The impact of credit revenues as a means of financing the general budget deficit on the inflation rate - a case study of Algeria during the period (1997-2023)

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ABSTRACT

This study aims to measure the relationship between credit revenues as a means of financing the public budget deficit and the inflation rate in Algeria during the period (1997–2023), in order to determine the effects of credit-based means of financing the public budget deficit on rising inflation rates in both the long and short term in Algeria.

The study found a long-term positive equilibrium relationship between external financing of the public budget deficit and inflation. Accordingly, the Algerian state's recourse to external financing to cover the public budget deficit leads to an increase in inflation rates in the Algerian national economy. Furthermore, 227.9% of short-term errors can be corrected annually in order to return to the long-term equilibrium situation.

1. INTRODUCTION:

In light of the growing importance that the public budget has come to occupy in various world economies, and with the increasing role that governments have started to play in economic activity, the public budget deficit has tended to increase in different countries around the world. With the limited financing capacity, the intensification of inflationary pressures, and the increasing burden of external and internal debts, these countries have been driven to seek financial means or methods capable of financing and covering this deficit at the lowest possible cost and damage.

Therefore, resorting to influencing the state's public revenues is considered one of the most important methods used to address the deficit and to finance public spending. However, the use of these mechanisms varies depending on the revenues available to the state, its economic situation, and the severity of the deficit it suffers from. All these factors can guide the state on how to resort to using them to finance its expenditures. Proper and correct use of these means helps the state overcome its crisis, while improper use leads to severe economic problems that cannot be easily resolved, such as falling into heavy indebtedness or experiencing an inflation crisis with dire consequences that are difficult to eliminate. Therefore, proper planning is necessary for the use of public revenues in financing the public budget deficit.

❖ **Problem Statement:**

In light of the above, the features of the problem under consideration emerge through the following main question:

- To what extent can credit sources used to finance the public budget deficit affect the inflation rate in Algeria during the period (1990–2023)?

❖ **Sub-questions:**

In order to better understand and grasp the details of this study, we pose the following sub-questions:

- Have external loans, as a means of financing the public budget deficit, contributed to generating inflationary pressures in Algeria?
- Is there a relationship between bank and non-bank loans as two means of financing the public budget deficit and the inflation rate in Algeria in the short and long term?

❖ **Research Hypotheses:**

As a preliminary response to the main question and sub-questions, we formulated the following hypotheses:

✓ **First Hypothesis:** The Algerian state's recourse to external financing to cover its public budget deficit led to inflation during the period (1997–2023).

✓ **Second Hypothesis:** There is a statistically significant positive relationship between both bank and non-bank financing of the public budget deficit and inflation in Algeria in the short and long term during the period (1997–2023).

❖ **Study Objectives:**

Through this study, we aim to achieve a set of objectives summarized as follows:

✓ To address a number of credit financing methods used to cover the public budget deficit in conventional economics, as well as their relationship with the inflation rate in economic theories.
✓ To attempt to build an econometric model that determines the nature of the relationship between credit financing methods for covering the public budget deficit and the inflation rate in Algeria during the period under study.

❖ **Study Methodology:**

In order to answer the research problem and to test the validity of the formulated hypotheses, the descriptive-analytical method was adopted to present and describe the study variables in a simplified manner. In the applied part of this study, the quantitative method was used by building an econometric model that enables us to measure the impact of credit-based means of financing the public budget deficit on the inflation rate in Algeria during the period (1997–2023), using the ARDL model and employing the EViews 13 software.

2. **The Conceptual Framework of the Impact of Credit Sources as a Means of Financing the Public Budget Deficit and Inflation:**

The issue of the public budget deficit is one of the fundamental concerns that has attracted the attention of researchers in various countries around the world. It is a financial problem characterized by its complexity and development, affecting all social, political, and economic fields, especially in the context of shrinking resources and expanding needs. This necessitates significant attention and careful planning in the search for financial means capable of financing and covering this deficit at the lowest possible cost and damage.

2.1. **Domestic Borrowing:**

The state resorts to financing its deficit by relying on its domestic resources within its geographical boundaries. The sources of domestic deficit financing are as follows:

2.1.1. **Borrowing from the Central Bank:**

The state finances its budget deficit by borrowing from the central bank. If this financing takes place through direct borrowing from the central bank by the state selling government bonds to it, and the central bank

in turn creates money to finance the purchase of those bonds, the inflationary effect in this case depends on the relationship between the change in the money supply and the change in demand for it. If the central bank's assets

increase due to its holding of government bonds and government deposits at the central bank also increase, then there is no change in the net claims on the government.

However, when the government uses the borrowed funds in spending operations in the form of payments to individuals, the private sector, and state employees, its deposits decrease in exchange for an increase in private sector deposits in banks. This causes an increase in bank deposits at the central bank, and thus increases the net credit granted by the central bank to the government. Consequently, the monetary base increases, followed by an increase in the money supply under the effect of the money multiplier.

If this increase in the money supply is met by an increase in demand for money due to the need for more transactions or due to a decrease in the interest rate reflecting the declining attractiveness of other assets, then this type of financing has no inflationary effect.

The inflationary effect occurs when the money supply exceeds its demand, causing a surplus in the money supply that ignites inflation rates. In this case, the general price level rises because the public disposes of the excess monetary balance by purchasing real assets (such as goods, land, etc.) or by purchasing other financial assets (such as bonds and certificates). At that point, the prices of real assets rise, causing inflation rates to escalate.

Moreover, the increased demand for financial assets raises their prices and lowers interest rates, which leads to an increase in private investment and aggregate demand, and ultimately results in increased inflation (Al-Afandi, 2016, p. 45).

2.1.2. Borrowing from Commercial Banks:

This financing mechanism is carried out through the sale of public debt bonds issued by the public treasury to commercial banks (Kaziz & Mokhtar, 2018, p. 232). This is based on the fact that commercial banks have the ability to create new money in the form of current accounts. The final effects of this financing method primarily depend on the amount of cash reserves available to these commercial banks.

If their reserves are sufficient to allow them to purchase government loan bonds without reducing the amount of credit they provide to the private sector, then the resulting effects on the money supply are expansionary. Conversely, when these reserves are insufficient and the banks resort to requesting credit from the central bank, if they decide to subscribe to government debt bonds, it will be at the expense of credit granted to the private sector (i.e., crowding out effects). Thus, this method would have no expansionary effect on the money supply within the country (Khoshnaw, 2019, p. 28).

Moreover, deficit financing can indirectly affect private investment, especially since, in developing countries with narrow and stagnant financial markets, credit granted to the private sector is a key factor in that sector's investment. Instead of limiting the credit extended to the private sector, commercial banks can resort to the central bank for assistance. If the latter provides such credit to the commercial banks, the result will be similar to the case in which the government obtains credit from the central bank (Sabrina, 2007, p. 147).

Thus, one of the advantages of adopting this mechanism is the financing of increasing government expenditure without causing a rise in taxes. Its disadvantages, however, are reflected in the crowding out of the private sector from the credit volume in the absence of surplus cash reserves in commercial banks, which leads to a decline in private investment and, consequently, an increase in inflation rates. To limit this phenomenon and restore economic balance, commercial banks resort to borrowing from the central bank (Qambour M., 2020–2021, p. 49).

2.1.3. Borrowing from the Private Sector Outside the Banking Sector:

This type of financing takes the form of borrowing from the public and from non-banking intermediary institutions, which include insurance and pension funds, open market operations with this sector, as well as the

issuance and sale of government bonds to the private sector. In return, the government obtains liquidity which it uses to cover part or all of the deficit (Kardoudi, Manaa, & Kardoudi, 2018, p. 201).

This type of financing does not have inflationary effects if it originates from resources allocated for consumption, as it leads to transferring a portion of the private sector's income to the state. Even if the state spends the proceeds from these bonds, the increase in government demand is offset by a decrease in private demand, which means that there is no increase in the general price level.

However, if the financing comes from idle or hoarded resources, it leads to an increase in the level of demand and aggregate spending, which means a rise in the price level. This reduces the real value of the money supply and exerts negative effects on income and government revenues, hindering the reduction of the deficit. As a result, the economy may enter a state of instability that could persist for long periods, during which it suffers from inflation or from unemployment and recession.

Among the most important factors necessary for the success of this developmental method in providing an adequate volume of savings available for employment in the national economy in the form of domestic loans are: the presence of an active financial securities market, and confidence in the government-issued securities available for subscription (Younes, 2015–2016, p. 209).

2.2. External Borrowing:

This refers to a set of external loans issued by the state outside its territorial borders and subscribed to by foreign individuals, private or public entities, or even some specialized international organizations. These loans are usually subscribed to in foreign currencies. The primary reason that drives countries to contract such loans is the public budget deficit resulting from ambitious development programs they seek to implement (Hazrashi & Lebbaz, 2011, p. 15).

This is due to the insufficiency of their domestic resources whether from the banking system or from individuals and non-financial institutions caused by several factors, such as weak domestic savings and the lack of flexibility in the productive apparatus to absorb new monetary issuance.

External financing methods can be limited to external loans (Kadri & Al-Arbawi, 2020, p. 111).

Among the most important international financial institutions through which such financing is carried out are the International Monetary Fund (IMF), the World Bank, regional banks, and other development and international financing institutions. The IMF provides loans or credit facilities that help the borrowing country reduce its deficit. However, these loans are often conditional upon the implementation of certain programs in the borrowing country. These loans aim to address financial imbalances through a package of reforms, including restructuring public expenditures, global economic openness, liberalizing the domestic market, and revisiting fiscal and monetary policies (Hamid Moussa, 2011, p. 928).

External borrowing is considered inflationary financing because it leads to an inflow of foreign currencies without a corresponding increase in goods and services (Saeed Ali, 2021, p. 38). States usually resort to it to cover part of their budget deficit, particularly expenses in foreign currency such as payments of foreign compensations, external debt burdens, and foreign goods needed to implement government and public sector projects.

In this context, the state needs a competent and effective public finance management sector capable of performing its regulatory functions and preparing the proper economic infrastructure to drive economic growth and reduce unemployment something that is often lacking in developing countries. One of the key features of such effective management is its ability to mobilize sufficient financial resources to fund public services and development

projects, as well as its capacity to allocate and spend these resources according to priorities and fiscal policy objectives (Shellal, 2016, p. 61).

External borrowing varies depending on the lending entity as follows:

2.2.1. Borrowing from Foreign Commercial Banks and International Capital Markets:

Borrowing from foreign commercial banks is one of the sources of external borrowing used to finance deficits. These are facilities provided by foreign commercial banks to finance the temporary shortfall in foreign currency reserves of developing countries (Al-Sayyid Ahmed, 2022, p. 55).

One of the main disadvantages of this source is that it comes with purely commercial terms, including very high interest rates and short repayment periods, which are not suitable for development loans, as their benefits usually materialize in the long term. What distinguishes these loans from other sources of financing is the speed with which they can be obtained (Abdel-Moati, 2017, p. 84).

2.2.2. Borrowing from Other Governments:

These loans are known as bilateral loans and are also referred to as official government loans. They are granted under formal agreements between states, with terms that vary from one country to another. Their conditions are generally more favorable in terms of interest rates and repayment periods compared to commercial loans (Qambour M., 2020–2021, p. 51).

2.2.3. Borrowing from International Organizations and Institutions:

These loans are also known as concessional loans and are granted by international institutions and organizations such as the International Monetary Fund and the World Bank. Their main advantages include concessional terms in terms of interest rates and maturity periods, and they are often allocated for specific purposes.

Despite the importance of this source, in recent years it has become a major cause of many economic crises faced by developing countries, due to the interventions and restrictions imposed by lending institutions on borrowing countries.

These loans can also become a major contributor to increasing a country's debt if overused. Instead of being a tool to address the budget deficit in particular and economic imbalances in general, they may worsen the economic crisis, such as the growing deficit in the balance of payments.

They are also a main reason for the decline in foreign currency reserves. As for their impact on the state's public budget, it lies in the increasing burden they impose, as external debt—represented by principal and interest payments constitutes a significant part of public expenditures. An increase in this burden reduces the flexibility in managing the public budget (Ajjam & Saud, 2017, p. 75).

In general, a key disadvantage of this type of financing is that if the borrowing country's currency depreciates, the principal and debt servicing costs will rise—since they are valued in the lender's currency leading to an increase in foreign debt and, ultimately, the country's inability to repay (Abdel-Moati, 2017, p. 84).

2.3. The Impact of Credit-Based Financing Methods for the Public Budget Deficit on Inflation Rates:

The increasing complexity of the public budget deficit in most countries in recent years has highlighted the urgent need to address it, due to the difficulty of reducing public expenditures or increasing public revenues in the short term, in order to eliminate this deficit which results in many negative effects on the economies of the affected countries, particularly developing ones. Many countries have resorted to various methods to finance their budget deficits.

Among the financing methods used to cover the budget deficit is external financing. One of its most important financial effects is that it may lead to an increase in the price level and thus to inflation. This is because it causes an inflow of foreign currencies without a corresponding increase in the supply of goods and services, which affects the general price level, resulting in higher inflation rates. Therefore, most countries refrain from resorting

to this method due to its potential economic consequences, such as the loss of decision-making sovereignty for borrowing countries, as well as the possibility of a depreciation in the borrowing country's currency, which leads to an increase in the principal and servicing costs of the debt when valued in the lender's currency. This exacerbates the external public debt and the country's inability to repay, ultimately resulting in a public budget deficit (Hammadi, 2023–2024, pp. 171–172).

Hence, the domestic market is considered the most suitable alternative for financing the budget deficit through the issuance of treasury bonds and bills. This mechanism is not necessarily inflationary, especially in the short term, as it allows the government to maintain the deficit without increasing the monetary base or international reserves. Therefore, this mechanism is considered effective in avoiding inflation and external crises (Abdel-Moati, 2017, p. 82). However, it requires the presence of a positive interest rate on bonds and a broad securities market, which is often lacking in developing countries.

On the other hand, financing the deficit through government bonds becomes inflationary if the monetary authority aims to keep interest rates low. Accordingly, this financing method depends on the central bank's policies.

As for financing the deficit through borrowing, it reflects the constraints facing both fiscal and monetary authorities under the interest rates applied to these bonds, and the resulting revenues from monetary creation. Although this process (public debt) is completely separate from the process of monetary issuance, there are three channels through which public debt may lead to an increase in the money supply. These channels are (Al-Mashhadani & Hammadi, 2013, pp. 72–73):

❖ **Political Pressure for Interest Rate Stability:**

The effectiveness of political pressure to stabilize interest rates operates through the central bank's response to the expected increase in interest rates resulting from the rising volume of public debt. If the increase in government debt leads to a rise in real interest rates and the monetary authority seeks to offset this increase, then the central bank will respond by increasing the money supply as part of its policy to stabilize real interest rates.

❖ **Economic Constraints on the Debt-to-GDP Ratio:**

The government imposes a set of economic constraints on the long-term growth of public debt, paying interest as a share of national income. If the government is unable to raise tax rates sufficiently to maintain the debt-to-income ratio within limits, one possible adjustment mechanism is through increasing the money supply. Thus, the growth in current debt will be partially financed by future monetary expansion, despite the impact on current money growth.

❖ **Time Inconsistency of Government Policies:**

Through this channel, debt policy can influence monetary policy. In other words, with nominal interest rates fixed, public debt creates an incentive for the government to generate unexpected inflationary pressures. This incentive arises from the possibility of reducing the real value of public debt through inflation rates that exceed the expectations of government bondholders at the time of purchase.

As pointed out by **Sargent & Wallace (1981)**, it is not possible to continue managing monetary policy without taking into account the path of public expenditure growth and the tax structure, especially under specific conditions. The government is constrained by the public's demand for the bonds it issues relative to the size of the economy and the interest rate. If the fiscal authority determines the amount of revenue that must be obtained from bond sales, then the monetary authority creates money to finance the gap between the required revenues to

cover the deficit and the value of bonds that can be sold to the public. Ultimately, the government's reliance on monetizing the public budget deficit leads to inflationary waves, as it is usually associated with monetary expansion. As this expansion rises, it leads to an increase in public spending without a corresponding increase in public revenues, resulting in a public budget deficit.

Meanwhile, **Miller & Sargent (1984)** demonstrated that the real interest rate is not constant but increases with the rising ratio of government bonds to the monetary base. Historical evidence indicates a growing deficit and that the possibility of fully monetizing it in the future (i.e., financing it solely through money creation) remains persistent and concerning (Shawaqfeh, 2012, pp. 120–121).

In the case of financing through external borrowing in developing countries, it leads to an inflow of foreign currencies (an increase in monetary balances) without a corresponding increase in real output (Ali Mohammed, 2017, p. 18).

Hence, financing the budget deficit whether through domestic or external borrowing leads to the creation of additional money (monetary financing). According to the **quantity theory of money**, this generates inflationary pressures, which lead to an increase in public spending without a corresponding rise in public revenues. This results in a persistent deficit that is financed through money creation, leading to a further rise in prices. Thus, the economy enters a **vicious cycle** between inflation and the public budget deficit (Qasmiouri, 2020–2021, p. 188).

3. Studying the Impact of Credit Sources as a Means of Financing the Public Budget Deficit on the Inflation Rate in Algeria During the Period (1997–2023):

3.1 Study Methodology:

In order to determine the relationship between credit revenues used to finance the public budget deficit and the inflation rate in Algeria during the period (1997–2023), a modern methodology will be used to test the cointegration relationship between the study variables. This method is represented by the Autoregressive Distributed Lag Model (ARDL), also known as the Bound Testing Approach, introduced by Pesaran et al. (2001). To carry out the various stages of the applied study, the statistical software EViews 13 was used. The data used to estimate this model were obtained from the World Bank database, specifically the World Development Indicators (WDI), and from the Bank of Algeria website.

3.2. Model Specification and Presentation of Study Variables:

This study relied on a multiple linear model to examine the extent to which credit revenues used to finance the public budget deficit affect the inflation rate in Algeria during the period (1997–2023), by formulating the mathematical relationship of the model as follows:

$$CPI = f(BF, Non - BF, Ext - F, OER)$$

Where inflation (CPI) is a function of credit revenues used to finance the public budget deficit (BF, Non-BF, Ext-F, OER) and other control variables (CV :Control variables) that affect inflation. As for the econometric model of the study, it is:

$$CPI_t = \alpha_0 + \alpha_1 BF_t + \alpha_2.Non - BF_t + \alpha_3 Ext - F_t + \alpha_4.OER_t + \mu_t$$

Where:
- **CPI:** The inflation rate, expressed by the Consumer Price Index (CPI); data extracted from the World Bank database, labeled as World Development Indicators.
- **BF:** Bank financing, representing the set of bank loans obtained by the state from commercial banks to finance its budget deficit; data sourced from the Bank of Algeria website.

- **Non-BF:** Non-bank financing, representing the set of loans granted to the state from outside the banking sector, such as borrowing from the private sector to finance the public budget deficit; data sourced from the Bank of Algeria website.

- **Ext-F:** External financing, representing the set of loans obtained by the state either from foreign commercial banks, international capital markets, other countries, or international organizations such as the International Monetary Fund and the World Bank; data sourced from the Bank of Algeria website.

- **OER:** The official exchange rate of the Algerian dinar against the US dollar; data extracted from the World Bank database, labeled as World Development Indicators.

- α_0: Represents the constant coefficient.

– α_1‘ α_2‘ α_3‘ α_4 Represent the response coefficients of the dependent variable (inflation) to the explanatory (independent) variables, respectively.

– **t :** Represents the time series, which includes 26 observations over the period (1997–2023).

– μ_i **:** The random error term.

3.3. Empirical Study Results:
3.3.1. Time Series Stationarity Test:

Before proceeding with the model estimation, it is necessary to examine the stationarity of the time series under study to avoid the problem of spurious regression, which yields good results such as a high coefficient of determination (R^2) and one or more statistically significant regression coefficients based on standard tests like Student and Fisher (Gujarati, 2012, p. 234) yet the results lack real meaning. In other words, applying the Ordinary Least Squares (OLS) method yields misleading results when the series are not stationary.

To test stationarity, unit root tests are used. Among the most important of these are the Augmented Dickey-Fuller (ADF) test, and the second is the Phillips-Perron (PP) test (Bourbonnais, 2015, pp. 268–269, 272). **Table (01)** presents the results of the Augmented Dickey-Fuller test.

Table 01: Results of the Augmented Dickey-Fuller (ADF) Test

	Augmented Dickey Fuller Test						
	At level			At 1st difference			
Variables	**Intercept**	**Trend and**	**None**	**Intercept**	**Trend and**	**None**	**Result of Cointegration**
	p-value	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**	
CPI	0,0936	0,0269	0,3522	0,0007	0,0029	0,0000	**I(1)**
BF	0,3267	0,1846	0,0164	0,0000	0,0000	0,0000	**I(1)**
Non-BF	0,3399	0,8039	0,0915	0,2915	0,3196	0,0428	**I(1)**
Ext-F	0,0671	0,0233	0,0191	-	-	-	**I(0)**
OER	0,9759	0,9271	0,9972	0,0140	0,0609	0,0038	**I(1)**

Source: Prepared by the researcher based on the outputs of EViews 13 software.

It is observed from the table that the time series for **CPI**, **BF**, and **Non-BF** are not stationary at level, as the **prob** value is greater than the 5% significance level. This means that the time trend is not statistically

significant, and therefore the null hypothesis (**H$_0$: the series is non-stationary**) is accepted, while the alternative hypothesis (**H$_1$: the series is stationary**) is rejected.

After taking the first difference of the time series, the results show that the **prob** value becomes less than the 5% significance level, which leads to rejecting the null hypothesis and accepting the alternative hypothesis, indicating that the time series become stationary at the first difference, i.e., they are integrated of order **I(1)**.

The results also indicate that the variable **OER** (Official Exchange Rate) is stationary at level, i.e., **I(0)**, since its **prob** value is less than 5%.

As for the **Phillips-Perron (PP)** test, the results shown in Table (02) below confirm the findings of the Augmented Dickey-Fuller (ADF) test. The stationarity of the time series is a mix of series that are stationary at level and those that are stationary after the first difference, i.e., **I(0)** and **I(1)**, with no presence of second-order integration **I(2)**. Moreover, the dependent variable, the inflation rate, is stationary at the first difference **I(1)**. Therefore, the condition for estimating the **ARDL model** is satisfied.

Table (02): Results of the Phillips-Perron (PP) Test

Phillips-perron Test						
Variables	**at level**			**at 1st difference**			**Result of Cointegration**
	Intercept	**Trend and intercept**	**None**	**Intercept**	**Trend and intercept**	**None**	
	p-value	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**	
CPI	0,0777	0,0848	0,5275	0,0000	0,0000	0,0000	**I(1)**
BF	0,4085	0,1846	0,1152	0,0000	0,0000	0,0000	**I(1)**
Non-BF	0,0016	0,0096	0,0003	-	-	-	**I(0)**
Ext-F	0,0647	0,0232	0,0190	-	-	-	**I(0)**
OER	0,9759	0,9271	0,9972	0,0150	0,0696	0,0046	**I(1)**

Source: Prepared by the researcher based on the outputs of EViews 13 software.

3.3.2. Estimation of the Study Model:

To conduct the cointegration test, it was necessary to estimate the ARDL model. As observed in Table (01) (see Appendices), the ARDL model, which automatically determines the optimal lag length according to the Akaike Information Criterion (AIC), indicated that the optimal number of lag periods for the dependent variable (CPI) is two (2), while the lag structure for the independent variables (Non-BF, BF, OER, Ext-F) is (3, 3, 3, 3) respectively.

The statistical results showed that the coefficient of determination (R^2 = 0.8819) indicates that the independent variables explained 88.19% of the variations in the dependent variable (CPI), while the remaining 11.81% is due to other variables not included in the estimated regression model.

3.3.3. Cointegration Test Using the Bound Testing Approach:

This step involves testing whether a long-term equilibrium relationship exists between the dependent variable and the independent variables. To verify the presence or absence of cointegration, the Bound Test is used.

As shown by the results in Table (03), the calculated F-statistic value of 4.7983 is greater than both the lower and upper critical bounds at the 2.5%, 5%, and 10% significance levels. This indicates the rejection of the null hypothesis (H₀: there is no long-run equilibrium relationship from the set of explanatory variables to the dependent variable the equation is not cointegrated) and the acceptance of the alternative hypothesis (H₁).

Therefore, it is concluded that cointegration exists, as the F-statistic exceeds both the lower and upper critical bounds, confirming the presence of a long-run equilibrium relationship between the independent variables and the dependent variable.

Table (03): Results of the Bound Test

Test statistic	Value	K
F-stasitic	4.798337	4
Critical Value Bounds		
Significance	Bound I0	Bound I1
%10	2,45	3,52
%5	2,86	4,04
%2.5	3,25	4,49
%1	3,74	5,06

Source: Prepared by the researcher based on the outputs of EViews 13 software.

3.3.4. Estimation of Long-Run Coefficients and the Error Correction Model (ECM):

Since the results confirmed the existence of a long-term equilibrium relationship (cointegration among the variables) based on the Bound Test methodology between the inflation rate and the independent variables, it is now possible to estimate the long-run coefficients and determine the short-run dynamics using the ARDL(2,3,3,3,3) model.

The results of estimating the long-run relationship between inflation as the dependent variable and the set of independent variables during the period (1997–2023) are as follows:

$$Cointeq = CPI - (-0,0025 * BF + 0,0016 * NON\_BF + 0,0192 * EXT\_F + 0,0675 * OER - 1,6753)$$

The following table summarizes the long-run relationship results of the ARDL model:

Table (04): Results of the Long-Run Relationship Test for the ARDL Model

Estimation of Long-Run Coefficients of the ARDL Model				
Prob	t-statistique	Std. Error	Coefficient	Variables
0,0922	-2,079200	0,001188	-0,002470	BF
0,5033	0,720904	0,002224	0,001603	Non-BF
0,0048	4,811358	0,006042	0,029068	Ext-F
0,2613	1,265900	0,015191	0,019230	OER
0,7033	-0,403467	4,152198	-1,675273	C

Source: Prepared by the researcher based on the outputs of EViews 13 software.

It is evident from the above table that:

Based on the long-run results summarized in the table, at the 5% significance level, not all independent variables are statistically significant. Bank financing (BF) and non-bank financing (Non-BF), as well as the official exchange rate (OER) of the Algerian dinar against the US dollar, are statistically insignificant, with probabilities of (Prob = 0.0922) and (Prob = 0.5033) respectively. This indicates that there is no proven significant impact of bank and non-bank financing to cover the public budget deficit on inflation rates in the Algerian economy.

This can be explained by the fact that the Algerian public treasury mainly relied on financing through withdrawals from the Revenue Regulation Fund to cover its budget deficit. This fund represented the largest share of the treasury's financing mix during the study period.

However, the external financing variable is statistically significant at the 5% level, with a probability of (Prob = 0.0048), which is below the accepted margin of error. This means it can be relied upon in long-term economic analysis. Thus, in the long run, external financing of the public budget deficit positively affects the inflation rate in Algeria: a 1% increase in external financing leads to a 4.8% increase in the inflation rate. Accordingly, Algeria's recourse to external financing to cover the budget deficit increases inflationary pressures in the national economy.

As for the short-run equilibrium relationship, it is evident from Table (02) (see Appendices), which includes the error correction term (CointEq(-1)), that its value is –2.279528, with a negative and statistically significant sign, since (Prob = 0.0131) is less than the 5% significance level. Therefore, this indicates that 227.9% of short-term errors are corrected annually in order to return to the long-run equilibrium state.

3.3.5. Model Diagnosis and Evaluation:
✓ **Test of the Normality of Residuals:**

To verify whether the residuals of the estimated model follow a normal distribution, the Jarque-Bera test is used. As shown in Figure (01), the Jarque-Bera probability (J-B = 0.4859) is greater than 5%, thus we accept the null hypothesis (H_0: the residuals follow a normal distribution).

Figure (01): Results of the Jarque-Bera Test
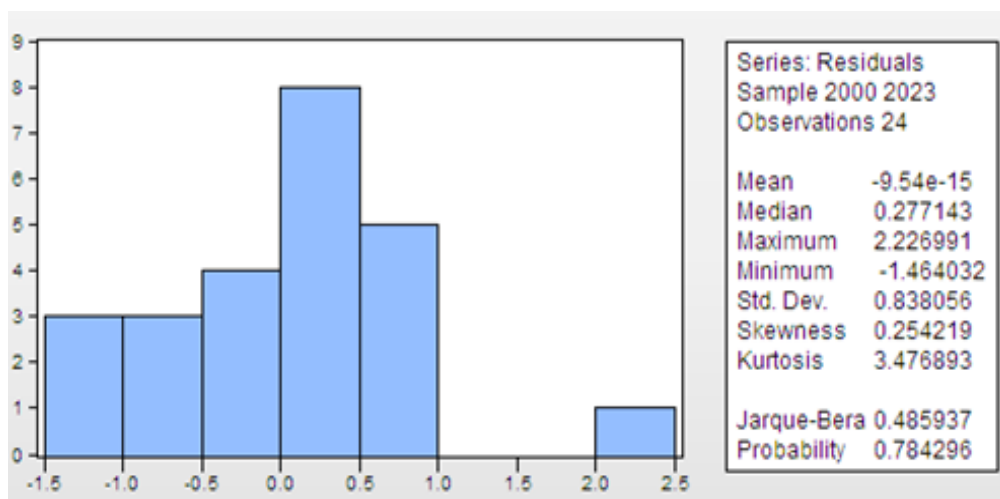
Source: Prepared by the researcher based on the outputs of EViews 13 software.

✓ **Test for Autocorrelation of Residuals:**

To verify the condition of residual independence, the Breusch-Godfrey test is used. Its results, shown in Table (05) below, indicate that the probability value of the F-statistic is 70.90%, which is greater than the 5%

significance level. Meanwhile, the Chi-Square probability is less than 5%, indicating the quality of the estimated parameters and confirming that there is no autocorrelation problem among the residual.

Table (05): Results of the Residual Autocorrelation Test (LM Test)

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0,386478	Prob. F(2,3)	0,7090
Obs*R-squared	4,916820	Prob. Chi-Square(2)	0,0085

Source: Prepared by the researcher based on the outputs of EViews 13 software.

✓ **Test for Homoscedasticity of Model Residuals:**

There are several tests to detect the constancy of residual variance, among which is the Breusch-Pagan-Godfrey test. This test is based on two competing hypotheses:

- H_0: There is no problem of heteroscedasticity in the error term.
- H_1: There is a problem of heteroscedasticity in the error term.

The results of this test are presented in Table (06) below. The results show that the F-statistic equals 0.4082, which is greater than the significance level $\alpha = 5\%$, and thus we accept the null hypothesis (H_0). Therefore, the random error term exhibits homoscedasticity (constant variance).

Table (06): Results of the Residual Homoscedasticity Test for the Model

| Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1,320311	Prob. F(18,5)	0,4082
Obs*R-squared	19,82835	Prob. Chi-Square(18)	0,3426
Scaled explained SS	1,065814	Prob. Chi-Square(18)	1,0000

Source: Prepared by the researcher based on the outputs of EViews 13 software.

✓ **Test for Parameter Stability of the Model:**

To verify the absence of any structural changes in the data used, two tests are employed: the Cumulative Sum of Recursive Residuals (CUSUM) test and the Cumulative Sum of Squares of Recursive Residuals (CUSUM of Squares) test. These are among the most important tests used to examine the stability of parameters in both the long and short term at the 5% significance level (Sahu & Naresh Kumar, 2018, p. 29).

These tests also reveal the presence of any structural changes in the data and indicate the extent of consistency between the long-run and short-run parameters within the critical bounds at the 5% significance level (Ifa & Imene, 2018, p. 244). Figure (02) below presents the test results.

Figure (02): Results of the Structural Stability Test of the Estimated Model Parameter
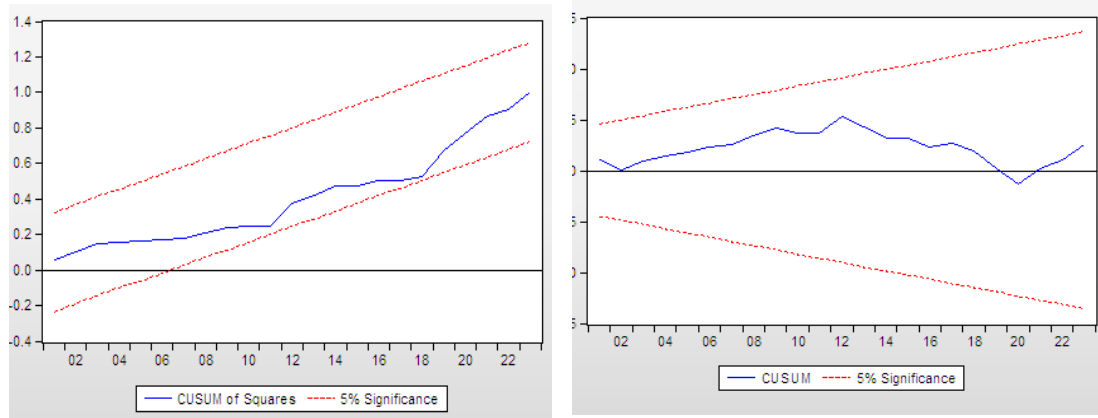
Source: Prepared by the researcher based on the outputs of EViews 13 software.

It is observed from the above figure that the plots of the CUSUM and CUSUM of Squares statistics remained within the 5% critical bounds, which indicates that the model is stable. The parameters remained within the confidence interval throughout the study period, confirming that the model maintained its stability and was free from structural changes during the entire period. This also affirms that the long-run parameters are stable and consistent with the short-run parameters.

4. CONCLUSION:

This study addressed the impact of credit revenues used to finance the public budget deficit on the inflation rate a case study of Algeria during the period (1997–2023). In line with the nature of the subject, we employed a modern econometric technique represented by the ARDL model. The aim of this study was to test the long-term relationship between the inflation rate and credit revenues used to finance the public budget deficit. The study reached a set of conclusions summarized as follows:

- The budget deficit reflects the inability of public revenues to keep up with the growth in public expenditures. The problem has gone beyond being an issue facing third world countries; even developed industrialized nations now consider it a real challenge that requires substantial efforts and precise planning, especially in light of shrinking resources and expanding needs.

- In modern economies, both advanced and developing, the budget deficit is financed either through domestic sources or external sources such as foreign loans or international aid. Many economists believe that choosing the appropriate method to finance the budget deficit is more important than the deficit itself, due to the negative economic and social impacts these methods may have on the national economy and society.

- The results of estimating the **ARDL-ECM model** showed that the value of the error correction coefficient (**CointEq(-1)**), estimated at **–2.279528**, is negative and statistically significant, confirming the existence of a long-term equilibrium relationship between the dependent variable and the set of independent variables. The value of the error correction coefficient also indicates that approximately **227.95%** of the deviation in the inflation rate from its long-term equilibrium value (in the previous year) is corrected in the current year

- The results further revealed that **bank financing (BF)** and **non-bank financing (Non-BF)** are statistically insignificant, indicating no proven significant effect of these two forms of financing the budget deficit on the inflation rate in the Algerian economy. However, **external financing** was statistically significant at the 5% level, with a probability of (**Prob = 0.0048**). Thus, in the long run, external financing of the budget deficit

affects the inflation rate in Algeria positively: a **1%** increase in external financing leads to a **4.8%** increase in the inflation rate. Accordingly, Algeria's recourse to external financing to cover the public budget deficit leads to increased inflationary pressures in the national economy.

In light of the study's findings, the following proposals and recommendations are presented:

✓ Resorting to **Islamic financing methods** to cover the public budget deficit, given their high financing capacity based on encouraging public and institutional participation in funding production and providing public goods in a more efficient and innovative manner.

✓ Integrating **Islamic finance** into the public budget structure, due to its unique ability to address deficits using various Islamic legislative tools that can ease expenditure pressures by providing additional financial resources such as zakat, waqf, investment, social solidarity, and Islamic sukuk.

✓ The need to **encourage domestic savings** to avoid or reduce reliance on external borrowing, and to ensure that external borrowing is limited to financing development projects that contribute to real output growth.

✓ The Algerian government should implement **fiscal and monetary policies** aimed at increasing production in economic sectors to reduce inflation rates, and limit deficit-financing policies, as they are among the most dangerous for the national economy by increasing the money supply and pushing inflation higher.

✓ Moving toward **rational and optimal use of financial resources** and controlling public spending, especially operational expenses, while fighting all forms of extravagance, waste, and public fund misuse.

✓ Striving to **integrate the informal economy** into the formal economy by offering financial facilities such as partial or full quasi-tax exemptions, conditional tax exemptions, and working to reduce tax evasion.

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6. APPENDICES:

Table (02): Error Correction Model (ECM)   Table (01): ARDL Model Estimation

Estimation in the Short Term

ARDL Cointegrating And Long Run Form
Dependent Variable: CPI
Selected Model: ARDL(2, 3, 3, 3, 3)
Date: 10/25/24 Time: 03:25
Sample: 1997 2023
Included observations: 24

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CPI(-1))	0.412625	0.429089	0.961629	0.3804
D(BF)	-0.004400	0.001880	-2.340924	0.0663
D(BF(-1))	0.000288	0.001699	0.169612	0.8720
D(BF(-2))	-0.001628	0.001379	-1.180495	0.2909
D(NON_BF)	-0.003779	0.001998	-1.891506	0.1171
D(NON_BF(-1))	0.002166	0.002358	0.918597	0.4004
D(NON_BF(-2))	-0.010747	0.003377	-3.182223	0.0245
D(EXT_F)	0.037820	0.018397	2.055805	0.0949
D(EXT_F(-1))	-0.030321	0.022129	-1.370194	0.2289
D(EXT_F(-2))	0.044447	0.015700	2.830938	0.0366
D(OER)	0.278495	0.229090	1.215658	0.2784
D(OER(-1))	0.256867	0.209847	1.224070	0.2755
D(OER(-2))	0.121370	0.132701	0.914616	0.4023
CointEq(-1)	-2.279528	0.605233	-3.766367	0.0131

Cointeq = CPI - (-0.0025*BF + 0.0016*NON_BF + 0.0192*EXT_F + 0.0675
  *OER -1.6753)

Method: ARDL
Date: 10/25/24 Time: 03:05
Sample (adjusted): 2000 2023
Included observations: 24 after adjustments
Maximum dependent lags: 3 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (3 lags, automatic): BF NON_BF EXT_F OER
Fixed regressors: C
Number of models evaluated: 768
Selected Model: ARDL(2, 3, 3, 3, 3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
CPI(-1)	-0.866903	0.380472	-2.278494	0.0717
CPI(-2)	-0.412625	0.429089	-0.961629	0.3804
BF	-0.004400	0.001880	-2.340924	0.0663
BF(-1)	-0.002570	0.001505	-1.708033	0.1483
BF(-2)	-0.000288	0.001699	-0.169612	0.8720
BF(-3)	0.001628	0.001379	1.180495	0.2909
NON_BF	-0.003779	0.001998	-1.891506	0.1171
NON_BF(-1)	-0.001147	0.001994	-0.575524	0.5899
NON_BF(-2)	-0.002166	0.002358	-0.918597	0.4004
NON_BF(-3)	0.010747	0.003377	3.182223	0.0245
EXT_F	0.037820	0.018397	2.055805	0.0949
EXT_F(-1)	0.020141	0.018660	1.079380	0.3297
EXT_F(-2)	0.030321	0.022129	1.370194	0.2289
EXT_F(-3)	-0.044447	0.015700	-2.830938	0.0366
OER	0.278495	0.229090	1.215658	0.2784
OER(-1)	0.253580	0.223031	1.136972	0.3071
OER(-2)	-0.256867	0.209847	-1.224070	0.2755
OER(-3)	-0.121370	0.132701	-0.914616	0.4023
C	-3.818832	8.954330	-0.426479	0.6875

R-squared	0.881977	Mean dependent var		4.454358
Adjusted R-squared	0.457096	S.D. dependent var		2.439442
S.E. of regression	1.797431	Akaike info criterion		4.025311
Sum squared resid	16.15379	Schwarz criterion		4.957937
Log likelihood	-29.30373	Hannan-Quinn criter.		4.272737
F-statistic	2.075819	Durbin-Watson stat		2.504194