Analyzing the Relationship Between Public Debt and Economic Growth in Nepal: An ECM Approach

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Abstract

The complex relationship between public debt and economic growth hinges on factors like debt sustainability, investment efficiency, and fiscal policy effectiveness, where excessive debt may stifle growth, while prudent management can bolster development initiatives. This paper delves into the analysis of the connection between public debt and economic growth in Nepal, spanning from fiscal year 1990/1991 to 2021/2022. The study employs conventional Error Correction Model (ECM) techniques, utilizing both descriptive and analytical research approaches with secondary data. Over the observed period, Nepal's GDP exhibited substantial growth, coinciding with an upsurge in total debt, hinting at a complex but generally positive connection. The regression analysis echoes this notion, emphasizing that internal and external debt can have a favorable impact on short-term GDP, but vigilance in managing high total debt levels is crucial. Nevertheless, the presence of potential autocorrelation in residuals necessitates further investigation for model refinement and policy implications. Prudent debt management in Nepal is crucial for fostering economic growth, necessitating prioritization of productive investments, fiscal discipline, and sustainable borrowing practices

Keywords: *Internal debt, External debt, Total debt, Impact, Descriptive, Economic growth*

1. Introduction

Public debt encompasses the money a government owes to external and domestic creditors, comprising borrowed principal and accrued interest. It serves as a financing tool when government revenue falls short of funding necessary activities and projects.

Economic growth measures a country's increasing overall economic output over time, reflecting improved productivity, investment, and resource allocation. When governments face budget deficits due to low revenue and high public demand, they may turn to options like borrowing and public debt to manage the fiscal burden and shift some costs to future generations.

The link between public debt and economic growth is intricate and debated. Public debt can stimulate growth through productive investments but may hamper it with high interest payments, crowding out private investments. Unsustainable debt can erode confidence and

lead to austerity measures, making the relationship context-dependent, requiring prudent debt management and balanced fiscal policies to maximize benefits and mitigate risks to growth.

Nepal's economic challenges include inadequate infrastructure, traditional agriculture, low investment, unemployment, energy crisis, and shocks from natural disasters and COVID-19, hindering growth (Ministry of Finance (MOF), 2021).

Public debt involves repaying borrowed principal plus interest to various entities, including individuals, institutions, and governments, within a specified timeframe. This significant concern affects present taxpayers, future generations, and overall expectations, carrying the risk of crisis contagion and growth challenges in our increasingly interconnected global landscape (Rosen, 2004; Musgrave, 1983).

Government debt, from both internal and foreign sources, addresses resource shortfalls for development and economic growth due to inadequate internal income, reflecting a democratic approach (Backhaus & Wagner, 2006)

Nepal faces financial challenges due to increasing government expenditure driven by inclusive policies since the 1990s. Over 47 years, total expenditures grew from Rs. 1,513.7 million (1975) to Rs. 1,079,978.8 million (2021), leading to rising domestic and external debts as sources of financing, with outstanding debts increasing significantly from Rs. 476.4 million to Rs. 800,320.1 million domestically and from Rs. 346.1 million to Rs. 927,926.0 million externally (Ministry of Finance (MOF), 2022).

Economic planning for development relies on resources, but government revenues from taxes and non-taxes are insufficient to meet growing demands; thus, public debt is crucial for resource mobilization, particularly in poor nations like Nepal striving to improve living standards through public expenditure.

As governments at different levels address people's needs, public debt becomes vital for inclusive growth, infrastructure, and social harmony. While essential, mismanagement and high debt levels can hinder development, necessitating empirical examination of debt's impact on real GDP.

Public debt can either positively fill resource gaps for development and improve living standards, or negatively burden the economy if resources are mismanaged or debt-financed projects fail to generate revenue for repayment, leading to sluggish growth and a debt trap. This study Analyzing the relationship between public debt and economic growth in Nepal.

2. Literature Review

Various research findings present divergent perspectives: Reinhart & Rogoff (2010) associated high debt/GDP levels (90% and above) with reduced growth, whereas Matiti (2013) identified a positive link between public debt and economic growth in Kenya. Tarick (2015) observed detrimental effects of domestic and external debt beyond specific

thresholds, while Mencinger et al. (2014) revealed non-linear impacts of public debt ratios on GDP growth in EU member states. Additionally, Shah & Pervin (2012) emphasized the enduring and significant influence of external debt service and stock on long-term GDP growth. Recent debt crises in Sri Lanka, Greece (2017), and Asia (1997) support classical economic concerns about excessive deficit financing (Gaspar et al., 2018; Ludvigson, 1996).

Despite increased budget and rising public debt, the Nepalese economy faces challenges with its low economic growth rate of 4.28% and a relatively high average inflation rate of 8.31%. According to Bhatta & Mishra (2020), achieving debt sustainability in Nepal requires targeting an optimal public debt to GDP ratio of 33%, necessitating significant GDP growth, higher investment, and a blend of increased savings and borrowing strategies.

Gurughararana (1996) raised concerns about the rising share of foreign debt in Nepal's foreign aid, hinting at a possible future debt crisis despite favorable terms. Koirala (2002) stressed the necessity of a debt management plan, presenting the dilemma of choosing between increased foreign debt for development or inaction. Pyakuryal (2004) highlighted Nepal's insufficient revenue surplus for development, with a growing debt service burden in the budget, underscoring the importance of careful external resource management

Bista (2011) found a negative relationship between public external debt and per capita GDP and investment in Pakistan from 1972-2009. CEID Nepal (2012) emphasized the importance of debt sustainability and evaluated the impact of debt on macroeconomic performance, providing recommendations.

Bhatta & Mishra's (2020) research revealing Nepal's optimal threshold at 33%, beyond which excessive public debt negatively impacts economic growth. Shrestha (2021) highlights potential benefits of productive debt use but acknowledges the risk of economic decline or default if Bhatta and Mishra's findings hold, given Nepal's current 41% Debt to GDP ratio.

Governments acquire both internal and external debt from diverse sources with the aim of fostering development within their respective countries. Consequently, the effectiveness of public debt is expected to exhibit a positive and significant impact on the GDP.

The conceptual framework as shown in figure 1, for this relationship can be illustrated as follows:

Conceptual Framework

Explanatory Variable   Dependent Variable

| Total Debts (TD) |

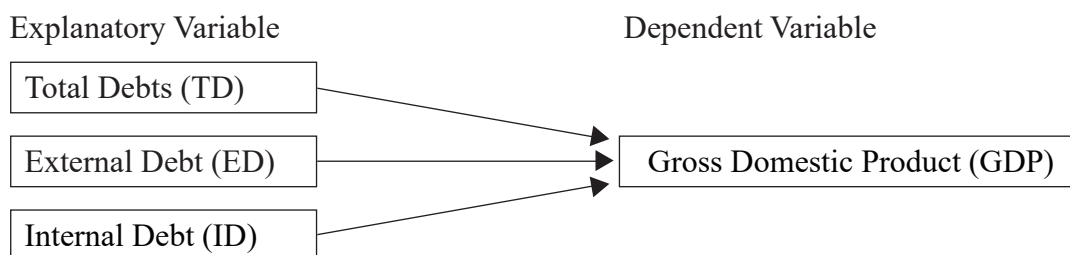| External Debt (ED) | → | Gross Domestic Product (GDP) |

| Internal Debt (ID) |

Figure 1: Conceptual Framework

The relationship between the explanatory variables in Nepal can be complex. Internal Debt (ID) may positively influence GDP when invested productively but can negatively affect growth if mismanaged. External Debt (ED) can contribute to GDP growth when used efficiently but may become detrimental if servicing costs become unsustainable. Total Debts (TB), representing the overall debt burden, can impact GDP positively with prudent management and productive investments but negatively if misused or unsustainable. The specific effects depend on factors like debt management, investment quality, and economic policies, requiring empirical analysis to determine their precise impact on Nepal's GDP.

3. Research Methodology

This investigation delves into the relationship between public debt and economic growth in Nepal. It employs a descriptive and exploratory approach to analyze how public debt influences the country's economic development. The study utilizes 33 years of secondary data, spanning from 1990 to 2022, sourced from publications by the NRB and Economic Surveys by the Ministry of Finance. GDP serves as a proxy for economic growth, while the study examines internal debt (ID), external debt (ED), and total debt (TD) as predictors. To explore the connection, the Engle-Granger Cointegration Test and Error Correction Model are applied.

3.1 Empirical Method

The empirical model aligns with the theoretical framework and is represented by the following equation. To leverage the desirable time series properties of the variables and facilitate direct elasticity calculation, logarithmic transformations are applied to the variables. Therefore, the econometric estimation model is as follows:

$GDP = \beta_0 + \beta_1\ ID + \beta_2\ ED + \beta_3\ TD + \varepsilon_t$

Where,

GDP= Gross Domestic Product
ID= Internal Debt
ED= External Debt
TD= Total Debt
ε_t = Stochastic Error Term

4. Results and Discussion

Presentation and discussion are divided into two parts; (a) Trend analysis and (b) Empirically econometric analysis.

4.1 Trend Analysis

Trend analysis is a method that involves studying current patterns to make predictions about the future. It examines changes over time, revealing how data tends to fluctuate and whether

it's likely to increase or decrease in the long run. This analysis is essential for understanding the impact of various factors over different time periods and their interactions with other variables. By identifying patterns, trend analysis helps assess the size and consistency of past and recent events, as well as their level of uncertainty. Furthermore, it serves as the foundation for making predictions and projections, taking into account the importance of timing and connections with other predictive factors. Consequently, this study relies on trend analysis to make informed conclusions about future developments.
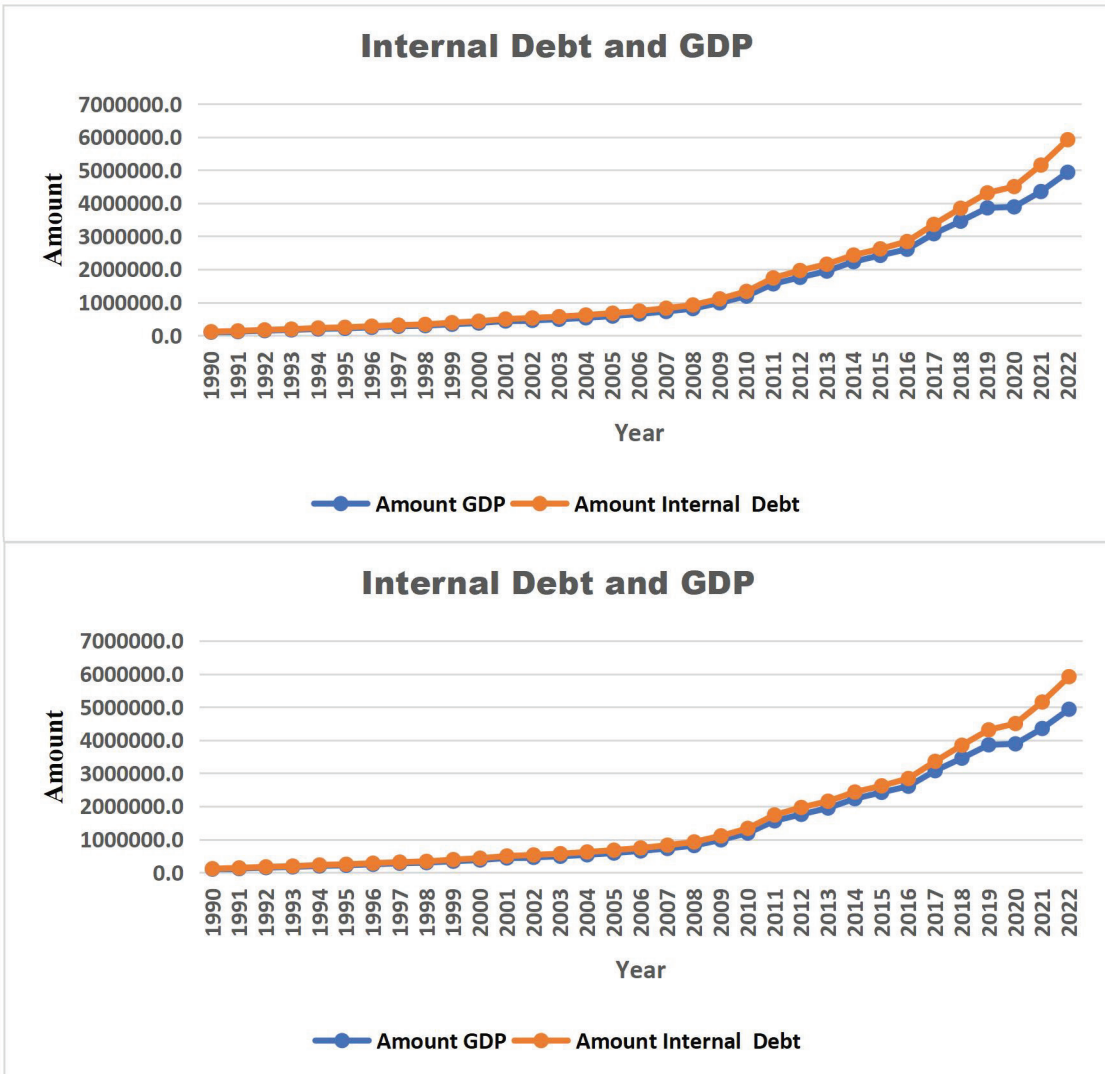

Figure 2: Trend Analysis of Gross Domestic Product (GDP) and Internal Debt(B)
(Source: MOF, Macroeconomics Dashboard)

To assess the trajectory of Gross Domestic Product (GDP) and Internal Debt (I) through statistical analysis, it is necessary to closely examine how their values have evolved over time as seen from figure 2.

GDP Trend: Over this period, the GDP has shown consistent growth from 1990 to 2022. In 1990, the GDP was NRs 103,416.0 billion, and by 2022, it had grown to NRs 4,933,696.6 billion. This represents substantial economic expansion, which indicates a positive trend in the country's economic performance.

Internal Debt Trend: The Internal Debt has also increased during this period. In 1990, the Internal Debt was NRs 14,673.1 billion, and by 2022, it had risen to NRs 984,285.2 billion. The Internal Debt has consistently grown over the years, suggesting that the country has accumulated more debt.

Relationship between GDP and Internal Debt: Looking at the data, we observe that both GDP and Internal Debt have been growing over the years, indicating a positive relationship. This suggests that as the country's economy expands (higher GDP), it has also been accumulating more debt (higher Internal Debt). However, it's essential to note that the rate of GDP growth has not always matched the rate of Internal Debt growth. For example, in some years, Internal Debt growth has been more rapid than GDP growth.

In summary, the data shows that the country's GDP has generally grown over the years, indicating economic expansion. At the same time, the Internal Debt has also increased, showing that the country has taken on more debt. While both GDP and Internal Debt have a positive relationship, the rate of growth in debt has not always aligned precisely with the rate of economic growth, suggesting variations in fiscal policies and economic conditions over the years.

To conduct an analysis of the trends in Gross Domestic Product (GDP) and External Debt (ED) using statistical data, one can closely examine the fluctuations in their values over successive years as observed from figure 3
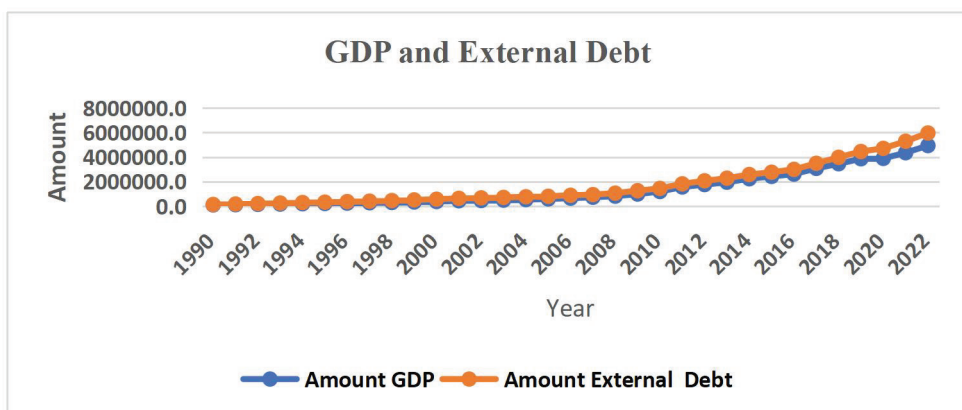

Figure 3: Trend Analysis of Gross Domestic Product (GDP) and External Debt (EB)

GDP Trend: Over this period, the GDP has shown significant growth from 1990 to 2022. In 1990, the GDP was NRs 103,416.0 billion, and by 2022, it had grown to NRs 4,933,696.6 billion. This represents substantial economic expansion, indicating a robust economic trend.

External Debt Trend: The External Debt has also increased over the years. In 1990, the External Debt was NRs 36,800.9 billion, and by 2022, it had risen to NRs 1,025,847.1 billion. The External Debt has consistently grown over the years, indicating that the country has accumulated more debt from external sources.

Relationship between GDP and External Debt: Examining the data, we observe that both GDP and External Debt have been growing over the years, indicating a positive relationship. This suggests that as the country's economy expands (higher GDP), it has also been accumulating more external debt. The rate of GDP growth has not always matched the rate of External Debt growth, which can vary from year to year.

In summary, the data analysis shows that the country's GDP has generally experienced significant growth over the years, indicating economic expansion. Concurrently, the External Debt has also increased, reflecting an accumulation of debt from external sources. While both GDP and External Debt exhibit a positive relationship, the rate of growth in debt does not always perfectly align with the rate of economic growth, emphasizing the importance of monitoring and managing external debt in the context of economic development.
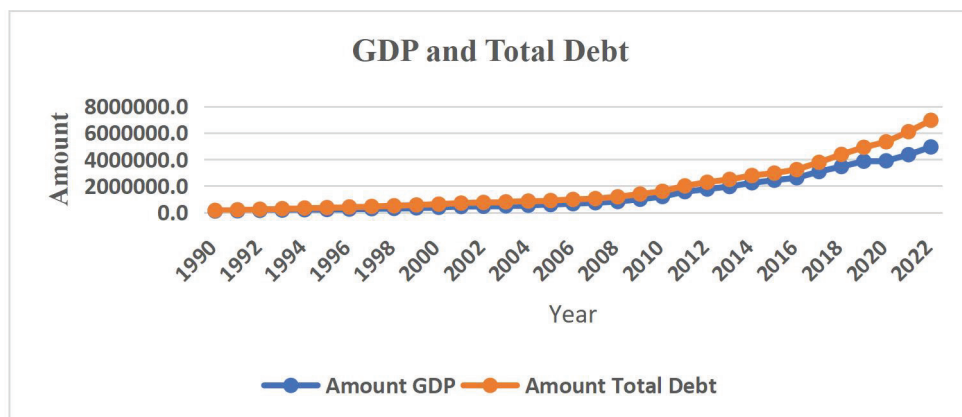

Figure 4: Trend Analysis of Gross Domestic Product (GDP) and Total Debt (TB)

GDP Trend: During the observed period from 1990 to 2022, the Gross Domestic Product (GDP) has displayed remarkable growth as shown in figure 4. In 1990, the GDP stood at NRs 103,416.0 billion, and by 2022, it had surged to an impressive NR 4,933,696.6 billion.

This considerable increase underscores substantial economic expansion, highlighting a strong and sustained upward trajectory in the country's economic performance.

Total Debt Trend: The Total Debt has also increased over the years. In 1990, the Total Debt was NRs 51,474.0 billion, and by 2022, it had grown to NRs 2,010,132.3 billion. The Total Debt consistently grew during this period, reflecting an accumulation of debt over the years.

Relationship between GDP and Total Debt: By examining the data, it is evident that both GDP and Total Debt have experienced growth over the years, indicating a positive relationship. This suggests that as the country's economy expands (higher GDP), it has also been accumulating more debt (higher Total Debt). It's important to note that while there is a positive relationship, the rate of GDP growth does not always precisely match the rate of Total Debt growth, which can vary from year to year.

Considerations: External factors, such as global economic conditions, fiscal policies, and borrowing practices, may have influenced these trends. Policymakers and economists should assess whether the rate of debt accumulation aligns with the country's economic growth and whether it is sustainable in the long term.

In summary, the data analysis reveals that the country's GDP has consistently grown over the years, signifying substantial economic expansion. Concurrently, the Total Debt has also increased steadily, reflecting a continuous accumulation of debt. While there is a positive relationship between GDP and Total Debt, it's essential to monitor the pace of debt accumulation in the context of the country's economic development and fiscal sustainability.Top of Form

4.2 Empirically Econometric Analysis

The econometric analysis involves the application of various statistical tests, including the Unit Root Test, Co-integration Test by Johansen, Residual Test, and Error Correction Model (ECM). Specifically, we focus on the Augmented Dickey-Fuller (ADF) tests conducted for GDP, Internal Debt (ID), External Debt (ED), and Total Debt (TD) over the period from 1990/91 to 2021/22. These tests aim to assess whether the data series exhibit unit roots, and the results are summarized in Table 1, which provides statistics for the Unit Root Test (Intercept only).

Table: 1: Summary of Unit Root Test

Variable	Level Form		First Difference		
	Specification	t-stat	Specification	t-stat	Results
LNGDP	Level	-0.97 (0.74)	Intercept	-4.00 (0.00)	I (1)
LNID	Level	1.65 (0.99)	Intercept	-4.08 (0.00)	I (1)
LNED	Level	-1.76 (0.38)	Intercept	-5.73 (0.00)	I (1)
LNTD	Level	-0.71 (0.82)	Intercept	-2.61 (0.10)	I (1)

Source: Researcher's Estimation using EViews 10

The outcomes of the unit root test indicate that all the examined variables exhibit a trend stationary behavior. This signifies that these variables indeed possess a discernible trend, yet this trend is not characterized by explosive growth or decline. Instead, it follows a stationary pattern, where the rate of increase or decrease remains consistent over time. To put it simply, these variables display a stable, non-explosive trend. Below, we provide a brief explanation of the unit root test results for each variable:

LNGDP: In its original form (level form) with an intercept included, the t-statistic for LNGDP is -0.97, with a standard error of 0.74. After taking the first difference (differencing it once) with an intercept term included, the t-statistic for LNGDP is -4.00, and the p-value is 0.00. The "I (1)" in the Results column indicates that LNGDP is integrated of order one. This means that LNGDP is non-stationary in its original form but becomes stationary after differencing it once.

LNID: In its original form (level form) with an intercept included, the t-statistic for LNID is 1.65, with a standard error of 0.99. After taking the first difference with an intercept term included, the t-statistic for LNID is -4.08, and the p-value is 0.00. The "I (1)" in the Results column indicates that LNID is integrated of order one. Similar to LNGDP, this means that LNID is non-stationary in its original form but becomes stationary after differencing it once.

LNED: In its original form (level form) with an intercept included, the t-statistic for LNED is -1.76, with a standard error of 0.38. After taking the first difference with an intercept term included, the t-statistic for LNED is -5.73, and the p-value is 0.00. The "I (1)" in the Results column indicates that LNED is integrated of order one. Like the previous variables, LNED is non-stationary in its original form but becomes stationary after differencing it once.

LNTD: In its original form (level form) with an intercept included, the t-statistic for LNTD is -0.71, with a standard error of 0.82. After taking the first difference with an intercept term included, the t-statistic for LNTD is -2.61, and the p-value is 0.10. The "I (1)" in the Results column suggests that LNTD is integrated of order one. Like the other variables, LNTD is non-stationary in its original form but becomes stationary after differencing it once.

In summary, for all four variables (LNGDP, LNID, LNED, and LNTD), the unit root test results indicate that they are integrated of order one (I (1)). This implies that these variables are non-stationary in their original forms but become stationary after taking the first difference. Stationary data is often a prerequisite for many econometric analyses.

4.3 Johansen test of co-integration

Table 2 presents the outcomes of the Johansen test, specifically focusing on co-integration rank tests. These tests play a crucial role in identifying the number of co-integrating equations within the dataset. The table presents results from the unrestricted co-integration rank test, utilizing two distinct statistical measures: the trace statistic and the maximum eigenvalue statistic.Top of Form

Table: 2: Johansen test of co-integration

Date: 09/05/23   Time: 13:35

Sample (adjusted): 1992 2022

Included observations: 31 after adjustments

Trend assumption: Linear deterministic trend

Series: LNGDP LNID LNED LNTD

Lags interval (in first differences): 1 to 1

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Unrestricted Cointegration Rank Test (Trace)

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Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.619819	49.39456	47.85613	0.0356
At most 1	0.321949	19.41419	29.79707	0.4634
At most 2	0.172354	7.369667	15.49471	0.5351
At most 3	0.047401	1.505400	3.841465	0.2198

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.619819	29.98037	27.58434	0.0241
At most 1	0.321949	12.04452	21.13162	0.5433
At most 2	0.172354	5.864267	14.26460	0.6307
At most 3	0.047401	1.505400	3.841465	0.2198

Max-eigenvalue test indicates 1 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: Researcher's Estimation using EViews 12

The trace statistic assesses whether the number of co-integrating equations is equal to or fewer than a specified value. The table provides eigenvalues, test statistics, critical values, and probabilities for different rank assumptions, with Prob.** indicating the likelihood under the null hypothesis. This test reveals 1 co-integrating equation at the 0.05 significance level.

Similarly, the maximum eigenvalue statistic evaluates the null hypothesis regarding a certain number of co-integrating equations, focusing on the largest eigenvalue. The table furnishes eigenvalues, test statistics, critical values, and probabilities, indicating 1 co-integrating equation at the 0.05 significance level.

In summary, the Johansen co-integration test determines long-term relationships among variables. The table results suggest one co-integrating equation among LNGDP, LNID, LNED, and LNTD. The test was conducted using EViews 12 software, with results based on the researcher's estimations.

Table: 3:   Co-integrating Relation

Dependent Variable: LNGDP
Method: Least Squares
Date: 09/05/23   Time: 13:39
Sample: 1990 2022
Included observations: 33

Variable	Coefficient	Std. Error	t-Statistic	Prob.

LNID	3.094155	0.805923	3.839270	0.0006
LNED	4.261976	1.854256	2.298483	0.0289
LNTD	-6.306442	2.607099	-2.418950	0.0221
C	5.525030	1.621205	3.407978	0.0019

R-squared	0.974957	Mean dependent var	13.54710
Adjusted R-squared	0.972367	S.D. dependent var	1.162569
S.E. of regression	0.193257	Akaike info criterion	-0.336378
Sum squared resid	1.083101	Schwarz criterion	-0.154983
Log likelihood	9.550236	Hannan-Quinn criter.	-0.275344
F-statistic	376.3402	Durbin-Watson stat	0.425312
Prob(F-statistic)	0.000000		

Source: Researcher's Estimation using EViews 12

This regression analysis provides valuable insights into the relationship between economic variables and Gross Domestic Product (GDP). Here's an explanation and justification within the context of Nepal:

The coefficient for LNID is 3.094, and it is statistically significant (p-value = 0.0006) from Table 3. This indicates that changes in internal debt have a positive and substantial impact on Nepal's GDP. When the country increases its internal debt, it tends to experience a significant increase in GDP. This relationship can be explained by the fact that internal debt can be used to finance various development projects and stimulate economic activity.

The coefficient for LNED is 4.262, and it is statistically significant (p-value = 0.0289). This suggests that alterations in external debt also have a positive impact on Nepal's GDP, although this impact is less pronounced than that of internal debt. External debt often comes with conditions and interest payments, so while it can boost economic activity, it also needs to be managed carefully to prevent future financial burdens.

The coefficient for LNTD is -6.306, and it is statistically significant (p-value = 0.0221). Interestingly, total debt exhibits a negative relationship with GDP. This means that high levels of total debt may lead to a decrease in Nepal's GDP. It's crucial for policymakers to strike a balance between utilizing debt for economic growth and managing the potential risks associated with high debt levels.

The constant term has a coefficient of 5.525 and is highly significant (p-value = 0.0019). This indicates that there is a substantial baseline level of GDP in Nepal that is not explained by changes in debt. This baseline growth could be attributed to various structural factors,

such as population growth and technological progress.

Overall, this analysis suggests that both internal and external debt can positively influence Nepal's GDP in the short term. However, it's important for policymakers to exercise caution and maintain prudent debt management practices to ensure long-term sustainability. Additionally, while this model explains a significant portion of the variation in GDP (high R-squared value), it's essential to consider other economic and contextual factors when making policy decisions.

Lastly, the low Durbin-Watson statistic (0.425) suggests the presence of autocorrelation in the residuals, which might require further investigation and model refinement.Top of Form

4.4 Unit Root Test Result of Residual

The Durbin-Watson statistic tests for autocorrelation in residuals, and a value near 2 implies minimal autocorrelation; however, in this instance, the low value of 0.425 may suggest the presence of some autocorrelation as from table 4.

Detect/ removal Serial correlation (Auto correlation) of residual

To systematically address serial correlation in the model, begin by introducing a one-period lag for the dependent variable. Subsequently, conduct a regression analysis, and if the Durbin-Watson (DW) value approximates two, it indicates the absence of serial correlation within the model.

Table: 4: Test of Serial correlation

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0.064272	Prob. F(2,25)	0.9379
Obs*R-squared	0.163693	Prob. Chi-Square(2)	0.9214

Source: Researcher's Estimation using EViews 12

From the given Breusch –Godfrey Serial Correlation LM Test, the Probability Chi- square (2) is more than 5 % as a result there is no serial correlation.

Test of Heteroskedasticity/homoscedastic

From the Heteroskedasticity test probability Chi-square (4) as seen in table 5 value also shows there is not Heteroskedasticity but it is homoscedastic.

Table: 5: Test of Heteroskedasticity/homoscedastic

Heteroskedasticity Test: Breusch-Pagan-Godfrey

Null hypothesis: Homoskedasticity

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F-statistic	0.664523	Prob. F(4,27)	0.6221
Obs*R-squared	2.867983	Prob. Chi-Square(4)	0.5802
Scaled explained SS	2.435401	Prob. Chi-Square(4)	0.6562

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Source: Researcher's Estimation using EViews 12

Test of normality

The result shows that the residual is normality distributed, it is desirable model

Table: 6: Test of normality
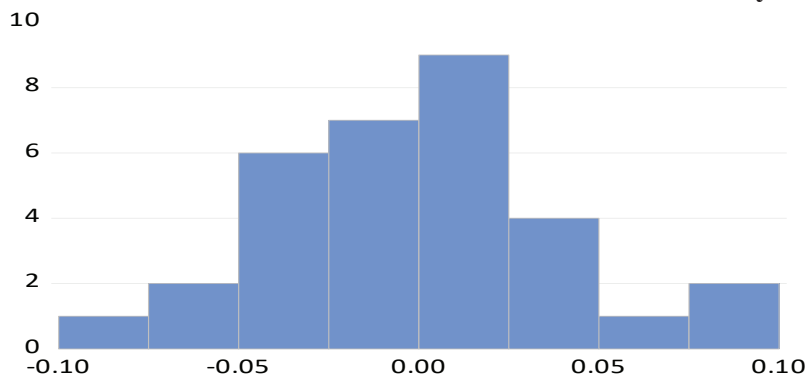
Series: Residuals	
Sample 1991 2022	
Observations 32	
Mean	−5.00e-16
Median	−0.001673
Maximum	0.095981
Minimum	−0.079442
Std. Dev.	0.039734
Skewness	0.558259
Kurtosis	3.385593
Jarque-Bera	1.860395
Probability	0.394476

Source: Researcher's Estimation using EViews 12

From above observations, it is desirable and good fit to check the unit root test of residual.

Table: 7: Unit Root Test Result of Residual

Null Hypothesis: D(ECT) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

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	t-Statistic	Prob.*

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Augmented Dickey-Fuller test statistic	−5.472272	0.0001
Test critical values: 1% level	−3.661661	
5% level	−2.960411	
10% level	−2.619160	

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*MacKinnon (1996) one-sided p-values.

Source: Researcher's Estimation using EViews 12

t- statistics is greater than EG value 5 percent 3.34 critical value, ECT has not unit root.

The residual of the model is found stationary and variables are co-integrated and they have long run relationship.

4.5 Error Correction Model

An error correction model is formulated to capture both long-term disequilibria and short-term dynamics, representing a short-term relationship. Table 7 displays the estimated error correction model.

Table:8 Error Correction Model

Dependent Variable: DLNGDP
Method: Least Squares
Date: 09/05/23   Time: 14:08
Sample (adjusted): 1991 2022
Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNID	-0.450757	0.399759	-1.127570	0.2694
DLNED	-1.340418	0.832544	-1.610026	0.1190
DLNTD	1.766518	1.182210	1.494250	0.1467
C	0.117339	0.015005	7.820049	0.0000
ECT(-1)	-0.027343	0.052015	-0.525670	0.6034

R-squared	0.146288	Mean dependent var		0.120784
Adjusted R-squared	0.019812	S.D. dependent var		0.050385
S.E. of regression	0.049884	Akaike info criterion		-3.015647
Sum squared resid	0.067186	Schwarz criterion		-2.786626
Log likelihood	53.25035	Hannan-Quinn criter.		-2.939733
F-statistic	1.156646	Durbin-Watson stat		1.243588
Prob(F-statistic)	0.351702			

Source: Researcher's Estimation using EViews 12

In this Error Correction Model (ECM) analysis for Nepal, aim to understand the short-term and long-term dynamics of the country's real GDP growth (DLNGDP) in relation to several key economic factors. Here's an explanation and justification in the context of Nepal:

The coefficient for DLNID is approximately -0.451, but it is not statistically significant (p-value = 0.2694). This suggests that short-term fluctuations in Nepal's internal debt do not have a significant impact on real GDP growth. This finding implies that changes in

domestic borrowing may not immediately affect the country's economic output.

The coefficient for DLNED is approximately -1.340, and while it is negative, it is not statistically significant at the 0.05 significance level (p-value = 0.1190). This indicates that short-term variations in external debt may not have a strong influence on Nepal's real GDP growth. This finding suggests that changes in foreign borrowing may not be a dominant factor in the short-term economic performance of Nepal.

The coefficient for DLNTD is approximately 1.767, but, like the other variables, it is not statistically significant (p-value = 0.1467). This implies that short-term changes in total debt, which combines internal and external debt, may not have a substantial effect on real GDP growth in Nepal. It suggests that debt dynamics might not be a primary driver of short-term economic fluctuations.

Constant (C): The constant term has a coefficient of 0.117 and is highly significant (p-value = 0.0000). This indicates that there is a baseline level of real GDP growth in Nepal that is not explained by the included variables. This baseline growth could be attributed to various factors such as population growth, technological progress, and other structural factors in the economy.

The lagged error correction term's coefficient is approximately -0.027, and it is not statistically significant (p-value = 0.6034). The ECT(-1) term captures the long-term equilibrium relationship between real GDP and the explanatory variables. In this case, it doesn't appear to have a significant short-term impact.

In summary, based on this ECM analysis, it appears that the short-term fluctuations in Nepal's real GDP growth are not strongly influenced by changes in internal debt, external debt, or total debt. The constant term (C) represents the baseline growth in the absence of these factors. It's essential to remember that this analysis is based on the available data and statistical results and should be interpreted cautiously in the context of Nepal's specific economic dynamics.

4.6 Pairwise Granger Causality Tests
Pairwise Granger Causality Tests are important for identifying causal relationships between time series data, helping to understand the direction of influence among variables.

Table:9 Granger Causality Test

Pairwise Granger Causality Tests
Date: 09/06/23   Time: 07:00
Sample: 1990 2022
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.

DLNID does not Granger Cause DLNGDP	30	0.44377	0.6466
DLNGDP does not Granger Cause DLNID		0.26139	0.7721
DLNED does not Granger Cause DLNGDP	30	0.32085	0.7285
DLNGDP does not Granger Cause DLNED		0.58806	0.5629
DLNTD does not Granger Cause DLNGDP	30	0.65713	0.5271
DLNGDP does not Granger Cause DLNTD		0.17792	0.8381
DLNED does not Granger Cause DLNID	30	0.09070	0.9136
DLNID does not Granger Cause DLNED		1.77159	0.1908
DLNTD does not Granger Cause DLNID	30	0.15162	0.8601
DLNID does not Granger Cause DLNTD		1.24246	0.3059
DLNTD does not Granger Cause DLNED	30	2.69552	0.0871
DLNED does not Granger Cause DLNTD		2.26931	0.1243

Source: Researcher's Estimation using EViews 12

The table presents Pairwise Granger Causality Test results between different variables, assessing causal relationships. The lack of significance (high p-values) in most cases suggests no strong causal links between the variables for the specified time period (1990-2022) and lag of 2, indicating that these variables may not be causally related within this context.

5. Conclusion

Between 1990 and 2022, Nepal's GDP witnessed substantial growth, soaring from NRs 103,416.0 billion to NR 4,933,696.6 billion, while Total Debt increased from NRs 51,474.0 billion to NRs 2,010,132.3 billion, suggesting a positive GDP-Total Debt relationship with varying annual growth rates.

This regression analysis for Nepal highlights that internal and external debt positively impact short-term GDP growth, while high total debt levels may negatively affect GDP; careful debt management is crucial. Additionally, a significant baseline GDP exists beyond debt changes, but the model suggests potential autocorrelation in residuals, requiring further investigation.

Based on the econometric analysis, variations in short-term real GDP growth (DLNGDP) do not appear to be substantially influenced by shifts in internal debt (DLNID), external debt (DLNED), or total debt (DLNTD), given their statistically insignificant coefficients (p-values > 0.05). A notable baseline GDP growth (indicated by the C coefficient) persists

independently of these variables, indicating the presence of broader economic drivers. Moreover, the long-term equilibrium term (ECT(-1)) exhibits no noteworthy immediate impact on GDP dynamics.

References

Backhaus, J., & Wagner, R. E. (Eds.). (2006). *Handbook of public finance*. Springer Science & Business Media

Bhatta, P.G., & Mishra, A. (2020). Estimating optimum growth-maximizing public debt threshold for Nepal. *NRB Economic Review, 32,* 1-28.

Bista, N.B. (2011). Government domestic and private investment in Nepal. *International journal of economic sciences*, 2(2), 62-73.

CEID Nepal (2012). *Report on study of overall situation of public debt in Nepal*. Centre for Innovation & Development (CEID), Lalitpur, Nepal.

Gaspar, V., Harris, J., & Tieman, A. (2018). *The wealth of nations: Governments can better manage what they own and owe*. IMF Blog.

GuruGharana, K. K. (1996). The role of foreign aid in economic development and poverty alleviation. *The Nepalese Journal of Public Finance and Development.* (Rajaswa), 2. Kathmandu: Ministry of Finance (MOF).

Koirala, L. B. (2002). Effective public debt management in Nepalese perspective, Rajaswa, 2. Kathmdndu: *Revenue Administration Training Center (RATC).*

Ludvigson, S. (1996). The macroeconomic effect of government debt in a stochastic growth model. *Journal of Monetary Economics, 38,* 25-45. https://doi.org/10.1016/0304-3932(96)01271-8

Matiti, C. (2013). The relationship between public debt and economic growth in Kenya. *International Journal of Social Sciences and Project Planning Management, 1,* 65-86.

Mencinger, J., Aristovnik, A., & Verbič, M. (2014). The impact of growing public debt on economic growth in the European Union. *The Amfiteatru Economic Journal, 16,* 403-414.

Ministry of Finance (MOF) (2021). Economic Survey, 2021. *Ministry of Finance, Government of Nepal.*

Ministry of Finance (MOF) (2022). Macroeconomic dashboard. www.mof.gov.np. *Ministry of Finance*, Government of Nepal

Musgrave, R. A. (1983). Public finance, now and then. *FinanzArchiv/Public Finance Analysis*, (H. 1), 1-13.

Pyakuryal, B. (2004). *Nepal's conflict economy: cost, consequences and alternatives*. Kathmandu: Nepal Economic Association.

Reinhart, M. T., & Rogoff, S. K. (2010). Growth in a time of debt. *American Economic Review, 100,* 573-578. https://doi.org/10.1257/aer.100.2.573

Rosen, H. S. (2004). Public finance. In *The encyclopedia of public choice* (pp. 252-262). Springer, Boston, MA.

Shah, M. H., & Pervin, S. (2012). External public debt and economic growth: empirical evidence from Bangladesh, 1974-2010. *Academic Research International, 3,* 508-515.

Shrestha, M. P. (2021). Nepal's debt nearly triples in the last five and half years. *The Kathmandu Post*. https://kathmandupost.com/money/2021/03/02/nepal-s-debt-

Tarick, B. (2015). *Investigating the impact of public debt on economic Growth in Jamaica*. Technical Report, Department Bank of Jamaica.