and sluggish growth. This research employs the Autoregressive Distributed Lag (ARDL) methodology to contribute to the empirical debate on the causal link between macroeconomic factors and budget deficit.

The study is structured as follows for the remaining portion: The budget deficit is briefly discussed and the literature is reviewed in Section 2. The data and variables utilised for the study are described in Section 3 along with the methodology. The empirical results are discussed in Section 4. Section 5 wraps up and discusses how the study's findings could affect policy.

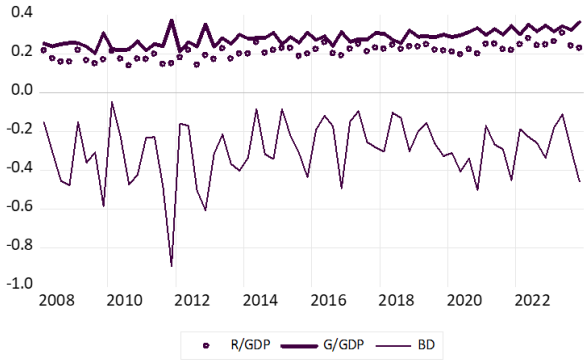

Fig. 1: Percentage of GDP allocated to government revenues and expenditures

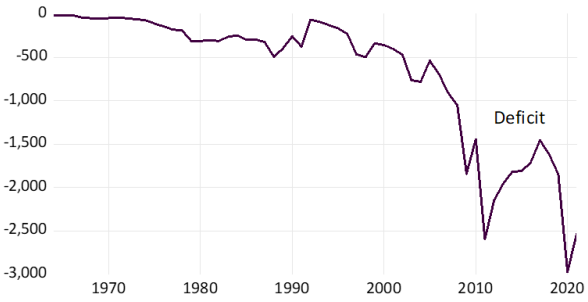

Fig. 2: Actual values of budget deficit without aid

2 Budget Deficit in Jordan

Throughout the years 2008–2023, Jordan's government outspent its income, creating a fiscal deficit. Interest payments on debt, tax evasion, and late tax payments have all contributed to a steady increase in spending. During the research period, government spending as a percentage of GDP averaged 30.1%, while government receipts averaged 22% of GDP. As a result, there was a 7.8% GDP budget deficit (Figure 1). This suggests that there will be a 7.8% GDP funding shortfall over this time, which will need to be covered by borrowing money and outside assistance. The budget deficit decreased from 10.3% of GDP in 2008 to 6.9% of GDP in 2023.

The high budget deficit in Jordan can be attributed to several factors, including internal and external shocks that sometimes require government intervention through fiscal policy. For example, the deficit in the 1970s and 1980s was mainly explained by the ambition to provide comprehensive social services, and was justified by the provision of free education at the primary, intermediate and secondary levels, health, and the provision of water and electricity to the majority of the Jordanian population. The shock of the rise in oil prices in the 1970s also affected the increase in government spending due to the implementation of the Economic Development Plan 1976-1980, and in the 1980s the decline in oil negatively affected revenue mobilization, as aid from Arab oil countries decreased and governments were unable to cover the increase in government spending.

The average budget deficit in the 1980s was 7.4% of GDP. Government spending decreased from 3.4% of GDP in 1990 to 2.4% of GDP in 1999 during the economic liberalisation phases of the 1990s, and there was a surplus from 1992 to 1996. Government revenue as a percentage of GDP increased from 33.3% in 1981–1989 to 34.4% in 1990–1999 years. According to Figure 2, this suggests that while the budget deficit rose in the new millennium, it decreased in the early phases of economic liberalisation.

While government spending, domestic revenue, and the budget deficit as a percentage of GDP decreased between 2000 and 2008, as we have previously explained, in the final years of the study period, government spending and revenue as a percentage of GDP continued to decline, on average, while the deficit increased, on average.

Jordan's fiscal deficit is continuing to grow, suggesting that debt and its associated payments will keep increasing without limitations. The high interest payments contribute to the increase in the debt-to-GDP ratio. Truly, policymakers should worry about the magnitude of the budget deficit. The majority of the

Table 1: Economic performance and budget deficit

Description	2008-2023
Deficits (percent of GDP)	7.8
Annual growth of real GDP	2.5
Rate of inflation	3.1
Interest rate	8.5
M2, a percentage of the GDP	114.6
Real Exchange Rate	0.404

deficit's external funding is from loans and grants, while the sale of government bills and bank financing are the internal sources. Similar to numerous other impoverished nations, Jordan is allocated grants from governments and bilateral and multilateral donor agencies either as project aid or budgetary assistance.

According to Keynesian reasoning, when there is a recession, a larger budget deficit lowers unemployment and boosts economic growth by raising aggregate demand. Over time, deficit spending can assist reduce the deficit by boosting tax revenues and encouraging faster growth. However, if the deficit happens during a time of rapid economic expansion, the private sector may be driven away since government borrowing discourages private sector spending and investment. The government creates money through the inflation tax and seigniorage, or the change in real money balances. When money is printed to cover a budget shortfall, inflation rises.

Economists are deeply engaged in debating the correlation between budget deficits and macroeconomic variables. Different hypotheses have been proposed to explain the connection between macroeconomic variables such as real GDP, interest rates, money supply, inflation, real exchange rates, and budget deficits. Neoclassical theory suggests that budget deficits lead to higher interest rates, disincentivize the purchase of private bonds, and hinder private spending and investment. Moreover, they contribute to the existing current account shortfall and increase inflation.

To gain a better understanding, it is valuable to explore the historical context of how the budget deficit relates to certain macroeconomic factors through additional testing. Table 1 outlines the patterns in Jordan's budget deficit and macroeconomic variables.

Over the 2008–2023 period, the economy generally experienced diminishing positive real GDP growth, with growth falling from 5% in 2009 to 2.7% in 2023 and the budget deficit falling from 10.3% of GDP in 2008 to 6.9% of GDP in 2023. Growth in the corporate environment, industrialisation, and human development are anticipated to propel Jordan's economy.

3 Literature Review

According to the Central Bank of Jordan, inflation and money supply as a percentage of GDP rose from -0.7% and 114.9% in 2008 to 2.1% and 117.9% in 2023. Theoretically, inflation could lower tax revenues, leading to an increase in the budget deficit. Inflation also leads to a rise in nominal interest rates and debt service, causing an expansion of the budget deficit. It is anticipated that inflation will have a negative effect on cash reserves. Inflation can have a positive effect on the government's financial situation by leading to higher revenue from elevated income tax brackets [1,14].

According to the Central Bank of Jordan, the interest rate decreased from 9.5% in 2009 to 8.8% in 2023. According to economic theory, a rise in the budget deficit results in a rise in the interest rate, which in turn causes a rise in the exchange rate. Therefore, exports are costly while imports are cheaper, causing a trade deficit. Epaphra [1] also states that an increased interest rate can also have a negative impact on the budget account through higher debt spending. On the other hand, increased interest rates signal a greater expense for borrowing in the bond market, leading governments to address the budget deficit. It is anticipated that the previous effect will prevail, leading to a negative relationship between interest rates and the budget account.

It is essential to conduct empirical research on the relationship between macroeconomic factors and budget deficit to assist policymakers in establishing whether there is a causal connection or simply a correlation between these variables. Nonetheless, there isn't always a direct correlation between the budget deficit and macroeconomic variables; for instance, while Keynesians explain a positive correlation, neoclassical theory suggests a negative correlation. Budget deficits, according to Keynesians, often boost aggregate demand and domestic output. In any case, it boosts individual investment and savings rates. The current account deficit is believed to be caused by a growth in the budget deficit, which in turn generates an expansion of imports and domestic absorption [15,16,17,18].

Budget deficits have a significant impact on important macroeconomic factors like real GDP, inflation, interest rates, and exchange rates. Research offers different perspectives depending on the region and economic circumstances. For instance, Abel et al. [19] demonstrated a positive relationship between budget deficits, inflation, and economic growth in BRICS nations, highlighting a bidirectional connection between budget deficits and economic growth. Similarly, Akosah [20] found that while short-term deficits can stimulate economic growth in Ghana, deficits exceeding 4% of GDP negatively impact growth.

Yusuff and Abolaji [21] observed a positive relationship between deficits and growth in Nigeria, a finding echoed by Umaru et al. [22], who indicated that budget deficits promote growth only when they surpass 2.02% of GDP. However, Sabr et al. [23] reported a weaker effect of budget deficits on economic growth in Iraq.

Tran [24] analyzed 48 Asian countries from 2000 to 2019, identifying that effective economic growth is achieved when budget balances fall between 22.7% and 25.2% of GDP, a range few countries achieved. Bhari [25] similarly found that fiscal deficits in Malaysia supported GDP growth during the 1997-98 and 2008-09 economic crises, aiding the country's recovery. Overall, the effect of budget deficits on economic growth varies based on the fiscal policy environment and economic conditions.

In contrast to this, Helali and Maha [26] found that the budget deficit has a harmful effect on the economic growth of Tunisia. Likewise, Kassem [27] found that in five countries - Algeria, Egypt, Morocco, Bahrain and Jordan, there is an inverse correlation between GDP growth and the budget deficit based on his extensive study. Mavodyo [28] also reported a negative correlation for the South African economy.

4 Research Methodology

This study aims to investigate how Jordan's budget deficit affected macroeconomic indicators between 2008 and 2023. We investigate the dynamic change between these variables using the ARDL model, which is the proper approach for this purpose. According to [29,30,31], the effectiveness, accuracy, and reliability of this method depend on three basic requirements.

–The variables are connected in the long term.
–No variables are integrated up to degree 2.
–The ARDL model is appropriate for models in which all variables are either integrated to degree 1 or stationary at the level. Nevertheless, when unit root tests provide conflicting outcomes, such as some variables being integrated to degree 1 and others being stationary at the level, it is essential to utilize the ARDL model.

4.1 Specification Model

As per the World Bank (WB), a budget deficit is the gap between revenue and expenses including grants, asset sales, interest on debt, transfers, and subsidies. The International Monetary Fund defines a budget deficit as follows.

$$\begin{aligned} Fiscal\,deficit = &[(Expenditure + transfers) \\ &- (Revnue + grants) \\ &+ (lending - repayments)] \end{aligned}$$

The budget deficit represents the shortfall between a government's expenditures and its revenues, indicating how much the government needs to borrow to cover its expenses. When government spending surpasses revenue, the deficit must be financed through borrowing or other forms of net lending.

Assumed by [32], governments run a balanced budget in the following equation 1:

$$G_t = T_t \tag{1}$$

According to [13], government spending may not be able to be funded by tax income alone. In this scenario, government spending may be financed by printing money (M), reducing the amount of foreign assets held (A), or issuing bonds (B). This implies that there are several ways to support the public sector: printing money, cutting foreign exchange reserves, borrowing locally and abroad, and obtaining grants. However, grants are not included in the conventional analysis of this study because, according to [13], grants are often distributed at the discretion of donors and, as a result, a budget deficit devoid of grants is preferable to the existing state of affairs and the way the government is really run.

$$\begin{aligned} Budget\,deficit = &[utilization of money printing \\ &+ (utilization of foreign income \\ &+ foreign loans) \\ &+ borrowing within the country] \end{aligned}$$

This indicates that there are four methods to back the government sector: printing money, reducing foreign exchange reserves, borrowing from domestic sources, and borrowing overseas. Grants are also given to governments. Therefore, a budget deficit free of handouts more accurately depicts the state of affairs now and how the government actually operates.

$$G_t - T_t = M_t + A_t + B_t \tag{2}$$

As per [13] and [32], the documented fiscal shortfall can be illustrated using Identity 2 in the following manner:

$$\frac{\mathrm{B}^g_{t+1}}{\mathrm{R}^*_t} = T_t + \mathrm{B}^g_t + G_t + \frac{M_{t+1} - M_t}{P_t} + A_t \tag{3}$$

where:

G_t: spending by the government at time t.
T_t: revenue from taxes.
B^g_t: public sector assets.
R^*_t: global level of interest rates.
M_t: circulating currency.

By rearranging identity 3, the budget deficit becomes as follows:

$$G_t - T_t + \frac{\mathrm{B}^g_{t+1}}{\mathrm{R}^*_t} = \mathrm{B}^g_t \pm \frac{M_{t+1} - M_t}{P_t} + A_t \tag{4}$$

The total government deficit, comprised of the budget deficit and actual net government assets, is displayed on the left side. The ways to finance the budget shortfall, such

as government bonds, are shown on the opposite side. The level of debt to be repaid increases as interest payments grow along with the budget deficit. The standard form for expressing Identity 4 is the following:

$$ln(G_t - T_t) = \xi_0 + \xi_1 ln(\mathrm{B}_t^g) + \xi_2 ln(M_t) + \xi_3 ln(A_t) + \mu_t \quad (5)$$

Taking loans to address the budget shortfall raises the government's demand for credit, putting it in competition with individuals and companies for credit. In the Keynesian framework, this occurs when the real interest rate rises, reducing investment spending, pushing interest rates up, and stalling the pace of capital accumulation. The money supply will rise if the budget deficit is made profitable. This drives down the interest rate while driving up the money stock and price level, barring a severe slump in the economy. Real tax revenues tend to decline as a result of increased inflation, uncertainty, and real interest rate volatility. As noted by [6,33,34,35], when the central bank operates.

The real GDP is regarded as a broad measure of the state of the economy that influences the budget deficit. For instance, during prosperous times, the deficit is low, and in order to stabilise the economy during recessions, higher public expenditure and lower taxes are required. Therefore, we can expand Model 5 to examine the relationship between real GDP, lending rate, money supply, inflation rate, real exchange rate, and budget deficit. This is the way in which the model of the study is presented:

$$Ln(BD_t) = \beta_0 + \beta_1 ln(\mathrm{GDP}_t^{real}) + \beta_2(P_t) + \beta_3(\mathrm{R}_t^1) + \beta_4 ln(M_t) + \beta_5 ln(\mathrm{ER}_t^{real}) + \mu_t \quad (6)$$

where:

BD_t: = the budget deficit at time t expressed as the natural logarithm.
GDP_t^{real}: Gross domestic product adjusted for inflation.
P_t: inflation rate.
R_t^1: interest rate for borrowing money.
M_t: supply of money.
ER_t^{real}: real exchange rate.
μ_t: error term is distributed with zero mean and constant variance.

4.2 Data Description

The data for this research were collected from the website of the Central Bank of Jordan, which is represented by quarterly data during the period 2008-2024. Table 1 presents the descriptive statistics for the study variables, and the results revealed that the average budget deficit amounted to about 503.2 million dinars per quarter, with a maximum of 1411.4 million dinars (fourth quarter in 2011) and a minimum of 56.3 (first quarter in 2010). This data showed a large fluctuation in the budget deficit, with a standard deviation of about 266.8 million dinars.

As for real GDP, the average was 6936.98 million dinars, with a maximum of 8618.7 (in the third quarter of 2023) and a minimum of 5156.5 million dinars (in the first quarter of 2008). Real GDP showed significant volatility, with a standard deviation of 818.5 million dinars.

The average inflation rate was 0.73%, with a maximum of 6.6% (Q1 2008) and a minimum of -3.2% (Q1 2009). Inflation showed high volatility, with a standard deviation of 1.37% throughout the duration of the study.

The average interest rate was 8.5%, with a maximum of 9.48% and a minimum of 6.38%. The standard deviation indicated a high volatility of 0.69%.

The average money supply was 30,179.76 million dinars, with a maximum of 42,663.07 million dinars and a minimum of 16,168.7 million dinars, and the standard deviation indicated a high volatility of 7,375.957 million dinars.

Finally, the real exchange rate rer; its average was 0.4037, with a maximum of 52.46 and a minimum of 0.3073, and the standard deviation indicated a slight volatility of 0.0496.

The uncertainty in the Middle East region causes noticeable fluctuations, resulting in economic challenges and slow growth rates in the area. The global economy experiences impacts on macroeconomic variables from events like the 2008 global financial crisis or the Covid-19 pandemic. Figure 3 depicts the variables of this research in a visual format.. Real GDP showed an upward trend during the study period. As for the deficit, it showed movements around 400 million dinars. On the other hand, inflation fluctuated between -2 to 2% throughout the sample period, while money supply showed an upward trend.

Table 3 displays the correlation among the variables examined, as weak correlations were found between pairs of explanatory variables, which helps to address the issue of multicollinearity.

4.3 Methodology for Estimation

To study the relationship between the budget deficit and the following variables: GDP, inflation, interest rate, M2 money supply and real exchange rate, this study used the following ARDL model:

$$Y_t = \sum_{i=1}^{p} \alpha_i Y_{t-i} + \sum_{i=0}^{q} \beta_i X_{t-i} + c + \varepsilon_t \quad (7)$$

where:

Y_t: The budget deficit is the dependent variable.

Table 2: Descriptive statistics of the variables

	Budget Deficit	GDP	Inflation	Interest rate	M2	RER
Mean	-503.2	6936.98	0.73	8.51	30179.76	0.40
Maximum	-56.3	8618.70	6.55	9.48	42663.07	0.52
Minimum	-1411.4	5156.50	-3.23	6.83	16168.70	0.30
Std. Dev.	266.81	818.50	1.37	0.69	7375.95	0.05
Observations	64	64	64	64	64	64

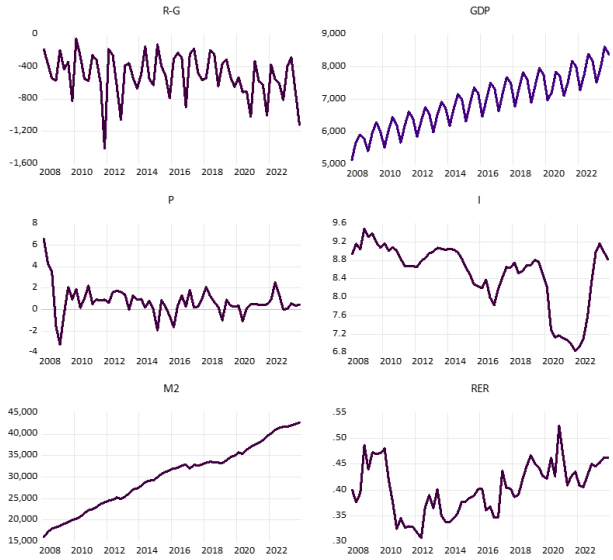

Fig. 3: Visual depiction of the variables included

Table 3: Results of the correlation test

	BD	GDP	P	I	M2	RER
BD	1					
GDP	0.01	1				
P	-0.05	-0.2	1			
I	-0.01	-0.53	0.08	1		
M2	0.18	0.91	-0.25	-0.63	1	
RER	0.05	0.32	-0.25	-0.15	0.3	1

X_{t-i}: vector of explanatory variables.
α_i: Dependent variable lag coefficient.
β_i: Vector of independent variables parameters.
c: Intercept.
p,q: Optimal lag degree.
ε_t: error term.

The ARDL error correction model parameter (p, q, q, q) leads to a methodology about long-run and short-run relationships. The ARDL model (1, 1, 0, 0, 0, 0) was employed by the researcher to derive the long-term equation and the error correction model for the short term.

$$\begin{aligned}\Delta Y_t =& \lambda(Y_{t-1} - \acute{\delta} X_{t-1}) \\ &+ \sum_{i=1}^{p-1} \phi_i \Delta Y_{t-1} \\ &+ \sum_{i=0}^{q} \acute{\mu}_i X_{t-i} + c + \varepsilon_t \end{aligned} \tag{8}$$

Where:

λ: coefficient for correction rate. A negative and statistically significant outcome is anticipated.
δ: symbolizes the array of coefficients for the long-term relationship.
$(EMC = Y_{t-1} - \acute{\delta} X_{t-1})$: represents the term for correcting errors that stem from the equilibrium relationship in the long run.
ϕ, $\acute{\mu}$: depict the short-term dynamic parameters.
Δ: represents the first difference of the variables.

5 Results

5.1 Unit Root Test

To examine how macroeconomic variables are related to budget deficit, the author initially conducted stationarity tests on the variables using the Augmented Dickey-Fuller (ADF) unit root test. The results are shown in Table 4, where the unit root test at the level indicates that the variables BD, GDP, i, and rer are non-stationary. At the 1% significance level, P and M2 are stationary.

The results of the unit root test at the first differentiation are also shown in Table 4, and they reveal that all variables were non-stationary at the level and became stationary following the first difference. Both the 1% and 5% significance levels indicated statistical significance in each test's outcome.

5.2 Cointegration Test

The next step is to use the bounds test to assess the long-run cointegration between the budget deficit and the explanatory variables once the degree of integration has been confirmed.

Table 4: Unit root test results (variables in natural logarithm form)

Variable	ADF	
	Stationarity test at level	**Stationarity test at first difference**
BD	-2.15	-14.84***
GDP	-0.94	-3.38**
P	-6.28***	-
i	-2.43	-4.76***
M2	-4.44***	-
RER	-2.59	-9.25***

Table 5: Test for Cointegration

F-Bounds Test:	**Null Hypothesis: "No levels relationship"**			
Test Statistic	Value	Significant.	I(0)	I(1)
F	**16.73**	10%	2.26	3.35
k	5	5%	2.62	3.79
		2.5%	2.96	4.18
		1%	3.41	4.68

Table 6: The estimated ARDL model's outcomes

Variable	**Coefficient**	**Standard error**	**Probability**
Long-run formula			
GDP	-2.85***	0.78	0
P	0.002	0.01	0.87
i	0.57***	0.19	0.015
M2	1.41***	0.35	0
rer	0.25	0.19	0.18
Short-run equation			
ECT	-0.99***	0.09	0
ΔGDP	-1.32***	0.2	0
c	9.21	0.88	0

These tests are formulated with the hypotheses presented below:

H_0: There is no long-term relationship (no cointegration) between the variables.

H_1: The variables are cointegrated.

Table 5 presents the findings from the cointegration test. The study's variables are cointegrated, according to the findings.

5.3 Model Estimation

By determining the maximum lag length for the lowest value of the Schwartz information criteria, the Schwartz SC criterion was utilised to calculate the ideal lag length for the ECM. Two sub-models—a long-term model and a short-term model—were produced during the model's estimate. Table 6 displays the estimation findings.

The long-term model estimation is expressed in the following manner:

$$\hat{bd} = -2.8504\,gdp + 0.0022\,p + 0.5761\,i + 1.4172\,m_2 + 0.2562\,rer \quad (9)$$

$$D(bd) = -0.990\,ECT - 1.322\,D(gdp) + 9.219 \quad (10)$$

where D represents the distinction between the two previously mentioned variables.

The pace of correction was -0.99. It is both significant and negative at the 1% level, in line with the theory. It suggests that there is a shared connection among the variables. Based on this outcome, the budget deficit gradually moves closer to equilibrium by 99% every quarter.

The long-term results showed a negative correlation between the fiscal deficit and GDP with statistical significance at 1%. Inflation and the real exchange rate did not show any significant relationship with the budget deficit, while the interest rate and money supply showed a positive significant relationship with the budget deficit at a significance level of 1%.

The short-term results showed that GDP has a positive relationship with the budget deficit with statistical significance at 5%.

5.4 Granger Causality

Examining the relationship between the variables under study is the last phase in this approach. Granger [36] created a method that examines the relationship of causation between several factors. Both paths of causality exist between the money supply and the deficit. At a significance level of 10%, the money supply caused the deficit, whereas at the same level the deficit caused the money supply. The GDP and the deficit have a significant one-way causal connection. The money supply affects GDP in both directions and has a major effect on it; at a significance level of less than 1%, the Granger deficit causes GDP. Strong unidirectional causality is shown by variables relating interest rates, GDP, and money supply; there is no causal relationship between the other variables.

This doesn't indicate that these variables have no impact on the fiscal deficit. In certain instances, certain economic factors may not have an immediate effect and may need more time to influence and engage with other variables.

6 Conclusion

This study examines the impact of Jordan's budget deficit on its real GDP, interest rate, money supply, inflation rate,

and real exchange rate. Quarterly data from 2008 to 2023 was analyzed using the ARDL approach to investigate the connection between macroeconomic factors. To confirm the variables' stationarity and establish a long-term relationship between them, unit root and cointegration tests were conducted. The unit root test findings showed that the variables are stationary, integrated at a level, and first-order. The test results for cointegration suggested a long-term connection among the macroeconomic variables, implying that the model variables may experience short-term deviations from their long-term trend before being brought back together by forces.

It is true that there is a complicated relationship between the budget deficit and many other economic factors—one that even the most advanced mathematical model finds difficult to explain. But macroeconomic issues like sluggish economic growth and excessive inflation are brought on by a large budget deficit. When the government prints money to cover its budget deficit, it might increase inflation; when it borrows to finance its deficit, it can push away private investment expenditure and raise interest rates. Therefore, increasing development expenditures, controlling the rise of current (recurrent) expenditures, and improving domestic revenue mobilization are the best ways to fund the budget deficit.

According to the results, which are consistent with those of the neoclassical school, which found that a rise in GDP lowers the budget deficit, Jordan's budget deficit is dependent on real GDP. The coefficient's negative sign is statistically significant. Budget deficits are lessened by increases in real GDP, but they impede economic expansion. Findings also indicated a causal link between the budget deficit and real GDP, with the former causing the latter. This means that government expenditure has to be directed towards programs that would increase productivity. There's no statistically meaningful correlation between inflation and the budget deficit, so instead of letting inflation drive growth, governments can employ foreign debt deliberately. Only necessary and important times should the government intervene, with an emphasis on borrowing for investments to boost the economy, fight corruption, enact equitable taxes, and improve the health care system. To guarantee the prudent and equitable use of borrowed cash, borrowing should be done under tight guidelines.

The budget deficit is another sign that the money supply is expanding. At the 10% significance level, there is a bidirectional causal link between the money supply and the budget deficit. There is no connection between the deficit and inflation. Notably, it is challenging to incorporate all of the macroeconomic factors linked to the budget deficit in a single research due to their multiplicity. Future research incorporating factors like labour force participation, unemployment, and gross fixed capital creation might be done to investigate the connections between the macroeconomic variables and the budget deficit in more detail. In order to comprehend the causal link between the current account deficit and the budget deficit, future research may further extend the analysis.

Acknowledgment

This research is funded by Zarqa University-Jordan.

References

[1] M. Epaphra, Analysis of budget deficits and macroeconomic fundamentals: A VAR-VECM approach. *Journal of Economics and Management*,**30**, 20–57 (2017).

[2] A.A. Mohammad, I.A. Khanfar, B. Al Oraini, A. Vasudevan, I.M. Suleiman, M. Ala'a, User acceptance of health information technologies (HIT): an application of the theory of planned behavior. *Data and Metadata*,**3**, 394-394 (2024).

[3] F.M. Aldaihani, A.A. Mohammad, H. AlChahadat, S.I.S. Al-Hawary, M.F. Almaaitah, N.A. Al-Husban, A. Mohammad, Customers' Perception of the Social Responsibility in the Private Hospitals in Greater Amman. In *The Effect of Information Technology on Business and Marketing Intelligence Systems* (pp. 2177-2191). Cham: Springer International Publishing (2023).

[4] A.A. Mohammad, F.L. Aityassine, Z.N. Al-fugaha, M. Alshurideh, N.S. Alajarmeh, A.A. Al-Momani, A.M. Al-Adamat, The Impact of Influencer Marketing on Brand Perception: A Study of Jordanian Customers Influenced on Social Media Platforms. In *Business Analytical Capabilities and Artificial Intelligence-Enabled Analytics: Applications and Challenges in the Digital Era* (pp. 363-376). Cham: Springer Nature Switzerland (2024).

[5] W. Easterly, K. Schmidt-Hebbel, Fiscal Deficits and Macroeconomic Performance in Developing Countries. *The World Bank Research Observer*,**8**, 211–237 (1993).

[6] M. Friedman, *Inflation and the Rise*. In Alan S. and Blinder (Ed,): A Monetary and Fiscal History of the United States 1961–2021. Princeton University Press (2024).

[7] H. Herr, J. Priewe, Beyond the Washington consensus: Macroeconomic policies for development. *International Politics and Society*,**2**, 72-97 (2005).

[8] M. Brownbridge, E. Tumusiime-Mutebile, Aid and Fiscal Deficits: Lessons from Uganda on the Implications for Macroeconomic Management and Fiscal Sustainability. *Development Policy Review*,**25**, 193–213 (2007).

[9] A.M. Al-Adamat, M.K. Alserhan, L.S. Mohammad, D. Singh, S.I.S. Al-Hawary, A.A. Mohammad, M.F. Hunitie, The Impact of Digital Marketing Tools on Customer Loyalty of Jordanian Islamic Banks. In *Emerging Trends and Innovation in Business and Finance* (pp. 105-118). Singapore: Springer Nature Singapore (2023).

[10] P. Pomeyie, *Macroeconomics: An introductory textbook*. Wade Laurel, Accra (2001).

[11] A.A. Mohammad, I.A. Khanfar, B. Al Oraini, A. Vasudevan, I.M. Suleiman, Z. Fei, Predictive analytics on artificial intelligence in supply chain optimization. *Data and Metadata*,**3**, 395-395 (2024).

[12] A.A. Mohammad, F.N. Barhoom, M.T. Alshurideh, B.M. Almohaimmeed, B. Al Oraini, A. Abusalma, S.I.S. Al-Hawary, A. Vasudevan, R.J. Kutieshat, *Impact of Green Supply Chain Practices on Customer Satisfaction of Industrial Sector in Jordan*. In: Musleh Al-Sartawi, A.M.A., Ghura, H. (eds) artificial intelligence, sustainable technologies, and business innovation: opportunities and challenges of digital transformation. Studies in computational intelligence. Springer, Cham. Forthcoming (2024).

[13] M.M. Lwanga, J. Mawejje, Macroeconomic effects of budget deficits in Uganda: A VAR-VECM approach. *Advances in Management & Applied Economics*,**4**, 81-108 (2014).

[14] A.I. Abueid, S.I.S. Al-Hawary, A.A. Mohammad, A. Vasudevan, A. Al sarayreh, M.M. Al-rfai, F.M. Aldaihani, A. Al-Momani, S. Saraireh, *Digital Finance and Fintech Innovations to-wards Disrupting Finance Innovation*. In: Musleh Al-Sartawi, A.M.A., Ghura, H. (eds) artificial intelligence, sustainable technologies, and business innovation: opportunities and challenges of digital transformation. Studies in computational in-telligence. Springer, Cham. Forthcoming (2024).

[15] N.J. Ezema, A. Orji, Dynamics of budget deficit and macroeconomic fundamentals: Further evidence from Nigeria. *International Journal of Academic Research in Business and Social Sciences*,**5**, 31-42 (2015).

[16] K.M. Al Sawaie, Macroeconomic determinants of bank credit: Evidence from Jordan. *International Journal of Innovation, Creativity and Change*,**12**, 501–510 (2020).

[17] K. Jahmani, S.I.S. Al-Hawary, A.A. Mohammad, A. Vasudevan, A. Al-Momani, H.M. Almomani, M. Masadeh, R.I. Mohammad, R.I. Mohammad, *The Internet of Things Adoption Landscape: Insights from a Comprehensive Bibliometric Review*. In: Musleh Al-Sartawi, A.M.A., Ghura, H. (eds) artificial intelligence, sustainable technolo-gies, and business innovation: opportunities and challenges of digital transformation. Studies in computational intelligence. Springer, Cham. Forthcoming (2024).

[18] K.M. Al Sawaie, N.A. Abbas, *The Impact of the Corona Pandemic on Bank Credit: Case of Jordan*. In International Conference on Business and Technology (pp. 1370-1375). Cham: Springer International Publishing (2022).

[19] G. Abel Molocwa, Y. Khamfula, P. Cheteni, Budget deficits, investment and economic growth: a panel cointegration approach. *Investment Management and Financial Innovations*,**15**, 182–189 (2018).

[20] N.K. Akosah, Threshold effect of budget deficits on economic growth in Ghana: An empirical analysis (2013). Available at https://dx.doi.org/10.2139/ssrn.2289523.

[21] S.A. Yusuff, A. Abolaji, The impact of budget deficit on economic growth in an emerging market: An application of the ARDL technique. *Asian Development Policy Review*,**8**, 351-361 (2020).

[22] A.D. Umaru, H.M. Aliero, M. Abubakar, Budget Deficit and Economic Growth in Nigeria. *CBN Economic and Financial Review*,**59**, 23-41 (2021).

[23] S. Sabr, Y. Ahmed, T. Khan, Government Budget Deficit and Economic Growth: Evidence from Iraq 1980-2018. *Arab Journal of Administration*,**41**, 389-404 (2021).

[24] O.K.T. Tran, Does there exist an optimal budget balance to improve economic growth? Empirical evidence from Asian countries. *Cogent Economics & Finance*,**10**, 2114174 (2022).

[25] A.A. Bhari, W.Y. Lau, M. Aslam, T.M. Yip, The nexus between fiscal deficit and economic growth in Malaysia. *JATI-Journal of Southeast Asian Studies*,**25**, 79-94 (2020).

[26] K. Helali, K. Maha, Budget Deficits Effects on Tunisian Economic Growth. *SSRN Electronic Journal* (2021). https://doi.org/10.2139/ssrn.3877118

[27] J. Kassem, The impact of fiscal deficit on economic growth: An empirical study in selected MENA countries. *Journal of Governance and Regulation*,**13**, 223–230 (2024).

[28] E. Mavodyo, The impact of budget deficit on economic growth and its channels in South Africa. *African Journal of Economic and Management Studies*,**14**, 509–523 (2022).

[29] A. Mohammad, R. Aldmour, S. Al-Hawary, Drivers of online food delivery orienta-tion. *International Journal of Data and Network Science*,**6**, 1619-1624 (2022).

[30] A.S. Al-Adwan, The meta-commerce paradox: exploring consumer non-adoption intentions. *Online Information Review*,**48**, 1270-1289 (2024).

[31] A. Subramanya, Fiscal deficit and economic growth nexus: Further evidence from India through disaggregated approach using ARDL bounds test to cointegration. *International Journal of Recent Scientific Research*,**12**, 42403–42407 (2021).

[32] L.A.V. Catão, M.E. Terrones, Fiscal deficits and inflation. *Journal of Monetary Economics*,**52**, 529–554 (2005).

[33] A. Al-Adwan, R.K. Meet, S. Anand, G.P. Shukla, R. Alsharif, M. Dabbaghia, Understanding continuous use intention of technology among higher education teachers in emerging economy: evidence from integrated TAM, TPACK, and UTAUT model. *Studies in Higher Education*, 1-20 (2024).

[34] A.S. Al-Adwan, S. AlMasaeed, H. Yaseen, H. Balhareth, L.A. Al-Mu'ani, M. CPavlíková, Navigating the roadmap to meta-governance adoption. Global Knowledge, Memory and Communication (2024). https://doi.org/10.1108/GKMC-02-2024-0105

[35] F.W. Ahking, S.M. Miller, The relationship between government deficits, money growthm and inflation. *Journal of Macroeconomics*,**7**, 447–467 (1985).

[36] C.W. Granger, Investigating Causal Relations by Econometric Models and Cross-spectral Methods. *Econometrica*,**37**, 424 (1969).

Khaled Mohammed Al-Sawaie is affiliated with the Faculty of Economics and Administration sciences at Zarqa University, located in Zarqa, Jordan. His research interests lie primarily in monetary theory and growth issues, where he has made significant contributions to both fields.His Orcid ID is: https://orcid.org/0000-0002-9866-2736

Nidal Ali Abbas is affiliated with the Faculty of Economics and Administration sciences at Zarqa University, located in Zarqa, Jordan. His research interests in cash policies and investment, where he has made significant contributions to both fields. His Orcid ID is: https://orcid.org/0000-0002-0131-0911

Ahmad HabesAlmajali is a Assistant Professor in the Department of Islamic Banking at the Faculty of Economics and Administrative Sciences at Zarqa University, Jordan. His research interests are in the fields of finance, investment and economic development. His Orcid ID is: https://orcid.org/0009-0008-5559-7912

Hamza Mahmoud Alrawashdeh is affiliated with the Faculty of Economics and Administration sciences at Zarqa University, located in Zarqa, Jordan. His research interests lie primarily in monetary theory and growth issues, where he has made significant contributions to both fields. His Orcid ID is: https://orcid.org/0009000692296524

Mohammad Matroud Al-Smeiran faculty member in the Department of Economics, College of Economics and Administrative Sciences, Zarqa University / Jordan. Research interests focus on investments and economic development issues in both aspects. His Orcid ID is: https://orcid.org/0009-0004-2354-3494

Fayez Haddad is a distinguished member of the Financial Technology Department at the Hourani Center for Applied Scientific Research, Al-Ahliyya Amman University in Amman, Jordan. His work focuses on advancing the field of financial technology through innovative research and practical applications. Dr. Haddad is dedicated to fostering academic and industry collaboration, contributing to the development of cutting-edge solutions in the rapidly evolving fintech landscape.

Asokan Vasudevan is a distinguished academic at INTI International University, Malaysia. He holds multiple degrees, including a PhD in Management from UNITEN, Malaysia, and has held key roles such as Lecturer, Department Chair, and Program Director. His research, published in esteemed journals, focuses on business management, ethics, and leadership. Dr. Vasudevan has received several awards, including the Best Lecturer Award from Infrastructure University Kuala Lumpur and the Teaching Excellence Award from INTI International University. His Orcid ID is: https://orcid.org/0000-0002-9866-4045

Suleiman Ibrahim Mohammad is a Professor of Business Management at Al al-Bayt University, Jordan (currently at Zarqa University, Jordan), with more than 23 years of teaching experience. He has published over 500 research papers in prestigious journals. He holds a PhD in Financial Management and an MCom from Rajasthan University, India, and a Bachelor's in Commerce from Yarmouk University, Jordan. His research interests focus on supply chain management, Marketing, and total quality (TQ). His Orcid ID is: https://orcid.org/0000-0001-6156-9063

Wen Zhou is a student in the Faculty of Liberal Arts at Shinawatra University, Thailand. Dedicated to academic growth and interdisciplinary learning, Wen Zhou actively engages in studies that foster critical thinking and a broad understanding of liberal arts disciplines, preparing for a dynamic and impactful future in their chosen field.