

An Empirical Analysis of Public Debt and Economic Growth: Tunisia as a Case Study

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Abstract

Public debt has resulted in various economic problems in Tunisia since the outbreak of its revolution in 2010. The main objective of study is to examine the impact of public debt on growth in Tunisia during the post-revolution period. This study uses a vector error correction model (VECM) to investigate the impact of public debt on economic growth in Tunisia. The results prove the long-term relationship between all the variables. This study shows the drawbacks of debt and how it hampers economic growth; hence, it has a negative influence on interest rates and investments. This will subsequently lead to an economic recession due to decreasing growth.

Keywords: Economic growth, Public debt, VECM.

JEL Codes: O47; H63; C22.

1. Introduction

Debt is an unavoidable phenomenon, often used to mitigate the adverse impacts of economic

shocks. From ancient times to the present day, the issue of indebtedness remains a significant global challenge confronting the economy worldwide.

According to economic theories, public debt is a catalyst for economic growth. Many regions, with better institutional quality benefit, from debt to boost their economic growth (Jalles, 2011; Kim, Ha & Kim, 2017). Thus, public debt stimulates economic growth in highly transparent countries. In this regard, two theories explain the relationship between public debt and economic growth: the traditional view which supports the negative impact of debt on economic growth. In terms of economic policy, the study suggests that prudent and balanced public debt management, focused on productive investments and mindful of social impacts, is essential for the economic well-being of the MENA region., (Ajili & Ayoub, 2020). This assumes that the effect of public debt on economic growth can be either positive or negative (Rahman et al, 2019).

To present, several studies have been conducted on the relationship between public debt and economic growth. Some studies support the positive effect of debt, whereas others show the opposite. Some authors associate this effect with a debt threshold, distinguish between direct and indirect effects, or even dissociate the short-term from the long-term effects in their analyses. Other studies support the hypothesis that the debt-growth relationship is positively or negatively related to corruption. However, the effect of corruption on the relationship between these two variables remains unclear.

In this context, this study examines the effect of debt on economic growth in the presence of corruption in Tunisia. It uses an estimation approach using the autoregressive vector model (VAR) and analyses annual data over a given period of time. The hypothesis supported in the VAR representation is that the progress of the economy can be well understood by describing the dynamic behavior of a vector of several variables depending linearly on their past (Sims, 1980). The use of this statistical model, developed by Christopher Sims (1980), is justified by its ability to capture the interdependencies between multiple time series and its response to inadequacies in Keynesian macro-econometric models.

The major questions that must be addressed lie in studying the nature of the relationship between debt and growth, verifying the role of corruption as a brake on growth, and explaining the link between the use of debt and corruption. First, we will examine the relationship between corruption, debt, and economic growth in Tunisia. This will allow us to identify the direction in which this relationship is evolving to see whether corruption has a direct or indirect influence on the debt-growth relationship and to determine whether this effect is short or long-term.

Second, we will verify these relationships in the Tunisian context. The objective of this part is to check if the results obtained in the previous part are applicable to Tunisia. This should be examined further, since the Tunisian context was marked by several political changes after the revolution. Ultimately, we will discuss the main causes of the economic slowdown while highlighting the role of corruption. This part will explain the persistent slowdown in growth in the Tunisian economy and give the necessary recommendations for its recovery.

We expect the empirical results to contribute to a better understanding of the association between public debt and economic growth. In addition, this paper aims to generate deeper and richer analyses of public debt files, from which useful political implications can be derived. This study can generate a more exhaustive understanding of the subject of external debt and provide useful and understanding political solutions for the Tunisian context. Our expectations related to the results will help us better assimilate the effect of debt on growth, especially in a mixed environment marked by several divergences.

2. Literature Review

Some studies focus on the factors that determine the level of public debt and its effect on growth. Reinhart and Rogoff (2010) present arguments - in a multi-country sample spanning approximately two centuries - suggesting that high levels of debt constrain growth. Yusuf and Mohd (2021) argue that domestic debt has a significantly positive impact on long-term growth, but its short-term impact was negative. The findings of Reinhart and Rogoff (2012) also support the idea that lower growth over a given period is associated with the same period of debt. The reasoning of Umaru, Ahmadu and Musa (2013), in terms of domestic debt and external debt, shows an inverse relationship between debt and economic growth but to a varying degree. The external debt has a significantly negative impact on growth, but domestic debt has a positive impact on growth.

Theories of economic growth try to explain the factors that determine the economic growth of a nation. The Solow model is among the most famous theories of economic growth. Robert Solow a créé ce modèle en 1956, qui suppose que la croissance démographique, l'accumulation de capital et le progrès technologique déterminent l'expansion économique. Il existe plusieurs raisons pour lesquelles le modèle de Solow a été critiqué. Some economists think it ignores institutional factors like the quality of education and political institutions, which can also affect economic growth. Some economists contend that it fails to adequately consider environmental factors like pollution and the depletion of natural resources, which may also have an effect on economic growth. Despite these criticisms, the Solow model is still in use.

The multitude of works that consider the slowdown in growth is due to exceeding a debt threshold or to government inefficiency has led Butkus & Seputiene (2018) to explain that trade balance seems to be a factor that determines the threshold level rather than institutional quality. In the same context, Agbékponou & Keballo (2019) analyze the 2007-2016 period and demonstrate that a debt threshold, estimated at 30.71% of the GDP, has a negative impact on the economy. More specifically, the central government debt slows down economic growth. However, if the debt threshold is below 30.71% of GDP, any additional debt stimulates economic growth. Rahman, Ismail & Ridzuan (2019) note, that there is no general rule regarding the relationship between public debt and economic growth. This relationship can be positive, negative, or even nonlinear.

Tunisia's debt has skyrocketed in the last several years. Public debt increased from 46.7% of GDP in 2013 to 79.4% of GDP in 2022. Numerous circumstances, such as the COVID-19 pandemic, the war in Ukraine, and the political crisis of 2011, are to blame for this spike.

The majority of Tunisia's debt is composed of foreign debt. In 2022, it accounted for 66.7% of GDP, up from 39.9% in 2013. In 2022, domestic debt represented 12.7% of GDP, up from 7.8% in 2013.

Concerns over the sustainability of Tunisia's debt have been raised by the country's rising debt. In order to lower debt, the Tunisian government has increased taxes and decreased spending on the general people. But during the ensuing years, it's likely that Tunisia's debt will keep growing. The increase of Tunisia's debt has several repercussions. It might be detrimental to Tunisians' level of living, financial stability, and economic growth.

In their investigations, Abdelhafidh (2014), Brini, Jemmali, & Ferroukh (2016), suggest that a reduction in external debt should promote economic growth in Tunisia. However, Zaghoudi, Mezni & Djali (2016) show that in the short term, the stock of debt and debt service has no effect on economic growth in relation to exports of goods and services. In the long-term, servicing the external debt is detrimental to the Tunisian economy. In addition, according to Nasfi and al.(2014), the impact of debt on growth becomes negative beyond a certain stock, and Tunisia must control its debts because additional increases will have negative effects on the economic performance of the country. In the same context, Belguith & Gabsi (2019) show that fiscal policy is sustainable in Tunisia, noting that the primary balances respond positively to an increase in debt. In addition, they prove that the budget deficit is stationary, which implies that the budget constraint lasts over time.

Faced with these divergences in the explanation of the effect of debt on growth, many works have focused on other factors that can influence the debt-growth relationship. As a result, the explanation of the differences in growth between countries is due to the institutional quality (Acemoglu, Johnson and Robinson, 2001). In addition, good institutional quality implies a greater impact of financing on economic growth (Law, Azman-Saini and Ibrahim, 2013; Law and Habibullah, 2006). Being an improvement over later work, the study of Sani, Said, Ismail & Mazlan (2019) analyses the direct and indirect impact of institutional quality on economic growth.

The control of corruption is one of the major determinants of institutional quality (Kandil, 2009), so the interaction between these two variables should be studied. According to Kandil (2009), improving institutional quality is not a major factor in attracting FDI to the MENA countries. In their study, Breen & Gillanders (2012) demonstrate the negative effect of corruption on the quality of regulation and the insignificance of institutional quality in the face of controlled corruption. However, Bjørnskov (2011) tries to dissect the decrease in corruption caused by improving institutional quality and concludes that this hypothesis is verified in formal institutions in the fight against corruption only in the unofficial economy.

For their part, Sani, Said, Ismail & Mazlan (2019) support the overall improvement in institutional quality in order to minimize the negative effect of debt or benefit from the advantages of public footprints. In terms of efficiency, controlling corruption is particularly important for the use of public funds (AVCI & AVCI, 2016). Financing in different sectors, mainly extraordinary expenses, public investments, budget deficits, and debt, is perceived as the main factor which generally affects the amount of public debt. They add that the

inefficient use of public funds can change the size of a government, which is directly related to public debt.

Other studies suggest that a failing institution causes the destabilization of the country's borrowing decisions, a diversion of funds borrowed for high-value projects, such as health or education, to potentially useless or very low-cost projects, and profitability, such as defense or infrastructure where corruption is widespread (Jalles, 2011). In order to make recommendations to reduce the level of debt and debt service of developing countries, the G-7, the World Bank and the IMF came forward to achieve such a mission.

In their investigation, Khemais, Mohamed & Nesrine (2016) explain that the debt problem does not emanate from its nature, but rather from the use of this debt. Low added value characterizes projects financed by external debt. Again, these projects use a skilled workforce and do not generate wealth in areas where the country generates competitive advantages. The consequences are harmful; they are translated by a bad allocation of the funds borrowed towards the wages of the public sector. This will slow down the growth, since these wages will be directed towards consumption. This will also accentuate the unemployment rate of the graduates.

In short, studies on the relationship between public debt and economic growth have been reviewed, and it has been shown that the research results have been different.

3. Evolution of Public Debt in Tunisia

The main objective of the Tunisian government for several years has been to establish sustainable economic growth and a stable macroeconomic balance. This objective has three phases marked by the evolution of public debt. The first phase covers the period 1986 to 2001, which is characterized by an unsustainable budget deficit. In 1986, the debt reached 52.22 % of GDP, including 14.10% of domestic debt and 38.12% of foreign debt. This level of debt is considered unsustainable and contributes to intervention by the International Monetary Fund (FMI) through a structural adjustment plan.

The second period is from 2002 to 2010, when public debt decreased, tempering decreased to 38.8% of GDP in 2010 compared to 52.22% in 1986. During this period, Tunisia experienced an acceleration of economic growth, with a GDP rate that reached 5.5% in 2002 and up to 6.3% in 2007. The third phase is the post-revolution era (after 2011), during which Tunisia is still facing an economic crisis marked by a high unemployment rate of nearly 18% in 2020, with a debt ratio of 85.6%. According to the statistics of the Tunisian Central Bank, this rate increased from 38.8% of GDP in 2010 to 90.13% in 2021. Figure (1) represents the evolution of public debt in Tunisia between 2010 and 2021.

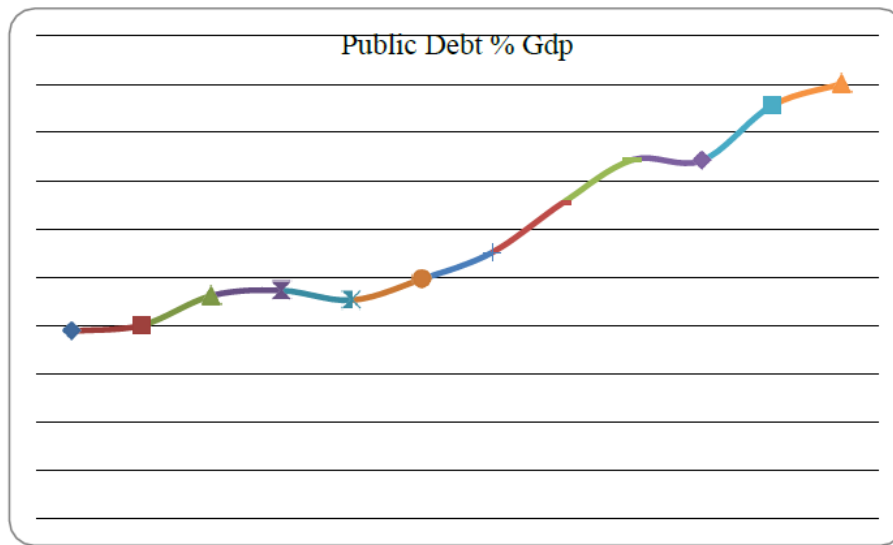


Figure 1. The evolution of public debt in Tunisia

Data Source: Central Bank of Tunisia This progressive trend began in 2011 and accelerated in the post-revolution period. This period is characterized by the rising repossession of financial needs with a massive drop in production and, consequently, a decrease in added value. These post-revolution years are marked by social movements, disturbances, strikes, and poor management of national production, particularly oil and phosphates, which signal the Tunisian government’s failing policy in terms of national production. In 2010, Tunisia was able to produce more than 8 million tons of phosphates with revenues of 825 million dinars, while in 2011 only 2.2 million tons were produced, 3.9 million in 2017 and 2.8 million in 2018. With regard to oil activity, national production fell from 80,000 barrels per day in 2010 to approximately 40,000 barrels in 2016 and to less than 35,000 barrels in 2020.

All these economic events have led to a deficit in the state’s budget, which then results in an orientation towards debt, whether external or internal, to finance the budget deficit. According to Tunisia's Central Bank, public debt service payments rose to over 11,130 billion dinars (9.4% of GDP) in 2020 and 14.911 billion dinars (11.9% of GDP) by the end of 2021. This financing imbalance essentially depends on the state's inability to control public expenditure, particularly the wage bill, which represents 61.9% of the state budget with a rate of 16% of GDP in 2021, compared to 8.9% in France, 5.5% in Jordan, 10.7% in Morocco, and 5.2% in Egypt.

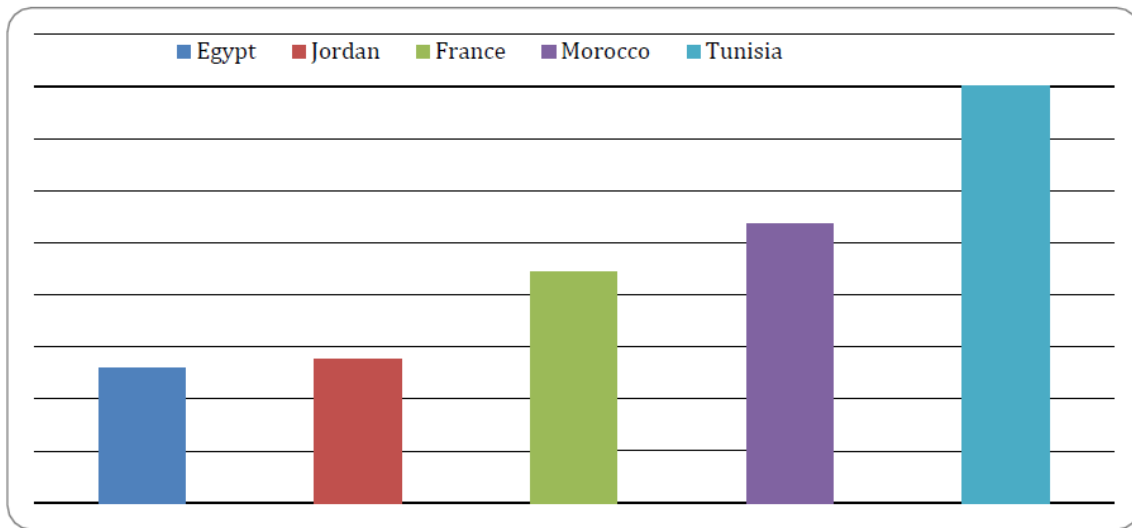


Figure 2. Comparative evolution of the payroll (% of GDP 2021)

Data Source. World Bank According to the Ministry of Finance in Tunisia, the state budget for 2022 is planned for 57.2 billion dinars (about 17.6 billion Euros), including 20 billion dinars (5.7 billion Euros) debt to finance government spending.

4. Analysis of the Impact of Public Debt on Economic Growth

a. Evolution of public debt and growth in Tunisia for the post-revolution period

Empirical studies that examine the correlation between public debt and growth are limited, although existing works are concentrated on developed countries. While examining the data on Tunisia, we notice a negative correlation between public debt and economic growth. Accumulated public debt represents a real economic problem for the future because it slows down growth and constitutes an obstacle for future generations.

In this study, we empirically test the correlation between public debt, expressed as a percentage of GDP, and economic growth measured by the growth rate of real GDP. Before testing the impact of public debt on economic growth in Tunisia, it is useful to analyze its evolution. Figure (3) represents the evolution of public debt and GDP growth in Tunisia between 2010 and 2021.

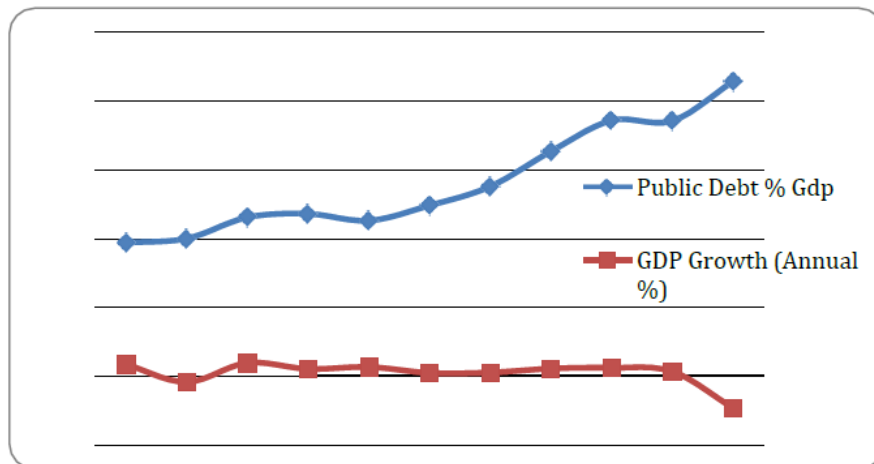


Figure3. Structure of Tunisia’s public debt (percentage of GDP)

Data Source. World Bank

Annual growth decreased from 3.51% of the GDP in 2010 to 1.40% in 2019 and -9.18% in 2020. In this period, public debt increased significantly, and economic growth slowed. Public debt has increased from 38.8% in 2010 to 55.1% in 2016, reaching 85.6% in 2020. This debt emanates mainly from loans granted by international organizations, particularly the International Monetary Fund (IMF) and World Bank. The debt crisis is increasingly harmful due to the dropping value of the local currency (Dinar) which fell from 1.92 TND/EUR in September 2010 to 3.31 TND/EUR at the beginning of 2022, hence the rise of debt. In sum, we see that Tunisia embarked on a dramatic process during the post-revolution years, characterized by a difficult economic situation and the challenge of achieving a successful democratic transition.

The relationship between public debt and economic growth can be described using the following simple linear regression equation: The equation used to determine the impact of public debt on economic growth in 2010-2020 period, is presented as follows:

$$Y_t = \beta_0 + \beta_1 * X_t + \varepsilon_t \tag{1}$$

Where: Y_t = GDP growth (annual %); β = parameter independent variable; X_t = Public Debt % of GDP; ε_t = error term of the equation

Using the Eviews10 program, the results of the estimation of the relationship between public debt and growth are presented in table (1):

Table 1. Relationship between public debt and economic growth

Variable	Coefficient	t-statistic	prob
Public Debt	-0.124353	-1.919144	0.0872
c	7.907053	2.086794	0.0665

Source. Own processing According to these results, we notice the negative and significant effect of public debt on economic growth in Tunisia with an estimated coefficient of the order -0.12, which clearly explains the successive deterioration in growth throughout the post-revolution period.

b. Data and Methodology

In order to conduct the analysis of public debt on economic growth in Tunisia, annual variables were obtained from the World Development Indicator (WDI 2021) and the Central Bank of Tunisia over the period 1990-2020.

Our empirical study is based on a VAR model with three variables transformed into a logarithm. The standard VAR model is described in equation (2):

$$Y_t = A(L)*Y_{t-1} + B(L)* X_t + \varepsilon_t \quad (2)$$

Where : Y_t : Vector of explained variables. X_t : Vector of explanatory variables. ε_t : The error vectors.

$A(L)$ and $B(L)$ the coefficients of endogenous and exogenous variables vectors.

This vector is of dimension 3 comprising the logarithm of the gross domestic product growth, the public debt % of GDP and the investment % of GDP. Our empirical analysis is carried out using the J- Multi software.

The following situations warrant the employment of ECMV because there is a long-term trend is evident in the time series, also, we will examine causal linkages between time series over an extended period of time and there is a long-term trend is to be taken into consideration while projecting the timeseries' future values.

5. Empirical Findings and Results Analysis

a. Lag length selection criteria

To choose the number of lag lengths, it is necessary to determine the optimal lag length p . It is that which minimizes the criterion of Akaike (AIC) and Schwarz (SIC). The lag length selection criteria to be evaluated include:

$$AIC_p = -2T \left[\ln \left(\hat{\sigma}_p^2 \right) \right] + 2p \quad (3)$$

Akaike information criterion

$$SIC_p = \ln \left(\hat{\sigma}_p^2 \right) + [p \ln(T)] / T \quad (4)$$

Schwarz information criterion

Thus, the choice of the optimal lag length number is 1; this result is confirmed by the Akaike and Schwarz criteria. The results are shown in table (2):

Table 2. Lag length selection

	AIC	SIC
1*	-1.5998*	-1.5073*
2	-1.5912	-1.4231

Source. Own processing

b. Unit Roots Test

Before estimating the VAR model, it is important to verify the stationary of data series. In this study, we retain the test Augmented Dickey-Fuller (ADF). The results presented in tables 3 and 4 show that all the variables in the system are not stationary at the level but are stationary at first difference.

Table 3. Unit Roots Tests*- variables in level

Variables	Critical Value			ADF
	1%	5%	10%	Level
GDP Growth (%)	-2.56	-1.94	-1.62	-1.52
Public Debt (%GDP)**	-3.96	-3.41	-3.13	0.25
Investment (%GDP)**	-3.96	-3.41	-3.13	-2.98
Interest Rate	-2.56	-1.94	-1.62	0.99

Source. Own processing

*output from J-Multi

**Variables are in log in a actual.

Table 4. Unit Roots Tests*- variables in first difference

Variables	Critical Values			ADF
	1%	5%	10%	Level
GDP Growth (%)	-2.56	-1.94	-1.62	-6.11
Public Debt (%GDP)**	-3.96	-3.41	-3.13	-4.43
Investment (%GDP)	-2.56	-1.94	-1.62	-3.90
Interest Rate	-2.56	-1.94	-1.62	-3.39

Source. Own processing

c. Co-integration Test

The second step is to apply the Johansen (1988 and 1991) co-integration tests. These results are reported in table (5). Our results indicate the rejection of the null hypothesis ($r=0$), mainly the absence of co-integration relationship between all variables. However, we cannot reject the hypothesis ($r=1$), thus the existence of co-integration relationship. A vector error correction model (VECM) is thus the correct specification.

Table 5. Test of co-integration rank

	Critical values	prob	1%	5%	10%
$r=0$	61.80	0.0077	60.81	53.94	50.50
$r=1$	21.25	0.6478	40.78	35.07	32.25
$r=2$	6.84	0.9009	24.69	20.16	17.98
$r=3$	1.45	0.8708	12.53	9.14	7.60

Source. Own processing According to the trace test, there is a cointegration relationship that leads us to proceed with the estimation of the vector error correction model. Error correction models introduced by Hendry allow the modeling of adjustments that lead to a long-term equilibrium situation. They are dynamic models that integrate both short- and long-term changes in the variables. The error correction model describes an adjustment process by combining two types of variables: first, difference variables that are stationary, which represent short-term fluctuations, and standard variables that ensure that the long term is taken into account.

$$\Delta X_t = \mu + \alpha\beta' X_{t-1} + \sum_{i=1}^{K-1} \tau_i \Delta X_{t-i} + u_t \quad (5)$$

Where: X_t : a vector with n integrated variables of order (1) Δ : Represents the operator of the first difference (1-L)

$$\Delta X_t = X_t - X_{t-1}$$

u_t : is an n -dimensional vector of residuals which follows a normal distribution characterized by a mean 0 and variance ω .

μ : is a vector of constant terms.

τ_i : is a short-term dynamic matrix.

α and β are matrices of dimension $(n.r)$ where r is the co-integration rank. The matrix β determines the rank of co-integration.

d. Impact of public debt on growth, impulse responses

The impact of public debt on economic growth has been the subject of several theoretical debates and varies according to schools of economic thought. For the classical school, this effect is negative on economic activity since debt is an obligation for future generations. In contrast, Barro (1984) shows that debt has no effect on economic activity. Keynesians believe

that public borrowing does not involve costs either for future generations or for present generations, since it constitutes investments that it generates. In the Tunisian context, the debt ratio tends to increase dramatically in the post-revolution period. The debt ratio is 90.2% of GDP in 2021 and is expected to reach 99.1% in 2026. In our study, we notice that the effect is positive in the short term following a shock of 1% to public debt on economic growth. This multiplier becomes negative during the following periods. Table (6) shows the impact of a 1% increase in public debt. Clearly, the impact of debt is negative and significant in Tunisia. Raising public debt by 1% has a positive effect on growth in the first year, but this impact becomes negative up to a multiplier of -9.33 for the fourth period and -16.04 for the sixth period. The negative impact of public debt on growth can be explained by the share of government employees' salaries in GDP, which was 16.9% in 2020 (IMF).

Although the Tunisian economy follows Keynesian theory, that is, government intervention in economic activity, growth responses following a debt shock follow the classical theory. This phenomenon is explained by the use of debt to pay salaries in the government sector but not to generate investments that boost growth and subsequently minimize debts. This explains the increase in debt service payments, which is approximately 12% of the GDP at the end of 2021. This leads to the government's inability to return debt and further worsens the economic situation.

Table 6. VEC impulse Function, Response GDP to Shocks

	T=1	T=2	T=3	T=4	T=5	T=6
GDP	1.43	-3.27	-5.85	-9.33	-12.58	-16.04

Source. Own processing Figure (4) provides more details regarding this negative impact on economic activity following a shock on public debt. They suggest that public debt strongly decreases growth in the medium and long terms; thus a debt control policy is necessary.

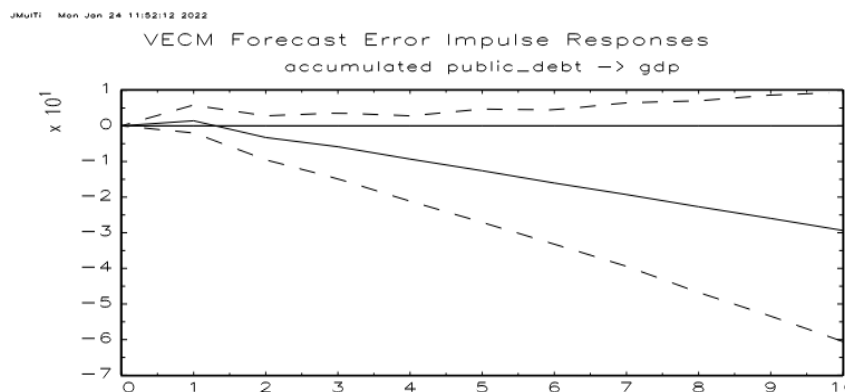


Figure 4. Accumulated feedback effect of public debt on GDP

Data source: Own processing

e. Impact of public debt on interest rate, impulse responses

While examining table (7), it appears that increase in public debt leads to strong and rapid responses in interest rates. Indeed, the cumulative response of the interest rate following an instantaneous shock of 1% on public debts is 0.72 in the first period and continues to propagate until it reaches 3.65 in the fourth period. The effect is therefore expansionary, and the Neo-Ricardian hypothesis (Barro 1974) is verified in the Tunisian context. The apparent rate of public debt recorded a significant increase in the post- revolution period from 45.5% of GDP share in 2010 to 90.2 % in 2021 (IMF). This upward trend in debt was accompanied by rising interest rates.

The sequence, therefore, seems to be as follows: the increase in debts directed towards financing needs, especially salaries in the case of Tunisia, but not towards investment needs that generate income increase - hence allowing paying public debt, induces increasing interest rates.

Table 7. VEC impulse Function, Response Interest Rate to Shocks

	T=1	T=2	T=3	T=4	T=5	T=6
Interest rate	0.72	1.67	2.60	3.65	4.68	5.73

Source. Own processing Figure (5) While it is evident that the interest rate responds swiftly to a debt shock, it is important to note that a direct debt shock also induces responses in the form of rising interest rates. Thus, we must investigate the harmful effect of rising interest rates on investment.

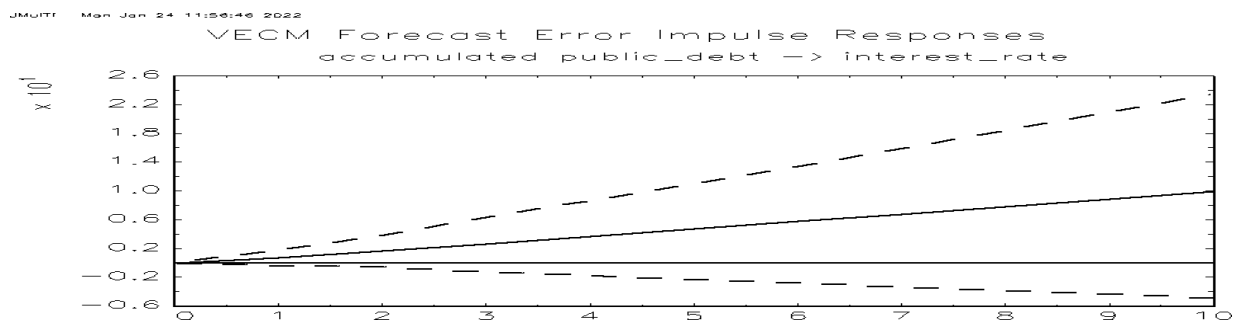


Figure 5. Accumulated feedback effect of public debt on interest rate

Source. Own processing

f. Impact of interest rate on public investment, impulse responses

According to table (8), we have noticed negative and instantaneous impulse responses of -0.11 of investment in the first period, following a one-unit decrease in the interest rate. They then continued to decrease rapidly to reach -0.73 in the sixth period. This is obvious if we examine figure (6), which presents the accumulated feedback effect of interest rates on public investment.

Table 8. VEC Impulse Function, Response Public Investment to Shocks

	T=1	T=2	T=3	T=4	T=5	T=6
Public investment	-0.11	-0.24	-0.36	-0.49	-0.61	-0.73

Source. Own processing An explanation of these answers can be provided if we analyze the fluctuation of interest rates in Tunisia after the revolution. It went from 4.87% in 2010 to 9% in 2021, which has harmful effects on investment since credit requests for investment purpose will decrease.

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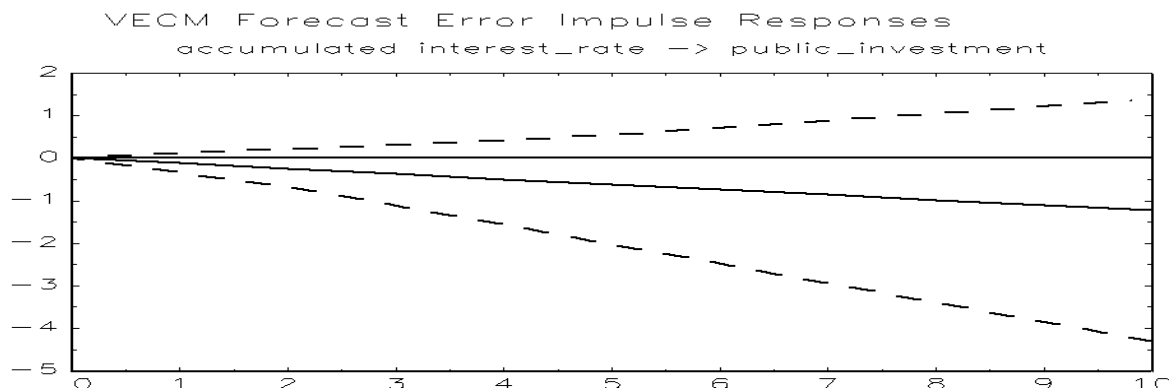


Figure 6. Accumulated feedback effect of interest rates on public investment

g. Impact of public investment on growth, impulse responses

Following a structural shock of 1% on public debts, the multiplier is negative (-8.8). This multiplier decreases further during the 10 periods. This allows us to conclude that the debts are oriented towards operating expenses, mainly salaries. Another explanation is that in the Tunisian context there is no control over credits granted for investment needs and, according to the latest report from the World Bank in 2021, non-productive credits are 13.6%. Thus, for an economic policy whose objective is to reduce the budget deficit, as in the case of Tunisia, particularly in the post-revolution period, it is necessary to regain the confidence of internal and external investors through economic, political and social measures. Limiting operating expenditure by reducing the share of wages in GDP is effective in achieving this objective without reducing growth.

Table 9. VEC impulse Function, Response GDP to Shocks

	T=1	T=2	T=3	T=4	T=5	T=6
GDP	-8.80	-16.39	-24.96	-33.84	-42.83	-51.72

Source. Own processing As shown in figure (7), the variable growth measured by GDP has a strong response to investment.

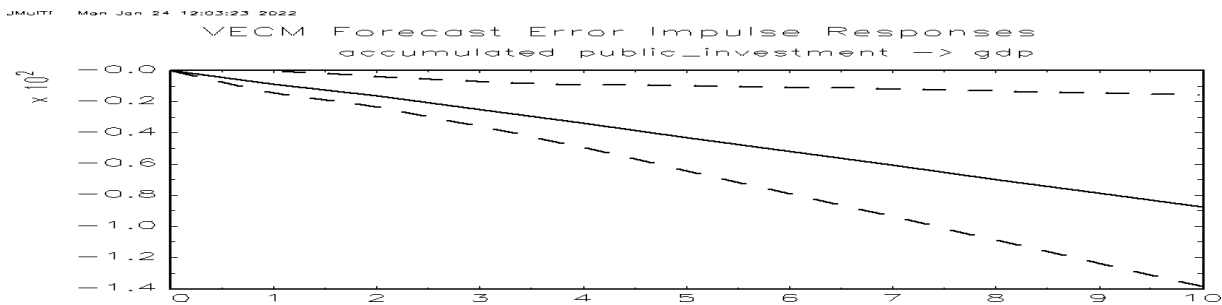


Figure 7. Accumulated feedback effect of public investment on GDP

When investment is impacted by a standard unit, the variable of growth decreases in the first period and continues to decrease in the following periods. This downward trend is explained by non-productive credits and public debts directed towards operating expenses and social transfers, which were the main objectives of the Tunisian government after the revolution to maintain political stability and control disturbances and strikes. This has resulted in the government's inability to pay its debts back and the impossibility of obtaining other external credits before implementing economic, social and political reforms to stabilize the economy and ultimately minimize the budget deficit.

6. Conclusion and Recommendation

This study focuses on the impact of public debt on growth in Tunisia between 1990 and 2021. The VECM model uses data on public debt, GDP, interest rates, and investment to test the relationship between them. We conclude that the negative relationship between public debt and economic growth contradicts Keynesian theory, although the Tunisian economy follows the Keynesian model. This result proves that the growth responses following a 1% shock to public debt are consistent with the neo-Ricardian theory. According to the World Bank, nonproductive credit is 13.6 %, which clearly explains this economic phenomenon. We also found that the wage portion is 16% of GDP in 2021 according to the IMF, so we have recognized that Tunisian government loans are oriented towards operating expenses. This, therefore, leads to an increase in interest rates and, subsequently, a decline in investment as well as economic growth.

Based on this study, possible solutions to this economic situation are as follows.

- ✓ Reduce employees and encourage them to retire early to reduce pressure on the budget.
- ✓ Rejecting any extension or renewal requests by those who reached retirement age.
- ✓ Reduce recruitment in the public sector, and boost the private sector.
- ✓ Encourage the private sector to invest and reach short and medium term goals.
- ✓ Encourage investments that will result in achieving short and medium term goals.
- ✓ Rationalize social expenditure and reduce energy subvention.

Despite the dramatic situation of the Tunisian economy after the revolution, it remains capable of fiscal and budgetary measures to overcome this economic crisis. A good example is the 1986 crisis, which was overcome through a structural adjustment program prepared by the International Monetary Fund.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Macrothink Institute.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

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Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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