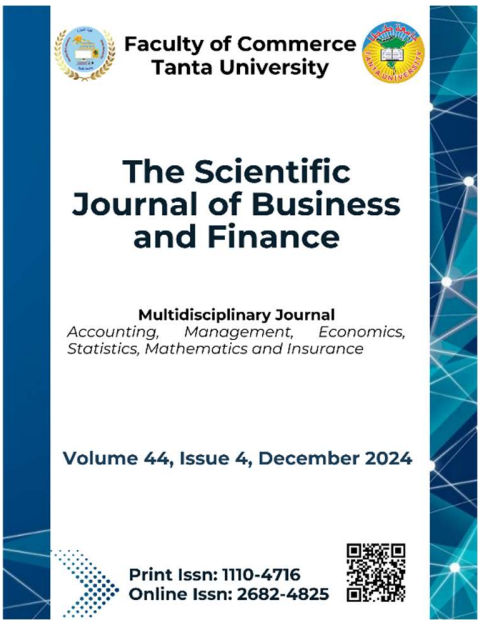

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Exploring the Non-Linear Impact of Government Debt and institutional quality on Economic Growth across the MENA Region: Evidence from GMM approach

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Abstract

This paper investigates the relationship between government debt and economic growth in MENA countries, analyzing data from 19 countries over the period 1996-2022. A conventional growth model was developed and then estimated in quadratic form using the dynamic panel generalized method of moments (GMM). The findings indicate that while government debt generally affects economic growth, the relationship varies by specification. Linear models show a positive impact of debt on growth, whereas quadratic models reveal a non-linear association: debt positively influences growth up to a threshold of 12-15%, beyond which it becomes detrimental. Robustness checks incorporating population growth and unemployment rates support these findings. Policy recommendations include reducing government debt to enhance economic growth and mitigate sustainability and solvency risks. Emphasis is placed on fostering sustainable economic growth, promoting private sector projects with international market focus, and strengthening legal and institutional frameworks to optimize the use of borrowed funds.

Keywords: government debt; institutional quality; threshold effect; economic growth; GMM

1. Introduction

Government debt's exponential increase has captured the interest of policymakers and academics aiming to comprehend the impact of this substantial publicly financed debt on economic development. The director of the public finance department of the IMF, Carlo Cottarelli, asserts that government debt levels in industrialized countries have reached unprecedented levels, even in the absence of a significant world conflict. Hence, it is imperative to ascertain the degree to which government debt impacts economic growth. In the Maastricht Treaty, the debt target is set at 60% of GDP, which strictly prohibits government debt from beyond this amount. Nevertheless, after the financial crisis of 2007-2008, and subsequent crises like as the European debt crisis, Covid-19 epidemic, and Russian-Ukrainian conflict, an economic deceleration had significant consequences for public finances. Within the Euro zone, the debt rate rose from 66.2% in 2007 to 88.6% in 2023. This growth varies in magnitude from one country to another. Ireland saw the most significant

surge in its debt level, reaching 90% of GDP, as a direct consequence of the financial crisis. Nevertheless, Ireland has managed to progressively decrease this ratio until it reached 43.3% in 2023. At 2023, Greece's debt has risen to a level above 168% of its GDP. In a similar vein, Spain and Portugal are currently facing a surge in their debt levels, surpassing 107 and 99% of their respective GDPs. Within the majority of eurozone nations, the level of debt to GDP exceeds the specified threshold.

The substantial surge in government debt is not limited to the countries inside the euro zone but has also been evident in other regions throughout the same timeframe. By the end of 2023, the government debt ratios in the United Kingdom, which were relatively modest in 2007, increased from more than 40% to almost 98% of GDP. Moreover, By the end of 2023, the United States government debt rose from in excess of 60% of GDP to 122% of GDP. furthermore, in Japan, the debt rate increased from a significant level of 50% of GDP in 2007 to 263% of GDP in 2023.

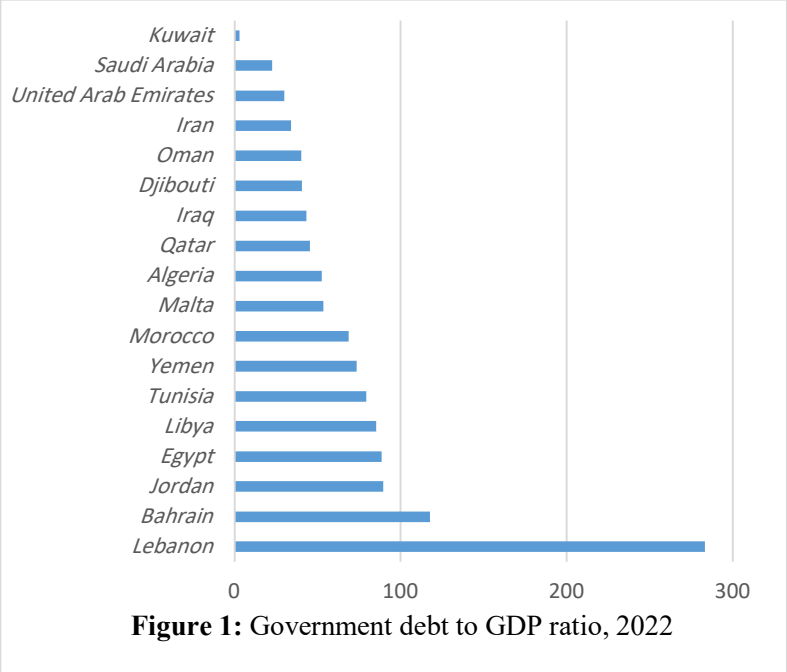

Figure 1: Government debt to GDP ratio, 2022

Looking at the countries of the MENA region, they were not far from these repercussions. where some countries in the region are threatened by an impending debt crisis, as their indebtedness level has surged in most of these countries figure (1). Egypt, Jordan, and Tunisia are increasingly standing on fragile economic ground faced with a rising threat of a possible debt crisis. The case of Lebanon perhaps acts more as a warning; the country is undergoing one of the world's worst economic collapses following defaultation on its debt. It puts into perspective the huge challenge these countries are passing through and how catastrophic the outcome is likely to be if the situation persists.

The significant surge in the debt rate witnessed recently is clearly connected, on one side, to the assistance programs implemented during the crisis and on the other side to the subsequent

contraction in income resulting from the economic slump. Hence, it is important to acknowledge that the expansion of budget deficits precisely determines the rise in the government debt ratio. Despite the economic situation being effectively managed since 2010, the debt rate of most industrialized nations has experienced a persistent increasing trend. Undoubtedly, this phenomenon has compelled academics and political leaders to investigate the influence of government debt on economic growth with more accuracy. Research within this specific perspective has extensively examined the economic implications of government debt.

Many scholars, including Elmendorf and Mankiw (1999), Ricardo (1820), Barro (1974) have conducted comprehensive literature evaluations to establish theoretical frameworks for investigating the correlation between government debt to GDP and economic prosperity. Subsequently, Singh (2006), and Cohen (2011) provide a comprehensive and rather thorough analysis of the correlation between government debt and economic development.

Moreover, the majority of empirical research on this topic aims to determine the most effective level of debt/GDP ratio, without a well-defined theoretical model that demonstrates the connections between government debt levels and growth dynamics Reinhart and Rogoff, (2009 and 2010); Panizza and Presbitero, (2012); Kumar and Woo, (2010); Checherita and Rother, (2010), and Ferreira, (2009). Although the Reinhart and Rogoff scenario has faced criticisms and its investigation revealed inaccuracies, the significant boundary of 90% seems to be essential as it addresses a deficiency in the existing body of literature on the topic.

It’s important to note that these works mainly concern panels of developed and emerging countries in Europe, Asia and America. For the Middle East and North Africa (MENA) region, certain countries are, in the best cases, included in the samples already considered. And, to our knowledge, no work has been fully devoted to examining the relationship between government debt and economic growth in the MENA region.

The main aim is to analyze the underlying essence of the correlation, if the correlation exists, between government debt and economic prosperity and to determine the presence of a potential boundary that could initiate a shift in this correlation.

The subsequent sections of the paper are as follows. Section II will provide a comprehensive overview of the theoretical and empirical research conducted on the relationship between government debt and economic growth. section III will be devoted to the specification of the model and the econometric methodology. section IV will present the results obtained and their economic interpretations. Finally, in conclusion, we summarize our major findings, policy recommendations and future research..

2. Literature Reviews

Most theoretical studies on the relationship between external debt and economic growth focus on the nature of the negative effects of debt overhang (for instance: Dooly (1986), Krugman (1988), Sachs (1989), Patillo et al. (2004)), which can be viewed at medium levels as having positive effects on welfare and growth, if the additional capital financed by new loans leads to increased productive capacity, which in turn increases the country's ability to meet its debt service obligations. However, if these burdens reach high levels, they will inevitably have negative effects.

In order to understand this non-linear effect of external debt, Krugman (1988) believes that increasing the size of external debt to a level that exceeds the country's ability to repay will make the burden of debt service an increasing function of the size of this country's productivity, which can be viewed as a tax deducted from the rate of return on investment towards external creditors.

In addition, an increase in external debt volumes leads to a decline in incoming foreign capital, due to increased uncertainty about the measures and policies that the government will take to meet these debts and the burdens associated with them, especially in times of crises where expectations increase that the government will resort to a set of distortionary measures (such as inflationary tax) Agenor and Montiel (1999); which may push potential investors either to wait, or not to risk in projects that support economic growth in light of this atmosphere surrounded by uncertainty Serven (1997). On the other hand, the accumulation of external debt can be associated with capital flight if the private sector expects a devaluation of the national currency or an increase in taxes as a measure by the local government to pay off these debts Oks and Wijnbergen (1995).

On the other hand, the negative effects of external debt may not only be related to the size of the debt but also to changes in the circumstances surrounding the country that may affect its ability to meet the burdens associated with these debts. Such circumstances may arise due to economic shocks or unfavorable political and social changes; which may increase the risk to existing creditors of the country's inability to repay its obligations; as a result, these creditors rush to claim their dues and potential creditors withdraw from subscribing to new loans. This ultimately leads to a decrease in the economic growth rate Arslanalp and Henry (2004). In this context, the only solution to re-attract investments and stimulate economic growth is to cancel these debts Deshpande (1997).

Despite the positive effects of external borrowing on economic growth (at reasonable levels) Wang (2009), it was shown that the buildup of external debt might lead to a reversal in the relationship between external debt and economic development when the government debt to GDP reaches the critical stage. This critical stage of debt will terminate the positive effects suggested by theoretical studies on external borrowing. Consequently, local governments will face greater limitations in carrying out their fundamental functions due to both conventional and non-traditional cyclical fluctuations. As a result, governments will redirect their export revenues and foreign exchange resources towards servicing their accumulated debts.

Singh (2006) acknowledges that a significant amount of government debt has adverse effects on economic growth and other measures of developmental progress, thereby compromising macroeconomic stability. Moreover, the research conducted by Alesina and Tabellini (1989) and Cerra et al. (2008) provided evidence for the presence of a correlation between the rise in debt and the phenomenon of capital flight. Consequently, economies with inadequate institutions have a tendency to accumulate debt, which in turn deters capital inflows and promotes capital flight. The theory of the burden of debt emphasized the detrimental impact of debt on the economic actor's expectations and, consequently, on investor decisions. According to the hypothesis of the theory, if a country is unable to fulfill its debt obligations, there would be reduced incentive to invest,

considering the anticipated expenses associated with maintaining this obligation. This exerts a deleterious impact on investment by directly influencing the flow of capital.

Empirical findings from Christensen (2005) and Hanson (2007) indicate that governments that bear a substantial amount of public debt encounter restricted investment from private sector, leading to a decline in overall national savings and an increase in borrowing costs. Hence, there exists a constraint in the expansion of credit. In the event of a longer maturity, the transfer of risks to banks, facilitated by the fixed interest rate of domestic borrowing, results in a decrease in returns, therefore giving rise to the occurrence of credit rationing.

Cohen (1993) lays the explanation for the deceleration in investment on debt servicing rather than its outstanding quantity. This implies that the decrease in investment is mostly caused by the outflow of money resulting from the repayment of the debt, rather than the magnitude of the financial obligation. Indeed, the resources that may be directed towards investment will be allocated towards the repayment of debt service. Issues with the repayment of debt service pose a challenge to economic transformation (Clements et al., 2003).

While the previous studies give significant insight into the theoretical foundation that explains debt accumulation, most of them are limited to either single, short periods or localized regions, and very few actually discuss empirical analysis of the non-linear relationship existing between debt and economic growth, particularly for the MENA region. At the same time, in most studies, the issue of the peculiar difficulties of external debt management arising in the countries of the MENA region is not developed in sufficient detail, considering economic volatility and political instability within the region.

Accordingly, the present study contributes to the existing literature in a number of significant ways by offering comprehensive analyses of the nexus between government debt and economic prosperity in the MENA region. The paper will contribute to the literature by addressing some main areas:. This paper applies advanced econometric techniques to realize the nonlinear effects of external debt on economic growth beyond the restrictive linear model adopted by earlier studies. The study also pinpoints the threshold level at which government debt changes from being beneficial to being detrimental to economic performance, showing more clearly the optimal levels of debt supporting growth and the critical thresholds beyond which debt becomes harmful to economic performance. Second, while previous studies have dominated the global and regional contexts, the current study focuses on the MENA region, which faces peculiar challenges regarding government debt management. The focus shall fall on a region that provides valuable insight into the dynamics of debt and growth within the economies of MENA and hence addresses the existing literature gap that has often neglected this economically and politically peculiar region. The contribution of this study, therefore, is the integration of dynamic panel data models precisely through the GMM method of estimation in an effort toward better and more serious tackling of the issues of endogeneity and estimation bias largely overlooked by most previous studies. The estimated results from this approach are an improvement in terms of being robust and reliable estimates of the relationship between external debt and economic growth and, thus, giving an accurate insight into exactly how debt impinges on long-term growth. Finally, besides the

academic contribution, the empirical findings from this study imply a number of practical policy recommendations that can help governments in the MENA economies manage their debt levels in a way that is conducive to sustainable economic growth. By identifying these critical debt thresholds, the research will indicate how a balance could be struck between borrowing for development without falling into the adverse implications of over-accumulation of debt.

2.1. The relationship between government debt and economic growth

The link between government debt and economic growth has recently been the subject of a series of empirical studies. Reinhart and Rogoff (2010[a]), A dataset consisting of almost 3700 annual observations was used to examine the correlation between total government debt and economic development in a selection of 44 countries, spanning 20 developed and 24 developing countries. The analysis demonstrates that there is no correlation between government debt and economic development, provided that the level of government debt is not above 90% of the Gross Domestic Product (GDP). It is evident that countries with a government debt/GDP ratio exceeding 90% experience significantly lower economic growth rates compared to countries with lower debt burdens. This characteristic of non-linearity is evident in emerging as well as advanced economies. An underlying assumption of the nonlinearity hypothesis is that the influence of debt on economic development is not invariably detrimental. Unquestionably, well managed debt may yield positive results, but if it exceeds a specific limit, it begins to be detrimental to investment and hence to economic development.

The scholars suggest that the lack of linear relationship could be elucidated by formulating the notion of "debt intolerance". Undoubtedly, upon an economy reaching the expected boundaries of debt acceptability, we observe an increase in market interest rates. Consequently, the rise in rates results in a corresponding rise in taxes, which in turn causes significant budgetary adjustments.

Moreover, Reinhart and Rogoff (2010[b]) demonstrate that within a cohort of 20 industrialised nations from 1790 to 2009, those countries with government debt exceeding ninety percent of GDP experience average yearly growth that is two percentage points lower compared to countries with debt below thirty percent of GDP. Accordingly, countries that above the 90% threshold have a growth rate of 1.7%, but countries with a government debt/GDP ratio below 30% have a growth rate of 3.7%. This disparity of two percentage points supports the notion of a more robust correlation between government debt and economic growth in developing countries.

In a later study, Herndon et al. (2013) re-estimated the results of Reinhart & Rogoff using the same data. Herndon found a number of errors in Reinhart's estimates, including errors in data collection and recording, selective data omission, and an inaccurate estimation methodology. The study concluded that exceeding the 90% of GDP debt barrier would have a positive effect on economic growth of 2.2%, not -1% as Reinhart had suggested.

In the same vein, Aschauer (2000) presents a growth model that examines the non-linear impact of public capital on the process of economic growth. The author posits that government debt serves as a mechanism for funding public capital. Evidence indicates that while an increase in government debt might have favorable outcomes, beyond a specific limit, these impacts turn unfavorable.

Along the same lines, the IMF (2002) carries out an empirical study to examine the link between debt and growth. The results of this study showed that when debt represents 160% to 170% of exports and 35% to 40% of GDP, it negatively affects economic growth. Also, it seems that the growth gap between low-debt countries and highly indebted countries is on average more than 2% per year. According to the IMF study, low-indebted countries are those where the debt represents less than 100% of exports or 25% of GDP, while the debt of highly indebted countries represents more than 367% of exports or more than 95% of GDP. . Finally, when we record a reduction in debt from 200% to 100% of exports, a gain of around 1 point in growth per capita is noted.

Ferreira (2009), for 20 OECD countries over the period 1988-2001, and by applying Granger causality tests, shows that increasing debt rates have negative effects on growth. The negative effect is statistically significant and occurs in both directions: high government debt reduces economic growth, and low growth worsens the debt.

The work of Minea and Villieu (2009) confirms the hypothesis of non-linearity. The study covered a sample of twenty-two OECD countries throughout the period 1978-2006. The authors propose a simple theoretical model in which the effect of the budget deficit on public investment expenditure depends on the amount of government debt. Low levels of debt have a favorable impact on investment spending as the deficit is likely to be offset by reduced consumer spending, which effectively absorbs the debt burden., since the debt burden is likely sucked up by lower consumer spending. Conversely, on large levels of debt, it becomes exceedingly difficult to decrease consumption expenditure, and the adjustment is made through investment spending, so that the link between budget deficit and public investment spending becomes negative. The results show that for a government debt threshold located around 120% of GDP, the public deficit – public investment relationship changes sign.

Based on a dataset of 101 industrialised and emerging economies spanning the years 1980 to 2008, The results obtained by Caner et al. (2010) were consistent to the findings reported by Reinhart and Rogoff (2010[a]). A government debt level of 77% of GDP was identified as the optimal amount for industrialised countries. Once the debt ratio exceeds this level, each further percentage point results with a 1.7% decline in annual real economic growth. In underdeveloped countries, the threshold is established at 64% of GDP. When this threshold is exceeded, the growth rate undergoes a decrease of around 2% of GDP. Without a doubt, the non-linear correlation between government debt and economic growth suggests that, when the level of debt is moderate, an increase in government debt compared to GDP stimulates investment growth to achieve accelerated economic developments. It should be emphasized that exceeding the set limits of debt hinders economic progress.

In a similar context, Abbas and Christensen (2010) aimed to determine the optimal level of domestic debt and its associated effects on economic growth, applying it to ninety-three low-income and emerging countries (including 40 countries from sub-Saharan Africa), during the period 1975-2004. The Engel-Granger causality test was used for this purpose. The study concluded that moderate levels of non-inflationary domestic debt as a percentage of GDP or as a

percentage of total bank deposits will have positive effects on economic growth; while these results are reflected in economic growth when debt levels exceed 35% of total bank deposits.

Kumar and Woo (2010) investigates the influence of elevated government debt on economic growth in a sample of developed and developing countries from 1970 to 2007. The results showed the negative linear effect of government debt on economic growth. Thus, a 10% increase in the government debt ratio leads to a 2% slowdown in the rate of economic growth. This relationship is also not always linear as the authors point out. For a debt rate below 30% of GDP, advanced countries experience an increase of 3.2% in GDP per capita, while this increase only amounted to 1.9% for a debt rate above 90%. of GDP. We note here that the more modest the government debt, the greater the average increase in GDP per capita at constant prices. Finally, for developing countries, the increase in GDP per capita at constant prices is higher as government debt decreases. Concerning developing and emerging countries, a negative relationship can be observed between the level of debt and gross fixed capital formation. This observation can confirm the existence of a transmission channel which acts through gross capital formation. On the other hand, this relationship does not appear in advanced countries.

In summary, Kumar and Woo (2010), by analyzing the components of growth, showed that the negative effect of high debt levels generally reflects a lull in labor productivity growth, mainly due to a decline investment and a deceleration in the expansion of the capital stock..

Checherita and Rother (2010), on a sample of 12 euro zone countries and over almost four decades, consider a quadratic relationship between government debt and economic growth. The results obtained prove that debt has an inverted U-shaped relationship with growth and thus confirm the non-linearity hypothesis. Beyond a threshold of 90% to 100% of the debt/GDP ratio, government debt is detrimental to economic growth. However, when debt reaches 70% of GDP, its negative effects on growth appear.

On a sample of 18 OECD countries and during the period 1980-2010, Cecchetti et al. (2011) examine annual data on GDP per capita and debt stock of the non-financial sector. They demonstrate that from a threshold estimated at around 85% of GDP, government debt negatively affects economic growth. By adopting the dynamic panel threshold effect method, Checherita et al. (2013) tried to analyze the non-linear impact of government debt on GDP growth for a sample of 12 eurozone countries during the period 1990-2010. The results show that in the short term government debt has a positive and statistically significant effect on economic growth. But beyond a threshold estimated at 67% of GDP, this positive effect declines and even becomes zero. When the debt to GDP ratio exceeds 95%, a high amount of debt has a detrimental impact on GDP growth.

After analyzing a group of OECD nations, Panizza and Presbitero (2012) validate an association relationship between government debt and economic development, especially when considering high levels of debt. Their empirical study convincingly substantiates the presence of a correlation between debt and industrial expansion. Their understanding of the relationship between these two factors is elucidated by the straightforward observation that sluggish economic development results in elevated levels of government debt. Undoubtedly, a substantial volume of government

debt has a direct impact on economic growth through a particular mechanism. A government burdened with a substantial amount of debt chooses to implement a stringent legislation to strengthen its financial situation, but these actions will overpower economic activity. Moreover, the adoption of stringent measures during an economic downturn amplifies its depressing consequences and ultimately intensifies the weight of government debt.

In an effort to mitigate negative effects on economic growth, numerous empirical investigations have endeavored to ascertain the "optimal" level of government debt. Indications of a nonlinear and negative relationship between government debt and economic growth are confirmed by these results. Actually, a negligible amount of government debt has no impact on economic growth, but if it exceeds a specific threshold, government debt significantly hinders such growth. Prior research has shown a crucial debt level ranging from 90% to 100% of GDP.

Nevertheless, in some instances, a small number of confirmed facts undermine the soundness of this standard requirement. In the case of Japan, its financial commitment surpasses 200% of its annual GDP. Hence, there is no clearly defined magic barrier beyond which development experiences a substantial negative transition. Hence, it is crucial to analyze the economic, fiscal, and institutional attributes of each nation individually prior to evaluating the critical debt threshold.

2.2. Relationship between government debt, institutional quality, and economic growth

In their research on emerging countries, Cordella et al. (2010) demonstrate that the relationship between government debt and GDP growth is influenced not just by the level of debt but also by the characteristics of institutions and regulations. The authors demonstrate that countries with robust institutional quality exhibit a significant level of excessive debt. This phenomenon occurs when the debt to GDP ratio surpasses 20% to 25%. Nevertheless, once the debt exceeds a level of seventy to eighty percent of GDP, its adverse effects become insignificant. In countries characterized by inadequate quality of institution, Interest rates in this country are comparatively lesser than others, while nonetheless acknowledging the significance of the debt load Similarly, Presbitero (2008) shown, within a sample of 114 developing nations, that the correlation between government debt and economic growth depends on the policies and institutions of respective country.

Consistent with prior research aiming to establish an optimal threshold of debt, also exist other studies that demonstrate the need of a specific degree of institutional quality to foster investments, promote growth, and hence reap the advantages of alleviating debt burdens. Faciledu (2003) demonstrates in a study examining the correlation between alleviate debt burdens and the quality of institution that deeply indebted impoverished nations possess inadequate institutions and need to attain a certain threshold of institutional quality to benefit from debt relief initiatives. Furthermore, Dessy and Vencatachellum (2007) shows that aid given to 14 African countries between 1989 and 2003 positively influenced resource distribution in those nations that carried out institutional reforms.

According to Harrabi et al. (2007), analysis of the relationship between debt relief and private sector credits is necessary, given the negative effect of domestic debt on private sector credits. From a sample of African countries during the period 1988-2004, the authors showed that in the

short term, debt relief has a significant positive effect on private sector credits, while its long-term effect term is positive only in the case of a stable institutional framework.

A new study by Kemoe and Lartey (2021) examines the influence of government debt on economic growth in 44 countries in sub-Saharan Africa. The authors also investigate whether the quality of institutions plays a role in this relationship. An increase in government debt is detrimental to economic growth, but this impact is mitigated by an increase in institutional quality, according to the research. The anti-corruption perception index or the government effectiveness indicator captures this phenomenon. Furthermore, it was shown that there is a threshold of institutional quality beyond which the impact of a rise in government debt on economic growth becomes beneficial. Therefore, by reducing corruption and its associated perception effects, and enhancing the quality of policymaking, it is expected that some of the inefficiencies commonly seen in the governments of the sub-region will be eliminated. This, in turn, will enable a favorable influence of debt on expansion.

Furthermore, Abbas et al. (2022) investigates the influence of government debt on financial development through the mediation of institutional quality using fixed effects (LSDV) and generalized method of moments (GMM) estimators. The results indicate that government debt has a detrimental effect on financial development. However, this adverse effect becomes beneficial when it interacts with institutional quality, which suggests that government debt's effectiveness depends on institutional quality, highlighting the need for policymakers to maintain a high threshold of institutional quality to optimize debt utilization.

Finally, El-Naser (2023) analyses the influence of government debt and institutional quality on economic development in the European Union from 2000 to 2021 by employing the Generalised Method of Moments (GMM) approach. The findings indicate that the improvement of institutional quality, specifically focusing on boosting regulatory quality and voice and responsibility, results in statistically significant benefits for both economic growth and fiscal sustainability. Furthermore, the findings validated the need to restrict government debt levels in order to guarantee financial sustainability.

The existing body of research suggests that governments with robust macroeconomic policies and efficient institutions are influenced by the magnitude of government debt.

3. Model Specification and Empirical Methodology

3.1. Model specification

Our empirical study will be based on a model from the aforementioned empirical literature. Thus, our objective is to study the effect of government debt on economic growth. The endogenous variable being the annual growth of GDP. The specified econometric model is a dynamic model on panel data. A dynamic model is a model in which one or more lags of the dependent variable appear as explanatory variables. Panel data econometrics brings a set of advantages, the most important of which is the control of unobserved country heterogeneity.

The fundamental model can be expressed in the subsequent equation::

$$y_{it} = ay_{i,t-1} + \beta Debit.pub_{it} + \partial X_{it} + \eta_i + \mu_t + \varepsilon_{it} \quad (1)$$

Or

$$y_{it} - y_{i,t-1} = (a-1)y_{i,t-1} + \beta Debit.pub_{it} + \partial X_{it} + \eta_i + \mu_t + \varepsilon_{it} \quad (2)$$

At time t, the explanatory variable y_{it} denotes the GDP growth rate for country i.

This is the endogenous explanatory variable denoted as $y_{i,t-1}$. This metric quantifies the increase in GDP of country (i) at time (t−1). $Debit.pub_{it}$ serves as an indicator to quantify the level of government debt for country (i) at time (t). X_{it} is a vector representing controlled variables. Variable μ_t represents the effect peculiar to each country, while η_i represents the temporal effect. Lastly, ε_{it} represents the error term.

The fundamental proposition of this research is to ascertain the influence of very high debt on economic growth. The hypothesis of conditional convergence posits that the coefficient of the lagged GDP per capita value is both negative and highly significant. It is the control variables and the individual specific effect that define the level of long-term per capita income towards which each country converges. On the contrary, a positive value of the coefficient means the convergence hypothesis is rejected and, in general, it refers to those processes in which catch-up proceeds in a dynamic manner.

The sample selected comprises 19 countries drawn from the MENA region throughout the time span of 1996-2022. The list of countries can be found in Appendix 1.

3.2. Definition of the variables and descriptive statistics

One of the endogenous variables is the yearly increase in GDP per capita. In Appendix 2, the explanatory variables are documented. The yearly growth rate of GDP per capita is used as a measure of economic activity performance. This metric is the most suitable for confirming the hypothesis of conditional convergence. This parameter was specifically employed in the empirical literature. The following studies were conducted by Patillo et al. (2004), Ferreira (2009), Checherita and Rother (2010), Kumar and Woo (2010), Presbitero (2010), and Baum et al. (2013).

With regards to the explanatory variables of the model, the variable of interest, gross government debt, quantifies the level of indebtedness and also aids in the interpretation of the debt position. Undoubtedly, the ability of an economy to make payments or simply manage its financial obligations is connected to its level of wealth. Consequently, government debt can be regarded as a reliable measure of the financial condition of nations.

As per the prevailing perspective, government debt has the potential to encourage short-term economic expansion but appears to have detrimental effects on long-term growth. In addition, there is an assumption derived from the theory that debt may stimulate economic expansion, albeit with parameters that have yet to be identified. Moreover, the correlation between these two factors is unclear and remains tainted by imprecision. The focal variable has been employed in practically all recent studies evaluating the relevance of the association between debt levels and economic

development. Reinhart and Rogoff (2009-2010), Cecchetti et al. (2011), Checherita and Rother (2010); Panizza and Presbitero (2012), and Kumar and Woo (2010).

Additionally, a set of controlled variables that is generally used in this form of estimation is also incorporated in the model (see Appendix 2).

Descriptive statistics relating to these variables were calculated for the entire sample (Appendix 3).

3.3. Econometric methodology

The econometric method adopted is the generalized method of moments (GMM) on dynamic panel data. In fact, the estimator of this model using the OLS method leads to biased and non-convergent estimators especially when the lagged dependent variable is correlated with the individual effects μ_i.

The GMM estimator, as suggested by Arellano and Bond (1991), relies on the observation that the lagged endogenous variable and the error term are orthogonal. This methodology facilitates the resolution of issues related to simultaneity bias, reverse causality, and omitted variables. Moreover, it enables the correction of endogeneity in all parameters that explain the phenomenon in the model. The suggested estimator follows the first difference GMM approach to remove particular individual impacts and incorporates previous values of the dependent variable as instruments.

Further on, the system GMM estimator was introduced by Blundell and Bond (1998). they combine first difference equations with level equations, where the variables are defined by their first differences. Blundell and Bond (1998) shown, by method of Monte Carlo simulations, that the system GMM estimator outperforms the first difference estimator. Under conditions of instrument weakness, the first difference GMM estimator produces skewed results when applied to finite samples.

We employ a two-step algorithm for estimate. The rationale for using this method is based on the observation that the estimator derived from it is both more efficient and effective compared to the estimator obtained in a single step. Roodman (2009). Undoubtedly, the two-step estimate algorithm is superior to the one-step method due to its consideration of the error variance-covariance matrix's structure.

4. Findings and Analysis

4.1. Findings from panel unit root tests

In this study, panel data will be subjected to two unit roots tests: the Levin-Lin-Chu (LLC) test and the Im-Pesaran-Shin (IPS) test. In summary, the findings of these tests are presented in Table 1. The null hypothesis of a unit root is the underlying assumption for these tests. The analysis of this table clearly indicates that the LLC test leads to the rejection of the null hypothesis that suggests the existence of a unit root. The vast majority of the variables exhibit stationarity at the linear level.

Adjusting for the variability of the autoregressive root using the IPS test significantly modifies the outcomes generated by LLC. Applications of the IPS test reveal that only the institutional variables exhibit non-stationarity.

Table 1: Results of panel unit root tests (linear and quadratic specifications)

Variable	*Model specification*	*LLC*		*IPS*	
gdp.cap.gr	constant and trend	-5,153	(0,0000)*	-5,754	(0,0000)*
	constant only	-5,607	(0,0000)*	-6,956	(0,0000)*
gov.debt	constant and trend	-2,388	(0,0057)*	-1,482	(0,0862)***
	constant only	-3,649	(0,0000)*	-0,443	(0,3670)
gdp.cap	constant and trend	-2,182	(0,0209)**	-0,410	(0,3670)
	constant only	-2,425	(0,9923)	-4,451	(1,0000)
inflation	constant and trend	-3,598	(0,0002)*	-2,159	(1,0000)
	constant only	-4,525	(0,0000)*	-7,903	(0,0191)**
invest	constant and trend	-3,437	(0,0003)*	-1,477	(0,0000)*
	constant only	-3,067	(0,0011)*	-2,988	(0,0698)***
unrate	constant and trend	-1,988	(0,0234)**	-0,938	(0,1739)
	constant only	-1,461	(0,0719)***	-1,886	(0,0296)**
ger	constant and trend	-0,483	(0,3142)	1,145	(0,8741)
	constant only	-2,107	(0,0175)**	1,157	(0,8766)
pop.growth	constant and trend	-4,265	(0,0000)*	-8,358	(0,0000)*
	constant only	-2,431	(0,0071)*	-5,351	(0,0000)*
trade.open	constant and trend	-7,555	(0,0000)*	-4,808	(0,0000)*
	constant only	-5,054	(0,0000)*	-3,587	(0,0002)*

*Note: *, ** and *** indicated rejection of unit root tests at 1%, 5% and 10% respectively. The p-values associated with the different statistics are shown in parentheses.*

4.2. Results of GMM estimations (linear and quadratic specifications)

A succinct summary of the results derived from the dynamic panel estimations can be seen in Tables 2 and 3. Table 2 provides a succinct summary of statistical regressions, including both linear and quadratic model estimations, under differing specifications. The estimates obtained after incorporating new control factors are presented in Table 3. Finally, table 4 presents a concise overview of the different defined thresholds that were evaluated.

The analysis of the findings reveal that all the coefficients linked to the lagged GDP/capita are negative and exhibit a high level of significance. Therefore, the hypothesis of conditional convergence is considered valid in every case when the threshold is established at 1%. Consequently, the result obtained confirms the concept of conditional convergence as suggested by Mankiw et al. (1992). In this context, the negative coefficient of *gdp.cap* is seen as a measure of the extent to which each country is approaching the long-term income level.

Furthermore, the logarithm of economic openness (*trade.open*) has a favorable impact on economic growth. Based on the analysis of Rodrigues and Rodrick (1999), the beneficial effect can be attributed to the correlation between the level of economic closure and the severity of macroeconomic imbalances. The statistical significance of the variable *log*(*trade.open*) is

contingent upon the inclusion of other variables in the model. This synthesises a body of studies that argues that openness is advantageous for economic growth only if a country reaches a certain threshold of development, enabling it to compete effectively in global markets.

An examination of the coefficients of the inflation *log(inflation)* reveals that they lack statistical significance and exhibit instability. The observed changes in signs suggest that the influence of inflation is generally negligible. More precisely, the value is positive and statistically insignificance in specifications. (2), (3), (1^*), (2^*), (3^*) whereas it is negative and still unsignificant in the other specifications. Despite the inconsistency with some theoretical studies that forecast a substantial and adverse correlation between inflation and economic growth, these findings are not unexpected.

With respect to the education variable log(ger), the findings suggest that the coefficients associated with this indicator exhibit the anticipated sign but lack statistical significance. This contradicts the findings of Barro and Sala-i-Martin's (1995) study on the determinants of economic growth, which demonstrates statistically a robust relationship between educational achievement and the degree of economic development. This phenomenon may be mostly attributed to the inadequate quality of education in the MENA region, which hinders the ability of schooling to effectively enhance economic growth. Furthermore, a delicate relationship continues to exist between educational achievements and economic progress, which can be attributed to the significant percentage of jobs in the public sector and the scarcity of vibrant and globally competitive sectors of the economy.

Within specifications (2) to (4), we systematically incorporated the subsequent institutional variables: Voice and accountability (voice.account), quality of regulation (*quality.reg*), and corruption (*cor*). These factors are considered in the regression analysis for both linear and quadratic model assumptions. Initial findings from specifications (2) and (2^*) indicate a strong and statistically significant beneficial impact of the account variable on economic growth. Undoubtedly, a conducive atmosphere that enables a certain level of autonomous exercise of both human and political rights is advantageous for fostering economic development. Furthermore, it is crucial to note that the quality of regulations index demonstrates a significant and positive relationship at the threshold of 5 percent in the linear estimation (3).

Regarding the non-linear specification, it is observed that the variable (*quality.reg*) becomes less significant, however its impact consistently maintained a favorable direction. The enforcement of governmental rules and regulations not solely promotes the expansion of the business community but also boosts economy by instilling confidence and minimizing uncertainty among investors, therefore stimulating increased investment. Finally, specification (4) demonstrates a statistically significant negative correlation between corruption and economic growth at the 5% significance level. The coefficient of the variable (*cor*) in the nonlinear specification (4^*) retains its negative sign but loses its significance. Evidently, even a minimal degree of corruption appears to exert an adverse impact on economic progress. These results corroborate the findings of Collier (2000), who demonstrated that corruption hinders the pace of economic expansion. furthermore, according to Wei (1997) and Mauro (1997) corruption frequently dominates investment. Johnson

et al. (1998) demonstrated that corruption ultimately leads to a decrease in tax collections, which forces countries to accumulate debt to tackle shortfalls in the public funding.

The application of a linear specification to the government debt demonstrates a statistically significant inverse relationship within the logarithm of government debt *log(gov.debt)* and the annual GDP per capita growth rate *(gdp.cap.gr)*. The given results corroborate the conclusions drawn from a significant corpus of empirical studies (Kumar and Woo, 2010; Cecchetti et al., 2011; Panizza and Presbitero, 2012; etc.). The results also indicate that government debt hinders economic growth even when institutional variables are taken into account.

However, prior analytical and empirical studies indicate that the linear equation may not be suitable for accurately evaluating the influence of a significant amount of debt on economic expansion, since the dynamics may not adhere to a pattern of linearity.

A systematic analysis of non-linearity in government debt entails incorporating the square of the debt indicator into the model's starting, intermediate, and final parameters. The application of the non-linear form did not modify the anticipated outcomes for the different factors incorporated in the linear specification. Statistical analysis of the data indicates that the variable *log*(*gov.debt*) has a statistically significant and positive effect on economic growth, with results at significance levels of 1% and 5%. Moreover, the square logarithm of the variable (*gov.debt.carr*) has a statistically significant and negative effect. Aggregate government debt and economic growth have a non-linear association. Undoubtedly, the contribution of government debt to economic growth is substantial, provided that it stays below a predetermined threshold. Once the level surpasses this threshold, its effect becomes significantly harmful.

This tendency can be elucidated by the observation that maintaining debt levels within realistic boundaries enables countries in the region to strengthen their economic development. Nevertheless, once over a given threshold, the debt can surpass the ability to repay and hence hinder growth due to the exorbitant expenses associated with its maintenance, so deterring investments.

Our endorsement of the hypothesis regarding the reliability of the instruments is grounded on the results obtained from the Sargan-Hansen tests. The statistics of this test suggest that the instruments employed can be considered highly dependable. The results obtained from the autocorrelation tests validate the premise that errors with orders of 1 and 2 do not display autocorrelation. This scenario is applicable to all specs.

Table 2: Results of linear and quadratic model estimations. Dependent variable: GDP per capita growth rate

	Linear specs.				*Nonlinear specs.*			
	(1)	*(2)*	*(3)*	*(4)*	*(1*)*	*(2*)*	*(3*)*	*(4*)*
Gdp.cap.gr (-1)	-0,513 (0,002)*	-0,408 (0,035)**	-0,547 (0,029)**	0,000 (0,591)	-0, 393 (0,080)***	-0,610 (0,051)***	-0,298 (0,357)	-0,524 (0,043)**
log(gdp.cap)	-0, 299 (0,000)*	-0,251 (0,000)*	-0,360 (0,005)*	-0,308 (0,00 8)*	-0,516 (0,000)*	-0,408 (0,005)*	-0,463 (0,000)*	-0,311 (0,042)**
log(invest)	0, 042 (0,008)*	0,038 (0,020)**	0,031 (0,027)**	0,029 (0,006)*	0,032 (0,051)***	0,031 (0,029)**	0,030 (0,034)**	0,032 (0,040)**
log(inflation)	-0,004 (0,609)	0,002 (0,715)	0,004 (0,332)	-0,004 (0,210)	0,000 (0,527)	0,002 (0,279)	0,000 (0,312)	-0,001 (0,915)
log(trade.open)	0,410 (0,121)	0,056 (0,216)	0,056 (0,206)	0,091 (0,002)*	0,035 (0,006)*	0,027 (0,473)	0,053 (0,000)*	0,051 (0,000)*
log(ger)	0, 068 (0,108)	-0,200 (0,237)	-0,057 (0,291)	0,002 (0,571)	0,214 (0,376)	-0,042 (0,543)	0,029 (0,729)	0,064 (0,560)
log(gov.debt)	-0, 025 (0,041)**	-0,037 (0,000)*	-0,012 (0,008)*	-0,012 (0,061)***	0,068 (0,000)*	0,057 (0,035)**	0,109 (0,005)*	0,111 (0,001)*
log(gov.debt.carr)					-0,025 (0,000)*	-0,028 (0,004)*		
voice.account		0,096 (0,046)**				0,062 (0,035)**		
quality.reg			0,051 (0,067)***				0,013 (0,200)	
cor				0,043 (0,032)**				-0,021 (0,100)
Obs.	168	99	99	99	168	99	99	99
Sargan test	3,689 (1)*	2,915 (1)*	4,237 (1)*	7,294 (1)*	3,510 (1)*	3,067 (1)*	4,44 (1)*	7,120 (1)*
AR1	-0,516 (0,437)*	-0,055 (0,592)*	0,712 (0,627)*	-1,438 (0,234)*	-0,594 (0,463)*	0,630 (0,618)*	-0,782 (0,529)*	-0,061 (0,644)*
AR2	0,509 (0,493)*	0,437 (0,527)*	-0,091 (0,834)*	1,386 (0,318)*	0,636 (0,533)*	-0,281 (0,582)*	0,627 (0,671)*	-0,211 (0,620)*

*Note: *, ** and *** significant at 1%, 5% and 10% respectively.%. Values in parentheses are p-values. Sargan-Hansen: instrument validity test. AR1 and AR2: Arellano-Bond statistic of the error autocorrelation test, respectively of order 1 and 2: the null hypothesis being the absence of first and second order autocorrelation.*

4.2. Tests for robustness

We assess the reliability of the previously obtained results by using additional control variables, specifically the logarithm of the population growth rate (*pop.growth*) and the logarithm of the unemployment rate (unrate), we evaluate the robustness of the previously derived findings. Table 3 presents the findings directly related to this specific standard.

Therefore, the criteria for conditional convergence are once again verified. The observed results demonstrate little deviation in comparison to the previously acquired estimates. Referring to the investment variable log(*invest*), it is crucial to emphasize that the results are generally substantial and consistent with the many theoretical investigations. Hence, in line with established ideas, the pace of investment exerts a favorable influence on socioeconomic development. Nevertheless, when the variable of unemployment rate is incorporated into the spec (1^{*}), the impact of the investment rate on GDP diverges towards negativity and lacks statistical significance. To explain this conclusion, one might consider the decrease in FDI in the MENA region, which can be ascribed to both the worldwide economic downturn and the increasing uncertainty caused by successive international shocks. These shocks encompass the unrest of the Arab Spring, the global outbreak of Covid-19, and the ongoing confrontation between Russia and Ukraine. Nations affected by these disruptive occurrences demonstrate elevated risk premiums in comparison to other countries in the region.

Based on the presented findings, it is evident that the inclusion of control variables had an impact on the signs and the importance of coefficients for the variables being studied. Generally, the findings of most regressions indicate that the unemployment rate has a negative but statistically insignificant impact on economic growth. Furthermore, it is worth mentioning that all the coefficients of the annual rate of population *(pop.growth)* exhibit the anticipated signs in all given regressions. Empirical growth models indicate that the population growth rate have a detrimental effect on economic growth.

Regarding the public debt, the documented findings were same as those achieved in the previous specs.

Unequivocally, the linear manifestation of government debt exerts a detrimental influence on economic development. Furthermore, the quadratic form shown in table 3 illustrates that government debt stimulates economic expansion, but only up to a specific bound. When the government debt exceeds this bound, its effect on economic growth turns negative, therefore indicating that These two variables exhibit a non-linear relationship. Nevertheless, it is crucial to acknowledge that the coefficients of government debt lack statistical significance, even when the rate of unemployment is included as a control variable. An explanation for such an occurrence might be ascribed to the substantial increase in unemployment in the MENA region, along with the failure of governments to effectively decrease it and generate additional employment opportunities. Consequently, the profound influence of government debt on GDP growth is eclipsed by the elevated unemployment rate.

Table 3. Results of linear and quadratic model estimations. Dependent variable: GDP per capita growth

	Linear specs.					*Nonlinear specs.*				
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(1*)*	*(2*)*	*(3*)*	*(4*)*	*(5*)*
gdp.cap.gr (-1)	-0,638 (0,022)**	-0,402 (0,061)***	-1,590 (0,069)***	-0,318 (0,075)***	-0,827 (0,168)	-0,705 (0,061)**	-0,430 (0,012)**	-2,109 (0,250)	-0,605 (0,054)***	-1,961 (0,731)
log(gdp.cap)	-0, 080 (0,738)	-0,314 (0,039)**	0,207 (0,613)	-0,219 (0,024)**	-0,087 (0,715)	-0,189 (0,621)	-0,523 (0,000)*	0,771 (0,703)	-0,468 (0,020)**	0,142 (0,531)
Log(invest)	0,069 (0,007)*	0,057 (0,019)**	0,073 (0,011)*	0,041 (0,008)*	0,058 (0,000)*	-0,011 (0,627)	0,037 (0,045)**	0,049 (0,015)**	0,025 (0,064)**	0,044 (0,706)
log(inflation)	-0,009 (0,081)***	0,007 (0,000)*	0,005 (0,795)	0,012 (0,000)*	0,008 (0,234)	-0,008 (0,210)	0,003 (0,516)	-0,008 (0,443)	0,006 (0,033)**	0,002 (0,693)
log(trade.open)	0,082 (0,034)**	0,051 (0,012)**	-0,025 (0,627)	0,041 (0,121)	0,019 (0,510)	0,143 (0,516)	0,051 (0,022)**	-0,062 (0,382)	0,039 (0,029)**	0,024 (0,629)
log(ger)	-0,597 (0,391)	0,173 (0,000)*	0,995 (0,207)	-0,079 (0,394)	0,714 (0,413)	0,202 (0,661)	0,186 (0,034)**	1,979 (0,457)	0,210 (0,534)	1,619 (0,307)
log(unrate)	-0,043 (0,515)		-0,081 (0,061)***		-0,067 (0,038)**	0,071 (0,364)		-0,055 (0,218)		-0,042 (0,241)
log(pop.growth)		-0,030 (0,035)**		-0,045 (0,000)*	-0,051 (0,207)		-0,048 (0,000)*		-0,051 (0,000)*	-0,050 (0,288)
log(gov.debt)					-0,034 (0,003)*	1,751 (0,527)	0,068 (0,004)*	0,347 (0,214)	0,180 (0,000)*	0,257 (0,376)
log(gov.debt.carr)						-0,329 (0,281)	-0,035 (0,008)*	-0,082 (0,027)**	-0,040 (0,001)*	-0,053 (0,248)
quality.reg			0,089 (0,062)***	0,030 (0,077)***	0,067 (0,122)			0,209 (0,037)**	0,012 (0,315)	0,036 (0,423)
Obs.	131	168	99	168	98	131	168	99	168	99
Sargan test	1,109 (1,000)*	5,142 (1,000)*	0,210 (1,000)*	4,799 (1,000)*	1,086 (1,000)*	0,318 (1,000)*	2,924 (1,000)*	0,572 (1,000)*	1,097 (1,000)*	4,011 (1,000)*
AR(1)	1,098 (0,421)	-1,037 (0,501)	0,356 (0,694)	-0,471 (0,380)	0,821 (0,411)	0,203 (0,839)	-0,254 (0,601)	-0,457 (0,634)	-0,603 (0,546)	-0,877 (0,798)
AR(2)	0,067 (0,383)	0,650 (0,534)	-0,264 (0,704)	-0,193 (0,761)	-0,501 (0,491)	0,482 (0,438)	0,911 (0,534)	0,815 (0,517)	-0,710 (0,593)	-0,234 (0,886)

*Note: *, ** and *** significant at 1%, 5% and 10% respectively.%. Values in parentheses are p-values. Sargan-Hansen: instrument validity test. AR1 and AR2: Arellano-Bond statistic of the error autocorrelation test, respectively of order 1 and 2: the null hypothesis being the absence of first and second order autocorrelation.*

4.3. The threshold effect

In this paragraph, we determine the optimal government debt threshold using the quadratic method. Recall that our equation takes the following form:

$$y_{it} = ay_{i,t-1} + \beta pub.debt_{it} + \partial X_{it} + \eta_i + \mu_t + \varepsilon_{it}$$

As has already been mentioned, The quadratic technique is founded on the concept of including the squared value of the "government debt" variable into the set of factors that are exogenous. This structure typically follows the following formulation:

$$y_{it} = ay_{i,t-1} + \beta pub.debt_{it} + \beta pub.debt_{it}^{\ 2} + \partial X_{it} + \eta_i + \mu_t + \varepsilon_{it}$$

Econometrically, the upper limit represents the ideal amount of debt that maximizes the growth of the economy. The level in question is mathematically defined as the one that cancels the first derivative of Y with respect to D.

$$\frac{dy_{it}}{dD_{it}} = 0 \gg \beta_1 + 2\beta_1 D_{it} = 0 \gg D_{it} = \ (-\frac{\beta_1}{2\beta_2})$$

Given that the government debt in our fundamental model is represented as a logarithm, a proper debt threshold may be determined using the following formula: $exp\ (-\frac{\beta_1}{2\beta_2})$.

Table 4: Government debt threshold as a % of GDP

spec (1) of table 2*	*spec (3*) of table 2*	*spec (4)' of table 3*
13.102%	15.117%	12.086%

Table 4 illustrates the threshold at which the impact of government debt turns negative following the diversion of debt. Observations reveal that the debt criterion for the whole sample ranges from 12% to 15% of GDP. Undoubtedly, the determined criteria are suitable for our specific situation, mostly because of the consistent findings of the several research examining the relationship between government debt and economic growth. The government debt levels in the countries in the MENA area are comparatively lower than those of industrialised countries, which largely accounts for the achieved benchmarks. We deem this significant due to the absence of academic research that has clarified the relation between government debt and GDP growth in the MENA region.

5. Conclusion, policy recommendations and future research:

The objective of this paper is to elucidate the potential correlation, if any, between public debt and economic development in the MENA region economies. Following a comprehensive examination of the primary theoretical literature, the task became to empirically examine the dynamics of the correlation between debt and growth. The estimations were based on a panel of 19 countries using Generalized Method of Moments (GMM).

The acquired econometric results indicate that, on the whole, government debt exerts an impact on economic growth. Nevertheless, two types of requirements have been implemented. Government debt has a robust and favorable linear impact on economic growth. Nevertheless, when taking into account the quadratic specification, government debt positively influences up to a specified level, beyond which its impact turns negative. The observed threshold falls within the range of 12% to 15%, therefore providing support for the notion of non-linear structure of the government debt. To assess robustness, the population growth rate and the unemployment rate are included as additional control variables.. The results are mostly statistically significant and exhibit consistency with the several theoretical studies.

Furthermore, the percentage point that determines the correlation between government debt and growth changes is approximately 15%. Considering the exceptionally low debt rates of many countries in the MENA area, particularly those that export oil, in comparison to industrialised nations, this threshold is not unexpected.

From the analysis of the results, specific economic policy recommendations might be developed. Governments can bolster economic growth by alleviating their excessive debt load. Indeed, government debt is primarily a matter of sustainability rather than strictly a requirement for liquidity. Hence, substantial amounts of government debt give rise to sustainability issues in public finances and solvency risks, as they result in a rise in the risk premium, who in turn raises the cost of borrowing. International borrowing. Furthermore, the gradual buildup of government debt leads to a significant rise in interest rates, therefore potentially impeding economic growth by reducing private investment. Above all, the pre-eminent need is to adopt and implement fiscal responsibility frameworks so as not to allow rising debt levels above the critical threshold, as identified by this study. In view of that, setting debt ceilings or fiscal rules that adjust with economic cycles can help nations avoid unsustainable debt accumulation and hence sustain positive growth momentum. Moreover, there is a need to ensure sustained, high-growth, and above all sustainable economic growth by addressing socio-economic concerns, particularly through investments in human capital through education, health care, and strong social safety nets. Such investments will create a more productive workforce, reduce unemployment, and ultimately reduce the economic burden on governments and the need for excessive borrowing. In addition, stimulating private enterprise that primarily targets international markets, which represent an important source of international currency, allows borrowing countries to meet their obligations. Finally, a well-developed legal and institutional infrastructure, especially one that combats corruption and respects the rule of law and property rights, is likely to direct borrowed funds toward more productive uses.

The findings of this study open up avenues for more in-depth studies; while the conclusions indicate that the debt threshold where the impact changes from positive to negative is around 15%. Future research could conduct longitudinal studies to explore how this threshold evolves over time and across different economic cycles and external shocks, especially in light of the unique economic contexts of MENA countries, which may be affected by global economic conditions such as interest rate changes in advanced economies or commodity price fluctuations, which would help understand external vulnerabilities that may affect domestic debt policies. The specific nonlinear relationship between debt and growth could be further explored by analyzing how government debt affects different sectors of the economy (e.g., agriculture, manufacturing, services). Such sector-specific analysis would provide more accurate policy recommendations.

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Appendices

Appendix 1. Countries

Algeria, Bahrain, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Malta, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates, Yemen.

Appendix 2. Variables and sources of data

Variables	*Description*	*Notation*	*Source*
Per capita GDP growth (annual %)	*The annual percentage of GDP per capita growth rate based on constant local currency.*	*gdp.cap.gr*	***World Development Indicators***
Government debt to GDP	*The gross debt of the general government as a percentage of GDP.*	*gov.debt*	
Population (annual growth)	*Is the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage.*	*pop.growth*	
Per capita GDP (constant 2017 US$)	*GDP per capita is the sum of gross value added by all resident producers in the economy plus any product taxes (less subsidies) not included in the valuation of output, divided by mid-year population*	*gdp.cap*	
Inflation	*Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services.*	*inflation*	
Gross capital formation to GDP	*Formerly gross domestic investment consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories*	*invest*	
Trade openness (%GDP)	*The ratio of exports plus imports over GDP*	*trade.open*	
Gross enrollment rate (% gross)	*Is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown*	*ger*	
Total unemployment (% of total labor force)	*Is the share of the labor force that is without work but available for and seeking employment.*	*unrate*	

Institutional variables	***Voice and accountability***	*This variable reflects the degree to which a country's citizens participate in the selection of their rulers.*	*voice.account*	***Worldwide Governance Indicators***
	Regulatory quality	*Reflects the government's ability to formulate and implement policies and regulations that enable and promote private sector development.*	*regional.quality*	
	Control of corruption	*It can be defined as the use of public power for private gain.*	*cor*	

Appendix 3. Descriptive statistics of the region:

Variable	***Mean***	***SD***	***Max***	***Min***	***Obs.***
gdp.cap.gr	7.374945	9.356675	71.86364	-63.8273	581
pop.growth	4.24078	3.935787	28.7274	-4.2541	639
gdp.cap	11457.36	14414.82	56560.04	718.3845	585
inflat	15.82997	54.57825	693.1364	-24.9086	547
invest	35.56921	11.46119	72.17273	9.446031	554
unrate	17.48921	10.90976	91.95455	0.463636	357
ger	150.5298	29.15341	189.5049	48.01818	477
trade.open	136.3695	57.34871	324.7943	45.27598	556
priv.credit	63.40436	41.56027	206.694	2.784581	610
bank.credit	90.70489	64.81299	295.4379	-101.898	610
gov.debt	95.1254	82.86381	762.9245	0	506
voice.account	-1.38155	1.016517	2.07203	-3.15579	381
political.stability	-0.44597	1.51613	2.386747	-4.90884	381
gov.effectiveness	-0.25196	1.19914	7.441364	-3.00912	383
regional.quality	-0.38662	1.227661	2.165877	-3.34737	381
rule.law	-0.20384	1.188105	2.470732	-2.97623	381
cor	-0.26209	1.104737	2.601182	-2.43603	381

Appendix 4. Correlation matrices

	gdp. cap.gr	*p. growth*	*gdp. cap*	*inflat*	*invest*	*unrate*	*ger*	*ade.open*	*private. credit*	*nk.credit*	*ov.debt*	*ice.accoun t*	*Po tical. bility*	*v.effective ness*	*gional.qu ality*	*le.law cor*
lp.cap.gr	1,000															
p.growth	0,499	1,000														
lp.cap	0,416	0,594	1,000													
flat	0,164	0,083	-0,210	1,000												
vest	0,197	0,117	-0,375	0,265	1,000											
rate	-0,201	-0,415	-0,696	0,079	0,376	1,000										
r	0,021	0,074	0,079	-0,230	0,278	-0,237	1.000									
ade.open	-0,072	-0,077	0,310	-0,291	-0,237	-0,351	-0.241	1,000								
ivate.credits	-0,094	-0,197	0,354	-0,381	-0,390	-0,400	-0,310	0,783	1,000							
nk.credit	-0,078	-0,143	0,175	-0,317	-0,380	-0,301	-0,271	0,581	0,924	1,000						
v.debt	-0,127	-0,213	-0,407	-0,386	-0,324	0,312	-0,072	0,078	0,195	0,560	1,000					
ice.account	-0,095	-0,172	0,410	-0,385	-0,310	-0,317	-0,346	0,807	0,814	0,640	0,086	1,000				
litical.stability	0,101	0,203	0,611	-0,415	-0,413	-0,627	-0,011	0,721	0,758	0,709	0,157	0,680	,000			
v.effectiveness	0,073	0,043	0,510	-0,410	-0,204	-0,298	-0,187	0,801	0,824	0,710	0,067	0,697	,792	1,000		
gional.quality	0,012	0,071	0,517	-0,506	-0,473	-0,418	-0,315	0,816	0,876	0,782	0,019	0,672	,691	0,901	1,000	
le.law	0,015	0,086	0,607	-0,412	-0,496	-0,576	-0,216	0,682	0,794	0,810	0,140	0,815	,901	0,793	0,894	,000
	0,156	0,276	0,682	-0,473	-0,315	,621	-0,208	0,529	0,679	0,509	0,179	0,646	,659	0,793	0,692	,826 00