RESEARCH PAPER

Impact of External Debt on Economic Growth: Evidence from Ethiopia Using an Autoregressive Distributed Lag model Approach

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Abstract

Debt overhang is the current Ethiopian principal challenge that creates underinvestment problem. Thus, the debt burden incurred deteriorates economic growth of the country. The main objective of the research was to examine the impact of external debt on economic growth in Ethiopia using annual data for period of 1981 to 2022 from National Bank of Ethiopia, Central Statistics Authority of Ethiopia, International Monetary Fund and the World Bank Database. The study employed Autoregressive Distributed Lag approach to analyze the impact of external debt on economic growth. The result of the study revealed that the bounds co integration test approach shows the presence of long run equilibrium relationship between the variables under consideration. In long run, the empirical growth equation revealed that external debt stock as a percentage of Gross National Income has a significant positive impact on economic growth in the long run; whereas its square has a significant negative impact with economic growth implying that there is a non-linear relationship between economic growth and external debt stock. The capital outflow (total debt service) which is needed to service external debt for country has negative impact on economic growth both in the long run and short run. However, external debt stock has a positive impact on economic growth in the long run if it is maintained at maximum level. The error correction term value which is speed of adjustment, -0.230584 is indicate that around 23% shocks happened in short run is restored (converge) to long run equilibrium per year and confirmed the existences of co-integration among the variables under consideration. Finally, the study suggested that, government instead of heavily depend on external debt for development it must mobilize domestic resources to stimulate the domestic revenue collection process to fill country financial gap. The government should also control the level capital outflow, to reduce capital outflow for debt servicing it needs a professional and skilled negotiation with international donor agencies and countries, stimulate production and promote the development of an economy. The government should adopt targeted policies such as improved foreign exchange supervision and incentives for domestic investment to effectively manage capital outflows.

Keywords: External debt, Economic growth, Capital outflow, Autoregressive distributed lag model, Co-integration, Ethiopia

Introduction

Ethiopia holds a vital role within Africa's geopolitical and economic framework. Being the continent's second-largest country by population, its substantial market potential and advantageous position in East Africa establish it as a key contributor to regional progress. Throughout the first twenty years of the 2000s, Ethiopia was commonly referenced as an exemplar of accelerated growth, maintaining robust yearly economic expansion from 2000 through 2020. Nevertheless, this story of continuous prosperity has become more complex in recent times due to a multi-faceted crisis a concurrent series of devastating challenges that have significantly strained the nation's capacity to recover. In 2024, Ethiopia's public debt reached roughly 32 percent of its total economic output. Between 1991 and 2024, the government's borrowing relative to economic performance, referred to as the debt-to-GDP ratio, typically remained near 34.72 percent, though it peaked at 53 percent in 2021, (National Bank of Ethiopia, 2025).

Ethiopia's macroeconomic position has been increasingly strained by repeated domestic and external shocks, which have widened both fiscal and balance-of-payments gaps. In 2023, the value of merchandise imports exceeded USD 17.7 billion, while export earnings remained limited at roughly USD 3.6 billion, underscoring the depth of the country's trade imbalance and restricted budgetary capacity. A growing portion of government spending has been devoted to servicing public debt and financing security-related expenditures, thereby limiting allocations to health, education, and other social priorities (MoFED, 2024). As of December 2022, total public liabilities combining domestic and foreign debt were estimated at about USD 59.3 billion, close to half of national output. While aggregate debt ratios offer a broad snapshot of fiscal exposure, they do not fully capture repayment pressures. More sensitive indicators point to heightened risk, including a debt service-to-export ratio of approximately 22 percent and scheduled repayments exceeding USD 7 billion between 2023 and 2025, which include a USD 1 billion Eurobond maturity due in December 2024. Reflecting these vulnerabilities, Ethiopia has been assessed as being at high risk of debt distress by international financial institutions (Deguenonvo, 2025).

Due to these weaknesses, international financial institutions have determined that Ethiopia faces a high risk of debt distress. Considering this situation, Ethiopia officially requested debt restructuring through the G20 Common Framework in early 2021. In doing so Ethiopia joined a limited number of African countries, including Ghana, Zambia and Chad, in seeking coordinated creditor action (Hart and Larvin, 2021).

However, implementation under the framework has proceeded at a sluggish pace. In December 2023, Ethiopia entered external default after informing Eurobond holders that it could not meet a USD 33 million interest payment on its USD 1 billion bond. The authorities cited acute liquidity shortages, alongside broader policy and strategic considerations, as the primary reasons for this action (Selenik, 2024).

Ethiopia can adopt a mix of internal and external policy options to end the current fiscal/financing gaps. Domestically also the augmentation of tax revenue requires fundamental changes, that are so far missing like broadening tax base, enhancing tax administration efficiency and doing away with wastage of public expenditure including those related to governance pervasiveness: corruption (Sisay, 2021). From an external perspective, the country has access to multiple debt restructuring and relief arrangements, as well as complementary financial instruments, each associated with varying advantages and operational constraints. If carefully designed and effectively implemented, these measures could create fiscal room to finance post-conflict recovery efforts, scale up social safety nets, enhance climate adaptation capacity, advance structural transformation, and contribute to

long-term stability and peace building (Ali, 2024).

The debt overhang framework argues that when public indebtedness reaches excessive levels, it can deter private investment and weaken economic performance, ultimately deepening poverty. Conversely, under sound fiscal management, borrowing can act as a catalyst for growth by financing productive investment, improving development outcomes, and increasing per capita income conditions essential for sustained poverty reduction (Spilioti and Vamvoukas, 2015). It is unclear whether Ethiopia's current debt situation matches what the debt overhang hypothesis predicts and this needs to be carefully studied with real data. Many studies have looked at how debt affects growth, but their finding have been clear and sometimes even conflicting.

In general, the effect of external debt on economic growth still a hotly debated topic in the development economics (Dogan and Sukruaglu, 2022). Many studies have looked at this connection using different methods and data analysis but they often reach very different results. While some findings point to a growth-enhancing role of external borrowing, others highlight its potential to hinder economic expansion. The absence of consistent evidence has prevented the emergence of a clear consensus, leaving the debt growth linkage unresolved and reinforcing the need for further context-specific empirical research (Chigeto, 2017; Daud, 2020).

Studies examining the connection between foreign debt and economic development have produced mainly contradictory research finding (Mahammed,2025). Certain research indicates that obtaining funds from international lenders can stimulate economic expansion, particularly when these resources are directed toward productive investments and development initiatives (Govdeli, 2019; Musibau *et al.,* 2018; Okoye *et al.,* 2017; Spilioti and Vamvoukas, 2015). Conversely, alternative studies propose that excessive foreign borrowing may hinder development by creating repayment difficulties, decreasing investment levels, and undermining economic stability (Al

Kharusi and Ada, 2018; Daud, 2020; Gachunga, 2018; Getinet and Ersumo, 2020; Moh'd Al-Tamimi and Mohammad, 2019; Senadza *et al.*, 2017). This negative view is supported by Udoh *et al.* (2020), who used a method called autoregressive distributed lag (ARDL)to show that passing on debt across generations hurts Nigeria's economic growth. Similar results were found by Awan and Qasim (2020), are researchers who conducted a practically research on the current issue and found that external debt has a clearly shown significant harmful effect on economic growth in Pakistan (Sandow, 2022).

The relationship between foreign debt commitments and economic growth patterns demonstrates a fundamentally non-linear nature. Research findings indicate that borrowing may stimulate growth only until reaching a specific limit, after which further debt accumulation proves harmful. Investigations employing this framework reveal that reasonable debt levels can facilitate growth when capital is effectively distributed, while overwhelming debt burdens create negative economic effects (Doğan and Bilgili, 2014; Égert, 2012; Reinhart and Rogoff, 2010). These contrasting results underscore persistent empirical challenges and establish compelling grounds for continued research into the ideal debt-growth dynamic.

The research timeframe was selected due to the accessibility, reliability, and comprehensive nature of data available for all model variables. The majority of information was obtained from domestic sources, including the National Bank of Ethiopia (NBE) and the Central Statistical Agency (CSA). When local sources provided insufficient or missing data, additional information was gathered from established international databases, particularly those maintained by the International Monetary Fund (IMF) and the World Bank (WB) (Canton, 2021).

Materials and Methods

Research Design

The research is rooted in a quantitative methodology framework, which proves appropriate for analyzing numerical correlations and validating economic theories through the use of secondary data sources. Through the application of econometric techniques, this approach enables comprehensive assessment of the relationship between foreign debt and economic development (Saungweme, 2020).

Sources and Types of Data

The empirical investigation utilizes yearly time-series information covering the period from 1981 to 2022, offering an adequately extended timeframe for dependable statistical conclusions. This research depends entirely on secondary information sources, encompassing over forty years of data, which strengthens the analytical foundation and allows for examining both extended-period and immediate-term relationships.

The research timeframe was chosen considering the availability, dependability, and completeness of pertinent information for all variables included in the model. Original data sources were obtained from domestic institutions, particularly the National Bank of Ethiopia (NBE) and the Central Statistical Agency (CSA). In cases where local documentation proved inadequate or unavailable, supplementary data were sourced from internationally recognized databases, including those managed by the International Monetary Fund (IMF) and the World Bank (WB) (Canton, 2021).

Econometric Model

Evaluating how external debt influences economic growth necessitates a robust theoretical foundation that connects borrowing patterns to long-term growth outcomes. Therefore, this research is based on neoclassical growth theory, which highlights capital accumulation, workforce changes, and technological advancement as the primary drivers of continuous economic development.

Following previous empirical studies (Aswata *et al.,* 2018; Hassan, 2020; Sani *et al.,* 2019), the analytical structure relies on the Cobb–Douglas production function, which is presented as follows (AS Hassan,2020):

$$Y_t = K_t^{\alpha}{}_t (A_t L_t)^{1-\alpha} \ldots \ldots \ldots . . (1)$$

In the above specification, Y_t denotes the level of aggregate output (income) in the economy at time t. K_t represents the stock of physical capital, while L_t refers to the labor input employed in the economy at the same period. (Carlin *et al.*, 2024). The term A_t captures the level of technological progress. The parameter α measures the output elasticity with respect to capital, whereas $1-\alpha$ reflects the output share attributable to labor, with the restriction that $0 < \alpha < 1$ (Makhubele, 2024).

Technological advancement is thought to make work easier (Harrod-neutral), meaning that effective labor is shown asAL. The production function shows that doubling all inputs will dou ble output,which lets us talk about output per ef fective worker. This change makes it easier to s tudy how productivity and growth change over time.

$$\frac{Y_t}{A_t L_t} = \frac{K^{\alpha}{}_t (A_t L_t)^{1-\alpha}}{A_t L_t} = \frac{K^{\alpha}{}_t}{(A_t L_t)^{\alpha}} \ldots \ldots (2)$$

Then it becomes capital to effective labour ratio as following

$$y = k_t^{\alpha} \ldots \ldots \ldots \ldots \ldots \ldots . (3)$$

Furthermore, based on the foregoing discussion, output per effective unit of labor can be assumed to be constant and to evolve in accordance with the next equations (4) and (5) (Tola, 2023).

$$\frac{Y_t}{L_t} = \frac{A_t L_t^{1-\alpha}}{L_t} \ldots \ldots \ldots \ldots \ldots \ldots \ldots . (4)$$

$$y_t = A_t (k_t)\alpha \ldots \ldots \ldots \ldots \ldots \ldots \ldots (5)$$

By taking the natural logarithm of the above equation, it can be expressed in the following form:

$$Lny_t = lnA_t + \alpha lnk_t \dots\dots\dots\dots (6)$$

After equation 5 can be turned in to natural logarithm, as shown in equation 6, it is also can be done by adding an external debt variable into the equation and substituting it in to equation 7. The result below can be derived like this.

$$Lny_t = \ln A_t + \alpha\ln D_t + \alpha\ln k_t \dots (7)$$

$$Lny_t = \ln A_t + \alpha\ln D_t + \alpha\ln k_t + \varepsilon_t \dots (8)$$

In equation (8),D stands for external debt,k shows the amount of physical capital that affects how much each worker can produce,andÎ¼isthe error term. To check if external debt has a nonlinear impact on economic growth, we can change can change the equation to include the squared term of D (Tola, 2023). This helps in understanding ifthere are certain points wherethe effect of debt changes or if its impact decreases over time.

$$Lny_t = \ln A_t + \alpha\ln D_t + (\alpha\ln D_t)^2 + \alpha\ln k_t + u_{t_m}(9)$$

In this case u_t is a stand for a new error term for the equation (Tola, 2020).

Model Specification

Based on the theory, a framework for studying growth is created to look at how outside debt affects the economy. The model uses a real GDP per person as a main thing being measured and includes several macroeconomic factors, like external debt, as things that explain the changes. Adding a lagged version of the main variable helps the model understand how growth continues and changes over time.

$$Lny_t = \ln A_t + \alpha\ln D_t + (\alpha\ln D_t)^2 + (EXD_{it})^2 + \alpha\ln k_t + u_{t_m}(10)$$

Within this framework, the variable t represents time, while the annual real GDP per capita for country i during period t is indicated. The delayed dependent variable reflects the starting GDP per capita level. The independent variable EXD corresponds to the nation's complete external debt stock. Additionally, the external debt squared component is included in the framework to investigate whether a nonlinear association exists between external debt and economic development in Ethiopia throughout the research timeframe (AS Hassan, 2020; Dawood *et al.*, 2024; D'Andrea, 2022; Hassan and Mayer, 2021).

Where t is time t Y_t represent the GDPP for a country equivalent to GDPP i at time t annually. Whereas, Y_{t-1} represent the initial GPDPP or the first lag of the dependent variable. The explanatory variable EXD represents a total external debt stock for the country. In addition, $(EXD_{it})^2$ the squared of this variable in a model will be used to test for the existence of nonlinear relation between external debt and economic growth for Ethiopia under the study (Tola, 2023).

All variables are transformed into natural logarithms, which facilitates interpreting the coefficients as elasticity and helps mitigate potential heteroskedasticity. The resulting empirical model, designed to test the debt overhang hypothesis, is specified as follows:

$$lnGDPPt = \alpha + \beta1 lnEXD + \beta2(lnEXD)^2 + \beta3 lnDSERV + \beta4 lnGCF + \beta5 lnTOT + \beta5 lnEXR + \beta6 lnINF + \varepsilon t \dots (11)$$

Where,

GDPP t = GDP at time t
EXD = Stock of external debt to GNI ratio
DSERV= Debt servicing
GCF= Gross capita formation
TOT=Terms of trade (captures external shocks)
EXR = Exchange rate
INF = Inflation rate

In the above model the parameters β1… β₆ is representing the coefficient of elasticity's measures (Tsigereda, 2017).

Variable definitions and priori expectation

The definition of variables and measurement methods adhere to conventional standards established in research on economic growth and debt. All metrics are calculated annually to maintain consistency across different time periods and facilitate the examination of trends. The anticipated direction of coefficient values is based on established economic theory and results from prior empirical studies.

Method of Estimation

Autoregressive Distributed Lag (ARDL) bounds testing method created by Pesaran *et al*. (2001) was used in this study to look at both long-term balance connections and short-term changes between the variables. The ARDL method is good for this because it works with variables that have different levels of integration, like I(0) or I(1), and it works well even with small data sets (Sarawar, 2023) (Table 1).

Table 1. Description and measurement of variables

No notations	Description	Expected sign	Measurement	Sources
Dependent variable				
1. GDP	Per capita GDP		annual %	NBE
Independent variables				
2. EXD	External debt stock	Mixed	% GDP	IMF &WB
3. TD	Term of Trade	Positive	ratio of GDP	WB
4. GCF	Gross capital formation Positive		Annual %	WB
6. ER	Exchange rate	Positive	Annual %	NBE
7. INF	Inflation rate	Negative	Annual %	NBE
8. DSERV	Debt services	Negative	Annual %	WB

Source: Author's description, 2023. NBE: National Bank of Ethiopia, IMF: International Monetary Fund, WB: World Bank.

The presence of co-integration among the variables is evaluated using the ARDL bounds testing procedure, whereas short-run dynamics are analyzed via an Error Correction Model (ECM) derived from the estimated ARDL framework. The inclusion of lagged terms for both the dependent and explanatory variables enables the model to capture dynamic relationships and the speed at which deviations from long-run equilibrium are corrected (Gafsi, 2025).

$$\Delta GDPP\,t = \beta_0 + \beta_1 EXD + \beta_2 EXD2 + \beta_2 DSERV + \beta_2 GCF + \beta_2 TOT + \beta_2 EXR + \beta_2 INF + ECT_{t-1}\cdots(12)$$

The best number of lags is chosen first by using a basic Vector Autoregressive(VAR) model and the Akaike Information Criterion(AIC). Once the right number of lags is found.

An unrestricted Error Correction Model (ECM) is then used to show both the short-term change and how quickly the variables actually return to their long-term balance obtained (Fernandez *et al.,* 2020; Ubesue, 2016).

$$\Delta GDPP\,t = \beta_0 + \sum_{i=0}^{p}\beta_1\Delta GDPPt-1 + \sum_{i=0}^{p}\beta_2\,\Delta EXDt + \sum_{i=0}^{p}\beta_3\,\Delta EXD^2 + \sum_{i=0}^{p}\beta_4$$
$$\Delta DSERVt + \sum_{i=0}^{p}\beta_5\Delta GCFt + \sum_{i=0}^{p}\beta_6\Delta TOTt + \sum_{i=0}^{p}\beta_7\,EXRt\sum_{i=0}^{p}\beta_8$$
$$\Delta INFt + \beta_9 GDPPt-1 + \beta_{10}EXDt + \beta_{11}\,EXDt^2 + \beta_{12}DSERVt + \beta_{13}GCFt + \beta_{14}TOTt + \beta_{15}EXRt + \beta_{16}INFt + ECTt-1\cdots(13)$$

The error correction term (ECT) is the defined in the following equation (Jama, 2021) as: stated as follows:

$$ECT_{t-1} = \Delta GDPP_t - \beta_0$$

$$- \sum_{i=0}^{p} \beta_1 \Delta GDPP_t - 1 - \sum_{i=0}^{p} \beta_2 \, \Delta \, EXD_t - \sum_{i=0}^{p} \beta_3 \, \Delta \, EXD^2 - \sum_{i=0}^{p} \beta_4$$

$$\Delta DSERV_t - \sum_{i=0}^{p} \beta_5 \Delta \, GCF_t - \sum_{i=0}^{p} \beta_6 \Delta TOT_t - \sum_{i=0}^{p} \beta_7 \, EXR_t - \sum_{i=0}^{p} \beta_8$$

$$\Delta INF_t + + ECT_{t-1} \, ... (14)$$

Results and Discussions
Descriptive Analysis

The descriptive statistics demonstrate significant fluctuations in Ethiopia's economic outcomes during the research timeframe from 1981 to 2022. Real GDP per capita expanded at a mean rate of roughly 5.6 percent, with the weakest growth figures recorded during the mid-1980s and the strongest performance noted in more recent periods (Sukadi, 2020). The comparatively restrained standard deviation indicates that while economic expansion varied across different periods, it consistently stayed within established parameters.

Furthermore,the country's external debt remain s high, averaging 58.92 percent of its Gross National Income from 1981 to 2022 as clearly shown below in figure 1. As a result, during this time period, the country has been accumulating more debt, with the debt burden increasing from a minimum of 10.5 to a maximum of 147.1 percent (Anosike, 2024). This justifies that financial gaps in the country is more highly supplement by foreign borrowing to bridge up gaps during financial constraints.

Trend Analysis of Economic Growth and Variables of Interest

The gross domestic per-capita of the country was sharply declined in 1993 from 293.35 to 176.46 in 1994 and was on stable trend up to 2004.This result align with Khuliso,2023. The economic performance of the country was begun to behave continuous improvement over the time starting from 2004 to 2020. However, the trends of external debt significantly fluctuate over time between 1980's-2005. The level debt stock as percentage GNI was larger in last two decades for the country than total debt stock in 2015 to 2022 over the passage of time. Generally, the trend of level debt stock as percentage GNI was stable beyond 2006 onwards for the country (Getinet and Ersumo, 2020).
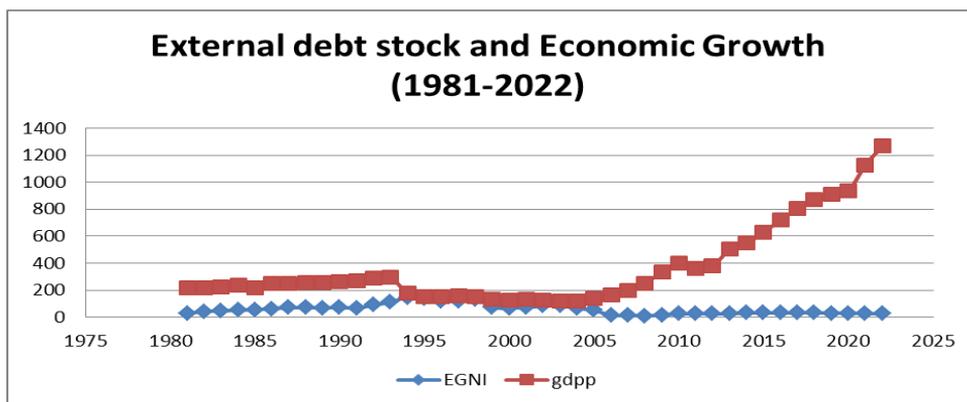

Figure 1. Trend of external debt stock and Economic growth
Source: Author's computation using NBE and WB database for EGNI and GDP per-capita respectively, 2023.

Fig. 2 below illustrates the relationship between total debt service and GDP per capita (GDPP) over the study period. The trend shows that total debt service has generally increased at a relatively steady pace, while the mean GDPP exhibited a gradual upward trajectory until 1997, after which it declined. From 2004 onward, GDP per capita experienced a sharp rise, significantly diverging from its previous

trend, before moderating in 2011. In contrast, the debt service trend remained relatively stable, displaying fewer pronounced fluctuations over the same period.

There was slightly small change in debt service in country. This indicate that the country is not totally service all of his debt burden with stated time this created the problem debt accumulation over the passage of time. The GDPP of the country was increasing slowly over the time between the ranges of 1981 to 1993 then after there was down turns in economic growth in the country (Makuria, 2013). After 1990 the economic performance of the country improving over time up to 1998 before becoming to down turns and continuously curb up over time from 2000 a head. This fluctuation in economic performance over time in a country is might be due to policy changes, drought in the region and political instability the country encountered during Ethio-Eritrea war from 1998-2000.
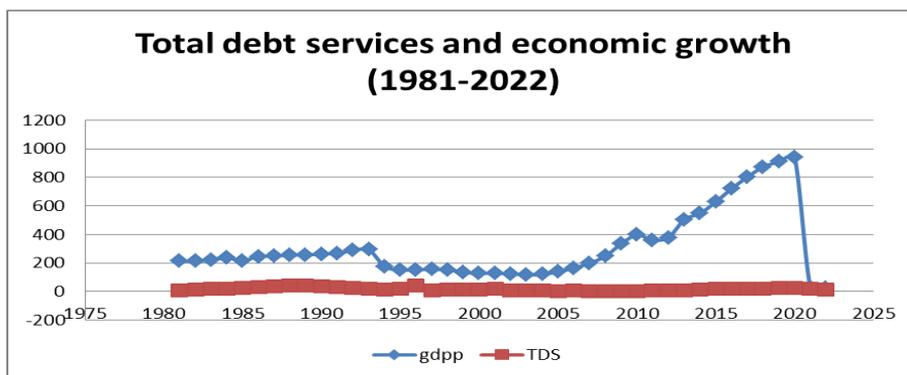

Figure 1. Total debt service data against GDPP values over the study period
Source: Own computation using NBE and WB database for TDS and GDP per-capita respectively, 2023.

Model Diagnostic Test

The ARDL model in this study passes through all standard econometric validity and robustness tests. Hence, the tests are presented as follows.

Unit root test

To verify the reliability of the time-series examination, the stationary characteristics of all variables were assessed through the Augmented Dickey–Fuller (ADF) test (Abdirashid, 2017). The findings reveal that the majority of variables display non-stationary behavior in their original forms but achieve stationarity following first-order differencing, whereas the inflation rate demonstrates stationary properties at its original level across multiple model configurations (Kholera and Sin, 2023).

Table 2. Stationarity tests for the study variables.

	Lngdpp	Lngcf	Inf	Egni	Egni^2	Rer	Tds
Stationarity I(0)							
With cst and trend	0.2830 (0.9744)	2.0152 (0.9998)	-5.5986 (0.000*)	-1.4773 (0.5344)	-1.7135 (0.4168)	-1.9688 (0.2988)	-2.0577 (0.2622)
With constant	-0.5936 (0.9738)	-1.3549 (0.8585)	-5.9677 (0.0001*)	-2.2348 (0.4580)	-2.1532 (0.5012)	-2.1227 (0.5175)	-2.2792 (0.4348)
Without cst and trend	1.2930 (0.9478)	3.2483 (0.9995)	-4.1750 (0.000*)	-0.7310 (0.3934)	-1.2879 (0.1791)	-0.3772 (0.5419)	-0.6355 (0.4355)
Stationarity I(1)							
With cst and trend	-3.7906 (0.0064*)	-7.1834 (0.0000*)	-16.6174 (0.0000*)	-5.757 (0.0000*)		-5.875 (0.0000*)	-7.857 (0.0000*)
With constant	-4.0771 (0.0142**)	-9.3382 (0.0000*)	-16.2601 (0.0000*)	-5.718 (0.0002*)		-7.602 (0.0000*)	-9.084 (0.0000*)
Without cst and trend	-3.6375 (0.0006*)	-5.9428 (0.0000*)	-15.5083 (0.0000*)	-5.820 (0.0000*)		-5.963 (0.0000*)	-7.985 (0.0000*)

Source: Author computation using Eviews 10, 2023. *, ** and *** indicate statistically significant at 10%, 5% and 1 % probability level, respectively (Tadele, 2015).

The findings from unit root testing across three different model specifications are displayed in Table 2. These findings reveal that when examined in their level form, all variables exhibit non-stationary behavior with the exception of the inflation rate. The majority of series demonstrate probability values that surpass the 5 percent significance threshold, confirming the existence of unit roots (IMF, 2020), whereas the inflation rate achieves stationarity only following first differencing. Upon applying these tests to the first-differenced series, all other variables attain stationarity, indicating that the majority of variables follow an integration of order one, I(1), while certain variables maintain integration of order zero, I(0) (Sekwati, 2025).

The simultaneous presence of I(0) and I(1) variables suggests the potential for a long-term equilibrium relationship to exist among these series. For this purpose, the Autoregressive Distributed Lag (ARDL) methodology introduced by Pesaran *et al*. (2001) proves especially appropriate, as it allows for the estimation of co-integration relationships between variables having mixed integration orders through ordinary least squares. The ARDL model framework establishes the dependent variable as a function of its previous lagged values alongside both current and lagged values of the independent variables, utilizing an optimally determined lag structure.

Multicollinearity Test

Table 3. Correlation analysis

	lnGDPP	Lngcf	Inf	Rer	Egni	Tds
Lngdpp	1.0000					
Lngcf	0.5776	1.0000				
Inf	0.0075	0.2588	1.0000			
Rer	0.3915	-0.1564	0.2018	1.0000		
Egni	-0.0615	-0.6652	-0.4038	-0.0110	1.0000	
Tds	0.4619	-0.2135	-0.2151	0.6198	0.3115	1.0000

Source: Author computation using Eviews 10, 2023

Correlation results indicate that GDP per capita is moderately related to the majority of the explanatory variables (see Table 3). External debt stock is negatively correlated with economic growth, whereas capital formation

and debt service display positive relationships. Notably, all correlation coefficients remain below commonly accepted multi-collinearity thresholds, suggesting that the estimated parameters are not adversely affected by strong linear relationships among the regressors.

information criteria. Although the Schwarz and Hannan–Quinn criteria suggested a more parsimonious lag order, the Akaike Information Criterion (AIC) which is more reliable in small-sample contexts identified two lags as optimal. Accordingly, this lag specification was employed in the subsequent ARDL estimations.

Model Lag selection criterion

Table 4 indicates that the selection of the optimal lag length was based on several

optimal. Consequently, this lag structure was adopted for subsequent ARDL estimations.

Table 4. Table Optimal Lag Length Selection Criteria

Lag	LagL	LR	FPE	AIC	SC	HQ
0	-1150.890	NA	4.26e+16	60.99419	61.33894	61.11685
1	-918.5137	354.6789	6.50e+12	52.13230	55.23510*	53.23625*
2	-837.7472	89.26834*	4.31e+12*	51.24985*	57.11068	53.33509

Source: Author computation using Eviews 10, 2023 *, ** and *** indicate statistically significant at 10%, 5% and 1 % probability level, respectively (Tadele, 2015). LR: Lag Ratio, NA: Not Applicable, FPE: Final Prediction Error, AIC: Akaike Information Criterion, SC: Schwartz-Bayesian Information Criterion, HC: Hannan-Quinn Information Criterion (Tola, 2023).

ARDL Model Bounds Co-integration Test Result

The results from the ARDL bounds test (Table 5) show strong evidence of a long-term balance or connection between the variables (Boakye *et al.*, 2022). According to Sana, 2018, the F-statistics from the ARDL model is higher than the upper critical value at common significance

levels, which means the result shows we can reject the idea that there is no long-term link (Nicosia, 2022). Overall, the result confirms that both the long-term and short-term behaviors in the model can be accurately estimated.

Table 1. Bound test result

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0) Asymptotic: n=1000	I(1)
F-statistic	6.137309	10%	2.03	3.13
K	7	5%	2.32	3.50
		2.5%	2.60	3.84
		1%	2.96	4.26

Source: Author computation, 2023.

As indicated by the F-statistics in Table 5, the F-value of 6.13 exceeds the upper bound values at all levels of significance. This result align with Shinwari *et al.* (2024). This necessitates the rejection of the null hypothesis, which posits no relationship between the variables, in

favor of the alternative hypothesis. This finding strongly suggests the presence of a co-integrating relationship among the variables. Consequently, both long-run and short-run models can be reliably estimated. The subsequent table presents the estimated

parameters for the long-run equation of the model.

Empirical analysis of impact of external debt on economic growth of Ethiopia

Long run ARDL-Result Estimation

The ARDL model was applied with real GDP per capita (GDPP) as the dependent variable to represent economic growth (Nguyen, 2019). The explanatory variables included gross capital formation (GCF), inflation (INF), external debt to GNI (EGNI) along with its squared term (EGNI²), trade openness (TD), the real exchange rate (RER), and debt service (TDS) by Kibona and kirame (2024), Adamu (2017). The Akaike Information Criterion (AIC) was used to determine the optimal lag length, which was found to be two lags for both the dependent variable and all the regressors.

The long-term outcome demonstrates that the extent of external debt is positive and

significant on GDP growth is at the 5 % level, and this has not been possible for other works to discover. Parsers on economic growth with the 5% level of significance level as shown by the model (Ebin, 2020). However, when we look at the squared term of external debt, there is a negative and significant effect at the same level (Hassan, 2020). This shows that the real debt and the economic performance of a state ship between external debt and economy and growth (Abdirashid, 2017).

Before reaching the turning point, an increase in external debt is linked to an average yearly growth of about 4.09%. This means that, in the long run, using external debt in a moderate way can boost private investment by creating positive effects that encourage production in the private sector. In such cases, the benefits from investments funded by debt are enough to cover the costs of repaying the debt. These findings match earlier studies by Chigeto (2017) and Hassan (2020).

Table 6. ARDL long run Estimation Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGCF	0.256712	0.110424	2.324783	0.0327
EGNI	0.040976	0.014964	-2.738257	0.0140
EGNI²	-0.000219	8.36E-05	2.620193	0.0179
TD	0.045769	0.024256	1.886931	0.0764
INF	-0.011174	0.011139	-1.003146	0.3299
RER	0.009119	0.003773	2.417254	0.0272
TDS	-0.038752	0.016984	2.281643	0.0357

Source: Author computation using Eviews 10, 2023.

In table 6, LNGCF stands for Long-run Gross Capital Formation, IMF represents inflation rate, EGNI is External debt as a percentage of GNI, RER EGNI² is External debt stock squared, TD is Term of Trade, and TDS stands for Total Debt Service(Hassan,2020). All these terms are used to describe different economic indicators over time.

The impact of Control Variables on Economic Growth in long run

Gross capital formation is a strong factor that helps drive long-term growth, showing how important investment is for increasing productive capacity. Debt service payments have a clear negative impact, which means paying off debt takes away resources that could be used for spending that helps the economy grow (Duru *et al.,* 2023).

The long-term results show that paying off debt has a strong negative effect on economic growth, and this effect is statistically significant

at the 5% level, which matches what theory predicts. In numbers, if debt payments increase by one percentage point, economic growth is expected to drop by about 3.8%, assuming other things stay the same. This finding strongly supports the ideas that having too much debt can be harmful and that paying it off takes away money that could be used for things that help the economy grow, especially in areas like building infrastructure. Furthermore, this result corroborates existing empirical findings, including those of Yusuf and Mohd (2021) for Nigeria and Nagou *et al.* (2021) for selected African countries, both of which report a pronounced long-run growth-reducing effect of debt service burdens.

The term of trade is the ratio of a country's export prices to its import prices. When the term of trade gets better, it can help increase economic growth (NESDC, 2024). This means that when a country gets better terms of trade (Nguyen, 2023), it can charge more for what it sells and pay less for what it buys. Long-term estimates show that the term of trade has a positive effect on Ethiopia's economy (Awadzia *et al.,* 2025; Sinta and Moraref, 2024). Specifically, a 1% increase in the term of trade is expected to raise economic growth by 4.5% each year, and this effect is significant at the 1% level, assuming other factors stay the same (Ali-mohamed *et al*., 2025).

Moreover, the estimated long-run elasticity of the real exchange rate shows a positive and statistically significant relationship with economic growth at the 5% significance level.

Specifically, a 1% increase in real exchange rate undervaluation is linked to about a 0.9% increase in economic growth per year, all else being equal (Kamphasa, 2021). This suggests that keeping a relatively competitive real exchange rate can help improve growth by supporting export performance and domestic production. This result is consistent with the findings from Rapetti (2020), who found that real exchange rate dynamics have a positive impact on economic growth in developing countries (Hellen, 2020).

Short run impact of external debt on economic growth in Ethiopia

The short-run dynamics were studied using an Error Correction Model (ECM). The estimated error correction term is negative, statistically significant, and less than one in absolute value, showing that the system adjusts steadily toward the long-run equilibrium. The coefficient of -0.230584 means that about 23% of any short-term deviation from the long-run growth path is corrected within a year (Ajufo, 2025). This suggests a reasonably quick adjustment speed, where shocks to economic growth in one period are partially reduced in the next. The significance of the error correction term confirms there is a real long-run relationship between the variables, with short-term imbalances slowly moving toward balance at an annual rate of roughly 23% (Awadzia *et al*., 2025; Bosupeng, 2019; Madhu and Giri, 2024).

Table 7. ARDL short-run estimated results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.169789	0.017729	9.576920	0.0000
D(EGNI)	0.004445	0.001893	-2.348230	0.0312
D(EGNI(-1))**	0.007302	0.001965	3.715002	0.0017
D(EGNI (-2))	-2.35E-05	1.04E-05	2.250829	0.0379
D(EGNI2(-1))**	-3.74E-05	9.58E-06	-3.905451	0.0011
D(TD)	0.004770	0.002295	2.078129	0.0532
D(TD(-1))***	-0.010373	0.002076	-4.996470	0.0001
D(INF)	-0.001912	0.000692	-2.764769	0.0133
D(INF(-1))	-0.001257	0.000713	-1.762814	0.0959
D(RER)	0.000861	0.000345	2.495895	0.0231
D(RER(-1))*	0.001265	0.000395	3.206931	0.0052
D(TDS)	0.003207	0.001311	2.446338	0.0256
D(TDS(-1))	-0.003225	0.001497	-2.154503	0.0458
ECM(-1)***	-0.230584	0.027696	-8.325592	0.0000

Source: Model Output (2023) NB: *, ** and *** indicate statistically significant at 10%, 5% and 1 % probability level, respectively. Debt stock (D) for each variables in the model of the study.

As shown in Table 7, the current level of external debt, known as EGNI, has a positive and significant effect on economic growth at the 5% level, matching the long-term results. If everything else stays the same, a one-percentage-point rise in external debt is linked to about a 0.4% rise in real GDP growth. Also, the external debt from one period earlier, EGNI(-1), has a positive and significant impact on current economic growth. This shows that some level of borrowing from abroad can help boost short-term economic growth (Okeke and Udenwa, 2025).

At the same time, the short-term effects of external debt are also statistically significant but have different signs, which fit with the long-term non-linear model. This suggests that external borrowing has two sides for Ethiopia's growth: at reasonable levels, it helps growth by making it easier to get money, but too much debt can lead to problems or create adverse effects that weaken growth performance. Overall, these results provide additional support for the existence of a non-linear debt–growth relationship, confirming that beyond a

certain threshold, external debt becomes detrimental to economic activity (WB, 2011).

Post estimation diagnostics tests

After estimating a model, it's important to run some tests to make sure the results are reliable. In dynamic models, the usual tests that are done include checking are done include checking for normality, autocorrelation, heteroscedasticity, model specification, and stability. These tests help ensure that the regression results from the model are not due to chance or incorrect assumptions, of diagnostic and that they are trustworthy.

Ramsey RESET test checks if the model is correctly set up or if there are any missing variables. The test statistics looks at how well the relationship between the main outcome and other factors is shaped. The result shows a RESET test p-value of 0.64, which is much higher than the usual significance level, even the 10% one (Hellen, 2020). This means there are no missing variables in the model. The autocorrelation test shows that the model isn't affected by serial correlation. The Breusch

-Godfrey Lagrangian Multiplier test result also doesn't provide enough evidence to say the lagged values in the model autocorrelation in the residuals at the 5% significant level (NEPT, 2024).

Table 8. Ramsey RESET Test

	Value	Df	Probability
t-statistic	0.473905	16	0.6420
F-statistic	0.224586	(1, 16)	0.6420

Source: Author computation using Eviews 10, 2023

The Ramsey RESET test was used to check if there are any important variables missing from the model and to see if the model as a whole is correctly specified. The test starts by assuming that the model is properly specified, and this assumption is considered true if the p-value is higher than the chosen significance level. In this case, the RESET test gave a p-value of 0.64, which is much higher than the usual significance levels of 10%, 5%, and 1%. This means we cannot reject the idea that the model is correctly specified, so it doesn't seem to have any important variables missing that could affect the results (Table 8).

Testing for autocorrelation is important because if it exists, the results from the OLS method might not be accurate or efficient, and this could lead to incorrect estimates of the beta values in the regression model. It's important to check for this issue. The autocorrelation test shows that the model does not have serial correlation. The commonly used Breusch-Godfrey test also supports this conclusion, as it does not reject the idea that there is no autocorrelation in the residuals at the 5% significance level.

Autocorrelation Test

Testing this model is important because significantly if there is autocorrelation, the estimates from the OLS method are not efficient and unbiased. This can lead to underestimating the beta values in the popular regression model. It's important to check ifthe model has this issue. The autocorrelation test shows that the model does not have serial Correlation. The most widely used Breusch-Godfrey test also does not reject the idea that there is no autocorrelation in the residuals at the 5% significance level.

Table 2. Breusch-Godfrey Serial Correlation LM Test

F-statistic	1.685798	Prob. F(2,15)	0.2186
Obs*R-squared	6.973843	Prob. Chi-Square(2)	0.0306

Source: Author computation using Eviews 10, 2023

Heteroscedasticity Test

Hetero-scedasticity happens when the spread of the error terms is not the same across all observations of the study, meaning the residuals vary in how far they are from the average line over time. Even though heteros cedasticity doesn't make the ordinary least squares (OLS) estimates wrong or biased, it makes them less efficient because they don't have the

don't have the smallest possible variance (Wool dridge, 2013). The prominent Breusch-Pagan-Godfrey test in Table 10 shows that both the F-statistical probability (0.86) and the Chi-square probability (0.74) are higher than the 5% significance level (Table 10). This means we means This means we can't reject the idea that we actually learn from this the error terms have constant variance, so we c onclude thatthe error spread is consistent and e venly around the average line.

Table 3. Heteroscedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.592519	Prob. F(20,17)	0.8689
Obs*R-squared	15.60862	Prob. Chi-Square(20)	0.7406
Scaled explained SS	2.887024	Prob. Chi-Square(20)	1.0000

Source: Author computation using Eviews 10, 2023.

Normality Test

After the model was estimated, several checks were done to make sure it was strong and dependable. First, the Ramsey RESET test was used to check if the model was set up correctly. The result had a p-value of 0.64, which means we can't say for sure that the model is missing important variables. Next, the Jarque–Bera test checked if the leftover numbers from the model followed a normal pattern. The test gave a JB value of 0.605 and a p-value of 0.73 (Fig. 3), showing the leftovers are normally spread out

(Makuria, 2013). Then, tests for patterns over time and changing error sizes didn't find any problems. Finally, the CUSUM and CUSUMSQ tests checked if the model's key numbers stayed stable over time, and both stayed within expected limits (Mahmood, 2013). All these tests together show the model meets the main rules for good regression analysis, making the findings trustworthy and accurate.
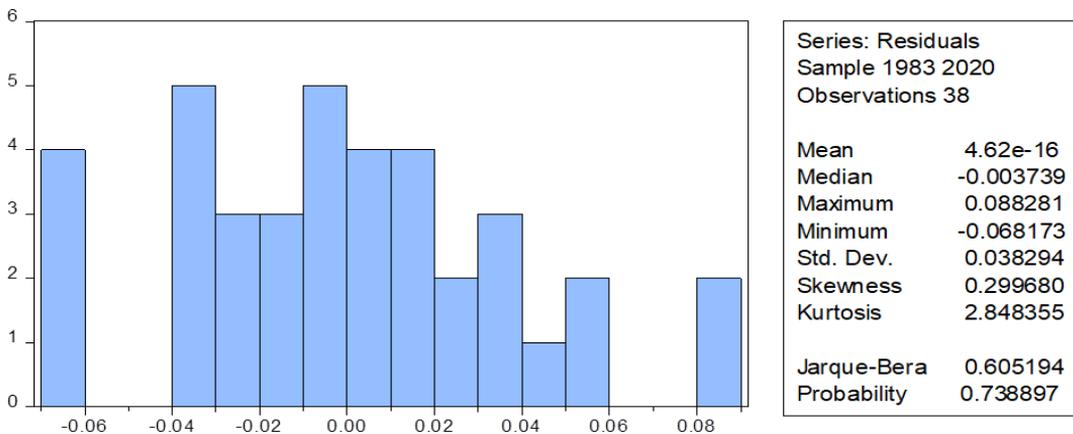

Figure 2. Normality Test: Jarque-Bera (JB) probability.

Source: Author computation using Eviews 10, 2023

Stability Test (Structural Breaks in Model)

In econometric analysis, structural break means an unexpected change in the model's parameters over time. This Significantly can make the model less reliable, lead to big forecasting mistakes, and make the study results less trustworthy. To check if the existence of the also the relationships found in the study are strong and reliable, there this research used two tests the cumulative sum are of recursive residuals (CUSUM) of recursive residuals (CUSUM) and final cumulative sum of squared recursive residuals (CUSUMSQ) (Tola, 2023).

Checking for stability is important to make sure the short term and long-term connections found in the model analysis empirically of the

study stay the same throughout the whole time period. These tests, based on the method by Brown *et al*. (1975), use residuals calculated step by step and don't need us to know where to know where breaks might happen, unlike the Chow test. The CUSUM test looks at the total the total of the recursive residuals, certainly while CUSUMSQ does the same but with the squared values of the result, the residuals. If the plotted results stay within the plotted result 5% significance level lines, we can't reject the idea can't reject the idea that the parameters are stable. However, if they cross those lines, it means there's a structural change observed, and we reject the idea of stability.

Figure 4 shows that the model result indicate the CUSUM plot stays within the value 5% significant lines (marked 5% by two red lines) At the same level of significance, were the

CUSUMSQ test gives similar results, supportin g the idea that the model is stable (Makhubele, 2024). We accept the idea that the parameters are stable and evenly spread out. Our model passed all the tests for diagnosis and stability. The straight lines in the chart show the 5% significance level.

The model's stability was checked using the CUSUM and CUSUMQ tests to make the to make the study results more believable

(Boakye *et al*., 2022; Selenik, 2024). At the 5% significance level, both tests shows consistent results, meaning the parameters are stable and evenly distributed. This shows the model meets all the necessary conditions necessary conditions for diagnosis and stability ,with the straight lines in the charts of the study representing the 5% critical limits.
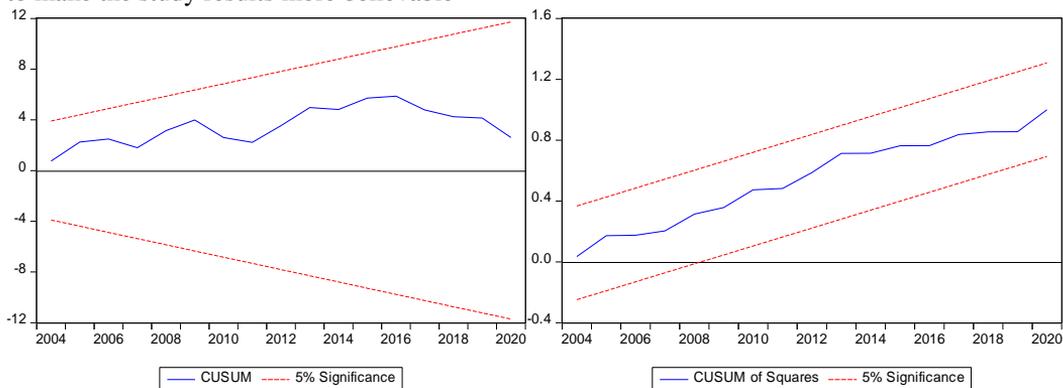

Figure 4. Stability Test: Structural Breaks in Model
Source: Author computation using Eviews 10, 2023

Conclusions

This study looks athow external debt has affect ed Ethiopia's economic growth over 40 years, from 1981 to 2022, using time series data. The reason for this study is because Ethiopia has often depended on borrowing from outsideto cover its yearly budget needs at differ ent times. During this time, the country has heavily relied on money coming in flowing from foreign sources to fill in the gaps in its domestic finances. This makes Ethiopia one of the most indebted countries in the East Africaregion. The high level of dependence on foreign funds shows that domestic financial resources are limited and that domestic saving are low. Because of this, borrowing has been seen as important for dealing with the most country's twin deficit problems and for helping to keep the economy growing.

To do this, the study mostly used an ARDL co-integration method to explain the long-term strong relationship between the variables. It also used an ECM to understand the short-term changes inthe relationship between extern

al debt and economic growth in Ethiopia. The results from the ARDL co-integration ARDL showed that there is a long-term connection between the variables used in the study.

The estimation results reveal that external debt exerts a nonlinear effect on Ethiopia's economic growth over the study period, operating in both the short and long run. At moderate levels, external debt contributes positively to economic growth by supporting investment and productive capacity. However, once debt exceeds a critical threshold, its impact becomes negative, reflecting rising debt-servicing burdens and macroeconomic inefficiencies. This evidence confirms the presence of an inverted U-shaped relationship between external debt and economic growth, indicating that while sustainable debt accumulation can foster economic expansion, excessive external indebtedness constrains growth performance.

Recommendation and Policy Implications

Drawing on the study's findings, targeted policy measures are recommended to help the government and policymakers manage external debt and its implications for economic growth. The results demonstrate a nonlinear relationship between external debt and economic performance in both the short and long run. While moderate levels of external debt contribute positively to growth, excessive accumulation exerts a significant adverse effect, underscoring the need for prudent debt management strategies.

Therefore, the sound policy implications following this finding suggested for the government. The government should work hard to cut down its heavy reliance on foreign loans and use the money borrowed from outside in ways that help the country grow and develop. By doing this, the government can make more money and be better able to pay back its debts. This helps create a sustainable debt situation that supports strong economic growth, removes the negative effects of debt, and brings in more investments. To support both sustainability and growth, the government must manage debt-related projects carefully so that they bring in income and allow timely repayment of the loan payments. Also, the money borrowed from abroad should not be used for everyday expenses, paying off old loans, or for projects that don't create value. Instead, it should be directed towards long-term projects that can boost the country's manufacturing sector and increase its growth rate.

Rather than relying heavily on external debt to finance development, the government could prioritize mobilizing domestic resources to strengthen revenue collection and address the country's financial gaps. This can be achieved by implementing innovative strategies to expand the tax base, reform tax administration, and minimize tax evasion and avoidance. Simultaneously, external debt should be allocated efficiently to support poverty reduction, address infrastructure deficits, stimulate production, and promote overall economic development. Proper allocation can foster inclusive growth while mitigating the negative impact of external debt on economic performance. Additionally, the government should manage capital outflows strategically, including debt servicing, through skilled negotiations with international donors and creditor countries.

According to the study, the government and those who make policy decisions should take clear steps to manage external debt and its impact on the economy. The results show that the relationship between external debt and how the economy is doing isn't always clear. It can change depending on the time. At a moderate level, external debt can help the economy grow, but if it gets too big, it can slow down growth. This shows how important it is to handle debt carefully to prevent issues.

Therefore, the government should carefully reduce its reliance on external debt and use borrowed funds in ways that help development and create value. By doing this, the government can earn mor income and better manage its ability to pay back debts. This approach helps maintain a sustainable level of external debt, which supports economic growth and removes negative effects of debt, making the country more attractive to investors.

To make sure that growth and sustainability go hand in hand, the government must manage debt-based projects well so that they can generate can generate income and repay debts on time. Also, borrowed funds should not be used loans be used for everyday expenses, paying back old loans, or projects that do not help the economy not help the economy. Instead, these funds should properly be directed toward long-term investments, which can help increase the growth rate of the manufacturing sector.

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Declaration of conflict of interest

The author declare that there is no competing interest.

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