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Article

Debt-Growth Nexus in the MENA Region: Evidence from a Panel Threshold Analysis

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Abstract: This study examines whether a debt-to-GDP threshold exists in the public debt and economic growth relationship for 20 Middle East and North Africa (MENA) countries from 1990 to 2016 using the threshold estimation technique. The empirical results reveal that there is a threshold effect in the public debt and economic growth relationship. The MENA region's debt-to-GDP threshold value as a developing region is lower than the debt threshold computed by earlier studies for developing countries. We found that the effect of public debt on economic growth is significant and positive only below the threshold value of debt-to-GDP. More precisely, debt has a promoting influence on economic growth when the debt is less than 58% of the GDP. This finding indicates that the relationship between public debt and economic growth is contingent on the debt-to-GDP ratio. Importantly, policymakers need to be more prudent when establishing a policy regarding debt issues.

Keywords: public debt; economic growth; threshold effects; MENA region

JEL Classification: E62; H63; N17; C24

1. Introduction

The substantially growing threat to the economic growth of debt accumulation has been one of the most controversial and discussed issues among economists and policymakers in both developed and developing countries. Recently, economic challenges, such as chronic fiscal balance deficits, which may affect the public debt ratio, have gained significance. In the aftermath of the financial crisis in 2007–2008, many studies have been conducted to examine the relationship between public debt and economic growth (Egbetunde 2012; Al-Zeaud 2014; Zouhaier and Fatma 2014; Akram 2015; Spilioti and Vamvoukas 2015; Fincke and Greiner 2015; Muye et al. 2017). By and large, the previous studies have confirmed that there is a closer link between public debt accumulation and economic growth, whether this linkage is positive or negative for any country.

In the 1980s, many countries in the Middle East and North Africa (MENA) region undertook reforms in the financial sector. These reforms were a part of the structural adjustment programs (SAPs) often adopted with the support of the IMF and the WB, particularly in low-income countries¹. The main goal of SAPs is to promote the long-term economic growth of a developing economy by decreasing borrowing in the country's fiscal imbalances in both the short and medium terms. These reforms led to considerable economic growth by the late 1990s. Nonetheless, the economic growth rate in the MENA region has underperformed and fluctuated compared to that in other developing regions, such as

¹ For example, Jordan, Morocco and Tunisia.

ASEAN-5 and Sub-Saharan Africa. Over the last decade, the average economic growth rates were 3.4% in MENA, 5% in ASEAN-5, and 4.7% in Sub-Saharan Africa². The MENA region is still facing various economic challenges, such as the fiscal deficit, current account deficit, and high debt accumulation (see [Saeed and Somaye 2012](#); [Asghari et al. 2014](#); [Samadi 2006](#)). Some countries of the MENA region, particularly non-oil countries, were affected by the global financial crisis in 2007–2008 because of their high interdependence on the US's financial assistance, which put pressure on them when this assistance was lost³. The MENA region witnessed significant development in its infrastructure accompanied by expansions in government expenditures, government size, and debt accumulation. As a developing region, MENA's debt-to-GDP ratio is high and troubling compared to that in other developing regions, such as ASEAN-5 and Sub-Saharan Africa. Over the last few decades, the debt-to-GDP ratio has held an average of approximately 43.7%, which is 2.1% higher than the average for ASEAN-5 and 9.9% higher than that for Sub-Saharan Africa⁴. Researchers studying the MENA region consider that the economic challenges are related to the broad interventions and the low quality of fiscal policies adopted by MENA governments, such as the larger government size than that in other developing regions.

These stylized facts about public debt and economic growth raise serious concerns regarding the debt-to-GDP ratio's threshold value at which economic growth can be sustained in the MENA region. This study aimed to address this issue. [Reinhart and Rogoff \(2010\)](#) showed that both developed and developing countries are highly concerned with their debt level. The authors suggested that a suitable debt-to-GDP threshold rate is 60% for developing countries and that exceeding this threshold will lead to negative consequences for developing countries' economies by increasing the burden on their economies through debt service and repayment.

This study examines whether there is a debt-to-GDP threshold in the public debt and economic growth relationship for 20 MENA countries. The MENA region is selected because many MENA countries undertook reforms in the institutional and financial sector by decreasing borrowing to reduce their fiscal imbalances in both the short and medium terms and attained economic growth through the gradual removal of trade barriers, which led to strengthened trade relationships. Data from only 20 MENA countries during the period from 1990 to 2016 are included because the data are bounded. This study contributes to the existing literature in three aspects. First, in terms of the policy, this study can directly help fiscal policymakers in the MENA region. Overall, in the MENA region, there is no fixed threshold for the debt-to-GDP ratio; it is dependent on a country's condition. The region must address many crucial issues to avoid potential bankruptcy. Therefore, determining the optimum debt-to-GDP level can prevent the adverse effects of overborrowing in the MENA region by providing signals for policymakers in managing debt accumulation. Second, while previous studies have identified the debt-to-GDP threshold values for some countries and regions, for example, the debt-to-GDP threshold of 90% for OECD countries estimated by [Reinhart and Rogoff \(2010\)](#), the MENA region may have a different debt-to-GDP ratio threshold value because of its different economic structure. The secure level of debt-to-GDP for the MENA region has not previously been investigated to the best of our knowledge. Finally, this study also sheds light on other explanatory variables and explores their influence on the MENA region's economic growth.

This study is organized as follows. Section 2 reviews the literature on the relationship between public debt and economic growth. Section 3 discusses the methodology and describes the data. Section 4 is devoted to discussing the empirical results. Finally, the last section presents a summary and conclusion of the findings.

² Source: world Bank.

³ In 1961, congress passed the Foreign Assistance Act, reorganizing U.S. foreign assistance programs and separating military and non-military aid. Egypt, Jordan, Iraq, Israel and Lebanon are the recipient countries in MENA.

⁴ Source: world Bank.

2. Literature Review

From a theoretical perspective, two streams of thought have been proposed to distinguish the relationship between public debt and economic growth. First, in the classical theory, Ricardian equivalence states that if a government borrows today, then it has to repay this borrowing in the future by raising taxes above the normal level; thus, the impact of debt accumulation on growth will be neutralized (Ricardo 1817). The Great Recession of the 1930s was the key catalyst for the development of the modern theory of public debt. According to Keynes, foreign assistance or foreign investment is required to fill the savings-investment gap. Furthermore, Keynes argued that fiscal policy is the best policy for growth in any economy because it meets the general public's needs. Second, the neo-classical theory argues that public debt directly influences economic growth contingent on the amount borrowed. If a government exploits and takes advantage of debt in inefficient ways, the amount of investment is anticipated to increase in the long run through spending on hospitals, schools, sanitation, and infrastructure as a strategy to counteract the negative effects of debt. As long as countries use the borrowed funds for productive investment and do not suffer from macroeconomic turbulence, policies that distort the economic motivation should be implemented to stimulate appropriate debt services and repayment.

In the neo-classical view, Diamond (1965) formally proposed public debt as a variable demonstrating economic growth. Diamond postulated that internal debt decreases the attainable capital stock due to the replacement of public debt for physical capital. In addition, Diamond contended that the decrease in capital stock arises from the internal borrowing of the government to finance the deficit. Fiscal and monetary policies play an essential role in promoting economic growth in the endogenous growth model. Consequently, through public debt as a fiscal policy tool, technical progress can be reached and result in a boost in economic growth. Nevertheless, Saint-Paul (1992) noted that using endogenous growth models noted that economic growth slowdowns arise from debt accumulation.

Furthermore, Krugman (1988) proposed the concept of "Debt Overhang" where the government's ability to repay external debt decreases below the actual debt value. Modern growth theories have recently demonstrated that the government debt-growth nexus is related to governance (see Zak and Knack 2001; Acemoglu and Robinson 2006). Against this backdrop, the main channel where public debt can affect economic growth is the long-term interest rate. The government's overborrowing to finance the fiscal balance deficit will result in a higher long-term interest rate. Consequently, the higher long-term interest rate tends to decelerate economic growth via the crowd-out of private investments.

Empirically, several macroeconomic studies have provided inconsistent or even contradictory results about the relationship between public debt and economic growth in developed and developing countries. By and large, empirical studies have demonstrated either a positive or negative association between the two variables. The preponderance of evidence has indicated that there is a significant influence of public debt on economic growth. Recently, research has shifted towards estimating the threshold value of debt-to-GDP that can maintain economic growth, rather than investigating the effect of public debt on economic growth itself. Nevertheless, many growth theories have admitted that government expansion is necessary for low-income countries to stimulate economic growth (see Levine 2005; Carlin and Mayer 2003). At the other extreme, most of the recent economic studies on the relationship between the public debt and growth relationship have contended that there is a non-linear (inverted U-shape) relationship between the accumulation of public debt and economic growth, where the effect of public debt on economic growth may change based on the level of economic development (See Pattillo et al. 2003; Kumar and Woo 2010; Cordella et al. 2010). As a consequence, there should be a level of secured debt that can boost economic growth. If a country borrows more without limitations, then economic growth will decrease even further.

After the financial crisis of 2008–2009, which was followed by the European debt crisis in countries including the PIIGS (Portugal, Italy, Ireland, Greece, and Spain), the relationship between public debt and economic growth for both developing and developed countries gained increased attention

among scholars. As government size increases over time, overborrowing to finance many unproductive projects may dampen long-term economic growth. El-Mahdy and Torayeh (2009); Bal and Rath (2014); Puente-Ajovín and Sanso-Navarro (2015); Zouhaier and Fatma (2014); Eberhardt and Presbitero (2015); and Mitze and Matz (2015) also contended that there is a negative relationship between public debt and economic growth. Conversely, several studies have employed recent econometric techniques to evaluate the debt-growth nexus. For example, Al-Zeaud (2014); Spilioti and Vamvoukas (2015); Fincke and Greiner (2015); Owusu-Nantwi and Erickson (2016); and Muye et al. (2017) maintained that public debt affects economic growth in a positive and significant manner.

In a major break with the existing macroeconomic literature, for 20 developed countries, Lof and Malinen (2014) commented that public debt has no real effect on economic growth even at higher public debt rates. In the second set of estimations, which considers more than two countries, as in our case, the results are different depending on the sample, and methodological tools are shown in Table 1.

Table 1. The main studies which estimate the debt-growth threshold level with more than two countries.

Author/s	Period	Countries	Methods	Outputs
Nasa (2009)	1970–2000	56 countries of heavily indebted countries	Panel Threshold Regression	Estimated debt-to-GDP threshold ratio at 45%.
Kumar and Woo (2010)	1970–2007	38 advanced and emerging economies.	Dynamic Panel GMM	A 10% increase in the debt-to-GDP ratio was offset by a 0.2% deceleration in real per capita GDP growth.
Reinhart and Rogoff (2010)	2 centuries	44 countries	Panel Analysis	Identify a 90% for both advanced and emerging market economies, while a debt-to-GDP of 60% for developing countries.
Cordella et al. (2010)	1970–2002	79 developing countries	SGMM	Debt-to-GDP ratio of 70–80% can sustain economic growth.
Baglan and Yoldas (2013)	1954–2008	20 advanced economies	Panel Threshold Regression	Identify a threshold effect of 20%.
Wright and Grenade (2014)	1980–2012	13 Caribbean countries	Panel OLS and Threshold Dynamics	Identify a 61% for the sample countries, with a debt/GDP ratio exceeding that threshold having an adverse impact on investment and growth.
Boukhatem and Kaabi (2015)	1990–2011	19 MENA countries	GMM Approach	Debt below 15% tends to boost economic growth.
Égert (2015)	1946–2009	20 Advanced countries 21 Emerging countries	Panel Threshold Regression	Identify a debt threshold between 20% and 60%.
Omrane et al. (2017)	1970–2010	4 MENA countries (Tunisia, Turkey, Morocco, Egypt)	Panel Threshold Regression	The debt-to-GDP estimated at 39.5%, beyond this threshold, debt was negatively associated with economic growth.
Khanfir (2019)	2003–2012	4 MENA countries (Tunisia, Algeria, Morocco, Egypt)	Panel Threshold Regression	A 187 debt-to-GDP threshold ratio of 42% correlated positively with economic growth

Given this backdrop, this present study fills the gaps in the following ways. First, while [Khanfir \(2019\)](#) and [Omrane et al. \(2017\)](#) focused on a few MENA countries using the panel smooth transition model (PSTR), this study differs in terms of the countries considered and methodology used. More precisely, this study conducts an empirical estimation of the entire sample of MENA countries using a different method (two regimes model) developed by [Hansen \(1996\)](#) during the most recent years (1990–2016) to determine the debt-growth nexus in the MENA region. Second, this study provides paramount evidence highlighting the role of the debt-to-GDP threshold in sustaining economic growth. In particular, we estimate whether there exists an optimum debt-to-GDP threshold value for the public debt-growth nexus. The outcomes of the study may have significant implications for economic policy. Therefore, if there is clear evidence that debt accumulation significantly restrains economic growth, then policymakers need to establish an effective policy that sustains and boosts economic growth. In summary, while most studies conducted in the MENA region have focused on a small group of countries, the present study adopts a different sample and methodology.

3. Methodology

3.1. Model Specification

The log-linearized Cobb-Douglas production function has empirically estimated the debt role in economic growth by controlling other explanatory variables. The model can be written as follows:

$$Y_{i,t} = \alpha_t + \beta_1 K_{i,t} + \beta_2 Pop_{i,t} + \beta_3 Debt_{i,t} + \beta_4 X_{i,t} + \mu_{i,t} \quad (1)$$

where $Y_{i,t}$ denotes real GDP per capita growth. α_t denotes time-fixed effect, $K_{i,t}$ denotes physical capital and $Pop_{i,t}$ denotes the population growth. $Debt_{i,t}$ denotes general government debt. $X_{i,t}$ is a vector of explanatory variables government expenditure ($GE_{i,t}$), which captures government policy, trade openness ($Open_{i,t}$) to measure the effect of trade policies; inflation rate ($inf_{i,t}$); and money supply ($M2_{i,t}$) as a percentage of GDP, and the initial income ($Initial_{i,t}$). Initial income is the lagged-dependent variable of the real GDP per capita growth to consider the convergence effect of the model.

3.2. Data and Variable Description

This study employs data for 20 MENA countries in estimating the growth model in Equation (1). The data adopt an annual frequency from 1990 to 2016. All the datasets are collected World Bank (WB) databases, except the data for Syria for the period 2010–2016, which has been obtained from the central bank and Central Bureau of Statistics of Syria. The real GDP per capita growth (Y) is a measure of economic growth, and (K) is the total investment as a percentage of GDP to proxy for gross capital formation. The population growth rate (Pop) has been used as a proxy for the labor force. Data for the public debt ($Debt$), the general government debt as a percentage of GDP, were collected from the IMF. Government expenditure (GE) is the total government expenditure as a percentage of GDP and captures government policy. The trade openness ($Open$) is the sum of exports plus imports as a percentage of GDP and is used as a proxy to capture trade openness. Money supply ($M2$) as a percentage of GDP used as a proxy for financial depth, as in [Baharumshah et al. \(2017\)](#). Inflation rate (Inf) is the annual percentage of average consumer prices. Finally, the initial income is the GDP per capita at constant prices (2010).

3.3. Methodology Selection

Previous studies have provided inconclusive results regarding the impact of debt accumulation on economic growth. The earlier studies show that debt accumulation effects may have nonlinear characteristics because of the potential presence of threshold in debt-growth nexus (see [Pattillo et al. 2003](#); [Kumar and Woo 2010](#); [Cordella et al. 2010](#)). Given the inconsistent results reported by earlier literature, this study estimates threshold effects in the debt-growth nexus for the case of MENA regions. The classical static panel data methods, such as fixed or random effect, have some

limitations, showing only the heterogeneity in intercepts and linear relationship among the variables. In contrast, the panel threshold method's main advantages are the shifting character or structural break in the association between dependent and explanatory variables (Lee and Wang 2015), explaining the possible nonlinear relationship between the threshold and dependent variables. The threshold model is considered an essential model for estimating many economic issues and has recently been utilized in many macroeconomic studies (Lee and Wang 2015). Consequently, to assess the nonlinear behavior of the debt-to-GDP ratio in the relationship with economic growth, this study employs the threshold regression approach suggested by Hansen (1996). The model in Equation (1) can be written based on the fixed effect panel threshold regression as follows:

$$rgdpcg_{i,t} = \mu_i + \beta_1 X_{i,t} I(Debt_{i,t} \leq \lambda) + \beta_2 X_{i,t} I(Debt_{i,t} \geq \lambda) + e_{i,t} \quad (2)$$

where $rgdpcg_{i,t}$ is the real GDP per capita growth, $Debt_{i,t}$ is the public debt, which is a threshold variable that divides the sample into upper and lower regimes; λ is the unknown threshold parameter; $I(\cdot)$ is the indicator function, which takes the value 1 if the argument in the indicator function is valid, and 0 otherwise; μ_i is the individual effect; and e_{it} is the disturbance. X_i is a vector of the control variables (investment, population growth rate, government expenditure, trade openness, inflation, money supply, and initial income). Equation (2) can be rewritten as two equations, Equation (3) represents the lower regime threshold and Equation (5) represents the upper regime threshold:

$$rgdpcg_{i,t} = \mu_{i,t} + \beta_1 X_{i,t} I(Debt_{i,t} \leq \lambda) \quad (3)$$

$$rgdpcg_{i,t} = \mu_{i,t} + \beta_2 X_{i,t} I(Debt_{i,t} > \lambda) \quad (4)$$

$$rgdpcg_{i,t} = \mu_{i,t} + \beta_1 X_{i,t} I(Debt_{i,t} \geq \lambda) \quad (5)$$

$$rgdpcg_{i,t} = \mu_{i,t} + \beta_1 X_{i,t} I(Debt_{i,t} < \lambda) \quad (6)$$

Therefore, this methodology allows for the examination of differentiating effects of public debt on economic growth in the lower and upper regimes depending on whether the threshold variable is smaller or higher than the threshold value γ . Coefficient β_1 and β_2 indicate the considered effects in the lower and higher regimes, respectively.

To carry out the panel threshold regression, we have to test the null hypothesis of linearity against the threshold model in Equation (2), where the null hypothesis is $H_0: \beta_1 = \beta_2$. According to Hansen (1996), there is a problem executing the LM and Wald test statistics under the null hypothesis because the λ parameter is not specified; therefore, inferences are implemented by calculating an LM or Wald statistic for each potential value of λ and depend on the least upper bound of the Wald or LM for all potential λ s (Law et al. 2013). Consequently, the inferences are conducted via bootstrapping in a model whose validity and properties were developed by Hansen (1996) because tabulations are not possible. Once the value of λ is obtained, the slope parameters $\hat{\beta}(\hat{\lambda})$ and $\hat{\gamma}(\hat{\lambda})$ can also be obtained.

4. Empirical Results

Table 2 shows the descriptive statistics for each variable employed in the model. The dataset is free from any extreme values, which may affect the estimated results' significance by affecting the mean, standard deviation, minimum, and maximum of each variable of the entire sample. Table 3 shows the correlation matrix of the variables employed in the analysis. Table 4 reports the panel threshold estimation results and presents the number of thresholds in terms of the debt-to-GDP ratio. According to the bootstrap p -values, the corresponding statistics F_1 , F_2 and F_3 suggest the number of thresholds. The test for the single threshold F_1 is highly significant, with a bootstrap p -value of 0.05, while F_2 and F_3 are nonsignificant, with bootstrap p -values of 0.16 and 0.68, respectively. In addition, the F statistic is highly significant. Therefore, we reject the linear model. The statistical significance of the threshold estimate is evaluated by the p -value calculated utilizing the bootstrap method with 1000 replications and a 0.1% trimming percentage. Consequently, the sample is split into two regimes. The point

estimate of the debt-to-GDP threshold value is 58.51%, with a corresponding 95% confidence interval of (52.3465, 58.9060) for the full sample model. The MENA region's debt-to-GDP threshold value as a developing region is close to 60%, as computed by Reinhart and Rogoff (2010), and 64% as computed by Grennes et al. (2010) for developing countries. This finding is also close to the debt-to-GDP threshold calculated by Sanusi et al. (2019), which is 57% for Southern African countries, and higher than the debt-to-GDP threshold value computed by Khanfir (2019); Omrane et al. (2017) and Boukhatem and Kaabi (2015). The estimated debt-to-GDP threshold is different from that found in previous studies conducted on the MENA countries because of the different sample and methodology employed.

Table 2. Descriptive and Summary Statistics for 20 Middle East and North Africa (MENA) Countries, 1990–2016.

Variables	Unit of Measurement	Mean	Std. Dev.	Minimum	Maximum
Rgdpcg	%	0.0140	0.0793	−0.6132	0.9276
Initial income	US\$ 2010 constant prices	8.2476	1.3796	4.7178	11.3513
Investment	% of GDP	3.1072	0.4072	0.4213	3.9282
Expenditure	% of GDP	3.4146	0.3044	2.4158	5.3189
Public debt	% of GDP	3.5971	0.9941	−0.5978	5.3924
Trade openness	% of GDP	4.2787	0.4322	2.1800	5.3478
Money growth	% of GDP	3.9866	0.6310	2.1492	5.5561
Population growth	%	2.8027	2.4244	−4.5365	17.5109
Inflation	%	8.6301	14.7768	−9.7976	105.215

Table 3. Correlations between Variables for 20 MENA Countries, 1990–2016.

	Rgdpcg	Initial	INV	Popgr	Exp	Debt	Open	Inflation	M2
Rgdpcg	1.0000								
Initial	−0.0545	1.0000							
INV	0.0735	0.1909	1.0000						
Popgr	−0.1138	0.3793	0.0944	1.0000					
Exp	−0.0288	0.1744	0.0851	−0.1953	1.0000				
Debt	0.0432	−0.5118	−0.1927	−0.1516	0.0868	1.000			
Open	−0.0209	0.4671	0.0939	0.2460	0.2463	−0.1796	1.0000		
Inflation	0.0299	−0.1877	0.0114	−0.0752	−0.1112	0.2114	−0.2975	1.0000	
M2	0.0182	0.1327	0.1818	−0.0045	0.3167	−0.0885	0.3042	−0.1529	1.0000

Notes: Rgdpcg = real GDP per capita; INV = total investment (% of GDP); Popgr = population growth; Exp = government expenditure (% of GDP); Debt = public debt (% of GDP); Trade openness = openness in trade policy (% of GDP); Inflation = inflation rate; M2 = money supply (% of GDP) and Initial = GDP per capita in constant prices (2010).

Table 4. Tests for Threshold Effects for 20 MENA Countries, 1990–2016.

Test for Single Threshold		
<i>p</i> -value (1%, 5%, 10% critical values)	F ₁	13.26 *** (0.05) (11.2595, 12.9904, 18.2513)
Test for Double Threshold		
<i>p</i> -value (1%, 5%, 10% critical values)	F ₂	8.33 (0.16) (10.2692, 13.0625, 16.3608)
Test for Triple Threshold		
<i>p</i> -value (1%, 5%, 10% critical values)	F ₃	5.99 (0.68) (24.4019, 34.6089, 56.4302)

Note: A total of 1000 bootstrap replications were used for each of the three bootstrap tests. *** denotes significant at 1% level.

To estimate how the debt-to-GDP threshold affects the economy under the upper and lower threshold values of the debt-to-GDP ratio, Table 5 shows the panel threshold model's empirical results for the debt-growth relationship from Equation (2). The coefficient estimates of the explanatory variables are significant for promoting growth. First, public debt turns out to be a significant positive determinant of economic growth in the lower regimes. Still, in the upper regime, public debt has a nonsignificant positive effect promoting growth. In other words, debt at a level below 58% of GDP positively influences economic growth. The result is ambiguous when debt exceeds 58% of GDP because the coefficient is insignificant. This implies that if the debt-to-GDP threshold level is beyond 58%, it tends to have positive or negative effects on the MENA region's economic growth. Arguably, this finding is consistent with the Laffer curve and the theory that debt accumulation tends to dampen economic growth through the burden of higher debt servicing in the long term.

Table 5. Regression Results using Public Debt (Debt) as a Threshold Variable. Dependent Variable: Real GDP per Capita.

	Coefficient	Standard Error
Regime-independent regressors		
Initial income	−0.0016 **	(0.0074)
Investment	0.0015 ***	(0.0005)
Population growth	−0.0047 **	(0.0019)
Government expenditure	−0.0018 **	(0.0003)
Trade openness	0.0004 **	(0.0002)
Inflation rate	−0.0020 ***	(0.0002)
Money supply	−0.0048 ***	(0.0018)
Threshold variable		
Debt-to-GDP ≤ 58.51	0.0092 ***	(0.002)
Debt-to-GDP > 58.51	0.0013	(0.001)
Constant	0.130 **	(0.637)
R-square	0.801	
No. Observations	540	

Note: ***, and ** denotes significant at 1% and 5% level respectively. The results correspond to a trimming percentage of 0.1%. F test that all ui = 0: F(19, 511) = 1.99. Prob > F = 0.0008.

Turning to physical capital, it positively affects economic growth, which is consistent with theory. Moreover, the labor force has a significant negative effect on economic growth, which reflects the labor market policies in the MENA region. Furthermore, government expenditure behavior is conflicting for the anticipations, since government expenditure is negatively and significantly associated with economic growth. This result shows the significance of fiscal policy for the MENA region. At 58% of debt-to-GDP ratio, government expenditure hinders economic growth. A plausible explanation is that ineffective governments in MENA countries depress private investment, so public investment may substitute private investment. Consequently, the MENA reign needs to allocate government expenditures prudently to curb adverse influences and take full advantage of beneficial economic growth. However, trade openness is in line with expectations. It has a significant positive influence on economic growth, possibly because of trade barriers removal.

The coefficient estimates of inflation are significant and negatively associated with economic growth. Besides which, the model shows that the money supply plays a significant negative role in promoting economic growth in the studied period. Although monetary policy has a vital role in enhancing the economic growth of any country, there has been a long debate in economics about the role of money in the economy. At 58% of the debt-to-GDP ratio, the money supply increases over time, coupled with a decrease in the interest rate. As a consequence, consumption, lending and borrowing will be increased. Hence, expansionary money policy leads to crowd-out investment, often resulting in stagnation, which finally hinders economic growth. Finally, the initial income coefficients are significant

and have a positive effect on economic growth. These findings are consistent with the theory. Overall, the ambiguity regarding the MENA region's estimations may be because of the development of the financial sector and indicate that the MENA region has not yet reached a sustainable level of debt.

To smooth short-run fluctuations, we split the MENA region's full sample into three periods over nine years for all variables. This leaves us with three intervals: 1990–1998, 1999–2007 and 2008–2016. Table 6 shows the threshold estimates for the periods.

Table 6. Threshold Estimates.

	Threshold Estimated	95% Confidence Interval
$\tilde{\gamma}^1$	26.59	(26.27, 27.60)
$\tilde{\gamma}^2$	47.69	(46.27, 48.76)

With the two estimated thresholds categorizing the countries into three levels based on their debt-to-GDP ratio, the significant estimate of each level proves the existence of nonlinear effects on the debt-to-GDP ratio. Table 7 shows the countries in each level of debt-to-GDP in the observed periods. In 1990, two countries, namely Bahrain and the UAE, had low levels of debt-to-GDP. On the other hand, 13 countries had a high debt-to-GDP threshold. By 1999, the number of countries with a medium level of debt-to-GDP had increased from five to seven, and the number of countries with a high level had decreased to nine. By 2008, Comoros, Djibouti, Ethiopia, and Tunisia had notably decreased their debt accumulation level and joined the countries with a medium level of debt-to-GDP, while Morocco and Jordan still had high levels of debt-to-GDP.

Table 7. 20 MENA Countries with Different Debt-to-GDP Threshold Levels, 1990–2016.

Threshold Variable	Period	Debt-to-GDP ≤ 26.59	$26.59 < \text{Debt-to-GDP} \leq 47.69$	Debt-to-GDP > 47.69
	(1990–1998)	Bahrain and UAE	Lebanon, Turkey, Oman, Iran, Qatar	Jordan, Ethiopia, Comoros, Syria, Egypt, Tunisia, Djibouti, Morocco, Algeria, Kuwait, Libya, Saudi Arabia, Yemen
Debt-to-GDP	(1999–2007)	Bahrain, Iran, Oman, UAE	Yemen, Turkey, Algeria, Saudi Arabia, Kuwait, Libya, Qatar	Jordan, Lebanon, Syria, Djibouti, Tunisia Morocco, Ethiopia Comoros, Egypt
	(2008–2016)	Algeria, Iran, Kuwait, Libya, Oman, Qatar, Saudi Arabia, UAE, Yemen, Syria	Tunisia, Djibouti, Turkey, Ethiopia, Comoros, Bahrain	Jordan, Lebanon, Morocco, Egypt

5. Summary and Conclusions

This study examined whether there is a debt-to-GDP threshold value in the public debt-economic growth nexus for 20 MENA countries over 1990–2016. This study's novel contribution is the adoption of the regression model proposed by Hansen (1996) to provide a reliable optimum debt-to-GDP threshold, which has not previously been addressed. The results reveal that debt promotes economic growth only below the debt-to-GDP threshold. The empirical findings also demonstrate that the estimated threshold percentage value for the developing MENA region is lower than the debt threshold computed by Reinhart and Reinhart and Rogoff (2010) and Grennes et al. (2010) for developing countries. This study concludes that debt has a positive effect on growth below the threshold value. In contrast, the impact of debt above the threshold value is ambiguous because the coefficient is nonsignificant.

This study's policy implications are that accumulating debt to boost economic growth is not a wise policy choice for countries in the MENA region. Instead, reducing the debt-to-GDP ratio seems to enhance these countries' economic performance; the average debt-to-GDP ratio of approximately 52% over the full sample period seems to support this view. Arguably, the relationship between public debt and economic growth depends on the debt-to-GDP ratio. This study finds that government debt can promote economic growth if used for productive projects and limited to optimal. Therefore, policymakers may eventually enhance growth by reducing the debt-to-GDP ratio, efficiently allocating financial sources, reducing sterile government-funded programs, and using timely austerity measures to curb shocks' effects financial crisis.

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