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Public Debt Trap Conundrum: Exploring the Threshold Level for Optimal Public Debt in Middle East and North African (MENA) Countries

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Abstract: *The vicious circle of public debt i.e. borrowing, debt servicing, and further borrowing for debt servicing has become a major impediment to economic growth and stability for developing countries. The instant study addressed the major knowledge gap regarding a clear understanding of the optimal level of public debt for 19 countries of the Middle East North African (MENA) region. For this purpose, panel data was derived from the World Bank. The participant variables of Central Government debt, debt square, total population, tax revenue, primary school enrolment, Gini coefficient, and per-capita income were analyzed by applying fixed effect regression with Driscoll-Kraay standard errors method. The results exhibited an inverted U-shaped association between per-capita income and public debt. The optimal threshold of public debt after which per-capita income began to decrease was found to be approximately 43,673.17 million (LCU). The income inequality was negative while tax revenue and primary school enrolment were positively and significantly associated with per-capita income, meanwhile, the population was found to be insignificant. It was concluded that the MENA countries must control their public debt and should not go beyond the threshold level in order to increase economic growth. Further, income inequality should be decreased to increase the per-capita income along with an enhanced focus on increasing tax revenue and education level.*

Key Words: Public Debt, Fixed Effect Model, Education, Tax Revenue, Income Inequality, Economic Growth, Non-Linear Relationship

Introduction

The linkage between government borrowing and GDP growth has been a prime focus for economists and policymakers, especially in the context of developing countries that relatively have bigger fiscal challenges. The low-income countries, in particular, grapple with unsustainable levels of public debt because its inescapable trap can derail economic development and perpetuate abject poverty. Over the past two decades, the world has encountered significant global challenges, including the financial crisis during 2007–08 and the pandemic of COVID-19. These crises have profound impacts on economies worldwide, particularly in developing nations, leading to heightened public debt pressures. In light of recent financial challenges, governments have implemented various measures to stabilize their economies. These interventions include bailouts for financial institutions, fiscal stimulus packages, and increased social welfare spending to mitigate the recession's effects (Blakely & Leigh, 2013; Rogoff, 2022; Pervaiz et al., 2024). These interventions have necessitated substantial government expenditures, often resulting in budget deficits and a rising burden of national debt. The debt to GDP ratio in the MENA region is given in Figure 1.

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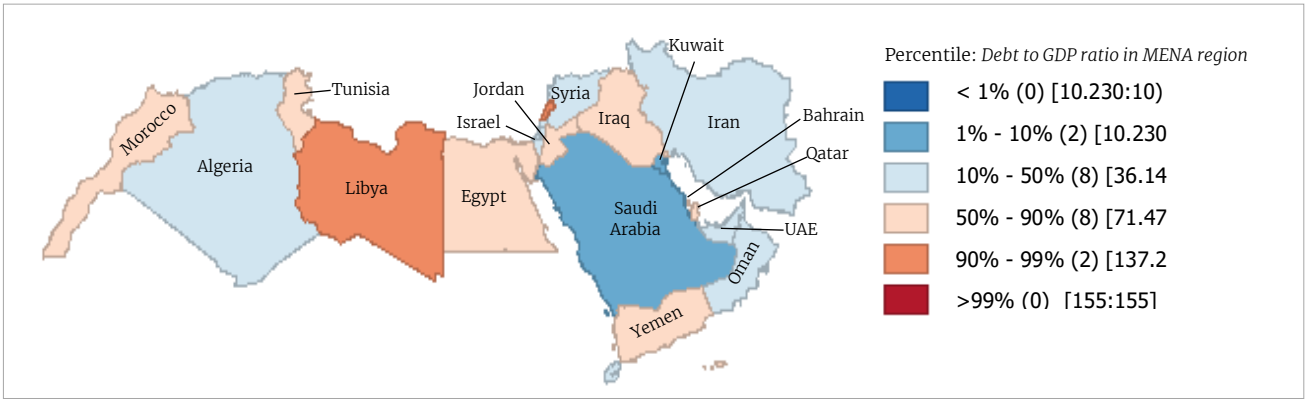
Figure 1

Debt to GDP ratio in MENA region (2023)



Similarly, in the aftermath of COVID-19's economic shock, governments have introduced unprecedented fiscal stimulus measures, such as direct cash transfers, grants to businesses, and expanded healthcare spending (Van Zwieten et al., 2020). While these actions supported individuals and businesses during the crisis and promoted economic recovery, they also required extensive borrowing, leading to a surge in public debt. The global public debt (Private and Public) reached to all-time high value of USD 250 trillion in 2023 which came to 237% of global GDP or at least 8 percentage points higher than its pre-pandemic level in 2018 (IMF, 2024).

Public debt is a complex phenomenon that significantly affects GDP growth; especially related to low-income countries, it gained an increased focus because countries require public debt due to their limited resources and external vulnerabilities. These countries have to frequently resort to borrowing from other countries and financial institutions in order to finance important infrastructural projects and social services for stimulating economic activity in the country. However, the implications of accumulating debt vary considerably amongst developing countries which require careful examination and analysis.

The rise in public debt has been found to have complex implications for GDP growth (Reinhart & Rogoff, 2010; Panizza, 2013; Saungweme, 2021). Research highlights a curvilinear trend for debt and GDP growth, often depicted as an inverted U-shaped curve. Initially, increasing debt supports economic expansion up to a certain threshold, beyond which further debt accumulation hampers growth. Doojav and Baatarkhuu (2024) in a seminal study empirically demonstrated the same pattern in Asian developing countries. They concluded an inverse U-shaped pattern between government borrowing and the rate of economic expansion indicating a threshold level of government borrowing that can maximize the GDP growth of these countries. Other researchers (Checherita-Westphal & Rother, 2012; Panizza et al., 2014; Loewald, Faulkner & Makrelov, 2020) also corroborated this non-linear relationship across different regions.

The key research problem can include the evaluation of the regression between the level of public debt and the rate of economic growth. It means that an increase in public debt significantly correlated with a decrease in growth, and the prudent management of national debt stimulated GDP growth. It is important to determine the optimal level of public debt which does not negatively affect the economic performance. The critical threshold as suggested by the literature varies markedly across regional contexts, socio-economic conditions, governance structures, and economic development. Further, the efficiency and effectiveness in the allocation and utilization of borrowed funds are equally important for sustaining economic growth. The allocation of resources amongst different sectors of the economy is crucial. The utilization of borrowed money in productive sectors e.g. infrastructure, healthcare, and education can yield higher returns as compared with non-productive purposes which could lead to diminishing returns and exacerbated fiscal challenges for the country.

Similarly, the balance between public debt and private sector investment is highly crucial in the dynamics of GDP growth. Higher levels of debt may increase interest rates and subsequently crowd out private investment. This crowding-out effect of public debt may hinder economic growth by stifling entrepreneurship and innovation. The influence of government borrowing in the context of private sector decision-making regarding investment has broader economic implications for the countries. Moreover,

the global economic conditions and the price fluctuation gain prime attention because the middle-income countries are relatively more vulnerable to external shocks which could impact the sustainability of public debt and economic growth. The analysis of the relationship between public debt and economic growth in region-specific conditions is direly required for valuable contribution to the academic discourse and influencing policymakers in this area.

There is a significant increase in the national debt in middle-income economies of Sub-Saharan Africa and East Asia especially after the financial crises of 2007-08 and the Covid-19 Pandemic. This increase in debt pressure affects the economic growth in this region negatively (Adam & Bevan, 2005). The correlation between GDP growth rates and government borrowing is not linear (Doojav & Baatarkhuu, 2024). A gap could be found in the literature regarding the scarcity of study for the assessment of the optimal level of government borrowing for the Middle East North African (MENA) countries i.e. Iran, Bahrain, UAE, Oman, Qatar, Kuwait, Iraq, Saudi Arabia, Jordan, Israel, Syrian Arab Republic, Cyprus, Türkiye, Yemen, Egypt, Libya, Tunisia, Algeria, Morocco.

The instant study investigates the non-linear nexus between government borrowing and GDP growth in middle-income economies of Sub-Saharan Africa. These nations have experienced fluctuating debt levels over recent decades. While debt relief policies adopted in the late 1990s and early 2000s initially reduced debt burdens, recent years have seen a resurgence due to increased borrowing for infrastructure projects, social programs, and budget deficits. For instance, the debt burden ratio for middle-income Sub-Saharan countries rose from 45% in the early 2000s to approximately 58% in 2020, with Ghana, Kenya, and Zambia witnessing a 60% increase during this period (World Bank, 2023).

Using the Fix effect regression with the Driscoll-Kraay standard Errors method (1998), this study estimates the non-linear debt-growth model. It seeks to identify the inflection for the debt at which economic growth peaks, providing critical insights for policymakers. Understanding this relationship will help governments make informed decisions on managing debt and fiscal policies, avoiding unsustainable debt burdens while achieving sustainable economic development. Additionally, this research contributes to the literature by offering empirical data and advanced econometric analyses, enhancing the understanding of the interplay of debt and GDP growth in the Sub-Saharan African and East Asian context.

Under the instant study, “the dynamic relationship between debt and growth was non-linear” served as the null hypothesis (H_o) whereas, "the dynamic relationship between debt and growth was not non-linear" was taken as the alternative hypothesis. The following were the research objectives of the instant study:

1. To empirically measure the non-linear relationship between public debt and economic growth.
2. To determine the optimal level of public debt for the region of MENA region countries.
3. To give recommendation to the policyholders related to the model.

Literature Review

Extensive research has been made in the literature on the nexus between GDP growth and government debt. The existing literature yields mixed evidence on the impact of debt on economic growth, with some studies finding positive and others negative relationships. Further investigation is required to explore the non-linear dynamics between these variables, especially in diverse regional contexts. This section summarizes some of these studies.

Reinhart and Rogoff (2010) conducted a comprehensive study on the correlation between public debt and economic growth, encompassing a diverse group of countries. Through empirical analysis, they identified a critical threshold of public debt, finding that government borrowing exceeding 90% of GDP is associated with diminished economic growth. The authors attributed this relationship to factors such as uncertainty, crowding out of investment, and fiscal imbalances. They advocated for fiscal policy and debt control management to achieve sustainable economic development. Checherita-Westphal & Rother (2010) found a curvilinear trend of on]]]impact of debt on growth with a threshold point beyond which the public debt was found to have a deleterious impact on economic growth in Euro area countries. They analyzed the time series data for four decades since 1970 for these countries. Their research explored the various pathways by which public debt influenced economic growth, encompassing effects on private savings,

public investment, total factor productivity, and interest rates. They presented additional arguments for debt reduction for sustained economic growth prospects.

Cecchetti et al. (2011) examined the impact of national debt on GDP growth in 18 OECD countries, accounting for non-linear relationships between 1980 and 2010. Their findings suggested that moderate debt levels can enhance welfare and economic growth, while excessive debt hinders growth. The study identified a threshold level of government debt at 85% of GDP. The authors emphasized the importance of monitoring and managing debt levels, as excessive debt poses significant risks to economic stability and growth. Presbitero (2012) focused on developing countries to explore the interplay between government debt (domestic and external borrowing) and GDP growth. An analysis of low- and middle-income economies from 1990 to 2007 showed that public debt negatively affected economic growth up to a threshold of 90% of GDP, and it had no significant impact beyond this point.

Similarly, Égert (2015) empirically examined the transmission mechanism of public debt's short-term impact on economic growth, focusing on European Union (EU) countries in the context of the sovereign debt crisis. He used a panel dataset of 25 EU sovereign member states by splitting the sample into two categories: "old" member states (1980-2010) and "new" member states (1995-2010). He employed a generalized economic growth model and indicated a non-linear impact of government borrowing on annual GDP growth rates. He identified debt burden inflection points which ranged from 80% to 94% for "old" member states but lower i.e. between 53% and 54% for "new" member states.

Panizza and Presbatero (2014) analyzed the causal regression between national borrowing and economic performance in OECD countries. Employing advanced econometric models, the researchers controlled for endogeneity biases and conducted robustness checks to confirm the accuracy of their results. The study revealed a negative correlation between debt and economic growth in OECD countries, suggesting that high debt levels hinder economic growth. Another evidence for the threshold for government debt and GDP growth was presented by Law et. al. (2021). They employed the dynamic panel threshold technique and examined the government debt to GDP growth in 71 developing countries by taking time series data from 1984 to 2015. They showed a threshold debt value of 51.65% which was much lower than most of the previous such studies. The study's findings were consistent with the debt-overhang hypothesis, which posits that high levels of government borrowing can hinder economic growth, while low debt levels do not significantly impede growth.

Doovaj and Baatarkhu (2024) estimated panel GMM and VAR models to examine the relationship between government borrowing and GDP growth in Asian developing countries, addressing potential endogeneity and reverse causality issues. Their findings revealed a statistically significant inverse U-shaped relationship between the rate of economic expansion and the national debt, with a threshold level of 50% of GDP identified for all Asian countries. Shah et al. (2024) also investigated the reverse causality of government borrowing on GDP growth in the context of developing countries. They employed a dynamic panel threshold model to analyze the impact of public debt on economic performance over the period 1990-2020, and also distinguished economies based on income levels in their sample data. Their results of the analysis indicated a threshold of 50.988% i.e. the national debt was found to negatively affect the economic performance of countries having low incomes above this level. Moreover, in the case of lower-middle-income countries and upper-middle-income countries, the government debt was found to affect GDP growth negatively beyond the turning point at 50.243% and 62.646% respectively.

Empirical Methodology

The instant study aimed to investigate the non-linear trend between economic growth and public debt. To achieve this objective, we employed a range of independent variables, including total central government debt, squared debt, Gini coefficient for income inequality, total population, primary school enrolment, and tax revenue. GDP per capita served as the dependent variable. We compiled a panel dataset for 19 countries of the MENA region, covering the period from 1990 to 2023.

Our data sources included the World Development Indicators (WDI) for central government debt, total population, primary school enrolment, and tax revenue, as well as the World Income Inequality Database (WIID) for the Gini coefficient, a proxy for income inequality. The research augments the existing

knowledge base in this area (Baum et al., 2013; Checherita-Westphal & Rother, 2012; Singh & Kumar, 2024) by estimating a panel regression model to capture the non-linear impact of the debt burden on per capita increase. The following table lists the variables used in this study, along with their descriptions and sources of data:

Table 1

Variable Specification and Measurement Used in the Study

S. No	Variables (Notations)	Measurements	Sources
1	Public Debt (Debt)	Central government debt current (LCU)	WDI
2	Economic Growth (GDP)	Per capita income current (LCU)	WDI
3	Income inequality (Gini)	GINI Coefficient	WIID
4	Population (Pop)	Total Population	WDI
5	Education (Edu)	Primary School Enrolment	WDI
6	Tax Revenue (TR)	Tax Revenue current (LCU)	WDI

The functional form of the model is given as under:

$lnGDP_{it} = f(Debt, Debt^{2}, lnGini, lnPop, lnEdu, lnTR)$

Whereas, the econometric form of the model is represented by the following equation:

$$lnGDP_{it} = \beta_o + \beta_1 lnDebt_{it} + \beta_2 lnDebt^{2}_{it} + \beta_3 lnGini_{it} + \beta_4 lnPop_{it} + \beta_5 lnEdu_{it} + \beta_6 lnTR_{it} + \varepsilon$$

Where 't' has been used for the time period and 'i' indicates the country, 'lnGDP' is the log of per capita GDP adjusted for inflation, 'lnDebt' is the log of the Central Government debt, 'lnDebt^{2}' is the quadratic term of the initial Central Government debt, 'lnGini' is the log of Gini coefficient, 'lnPop' is log of the total population, 'lnEdu' is a log of primary school enrolment, 'lnTR' is a log of tax revenue, and 'ε' is the error term.

Empirical Estimation and Interpretations

The summary statistics for the variables used in the analysis for Middle East North African countries are shown in Table 1.

Table 2

Descriptive Analysis

Variables	Mean	Maximum	Minimum	Std. dev.
Lnper	08.69	11.49	03.12	11.49
Lndebt	23.85	32.00	18.74	02.61
lngini	03.66	03.87	03.25	00.11
lnpop	16.05	18.52	12.81	01.46
lntr	24.15	33.34	15.42	03.46
lnpri	04.58	04.83	04.13	00.11

Table 2 shows the relationship between dependent and independent variables. The fixed effect, random effect, and Driscoll-Kraay robust stranded error model are used to find the relationships. 'lnGDP' was taken as dependent variable.

Table 3

The relationship between dependent and independent variables (Fixed Effect, Random Effect, and Driscoll-Kraay)

Variables	Fixed Effect (FE)	Random Effect (RE)	Driscoll-Kraay
lnDebt	2.818*** (0.007)	4.852*** (0.000)	1.225*** (0.014)
lnDebt^{2}	-0.137*** (0.018)	-0.258*** (0.000)	-0.025*** (0.043)
lnGini	-1.332*** (0.008)	-6.875 *** (0.000)	-1.332*** (0.035)
lnPop	0.085 (0.558)	-0.934*** (0.000)	0.085 (0.487)
lnTR	0.523*** (0.000)	0.557*** (0.000)	0.523*** (0.001)

Variables	Fixed Effect (FE)	Random Effect (RE)	Driscoll-Kraay
lnEdu	0.504*** (0.002)	1.575*** (0.000)	0.504*** (0.003)
	R^2 = 0.90 Chi^2= 138.36 (0.000)	R^2 = 0.91 Chi^2= 915.33 (0.000)	R^2 = 0.90 Chi2= 180.01 (0.000)
Hausman Test	Chi^2 = 427.52 (0.000)		

The Hausman specification test revealed that the fixed effects model was appropriate, as evidenced by a Chi-squared probability of 0.00. Consequently, we rejected the null hypothesis that the random effects model was suitable.

Table 4

Diagnostic Tests

Wooldridge test	Modified Wald test	Pesaran's test
F statistics: 104.50 (0.0000)	Chi^2 : 9405.30 (0.0000)	Pr Statistics: 0.0013 (0.4400)

Table 4 presents the results of diagnostic tests. The Wooldridge test for autocorrelation detected significant autocorrelation among variables ($p < 0.05$), leading us to fail to reject the null hypothesis that a degree of similarity existed between a given panel series and its lagged version. The Modified Wald test indicated the presence of heteroskedasticity in the data ($p < 0.05$), causing us to fail to reject the null hypothesis of heteroskedasticity. Pearson's test revealed significant cross-sectional dependence between cross-sections ($p < 0.05$). To address the issues of heteroskedasticity, autocorrelation, and cross-sectional dependence, we employed the non-parametric estimator proposed by Driscoll-Kraay (1998).

The curvilinear relationship between government borrowing and per capita income was examined using fixed effects regression with Driscoll-Kraay standard errors. The results revealed a positive relationship between public debt and per capita income, with a coefficient of 1.25. This indicated that a one percentage point increase in public debt would correspond to a 1.25 percentage point increase in per capita income. Our findings were consistent with those of Doojav and Baatarkhuu (2024). Notably, the model suggested an inverse U-shaped relationship between public debt and per capita income. Specifically, low levels of public debt had a positive impact on per capita income, while high levels had a negative impact. This result was significant at the 5% level and aligned with previous literature, including Eberhardt and Presbitero (2015).

Furthermore, our analysis revealed a negative and significant relationship between income inequality (GINI) and per capita income. The coefficient of Gini was -1.33, indicating that a one percentage point increase in income inequality would correspond to a 1.33 percentage point decrease in per capita income. This finding was in line with previous studies by Aghion, Caroli & Garcia-Penalosa (1999) and Ostry, Berg & Tsangarides (2014).

In addition, our results showed that population was positively related to per capita income, although this relationship was insignificant ($p = 0.487$). In contrast, tax revenue was positively related to per capita income, with a one percentage point increase in tax revenue corresponding to a 0.523 percentage point increase in per capita income. This result was significant at the 5% level ($p = 0.001$) and aligned with findings by Besley, Ilzetzki, & Persson (2013) and Bird & Zolt (2005). Lastly, our empirical model indicated that primary school enrolment had a significant and positive relationship with GDP per capita. A one percentage point increase in primary school enrolment would correspond to a 0.504 percentage point increase in GDP per capita and vice versa.

Threshold Level of Debt

The threshold level of public debt was estimated after which per capita income started to decrease; we determined the minimum debt level at which the relationship between minimum debt and the per capita income changed direction. This is often called the turning point in a quadratic relationship. In our

regression output, the per capita income was regressed on the linear term of public debt and the squared term of public debt. The coefficients are as under:

$$\ln GDP = \beta_0 + \beta_1 \ln Debt + \beta_2 \ln Debt^2$$

Where $\beta_0 = -16.47$ $\beta_1 = 1.225$ $\beta_2 = -0.025$

We found the turning point; we took the derivative of the equation with respect to debt and set it equal to zero:

$$\frac{d(\ln GDP)}{d(\ln Debt)} = \beta_1 + 2\beta_2 \ln Debt = 0$$

The analysis revealed that the threshold level of the public debt (Debt) after which per capita income (GDP) began to decrease was approximately a log of 24.5. By taking its anti-log, it was observed that the level of public debt should be less than approximately 43,673.17 million (LCU) to increase the level of per capita income in the MENA region. This indicated that the initial level of public debt may increase the per capita in the region, however, beyond the threshold level of debt i.e. 43,673.17 million (LCU) tend to decrease the per capita income in the MENA region. It was due to the heavy burden of public debt which could not allow the economy to grow.

Conclusion and Recommendations

According to the empirical estimations, the instant study concluded that there was an inverted U-shaped relationship between public debt and GDP per capita in the MENA region. A low level of public debt caused to increase in the GDP per capita, on the other hand, a high level of public debt beyond 43,673.17 million (LCU) had a negative impact on GDP per capita. Other indicators like population, tax revenue, and primary school enrolment had a positive impact on GDP per capita. Tax revenue and school enrolment were significant while population had an insignificant relationship with GDP per capita. Based on the results, it was concluded that income inequality had a negative and highly significant impact on GDP per capita.

The following recommendations are suggested on the basis of the above-mentioned empirical findings.

1. Countries with high public debt cause to decrease the GDP per capita so it is recommended that countries should control the public debt pressure and keep it at less than the threshold level. Nations should rely on their own resources and production in order to decrease the pressure of debt.
2. High income inequality causes to decrease the per capita income in the specific region. It is suggested to decrease the income inequalities through fare tax system.
3. Education is also positively related with per capita income. It is recommended to increase the primary school enrolment; government should give the subsidies to the education sector that helps to increase the education level.
4. In the last, it is also suggested to increase the tax revenue in the specific countries of the region which helps to increase the GDP per capita of the nation.

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