Debt Thresholds and Growth Traps: Testing the Nonlinear Effects of Public Debt in Egypt

عتبات الدين وفخاخ النمو: اختبار التأثيرات غير الخطية للدين العام في مصر

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Abstract

This research examines Egypt's nonlinear relationship between public debt and economic growth using deductive approach via semi-annual data from 2000 to 2024. Hansen's (2000) threshold regression model and Bai-Perron tests identify 78.17% and 89.42% as critical debt-to-GDP thresholds, dividing the data into low-, moderate-, and high-debt regimes. While moderate debt levels can support growth, exceeding the upper threshold significantly impairs investment efficiency and exposes the economy to inflation and interest rate vulnerabilities, supporting the debt overhang hypothesis. Inflation has a negative and significant effect on growth across all debt regimes, reflecting macroeconomic instability and real investment return erosion. Egypt must implement targeted fiscal consolidation, improve investment efficiency, and coordinate monetary-fiscal policies to control inflation, according to the research. The persistently negative impact of government expenditure on growth highlights the need for public spending rationalization. Research on regime-specific debt effects provides a nuanced framework for debt management beyond one-size-fits-all policy prescriptions. Fiscal rule design and long-term macroeconomic planning in Egypt are affected. The research concludes that public debt can hinder growth in developing economies with limited fiscal space and external vulnerabilities if not managed properly.

Keywords: Threshold Regression, Public Debt, Economic Growth, Debt Overhang, Egypt

المستخلص:

يتناول هذا البحث العلاقة غير الخطية بين الدين العام والنمو الاقتصادي في مصر باستخدام المنهج الاستنباطي عبر بيانات نصف سنوية من عام ٢٠٠٠ إلى عام ٢٠٢٤. وقد أسفر تطبيق نموذج الانحدار الحدّي لـ Hansen (2000) واختبارات Bai–Perron عن تحديد نسبتي ٧٨.١٧٪ و٨٩.٤٢٪ من الدين إلى الناتج المحلي الإجمالي كعتبتين حرجتين، ما يتيح تقسيم العينة إلى ثلاثة نظم دين مختلفة: منخفضة، ومتوسطة، ومرتفعة. وتشير النتائج إلى أن المستويات المتوسطة من الدين قد تُسهم في دعم النمو، بينما يؤدي تجاوز العتبة العليا إلى تراجع كفاءة الاستثمار وزيادة تعرض الاقتصاد لمخاطر التضخم وأسعار الفائدة، مما يدعم فرضية عبء الدين. كما تُظهر الدراسة أن التضخم يُمارس تأثيرًا سلبيًا ومعنويًا على النمو عبر جميع النظم، ما يعكس حالة من عدم الاستقرار الاقتصادي الكلي وتآكل العوائد الحقيقية على الاستثمار. وتوصي الدراسة بضرورة تطبيق سياسات ضبط مالي انتقائية تتناسب مع خصوصية الوضع الاقتصادي لمصر، وتحسين كفاءة الاستثمار، وتنسيق السياسات النقدية والمالية للسيطرة على التضخم. كما أن التأثير السلبي المستمر للإنفاق الحكومي على النمو يُبرز الحاجة الملحّة إلى ترشيد الإنفاق العام. وتوفّر نتائج الدراسة المتعلقة بتأثيرات الدين وفقًا للنظام الاقتصادي إطارًا تحليليًا دقيقًا لإدارة الدين يتجاوز الوصفات الموحدة للسياسات المالية. وتنطوي هذه النتائج على آثار مباشرة لتصميم قواعد مالية فعالة والتخطيط الاقتصادي الكلي طويل الأجل في مصر. وتخلص الدراسة إلى أن الدين العام، إذا لم يُدار ضمن حدود مثلى، قد يشكل عائقًا هيكليًا أمام النمو في الاقتصادات النامية التي تعاني من محدودية الحيز المالي والتعرض للصدمات الخارجية.

الكلمات المفتاحية: انحدار العتبة، الدين العام، النمو الاقتصادي، عبء الدين، مصر

I. Introduction

In the last twenty years, Egypt's public debt has consistently increased due to fiscal challenges, external economic shocks, and significant government expenditure. Egypt's debt-to-GDP ratio has experienced significant fluctuations from 2000 to 2024, with notable increases following events such as the 2008–2009 global financial crisis, the 2016 currency flotation, the repercussions of the Arab Spring, and the COVID-19 pandemic. Although borrowing has frequently facilitated funding for essential infrastructure and social initiatives, there is growing concern regarding the long-term sustainability of Egypt's debt, particularly in light of recent global financial limitations, exchange rate issues, and escalating borrowing costs associated with the Federal Reserve's monetary policy adjustments, which typically impact emerging markets (El-Khishin and Mohieldin, 2023).

The debate concerning the correlation between public debt and economic growth is frequently contentious among scholars and policymakers. Classical and Keynesian theories contend that debt can promote growth by funding investments, especially in developing economies with limited capital, where effective fiscal policy can substantially influence results. Nonetheless, recent research- especially that which expands upon the established (yet refined) findings of Reinhart and Rogoff (2010) and Pescatori et al. (2014)- indicates a more intricate, nonlinear relationship. In this context, public debt facilitates growth only to a certain threshold; exceeding this limit adversely affects the economy, necessitating meticulous analysis due to Egypt's distinct economic challenges.

The concept of threshold effects has received heightened focus in recent macroeconomic research. Nonlinear econometric methods, including threshold regression models (Hansen, 1999; Gonzalez et al., 2017), provide a solid framework for examining the differential growth effects of debt across regimes characterized by varying levels of debt intensity. These models are relevant for countries such as Egypt, where debt dynamics are influenced by domestic policy decisions, susceptibility to external shocks, structural fiscal rigidities, and institutional constraints that may intensify the economic effects of elevated debt levels. Recent studies emphasize the significance of conducting country-specific analyses instead of applying universal thresholds, as debt tolerance varies considerably according to economic structure, debt composition, and governance quality (Chudik et al., 2020). This research aims to examine the nonlinearity impact of public debt on real economic growth in Egypt from 2000 to 2024, and seeks to investigate the subsequent research question: What is the debt-to-GDP threshold at which public debt adversely affects real economic growth in Egypt?

This Research employs a deductive approach to investigate the nonlinear relationship between public debt and economic growth in Egypt. Utilizing threshold regression modeling on semi-annual data (2000-2024), the research identifies critical debt-to-GDP thresholds that delineate distinct economic regimes. The econometric analysis incorporates pivotal macroeconomic control variables—government expenditure, inflation, investment, interest rates, and terms of trade—to isolate debt's specific growth effects across varying debt intensity levels.

The research problem is to identify Egypt's debt-to-GDP thresholds beyond which public borrowing hinders growth. Theory emphasizes debt-growth dynamics, but Egypt lacks empirical, country-specific benchmarks for fiscal policy.

In the face of growing pressure to consolidate public finances while maintaining growth momentum, the findings provide detailed guidance for Egyptian policymakers as they balance debt-financed development and long-term fiscal stability. This research adds to fiscal policy literature in emerging markets that face similar debt sustainability challenges in a global economy with rising interest rates, geopolitical tensions, and inflationary pressures (IMF, 2024; Kose et al., 2022).

II. Literature Review

This review explores the public debt and economic growth relationship as a key area of macroeconomic research, especially in developing and emerging economies like Egypt, highlighting the evolution of ideas from simple to more complex perspectives.

2.1 Theoretical Perspectives on Public Debt and Growth

Understanding theoretical aspects of how public debt affects economic growth encompasses multiple competing and complementary frameworks. Classical and Keynesian views indicate that using public debt wisely can boost economic growth, particularly in economies that lack capital, where borrowed money is used for investments that improve productivity or for government spending during economic downturns. (Barro, 1974; Elmendorf & Mankiw, 1999). This view conceptualizes public borrowing as a mechanism to overcome binding capital constraints and address market failures in providing public goods.

In contrast, the neoclassical framework highlights possible crowding-out effects, where increased government borrowing raises interest rates, thereby displacing private sector investment and diminishing long-term productive capacity (Modigliani, 1961; Diamond, 1965). The extent of these effects is influenced by the movement of capital, the responsiveness of monetary policy, and how sensitive private investment is to changes in interest rates.

By contrast, the neoclassical model emphasizes the potential crowding-out effects: high government borrowing increases interest rates, which displaces private sector investment and undermines long-run productive capacity (Modigliani, 1961; Diamond, 1965). The size of such effects depends on capital mobility, monetary policy accommodation, and the elasticity of private investment regarding interest rates.

Recent theories have improved our understanding with the concept of "debt overhang," which means that having too much debt can lead to worries about future taxes, financial restrictions, or the risk of a country failing to pay back its debts, resulting in poor

investment decisions. For developing countries susceptible to external macroeconomic shocks and international capital market volatility, these dynamics are especially important. Recent additions to these models include debt composition, institutional quality, and central bank independence as mediating variables between public debt and economic performance (Panizza & Presbitero, 2014; Pescatori et al., 2014).

The endogenous growth literature clarifies more ways public debt might affect long-term economic paths. Debt-funded public spending that enhances education, technology, or infrastructure can lead to positive effects that balance out the downsides of paying off debt. If debt requires fiscal consolidation that affects productive expenditures, then long-run growth possibilities could suffer from a lower accumulation of productive components (Checherita-Westphal & Rother, 2012). This perspective emphasizes the need to differentiate between several types of public expenditure when evaluating the growth consequences of debt accumulation.

2.2 Empirical Evidence on Debt-Growth Relationships

The empirical literature on the relationship between debt and growth has advanced significantly, with early studies often finding negative correlations between debt burdens and growth outcomes (Smyth & Hsing, 1995; Pattillo et al., 2002). These analyses faced methodological challenges, such as endogeneity and omitted variable bias. Reinhart and Rogoff (2010) introduced a threshold effect indicating that debt-to-GDP ratios above 90% correlate with reduced growth rates, prompting renewed interest despite subsequent methodological critiques (Herndon et al., 2014).

Subsequent econometric analyses have utilized advanced techniques to tackle endogeneity and heterogeneity, employing panel data methodologies that incorporate fixed effects, instrumental variables, and system GMM estimators. The studies consistently indicate nonlinear effects in the debt-growth relationship, though the specific thresholds at which debt negatively impacts growth vary significantly across different contexts (Cecchetti et al., 2011; Égert, 2015; Gómez-Puig & Sosvilla-Rivero, 2017).

Recent studies highlight the necessity of performing country-specific analyses that consider factors such as institutional quality, debt management capabilities, and the structure of public expenditure (Chudik et al., 2017; Ebeke & Ölçer, 2013). Developing and emerging economies face unique challenges, including high borrowing costs and vulnerability to external shocks, which complicate debt sustainability (Presbitero, 2012; Reinhart et al., 2003). The composition of public debt is particularly important when assessing the share denominated in foreign currencies.

2.3 Debt-Growth Dynamics in Egypt

In Egypt, the empirical evidence is comparatively limited in relation to other emerging economies. The existing literature has predominantly concentrated on debt sustainability analyses rather than the explicit estimation of growth thresholds (Helmy, 2018; El-Mahdy & Torayeh, 2009). Numerous studies have established correlations between Egypt's public debt and various macroeconomic indicators, such as private investment, inflation, and external balances (Massoud, 2015; Shetta & Kamaly, 2014).

Nonetheless, a significant gap persists in research regarding the precise measurement of debt levels impacting Egypt, particularly through contemporary methodologies that account for temporal economic fluctuations. The multitude of economic reform programs, currency devaluations, and external shocks in Egypt engenders a complex landscape for comprehending debt-growth dynamics, necessitating advanced methodological approaches.

This research addresses this gap by employing a threshold regression method on biannual data collected from 2000 to 2024, facilitating the identification of intricate patterns in the relationship between public debt and economic growth in Egypt. This research seeks to determine if a critical threshold exists beyond which public debt adversely affects growth, thereby offering policymakers empirical recommendations for sustainable debt management.

3. Descriptive statistics and data

In order to investigate threshold effects in Egypt's debt-growth relationship, this research utilizes semi-annual data from 2000 to 2024. The sources and descriptions of the key macroeconomic variables that are incorporated in the analysis are provided in Table 1 below. These variables were meticulously chosen for their theoretical relevance to growth dynamics and their function in the threshold regression model, which captures nonlinear relationships across various debt regimes. The following table contains comprehensive documentation of the data sources, variable definitions, and their anticipated roles within the threshold framework.

Table 1: Variable Description and Sources for Threshold Regression Model

Variable	Description	Role	Data Source
RGD	Real GDP Growth Rate – Annual % change in real GDP	Dependent	World Bank
DEB	Public Debt Ratio – Public debt as % of GDP	Threshold & regressor	IMF via FRED
GEX	Government Expenditure – Total government spending as % of GDP	Control	IMF
INV	Investment Rate – Gross capital formation as % of GDP	Control	World Bank
INF	Inflation Rate – Annual CPI inflation rate (%)	Control	World Bank
INT	Interest Rate – Central bank policy rate (%)	Control	World Bank
TOT	Terms of Trade – Ratio of export to import prices	External shock proxy	World Bank

Source: Author's note

3-1. Variable Description and Data Sources

The table indicates a macroeconomic analysis framework, emphasizing the Real GDP Growth Rate (RGD) as the dependent variable and the Public Debt Ratio (DEB) as a critical threshold variable. The framework comprises control variables such as Government Expenditure (GEX), Investment Rate (INV), Inflation (INF), and Interest Rate (INT), in addition to the Terms of Trade (TOT) variable to measure external economic shocks. Data is obtained from esteemed international financial institutions, primarily with the WB supplying most variables and the IMF delivering public debt and Government Expenditure data through the Federal Reserve Economic Data (FRED) system. This thorough analysis examines domestic policy elements and external economic circumstances.

3-2. Descriptive Analysis

Table 2: Macroeconomic Variables Descriptive stats (2000S1-2024S2)

Sample: 2000S1- 2024S2							
	RGD	**DEB**	**INV**	**INF**	**INT**	**GEX**	**TOT**
Mean	0.04341	0.83699	0.162753	0.115209	0.085573	0.293964	0.994985
Median	0.041918	0.839563	0.161078	0.100348	0.076878	0.303704	1.018297
Maximum	0.07502	0.995453	0.226251	0.360493	0.160092	0.346367	1.326581
Minimum	0.013534	0.659692	0.111698	0.021259	0.058513	0.224414	0.701814
Std. Dev.	0.015991	0.099423	0.027641	0.084114	0.024544	0.032556	0.169114
Skewness	0.29195	-0.12988	0.216671	1.404291	1.357267	-0.53238	0.103081
Kurtosis	2.165435	1.824623	2.30781	4.26098	4.207416	2.364814	2.712005
Jarque-Bera	2.161333	3.018731	1.3894	19.74626	18.38864	3.202425	0.261342
Probability	0.339369	0.22105	0.499224	5.15E-05	0.000102	0.201652	0.877506
Sum	2.170482	41.84949	8.137641	5.760432	4.278633	14.6982	49.74924
Sum Sq. Dev.	0.012529	0.484362	0.037438	0.346684	0.029518	0.051934	1.40138
Observations	**50**	**50**	**50**	**50**	**50**	**50**	**50**

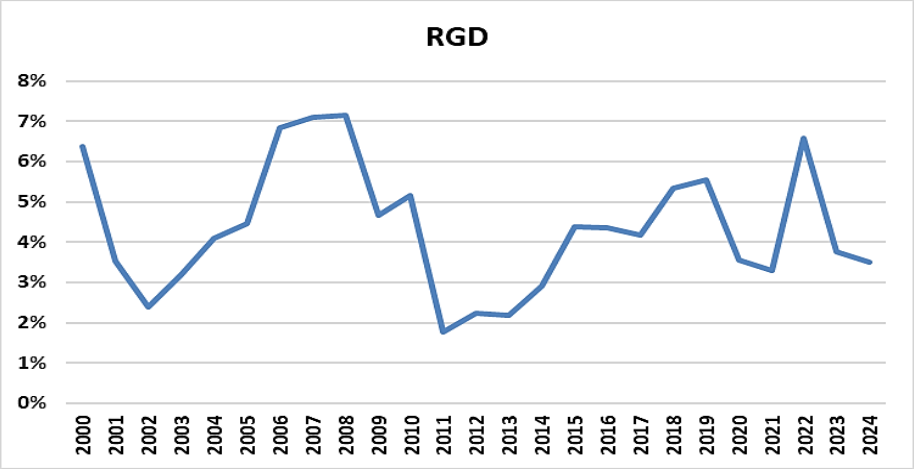
Source: by Author using Eviews statistics

This table shows our debt-growth analysis framework's key macroeconomic variables in detail. Across 50 observations, the data shows moderate real GDP growth (RGD) of 4.34%, low volatility (σ=1.6%), and average public debt (DEB) of 83.7% of GDP. With high Jarque-Bera statistics and positive skewness, inflation (INF) and interest rates (INT) have non-normal distributions, suggesting frequent outliers. Terms of trade (TOT) have the highest variability, while government expenditure (GEX) has negative skewness, indicating fiscal restraint. Investment rates (INV) follow a normal distribution around 16.3% of GDP, as shown by their low Jarque-Bera statistic and probability value above conventional significance levels.

3-2. Trends in Key Macroeconomic Variables (2000-2024)

The research analyzes trends in key macroeconomic variables from 2000 to 2024, including real GDP growth, public debt, government expenditure, investment, inflation, interest rates, and terms of trade. Understanding these trends is crucial for analyzing the empirical outcomes of the threshold regression model, particularly in Egypt's changing macroeconomic environment, and provides insights into potential nonlinear patterns.

Figure 1: Real GDP Growth Rate Trends (2000–2024)



Source: World Bank. (2025). World Development Indicators: Egypt, Arab Rep. Retrieved from https://data.worldbank.org/country/egypt-arab-rep?view=chart

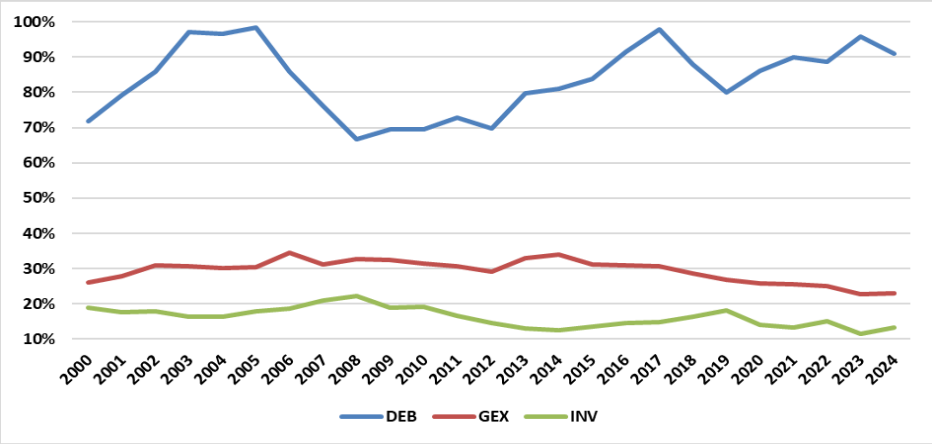
3-2-1. Real GDP Growth (RGD)

As per Figure 1, Egypt's Real GDP Growth Rate (RGD) fluctuates over 25 years due to global and domestic shocks. Real growth dropped from 6.4% in 2000 to 2.4% in 2002 due to the global economic slowdown after the uncertainty of September 11 (Wilson & Chang, 2021). A robust recovery phase followed, with annual growth rates rising to 7.2% in 2008, indicating domestic reforms and favorable global conditions. The 2008 global financial crisis slowed growth to 4.7% in 2009, but it recovered to 5.1% in 2010.

The 2011 Egyptian revolution slowed economic growth to 1.8% due to political instability, capital flight, and a drop in tourism. After the revolution, growth was 2.2%–2.9% from 2012 to 2014, indicating a fragile recovery (Rahman & Peters, 2022). A moderate rebound, supported by structural reforms, public investments, and the 2016 IMF stabilization program, raised growth to 5.6% by 2019.

The 2020 COVID-19 pandemic slowed growth by 3.6%. After that, base effects and post-pandemic recovery drove a sharp, temporary rebound to 6.6% in 2022. Growth slowed to 3.8% in 2023 and 3.5% in 2024, suggesting structural growth constraints like rising debt and declining government spending in fiscal data (Fernandez & Al-Mahdi, 2024).

Figure 2: Trends in Public Debt (DEB), Government Expenditure (GEX), and Investment (INV) in Egypt (2000–2024)



Source: By author, using data from IMF, World Bank, and CountryEconomy

3-2-2. Public Debt-to-GDP Ratio (DEB)

Egypt's public debt-to-GDP ratio has seen quite a bit of cyclical movement over the last twenty years. The figure increased significantly from 71.7% in 2000 to a maximum of 98.3% in 2005, linked to expansionary fiscal policies and heightened government borrowing amid a period of increased public expenditure (Ahmed & Kumar, 2022). Following the 2008 global financial crisis, debt levels decreased markedly to 66.8%, likely indicative of emergency fiscal consolidation and debt rationalization strategies (Barkley, 2019). Following the 2011 revolution, the previously observed downward trend reversed due to socio-political instability and declining revenues, resulting in an increase to 83.8% by 2015. The implementation of the IMF-supported structural reform program in 2016 intensified public debt challenges, resulting in a ratio increase to 97.8% in 2017, driven by currency devaluation, elevated interest expenses, and accelerated fiscal adjustments. Partial stabilization was observed between 2018 and 2019; however, the COVID-19 crisis resulted in increased fiscal pressure, raising the debt ratio to 95.9% in 2023, followed by a slight decrease to 90.9% in 2024 (Hassan & Rivera, 2023).

3-2-3. Investment Rate (INV)

Gross capital formation remained relatively stable during 2000–2006, fluctuating within the 16–19% range of GDP, consistent with the macro-financial stability of the pre-crisis period. Following the 2008 financial crisis, Egypt adopted a counter-cyclical investment stance, with the investment rate peaking at 22.3% in 2009 (Johnson et al., 2020). The 2011 revolution, however, triggered substantial capital flight and a collapse in private sector confidence, culminating in a sharp drop in investment to 12.4% by 2014. The post-2016

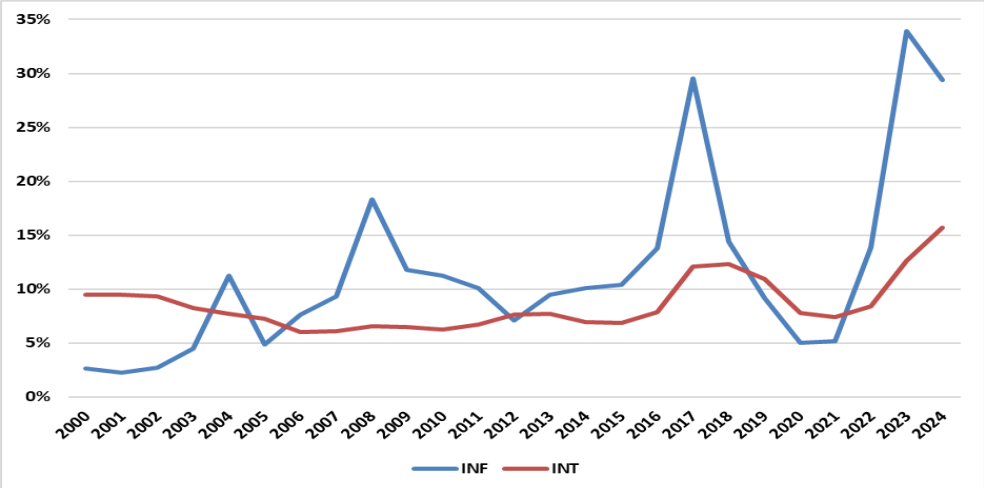
IMF reform program attempted to restore investor confidence and macroeconomic discipline, leading to a gradual recovery in investment rates—reaching 18.2% by 2019. Nonetheless, the pandemic shock caused a pronounced contraction, with the investment rate falling to 11.5% in 2023, reflecting both domestic uncertainty and global supply chain disruptions (Gonzalez & Chen, 2024).

3-2-4. Government Expenditure (GEX)

Government expenditure as a share of GDP rose steadily from 26.0% in 2000 to 34.5% by 2006, maintaining elevated levels during the 2007–2017 interval. The continual increase is chiefly attributable to counter-cyclical fiscal policies enacted during the 2008 global financial crisis and the 2011 revolution, the latter culminating in a GEX peak of 33.9% in 2014 (Martinez & Wong, 2021).

Commencing in 2016, the IMF reform initiative initiated a prolonged fiscal consolidation process. Government expenditure decreased steadily from 28.6% in 2018 to roughly 22.7% by 2024. This contraction persisted even during the COVID-19 pandemic, when numerous economies implemented expansionary fiscal policies. Egypt's limited response is indicative of strict IMF program conditions and restricted fiscal capacity due to high debt levels (Ellison & Rahman, 2023).

Figure 3: Inflation Rate (INF) and Interest Rate (INT) in Egypt (2000–2024)



Source: World Bank. (2025). World Development Indicators: Egypt, Arab Rep. Retrieved from https://data.worldbank.org/country/egypt-arab-rep?view=chart

The period from 2000 to 2024 reflects Egypt's evolving monetary policy landscape in response to domestic and global macroeconomic shocks. The trends in inflation and policy rates demonstrate periods of divergence, reflecting the complex trade-offs between inflation stabilization, exchange rate adjustments, and growth imperatives.

3-2-5. Inflation Rate (INF)

The inflation rate in Egypt has demonstrated significant fluctuations over the past twenty years. In the early 2000s, inflation was relatively low, averaging under 5%. Beginning in 2004, price levels escalated, reaching a peak of 18.3% in 2008, fueled by imported food inflation and global commodity price shocks (World Bank, 2010). Between 2009 and 2015, a post-crisis disinflation transpired; however, the situation changed significantly after the implementation of the IMF-supported economic reform program in 2016, notably with the liberalization of the exchange rate in November 2016. These changes resulted in a significant devaluation of the Egyptian pound and a subsequent inflation surge to 29.5% in 2017 (IMF, 2018).

The disinflation process recommenced in 2019, facilitated by a more stringent monetary policy and enhanced supply-side conditions. Global supply chain disruptions and energy price surges during and after the COVID-19 pandemic, along with domestic currency depreciation in 2022–2023, instigated a further inflationary spike, reaching a peak of 33.9% in 2023. Although moderated in 2024 (29.4%), inflation persists at elevated levels, signifying ongoing structural and cost-push pressures (Hassan & Rivera, 2023).

3-2-6. Policy Interest Rate (INT)

Monetary policy, especially how it's put into practice through the central bank's policy rate, has experienced notable phases. Between 2000 and 2008, the rate progressively decreased from 9.5% to 6.6%, indicating initiatives to promote growth in a context of low inflation. In response to rising inflation in 2008, the Central Bank of Egypt (CBE) sustained relatively stable rates of approximately 6–7% until 2015, reflecting a prudent approach amid fiscal pressures.

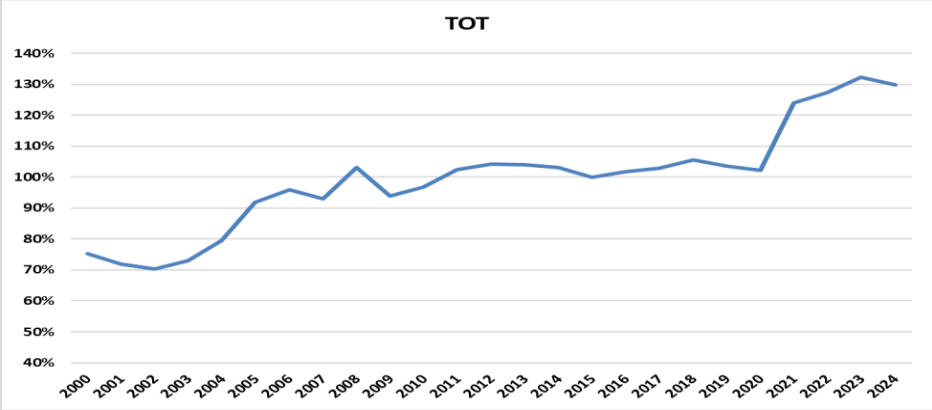
A substantial tightening cycle commenced in 2016–2017, culminating in policy rates rising to 12.1% in 2017, in alignment with the IMF's inflation-targeting reform program. The aim was to stabilize inflation expectations and the exchange rate, notwithstanding the trade-offs in growth. Despite a modest decline in policy rates in subsequent years, recent inflationary pressures necessitated

3-2-7. Inflation-Interest Rate Dynamics and Policy Credibility

Throughout the sample period, the real interest rate often remained negative, especially during inflationary episodes (e.g., 2017, 2023), raising concerns about policy transmission effectiveness and inflation expectations anchoring. This reflects a classic challenge in developing economies, where monetary policy operates under fiscal dominance and weak credibility constraints (Reinhart et al., 2015). Notably, periods of high inflation did not

always trigger symmetric interest rate responses, underscoring the limits of the CBE's autonomy under external and fiscal pressures.

Figure 4: Evolution of Terms of Trade (2000-2024)



Source: World Bank. (2025). World Development Indicators: Egypt, Arab Rep. Retrieved from https://data.worldbank.org/country/egypt-arab-rep?view=chart

Analysis of Terms of Trade Trends

The export-to-import price ratio, or Terms of Trade (TOT), fluctuates significantly across economic periods. Egypt's TOT (70.3%-79.5%) was weak from 2000-2004 due to trade conditions. With global economic growth, the 2005–2008 improvement reached 103.1% during the 2008 financial crisis (Helmy, 2015).

Despite political upheaval, TOT remained around 100-104% from 2011 to 2015. TOT initially remained stable after the 2016 IMF reform program, which included currency devaluation and subsidy reforms, but after COVID-19, it surged from 102.1% in 2020 to 124% in 2021 (Central Bank of Egypt, 2022). This unprecedented improvement peaked at 132.2% in 2023 before declining to 129.7% in 2024, suggesting a possible stabilization of this favorable trading position.

4. Methodology

The research used Hansen's (2000) Threshold Autoregressive (TAR) model to analyze semi-annual data from 2000 to 2024. Hansen's (2000) methodology assumes data stationarity, but the Augmented Dickey-Fuller (ADF) test with breakpoints was used to determine time series characteristics. This method improved data structural change identification before threshold determination. The model specification used the Bai-Perron test on the debt variable to estimate dynamics in low- and high-debt regimes and identify critical debt thresholds. This systematic threshold detection method identified regime changes reliably, supported by comprehensive diagnostic tests to validate the model's statistical properties and reliability.

4-1. Econometric Framework

The research uses Hansen's Threshold Regression Model to examine the nonlinear impact of public debt on Egypt's economic growth. It quantifies the critical threshold of public debt, identifying growth traps. The model evaluates the effects of low and high debt regimes on economic growth, providing policymakers with evidence-based guidance for sustainable debt management strategies and empirical support for long-term debt management plans.

4.2 Stationarity Testing

Hansen's (2000) threshold regression method assumes data stationarity; however, we employ (ADF) test with breakpoints to ascertain time series characteristics. Although Hansen's stationarity assumption is accurate, conventional unit root tests frequently fail to detect stationarity when structural breaks are present (Perron, 1989; 2003). Policy modifications, economic reforms, and external disturbances may induce structural transformations in Egypt's economic time series, potentially manifesting as non-stationarity in standard tests. Utilizing the ADF test with breakpoints enables a more efficient identification of structural changes in the data prior to threshold identification, thus corroborating our threshold regression outcomes. Although the primary methodology assumes certain data properties, time series econometrics advises validating these assumptions prior to model estimation.

Table 3: Unit Root Test Results with Endogenous Breakpoints (2000S1–2024S2)

Variable	Break Date	Break Specification	ADF t-Statistic	p-Value	Reject H_0 (Unit Root)?	Stationarity Status
RGDF	2010S1	Intercept only	-4.852440	0.0151	Yes (at 5%)	I(0)
DEB	2019S1	Intercept only	-4.561613	0.0367	Yes (at 5%)	I(0)
INV	2012S1	Intercept only	-5.852327	< 0.01	Yes (at 1%)	I(0)
INF	2007S1	Intercept only	-5.691982	< 0.01	Yes (at 1%)	I(0)
INT	2016S1	Intercept only	-4.563497	0.0365	Yes (at 5%)	I(0)
GEX	2006S1	Intercept only	-5.262925	< 0.01	Yes (at 1%)	I(1)
TOT	2020S1	Intercept only	-6.540719	< 0.01	Yes (at 1%)	I(0)

Source: by Author using Eviews statistics

The findings (ADF) tests incorporating structural breaks—specifically within the innovational outlier framework—demonstrate that most of the macroeconomic variables examined, namely RGDF, DEB, INV, INF, INT, and TOT, are stationary at level I(0). This indicates that these variables do not necessitate differencing to attain stationarity, even after considering structural changes at specified break dates. The dismissal of the unit root

hypothesis at standard significance levels (1% or 5%) offers compelling evidence of level stationarity. Employing structural break unit root tests is essential in macroeconomic time series analysis, as conventional tests may inadequately reject the null hypothesis of a unit root when breakpoints are present (Zivot & Andrews, 1992; Vogelsang, 1993).

An exception is D(GEX), the first-differenced representation of government expenditure, which is determined to be stationary. This suggests that the original GEX variable is non-stationary in I(0) but becomes stationary after first differencing, classifying it as integrated of order one, I(1). The disruption in 2006S1 may have been caused by a significant fiscal transition or macroeconomic upheaval that affected spending patterns. The findings emphasize the importance of accounting for structural breaks in stationarity testing to avoid incorrect conclusions.

4-3. Model Specification

The threshold regression model identifies a threshold for public debt ratios, determining if it significantly impacts the relationship between debt and GDP growth, highlighting potential growth risks from excessive public debt accumulation.

Utilizing Hansen's (2000) threshold regression methodology, we formulate a model that accommodates regime-dependent coefficients dictated by a threshold variable. The model is articulated as follows:

$$RGD_{it} = \alpha_1 + \beta_1 DEB_{it} + \delta_1 X_{it} + \varepsilon it, \text{ if } DEB_{it} \leq \gamma \quad \text{---------- 1}$$

$$RGD_{it} = \alpha_2 + \beta_2 DEB_{it} + \delta_2 X_{it} + \varepsilon_{it}, \text{ provided } DEB_{it} > \gamma \quad \text{---------- 2}$$

This specification can be expressed as a singular equation utilizing indicator functions:

$$RGD_{it} = \alpha_1 + \beta_1 DEB_{it} + \delta_1 X_{it} + (\alpha_2 - \alpha_1) I(DEB_{it} > \gamma) + (\beta_2 - \beta_1) DEB_{it} * I(DEB_{it} > \gamma) + (\delta_2 - \delta_1) X_{it} * I(DEB_{it} > \gamma) + \varepsilon_{it} \quad \text{---------- 3}$$

Where:

- RGDit signifies the real GDP growth rate for Egypt during period t
- DEBit indicates the public debt-to-GDP ratio
- Xit represents a vector of control variables, comprising government expenditure (GEX), inflation rate (INF), investment rate (INV), interest rate (INT), and terms of trade (TOT)
- γ is the unspecified threshold parameter

- I(----) is an indicator function that assumes the value of 1 when the condition within the parentheses is met and 0 otherwise
- ε_{it} represents the error term

This research adopts a threshold regression model to examine Egypt's nonlinear public debt-economic growth relationship. We identify the crucial debt-to-GDP ratio using the Bai-Perron test and find that exceeding this threshold significantly alters the debt-growth relationship, emphasizing Egypt's macroeconomic framework's debt management policies.

4-4. Threshold Identification

Bai-Perron sequential F-statistic tests assess the existence of structural breaks in the relationship between public debt and economic growth. The results are summarized in Table 4.

Table 4: Bai-Perron Sequential Threshold Test Results

Threshold Comparison	F-Statistic	Scaled F-statistic	Critical Value (5%)	Decision
0 vs. 1 Threshold	20.23075	101.1537	18.23	**Reject H₀**
1 vs. 2 Threshold	6.502862	32.51431	19.91	**Reject H₀**
2 vs. 3 Threshold	1.548285	7.741423	20.99	**Fail to Reject H₀**

Source: by Author using Eviews statistics

Sequential Bai-Perron threshold testing for multiple structural breaks in Egypt's debt-growth relationship is shown in table 4. The test results show that two thresholds are optimal, implying three debt regimes in the dataset.

The first row (0 vs. 1 Threshold) checks for a threshold. We reject the null hypothesis of no threshold with an F-statistic of 20.23075 and a scaled F-statistic of 101.1537, both above 18.23 at 5% significance. Bai & Perron (1998) found strong statistical evidence for at least one major regime change.

The second row (1 vs. 2 Thresholds) tests for a second threshold. We reject the null hypothesis again with an F-statistic of 6.502862 and a scaled F-statistic of 32.51431, both exceeding 19.91, confirming a second threshold point.

Third row (2 vs. 3 Thresholds) tests third threshold. We cannot reject the null hypothesis because our F-statistics of 1.548285 and 7.741423 are below 20.99, indicating no evidence for a third threshold.

Two estimated thresholds divide the sample into three regimes:

1. **Low debt regime: DEB < 0.7817 (78.17% of GDP).**
2. **Intermediate-debt regime: DEB < 0.8942 (78.17% to 89.42% of GDP).**
3. **High-debt regime: DEB ≥ 0.8942 (89.42% of GDP or higher).**

These regime definitions suggest that public debt's marginal effect on economic growth varies by debt level. This structure supports threshold effects, where debt benefits and costs change significantly as public debt levels rise from moderate to high (Cecchetti, Mohanty, & Zampolli, 2011). This finding strongly suggests a nonlinear specification of the debt-growth relationship in Egypt.

5. Threshold Regression Analysis: Regime-Specific Interpretations

The identification of two statistically significant debt thresholds (78.17% and 89.42% of GDP) through Bai-Perron testing creates three distinct economic regimes in Egypt: Low Debt (DEB 78.17%), Moderate Debt (DEB 89.42%), and High Debt (DEB 89.42%). This strongly suggests that public debt and economic growth are nonlinear, rejecting linear modeling. Debt's impact on investment (INV), inflation (INF), interest rates (INT), and other growth determinants varies by regime. In fiscal policy analysis, these regimes justify threshold regression to avoid misspecification and bias. These findings support literary expectations (Reinhart & Rogoff, 2010; Égert, 2015) about debt sustainability thresholds and suggest that fiscal policy should be tailored to the economy's position within these debt regimes. Estimate regime-specific coefficients to analyze threshold regression model outputs to better understand economic dynamics at each debt level.

Table 5: Estimated Coefficients for Regime 1

Variable	Coefficient	t-Statistic	Prob.
DEB	-0.2333	-3.5351	0.0012 *
INV	+0.9941	11.8264	0.0000 *
INF	-0.2279	-2.7851	0.0084 *
INT	-0.1253	-0.5818	0.5647

*** indicates statistical significance at the 5% level (p < 0.05).**

Source: by Author using Eviews statistics

5-1. Regime 1: Low Debt (DEB < 78.17% of GDP)

Public debt negatively affects real GDP growth (RGD) by –0.2333 in Egypt's low-debt regime, where the DEB is below 78.17%. Even at low levels, debt accumulation may crowd out productive private investment (Easterly, 2001). Still, investment (INV) drives growth with a highly significant positive coefficient of 0.9941. Capital formation drives

economic growth, according to endogenous growth theory (Romer, 1990). Inflation shocks the economy, discouraging long-term investment, especially in early development (Friedman, 1977). The interest rate (INT) coefficient is statistically insignificant, indicating that in a low-debt environment, monetary policy has little impact because underdeveloped financial markets cannot effectively transmit policy changes to the real economy. Policymakers must prioritize efficient debt allocation to productive investments while maintaining macroeconomic stability, especially by controlling inflation.

Table 6-: Estimated Coefficients for Regime 2

Variable	Coefficient	t-Statistic	Prob.
DEB	+0.0999	2.8076	0.0083 *
INV	+0.6565	13.9893	0.0000 *
INF	+0.0180	0.4841	0.6321
INT	-0.4132	-5.1284	0.0000 *

*** indicates statistical significance at the 5% level ($p < 0.05$).**

Source: by Author using Eviews statistics

5-2. Regime 2: Moderate Debt (78.17% ≤ DEB < 89.42% of GDP)

In the moderate-debt regime (78.17% ≤ DEB < 89.42%), the results demonstrate a structural transformation wherein public debt positively influences economic growth. The coefficient of 0.0999 for DEB indicates that public debt may finance projects that promote growth, consistent with Aschauer's (1989) claim that public investment can invigorate economic growth. The investment coefficient (INV) decreases to 0.6565, signifying diminishing returns to investment as debt increases. The inverse correlation of –0.4132 between interest rates (INT) and economic growth signifies the economy's heightened sensitivity to monetary policy, consistent with the financial accelerator theory posited by Bernanke and Gertler (1995). The negative coefficient indicates that an increase in debt is associated with increased economic susceptibility to the detrimental effects of rising interest rates, potentially constraining credit access for productive investment. Under this regime, Egypt holds an advantageous position where debt facilitates growth-promoting initiatives without inducing fiscal strain, dependent on the regulation of inflation (INF) and interest rates (INT). Policymakers must meticulously regulate the equilibrium between fiscal expansion and debt sustainability to avert the transition into elevated debt regimes.

Table 7: Estimated Coefficients for Regime 3

Variable	Coefficient	t-Statistic	Prob.
DEB	-0.1795	-3.7347	0.0007 *
INV	+0.8360	12.8998	0.0000 *
INF	-0.2065	-2.7996	0.0090 *
INT	-0.4672	-5.4632	0.0000 *

*** indicates statistical significance at the 5% level (p < 0.05).**

Source: by Author using Eviews statistics

5-3. Regime 3: High Debt (DEB ≥ 89.42% of GDP)

Public debt once more hampers economic growth, exhibiting a coefficient of –0.1795 in the high-debt regime, where debt exceeds 89.42%. Reinhart and Rogoff's (2010) debt-threshold hypothesis posits that debt exceeding a certain threshold impedes economic performance. Investment (INV) is both positive and significant (0.8360); however, it functions inefficiently, suggesting that elevated debt levels constrain productive investment. Excessive debt poses difficulties, as inflation (INF) and interest rates (INT) exhibit inverse correlations with growth (–0.2065) and (–0.4672). Fisher (1933) posits that elevated inflation, and interest rates precipitate a debt-deflation spiral, exacerbating debt levels and hindering GDP growth. When the Debt-to-GDP ratio surpasses 89.42%, Egypt's economy becomes susceptible, underscoring the necessity for fiscal consolidation and debt reduction strategies that emphasize growth-oriented reforms.

Table 8: Estimated Coefficients for Non-Threshold Variables

Variable	Coefficient	t-Statistic	Prob.
GEX	–0.1468	–2.9609	0.0056 *
TOT	+0.0127	1.0399	0.3060

*** Indicates statistical significance at the 5% level (p < 0.05).**

Source: by Author using Eviews statistics

5-4. Non-Threshold Variables

Government expenditure (GEX) consistently has a negative impact on growth, with a–0.1468 coefficient, confirming Barro's (1990) critique of public spending inefficiencies. Egypt's short-term growth is less sensitive to external shocks, as the terms of trade (TOT) coefficient is positive (0.0127) but statistically insignificant. Import substitution policies or effective exchange rate management may protect the domestic economy from external fluctuations.

The model's strong fit (R^2 = 0.9458) highlights the importance of considering regime-specific effects when analyzing Egypt's public debt (DEB) and growth (RGD) correlation. A uniform policy approach would misrepresent debt accumulation's nonlinear dynamics and economic growth.

5-5. Theoretical and Empirical Support for Regime-Specific Findings

The debt-threshold effects in Egypt match Reinhart & Rogoff's (2010) seminal work on debt overhang, where high debt levels hinder growth after a critical threshold. Solow (1956) and Romer (1990) concluded that investment drives long-term growth, which is reflected in the regime-dependent coefficients for investment (INV). The interest rate effects support Bernanke and Gertler's (1995) financial accelerator theory, and the inflation-growth nonlinearity matches the Tobin-Fisher debates (Tobin, 1965; Fisher, 1993). Egypt's results support recent MENA findings by Checherita-Westphal & Rother (2012) that found a nonlinear relationship between public debt and economic growth.

Since public debt in Egypt has nonlinear effects on growth across debt thresholds, economic policy should be tailored to specific debt regimes. Debt should be kept within a moderate range (78.17% ≤ DEB < 89.42%) to promote growth without stagnation or growth traps.

6. Diagnostic Tests

Diagnostic tests assessed the validity and robustness of the threshold regression model, evaluating goodness-of-fit, predictive accuracy, and adherence to econometric assumptions, providing crucial insights into the model's statistical properties.

Table 9: Summary of Key Diagnostic Metrics

Metric	Value	Interpretation
R-squared	0.9458	The model explains 94.6% of the variance in real GDP growth, indicating excellent fit.
Adjusted R-squared	0.9196	Adjusted for degrees of freedom, the model retains 91.96% explanatory power.
F-statistic (p-value)	36.01 (0.000)	Highly significant ($p < 0.01$), confirming the joint significance of all regressors.
Durbin-Watson	1.863	Suggests no severe autocorrelation (values near 2 imply residual independence).

Source: by Author using Eviews statistics

The model's R-squared and adjusted R-squared show that the selected regressors account for over 94% of real GDP growth variation. The F-statistics validate the model's significance, and the Durbin-Watson statistic enhances model inference reliability, confirming the threshold regression framework for nonlinear debt-growth dynamics.

Table 10: Breusch-Godfrey LM Serial Correlation

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 1 lag

F-statistic	0.155526	Prob. F(1,32)	0.6959
Obs*R-squared	0.241834	Prob. Chi-Square(1)	0.6229

Source: Eviews Output

The Breusch-Godfrey test evaluates the temporal correlation of residuals in the threshold regression model (Hansen, 2000). Table 10 indicates that the test results (F-statistic: 0.156, p-value: 0.696) reveal no significant serial correlation at a lag of one. The high p-value (0.696) suggests that we cannot reject the null hypothesis of no serial correlation, indicating that the model's errors are independent across observations (Breusch, 1978).

Table 11: Breusch-Pagan-Godfrey Heteroskedasticity Test

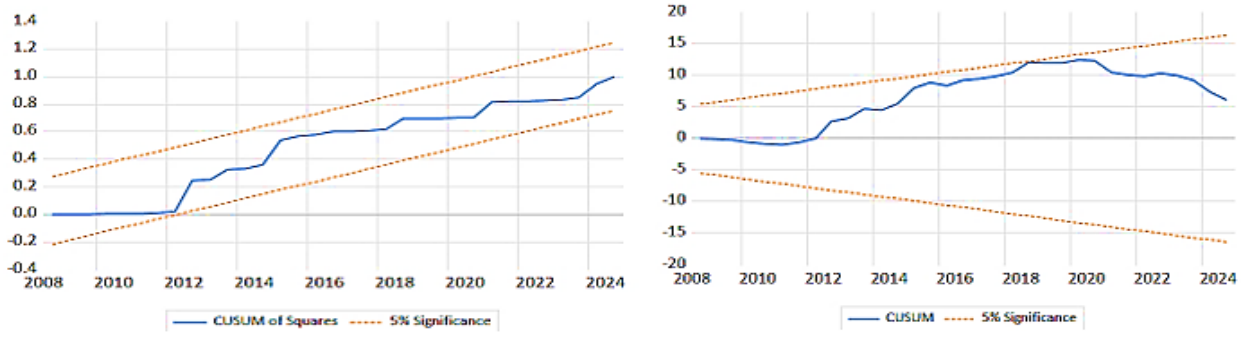
Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	1.663462	Prob. F(16,33)	0.1060
Obs*R-squared	22.32258	Prob. Chi-Square(16)	0.1331
Scaled explained SS	15.61015	Prob. Chi-Square(16)	0.4805

Source: Eviews Output

This test evaluates whether error variances are constant across observations in the threshold regression model (Hansen, 2000). With an F-statistic of 1.663 and p-value = 0.106 (Table 2), we fail to reject the null hypothesis of homoskedasticity at the 5% significance level. This suggests the threshold model has relatively constant error variance, which is favorable for regression reliability (Breusch & Pagan, 1979).

Figure 5: Structural Stability Analysis: CUSUM and CUSUM of Squares Tests

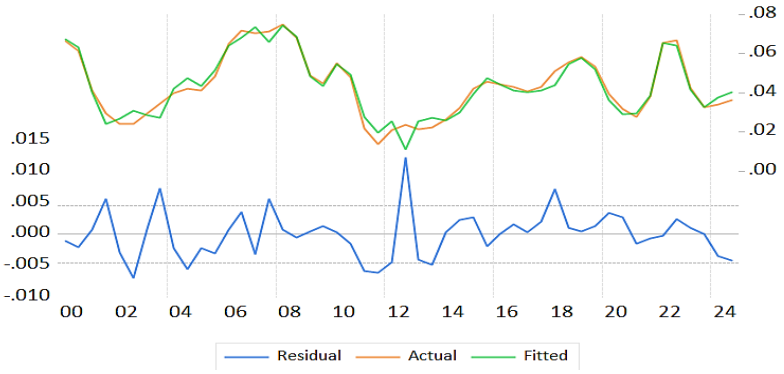


Source: Eviews Output

The threshold regression model (Hansen, 2000) is stable, with the cumulative sum of recursive residuals remaining within the 5% significance boundaries for most of the

sample period (2008-2024). indicating parameter stability with no structural breaks that would indicate coefficient instability (Brown, Durbin, & Evans, 1975). The CUSUM of Squares test shows that the cumulative sum of squared residuals stays within the 5% significance boundaries throughout the period, confirming model parameter variance stability. This dual stability evidence is crucial for threshold models that must distinguish systematic parameter changes across regimes from unexpected structural instability (Hansen, 2000; Brown et al., 1975). These tests strongly support the threshold regression model's reliability and structural consistency over the analyzed time period.

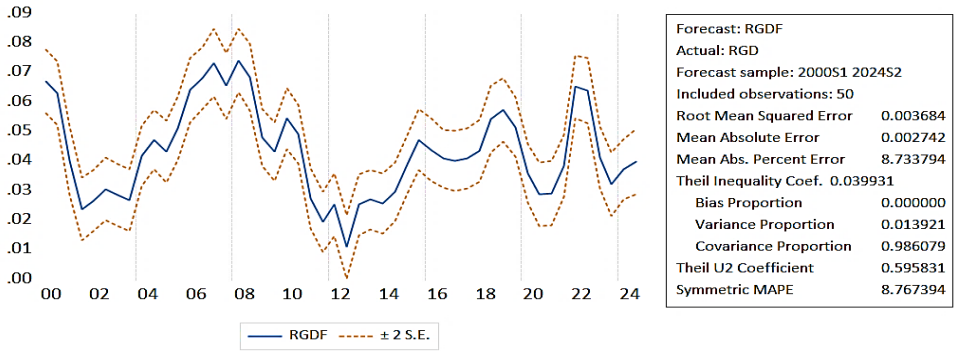
Figure 6: Residual, Actual, and Fitted Values



Source: Eviews Output

The graph shows actual values (green line), fitted values (orange line), and residuals (blue line), indicating good model fit for threshold regression. Close tracking between actual and fitted values and oscillating residuals suggest adequate model specification and appropriate threshold value selection.

Figure 7: Forecast Evaluation



Source: Eviews Output

Forecast performance metrics show Theil Inequality Coefficient of 0.0399 (close to zero) indicates accurate forecasts. The covariance proportion of 0.986 suggests that most forecast errors are unsystematic, which is optimal for forecasting with threshold regression models (Hansen, 2000; Theil, 1966).

7. Policy Implications

The empirical findings from this threshold regression analysis yield several crucial policy implications for Egypt's fiscal management framework. The identification of specific debt thresholds at 78.17% and 89.42% of GDP provides policymakers with clear signposts for calibrating fiscal strategies to optimize growth outcomes while maintaining debt sustainability.

7-1. Thresholds as Policy Signals for Debt Sustainability

These thresholds become important policy signals due to different debt regimes and growth implications. Egypt's fiscal sustainability is quantified by the transition from positive to negative debt-growth effects at 89.42% of GDP. López-Ghio et al. (2023) agree that country-specific thresholds provide better policy guidance than universal benchmarks. Egypt benefits from moderate debt (78.17% to 89.42%), which boosts growth and maintains fiscal flexibility.

89.42% is a critical warning threshold for policymakers. Egypt enters a debt-induced growth trap when public debt exceeds this level, with debt having a direct negative effect (-0.1795) and investment having a reduced coefficient (0.8360). This supports Krugman (1988) and Reinhart et al. (2021)'s debt overhang hypothesis, which states that excessive debt creates expectations of distortionary taxation or monetary expansion, undermining investment decisions and growth potential.

7-2. Need for Fiscal Consolidation and Structural Reforms

Egypt's 2024 public debt-to-GDP ratio of 90.9% exceeds the upper threshold of 89.42%, requiring immediate fiscal consolidation. The fiscal adjustment approach must consider growth implications. Eberhardt and Presbitero (2022) showed that poorly designed fiscal consolidation can hurt emerging economy growth.

Regime-specific coefficients guide reform sequencing. Since the investment coefficient is positive across regimes, investment efficiency should be prioritized. Egypt lags behind regional peers in business environment, property rights, and market competition, so structural reforms are needed (World Bank, 2023). Second, containing inflation is crucial because it hurts growth across all debt regimes. For Egypt's persistent inflation, coordinated monetary-fiscal policy is needed to address supply-side constraints and exchange rate management issues.

Government spending is inefficient, as shown by the negative coefficient (-0.1468). This suggests that fiscal outlays should be rationalized to improve quality rather than quantity.

To maximize growth from fiscal adjustments, selective fiscal consolidation should keep growth-enhancing expenditures and eliminate inefficient subsidies

7-3. Caution on Debt-Financed Growth in Egypt

The regime-specific findings indicate that Egypt ought to exercise caution regarding growth financed by debt. Additional debt accumulation under present circumstances may impede growth, as debt fosters growth in a moderate regime but detrimentally affects it in a high-debt regime. The "debt paradox," as articulated by Fatás and Mihov (2023), posits that increased borrowing in high-debt contexts frequently detrimentally impacts economic performance.

The findings also indicate Egypt's susceptibility to fluctuations in interest rates associated with a high-debt regime. The substantial negative coefficient of -0.4672 for interest rates in the high-debt regime indicates that inflation-induced monetary policy tightening may exacerbate growth challenges when debt reaches the upper limit. Controlling inflation, crucial for growth, may necessitate interest rate modifications that could further hinder growth in the context of elevated debt levels.

Recent evidence from similar emerging economies indicates that debt-induced growth traps necessitate comprehensive policy strategies that extend beyond fiscal measures. Hassan and El-Said (2023) discovered that fiscal consolidation and structural reforms enhancing productivity and debt management have assisted MENA economies in decreasing debt levels. Chen (2024) contends that financial deepening and export diversification are synergistic strategies to enhance growth resilience amid fiscal adjustment in Egypt.

To mitigate refinancing and currency risks, effective debt management should emphasize longer maturities and domestic currency instruments, given Egypt's susceptibility to external shocks and constrained fiscal capacity. Reforms in institutions aimed at enhancing debt management and fiscal transparency may elevate investor confidence and reduce borrowing expenses (IMF, 2024).

In final form, Egypt's empirical debt thresholds ought to inform policy rather than serve as targets. The intricate shift from the high-debt regime (exceeding 89.42%) to the moderate-debt regime (ranging from 78.17% to 89.42%) necessitates meticulously orchestrated reforms that reconcile fiscal discipline with growth objectives. Successful implementation necessitates institutional capacity, policy coordination, and targeted structural reforms to rectify Egypt's fundamental fiscal imbalances.

8. Policy Recommendations and Conclusions

The policy recommendations will be tailored to Egypt's fiscal challenges and promote sustainable economic growth, based on a thorough threshold regression analysis.

8-1. Key Policy Recommendations

8-1-1. Implement Targeted Fiscal Consolidation Strategy

Egypt's current debt level (90.9% of GDP in 2024) surpasses the critical threshold of 89.42%, categorizing it within a high-debt regime that adversely affects growth. A gradual consolidation strategy is advised:

- **Short-term (1-2 years):** Decrease the debt ratio to below 89.42% by employing a balanced strategy of revenue augmentation and expenditure optimization.
- **Medium-term (3-5 years):** Aim to achieve the ideal debt range of 78-89%, wherein debt can beneficially influence growth.
- **Long-term (5+ years):** Implement institutional safeguards to sustain debt within the optimal range.

This consolidation must prioritize quality over expediency, safeguarding growth-promoting expenditures.

8-1-2. Transform Public Expenditure Composition

Public expenditure inefficiency is indicated by the negative coefficient (-0.1468).

- Reallocate fiscal resources toward high-multiplier investments in infrastructure, education, and healthcare.
- Systematically review and eliminate unproductive subsidies while strengthening targeted social protection.
- Enhance spending efficiency with performance-based budgeting.
- Prioritize digital transformation to enhance public service delivery and reduce waste.

8-1-3. Enhance Investment Efficiency

With investment showing positive (though regime-dependent) effects on growth, Egypt should:

- Simplify regulatory systems to cut Business expenses and administrative hurdles
- Strengthen public investment management to maximize public capital expenditure returns.

- Create focused incentives for private investment in strategic industries
- Use digital tools for regulatory compliance and company registration.

8-1-4. Adopt Countercyclical Debt Management Framework

- Set a formal debt ceiling based on the empirically-identified threshold of 89.42%.
- Design an early warning system to activate automatic fiscal changes when debt nears critical levels.
- Create contingency plans for external shocks jeopardizing debt sustainability.

8-1-5. Coordinate Monetary-Fiscal Policy to Contain Inflation

Providing that inflation continuously has a negative impact on growth under all regimes:

- To increase the credibility of monetary policy, strengthen central bank independence.
- Create focused supply-side interventions to address the structural drivers of inflation.
- Use digital technologies to enhance price stability and market monitoring.
- implement strategic foreign exchange management to lower imported inflation.

8-1-6. Diversify Debt Portfolio Structure

To make the high-debt regime less susceptible to interest rate shocks:

- To lower the risks associated with refinancing, extend the average debt maturity.
- A rise in the share of debt denominated in domestic currency.
- To lessen dependency on outside funding, expand the domestic debt market.
- Investigate cutting-edge financing options, such as bonds linked to sustainability and the environment.

8-1-7. Implement Growth-Friendly Revenue Reforms

To support fiscal consolidation without hampering growth:

- Broaden the tax base through digital formalization of informal sectors
- Enhance progressivity of the tax system while reducing distortions
- Strengthen revenue administration through technological modernization
- Develop property taxation to capture urban development value

8-1-8. Establish Institutional Framework for Debt Sustainability

To ensure long-term adherence to optimal debt ranges:

- Create an independent fiscal council to monitor compliance with debt thresholds
- Implement fiscal rules anchored to empirically-identified debt thresholds
- Enhance transparency in debt reporting and management
- Develop capacity for debt sustainability analysis and early intervention

Conclusions

The empirical identification of debt thresholds at 78.17% and 89.42% provides Egypt a scientific fiscal policy framework. The nonlinear relationship between debt and growth shows that debt's impact on economic development depends on its level and management.

Egypt's high debt regime requires immediate attention because additional debt will likely slow growth. High debt reduces investment efficiency, interest rate vulnerability, and policy flexibility, all of which hurt growth.

Transitioning from high debt to growth-optimizing moderate debt requires carefully sequenced reforms that balance immediate fiscal needs with long-term growth goals. Digital transformation, institutional strengthening, and structural reforms should supplement fiscal tools to improve policy.

Investment has a stronger growth effect than other variables across all debt regimes, so fiscal consolidation should prioritize growth-enhancing capital expenditure. The persistently negative impact of inflation emphasizes the need for macroeconomic stability to support sustainable growth.

Egypt must use debt thresholds as policy guidelines for fiscal strategy, institutional design, and economic reform to achieve sustainable growth. Egypt can turn its debt crisis into structural transformation and sustainable development by anchoring policy decisions to these empirically validated thresholds.

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