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Article

Fiscal policy and inflation determinants in Tunisia: An ARDL model approach

Samira Youssef Brahmia[1,2,3]

[1] Department of Finance and Investment, Faculty of Business Administration, University of Tabuk, Tabuk 71491, KSA; Sbrahmyah@ut.edu.sa
[2] CODECI, FSEG Sfax-University of Sfax, Sfax 3018, Tunisia
[3] ISFF Sousse-University of Sousse, Sousse 4000, Tunisia

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Abstract: This study examines the determinants of inflation in Tunisia from 1998 to 2023, with a particular focus on the role of fiscal policy. The study analyzes the long-run and short-run relationships between inflation and key macroeconomic variables, including government expenditure, government revenue, money supply, balance of trade, and budget deficits using ARDL model. The empirical findings reveal that budget deficits have a significant and positive impact on inflation, underscoring the critical role of fiscal imbalances in driving price instability. In contrast, government expenditure, government revenue, money supply, and balance of trade do not exhibit statistically significant long-term effects on inflation. The results highlight the importance of fiscal discipline and effective coordination between fiscal and monetary policies to achieve price stability. These findings provide valuable insights for policymakers in Tunisia and other developing economies facing similar inflationary pressures, emphasizing the need for prudent fiscal management and structural reforms to mitigate inflation volatility and ensure macroeconomic stability.

Keywords: inflation dynamics; monetary-fiscal interaction; macroeconomic stability; ARDL; Tunisia

1. Introduction

Inflation remains a key macroeconomic concern in both developed and developing economies, affecting economic stability, investment decisions, and social welfare. In developing economies such as Tunisia, inflation volatility poses significant challenges for policymakers, as unpredictable fluctuations in price levels can undermine growth prospects, distort resource allocation, and erode purchasing power. Given Tunisia's economic structure—characterized by a significant public sector, reliance on agriculture and tourism, and vulnerability to external shocks—understanding the factors' driving inflation is essential for designing effective stabilization policies.

Despite various policy interventions, inflation in Tunisia continues to exhibit volatility, raising concerns about the effectiveness of fiscal policy measures in stabilizing prices. The core objective of this study is to examine the impact of fiscal policy on inflation dynamics in Tunisia, specifically analyzing how government expenditure, government revenue, budget deficits, money supply, and balance of trade influence inflation over time. While economic theories provide different perspectives on the fiscal policy-inflation relationship, empirical evidence varies depending on the economic structure, policy environment, and external influences affecting a country.

Tunisia has experienced periods of high inflation, often linked to fiscal imbalances, external trade deficits, and monetary policy constraints. Given the

country's efforts to implement structural economic reforms and maintain fiscal sustainability, it is critical to assess whether fiscal policy decisions contribute to inflationary pressures or help mitigate them. This study is motivated by the need to provide empirical evidence on whether Tunisia's fiscal policy framework effectively manages inflation or exacerbates its volatility.

The research is guided by the following key question: To what extent do fiscal policy variables (government expenditure, government revenue, budget deficits, money supply, and balance of trade) influence inflation in Tunisia? Answering this question is crucial for policymakers seeking to improve fiscal management and control inflation while fostering sustainable economic growth.

To investigate this issue, this study employs the Autoregressive Distributed Lag (ARDL) model, a robust econometric approach well-suited for analyzing both short-run and long-run relationships in time-series data. The ARDL model allows us to determine whether fiscal policy variables have a statistically significant effect on inflation in Tunisia and whether their impact differs in the short and long term.

The analysis uses annual data from 1998 to 2023, sourced from the Central Bank of Tunisia and the World Bank, ensuring a comprehensive assessment of Tunisia's inflation dynamics over the past two decades. The study applies econometric techniques such as unit root tests, cointegration analysis, and Granger causality tests to establish relationships between the key fiscal variables and inflation.

This paper is structured as follows: Section 2 provides a literature review on the relationship between fiscal policy and inflation, drawing insights from both theoretical perspectives and empirical studies. Section 3 outlines the research methodology, detailing the econometric approach, model specification, and data sources. Section 4 presents the empirical findings and statistical results. Section 5 discusses the implications of the findings in the context of fiscal and monetary policy coordination. Section 6 concludes with key insights, policy recommendations, and suggestions for future research. By providing a comprehensive analysis of the fiscal policy-inflation relationship in Tunisia, this study contributes to the broader economic literature and offers actionable policy insights for managing inflation in developing economies.

2. Literature review

Inflation is a key macroeconomic challenge, particularly in developing economies where fiscal policy significantly influences price stability. While fiscal deficits, government spending, and revenue policies impact inflation, their effects vary across countries depending on economic structure and policy frameworks. In developed economies, strong monetary institutions mitigate fiscal policy's inflationary impact, whereas in Tunisia, fiscal imbalances and monetary financing may amplify inflationary pressures. This section reviews the theoretical and empirical literature on the fiscal policy-inflation nexus, focusing on government expenditure, revenue, budget deficits, money supply, and trade balance, while identifying gaps that justify this study's focus on Tunisia.

Understanding the relationship between fiscal policy and inflation is essential for policymakers to design effective economic stabilization strategies (Fischer et al., 2002). Fiscal policy, encompassing government revenue and expenditure,

significantly influences economic outcomes. Keynesian theory suggests that increased government spending raises aggregate demand, potentially leading to inflation when the economy nears full capacity, while spending cuts reduce inflationary pressures (Blanchard, 2009; Blanchard and Johnson, 2013). In contrast, Monetarist theory, as articulated by Friedman (1968), posits that inflation is primarily driven by money supply, with fiscal deficits contributing to inflation if financed through monetary expansion (Sargent and Wallace, 1981) Empirical studies show mixed results. In developed economies, strong monetary frameworks often weaken the link between fiscal policy and inflation (Catao and Terrones, 2005). Understanding the fiscal-monetary policy interplay remains crucial for managing inflation effectively.

Tunisia's fiscal policy plays a n important role in shaping inflation dynamics, with government spending, taxation, and monetary policy influencing macroeconomic stability. Research using different econometric models has provided valuable insights into these relationships. A Fiscal DSGE model analysis highlighted the need for policy coordination to control inflation (Slaimne et al., 2011). while a SVAR model demonstrated the significant impact of discretionary fiscal policies on economic stability (Mahfoudh and Gmach, 2021). An ARDL model assessment found that taxation and government revenue influence economic performance, though their inflationary effects vary (Mahfodh and Gmach, 2021). Additionally, End et al. (2020) review of Tunisia's monetary policy post-Arab Spring linked fiscal imbalances to inflation trends. However, limited studies integrate fiscal and monetary perspectives using advanced econometric techniques like ARDL. This study addresses this gap by examining both short- and long-run effects of fiscal policy on inflation in Tunisia from 1998 to 2023, providing empirical insights for economic stability. For instance, Afonso and Jalles (2014) examined the impact of fiscal policy on economic performance in a broad sample of countries, finding that fiscal consolidation is generally associated with lower inflation in the long run.

2.1. Government revenue and inflation

The relationship between government revenue and inflation is pivotal in understanding fiscal policy's role in macroeconomic stability. Government revenue, primarily derived from taxes and other forms of public income, can influence inflation through its effects on fiscal balance and aggregate demand. Higher government revenue typically enables better fiscal balance, reducing the need for deficit financing, which can help mitigate inflationary pressures. This is particularly relevant in developing economies where fiscal imbalances often lead to inflationary financing methods, such as printing money.

Recent empirical studies offer nuanced insights into this relationship. Nguyen and Trinh (2018) examined the impact of government revenue on inflation in Vietnam, finding that increased government revenue helps stabilize inflation by improving the fiscal position and reducing reliance on debt and monetary expansion. Their study suggests that efficient tax collection and enhanced revenue generation are crucial for controlling inflation. Additionally, David and Leigh (2018) explored how fiscal consolidations, which often involve increasing government revenue through taxation, affect inflation. They found that successful fiscal consolidations can lead to lower

inflation rates, particularly when public debt levels are high and inflation expectations are well-anchored. This underscores the importance of credible and sustainable fiscal policies in achieving price stability. Moreover, the composition of government revenue also matters. For example, indirect taxes such as Value Added Tax (VAT) can have immediate inflationary effects by directly increasing prices, while direct taxes like income tax might have a more muted impact on inflation through their effects on disposable income and aggregate demand.

In developing economies, efficient revenue generation is often challenged by Informal economic activities and administrative inefficiencies. Enhancing the efficiency of tax systems and broadening the tax base are critical strategies for increasing government revenue without exacerbating Inflation. Studies like that of Gupta (2017) highlight the need for structural reforms in tax administration to ensure that increased revenue does not lead to Inflationary pressures.

2.2. Government expenditure and inflation

The relationship between government expenditure and inflation is a significant focus in economic research, particularly in the context of developing economies where fiscal policy plays a crucial role in macroeconomic stability. Government expenditure can influence inflation through various channels. In line with Keynesian economic theory, a rise in government expenditure stimulates aggregate demand, potentially causing inflation to increase, particularly when the economy is functioning close to or at full capacity. This is because higher demand can push up prices when supply constraints exist. Conversely, reducing government expenditure can decrease aggregate demand, thereby alleviating inflationary pressures.

Empirical evidence on this relationship is mixed, often varying by country and economic context. In developing economies, studies have shown that government spending tends to have a more pronounced impact on inflation. For instance, Ouedraogo and Sourouema (2018) investigated the effect of government spending on inflation in the West African Economic and Monetary Union (WAEMU) countries. They found that increased government expenditure significantly raised inflation, highlighting the direct impact of fiscal policy on price levels in these economies. Furthermore, Tujula and Wolswijk (2020) analyzed fiscal policy and its impact on the business cycle in OECD countries, concluding that counter-cyclical fiscal policies, including increased government spending during economic downturns, can help stabilize inflation. However, they also noted that the effectiveness of such policies depends on overall fiscal discipline and the ability to manage public finances sustainably. Likewise, David and Leigh (2018) have also emphasized the role of public debt and inflation expectations in shaping the relationship between fiscal consolidations (which often involve cuts in government spending) and inflation. Their findings suggest that while fiscal consolidations can lead to lower inflation, the outcomes are significantly influenced by the levels of public debt and the credibility of fiscal policy. Similarly, Balcilar et al. (2017) used time series data to explore the dynamic effects of fiscal policy shocks on inflation in South Africa, highlighting the significance of government expenditure in influencing inflationary pressures.

2.3. Budget deficit and inflation

A budget deficit occurs when a government's expenditures exceed its revenues, often necessitating borrowing or money creation to finance the gap. This can lead to inflationary pressures if the deficit is monetized, increasing the money supply without a corresponding increase in goods and services.

Prior literature provides robust evidence of the connection between budget deficits and inflation. For instance, Catao and Terrones (2019) conducted an extensive study across emerging markets and found a strong positive correlation between budget deficits and inflation. Their analysis indicates that larger deficits are associated with higher inflation rates, particularly in countries with limited access to international capital markets and weak fiscal institutions. This underscores the inflationary risk posed by fiscal imbalances in developing economies. Similarly, Kirchner and Van Wijnbergen (2016) explored the dynamics of fiscal deficits and inflation in emerging markets, emphasizing the role of monetary policy. They found that when fiscal deficits are financed through money creation, it leads to significant inflationary pressures. Their study highlights the importance of coordination between fiscal and monetary policies to manage inflation effectively. Likewise, Buiter (2018) examined the impact of fiscal deficits on inflation in various economies and found that the relationship is contingent on the credibility of fiscal and monetary authorities. In countries where fiscal discipline is weak and monetary policy lacks independence, budget deficits tend to have a more pronounced impact on inflation. This suggests that institutional quality plays a crucial role in mediating the effects of fiscal deficits on inflation. Belguith and Ellouze (2020) utilized vector autoregression (VAR) models to analyze the relationship between fiscal policy variables, including budget deficits and inflation. Their findings indicate that budget deficits significantly contribute to inflationary pressures in Tunisia, emphasizing the need for fiscal consolidation and improved fiscal governance to achieve macroeconomic stability. Therefore, effective management of budget deficits, through both fiscal consolidation and robust fiscal institutions, is essential for controlling inflation, particularly in developing economies where fiscal imbalances are more likely to lead to inflationary outcomes. Akinbobola (2012) employed cointegration and error correction models to analyze the relationship between fiscal deficits and inflation in Nigeria, finding evidence of a long-run equilibrium relationship between the variables. Similarly, Adam and Bevan (2005) used cointegration techniques to study the impact of fiscal policy on inflation in developing countries, concluding that fiscal deficits have a significant long-run impact on inflation.

2.4. Money supply and inflation

The classical quantity theory of money, articulated by Milton Friedman, posits that inflation is "always and everywhere a monetary phenomenon," suggesting that changes in the money supply have direct impacts on the price level when the velocity of money and real output are stable (Blanchard and Johnson, 2013). Recent empirical research continues to explore this relationship, particularly in the context of both developed and developing economies. Bordo and Siklos (2018) provided a comprehensive historical analysis, emphasizing that central bank credibility and

inflation targeting are crucial in moderating the inflationary effects of changes in the money supply. Their study underscores the importance of effective monetary policy frameworks in controlling inflation. However, in developing economies, where monetary policy may be less effective, the relationship between money supply and inflation tends to be more pronounced. For instance, Naceur and Kandil (2019) examined the impact of money supply on inflation in Middle Eastern and North African (MENA) countries. They found that increases in money supply significantly contributed to inflationary pressures, highlighting the challenges these countries face in maintaining price stability amid rapid monetary expansion. Moreover, Mishra and Mishra (2020) explored the dynamics of money supply and inflation in India using time series econometric models. Their findings indicated a strong positive correlation between money supply growth and inflation, particularly in periods of high economic growth. This study demonstrated that in the absence of stringent monetary controls, increases in money supply could lead to substantial inflationary pressures. While Teles and Mussolini (2014) focused on inflation-targeting regimes and the role of money supply in monetary policy. They argued that even in regimes where inflation targeting is the primary focus, controlling the money supply remains crucial for achieving long-term price stability. Their empirical analysis showed that deviations from targeted money supply levels could lead to significant inflationary fluctuations.

2.5. Balance of trade and Inflation

The relationship between the balance of trade and inflation is multifaceted, involving the interplay between external economic activities and domestic price levels. A trade deficit, where imports exceed exports, can lead to inflationary pressures by weakening the domestic currency, thereby increasing the cost of imported goods and services. Siddique et al., (2019) investigated the impact of trade openness on inflation in developing countries. Their study found that trade deficits tend to exacerbate inflationary pressures, as increased reliance on imports makes countries vulnerable to external price shocks and currency depreciation. The findings underscore the importance of maintaining a balanced trade position to mitigate inflation risks. Furthermore, Yazid and Kurniawan (2017) explored the balance of trade and inflation dynamics in Indonesia, an emerging market economy. Their analysis revealed that trade deficits contributed to higher inflation by increasing the cost of imported goods, particularly in periods of currency depreciation. The study highlighted the need for policies aimed at boosting exports and achieving a more favorable trade balance to control inflation. Additionally, Narayan and Narayan (2010) examined the long-term relationship between trade balance and inflation in Asian economies. Using cointegration and error correction models, they found that a persistent trade deficit leads to inflationary pressures over time, primarily due to the depreciation of the local currency and increased import prices. This long-term perspective emphasizes the structural aspects of trade and its implications for inflation. Hossain (2021) concluded that while the short-term effects of trade deficits on inflation might be moderate, the long-term impacts are significant. This suggests that sustainable trade policies and efforts to improve trade balances are critical for long-term price stability.

In the context of Tunisia, the fiscal policy landscape has been marked by efforts to balance economic growth and fiscal sustainability. Previous research has shown that fiscal policy plays a significant role in economic performance. Boughrara & Ghazouani (2010) investigated the relationship between fiscal deficits and inflation in Tunisia, finding that fiscal deficits financed through money creation contribute significantly to inflationary pressures. More recent studies have provided additional insights. For instance, Boughzala (2019) explored the effects of fiscal policy on inflation in Tunisia, emphasizing the importance of controlling government expenditure to manage inflationary pressures. The study highlighted the need for structural reforms to enhance fiscal discipline and improve the efficiency of public spending.

Despite extensive research on the relationship between fiscal policy and inflation, limited empirical studies focus specifically on Tunisia using advanced econometric models. While previous research has explored the general impact of fiscal variables on inflation in developing economies, few studies employ the Autoregressive Distributed Lag (ARDL) model to examine both short-run and long-run effects within the Tunisian context. Moreover, the existing literature often isolates fiscal or monetary policy, failing to consider their combined influence on inflation dynamics. This study fills this gap by integrating fiscal and monetary perspectives, providing a more comprehensive empirical analysis of how government expenditure, revenue, budget deficits, money supply, and trade balance impact inflation. The findings contribute to policy discussions on inflation control, particularly for developing economies with fiscal constraints similar to Tunisia.

3. Methodology

3.1. Research model and variables

The Quantity Theory of Money (QTM) serves as a fundamental framework for understanding the relationship between money supply and inflation. The basic equation representing QTM is:

$$MV = PQ \tag{1}$$

where:

M = Money supply;

V = Velocity of money (the rate at which money circulates in the economy);

P = Price level;

Q = Real output (GDP).

Further, this study examines the impact of fiscal policy on inflation in Tunisia using the Autoregressive Distributed Lag (ARDL) model, which allows for estimating both short-run and long-run relationships between macroeconomic variables. The empirical model is specified as:

$$Inf_{it} = \alpha 0 + \alpha 1\ GoE_{it} + \alpha 2\ GoR_{it} + \alpha 3\ MSup_{it} + \alpha 4\ BoT_{it} + \alpha 5\ BD\ it + \varepsilon_{it} \tag{2}$$

where:

Inf_{it} = Inflation rate (dependent variable);

GoE_{it} = Government expenditure;

GoR_{it} = Government revenue;
$MSup_{it}$ = Money supply;
BoT_{it} = Balance of trade;
BD_{it} = Budget deficit;
ε = Error term.
After taking logarithm for Equation (2).

$$\text{Ln } Inf_{it} = \alpha 0 + \alpha 1 \text{ Ln } GoE_{it} + \alpha 2 \text{ Ln } GoR_{it} + \alpha 3 \text{ Ln } MSup_{it} + \alpha 4 \text{ Ln } BoT_{it} + \alpha 5 \text{ Ln } BD_{it} \quad (3)$$

3.2. Variables description

The study examines the relationship between fiscal policy and inflation in Tunisia using key macroeconomic variables. Inflation (Inf), the dependent variable, is measured by the consumer price index. The independent variables include Government Expenditure (GoE), representing total public spending, and Government Revenue (GoR), which captures government income from taxes and other sources—both sourced from the Central Bank of Tunisia. Money Supply (Msup), reflecting total liquid assets in the economy, and Balance of Trade (BoT), measuring the difference between exports and imports, are obtained from the World Bank Database. Lastly, Budget Deficit (BD), indicating fiscal imbalances, is also sourced from the World Bank as shown in **Table 1**.

Table 1. Variables description.

Variable		Code	Definition	Source of Data
Dependent variable	Inflation	Inf	Represents the consumer price index, measuring fluctuations in consumer expenses using the Laspeyres formula.	Central Bank of Tunisia
Independent variables	Government Expenditure	GoE	Total government public spending across various levels, including expenditures on administration, defense, education, healthcare, infrastructure, etc.	Central Bank of Tunisia
	Government Revenue	GoR	Total income received by the government from tax revenues, non-tax revenues, and other sources to finance obligations.	Central Bank of Tunisia
	Money Supply	Msup	Total monetary assets available in the economy, including currency, bank reserves, deposits, and other liquid assets.	World Bank Database
	Balance of Trade	BoT	Difference between a country's exports and imports over a specific period, categorized as trade surplus or trade deficit.	World Bank Database
	Budget Deficit	BD	Current and capital revenue minus total government expenditure and lending minus repayments in local currency.	World Bank Database

3.2. Analysis of the data

The study's analysis was conducted using secondary data obtained from the official Tunisia Central Bank and the World Bank. The variables utilized were clearly defined with data sourced from the World Bank. EViews 12 software was utilized for the analysis due to its flexibility and user-friendly features. This software effectively supported tasks such as data management, visualization, and analysis, leading to a thorough and efficient analytical process.

3.3. Econometric methodology

This study employs econometric techniques to address time series challenges, causality, and cointegration. The Autoregressive Distributed Lag (ARDL) model is used to estimate long-term relationships and dynamic interactions between variables. Unlike traditional regression models, ARDL includes lagged values of both dependent and independent variables, capturing temporal dynamics. When cointegration is present, an Error Correction Mechanism (ECM) is incorporated to adjust short-term deviations toward long-term equilibrium. Therefore, If the *F*-statistic exceeds the upper bound critical value, a long-run relationship is confirmed. The analytical framework incorporates various econometric techniques, such as the Augmented Dickey-Fuller Unit Root Test to check if the variables are stationary or contain a unit root. If the test statistic is more negative than the critical value, the null hypothesis of non-stationarity is rejected.

DOLS represents a statistical methodology employed for estimating parameters in dynamic regression models that integrate time series data, which may exhibit potential integration characteristics. DOLS proves to be an effective instrument in the estimation of cointegrating relationships, particularly in economic datasets characterized by non-stationarity. Its utility lies in its ability to rectify potential biases stemming from dynamic variable interactions, thereby ensuring that the estimated parameters accurately capture genuine long-term relationships.

The general formula for a DOLS model can be represented as follows:

$$Yt = \alpha + \beta X_t + \sum_{k=p}^{q} \gamma k \Delta Xt + k + \epsilon_t \quad (4)$$

where:

Yt: is the dependent variable at time *t*.

α: is the intercept term.

β: is the coefficient for the long-run relationship between Yt and X_t.

X_t: are the independent variables at time *t*.

ΔX_{t+k}: is the first difference of the independent variables, where *k* ranges from $-p$ (lags) to q (leads).

γk: are the coefficients for the differenced independent variables, capturing the short-run dynamics.

ϵ_t: is the error term, assumed to be white noise.

The Johansen cointegration test is a statistical procedure used to determine the number of cointegrating relationships among a set of non-stationary time series variables. The Objective is to determine if there exists a long-run equilibrium relationship between inflation and fiscal policy variables. The starting point for the Johansen test is a VAR model of order *k*, which captures the dynamics of a set of n non-stationary time series variables:

$$Xt = A_1 X_{t-1} + A_2 X_{t-2} + \cdots + Ak X_{t-k} + \epsilon_t \quad (5)$$

where:

Xt is an $n \times 1$ vector of non-stationary I(1) variables.

*A*1, *A*2, …, *Ak* are $n \times n$ matrices of coefficients.

ϵ_t is an $n \times 1$ vector of white noise error terms.

To test for cointegration, the VAR model is transformed into a Vector Error Correction Model (VECM), which can be expressed as:

$$\Delta \mathrm{Xt} = \Pi Xt - 1 + \sum_{i=1}^{k-1} \Gamma \mathrm{i} \Delta \mathrm{Xt} - \mathrm{i} + \epsilon \mathrm{t} \quad (6)$$

where:

$\Delta Xt = Xt - Xt{-}1$ represents the first difference of Xt.

$\Pi = \alpha\beta'$ is the impact matrix, which provides information about the long-term relationships among the variables. α is the matrix of adjustment coefficients, indicating the speed at which the system returns to equilibrium. β is the matrix of cointegrating vectors, representing the long-term equilibrium relationships.

Γi are matrices capturing short-term dynamics.

k is the number of lags included in the model.

The Johansen test provides two main statistics to test for the number of cointegrating vectors (r):

$$\text{Trace Statistic} = -\mathrm{Ti} = \mathrm{r} + 1 \sum \mathrm{n} \ln(1 - \lambda i) \quad (7)$$

The trace test examines the null hypothesis that there are at most r cointegrating vectors. The maximum eigenvalue test evaluates the null hypothesis that the number of cointegrating vectors is r against the alternative of r + 1.

$$\text{Max nEigenvalue Statistic} = -T \ln(1 - \lambda_{r+1})$$

The ECM is based on the idea that even though time series variables may deviate from their long-run equilibrium in the short run, they tend to adjust to restore equilibrium over time. The ECM captures this adjustment process, quantifying how quickly the variables return to equilibrium following a short-term shock.

$$\Delta Y_t = \alpha + \beta\, \Delta X_{t+\lambda}(\mathrm{ECT}_{t-1}) + \epsilon_t \quad (8)$$

where:

$\Delta Yt = Yt - Yt{-}1$ is the change in the dependent variable.

$\Delta Xt = Xt{-}Xt{-}1$ is the change in the independent variable.

α is the intercept term.

β is the short-run coefficient measuring the immediate impact of changes in Xt on Yt.

λ is the error correction coefficient, indicating the speed of adjustment back to the long-run equilibrium.

ϵt is the white noise error term.

ECTt−1 is the error correction term, which is the lagged residual from the long-run cointegration equation:

$$\mathrm{ECT}_{t-1} = Y_{t-1-\gamma} X_{t-1} \quad (9)$$

The Granger Causality Test examines whether one time series can predict another, helping to determine the direction of causality between economic variables. It does not imply true causation but assesses the predictive power of past values of one variable on another. In this study, the test evaluates whether fiscal policy variables (government expenditure, revenue, budget deficits, money supply, and trade balance)

Granger-cause inflation in Tunisia. The null Hypothesis is the independent variable does not Granger-cause inflation (i.e., past values of the variable do not significantly improve inflation forecasts).

4. Results

4.1. Descriptive statistics

Table 2 presents the descriptive statistics for the variables of the study. The statistics include measures of central tendency, dispersion, the shape of the distribution, and other summary statistics based on 26 observations. The variables show varying levels of central tendency and dispersion. For instance, Ln GoR (government revenue) and Ln MSup (money supply) have higher average values compared to others. Moreover, the standard deviation indicates that Ln BoT (balance of trade) is the most volatile, whereas Ln GoE (government expenditure) is the least. Skewness and kurtosis values suggest that most variables are fairly symmetric with moderate tail weight, except for Ln BD (budget deficit), which shows significant kurtosis, indicating potential outliers. The Jarque-Bera test confirms normal distribution for most variables except for Ln BD

Table 2. Descriptive statistics.

Statistic	LNInf	Ln GoR	Ln MSup	Ln GoE	Ln BoT	Ln BD
Mean	1.46	11.87	10.76	9.87	8.05	8.91
Median	1.47	12.01	10.71	9.92	8.27	9.12
Maximum	2.25	12.46	11.71	10.15	9.86	9.25
Minimum	0.76	10.94	9.99	9.51	5.09	7.35
Std. Dev.	0.38	0.53	0.55	0.22	1.31	0.48
Skewness	0.25	−0.37	0.18	−0.34	−0.32	−0.27
Kurtosis	2.54	1.63	1.84	1.69	2	6.53
Jarque-Bera	0.51	2.63	1.6	2.35	1.63	32.14
Probability	0.77	0.27	0.45	0.31	0.44	0.000
Sum	38.08	308.68	279.72	256.7	209.39	231.62
Sum Sq. Dev.	3.7	6.93	7.69	1.26	42.68	5.78
Observations	26	26	26	26	26	26

4.2. The Augmented Dickey-Fuller (ADF)

ADF test is used to check for the presence of unit roots in time series data, which indicates whether the data is non-stationary. The null hypothesis for the ADF test is that the time series has a unit root (is non-stationary). As shown in **Table 3**, all the variables Ln Inf, Ln GoE, Ln MSup, Ln BoT, and Ln BD are non-stationary at their levels. However, all the variables become stationary after first differencing, as indicated by the significant *t*-values and low *p*-values.

These results suggest that most variables require first differencing to achieve stationarity, which is crucial for time series analysis to avoid spurious regression results.

Table 3. Augmented Dickey-Fuller test results.

Variables	Level					First Difference				
	1%	5%	10%	*t*-Values	*p*-Values	1%	5%	10%	*t*-Values	*p*-Values
LNInf	−3.74	−2.99	−2.64	−1.93	0.31	−3.74	−2.99	−2.64	−9.72	0.00
Ln GoE	−3.72	−2.99	−2.63	−1.37	0.58	−3.74	−2.99	−2.64	−5.74	0.00
Ln GoR	−3.72	−2.99	−2.63	−3	0.05	−4.39	3.61	−3.24	−3.708	0.041
Ln MSup	−3.72	−2.99	−2.63	1.62	1	−3.74	−2.99	−2.64	−4.75	0.00
Ln BoT	−3.72	−2.99	−2.63	−1.27	0.63	−3.74	−2.99	−2.64	−6.26	0.00
Ln BD	−3.72	−2.99	−2.63	−1.49	0.52	−3.74	−2.99	−2.64	−6.59	0.00

4.3. Cointegration

Table 4 presents the result of an Unrestricted Cointegration Rank Test (Trace), which is used to determine the number of cointegrating relationships in a multivariate time series dataset. The trace test suggests that there are at least two cointegrating equations at the 5% significance level. This indicates a long-run equilibrium relationship among the variables in the dataset. The presence of cointegrating relationships implies that despite short-term fluctuations, the variables move together in the long run.

Table 4. Unrestricted cointegration rank test (trace).

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.92	170.91	117.71	0
At most 1 *	0.86	110.66	88.8	0
At most 2 *	0.67	63.51	62.75	0.05
At most 3	0.5	36.52	42.92	0.19
At most 4	0.44	19.5	25.87	0.25
At most 5	0.22	5.95	12.52	0.47

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level ** MacKinnon-Haug-Michelis (1999) *p*-values

4.4. VAR result

The VAR Lag Order Selection Criteria table provides strong evidence that a VAR model with one lag is optimal for the given data. This conclusion is robust across multiple criteria (Log L, LR, FPE, AIC, SC, HQ), each indicating that the model fit improves significantly with one lag and that further lags do not provide additional benefits. This optimal lag length should be used in subsequent VAR modeling and analysis to ensure accurate and reliable results. (see **Table 5**)

Table 5. VAR Lag Order Selection Criteria.

Lag	Log L	LR	FPE	AIC	SC	HQ
0	40.73	NA	3.95E-08	-2.86	-2.61	-2.79
1	173.53	201.8504*	7.44e-12*	-11.48219*	-10.01954*	-11.07652*

4.5. Correlation result

The correlation matrix provides insight into the linear relationships between the variables, which can be useful for understanding the dynamics and interactions within the dataset. However, it is important to note that correlation does not imply causation, and further analysis (such as Granger causality) would be needed to Infer causality. The correlation matrix shows the strength and direction of the linear relationships between pairs of variables. There are very strong positive correlations between Ln GoR, Ln MSup, and Ln GoE, indicating that these variables tend to move together. As government revenue increases, money supply and government expenditure also increase. Ln Inf shows moderate positive correlations with Ln GOR, Ln MSup, Ln GoE, and Ln BoT, suggesting that Inflation is somewhat Influenced by these factors. Ln BD has negative correlations with all other variables, particularly with Ln MSup and Ln GoR, indicating that higher budget deficits are associated with lower values of these variables. (see **Table 6**)

Table 6. Correlation matrix.

	Ln Inf	**Ln GOR**	**Ln MSUP**	**Ln GOE**	**Ln BoT**	**Ln BD**
Ln Inf	1					
Ln GOR	0.598	1				
Ln MSUP	0.566	0.958	1			
Ln GOE	0.558	0.975	0.918	1		
Ln BoT	0.504	0.91	0.886	0.881	1	
Ln BD	−0.422	−0.543	−0.707	−0.377	−0.533	1

4.6. DOLS estimation results

Among the variables, Ln BD (Log of Budget Deficit) has a *p*-value of 0.05, indicating that it is marginally significant at the 5% level. This suggests that the budget deficit has a statistically significant positive impact on inflation in Tunisia. The other variables (Ln MSup, Ln GoR, Ln GoE, and Ln BoT) have *p*-values greater than 0.05, indicating that they are not statistically significant. That is to say, there is not enough evidence to suggest that these variables have a significant impact on the dependent variable within this model. The results suggest that, in this model, the budget deficit is the most influential factor affecting the dependent variable (Ln Inf), with a positive relationship. However, the lack of significance for other variables suggests that their effects are not strong enough to be distinguished from zero in this analysis. The positive coefficient for the budget deficit indicates that an increase in the budget deficit is associated with an increase in Inflation. (see **Table 7**)

Table 7. Dynamic least squares (DOLS) estimation results.

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
Ln MSup	17.31	16.57	1.04	0.41
Ln GoR	5.57	7.53	0.74	0.48
Ln GoE	−42.02	41.7	−1.01	0.42
Ln BD	10.43	4.85	2.15	0.05
Ln BoT	0.48	0.57	0.84	0.43
C	68.22	47.09	0.83	0.43

4.7. Error correction model

ECM analysis suggests that both current and lagged values of certain variables significantly influence the dependent variable. Table 8 shows CointEq(−1) coefficient (−1.399114) and Prob. (0.0000), the highly significant and negative error correction term indicates a strong adjustment back to long-term equilibrium. A value of −1.399 suggests a rapid correction of disequilibrium at about 140% per period. This rapid adjustment implies that any short-term deviations from the long-term inflation path are quickly corrected, reflecting effective policy mechanisms or market forces in bringing inflation back to equilibrium.

Table 8. ECM regression result.

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
D(LN_GOR)	4.255592	1.198832	3.549783	0.0053
D(LN_GOR(−1))	5.171055	1.598065	3.235822	0.0089
D(LN_GOE)	−4.789077	2.006518	−2.38676	0.0382
D(LN_BD)	0.833549	0.354051	2.354322	0.0403
D(LN_BD(−1))	−0.758704	0.176106	−4.308218	0.0015
D(LN_BOT)	−0.0117	0.08646	−0.135328	0.895
D(LN_BOT(−1))	−0.222581	0.086944	−2.560053	0.0284
CointEq(−1)*	−1.399114	0.16583	−8.437044	0.0000

* *P*-value incompatible with t-bounds distribution.

4.8. Granger-causality test

The Granger causality test results indicate whether one-time series can predict another. The null hypothesis for each test states that the first variable does not Granger cause the second variable. Based on Table 9, the findings can be summarised as below:

- Ln GoR → Ln Inf. The *p*-value is 0.0692, which is slightly above the conventional 5% significance level. This suggests a marginal indication that Ln GoR might Granger-cause Ln Inf, but it is not statistically significant at the 5% level. Thus, we cannot conclusively reject the null hypothesis that Ln GoR does not Granger-cause Ln Inf.
- Ln MSup → Ln Inf. The *p*-value is 0.1040, which is above 0.05. This indicates that Ln MSup does not significantly Granger-cause Ln Inf. Thus, we do not reject the null hypothesis.

- Ln GoE → Ln Inf. The *p*-value is 0.0210, which is below 0.05. This indicates that Ln GoE significantly Granger-causes Ln Inf. Thus, we reject the null hypothesis and conclude that government expenditure can help predict future Inflation. This suggests that changes in government expenditure can be used to predict future changes in Inflation. Policymakers should consider the impact of government expenditure on Inflation when making fiscal decisions.
- Ln BoT → Ln Inf. The *p*-value is 0.0748, which is above 0.05 but below 0.1. This suggests a marginal indication that Ln BoT might Granger-cause Ln Inf, but it is not statistically significant at the 5% level. Therefore, we cannot conclusively reject the null hypothesis that Ln BoT does not Granger-cause Ln Inf.
- Ln BD → Ln Inf. The *p*-value is 0.9036, which is much higher than 0.05. This indicates that Ln BD does not Granger cause Ln Inf. Therefore, we do not reject the null hypothesis.

In summary, the Log of Government Expenditure significantly causes the log of Inflation. Moreover, no significant Granger causality was found for the other variables to Log Inflation, meaning that changes in these variables do not predict changes in Inflation and vice versa. These findings provide valuable insights into the dynamic relationships between Inflation and key economic variables in Tunisia, which can Inform both policy decisions and further academic research.

Table 9. Granger causality test results.

	Null Hypothesis	***F*-Statistic**	**Prob.**
Ln GoR ⟶ Ln Inf	Ln GoR does not Granger Cause Ln Inf	3.08	0.07
Ln MSUP ⟶ Ln Inf	Ln MSup does not Granger Cause Ln Inf	2.55	0.1
Ln GoE ⟶ Ln Inf	Ln GoE does not Granger Cause Ln Inf	4.73	0.02
Ln BoT ⟶ Ln Inf	Ln BoT does not Granger Cause Ln Inf	2.98	0.07
Ln BD ⟶ Ln Inf	Ln BD does not Granger Cause Ln Inf	0.1	0.9

5. Discussion of the findings

This study highlights the challenges inflation volatility poses to economic stability, particularly in developing economies like Tunisia. It underscores the importance of understanding the determinants of inflation and its volatility to formulate effective fiscal and monetary policies. The document sets the context by contrasting Keynesian and Monetarist views on fiscal policy's role in influencing inflation.

The relationship between fiscal policy and inflation varies between developed and developing countries. Advanced economies typically possess well-defined monetary policy structures that help mitigate the effects of fiscal deficits on inflation rates. Conversely, in developing nations, the relationship between fiscal deficits and inflation is more pronounced, largely due to constraints such as restricted access to global capital markets.

The study employs several econometric models and tests to analyze the relationship between fiscal policy and inflation in Tunisia. For instance, (DOLS) model is used to estimate the long-term relationships among variables such as

government expenditure, revenue, money supply, balance of trade, and budget deficit. In Table 3, a positive coefficient of Money Supply (17.31) suggests that an increase in the money supply is associated with an increase in inflation. However, the relationship is not statistically significant at the conventional levels (*p*-value = 0.41), indicating that changes in money supply do not have a discernible long-term impact on inflation in this model. Although monetarist theories suggest a strong link between money supply and inflation, this result may imply that other factors or policy interventions in Tunisia mitigate the direct impact of money supply changes on inflation. This result aligns with Naceur & Kandil (2019); Khan & Schimmelpfennig (2006); Mishra et al., (2020); Christensen & Gupta (2012). Moreover, Government Revenue positive coefficient (5.57) but statistically insignificant coefficient (*p*-value = 0.48) suggests that government revenue increases may lead to higher inflation, although this effect is not significant in the long run. This result could indicate that while increasing government revenue (potentially through taxation) might contribute to inflationary pressures, other variables or external factors might dilute this effect in Tunisia. This result copes with Combes et al., (2017); Manea (2020); Rafiq (2019); Baum & Koester (2017); Azam et al., (2024). However, the result contrasts with the findings of Azam & Khan (2022), who observed a significant relationship between taxation policies and inflation in Central Asian economies. The difference could be attributed to variations in fiscal structures, where Tunisia's revenue collection relies more on indirect taxes rather than progressive taxation, leading to a weaker inflationary impact. Furthermore, Table 3 shows a negative coefficient for Government Expenditure (−42.02), which indicates that an increase in government expenditure is associated with a decrease in inflation. However, this relationship is not statistically significant (*p*-value = 0.42). While Keynesian economics posits that increased government spending can lead to higher demand and inflation, the negative sign might suggest that in Tunisia, government expenditure could be focused on productive investments or subsidies that help reduce inflationary pressures. Yet, the insignificance implies this conclusion is tentative. Prior studies support these findings such as Abdullah et al., (2019); Hallerberg and Scartascini (2017); Rafiq and Zeufack (2019); Auerbach and Gorodnichenko (2017). Nevertheless, the empirical estimates of Galí and Gambetti (2019) study show a significant negative association between inflation and growth above the threshold level of inflation.

The Budget Deficit coefficient (10.43) is positive and statistically significant at the 5% level (*p*-value = 0.05), indicating a robust relationship where an increase in the budget deficit is associated with higher inflation. The significant positive impact of budget deficits on inflation suggests that fiscal imbalances are a key driver of inflation in Tunisia. This highlights the importance of fiscal discipline and the need for policies aimed at reducing budget deficits to control inflation. This finding aligns with Muhammad and Saleem (2018); Feld et al., (2020); Jalles (2020). Besides, supporting the findings Bhanumurthy and Kumawat (2016); Baharumshah and Ariff (2017), however, Tunisia's reliance on external borrowing rather than monetary financing might explain some deviations in inflationary trends. Further, the Balance of Trade coefficient is a positive but statistically insignificant coefficient (0.48, *p*-value = 0.43) suggesting a weak and non-significant relationship between balance of trade and inflation. While a trade deficit can theoretically lead to inflation by weakening the

currency and increasing import costs, the lack of significance here may reflect other compensatory mechanisms in Tunisia's trade or monetary policies that neutralize the inflationary impact. As Blanchard and Milesi-Ferretti (2012) found while trade deficits can theoretically lead to inflation, the effect is often mitigated by monetary policy and exchange rate adjustments, resulting in a statistically insignificant relationship.

However, the lack of significance for money supply and government revenue implies that coordination between monetary and fiscal policies is crucial to manage inflation effectively without relying solely on changes in money supply or revenue adjustments. Although the negative coefficient for government expenditure is not significant, it suggests that well-targeted government spending might help mitigate inflationary pressures. Policymakers should consider focusing expenditures on sectors that enhance productivity and reduce costs. For instance, the insignificance of the balance of trade indicates that external economic factors or effective trade policies may help buffer the inflationary impact of trade imbalances. Policymakers might explore strengthening trade policies and enhancing export competitiveness.

On the other hand. Table 8 indicates the probability value of 0.07 is slightly above the conventional significance level of 0.05, indicating a marginal predictive relationship where government revenue might Granger-cause inflation. However, it is not statistically significant at the 5% level. While government revenue changes might influence future inflation rates, this relationship is not strong enough to be statistically significant. Policymakers should still consider monitoring revenue policies and their potential inflationary impacts, but the effect may be influenced by other variables or external factors. In addition to, changes in money supply do not significantly predict inflation in the short run, suggesting that monetary policy alone may not be a reliable tool for inflation prediction. Policymakers might focus on a broader set of indicators and variables to effectively manage inflation. Government expenditure is a key predictor of future inflation, highlighting its importance in fiscal policy planning. Tunisian policymakers should carefully consider the inflationary impacts of their spending decisions, ensuring that expenditures are directed towards productive and non-inflationary purposes. While variables like government revenue and balance of trade show marginal predictive relationships, they do not reach statistical significance impacts on inflation within the studied model, though they still play crucial roles in the broader economic context. This may indicate the need for a more comprehensive approach, considering other macroeconomic factors. The findings suggest that Tunisian policymakers need to focus on fiscal consolidation and efficient public spending to manage inflationary pressures. The study's approach can also be applied to other developing economies facing similar fiscal and monetary challenges.

The differences between the DOLS and Granger causality results emphasize the need to differentiate between short-term and long-term dynamics when designing fiscal and monetary policies.

6. Conclusions

This study investigates the complex interplay between Inflation, Government Expenditure, Government Revenues, Money Supply, Balance of Trade, and Budget Deficit in Tunisia from 1998 to 2023. Utilizing a thorough analysis that incorporates

various statistical techniques. The study has produced important findings that carry substantial implications for the country's future development. The principal outcomes of our research are as follows:

1) Budget deficits significantly increase inflation in Tunisia, highlighting the need for fiscal discipline to prevent economic instability and loss of purchasing power.
2) Money supply changes do not have a significant long-term impact on inflation, suggesting that other economic or policy factors mitigate its expected effect.
3) Government revenue shows an insignificant positive relationship with inflation, indicating that taxation alone may not drive inflationary pressures.
4) Government expenditure appears to reduce inflation, but the effect is statistically insignificant, implying that productive public spending might help control inflation.
5) Balance of trade has a weak and insignificant impact on inflation, suggesting that trade policies or monetary adjustments offset inflationary effects.
6) Policymakers should prioritize fiscal consolidation and coordinated monetary-fiscal policies to manage inflation effectively, while enhancing trade and export strategies.
7) While focused on Tunisia, the study's findings offer valuable insights for other developing economies, guiding inflation control strategies through fiscal policy.

7. Policy implications

The results of this research carry significant fiscal policy implications for Tunisia, as outlined below:

1) The significant impact of budget deficits on inflation underscores the need for fiscal consolidation and prudent budget management. Policymakers should prioritize reducing deficits to stabilize prices and maintain economic stability.
2) The lack of significant relationships between money supply, government revenue, and inflation implies that a coordinated approach is necessary. Policymakers should ensure that monetary and fiscal policies work together to manage inflation effectively, rather than relying on isolated policy measures.
3) Although the study did not find a statistically significant effect, the potential for government expenditure to mitigate inflationary pressures suggests that spending should be directed towards productive investments and sectors that enhance productivity and reduce costs. This approach can help alleviate inflation without exacerbating fiscal imbalances.
4) Strengthening trade policies and enhancing export competitiveness can help buffer the inflationary impact of trade imbalances. Policymakers should focus on maintaining a balanced trade position to mitigate inflation risks associated with currency depreciation and import costs.
5) Given the complex nature of inflation dynamics, policymakers should consider a broad set of economic indicators and variables when designing policies. This comprehensive approach can help in identifying and addressing the various factors contributing to inflation volatility.
6) The study's approach and findings can be applied to other developing economies facing similar fiscal and monetary challenges. The insights provided by this

research can guide policymakers in other contexts to better understand the relationship between fiscal policy and inflation and to formulate more effective policies for economic stability.

8. Limitations and future research avenues

The study on fiscal policy and its effect on inflation volatility in Tunisia may have several limitations, although they were not explicitly detailed in the document. Based on typical considerations in similar studies, the following limitations might be relevant:

- The study may not fully account for external factors, such as global economic conditions, political instability, or international trade dynamics, that can influence inflation volatility in Tunisia. These factors could introduce noise into the analysis and affect the interpretation of the results.
- The study period may not be long enough to capture the full range of economic cycles and structural changes in the Tunisian economy. Short-term analyses may not reflect long-term trends or the impact of policy changes over time.
- While the study's methodology and findings can apply to other developing economies, the specific context of Tunisia might limit the generalizability of the results. Differences in economic structure, institutional frameworks, and policy environments may lead to different outcomes in other countries.

The findings presented in this article suggest several promising avenues for future research, which are detailed as follows:

1) Investigate the impact of fiscal policy on inflation in specific sectors of the economy, such as agriculture, manufacturing, and services, to provide more detailed insights for policymakers.
2) Consider the influence of external factors, such as global economic conditions, exchange rates, and international trade policies, on the relationship between fiscal policy and inflation volatility.
3) Conduct comparative studies between Tunisia and other developing economies to understand the similarities and differences in how fiscal policy affects inflation, which can help tailor policy recommendations to specific contexts.
4) Examine the implementation and effectiveness of various fiscal policies in controlling inflation and reducing volatility, taking into account the institutional and political contexts that influence policy outcomes.
5) Investigate how the growth of the digital economy and technological advancements influence fiscal policy and inflation dynamics, particularly in terms of tax revenue collection and public spending efficiency.

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