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The Dance of Debt and Growth in South Asian Economies: Panel ARDL and NARDL Evidence

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Abstract: *This article explores the complicated relationship between external debt and economic growth in South Asian IMF member countries, emphasizing the critical role of external debt in financing development while underscoring the necessity of sensible debt management. Using a diverse regional context, including case studies of India, Bangladesh, Sri Lanka, and Pakistan, it highlights the impact of external debt on economic trajectories within distinct national settings. Employing a comprehensive dataset spanning over three decades and utilizing both Panel Autoregressive Distributed Lag (PARDL) and Panel Nonlinear Autoregressive distributed lag (PNARDL) techniques, the study reveals significant insights into short-term, long-term, and asymmetric dynamics in this relationship. The results underline the importance of sustainable borrowing practices and sensible debt management to sustain long-term economic prosperity. Additionally, the article emphasizes the integral role of government stability, the significance of addressing domestic production limitations, and the critical need for price stability. Policy recommendations are offered to guide South Asian nations in optimizing the positive impact of external debt on economic growth while avoiding potential pitfalls. Overall, this research contributes valuable insights for policymakers and scholars, shedding light on the intricate dynamics of economic growth in this region.*

Key Words: External Debt, Economics Growth, Inflation, PARDL, PNARDL

Background

External debt is necessary for countries to finance investments in infrastructure, human capital, technology, and economic growth and address the balance of payments. It plays a pivotal role in supporting development initiatives and crisis management (Davis, 1992). However, careful debt management is essential to avoid overburdening future generations and maintain fiscal sustainability (Šević, 2007). External debt plays a crucial role within IMF member countries by enabling them to finance strategic investments in sectors like infrastructure, education, and technology, which are instrumental in driving economic growth. Borrowing from external sources allows these nations to expedite development projects, create jobs, and enhance competitiveness, contributing to overall economic expansion. However, prudent debt management is vital to ensure that borrowed funds are channeled effectively and that debt sustainability is maintained, thus minimizing risks and maximizing the positive impact of external debt on the economic growth trajectories of IMF member countries (Mupunga and Le Roux, 2015). The dynamic relationship between external debt and economic growth in South Asian countries is influenced by multiple factors, including debt levels, borrowing terms, governance, and economic policies. (Azam & Feng, 2017) India has adeptly balanced external borrowing, managing around $558 billion in external debt in 2020, channeling it into sectors like technology and manufacturing, contributing to a substantial GDP of approximately $2.9 trillion in the same year (World Bank). Bangladesh, with a GDP of about $303 billion in 2020, effectively harnessed external borrowing to propel growth, particularly in the textile and garments industry (Islam et al., 2019), while maintaining prudent debt management. Conversely, Sri Lanka and Pakistan have grappled with the challenges of high external debt burdens. In 2020, Sri Lanka's external debt reached approximately $39 billion, while Pakistan's stood at roughly $113 billion (IMF, 2021),

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resulting in constraints on public spending, fiscal deficits, and potential macroeconomic instability (Amara et al., 2016; Rauf and Khan 2017).

In this diverse regional context, each country's unique circumstances and policy choices shape the impact of external debt on their economic trajectories. Effective debt management, accompanied by structural reforms, efficient utilization of borrowed funds, and targeted policy measures, is crucial for South Asian nations to ensure that external debt contributes positively to sustainable economic growth while avoiding potential pitfalls (Ahmad et al., 2016; Wangui, 2019; Chen et al., 2023). Therefore, the complex interaction between external debt and economic growth establishes distinction dynamics within both developed and developing countries. Developed economies employ external debt as a means to catalyze innovation and fund transformative initiatives, yet a cautious approach is required to mitigate the risks of over-indebtedness and ensure sustained growth (Reinhart & Rogoff, 2010; Barro, 1990; Aghion & Bolton, 1997). In contrast, developing nations rely on external borrowing to bridge resource gaps for critical development projects, emphasizing the pivotal role of effective debt management in optimizing growth potential while avoiding potential pitfalls (Easterly, 2001; Chowdhury & Mavrotas, 2006; Al-Fadhat & Nadhir, 2019).

The empirical study aims to enhance the current body of knowledge by undertaking a systematic analysis of IMF member countries in South Asia. The selected time frame for this analysis spans from 1990 to 2021. The empirical findings are derived through the utilization of two distinct techniques: the Panel ARDL and the Panel NARDL. The Panel ARDL technique provides insights into both short-term and long-term relationships among the variables, whereas the Panel NARDL technique delves into asymmetric relationships among these variables. This research attempts to represent an important contribution to the existing literature on economic dynamics in South Asian IMF member countries, shedding light on the details of their economic relationships and offering valuable insights for policymakers and scholars alike. The comprehensive analysis of this dataset covering over three decades enables a deeper understanding of the economic trends and relationships in this region. Furthermore, the application of both Panel ARDL and Panel NARDL techniques ensures a robust examination of the data, capturing both short-term, long-term term, and asymmetric dynamics, which is essential for a better understanding of the factors influencing these economies.

Literature Review

(Ale et al., 2023), examined the association between external debt and economic growth in five South Asian economies. This study used time series and the period from 1980 to 2020 and an econometric approach Cross-Sectional Dependence CS-ARDL. The study results show that external debt and economic growth negatively correlated in the short and long term. The study recommended that South Asian countries encourage domestic investment and saving in order to reduce their dependence on outward debt, as increased foreign debt is associated with slower economic growth.

(Aloulou et al., 2023) Studied the association between external debt and economic growth in Tunisia. The time series approach ARDL used as well as time considered from 1965 to 2019. The study outcomes described that the under an asymmetry approach variable holds long-term association. Moreover, the study also showed that external debt negatively correlated with national growth. This study implied that if a specific state reduces and maintains its other expenditures, it has too much benefit from external debt.

(Agyeman et al, 2022) Studied the association between the flow of capital and its impact on external debt in sub-Saharan economies. They used data from 2000 to 2015, and the econometric technique dynamic system GMM was used for estimation. The results showed that both capital flight and external debt individually have a negative and significant effect on economic growth. Besides, the study also shows that low capital flight is not worse for economic growth. Therefore, the paper concluded that efforts to enhance effective external debt management in sub-Saharan economies order the reduction of capital flight.

(Lau et al., 2022), examined the nexus between debt and economic growth in Asian Developing nations. These economies, faced with very high indebtedness, used substantial external debt for fiscal operations. The study identified the suitable edge of external debt to GDP that impacts economic growth and the time

period 1980 to 2016. The results highlighted a significant and negative effect of external debt on growth in most of those economies. The study recommended these Asian countries achieve sustainable economic growth and offer flexibility to employ fiscal tools against potential future economic shocks.

(Sharaf, 2022), studied a multivariate approach to explore the asymmetric and threshold impact of external debt on the economic growth of Egypt. He used time series data from 1980 to 2019. The NARDL cointegration and a VECM to estimate short- and long-term equilibrium dynamics. As well as multiple structural breaks model used for non-linear association between external debt and economic growth. The study shows a negative and significant long-term effect on economic growth in both shocks of external debt, positive and negative.

(Uchenna et al., 2020), Studied how external debt affects economic growth in Nigeria. Also investigated how Gross fixed capital formation (GFCF), exchange, and inflation rate contributed economic growth of Nigeria. The study employed OLS and GLS to estimate the model parameters. The results showed a positive connection between external debt, inflation, exchange rate, and economic growth. Conversely, economic growth is negatively correlated with GFCF. The study suggested that external debt has played an important role in promoting economic growth in Nigeria.

(Awan and Qasim, 2020), examined how external debt affects Pakistan's economic growth. The data nature is a time series, and data was collected from 1980 to 2017. Econometrics approaches, i.e., ADF, ARDL, and ECM, were employed to assess variable relationships in the short and long run. The study outcomes show that debt services, population growth, import volume, and external debt have negative effects on GDP. At the same time, participation of the labor force, gross, gross capital formation, and exports have a positive impact on GDP. The study recommended that Pakistan boost revenue through suitable taxation, improve exports, and improve productivity and efficiency.

Methodology

Data and Data Sources

This dataset, spanning from 1990 to 2021 and sourced from the World Development Indicators (WDI), relates to South Asian countries, offering a valuable window into their economic evolution. This period captures crucial economic shifts and growth patterns in the region. The dataset includes essential variables such as GDP growth, external debt, government consumption, imports, and inflation. These variables are pivotal in comprehending the multifaceted determinants of economic performance within South Asia.

Model Specification

GDP grwoth	*f (External Debt*	*Government Consumption*	*Import*	*Inflation*
Dependent Variable	Independent variables			

$$GDPG_{it} + a_{it} + \beta_1 EXTDEBT_{it} + \beta_2 GOVCONS_{it} + \beta_3 IMPORT_{it} + \beta_4 INFL_{it} + \varepsilon_{it} \ldots (1)$$

Econometric Model

$GDPG_{it}$	a_{it}	$\beta_1 EXTDEBT_{it}$	$\beta_2 GOVCONS_{it}$	$\beta_3 IMPORT_{it}$	$\beta_4 INFL_{it}$	ε_{it}
Dependent Variable		Department variable				Error term
	Intercept	Coefficient values				
		$\beta_1 < 0$	$\beta_2 > 0$	$\beta_3 > 0$	$\beta_4 < 0$	

Unit Root Test

A panel unit root shows the presence of a unit root in a panel. Basically, it shows non-stationarity, where a time series variable does not possess a stable mean or trend over time. There are several types of panel unit root tests that are commonly used to calculate the presence of unit roots in panel data. These two commonly used: Levin-Lin-Chu (LLC) Test (Levin et al., 2002) and Im-Pesaran-Shin (IPS) Test (2003). This study also used LLC and IPS unit root tests.

LLC and IPS Tests

The Levin-Lin & Chu test was introduced by Andrew Levin and Chien-Fu Lin in 1992 (Levin et al., 1992) and later expanded with Chia-Shang James Chu's contribution in 2002. It builds upon the Dicky-Fuller unit root test and consists of two steps to estimate the stationary of data. The first step involves permitting variation and lag coefficients of the dependent variable across different units, while the second step includes unit-specific time trends. LLC approach is useful for examining divergence and lag coefficients within multiple units. The LLC test equation for the ADF test statistic is given by:

$$\Delta y_{it} = \delta y_{i,t-1} + \sum_{L=1}^{p-1} a_{iL}\, \Delta y_{i,t-1} + \vartheta_{mi} d_{mt} + \varepsilon_{it} \dots (2)$$

Where, Δy_{it}= is the 1st difference of the variable for entity I at time t, a_i= represent individual fixed effects, β = coefficient of time trend, γ= coefficient of lagged of dependent variable, δ_j =coefficient on lagged differences and p= number of lagged difference while ε_{it}Is error term. The d_{mt} shows the vector of deterministic variables and ϑ_{mi} Equivalent vector of coefficients for model m = 1, 2, 3.

Cointegration

Cointegration is a statistical concept that describes a long-term equilibrium relationship between two or more non-stationary time series variables. When two or more variables are cointegrated, it means that even though each individual variable may not be stationary on its own, a linear combination of these variables exists that is stationary. Panel cointegration tests, like the Pedroni test, Kao, or Westerlund test, consider the joint behavior of variables across entities and time periods. These tests examine whether a linear combination of variables is cointegrated for the entire panel. The presence of panel cointegration suggests that there is a common equilibrium relationship shared across the entities.

Pedroni Cointegration Test

Pedroni cointegration test is a statistical approach used to test for cointegration in panel data. Its study, cross-sectional dependence, and heterogeneity among entities. It extends the conventional Engle-Granger co-integration test to panel data. The basic equation of this test is:

$$\Delta y_{it} = a_i + \beta i_t + \sum_{j=1}^{\rho} \delta_{ij}\, \Delta \gamma_{yit} + \sum_{k=0}^{\rho} \gamma_{ij}\, \Delta \gamma_{yi,t-k} + \varepsilon_{it} \dots (3)$$

Where: Δy_{it} is the variable of interest for entity i at time t, a_i Is the individual fixed effect for an entity I, βi_t Is the coefficient of the time trend for entity I, $\Delta \gamma_{yit}$ Represents the 1st difference of the variable yit for entity i at time t. δ_{ij}represents the coefficient of the 1st difference of yit in the equation for entity I, yik represents the coefficient of the lagged 1st difference of yit in the equation for entity i and lag k, p is the number of lags for the 1st differences, q is the number of lags for the lagged first differences, ε_{it} Is the error term. Pedroni co-integration test (1999) studied the long-term relationships between variables based on their stationarity and unit root test results. Panel co-integration takes into account various characteristics and individual outcomes, allowing for cross-sectional interdependence. Pedroni established seven co-integration tests, categorized into two groups: the panel-v statistic and the panel rho-statistic. Some tests, like the panel ADP test and the panel PP test, fall within the dimension, while the remaining three tests extend beyond.

KAO Cointegration Test

The Kao cointegration test is another method used to test for cointegration in panel data. It focuses on the presence of a long-term relationship among variables across section entities and time periods. This test estimates cross-sectional dependence and individual-specific heterogeneity in panel data. The basic equation for the Kao cointegration test is given by:

$$\Delta y_{it} = a_i + \beta i_t + \sum_{j=1}^{\rho} \delta_{ij}\, \Delta y_{it} + \varepsilon_{it} \dots (4)$$

Where: y_{it}represents the variable of interest for entity i at time t, a_i Is the individual fixed effect for entity i, βi is the coefficient of the time trend for an entity I, Δy_{it} is the first difference of the variable yit for an entity I at time t, δ_{ij} is the coefficient of the first difference of yit in the equation for entity i, p is the number of lags for the first differences, and ε_{it} Represents the error term. Therefore, the null hypothesis of the Kao test is no cointegration against the alternative hypothesis of cointegration. The test statistic follows a normal distribution under the null hypothesis. The Kao test is intended for panel data with cross-sectional dependence.

Panel ARDL

Pesaran et al. (1995, 1997) proposed the ARDL approach for cointegration analysis within single equation models. This method involves two steps to estimate a long-term relationship. First, it checks if a co-integrated relationship exists among all variables. Suppose such a relationship is confirmed, estimate the long-run coefficients of ARDL's results. This approach emphasized the need to implement cross-equation restrictions on long-run parameters using maximum-likelihood estimation, verified by the Hausman test. The PMG Estimator is used for estimations, which averages unrestricted single-country coefficients. It serves as an effective alternative to other panel estimators, i.e., DOLS and FMOLS. The Panel ARDL model is derived from the ARDL (p, q) model within the Pesaran et al. ARDL-UECM model. It applied to establish a standard log-linear functional specification for estimating the long-run relationships between variables. (Fatima et al., 2023)

$$\Delta GDPG + a_i + \sum_{f=1}^{m-1}\beta_{ij}\Delta GDPG_{i,t-j} + \sum_{g=0}^{n-1}\beta_{ij}\Delta EXTDEBT_{i,t-j} + \sum_{h=1}^{0-1}\beta_{ij}\Delta GOVCONS_{i,t-j} + \sum_{i=1}^{p-1}\beta_{ij}\Delta IMPORT_{i,t-j} + \sum_{j=1}^{q-1}\beta_{ij}\Delta INFL_{i,t-j} + \emptyset_1 GDPG_{i,t-j} + \emptyset_2 EXTDEBT_{i,t-j} + \emptyset_3 GOVCONS_{i,t-j} + \emptyset_4 IMPORT_{i,t-j} + \emptyset_5 INFL_{i,t-j} + \varepsilon_{it} \dots (5)$$

$$\Delta EXTDEBT + a_i + \sum_{f=1}^{m-1}\eta_{ij}\Delta EXTDEBT_{i,t-j} + \sum_{g=0}^{n-1}\eta_{ij}\Delta GDPG_{i,t-j} + \sum_{h=1}^{0-1}\eta_{ij}\Delta GOVCONS_{i,t-j} + \sum_{i=1}^{p-1}\eta_{ij}\Delta IMPORT_{i,t-j} + \sum_{j=1}^{q-1}\eta_{ij}\Delta INFL_{i,t-j} + \partial_1 GDPG_{i,t-j} + \partial_2 EXTDEBT_{i,t-j} + \partial_3 GOVCONS_{i,t-j} + \partial_4 IMPORT_{i,t-j} + \partial_5 INFL_{i,t-j} + \varepsilon_{it} \dots (6)$$

$$\Delta GOVCONS + a_i + \sum_{f=1}^{m-1}\varphi_{ij}\Delta GOVCONS_{i,t-j} + \sum_{g=0}^{n-1}\varphi_{ij}\Delta GDPG_{i,t-j} + \sum_{h=1}^{0-1}\varphi_{ij}\Delta EXTDEBT_{i,t-j} + \sum_{i=1}^{p-1}\varphi_{ij}\Delta IMPORT_{i,t-j} + \sum_{j=1}^{q-1}\varphi_{ij}\Delta INFL_{i,t-j} + \gamma_1 GDPG_{i,t-j} + \gamma_2 EXTDEBT_{i,t-j} + \gamma_3 GOVCONS_{i,t-j} + \gamma_4 IMPORT_{i,t-j} + \gamma_5 INFL_{i,t-j} + \varepsilon_{it} \dots (7)$$

$$\Delta IMPORT + a_i + \sum_{f=1}^{m-1}\Omega_{ij}\Delta IMPORT_{i,t-j} + \sum_{g=0}^{n-1}\Omega_{ij}\Delta GDPG_{i,t-j} + \sum_{h=1}^{0-1}\Omega_{ij}\Delta EXTDEBT_{i,t-j} + \sum_{i=1}^{p-1}\Omega_{ij}\Delta GOVCONS_{i,t-j} + \sum_{j=1}^{q-1}\Omega_{ij}\Delta INFL_{i,t-j} + \mu_1 GDPG_{i,t-j} + \mu_2 EXTDEBT_{i,t-j} + \mu_3 GOVCONS_{i,t-j} + \mu_4 IMPORT_{i,t-j} + \mu_5 INFL_{i,t-j} + \varepsilon_{it} \dots (8)$$

$$\Delta INFL + a_i + \sum_{f=1}^{m-1}\tau_{ij}\Delta INFL_{i,t-j} + \sum_{g=0}^{n-1}\tau_{ij}\Delta GDPG_{i,t-j} + \sum_{h=1}^{0-1}\tau_{ij}\Delta EXTDEBT_{i,t-j} + \sum_{i=1}^{p-1}\tau_{ij}\Delta GOVCONS_{i,t-j} + \sum_{j=1}^{q-1}\tau_{ij}\Delta IMPORT_{i,t-j} + \lambda_1 GDPG_{i,t-j} + \lambda_2 EXTDEBT_{i,t-j} + \lambda_3 GOVCONS_{i,t-j} + \lambda_4 IMPORT_{i,t-j} + \lambda_5 INFL_{i,t-j} + \varepsilon_{it} \dots (9)$$

Here, $\beta_{ij}\Delta GDPG_{i,t-j}$, $\eta_{ij}\Delta EXTDEBT_{i,t-j}$, $\varphi_{ij}\Delta GOVCONS_{i,t-j}$, $\Omega_{ij}\Delta IMPORT_{i,t-j}$ and $\tau_{ij}\Delta INFL_{i,t-j}$ Are the dependent variables while ai is the coefficient of the specific country. Therefore, $\emptyset_{ij}, \partial_{ij}, \gamma_{ij}, \mu_{ij}, \tau_{ij}$ shows the short-run dynamic coefficient comparative to each country and ε_{it} Is error term. Long-run coefficients are assumed to be identical to all countries. If the coefficient β_{ij} Is significantly negative, it indicates the presence of a long-term relationship between the independent variable and the explanatory variables.

Panel NARDL

The ARDL method lacks consideration for the possibility of asymmetric relationships between variables. The effect of positive and negative variations in the decomposed series on the dependent variable is preserved equally. This approach is not suitable for understanding the degree of association between

variables, as there could be asymmetric connections between them. Therefore, the preference is for the Nonlinear ARDL (NARDL) model. Hence, the NARDL model, a nonlinear extension of the ARDL approach, is chosen to explore asymmetric relationships and is centered around the concept of long-run asymmetric associations.

$$GDPG_{it} + a_{it} + \beta_1^{+}EXTDEBT_{it} + \beta_1^{-}EXTDEBT_{it} + \beta_2^{+}GOVCONS_{it} + \beta_2^{-}GOVCONS_{it} + \beta_3^{+}IMPORT_{it} + \beta_3^{-}IMPORT_{it} + \beta_4^{+}INFL_{it} + \beta_4^{-}INFL_{it} + \varepsilon_{it} \dots (10)$$

The relationship between GDPG and EXTDEBT shows both positive ($\beta_1^{+}EXTDEBT_{it}$)and negative ($\beta_1^{-}EXTDEBT_{it}$) effects, indicating a distribution around equilibrium. The error term ε_{it} Represents potential deviations from this long-term equilibrium relationship. Therefore, the association between $GDPG_{it}$ And show both positive. ($\beta_1^{+}GOVCONS_{it}$), ($\beta_1^{+}IMPORT_{it}$), *and* ($\beta_1^{+}INFL_{it}$) negative ($\beta_1^{-}GOVCONS_{it}$), ($\beta_1^{-}IMPORT_{it}$), and ($\beta_1^{-}INFL_{it}$) effects, referring to a distribution of equilibrium.

In equation (1), the outcomes of EXTDEBT can be decomposed into two parts, +ve and -ve components:

$$EXTDEBT_{it} = EXTDEBT_0 + EXTDEBT_1^{+} + EXTDEBT_1^{1} \dots (11)$$

$$GOVCONS_{it} = GOVCONS_0 + GOVCONS_1^{+} + GOVCONS_1^{1} \dots (12)$$

$$IMPORT_{it} = IMPORT_0 + IMPORT_1^{+} + IMPORT_1^{1} \dots (13)$$

$$INFL_{it} = INFL_0 + INFL_1^{+} + INFL_1^{1} \dots (14)$$

Where EXTDEBT, GOVCONS, IMPORT, and INFL indicate the random initial values and $EXTDEBT_1^{+} + EXTDEBT_1^{1}$, $GOVCONS_1^{+} + GOVCONS_1^{1}$, $IMPORT_1^{+} + IMPORT_1^{1}$, and $INFL_1^{+} + INFL_1^{1}$ show the partial sum approach, which sums positive and negative deviations correspondingly and is defined as:

$$EXTDEBT_1^{+} = \sum_{j=1} \Delta EXTDEBT_j^{+} = \sum_{j=1} \max(\Delta EXTDEBT_j, 0) \dots (15)$$

$$EXTDEBT_1^{-} = \sum_{j=1}^{t} \Delta EXTDEBT_j^{-} = \sum_{j=1}^{t} \max(\Delta EXTDEBT_j, 0) \dots (16)$$

$$GOVCONS_1^{+} = \sum_{j=1} \Delta GOVCONS_j^{+} = \sum_{j=1} \max(\Delta GOVCONS_j, 0) \dots (17)$$

$$GOVCONS_1^{-} = \sum_{j=1}^{t} \Delta GOVCONS_j^{-} = \sum_{j=1}^{t} \max(\Delta GOVCONS_j, 0) \dots (18)$$

$$IMPORT_1^{+} = \sum_{j=1} \Delta IMPORT_j^{+} = \sum_{j=1} \max(\Delta IMPORT_j, 0) \dots (19)$$

$$IMPORT_1^{-} = \sum_{j=1}^{t} \Delta IMPORT_j^{-} = \sum_{j=1}^{t} \max(\Delta IMPORT_j, 0) \dots (120)$$

$$INFL_1^{+} = \sum_{j=1} \Delta INFL_j^{+} = \sum_{j=1} \max(\Delta INFL_j, 0) \dots (21)$$

$$INFL_1^{-} = \sum_{j=1}^{t} \Delta INFL_j^{-} = \sum_{j=1}^{t} \max(\Delta INFL_j, 0) \dots (22)$$

The form of the estimated Panel NARDL model:

$$GDPG_{it} + a_{it} + \beta_1^{+}GDPG_{it-1} + \varphi_1^{+}EXTDEBT_{it-1} + \varphi_1^{-}EXTDEBT_{it-1} + \beta_1 EXTDEBT_{it} + \vartheta_1^{+}GOVCONS_{it} + \vartheta_1^{-}GOVCONS_{it} + \beta_2 GOVCONS_{it} + \kappa_1^{+}IMPORT_{it} + \kappa_1^{-}IMPORT_{it} + \beta_3 IMPORT_{it} + \pi_1^{+}INFL_{it} + \pi_1^{-}INFL_{it} + \beta_4^{-}INFL_{it} + \sum_{j=0}^{n-1}(\varphi_1^{+}EXTDEBT_{it-1} + \varphi_1^{-}EXTDEBT_{it-1}) + \sum_{j=0}^{n-1}(\vartheta_1^{+}GOVCONS_{it} + \vartheta_1^{-}GOVCONS_{it}) + \sum_{j=0}^{n-1}(\kappa_1^{+}IMPORT_{it} + \kappa_1^{-}IMPORT_{it}) + \sum_{j=0}^{n-1}(\pi_1^{+}INFL_{it} + \pi_1^{-}INFL_{it}) + \vartheta ect'i + \varepsilon_{it} \dots (10)$$

The asymmetric ECM is represented by ect′i,t, and the rate at which the system returns to long-run equilibrium after a shock is represented by ϑi.

Results and Discussion

Table 1

CD Test Results

Test	EXTDEBT	GDPG	GOVCONS	IMPORT	INFL
Breusch-Pagan LM	202.255*	72.2719*	49.2681*	89.6513*	99.1270*

Pesaran scaled LM	34.1877*	10.4563*	6.25647*	13.6294*	15.3594*
Bias-Corrected scale LM	34.0909*	10.3596*	6.15969*	13.5326*	15.2626*
Pesaran CD	5.28395*	7.77161*	-0.08254	3.29468*	8.48912*

Table1 shows the cross-sectional dependency outcomes. The asterisk (*) is used to show statistical significance at the 1% level. The p-value of Breusch-Pagan LM, Pesaran scaled LM, and CD and Bias-corrected scale are significant at level, which means we reject HO and accept HA and HA: cross-sectional dependency exists in the series.

Table 2

Descriptive statistics

	GDPG	EXTDEBT	GOVCONS	IMPORT	INFL
Mean	5.087057	42.29911	10.92068	29.82709	7.499438
Median	5.149152	38.15067	10.35801	26.30086	7.012367
Maximum	18.36085	139.7764	22.78158	72.44380	22.56450
Minimum	-10.00970	14.88005	4.053250	8.452911	2.007174
Std. Dev.	2.840125	23.52287	4.592651	14.64475	3.730388

Descriptive statistics describes a concise summary of the dataset, i.e., averages, variability, and distribution (Gul and Khan, 2021; Gul et al., 2023). In table 2, GDPG is dependent, while other independent variables. The mean of external debt is 42.29, which height while inflation holds 7.499 means of the data. The lowest median value is held by GDP growth, while height is external debt at 38.15. The standard deviation of 2.84% provides minimum variation in the series. Therefore, the external debt standard deviation is 23.52 computes the average spread from the mean. Thus, the external debt standard deviation is higher than other series in the projected model.

Table 3

Correlation coefficient

Variable	GDPG	EXTDEBT	GOVCONS	IMPORT	INFL
GDPG	1.000000				
EXTDEBT	-0.140420	1.000000			
GOVCONS	0.109647	0.565233	1.000000		
IMPORT	0.154807	0.636375	0.702818	1.000000	
INFL	-0.089774	-0.028603	0.048617	0.047240	1.000000

In statistics, correlation describes the direction of two variables. This correlation matrix presents the pairwise correlations between different variables such as inflation, GDP growth, external debt, import, and government stability. Most variables hold weak and positive and negative correlations with each other. Furthermore, some variables have strong associations with each other, like government consumption and imports, as well as external debt and government stability. External debt also has a strong association with imports.

Table 4

Lag Length Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2091.209	NA	54505289	32.00319	32.11293	32.04778
1	-1532.634	1065.984	15802.71*	23.85700*	24.51544*	24.12456*
2	-1512.061	37.69073	16935.85	23.92459	25.13174	24.41511
3	-1493.107	33.27842	18650.65	24.01689	25.77274	24.73037
4	-1471.612	36.09840*	19830.32	24.07041	26.37495	25.00685

Lag selection criteria are essential tools used in time series analysis to determine the appropriate number of lags in a model, such as ARIMA or VAR. There are many criteria, such as LogL, LR, FPE, and HQ. Most

studies used AIC and SC criteria due to their features. The asterisk (*) indicates the lag length that is recommended based on that specific criterion. This study employed AIC criteria, and according to AIC, Lag 1 is suitable.

Table 5

Panel Unit Root Test

Variable		At Level		At 1st Difference		Outcomes
		II***	II & T**	II***	II & T**	
GDPG	LL & C	-4.41771 (0.0000) *	-325279 (0.0006) *	-	-	I (0)
	IPS	-4.97120 (0.0000) *	-3.89358 (0.0000) *	-	-	
EXTDEBT	LL & C	-1.00113 (0.1584)	0.74102 (0.7707)	-4.71977 (0.0000) *	-3.76464 (0.0001) *	I (1)
	IPS	02.9664 (0.6166)	0.68998 (0.7549)	-6.95143 (0.0000) *	-6.09752 (0.0000) *	
GOVCONS	LL & C	-1.07257 (0.1417)	0.29563 (0.6162)	-3.58557 (0.0002) *	-2.52470 0.01520	I (1)
	IPS	-1.21400 (0.1124)	0.22500 (0.5890)	-6.59688 (0.0000) *	-5.23117 (0.0000) *	
IMPORT	LL & C	-1.10636 (0.1343)	-0.47315 (0.3181)	-8.29085 (0.0000) *	-7.16099 (0.0000) *	I (1)
	IPS	-0.88406 (0.1883)	-0.06394 (0.4745)	-7.64915 (0.0000)*	-6.38858 (0.0000) *	
INFL	LL & C	-2.62731 (0.0043) *	-1.17956 (0.1191)	-	-	I (0)
	IPS	-3.48803 (0.0002) *	-2.10933 (0.0175) *	-	-	

II* II& T** represent individual intercept and intercept and trend, respectively.

Unit root tests are crucial for both time series and panel data analysis, particularly when dealing with data time series and cross-sectional dimensions. Panel data consists of data observations across multiple individuals (cross-sectional units) and time periods. The concept of stationarity is essential in time series analysis because it affects the validity of various statistical analyses and modeling techniques. Table 5 describes panel unit root tests of LLC and IPS. The GDP growth and Inflation are stationary at I(0), while external debt, government consumption, and import are non-stationary at I(0) but stationary at I(1). When a mixed order of integration occurs in a series, then we use the Panel ARDL approach.

Table 6

Pedroni Cointegration test

Tests	II and IT	No Intercept or Trend
P-v-S	-0.485130 (0.6862)	0.531514 (0.2975)
P-rho-S	-2.552609 (0.0053)	0.855722 (0.8039)
P-PP-S	-11.19394 (0.0000)	-2.923561 (0.0017)
P-ADF-S	-4.954957 (0.0000)	-9.649551 (0.0000)
G-rho-S	-1.746502 (0.0404)	-1.947670 (0.0257)
G-PP-S	-15.18917 (0.0000)	-12.18950 (0.0000)
G-ADF-S	-4.307577 (0.0000)	-4.992107 (0.0000)

In this table, P, G, and S indicate panel, group, and statistic. Therefore, II and IT show individual intercepts and trends, respectively.

Cointegration capture is the attraction to statisticians, econometricians, and economists due to the long-term association between and among variables. Many tests are used for cointegration in both time series

and panel data. In panel mostly used cointegration and Kao cointegration tests. The Pedroni Cointegration Test measures the presence of cointegration among variables. In this case, two different specifications are considered: II and IT. The test involves multiple statistics, each with associated p-values, which are used to evaluate the null hypothesis of no cointegration. The rule of thumb is if the p-values <0.05. It suggests that the reject H_0 and accept H_A and H_A: cointegration exist among the variables. In Table 4.6, most tests are significant means cointegration exists among the variables in this targeted model.

Table 7

Kao Residual Cointegration Test

Test	Intercept and Trend	
ADF	t-statistic	Prob.
	-5.276855	0.0000
Residual variance	10.85550	
HAC variance	5.743967	

The Kao Residual Cointegration Test is used to determine whether there is a cointegrating relationship among variables. In Table 7, the test statistic for the ADF test is -5.276855, and the prob. value is 0.0000. it is highly significant, and cointegration exists among the variables. The residual variance is calculated as 10.85550, which measures the variability of the residuals from the cointegration equation. The HAC (Heteroskedasticity and Autocorrelation Consistent) variance is 5.743967, which shows heteroskedasticity and autocorrelation in the residuals.

Table 8

Long run coefficient

Dependent Variable: D(GDPG), PARDL & PNARDL (1, 1, 1, 1, 1)				
	(a) PARDL		(b) PNARDL	
Variables	Coefficient	t-statistics	Coefficient	t-statistics
EXTDEBT	-0.033	-3.221		
EXTDEBT$^+$			-0.041	-2.931
EXTDEBT$^-$			-0.044	-3.880
GOVCONS	0.562	4.764		
GOVCONS$^+$			-0.220	-3.265
GOVCONS$^-$			-0.184	-3.688
IMPORT	0.077	3.563		
IMPORT$^+$			0.074	2.299
IMPORT$^-$			0.172	2.876
INFL	-0.012	0.310		
INFL$^+$			-0.158	-3.622
INFL$^-$			-0.245	-6.880

Table 8 displays the outcomes of Panel ARDL and non-linear ARDL model with a (1, 1, 1, 1, 1) lag structure. The coefficient values explain the explanatory variable depends on dependent variables along with long-run direction. In segment (a), the coefficient value of external debt is -0.033, and it is highly significant. It means that when there is a 1 percent increase in external debt, there is a -0.033 percent decline in GDP growth. High consumption of a state enhances economic activities as well as direct and indirect external debt. When 1 percent increases government stability, 0.56 percent increases GDP growth. Imports determine the industry position of a state. If a state imports a number of goods, it means the state industry insufficient production of the people. In the case of Pakistan, when 1 percent increase in imports as a result of 0.07 percent GDP growth increase in the long run. Therefore, inflation is a macroeconomic variable that determines the pattern of buyers. Creeping inflation is beneficial for economic growth. Unfortunately, Pakistan is one of the countries where people are facing inflation. When there is a 1 percent increase in inflation due to a -0.012 percent decline in economic growth. The Panel ARDL results conclude that some variables have positive while some have negative impacts on economic growth. Part (b) in the same table

describes the PNARDL test. Both external debt, positive and negative, are statistically significant and have direct and indirect impacts on GDP growth. When external debt positive increases by 1 percent, the GDP growth reduces by -0.041 percent. Besides, the external debt negative increased by 1 percent as a result, reducing -0.044 percent of GDP growth. In other words, positive external debt holds a negative association, while negative external debt captures a direct association. The positive and negative shock of government consumption disturbs the entire economic activities of a state when a 1 percent increase in government consumption reduces -0.220 percent GDP growth. While negative shock is direct associate with government stability. Thus, 1 percent government consumption negative increase, the GDP growth is reduced by -0.184 percent. Parallel, import positive and negative shock significant impact on GDP growth. The import positive direct while import negative indirect associated with GDP growth. Thus, a 1 percent import positive (negative) increase as a result of GDP growth increase of 0.072 and (reduced) 0.172 percent, respectively. In the long run, inflation has negative and positive indirect and direct and significant impacts on GDP growth. GDP growth declined by -0.158 percent when inflation increased by 1 percent. Also, when inflation rises by 1 percent, the GDP growth declines by -0.245 percent. Overall results conclude that all explanatory variables are statistically significant on dependent variables in the long run.

Table 9

Short-Run Coefficients

Dependent Variable: D(GDPG), PARDL (1, 1, 1, 1, 1)				
	(a) PARDL		(b) PNARDL	
Variables	Coefficient	t-statistics	Coefficient	t-statistics
D(EXTDEBT)	-0.195451	-1.870995***		
D(EXTDEBT+)			-0.190348	-2.038202**
D(EXTDEBT-)			-0.031117	-2.244886**
D(GOVCONS)	-0.572916	-0.995052		
D(GOVCONS+)			-0.298043	-0.430859
D(GOVCONS-)			-1.065897	-1.434562
D(IMPORT)	0.219128	2.214988**		
D(IMPORT+)			0.181778	3.259732*
D(IMPORT-)			0.251720	1.751740***
D(INFL)	-0.074753	-1.9683320***		
D(INFL+)			-0.351388	-1.096469
D(INFL-)			0.049196	0.205373
COINTEQ01	-0.990697	-12.05723*	-0.973845	6.342433
C	-2.130192	-1.637910	3.337763	4.000610***

*, ** & *** indicate 1%, 5%, and 10% significant level respectively.

Table 9 explains the PARDL and PNARDL short-run results. In part (a), external debt has a negative and statistically significant impact on GDP growth at 10%. In the short-term, government consumption sign is negative but does not have a significant effect on GDP growth. The import is positive, while inflation has a negative impact on GDP growth at 5% and 10%. Additionally, cointeq01 of PARDL is 0.99 and highly significant. Similarly, the PANRDL ECM value is -0.97 (t-statistics value high 1.96, which refers to significant). It indicates the short-run equilibrium towards long-run equilibrium or short-run convert to long-run. Part (b)describes the PNARDL outcomes. External debt positive and negative significant impact on GDP growth. The external debt positive is indirect (external debt positive increase 1 percent, the GDP growth decline -0.19 percent) while the negative is direct (external debt negative raise 1 percent, the GDP growth reduced -0.03 percent) association with GDP growth. In the short run, government consumption and inflation are insignificant, like PARDL regression. The import has a direct and indirect impact on GDP growth. Overall, outcomes show that the targeted variables have direct and indirect significant impacts on GDP growth in the short run, except for government consumption and inflation.

Conclusion and Policy Recommendation

The results provide a comprehensive picture of the complex relationships between various external debt and GDP growth in South Asian IMF member countries. These results carry significant implications for understanding the drivers of economic growth in the region and for shaping future policy decisions. External debt emerges as a crucial determinant of economic growth. The highly significant negative coefficient indicates that increasing levels of external debt have adverse effects on GDP growth. It underscores the importance of sensible debt management practices to sustain long-term economic prosperity. The positive impact of government stability on GDP growth underscores the integral role of political stability in fostering economic growth. This finding highlights that countries with more stable governance structures tend to experience higher long-term economic growth rates. The link between imports and GDP growth emphasizes the significance of a nation's industrial capacity. Specifically, higher import levels correspond to increased long-term GDP growth, indicating that addressing domestic production limitations is essential for driving sustainable economic growth. Inflation, as a macroeconomic variable, plays a notable role in determining economic patterns. The results reveal that inflation has a substantial impact on GDP growth, with negative inflation shocks leading to significant declines in economic growth. This underscores the importance of maintaining price stability to support long-term economic growth. In the short run, external debt continues to exert significant influences on GDP growth, both positively and negatively. This suggests that changes in external debt levels can have short-term implications for economic performance. The short-term effects of government consumption and inflation on GDP growth appear to be less significant, as these variables do not exhibit strong impacts in the short run. The presence of cointegration in the PARDL model and the highly significant ECM value in the PANRDL model lend credibility to the model's validity. This suggests that economic variables tend to align with their long-term effects, indicating that the models effectively capture the underlying economic dynamics. This comprehensive analysis reveals that the economic growth of South Asian IMF member countries is influenced by a combination of factors, including external debt, government stability, imports, and inflation. Sensible debt management and political stability are essential for long-term economic prosperity. The role of domestic production capacity, as reflected in import levels, is crucial for sustained growth. Additionally, maintaining price stability is critical, as inflation can have detrimental effects on economic growth.

Policy Recommendations

Implement and maintain sound debt management practices to ensure that external debt levels remain manageable. This includes monitoring debt sustainability indicators and considering the terms and conditions of borrowing. Promote Government stability and good governance to create an environment conducive to investment and economic growth. Implement consistent and investor-friendly policies that provide certainty for businesses and attract both domestic and foreign investment. Implement effective monetary policies aimed at maintaining price stability and controlling inflation. Develop strategies to manage inflation expectations and prevent excessive price increases.

These policy recommendations aim to address the complex dynamics uncovered in the analysis, including the relationship between external debt, government stability, imports, and inflation. By implementing these strategies, South Asian IMF member countries can work towards fostering sustainable economic growth and stability in the region.

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