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# The impact of external public debt on economic growth: an economic study: the case of Morocco

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**Abstract**

This study examines the impact of external public debt on Morocco's economic growth from 1998 to 2022, using gross domestic product (GDP) as the dependent variable. Key explanatory variables include external public debt, gross national savings, external public debt service, and the investment rate. Employing annual time series data, the study adopts advanced econometric techniques such as the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests to assess stationarity, Johansen cointegration to identify long-run relationships, and the Vector Error Correction Model (VECM) to analyze both short- and long-term dynamics. The results show a significant long-run equilibrium relationship between the variables. External public debt and debt servicing negatively affect GDP, highlighting their detrimental impact on Morocco's economy. Conversely, gross national savings and the investment rate show potential for positive growth contributions. These findings align with global evidence and emphasize the critical need for effective external debt management. To enhance growth, policymakers should focus on optimizing debt allocation toward productive investments, diversifying exports to bolster foreign exchange reserves, and encouraging domestic savings to reduce external borrowing reliance. This study provides valuable insights into debt sustainability challenges and contributes to the discourse on public finance strategies for developing economies like Morocco.

**Keywords:** Economic Growth, Gross Domestic Product, External Debt Public, External Debt Public Service, VECM, Johansen Cointegration approach, Morocco**.**

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## 1. Introduction

Economic growth is a primary macroeconomic objective for all countries, serving as a vital indicator of progress and development. Achieving sustained growth requires significant investments in infrastructure, productive capacities, and human capital, with gross domestic product (GDP) being the most widely used metric to measure economic performance. For developing nations, however, limited financial resources, low domestic savings, and suboptimal productivity often constrain their ability to finance growth initiatives independently. Consequently, many rely on external borrowing to bridge resource gaps and meet their development needs (Krugman, P. R ,1988).

External public debt has long been considered a critical tool for stimulating economic activity and balancing budgets in resource-limited economies. It provides governments with the means to fund public spending, strengthen productive sectors, and create a favorable environment for private investment. However, foreign borrowing is not without risks. High levels of external debt can lead to significant debt-servicing obligations, crowd out productive investment, and create economic vulnerabilities, particularly in developing countries where debt sustainability is often precarious (Sachs J. D, 1989).

In Morocco, external public debt has played a pivotal role in financing development projects and addressing

fiscal deficits over the past two decades. Between 1998 and 2005, Morocco successfully reduced its external debt by $5.3 billion. However, since 2005, the trend reversed, with external public debt rising sharply to $35.5 billion in 2019, equivalent to 29.5% of GDP (Ministry of Economy and Finance, 2020). This growing dependence on foreign borrowing raises concerns about the potential negative effects on Morocco's economic growth, particularly given the increasing burden of debt servicing and its implications for public finances. In 2022, this upward trend continued, with external debt reaching $42 billion, driven by increased borrowing to mitigate the economic impacts of the COVID-19 pandemic and to finance large-scale infrastructure projects. This increasing reliance on foreign borrowing raises concerns about the potential negative effects on Morocco's economic growth, particularly given the rising burden of debt servicing, which reached unprecedented levels in 2022, and its implications for public finances.

This study examines the impact of external public debt on Morocco's economic growth during the period 1998–2022. Specifically, it aims to test two hypotheses:

1. An increase in the stock of external public debt negatively affects economic growth.

2. An increase in external public debt service negatively impacts economic growth.

To explore these hypotheses, the study employs a robust quantitative methodology based on the Johansen Vector Error Correction Model (VECM), using econometric techniques to identify both short- and long-term relationships between external debt and economic growth. The paper is structured as follows: the first section provides a review of theoretical and empirical literature, along with an overview of Morocco's external debt history. The second section details the econometric modeling, including data sources, variable specification, and results. The final section concludes with a discussion of policy implications and recommendations for sustainable debt management.

By analyzing the relationship between external debt and economic growth, this study seeks to contribute to the ongoing discourse on public finance strategies for developing economies, offering insights into effective debt management policies that balance immediate development needs with long-term economic stability.

## 2. Literature Review

Government debt remains a contentious topic among economists, with perspectives diverging significantly depending on theoretical frameworks. While some scholars argue that debt is a necessary tool for economic development, others view it as inherently harmful, particularly for long-term growth prospects. This section reviews the theoretical underpinnings, empirical studies, and contemporary perspectives on public debt and its relationship with economic growth.

### 2.1 Theoretical Literature Review

The classical school of economics views public debt negatively, associating it with deferred taxation and potential intergenerational inequities. Ricardo, D. (1817) posits that citizens perceive public borrowing as future taxes, prompting precautionary savings that neutralize the stimulative effects of debt. Barro, R. J. (1989) extends this argument, suggesting that rational economic agents anticipate tax increases and adjust their savings accordingly, negating any positive impact of debt-financed fiscal policies. Similarly, Adam Smith, A. (1759) critiques public borrowing for fostering irresponsible government spending, while J. B. Say (1799) warns against its wealth-destructive nature due to interest obligations. Hayek, F. A. (1989) criticizes debt-fueled growth as unsustainable, arguing that it leads to investments exceeding national savings.

Recent contributions from Modern Monetary Theory (Kelton, S., 2020) challenge these views by arguing that countries with sovereign currencies can strategically use debt without default risk, provided inflationary pressures are managed. Scholars like Stiglitz, J. (2012) further emphasize the potential for public debt to drive inclusive growth through targeted investments in education and healthcare, particularly when addressing modern challenges such as climate change, technological disruptions, and post-pandemic recovery.

Empirical studies by Krugman, P. R. (1988), Sachs, J. D. (1989), Froot, K. A. (1989), and Calvo, G. A. (1989) corroborate the negative view, highlighting how debt accumulation and servicing tax future production and crowd out private investment. These arguments underscore the classical belief that the state should limit its economic intervention and operate within the confines of its resources. In contrast, Keynesian economics champions the utility of public debt as a catalyst for economic recovery and long-term growth. Keynesian scholars argue that debt-financed public expenditure stimulates aggregate demand, fostering investment, production, and employment through a multiplier effect. Harrod and Domar's growth models (Harrod, R. F.

(1939); Domar, E. D. (1946)) posit that sustained growth is contingent on sufficient investment, which may necessitate external borrowing. From this perspective, controlled public debt is a strategic tool for addressing unemployment, promoting infrastructure development, and reducing poverty.

2.2 Empirical Literature Review

Empirical studies provide a nuanced understanding of the relationship between public debt and economic growth, emphasizing context-specific outcomes. Raffinot, M., & Gürbüz, A. (2001) analyzed Turkey's debt dynamics using a linear model and differentiated between domestic and external debt. They concluded that while external debt positively influences private investment and growth, domestic debt exerts a crowding-out effect. Similarly, Mohamed, M. A. (2018) examined the relationship between external debt and GDP growth in Sudan from 1969 to 2015. Using the Vector Error Correction Model (VECM), Mohamed found that while external debt positively contributes to economic growth in the long run, adverse impacts arise from unfavorable exchange rates and inefficiencies in foreign direct investment. These findings highlight the importance of stable macroeconomic conditions for leveraging external borrowing effectively.

Research by Ostry, J. D., Ghosh, A. R., & Espinoza, R. A. (2015) complements these studies by analyzing debt sustainability through non-linear frameworks, revealing that optimal debt thresholds vary significantly across income levels and institutional capacities. Additionally, Woo, J., & Kumar, M. S. (2015) demonstrate how public debt's impact on growth is mediated by policy coherence and fiscal discipline, with notable variations observed in emerging economies.

Focusing on Morocco, Chkiriba, A., & Oumansour, Y. (2019) employed the ARDL bounds testing approach to investigate the impact of external debt on economic growth for the period 1988–2016. Their findings indicate that external public debt negatively affects GDP growth in both the short and long terms, with the short-term effects being particularly pronounced. These results align with broader empirical literature highlighting the detrimental effects of excessive public debt. Reinhart, C. M., & Rogoff, K. S. (2010) provide an important addition by highlighting that the negative effects of debt on growth are often observed when public debt exceeds a certain threshold (typically 90% of GDP).

Moreover, despite the extensive focus on debt-to-GDP thresholds, limited research evaluates how debt interacts with emerging factors such as climate adaptation financing, highlighting a critical area for future exploration.

Contemporary literature also explores the role of institutional quality in mediating the impact of public debt. Countries with strong governance and transparent financial management are better equipped to utilize debt productively, mitigating potential risks (Panizza, U., & Presbitero, A. F. (2013)).

The interplay between institutional quality and external shocks remains poorly understood, particularly in nations reliant on commodity exports. Deepening the discussion on governance, corruption, and transparency can offer further insights, particularly by referencing countries with similar economic frameworks to Morocco.

Collectively, these studies highlight the critical role of effective debt management in determining the impact of public borrowing on economic growth. Mismanagement of external debt often leads to negative outcomes, including reduced investment and economic stagnation. Several gaps remain in the existing literature, such as insufficient exploration of the short-term positive impacts of debt in stimulating growth during economic downturns and the lack of consensus on the optimal debt-to-GDP ratio for developing countries.

Models that incorporate a comprehensive set of variables—including institutional quality, external shocks, and debt composition—are necessary to address these gaps. Drawing sharper contrasts between theoretical perspectives and empirical findings, as well as exploring emerging challenges such as technological changes and climate adaptation, would further enhance understanding of public debt's impact on economic growth.

## 3. Historical Overview of Moroccan Debt

3.1. From Ambition to Failure (1960-1980)

In the 1960s, Morocco embarked on ambitious economic development plans to improve living standards and achieve economic independence. The First Plan (1960–1964) aimed to enhance agricultural productivity and establish basic industries but was hindered by financial constraints. In July 1964, Morocco secured its first $1.3 million loan from the International Monetary Fund (IMF) to address funding shortfalls.

The Second Plan (1965–1967) focused on economic liberalization and encouraging private sector investment. However, public savings covered only one-third of state investments in 1968, leading to a growing reliance on external borrowing. The external debt stock rose from $256 million in 1963 to $566 million in 1968 and doubled

by 1975.

Despite temporary economic gains—phosphate prices surged from $14/ton in 1973 to $68/ton in 1975, boosting public investment—the economy faltered as phosphate prices plummeted to $30/ton in 1976. Rising international interest rates and currency instability further exacerbated economic difficulties. By 1982, external debt reached 88% of GDP ($3.5 billion), marking a critical juncture in Morocco's economic history.

3.2. From Failure to Adjustment (1983-1993)

In 1983, Morocco faced a payments crisis that necessitated the rescheduling of $2.4 billion in foreign debt under the supervision of the IMF and World Bank. Structural Adjustment Programs (SAPs) were implemented to:

- Promote economic liberalization,
- Enhance competitiveness in global markets,
- Reduce state involvement in the economy while expanding the private sector's role.

While the SAPs led to short-term hardships, including reduced public spending, they eventually stabilized the economy. By 1991, improvements in budget performance, foreign exchange reserves, and the balance of payments restored investor confidence and positioned Morocco for further reforms.

3.3. From External Debt to Internal Debt (1993-2009)

Starting in 1993, Morocco shifted its borrowing strategy, prioritizing domestic over external debt to reduce reliance on foreign creditors. Key measures included:

- Channeling investments toward priority sectors such as infrastructure and education,
- Facilitating international trade,
- Adopting a social approach to support low-income families.

These reforms, coupled with favorable global conditions, enabled Morocco to access domestic markets under improved terms. By 2009, despite the global financial crisis, Morocco's GDP grew by 5%, demonstrating economic resilience. However, external debt continued to impose fiscal pressures.

3.4. Structure and Evolution of External Public debt in Morocco (2010-2022)

Morocco's external public debt has evolved significantly in recent decades. By 2019, the stock of public external debt stood at $35.5 billion, representing 29.5% of GDP. The increase was driven primarily by Treasury borrowing, which rose by 9.1% compared to 2018. The debt-to-GDP ratio remained stable, highlighting Morocco's efforts to manage debt sustainability.

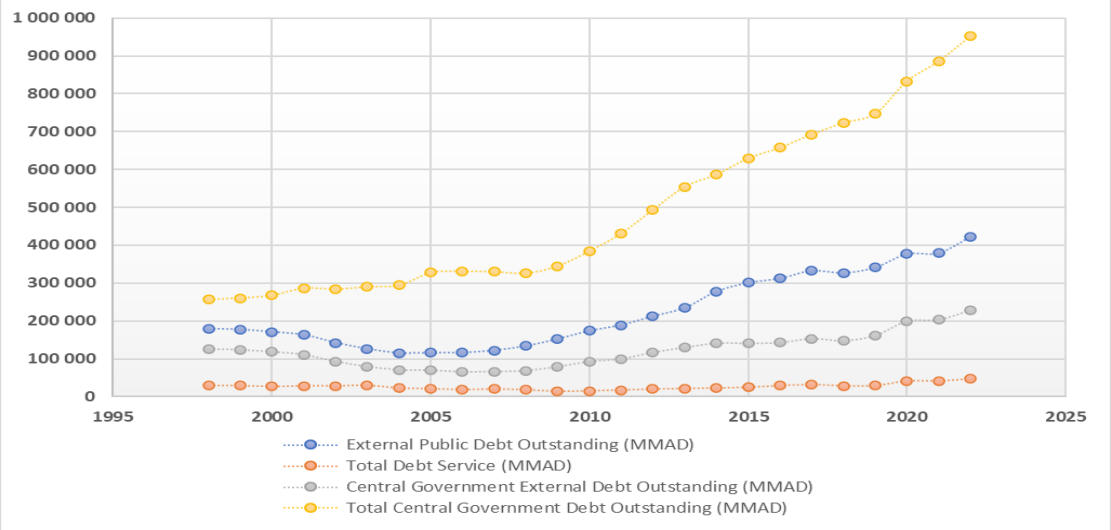



Figure 1. Evolution of the components of the external public debt for the period 1998-2022
Source: Authors, data from Ministry of Economic, Finance and Administration Reform (2024)

Since 2019, external debt trends have reflected Morocco's ambitious development agenda. By 2024, the external debt stock is projected to approach $42 billion due to:

- Increased borrowing to fund major infrastructure projects like the Tanger-Med port expansion and

renewable energy initiatives,

- Rising interest payments due to tightening global financial conditions,
- Continued reliance on external markets to finance fiscal deficits.

Despite these challenges, Morocco's external debt remains below the critical thresholds identified by international standards. Debt management reforms, such as enhanced fiscal discipline and diversified funding sources, have mitigated risks and supported economic stability.

Morocco's debt trajectory highlights its evolving fiscal strategy, balancing growth ambitions with the need for sustainability. While external debt has facilitated critical investments, its long-term impact underscores the importance of prudent management, particularly amid global economic uncertainties. Enhanced governance, debt transparency, and economic diversification remain pivotal for maintaining fiscal health and driving future growth.

## 4. Methodology of research

4.1. Data Sources and Specification of Model

The data for conducting this study has been taken from a source « World Bank», and « Ministry of Economic, Finance and Administration Reform ». Annual data of Morocco used for this study starting from the year 1998 to 2022 which means that research depends upon times series data and its methodology, using version 10 of the EViews software. There are 5 important variables observed to drive a model to study the impact of public external debt on the growth of Moroccan's economy.

Many papers especially for macroeconomic and microeconomic studies, make models on the movements of time series from its history and present and past values with a linear model, this is the case where the series is not deterministic (stochastic process). Each observation is a random variable and the variables evolve according to certain laws. It's, therefore, necessary to estimate a dynamic model.

Therefore, this study provides a multivariate analysis of the relationship between Morocco's external debt, external debt service and economic growth, which will help to suggest whether external debt or external debt service can help stimulate higher levels of investment and economic activity in Morocco. In addition, the study used a relatively long and frequent 21-year period of data compared to the data used in many previous studies. The importance of longer time series datasets in any cointegration analysis cannot be overemphasized. Furthermore, based on the findings, this study provides valuable, relevant and practical recommendations for improving policy making.

To estimate the external debt, we use the VECM model (vector error correction model). This model applies when the series are not stationary but cointegrated; it makes it possible to study the long-term stable relations while at the same time analyzing the dynamics of the short-term variables.

Following the model built for purpose of testing the hypothesis for this study, we chose a dependent variable « Gross Domestic Product »(GDP)as an indicator of economic activity, and four independent variables namely « External Debt Public»(EDP), « Gross National Savings »(GNS), « External Debt Public Service » (EDPS) and « Investment Rate »(IR). As well as the model was designed as follows:

$$Y_t = \beta_0 + \beta_1 X_{1_t} + \beta_2 X_{2_t} + \beta_3 X_{3_t} + \beta_4 X_{4_t} + \varepsilon_t GDP_t$$

$$= \beta_0 + \beta_1 EDP_t + \beta_2 GNS_t + \beta_3 EDPS_t + \beta_4 IR_t + \varepsilon_t$$

Where;

$Y_t$ **:** Dependent variable $GDP_t$

$(X_{1_t}, X_{1_t}, X_{1_t} \text{ and } X_{1_t})$**:** independent variables $EDP_t$, $GNS_t$, $EDPS_t$ and $IR_t$

$\beta_o$ : The constant term.

$\beta_1, \beta_2, \beta_3, \text{and } \beta_4$ : Are represent the coefficient of each variable or parameter of the regression.

$\varepsilon_t$ **:** The error term.

All series have been log-transformed $(ln)$, this step is necessary to check the partial characteristics of the short

and long-term elasticities of the model.

$$ln(GDP)_t = \beta_0 + \beta_1 ln(EDP)_t + \beta_2 ln(GNS)_t + \beta_3 ln(EDPS)_t + \beta_4 ln(IR)_t + \varepsilon_t$$

4.2. The Study process

There are several models for the analysis, but before applying one of these models it is mandatory to study the stationarity of the variables (the study is carried out essentially from the study of the autocorrelation functions), we say that a time series is stationary if it has no trend or seasonality (verification by tests).

- **Step1: Study of the stationarity of the variables**
- **Step 2: Selection of the optimal number of lags.**
- **Step 3: Cointegration test**
- **Step 4: Study of the VECM model**
- **Step 5: Validation of the model**

4.2.1 Stationarity test

A process is stationary if it has no trend or seasonality and therefore fluctuates around a constant mean. It appears therefore that stationarity is a requirement that ensures the use of the model outside the period over which it was estimated

A process (X) is said to be stationary if it satisfies the following conditions:

- $\mathbf{E}(\mathbf{X}_t) = \mu \;\; ; \forall t$, the expectation is a constant independent of time
- $\mathbf{Var}\,(\mathbf{X}_t) = \sigma_x^2 < \infty \;; \forall t$, the variance is finite and independent of time
- $\mathbf{Cov}\,(\mathbf{X}_t, X_{t+k}) = \mathbf{E}(\mathbf{X}_t - \mu)(X_{t+k} - \mu) = \gamma_k$, the covariance is independent of time.

There are two types of non-stationary series: TS (trend stationery) and DS (difference stationery). The first type is stochastic, i.e. the effect of a shock on the series is transitory. However, the DS series ensures that the effect of a shock on this process is permanent. We can make it stationary by applying a first difference filter.

➔ **Dickey-Fuller Test (1979):**

To determine whether a series is stationary or not, we need to test for the presence of a unit root. Some common tests for unit root will be discussed here, namely the Dickey-Fuller test and the Augmented Dickey-Fuller test.

These tests allow detecting the non-stationarity and the nature of the processes (TS or DS), which makes it possible to deduce the adequate method to stationary the series.

The construction of this test is based on three models:

- **Autoregressive model of order 1:**

***Model (1):***

$$\Delta X_t = \rho X_{t-1} + \sum_{i=1}^{p} \rho \Delta X_{t-i} + \varepsilon_t$$

- **Autoregressive model with constant:**

***Model (2):***

$$\Delta X_t = \rho X_{t-1} + c + \sum_{i=1}^{p} \rho \Delta X_{t-i} + \varepsilon_t$$

- **Autoregressive model with constant and trend:**

***Model (3):***

$$\Delta X_t = \rho X_{t-1} + c + \beta t + \sum_{i=1}^{p} \rho \Delta X_{t-i} + \varepsilon_t$$

Where;

$X_{t-1}$ : Lag 1 of time series

$\Delta X_{t-1}$ : First difference of the series at time $(t-1)$

$\varepsilon_i \sim WN(0, \sigma_\varepsilon^2)$ (White Noise)

➔ If the null hypothesis $H_0 : \rho - 1$ is accepted in one of the three models mentioned above, then is non-

stationary.

➔ In the framework of the model (3) if $\beta$ is significantly different from zero and the null hypothesis is rejected $\rho < 1$ then the series is of type TS.

4.2.2. Selection of the optimal number of lags

In economics, the dependence of a variable **Y** on another variable **X** is rarely instantaneous. Very often, **Y** responds to **X** with a time interval. Such a time interval is called a "**lag**".Many lags result in a loss of degrees of freedom, can cause serial correlation in the error terms. So how many lags should he use for the model and/or variables?

There is no hard and fast rule on how long the time lag length is. It is an empirical issue. As noted in Damodar Gujarati Basic Econometrics, there is no a priori guide as to what the maximum length of the lag should be. Also, from Jeffery Wooldridge's Introductory Econometrics: A Modern Approach with:

- Annual data, the number of lags is usually small 1 or 2.
- Quarterly data 1 to 8 lags are appropriate.
- Monthly data 6, 12, or 24 lags can be used with sufficient data points.

We decide from a criterion such as Akaike or Schwarz to choose the model that gives the lowest values of these criteria (rule of thumb). Function $AIC_{(p)}$ and $SC_{(p)}$ are calculated as follows:

- Akaike Information Criterion: $AIC_{(p)} - \ln[det|\sum e|] + \frac{2k^2p}{n}$
- Schwartz (Bayesian Information Criterion): $SC_{(p)} = \ln[det|\sum e|] + \frac{k^2p\ln(n)}{n}$

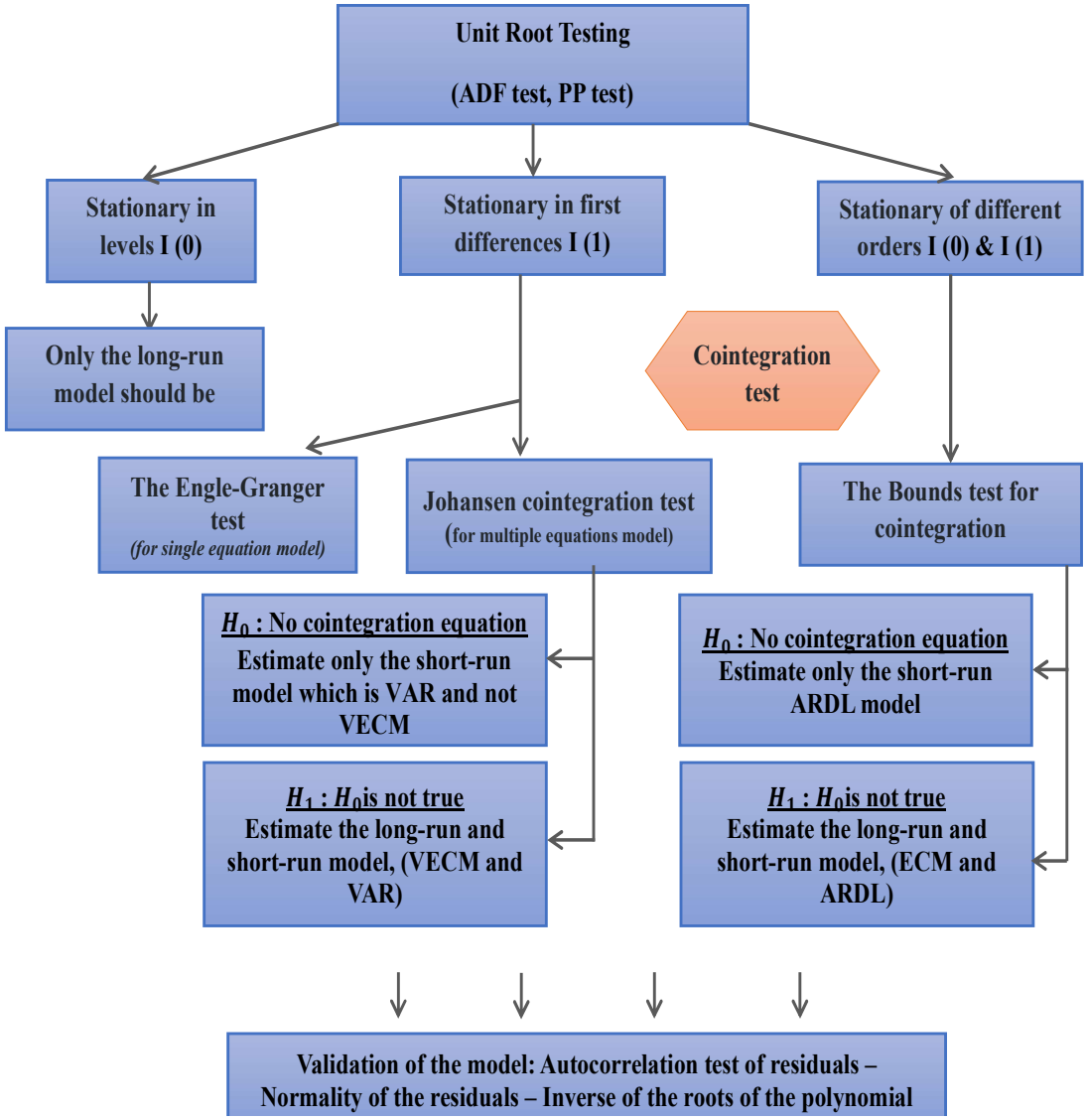
Where; $k$: Number of variables in the system, $n$: number of observations, $p$: Number of lags, $\sum e$: matrix of variances and covariances of the residuals of the model.

4.2.3. After unit root tests, what's next, and why did we choose VECM?

The outcome of unit root testing matters for the empirical model to be estimated. The following scenarios (S1, S2, and S3) explain the implications of unit root testing for further analysis.

• **Summary of the econometric approach**




Source: Authors

**5. Results and Discussion**

The variables were log-transformed to keep them at the same level. First, we ran regression analysis of the already log-transformed independent and dependent variables and discovered that the estimation could be spurious due to high R-square (98%) and low Durbin Watson Test (1.393). Regression results are presented below in table 1.

We tested for stationarity of the time series by employing Augmented Dickey-Fuller (ADF) Test, and the Phillips Perron test for confirmation, the data became stationary after the first lag with drift. Since the times series were stationary after the first lag with the stationarity process of $\Delta \ln(GDP)_t = \ln(GDP)_t - \ln(GDP)_{t-1}$

Then, we tested to examine if there is a long-run relationship among the variables by employing Johansen Cointegration Test. There is more than one cointegration
equation among the variables which affirms the use of VECM adopted in this study. The fact that the data were not stationary until after the first difference and the variables are cointegrated, necessitates the use of

VECM. The results of Augmented Dickey-Fuller (ADF), Phillips Perron Test, Johansen Cointegration Test, both short and long-run VECM, and validation of model results are shown in Table 2, 3, 4, 5, and 6 respectively.

Table 2 reveals ADF and PP Test results in which after the first difference the variables became stationary. The cointegration test result in table 3 shows the trace test indicates with a probability of 0.05, that there are 3 cointegration relationships between the different variables of the model. Therefore, the hypothesis of cointegration is retained, which will lead us to estimate the model with VECM, which allows us to make a long-term estimate.

Table 1: Regression Analysis Dependent Variable= ln (GDP)

| **Dependent Variable: LNGDP** | | | | |
|---|---|---|---|---|
| **Method: Least Squares** | | | | |
| **Sample: 1998 2022** | | | | |
| **Included observations: 24** | | | | |
| **Variable** | Coefficient | Std. Error | t-Statistic | Prob. |
| **LNEDP** | 0.266356 | 0.054396 | 4.896592 | 0.0001 |
| **LNGNS** | 0.695543 | 0.086737 | 8.018969 | 0.0000 |
| **LNEDPS** | 0.004703 | 0.086450 | 0.054396 | 0.9573 |
| **LNIR** | 0.682105 | 0.239753 | 2.845031 | 0.0112 |
| **C** | 3.542007 | 1.745321 | 2.029430 | 0.0584 |
| **R-squared** | 0.985390 | Mean dependent var | | 25.04116 |
| **Adjusted R-squared** | 0.981953 | S.D. dependent var | | 0.404018 |
| **S.E. of regression** | 0.054276 | Akaike info criterion | | -2.792750 |
| **Sum squared resid** | 0.050080 | Schwarz criterion | | -2.544786 |
| **Log likelihood** | 35.72025 | Hannan-Quinn criter. | | -2.734337 |
| **F-statistic** | 286.6507 | Durbin-Watson stat | | 1.393014 |
| **Prob(F-statistic)** | 0.000000 | | | |

Source: Made by ourselves

Table 2: Augmented Dickey-Fuller& Phillips Perron test for Unit Root Result

| **Variables** | **Model** | **ADF** | | | | | **P P** | | **Decision** |
|---|---|---|---|---|---|---|---|---|---|
| | | **level** | | **Data Generator Process** | **1st Differences** | | | | |
| | | **T-static** | **Prob** | | **T-static** | **Prob** | **T-static** | **Prob** | |
| **lnGDP** | **Trend&intercept** | 0.689411 | 0.4994 | **DS with Drift** | - | - | - | - | **I(1)** |
| | **Intercept** | 0.948819 | 0.3546 | | - | - | - | - | |
| | **None** | 3.107149 | 0.9988 | | 2.314969 | 0.0233 | 2.251111 | 0.0268 | |
| **LnEDP** | **Trend&intercept** | 4.218557 | 0.1186 | **DS** | - | - | - | - | **I(1)** |
| | **Intercept** | - | - | | - | - | - | - | |
| | **None** | - | - | | 2.689703 | 0.0099 | 2.631627 | 0.0113 | |
| **lnGNS** | **Trend&intercept** | 1.240418 | 0.2307 | **DS without Drift** | - | - | - | - | **I(1)** |
| | **Intercept** | 0.867649 | 0.3964 | | - | - | - | - | |
| | **None** | 2.183791 | 0.9904 | | 3.439301 | 0.0016 | 3.468610 | 0.0015 | |
| **lnEDPS** | **Trend&intercept** | 3.828547 | 0.0068 | **TS** | - | - | - | - | **I(1)** |
| | **Intercept** | - | - | | - | - | - | - | |
| | **None** | - | - | | 4.899988 | 0.0001 | 5.075527 | 0.0000 | |
| **lnIR** | **Trend&intercept** | 0.462082 | 0.6496 | **DS without Drift** | - | - | - | - | **I(1)** |
| | **Intercept** | 1.542823 | 0.1394 | | - | - | - | - | |
| | **None** | 0.484041 | 0.8111 | | 4.3966657 | 0.0002 | 4.401927 | 0.0001 | |

Source: Made by ourselves

Table 3: Johansen Cointegration Test Results

| | | | | |
|---|---|---|---|---|
| **Sample (adjusted): 2000 2022** | | | | |
| **Included observations: 22 after adjustments** | | | | |
| **Trend assumption: Linear deterministic trend** | | | | |
| **Series: LNGDP LNEDP LNGNS LNEDPS LNIR** | | | | |
| **Lags interval (in first differences): 1 to 1** | | | | |
| **Unrestricted Cointegration Rank Test (Trace)** | | | | |
| **Hypothesized** | | Trace | 0.05 | |
| **No. Of CE(s)** | Eigenvalue | Statistic | Critical Value | Prob.** |
| **None *** | 0.881315 | 109.8267 | 69.81889 | 0.0000 |
| **At most 1 *** | 0.829519 | 67.20115 | 47.85613 | 0.0003 |
| **At most 2 *** | 0.642384 | 31.81853 | 29.79707 | 0.0289 |
| **At most 3** | 0.412104 | 11.25263 | 15.49471 | 0.1964 |
| **At most 4** | 0.030938 | 0.628541 | 3.841466 | 0.4279 |
| **Trace test indicates 3 cointegrating eqn(s) at the 0.05 level** | | | | |
| *** Denotes rejection of the hypothesis at the 0.05 level** | | | | |
| ****MacKinnon-Haug-Michelis (1999) p-values** | | | | |

Source: Made by ourselves

5.1. Estimating Vector Error Correction Models:

5.1.1. VECM Results (Long-Run Relationship among the Variables)

The aim here is to propose, in an integrated model, a static representation that constitutes a long-term target (the cointegration relationship) and a dynamic short-term representation (the adjustment to this target)

Consider $N$ integrated processes $(x_{i,t}, t \in Z)$ of order one satisfying a cointegrating relationship represented by the vector $\alpha$ such that the linear combination:

$$\mu_t = \alpha_0 + \alpha_1 x_{1,t} + \alpha_2 x_{2,t} + \ldots + \alpha_N x_{N,t} \text{ ; } \textit{Be stationary} \rightarrow \textit{I (0)}$$

Where;

$\alpha_0$ : Constant; and $(\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5)$:the coefficients of the equation of the long-term relationship.

Then there exists an $ECT$ representation for each process $(x_{i,t}, t \in Z)$ such as:

$$\Delta x_{i,t} = c + \gamma \underbrace{\mu_{t-1}}_{ECT_{t-1}} + \sum_{k=1}^{p} \beta_{1,i} \Delta x_{1,t-k} + \sum_{k=1}^{p} \beta_{2,i} \Delta x_{2,t-k} + \cdots + \sum_{k=1}^{p} \beta_{N,i} \Delta x_{N,t-k} + \varepsilon_t$$

The coefficient $\gamma < 0$ represents the $ECT$ (Error Correction Term) recall force.

If the coefficient $\gamma$ in front of the residual of the cointegrating relationship is positive or zero, the **ECT** representation is not valid.

Specification of the error correction model:

$$\Delta lnGDP_t = c + \sum_{i=0}^{p} \beta_1 \Delta lnGDP_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta lnEPD_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta lnGNS_{t-i} + \sum_{i=0}^{p} \beta_4 \Delta lnEPDS_{t-i} + \sum_{i=0}^{p} \beta_5 \Delta lnIR_{t-i} + \gamma ECT_{t-1} + \varepsilon_t$$

Where $ECT_{t-1}$ :Corresponds to the lagged residual from the long-term equilibrium equation.

Table 4: VECM Results (Long-Run Relationship among the Variables)

| **Vector Error Correction Estimates** | |
|---|---|
| **Sample (adjusted): 2000 2022** | |
| **Included observations: 22 after adjustments** | |
| **Standard errors in ( ) & t-statistics in [ ]** | |
| **Cointegrating Eq:** | **CointEq1** |
| **LNGDP(-1)** | **1.000000** |
| **LNEDP(-1)** | **6.548394** |
| | (1.07286) |
| | [ 6.10366] |
| **LNGNS(-1)** | **-11.49513** |
| | (1.39725) |
| | [-8.22699] |
| **LNEDPS(-1)** | **2.799499** |
| | (1.81808) |
| | [ 1.53981] |
| **LNIR(-1)** | **20.20800** |
| | (3.89994) |
| | [ 5.18162] |
| **C** | **49.67519** |

Source: Made by ourselves

Looking at the cointegrating vector, we note the sign of the long-term relationship (positive or negative):

$$ECT_{t-1} = 1.0000lnGDP_{t-1} + 6.5483lnEDP_{t-1} - 11.49513lnGNS_{t-1} + 2.7994lnEDPS_{t-1} + 20.2080lnIR_{t-1} + 49.67519$$

The sign of the coefficients of the long-run relationship is the opposite sign of that which we retain in the result. If we have a negative sign, it means that this variable is positively related to the dependent variables and vice versa.

$$lnpib_{t-1} = -6.5483lnEDP_{t-1} + 11.49513lnGNS_{t-1} - 2.7994lnEDPS_{t-1} - 20.2080lnIR_{t-1} - 49.67519$$

We can conclude:

- The variable EDP carries a negative sign from an economic point of view, a 1% increase in EDP implies a decrease of more than 6% of GDP.
- The variable GNS has a positive sign from an economic point of view, an increase of 1% of GNS implies an increase of more than 11% of the GDP.
- The EDPS variable carries a negative sign from an economic point of view, a 1% increase in EDPS implies a decrease of more than 2% in GDP.
- The variable IR carries a negative sign from an economic point of view, a 1% increase in IR implies a decrease of more than 20% in GDP.

**5.1.2. VECM Results (Short-Run Relationship among the variables)**

The table below reports the estimation of the cointegrating relationship, we have LNPIB as endogenous variable and LNEDP, LNGNS, LNEDPS, and LNIR as endogenous variables.

The coefficient must be negative and between -1 and 0. If so, this means that if the model suffers a shock in the period of (t-1), it will converge to the long-run equilibrium covering the percentage in period t.

Note that all the $\gamma$ coefficients of the cointegration relation are negative, so the VECM representation is valid.

Table 5: VECM Results (Short-Run Relationship among the variables)

| Error Correction: | D(LNGDP) | D(LNEDP) | D(LNGNS) | D(LNEDPS) | D(LNIR) |
|---|---|---|---|---|---|
| **CointEq1** | **-0.031009** | -0.024616 | -0.022078 | -0.063562 | -0.026124 |
| | (0.00910) | (0.01295) | (0.01758) | (0.02540) | (0.00886) |
| | **[-3.40846]** | [-1.90040] | [-1.25578] | [-2.50218] | [-2.95003] |
| **D(LNGDP(-1))** | **-0.471369** | -0.443108 | -0.502321 | -2.629805 | -0.449338 |
| | (0.32518) | (0.46300) | (0.62843) | (0.90799) | (0.31653) |
| | [-1.44956] | [-0.95704] | [-0.79932] | [-2.89628] | [-1.41955] |
| **D(LNEDP(-1))** | **0.137163** | 0.453994 | 0.027642 | 0.186086 | 0.081478 |
| | (0.15523) | (0.22102) | (0.29999) | (0.43344) | (0.15110) |
| | [ 0.88362] | [ 2.05409] | [ 0.09214] | [ 0.42932] | [ 0.53922] |
| **D(LNGNS(-1))** | **0.079334** | -0.208648 | -0.065266 | -0.108387 | -0.022250 |
| | (0.19349) | (0.27549) | (0.37392) | (0.54026) | (0.18834) |
| | [ 0.41002] | [-0.75737] | [-0.17454] | [-0.20062] | [-0.11814] |
| **D(LNEDPS(-1))** | **0.275043** | 0.214198 | 0.300912 | 0.497843 | 0.169948 |
| | (0.08248) | (0.11743) | (0.15939) | (0.23030) | (0.08029) |
| | [ 3.33473] | [ 1.82398] | [ 1.88785] | [ 2.16170] | [ 2.11681] |
| **D(LNIR(-1))** | **0.401810** | 0.639380 | 0.359059 | 1.522089 | 0.193503 |
| | (0.29724) | (0.42321) | (0.57443) | (0.82996) | (0.28933) |
| | [ 1.35182] | [ 1.51078] | [ 0.62507] | [ 1.83392] | [ 0.66879] |
| **C** | **0.061374** | 0.046436 | 0.075785 | 0.128054 | 0.028675 |
| | (0.01696) | (0.02415) | (0.03278) | (0.04736) | (0.01651) |
| | [ 3.61817] | [ 1.92267] | [ 2.31184] | [ 2.70359] | [ 1.73663] |
| **R-squared** | 0.624731 | 0.442974 | 0.235194 | 0.520387 | 0.432907 |
| **Adj. R-squared** | 0.451530 | 0.185885 | -0.117793 | 0.299027 | 0.171172 |
| **Sum sq. resids** | 0.039243 | 0.079557 | 0.146566 | 0.305972 | 0.037184 |
| **S.E. equation** | 0.054943 | 0.078229 | 0.106181 | 0.153416 | 0.053482 |
| **F-statistic** | 3.606972 | 1.723039 | 0.666297 | 2.350861 | 1.653990 |
| **Log likelihood** | 33.95826 | 26.89136 | 20.78132 | 13.42116 | 34.49726 |
| **Akaike AIC** | -2.695826 | -1.989136 | -1.378132 | -0.642116 | -2.749726 |
| **Schwarz SC** | -2.347319 | -1.640630 | -1.029626 | -0.293609 | -2.401219 |
| **Mean dependent** | 0.052806 | 0.035132 | 0.055259 | 0.013183 | 0.011004 |
| **S.D. dependent** | 0.074188 | 0.086701 | 0.100430 | 0.183239 | 0.058746 |

Source: Made by ourselves

The VECM equation for the variables (we interested for equation of GDP):

$$D(LNGDP) = -0.0310085069065 * (LNGDP(-1) + 6.5483941401 * LNEDP(-1) - 11.4951256923 * LNGNS(-1) + 2.79949906713 * LNEDPS(-1) + 20.2079952427 * LNIR(-1) + 49.6751918812) - 0.471369399617 * D(LNGDP(-1)) + 0.137163490204 * D(LNEDP(-1)) + 0.0793336912594 * D(LNGNS(-1)) + 0.275042690361 * D(LNEDPS(-1)) + 0.401810024187 * D(LNIR(-1)) + 0.0613737843674$$

$$\Delta lnGDP_t = \gamma ECT_{t-1} - 0.471369\Delta lnGDP_{t-1} + 0.137163\Delta lnEDP_{t-1} + 0.079334\Delta lnGNS_{t-1} + 0.275043\Delta lnEDPS_{t-1} + 0.40181\Delta lnIR_{t-1} + 0.061374$$

In the explanatory equation for GDP, it carries a negative sign **(-0.31009)** and significantly so at the 5% level. For the statistic **|-3.40846|>1.96** the GDP variable is characterized by the return to the long-term target.

## 5.2. Validation and stability of model:

As we can see, the three tests allow us to conclude that the residuals of our model are normal and free of heteroscedasticity and autocorrelation, which is essential for the continuation of our estimation. As well as the graphical representation of the inverse of the roots of the characteristic polynomial of the model shows that the roots are inside the unit circle (less than 1 in modulus) from which the model satisfies the condition of stability.

Table 6: Summary of test results

| Test | Prob |
|---|---|
| **Normality test Jarque-Berra** | 0,6525 |
| **Autocorrelation test B-G Seriel Correlqtion LM test** | 0,4953 |
| **Heteroscedqsticity test Breusch-Pqgqn-Godfrey** | 0,3355 |

Source: Made by ourselves

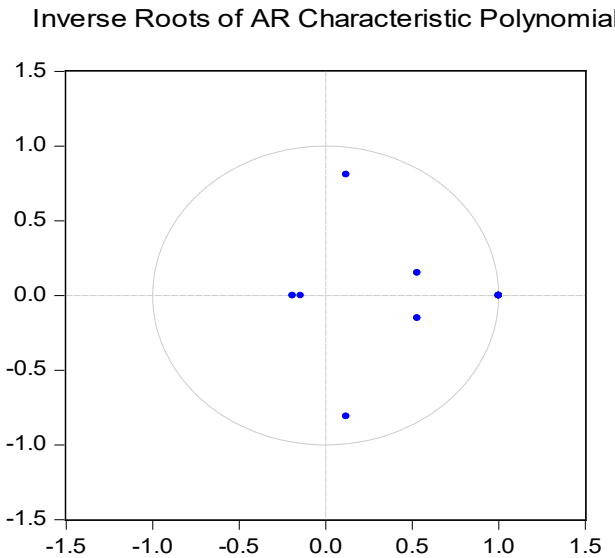



Figure 2. Inverse Roots of AR Characteristic Polynomial

Source: Made by ourselves (EViews10)

## 6. Conclusion and Recommendation

The relationship between external debt and economic growth has been a longstanding subject of debate, particularly for developing countries like Morocco. This study revisited this relationship using a robust econometric approach, analyzing data from 1998 to 2022 through a Vector Autoregressive (VAR) model and a Vector Error Correction Model (VECM). These models enabled the examination of both short- and long-term dynamics between Morocco's economic growth and its key determinants: external public debt (EDP), gross national savings (GNS), external debt service (EDPS), and the investment rate (IR).

The findings reveal that external public debt has a significant negative long-term impact on economic growth, with a 1% increase in EDP leading to a 6.55% decrease in GDP. This result aligns with the "debt overhang" theory, suggesting that excessive external debt becomes a burden, crowding out productive investments and hampering economic performance. In contrast, in the short term, external public debt exerts a positive but statistically insignificant impact, while external debt service positively influences economic growth and is statistically significant. These mixed findings underscore the complexity of the debt-growth relationship and the critical role of efficient debt management. The short-term positive effects of external public debt, though statistically insignificant, suggest that temporary fiscal stimulus may be achievable when debt is managed prudently. However, the long-term risks of mismanagement highlight the need for structural reforms to maximize the productive use of borrowed resources.

From a policy perspective, the study highlights the importance of prudent external borrowing, emphasizing that debt must be channeled into productive investments that generate sustainable growth and employment. Improving the efficiency of investment allocation, diversifying exports to enhance foreign exchange earnings, and adopting import substitution strategies to reduce dependency on foreign currency are essential. Moreover, strengthening domestic savings and attracting foreign direct investment (FDI) are vital to reducing reliance on external debt. In addition to these measures, Morocco should consider leveraging public-private partnerships (PPPs) to enhance infrastructure development. Such collaborations can attract private sector financing and expertise, reducing pressure on public debt while accelerating the pace of economic development.

Effective governance and institutional quality are crucial in mitigating the adverse effects of external debt. Transparent procurement processes, accountability in resource allocation, and anti-corruption measures ensure that borrowed funds are utilized for productive purposes. Moreover, institutional reforms that enhance fiscal discipline and improve policy coherence are critical for maintaining long-term debt sustainability. Strengthening governance not only enhances debt management but also bolsters investor confidence, which is crucial for attracting FDI and promoting economic stability.

Morocco's ambition to achieve emerging market status hinges on its ability to balance external borrowing with fiscal sustainability. Policymakers must prioritize debt sustainability by adhering to international best practices, regularly monitoring debt indicators, and ensuring effective governance of borrowed resources. These measures will not only mitigate the adverse effects of debt but also unlock its potential to drive long-term economic development. Additionally, prioritizing investments in high-value sectors such as technology, renewable energy, and industrial manufacturing can foster economic diversification and reduce reliance on debt-financed consumption.

These findings resonate with broader evidence from developing countries, where external debt often constrains growth when it exceeds sustainable thresholds. Lessons from emerging markets, such as Turkey and Malaysia, underscore the importance of tailored debt management frameworks that align with local economic conditions. Future research should expand on these findings by incorporating the role of institutional quality and governance in mediating the effects of external debt. Such studies could provide deeper insights into optimizing debt management strategies, ensuring that external borrowing contributes positively to economic growth in developing economies. Furthermore, future research should explore how external debt interacts with macroeconomic shocks, such as commodity price fluctuations or global interest rate hikes, to provide actionable insights for policymakers navigating volatile economic environments.

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