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PUBLIC DEBT SUSTAINABILITY IN NEPAL

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ABSTRACT

This paper estimates the public debt sustainability in Nepal. Using the yearly time series data for the period of forty-eight years ranging from 1974/75-2021/22, the study employs ARDL method to assess the country's debt sustainability framework, where the dependent variable is debt-to-GDP ratio whereas debt service ratio and primary balance to GDP ratio are independent variables under the study. The results of ADF show that all the variables used in this study are in I (0) and I (1) form. The computed F-statistic exceeds the critical upper bound values at conventional significance levels (i.e 5% or 10%), which confirms the presence of a long-run equilibrium relationship between the dependent and independent variables. The confirmation of co-integration implies that although individual fiscal indicators may fluctuate in the short term, they move together in the long run in a manner consistent with intertemporal budget constraints. This co-movement is a key criterion for debt sustainability. In technical terms, it suggests that the Nepalese government adjusts its fiscal policy over time to ensure that the present value of its primary balances is sufficient to offset its outstanding debt obligations. Therefore, the study's findings—grounded in robust econometric testing—support the conclusion that Nepal's public debt is sustainable in the long run, provided current fiscal behaviors and institutional responses remain consistent.

INTRODUCTION

Public debt sustainability refers to a government's ability to service its debt without resorting to excessive adjustments in revenue or expenditure that could jeopardize economic stability. In the context of developing economies like Nepal, maintaining public debt sustainability is crucial for long-term fiscal health and economic growth. According to the International Monetary Fund (IMF, 2023), Nepal has demonstrated a commitment to fiscal discipline by rationalizing expenditure in response to weak revenue performance, which has helped manage its debt levels amid global and domestic shocks. Debt sustainability analysis (DSA) frameworks developed by institutions such as the IMF and the World Bank are instrumental in assessing a country's debt-carrying capacity and identifying potential risks (IMF & World Bank, 2022).

Many nations have diverse and sustainable levels of public debt, depending on local circumstances. The factors that determine the sustainable level of public debt include its magnitude as well as its features including currency composition, maturity pattern, and fixed or variable rate debt servicing. The persistent debt load raises the possibility of sovereign insolvency, particularly in recessionary times. As debt grows, the risk of default or non-repayment increases, which widens sovereign spreads and makes debt sustainability more difficult to achieve. Furthermore, greater private loan spreads are a direct result of higher sovereign spreads, and this has an effect on both consumption and investment (Mukherjee & Kaur, 2014).

Public debt sustainability is a crucial economic issue that affects the financial stability and development prospects of a country. For Nepal, a developing economy with aspirations for sustainable growth, maintaining manageable levels of public debt is essential to secure long-term economic stability. Nepal's public debt has been rising steadily over the years, driven by factors such as government borrowing to fund infrastructure projects, social welfare programs, and responses to natural disasters. The COVID-19 pandemic significantly increased public spending, further elevating the debt levels. Debt sustainability is measured by the ability of a country to service its debt without resorting to excessive borrowing or compromising economic growth. Key indicators include the debt-to-GDP ratio, debt servicing capacity, and fiscal deficit. In Nepal's context, the debt-to-GDP ratio has increased, reflecting growing financial obligations relative to the economy's size. Any government, like any private citizen, must borrow money when its outlays exceed its revenue. But aside from taxes, public debt is a component of income rather than a source of it. Since it incorporates the revenues for a specific year, public debt could be thought of as the government's "revenue" that increases the nation's overall resources.

Attaining significant and enduring economic growth stands as a fundamental aspiration for developing economies worldwide. For Nepal, like many others in similar circumstances, the pursuit of economic expansion has been intricately linked to the practice of borrowing, encompassing both domestic and international avenues. This borrowing mechanism has served as a vital strategy for Nepal to address its resource deficit and pave the way for sustainable development and progress. (Bhatta & Mishra, 2020).

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In relation to the abovementioned context, the prime objective of this study is to address the sustainability of Nepalese public debt by analyzing primary balance to GDP ratio as dependent variable in relation with interest payment to GDP ratio and total debt to GDP ratio as independent variables.

The paper is organized into five sections. Section 1 introduces the topic under investigation, while Section 2 presents a review of the relevant literature. Section 3 outlines the model specification and research methodology, and Section 4 reports and discusses the empirical findings. The study concludes in Section 5.

LITERATURE REVIEW

The evolution of academic thought on public debt sustainability points to a nuanced consensus that public debt can support stability and growth when managed within sound institutional and macroeconomic frameworks, but becomes harmful once critical thresholds are exceeded. Recent evidence from Nepal, as highlighted in the IMF Staff Report (2023), shows how disciplined fiscal adjustment, monetary tightening, and external support through the Extended Credit Facility can help a low-income country absorb global shocks, stabilize inflation, narrow external imbalances, and strengthen long-term debt sustainability. Nevertheless, evidence from Nigeria shows that increasing debt servicing and interest burdens can suppress economic growth by displacing productive investment, underscoring the need for effective utilization of borrowed funds and economic diversification (Jacob & Sule, 2022). Broader cross-country studies reinforce this conditional view: Reis (2022) notes that advanced economies have sustained higher debt levels largely due to low borrowing costs, while Beqiraj *et al.* (2018) caution that weak long-term debt strategies undermine sustainability even when short-term adjustments are made. Empirical threshold analyses further suggest limits to safe borrowing, with Kaur and Mukherjee (2014) identifying growth slowdowns in India beyond a 61% debt-to-GDP ratio, and Checherita and Rother (2010), alongside Reinhart and Rogoff (2010), documenting adverse growth effects once debt approaches 90–100% of GDP in advanced economies. Collignon (2012) and Yakita (2008) emphasize that institutional discipline, fiscal rules, and initial debt levels critically shape outcomes, underscoring that public debt is most effective as a development tool when aligned with credible policies, strong institutions, and prudent long-term planning.

In Nepalese context, Bhatta and Mishra (2020) find that a public debt–to–GDP ratio of about 33 percent is optimal for supporting Nepal's economic growth, though their study does not conclusively determine whether Nepal's public debt is sustainable. Overall, the issue of public debt sustainability in Nepal remains underexplored in the literature, creating a clear research gap that this study seeks to fill.

MATERIALS AND METHODS

The autoregressive distributed lag (ARDL) cointegration approach developed by Pesaran and Shin (1999) and extended by Pesaran *et al.*, (2001) is employed to examine the long-run relationship among public debt sustainability indicators in Nepal. The model analyzes the dynamic interaction between the primary balance-to-GDP ratio, total public debt-to-GDP ratio, and interest payment-to-GDP ratio. The primary balance is specified as the dependent variable to capture the government's fiscal response to rising debt and interest obligations.

$= Pt/GDPt = f(Pt/GDPt, it/GDPt)$…. (i)

ARDL is a suitable time-series technique in the case of the macro-fiscal data of Nepal. Since it can be used regardless of whether the variables are integrated of order I(0) or I(1), and it does not involve severe assumptions about the exogeneity of the regressors (Pesaran and Shin, 1999).

The bounds testing procedure that has been suggested by Pesaran *et al.* (2001) is used to determine the presence of a long-run relationship between the variables. Which gives two sets of critical values of variables integrated of order I(0) and I(1). When the calculated F-statistic is greater than the upper bound critical value, then the null hypothesis of no cointegration is rejected, and this implies that there is a stabilized long-run relationship. On the other hand, below the lower bound of the F-statistic portrays that there is no cointegration, whereas above the bounds give inconclusive outcomes. When cointegration is determined, both short-run and long-run coefficients are estimated by ordinary least squares. The choice of the most optimal lag lengths, where the selection criteria may be the Akaike Information Criterion (AIC) or the Schwarz Bayesian Criterion (SBC).

Based on the above equation (i), the linear regression equation model was developed as follows:

$$\frac{Pt}{GDPt} = \beta 1 + \beta 2\frac{Dt}{GDPt} + \beta 3\frac{it}{GDPt} + \varepsilon t \quad \text{..... (ii)}$$

Based on the above regression model, the ARDL model was tested to find the relationship between the variables:

$$\Delta\frac{Pt}{GDPt} = \beta 1 + \delta \mathrm{ECMt} - 1 + \Sigma_{(i=1)}^{P}\beta 2\Delta\frac{Dt-i}{GDPt-i} + \Sigma_{(i=1)}^{P}\beta 3\Delta\frac{it-i}{GDPt-i} + \Sigma_{(i=1)}^{P}\beta 4\Delta\frac{Pt-i}{GDPt-i} + \beta 5\frac{Dt}{GDPt} + \beta 6\frac{it}{GDPt} + \varepsilon t \quad \text{..... (iii)}$$

In equation (iii), coefficient δ represents the speed at which the variables return to their long-run equilibrium following a short-run shock. This parameter is commonly referred to as the error correction term (ECM coefficient). Where Δ is the first difference operator, is the usual white noise residuals, and k is the number of optimal lag orders selected in the study. The coefficients (β1 β5) represent the long-run relationship.

This study uses annual time-series data on GDP, total debt, interest payment and primary balance for the period

Variables	Definition	Source
Dt	Total debt at a time't' in Rs.10 million	Nepal Rastra Bank
GDPt	Gross domestic product at a time't' in Rs.10 million	Nepal Rastra Bank
Pt	Primary balance which represents the difference between the government expenditure and tax revenue [i.e Pt = (G-T)] in Rs.10 million	Nepal Rastra Bank
it	Interest payment of government bond in Rs.10 million	Financial Comptroller General Office, Public Debt Management Office and Nepal Rastra Bank.

ranging from 1974/75 to 2021/22. The variables used in estimating the sustainability are defined below:

Trend Analysis

As a part of descriptive statistics, the paper observes the trend of primary balance to GDP ratio, debt to GDP ratio and interest payment on government bonds to GDP ratio which is shown in figure 1 as below:

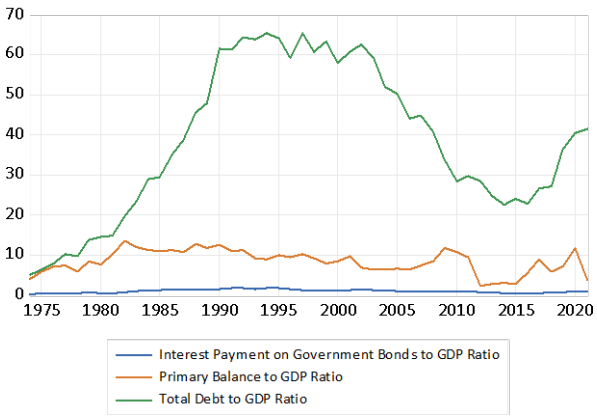

Figure 1: Trend Analysis

Source: Author's estimation

Figure 1 shows that Nepal's debt-to-GDP ratio rose sharply until the early 1990s, declined steadily to below 30 percent by 2015 due to fiscal consolidation and stronger growth, and then increased again after 2016/17 to over 40 percent by 2021/22 driven by infrastructure spending, reconstruction, and pandemic-related outlays. Throughout the period, the primary balance remained mostly in deficit with only brief surpluses, while interest payments stayed low and stable, indicating manageable debt servicing. Overall, the trends suggest a shift from high debt accumulation to consolidation and then renewed fiscal expansion, underscoring the need for continued fiscal reforms to maintain long-term sustainability.

RESULTS AND DISCUSSIONS

The study is based on the set of factors that determine long-run sustainability of Nepalese public debt from 1974/75-2021/22 where primary balance to GDP ratio is the dependent variable followed by debt to GDP ratio and interest payment on government bonds to GDP ratio as the independent variables.

Table 1: Descriptive statistics

	Observations	Mean	Median	Maximum	Minimum	Standard Deviation
Primary balance to GDP ratio	48	8.343604	8.660457	13.46235	2.197667	2.904898
Debt to GDP ratio	48	38.36036	37.63920	65.53307	4.954521	19.15449
Interest Payment on government bonds to GDP ratio	48	0.926019	0.854560	1.732659	0.201795	0.430222

Descriptive Statistics

Table 1 shows the statistical nature of the collected data under the study where the Primary balance to GDP ratio ranged from a minimum of 2.197 to a maximum of 13.462, with a mean of 8.343 and a standard deviation of 2.90. Similarly, the Debt to GDP ratio had a mean of 38.36, ranging from a minimum value of 4.954 to a maximum of 65.533, with a standard deviation of 19.15. Moreover, the Interest Payment on government bonds to GDP ratio varied from its lowest value of 0.201 to its highest of 1.732, with a mean value of 0.926 and a standard deviation of 0.43. The high standard deviation of 19.154 suggests that the Debt to GDP ratio exhibited significant volatility throughout the study period.

Unit Root Test

Before choosing an appropriate time series methodology, it is essential to conduct a preliminary examination of the data to assess stationarity, as the use of non-stationary series can produce spurious regression results (Granger & Newbold, 1974; Gujarati & Porter, 2009). A time series is considered stationary when its mean, variance, and autocovariance remain constant over time. Such series typically fluctuate around a stable mean and exhibit consistent variance, indicating a tendency to revert to

Table 2: Augmented Dickey Fuller (ADF) Test

	ADF test		
Variables	t-stat	p-value	Order of Integration
Primary balance to GDP ratio	-2.945204**	0.0478	I(0)
Interest payment on government bonds to GDP ratio	-1.821765	0.3656	
dInterest payment on government bonds to GDP ratio	-4.927106***	0.0002	I (1)
Debt to GDP ratio	-1.797051	0.3775	
dDebt to GDP ratio	-4.949133***	0.01	I (1)

*Note: *** implies significance at 1% level and ** indicates significance at 5% level.*

equilibrium following shocks (Box & Jenkins, 1976).

Table 2 reports the results of the Augmented Dickey Fuller test and shows that the primary balance to GDP ratio is stationary at level, as indicated by a statistically significant t-statistic at the 5 percent level, confirming that it is integrated of order zero I(0). In contrast, both the interest payment on government bonds to GDP ratio and the debt to GDP ratio are non-stationary at level, with insignificant test statistics and high p-values, implying the presence of a unit root. However, after first differencing, both variables become stationary, as reflected by highly significant ADF test statistics at the 1 percent level, indicating that they are integrated of order one I(1).

Lag Selection

Before estimating the ARDL model, lag length has to be determined. We employed Vector Autoregressive (VAR) approach to determine the most suitable lag length. Various criteria, including FPE, AIC, SC, and HQ, were considered for the selection of the lag length. This study has taken into account all of these criteria and the chosen lag length was 1 based on on several * present in a single row because maximum number of * are present in second row. The researcher has taken the AIC (Akaike information criterion) criteria which is suitable for this study according to the nature of the variables as shown

Table 3: VAR lag length selection

Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-279.5499	NA	75.91151	12.84318	12.96483	12.88829
1	-170.8090	197.7107*	0.816587*	8.309499*	8.796097*	8.489953*
2	-166.5028	7.242142	1.017556	8.522857	9.374402	8.838651

in Table

indicates the lag order chosen by the criterion. LR denotes the sequential modified LR test statistic, with each test conducted at the 5% level. FPE stands for Final Prediction Error, while AIC represents the Akaike Information Criterion. SC indicates the Schwarz Information Criterion, and HQ refers to the Hannan-Quinn Information Criterion.]

Bound Test for Co-integration

To examine the existence of a long-run relationship (cointegration) between dependent and the independent variables, the ARDL bounds testing approach is employed. The calculated F-statistic is compared with the critical values at different significance levels provided by Shin and Pesaran (2001). The findings are reported in Table 4, which then allows for the estimation of both long-run relationships and short-run dynamics within the ARDL framework.

Table 4 reports the results of the ARDL bounds test for

Table 4: ARDL bound test result

Computed F-statistic	5.014763
1% critical bound value	
I (0)	5.15
I (1)	6.36
5% critical bound value	
I (0)	3.79
I (1)	4.85
10% critical bound value	
I (0)	3.17
I (1)	4.14

cointegration and shows that the computed F-statistic of 5.0148 exceeds the upper bound critical value at the 5 percent significance level but remains below the 1 percent upper bound, indicating the existence of a long-run cointegrating relationship among the variables at the 5 percent level of significance. Since the F-statistic lies

above the I(1) bound at 5 percent, the null hypothesis of no cointegration is rejected, confirming a stable long-run equilibrium relationship among the variables included in the model. This result validates the application of the ARDL approach and supports further estimation of both long-run and short-run dynamics within the specified framework.

ARDL Model

When variables are non-stationary in levels but become stationary after differencing, cointegration techniques allow researchers to test for the presence of a long-run equilibrium relationship among them. The Autoregressive Distributed Lag (ARDL) approach to cointegration, introduced by Pesaran and Shin (1999) and Pesaran *et al.* (2001), provides several advantages: it can be applied whether the regressors are integrated of order I(0) and/or I(1), performs well in small samples, allows different variables to have different optimal lag lengths, yields unbiased long-run coefficient estimates, and produces valid t-statistics even in the presence of endogeneity among regressors.

This paper employed ARDL estimation in order to examine short run and long run relationship among variable. First the ARDL long run test is conducted and

Table 5: ARDL long run model result

Variable	Coefficient	Stand. Error	t-Statistic	Prob*
Interest payment to GDP ratio	6.224777	2.573412	2.418881	0.0200
Total debt to GDP ratio	-0.092167	0.055067	-1.673732	0.1016

Table 5 shows the result of long run ARDL model.

Table 5 shows the long run relationship between the dependent and independent variables which is expressed

$$\frac{Pt}{GDPt} = \beta 1 - 0.0922\frac{Dt}{GDPt} + 6.2248\frac{it}{GDPt} + \varepsilon t \text{.....(iv)}$$

in the following equation.

Table 5 presents the estimated long run coefficients from the ARDL model and indicates that interest payment to GDP ratio has a positive and statistically significant effect on the dependent variable, with a coefficient of 6.2248 that is significant at the 5 percent level, implying that higher interest payments relative to GDP are associated with an increase in the primary balance to GDP ratio in the long run. This indicates a strong and statistically significant fiscal adjustment in response to rising debt servicing cost. Nepal's fiscal authorities actively improve the primary balance when interest burden increases, which supports short run debt sustainability by preventing interest cost from escalating into uncontrolled debt accumulation. In contrast, the total debt to GDP ratio carries a negative coefficient of −0.0922, suggesting an inverse long run relationship with the primary balance, although this effect is statistically insignificant at conventional levels. This result suggest that Nepal's fiscal policy doesn't response systematically or positively to rising debt level, implying limited forward look fiscal discipline. The estimated long run relationship expressed by the equaiton (iv) indicates that interest payment dynamics play a more influential role in shaping the long run fiscal position than the overall debt stock during the study period, while the negative but weakly significant debt coefficient points to limited long run fiscal pressure arising directly from debt accumulation.

Error correction model

The error correction model shows the short-run relationship between the dependent and independent variables. In the short-run, some variables are moving in different path but they can significantly impact on dependent variables. Engle and Granger (1987) demonstrated that any set of cointegrated variables can be represented within an error correction model framework. Table 6 shows the summary results of the

Table 6 : Error correction model

Variable	Coefficient	Std. Error	t-Statistics	Prob.
C	3.721692	0.999213	3.724623	0.0006
D(Total debt to GDP ratio)	0.078346	0.069265	1.131106	0.2644
cointEq(-1)*	-0.619949	0.156159	-3.969973	0.0003

ECM for Nepalese context.

Table 6 shows that the coefficient of the error correction model is minus sign and its associated probability value is significant at 5%, so the model is valid. The ECM shows the rate of correction of deviated value. The deviated value is correcting at the rate of 61.99 percent every year and back to equilibrium position after every nineteen months approximately [(100/61.99)*12= 19.35]. The coefficient value of residual term is less than -1 which suggests the low speed of adjustment in equilibrium position in the long run.

In the short run, total debt to GDP ratio has statistically significant positive impact on the primary balance to GDP ratio which means 1 percent increase in total debt to GDP ratio leads the Primary balance to GDP ratio to increase by 0.078 percent. The researcher couldn't find any relationship between interest payment on government bonds to GDP ratio and primary balance to GDP ratio

in the short-run.

ARDL Stability Conditions

The CUSUM statistics that appear within 5 percent confidence interval accept long run relationships among variables. At the same time, the results also show stability among the coefficients and absence of structural break.

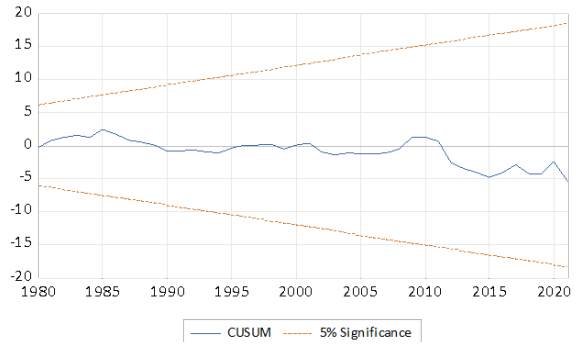

Figure 2: CUSUM Statistics

Figure 2 shows the CUSUM statistics.

Figure 2 shows the CUSUM statistics at 5% level of significance. The cumulative sum lies between the significance level indicate that the model is stable.

The CUSUMSQ test that lies between five percent level of significance shows stability of the model. Figure 3

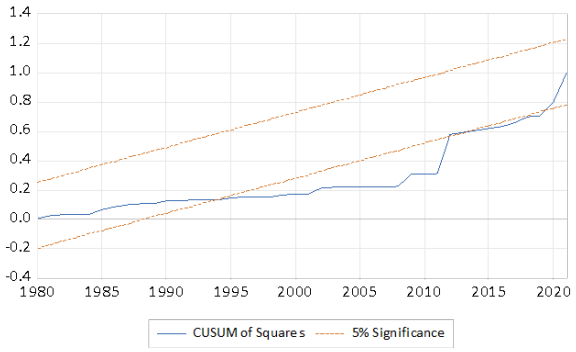

Figure 3: Figure 3: CUSUMSQ Statistics

shows the CUSUMSQ statistics.

Figure 3 shows the stability of the model at 5% level of significance. Figure depicts that the model lies between 5% level of significance in the beginning year and at the end also but at the middle phase of the study, it becomes fluctuates and falls below the lines of significance but comes back to stable form at the end.

Table 7 : ARDL Residual Serial Correlation Test

Primary balance to GDP ratio			
F-stat	2.194046	Prob. F	0.1462
Obs*R-squared	2.387370	Prob. Chi-square	0.1223

ARDL Residual Diagnostics

As shown in Table 7, the probability value of F-statistic and the probability value of Chi- square statistic are greater than 0.05 which suggests that there is no problem of serial correlation in the estimated ARDL model.

Table 8 : ARDL residual Heteroskedasticity test

Primary balance to GDP ratio			
F-stat	2.266698	Prob. F	0.0780
Obs*R-squared	8.344742	Prob. Chi-square	0.0797

As shown in Table 8, the probability values are greater than 0.05 which suggests that no problem of heteroskedasticity was found in the estimated ARDL model.

Table 8 : ARDL residual Ramsey RESET test

Primary balance to GDP ratio			
F-stat	0.678694	Prob. F	0.4148

As shown in Table 9, the probability values are greater than 0.05 which suggests that no problem of stability under Ramsey RESET test was found in the estimated ARDL model.

DISCUSSION

The empirical findings of this study are broadly consistent with the existing literature on public debt sustainability, particularly in the context of developing economies like Nepal. The confirmation of a long-run cointegrating relationship among primary balance, debt-to-GDP ratio, and interest payments aligns closely with the IMF and World Bank debt sustainability frameworks, which emphasize intertemporal budget constraints and fiscal adjustment mechanisms as key indicators of sustainability. Similar to the IMF (2023), which highlights Nepal's ability to maintain macroeconomic stability through fiscal discipline despite shocks, this study finds that rising interest payments are positively and significantly associated with improvements in the primary balance in the long run, suggesting an active fiscal response to debt servicing pressures. This result also resonates with Reis (2022), who argues that debt sustainability depends not merely on debt stock but on the government's capacity to generate sufficient fiscal effort relative to servicing costs. The negative but statistically insignificant long-run effect of the debt-to-GDP ratio on the primary balance supports the argument advanced by Collignon (2012) and Beqiraj *et al.* (2018) that debt accumulation does not

automatically undermine sustainability if supported by institutional discipline and credible fiscal adjustments. Moreover, the moderate speed of adjustment identified in the error correction model reinforces Yakita's (2008) assertion that initial debt levels and gradual fiscal corrections play a crucial role in maintaining long-term equilibrium. Unlike studies such as Reinhart and Rogoff (2010) and Checherita and Rother (2010), which identify clear debt thresholds beyond which growth and stability deteriorate, Nepal's debt ratio remains well below such critical levels, explaining why debt pressure appears limited in the long run. Overall, the findings corroborate prior evidence that Nepal's public debt remains sustainable, provided fiscal responsiveness to interest obligations continues and borrowing is managed within a stable institutional framework, thereby extending and reinforcing conclusions drawn in earlier national and international studies

CONCLUSION

This study concludes that Nepal's public debt is sustainable in the long run, as evidenced by the statistically significant long-term relationships identified through the ARDL model. The findings highlight that while rising interest payments are positively associated with the primary balance, indicating a responsive fiscal stance, the total debt-to-GDP ratio shows a negative but statistically insignificant impact on fiscal balance in the long term. In the short term, the influence of debt is modest but positive. The error correction model indicates a moderate speed of adjustment back to equilibrium, underscoring the economy's capacity to correct fiscal imbalances over time. Furthermore, diagnostic tests confirm the model's reliability, with no issues of serial correlation, heteroskedasticity, or structural instability. These results underscore the importance of sustained fiscal prudence, effective debt management strategies, and continued structural reforms to maintain public debt at manageable levels and support long-term macroeconomic stability in Nepal.

For nations grappling with economic challenges, such as underdeveloped and developing countries, public borrowing becomes essential to address slow growth, internal conflicts, and natural disasters. However, the sustainability of public debt is a complex issue, varying by country and influenced by factors such as debt magnitude, currency composition, and maturity patterns. In Nepal, the increasing public debt ratio, projected to reach 41.49% of GDP by 2021/22, raises concerns about future economic stability, despite recent efforts to maintain fiscal discipline. Given Nepal's reliance on both domestic and external borrowing to fund development, the country faces the ongoing challenge of balancing debt management with sustainable growth.

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