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Public Debt's Role in Sustainable Economic Growth: An Extensive Case Study of Pakistan

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ABSTRACT

Objective: A general objective belonging to this research includes the analysis of the influence of public debt on sustainable economic growth in Pakistan. It employs time series data records from 1980-2022.

Research Gap: Prior research does not produce strong conclusions that link the public debt to sustainable economic growth. While several studies have attempted to explore this relationship, most lack robust econometric testing or fail to consider the stationarity of data and long-run dynamics.

Design/Methodology/Approach: To start, through the ADF test, we can determine stationarity, especially when using econometric and statistical tools. To ensure that the order of all variables is I (1), this research uses a co-integration approach based on this conclusion. To this end, the aim of research is to address the public debt influence on economic growth, and as the dependent variable, the study considers Gross Domestic Product. Net trade and Foreign Direct Investment are also used in the model as exogenous variables along with external debt, debt service, and inflation.

The Main Findings: External debt, net trade, and inflation positively influence GDP, while debt servicing and FDI negatively affect growth.

Theoretical / Practical Implications of the Findings: The conclusion as presented in the paper shows that in measuring the effect of the public debt, variables known as Debt service and External debt are employed. According to the findings of the study, the longtime indicates higher foreign debt, net trade, and inflation as positive drivers of the Gross Domestic Product of Pakistan. However, debt servicing and Foreign Direct Investment are inversely related. So, these findings offer practical insight for policymakers to evaluate debt sustainability while considering the broader implications for economic growth.

Originality/Value: This research adds value by applying time series econometric techniques, specifically ADF testing and co-integration, to a 43-year dataset focused on Pakistan. It uniquely combines public debt indicators with trade, inflation, and FDI to offer a more comprehensive view of their collective impact on sustainable economic growth.

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1. Introduction

An intricate correlation between sustainable economic growth as well as public debt remains a subject of ongoing discussion among economists and policymakers. In the context of Pakistan, this relationship assumes an even more complex dimension due to the country's unique economic and geopolitical dynamics (Safdar & Malik, 2020). From a sustainability perspective, one may argue that relying on short-term public debt for growth, rather than long-term production, is not a feasible long-term strategy (R. Ali & Mustafa, 2012; Malik

& Kemal, 2018; Ramzan, HongXing, Abbas, Fatima, & Hussain, 2023).
Public debt involves financial obligations incurred by various levels of government to cover budget shortfalls arising from increased program expenditures compared to projected revenue. (Greiner & Fincke, 2016; White & Wildavsky, 2021; Yared, 2019). The main goal of the management of public debt is to guarantee that the government's financial needs are satisfied at the lowest price feasible in any short to extended period, although optimizing risk levels to ensure sustainability. The overall debt of Pakistan as per the consideration of State Bank of Pakistan and obligations amounted to Rs 81.194 trillion ($131 billion) by the conclusion of December 2023, indicating a 27.2% rise from Rs 63.834 trillion in the same time of the preceding fiscal year (Banks, 2023; Nitsi & Ioannidis, 2025). This substantial rise shows continuous fiscal pressures and challenges in managing debt sustainability. The most recent statistics issued by the SBP indicate that the primary factors contributing to the increase in debt and liabilities were the foreign debt and the corresponding interest payments. The total external debt, including loans from the IMF, foreign direct investment, and other sources, increased by 26.17% to reach Rs 33.611 trillion. The debt from the IMF alone surged by 24.17% to Rs 2.142 trillion (Ejaz, 2011; Mansoor, Baig, & Lal, 2020; Nizami, Ihsan, & Hasan, 2020; Zaman, 2023).
State public debt is a critical element in assessing the strategy of a state's finances, and it has far-reaching impacts on development and sustainability (Muraguri et al., 2022; Pamies & Reut, 2020). History shows Investment ratio in Pakistan's public debt had large swings during early 2000s because of external economic conditions and domestic policy decisions. They have also greatly transformed almost all aspects of the entire country's development indicators and fiscal stability as well as the economic growth (Akram, 2017; Salman & Ali, 2022) This will find out the public debt impact on sustainable growth in Pakistani economy.

1.1. Problem Statement
Economic growth is the sustained rise in GDP, while sustainable growth maintains steady expansion without harming the environment. Sustainable development faces challenges like weak institutions and political instability from wars, climate change, poverty, and unemployment. Key measures include strategic investment, innovation, supportive policies, and international collaboration (Ramzan et al., 2023). Several factors contribute to the growth of national debt, such as fiscal deficits, changes in government cash balance, currency fluctuations, and fiscal and monetary policies. Total liabilities, including external and domestic obligations, increased by 27.51% to Rs4.623 trillion. Debt servicing also rose by 28.82% to Rs5.702 trillion in the first half of FY24, compared to Rs4.426 trillion in the same period of FY23 (Naveed & Islam, 2024).

1.2. Objectives of the Study
The following are objectives of the study:
- To investigate the public debt impact on sustainable growth of economy and fiscal policymaking in Pakistan.
- This investigation intends to assess the consequences of external public debt, debt servicing, FDI, Net trade, inflation, and its consequences for long-term, sustainable economic growth.

1.3. Research Questions
- To what extent does public debt impact sustainable economic growth and fiscal policymaking in Pakistan?
- What are the long-term effects of external public debt, debt servicing, foreign direct investment (FDI), net trade, and inflation on sustainable economic growth in Pakistan?

2. Literature Review
Mahmood, Rauf, and Ahmad (2009) analyzed the sustainability of public and external debt on the economy of Pakistan via the data through the period of 1970-2000. Traditional debt ratios and traditional debt models (external and public debt sustainability) are used for estimation. The data about variables such as overall deficit, domestic financing, bank borrowing, external financing, primary deficit, and non-bank borrowing are collected from authoritative sources such as the government financial statistics yearbook, the annual report of the SBP for certain years 2008 and the Pakistan Economic Survey (2008-09). Results of this research show that both public and external debt were unsustainable. The main causes of unsustainability were current account imbalances and primary deficit.
Ejaz (2011) examined the sustainability of debt burden in Pakistan by using the time series analysis from the period of 1971-2008. Their primary goal is to inspect the sustainability of Pakistan's debt and its load of

external debt. The debt dynamic equation is used for estimation purposes. The factors include public debt, primary budget deficit, external debt, interest rate, current account balance, reserve money, GDP, as well as exports. The study showed that of all the analyzed variables, current account and primary budget deficits had the strongest effect on the indebtedness of the Pakistani state. They also conclude that the economy will be sustainable if the debt burden is stable in next few years, while it will be unsustainable with an unstable debt burden.

Akhter and Hassan (2012) studied the negative effects of public debt burden on economic growth. Evidence is taken from the country of Bangladesh from the period of 1980-2012. The estimation process included the use of many approaches, including OLS, ADF, ECM, VECM, and cointegration analysis. This research used two models: the GDP growth model and the public debt model. The data on variables such as consumption, investment, total debt burden, tax revenue, subsidies, net exports, reserves, GDP growth, and external and domestic debt-GDP ratio are collected from Monthly Economic Trends, the Bangladesh Economic Survey, and the Statistical Yearbook of Bangladesh. The finding of this study shows a significant relationship between investment and stock reserves of stocks. While insignificant relation with consumption, tax, subsidies, net export and GDP growth were negatively affected by external debt.

Chandia and Javid (2013) examined the debt sustainability in Pakistan economy by taking data from the period of 1971-2008. The research aim is also to analyze the sustainability of debt in the context of the Pakistani economy and investigate the correlation between public liabilities as well as surplus for the existence of sustainable long run relations with GDP. The methods used to estimate several variables including the real exchange rate, public liabilities as well as the future primary public expenditure, private sector consumption, government revenue as well as the real interest rate and tax comprise of extended fiscal reaction function, the fiscal reaction function, the revenue as well as expenditure reaction functions, vector autoregressive model and another which analyzes the debt. The data of the variables was measured by PIFS, Pakistan Statistical Year Book 2008 and Pakistan Economic Survey. The paper identifies the positive correlation between the average value of the Surplus GDP ratio as well as the Lagged debt. Additionally, expenditures and income positively influence debt, whereas production and consumption negatively impact government spending. Finally, there will be a persistent correlation between public liabilities and surplus to GDP in the long term.

H. Ali, Farooq, and Mumtaz (2016) analyzed the nexus relationship found between trade openness, external debt and economic growth in Pakistan. The causality analysis from ARDL through modeling approach & co-integration by taking time series analysis over the period from 1974- 2016, by using SBP as well as WDI. Such an article used unit root tests and ARDL techniques for estimation. The research used the GDP as dependent variable, although the independent variables are formation of capital and external debt or foreign direct investment, inflation as well and trade. The research suggests that capital formation and external factors have an adverse impact on economic growth, but favorable positive impact on investment in foreign direct and on trade openness.

Akram (2017) investigates the public debt role on Sri Lanka economic growth by taking a time series analysis of the period from 1975 to 2014. ARDL techniques are used for estimation. The data of all variables like investment, per capita GDP, external debt, population growth, domestic debt as well as debt servicing were gathered from WDI, global development finance and international financial statistics. The research found that per capita GDP is positively correlated with domestic debt, but negatively correlated with investment, external debt, population growth, and debt servicing.

Malik and Kemal (2018) examined the sufficient debt condition in Pakistan. This study used an accounting approach for the estimation of variables like government purchases, taxes, interest on private, shift in cash reserves, as well as new borrowing from the private sector by gathering the data from IMF, World Bank, CIPA index, DRI and HIPC. The findings of the study show that if the fiscal deficit is lowered, higher to maintain the debt level sustainable. Also, a lower fiscal level increases the chances of financing development expenditures.

Mansoor et al. (2020) evaluated the debt sustainability of Pakistan through the fiscal reaction function by using the time series analysis from 1980-2019. This study used the fiscal reaction approach and ARDL techniques for estimation. The data on variables like foreign exchange earnings, total money supply, GDP per capita, primary balance, government revenue, interest rate, and trade openness were gathered from of

State Bank of India and the Ministry of Finance. The findings indicate a substantial adverse correlation between primary balance as well as external debt. Additionally, there is evidence of a long-term association between GDP per capita, external debt, and trade openness.
Law, Ng, Kutan, and Law (2021) studied threshold analysis and non-linearity between economic growth and public debt by utilizing the 71 developing countries panel data from period of 1984 to 2015. Dynamic model threshold theory is used for estimation. Data on public debt, income, financial development, population growth, inflation, real GDP per capita growth, trade openness, as well as human capital were gathered from WDI and IMF. The investigation's outcomes indicate that debt has a statistically significant as well as adverse impact on the economic growth of nations that are developing nations.
Salman and Ali (2022) investigated external debt and growth nexus: a case study for Pakistan by using time series data from 1980-2020. This research used WDI for analysis. This study used unit root test, ADF, ARDL and bound test for estimation. This article used GDP as dependent variable and inflation rate, labor force, gross capital formation, broad money, external debt, urban growth, real effective exchange rate, as well as development assistance as explanatory variables. The investigation's outcomes indicate an adverse long-term correlation between economic growth as well as external debt, but a positive connection exists between debt as well as economic growth in the short term.
Islam, Ahmed, and Faraz (2023) examined the sustainability of public debt in Pakistan by using a trend analysis from 1976-2021. That investigation used fiscal reaction function and debt sustainability analysis for estimation. The data were gathered from WDI, SBP, and IMF of variables like public debt, primary balance, external debt, current account balance, output growth as well as oil prices. The analysis concludes the continued rise in debt would result in the country's inability to handle a significant debt burden. Therefore, it is necessary to implement fiscal and monetary policies to stimulate growth in the economy.

2.1. Research Gap and Conclusion
In examining the correlation between sustainable economic growth as well as public debt in Pakistan, there has been a notable research gap in comprehensively understanding the longitudinal impacts of debt accumulation over the last two decades. While previous studies have explored various facets of Pakistan's economic challenges and debt dynamics, a detailed analysis of how these debt levels have specifically influenced economic growth and developmental indicators remains underexplored. This includes an in-depth exploration of macroeconomic variables such as GDP growth, employment rates, poverty levels, and human development indices in correlation with rising public debt. Furthermore, while there exists some research about the influence of public debt on Pakistan's fiscal policies, there is a lack of thorough evaluations that specifically connect these policies to the general goals of economic sustainability since the 2000s. This gap extends to understanding the policy responses to debt levels and their effectiveness in stabilizing and stimulating long-term economic growth, considering both internal governance factors and external economic pressures. Research often overlooks the nuanced interactions between external debt obligations, trade deficits, and foreign reserve adequacy, and how these elements collectively influence the country's economic resilience and sustainability prospects. Thus, a comprehensive study addressing these interconnected dimensions could provide valuable insights for policymakers and economic strategists.

3. Theoretical and Conceptual Framework
This section provides a foundation for analyzing the impact of public debt on sustainable economic growth. Economic growth, defined as increased GDP, becomes unsustainable if overly reliant on short-term debt. The Solow Neo-Classical Growth Model explains how capital and labor contribute to growth, with external debt influencing savings and investment. Classical economists like Smith, Ricardo, and Hume argued that public debt reduces private investment and burdens future generations. In contrast, Keynesian theory sees public debt as a tool to boost aggregate demand, employment, and output during economic downturns (Khan, Rafique, & Yousaf, 2022; Pathan & Ahmed, 2022). The Ricardian Equivalence Theorem posits that government borrowing has a neutral effect, as rational agents adjust savings accordingly. Debt Sustainability Analysis (DSA) uses indicators like GDP growth, interest rates, and primary balance to assess long-term debt viability. Solvency theory addresses a country's capacity to meet long-term obligations, while liquidity theory focuses on short-term debt servicing using reserves. Together, these theories guide the study's empirical

investigation (Islam et al., 2023; Lima, 2022).

4. Data and Model Specification

Recent research indicates that attaining credible outcomes requires the use of accurate data. To investigate how sustainable economic growth impacts public debt in relation to Pakistan. Time series data covering from 1980-2022 has been gathered from reliable sources such as the World Development Indicator (WDI).

This study utilizes the theory of Johansen Co- integration to examine the degree to which gross domestic product is related to public debt as well as vice versa. External debt, as well as debt service, are used to check the effect of public debt. This will be useful to identify the relationship in the long run as well as the short run of the different variables. The equation explains the following perception:

$$\mathbf{GDP_t = \beta_0 + \beta_1 ED_t + \beta_2 DS_t + \beta_3 FDI_t + \beta_4 NT_t + \beta_5 INF_t + \mu_t} \ldots\ldots\ldots\ldots \textbf{ eq } (4.1)$$

Now,

μt is referred to as a Stochastic disturbance term, commonly referred to as the error term. β0 represents Intercept. Slope coefficients are β1, β2, β3, β4, β5 refer to the slope of the regression line. Gross Domestic Product is always referred to by the abbreviation GDP. Referring to the acronym ED, it is an abbreviation for external debt. Debt servicing is DS. It is acknowledged that FDI stands for Foreign Direct Investment. Net trade is defined by NT. INF stands for inflation.

Table 1: List, Source and Unit of Variables

Variables	Variables (Abbreviations)	Unit of Measurement	Source	Expected sign
Dependent Variables				
GDP	GDP	Current US$	WDI	
Independent Variables				
External debt	ED	Current US$	WDI	-
Debt servicing	DS	Current US$	WDI	+
Foreign direct investment	FDI	Current US$	WDI	+
Net trade	NT	Current US$	WDI	+
Inflation	INF	Annual%	WDI	-

5. Estimation Analysis

Descriptive analysis may help you comprehend future values and past patterns of variables. Before the econometric estimate, descriptive statistics use numerical values such as mean, skewness, standard deviation, median, and Kurtosis to characterize the variables. The Table details the descriptive analysis of the study's associated variables.

Table 2: Description of Analysis

Variables	Mean	Median	Std. Dev	Skewness	Kurtosis
GDP	1.43	9.79	1.15	0.65	1.94
ED	4.54	3.42	3.31	1.17	3.45
DS	3.91	3.00	3.27	2.19	7.83
FDI	-1.17	-7.22	1.33	-1.76	5.96
NT	-1.13	-3.97	1.15	-1.15	3.19
INF	8.46	7.92	4.08	0.84	3.93

Source: Authors' Estimation

All variables reported by the World Development Indicators (WDI) are measured in current US dollars. The findings show that external debt (ED) positively affects GDP, while FDI negatively affects growth in Pakistan because most investments go in to non-productive sectors and profits also sent back to the oversees country. The main issue behind this problem is weak institutions performance and transfer of low technology that support limited local industries and further reduce the positive foreign investment impact on economic growth. So, the values of FDI that represent the net inflows of a country based on the balance of payments can be a negative only when outflows of a country have more than country inflows during some years. Net Trade (NT) is calculated in the form of exports minus imports. Its negative mean value indicates that on average our imports were higher than exports.

5.1. Correlation Matrix

The correlation coefficients among several parameters are shown tabular in a correlation matrix. The correlation between each potential set of data in a table is shown by the matrix.

Table 3: Correlation of Matrix

	GDP	ED	DS	FDI	NT	INF
GDP	1.00					
ED	0.94	1.00				
DS	0.79	0.91	1.00			
FDI	-0.54	-0.41	-0.20	1.00		
NT	-0.94	-0.92	-0.79	0.53	1.00	
INF	0.12	0.20	0.31	-0.21	-0.21	1.00

Source: Authors' Estimation

In the table, GDP shows a positive relation with ED, DS and INF which are 94%, 79%, and 12 % Correlated, while FDI and NT have a negative relation which is 54% and 94% correlated with GDP. DS and INF show a positive relation with ED which is 91% and 20% while FDI and NT have a negative relation with ED which is 41% and 92% correlated with ED. DS has a negative relation with FDI and NT which are 20% and 79% correlated, while INF is positively 31% correlated with DS. FDI is positively 53% correlated with NT while negatively 21% correlated with INF. NT has negative 21% correlation with INF.

Figure 1: The All-Variables Matrix Plot

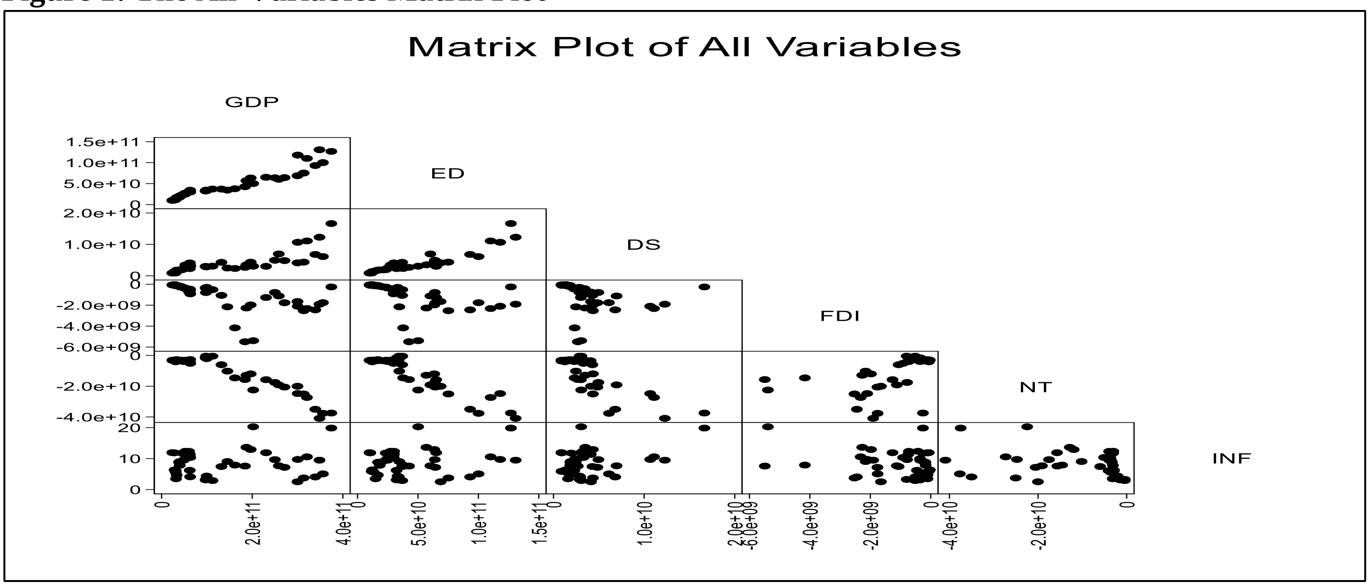


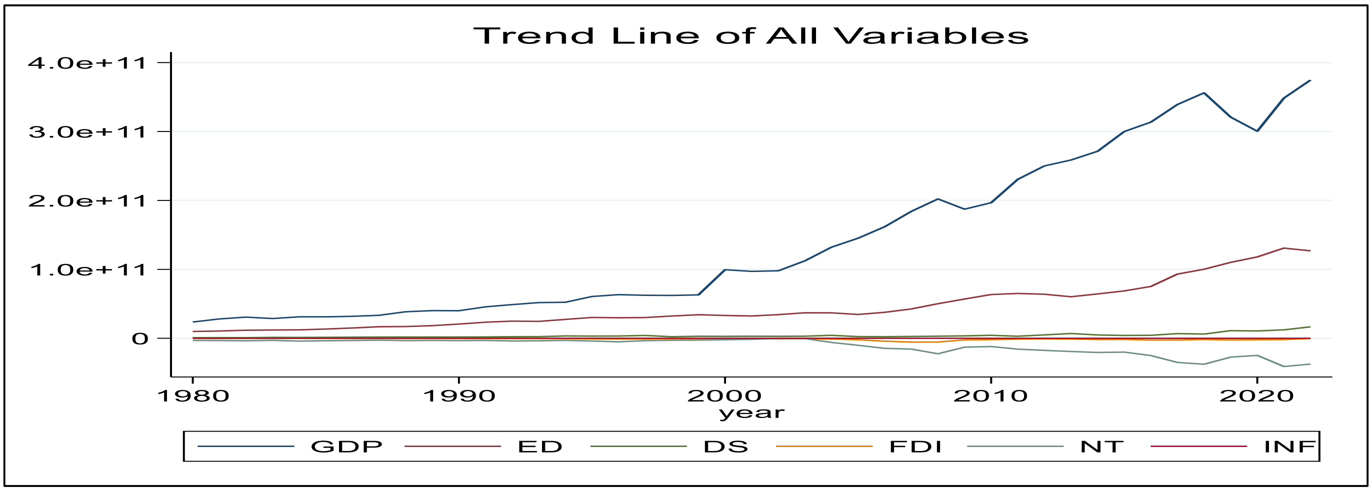
Figure 1 indicates the all-variables relationships that shows ED, DS and INF with GDP positive while other variables FDI and NT relationships with GDP are indirect and linear.

5.2. Trend Line Plot of all Variables

It explains that the plot of all variables' trend lines used in model estimation is shown in Figure 2.

The figure below shows the trends of six economic indicators, such as GDP, ED, DS, FDI, NT, and INF from 1980 to 2023. The blue line shows the highest GDP growth after 2000, showing a strong performance of the economic ED also rises steadily. DS, FDI, NT, and INF remain stable with minor changes. After 2005, NT shows a slight decline while DS and FDI show trend upward. INF stays mostly flat, shows stable inflation. The graph shows GDP growth is strong compared to other variables.

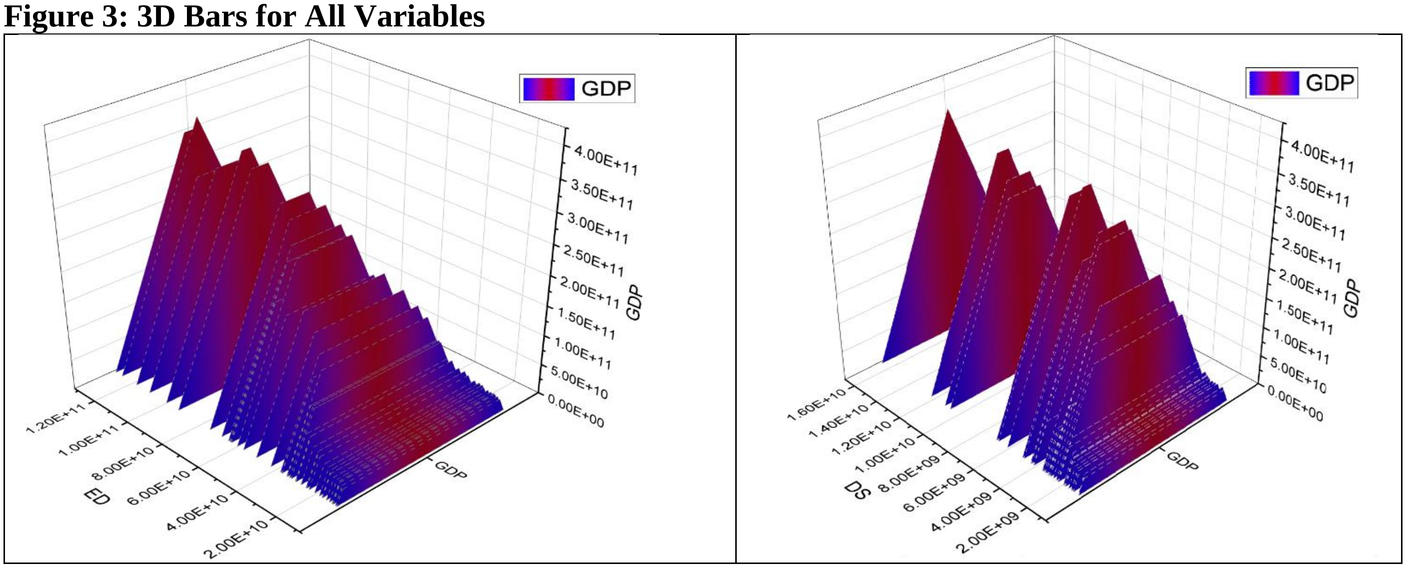
Figure 2: Plot of all Variables Trend line

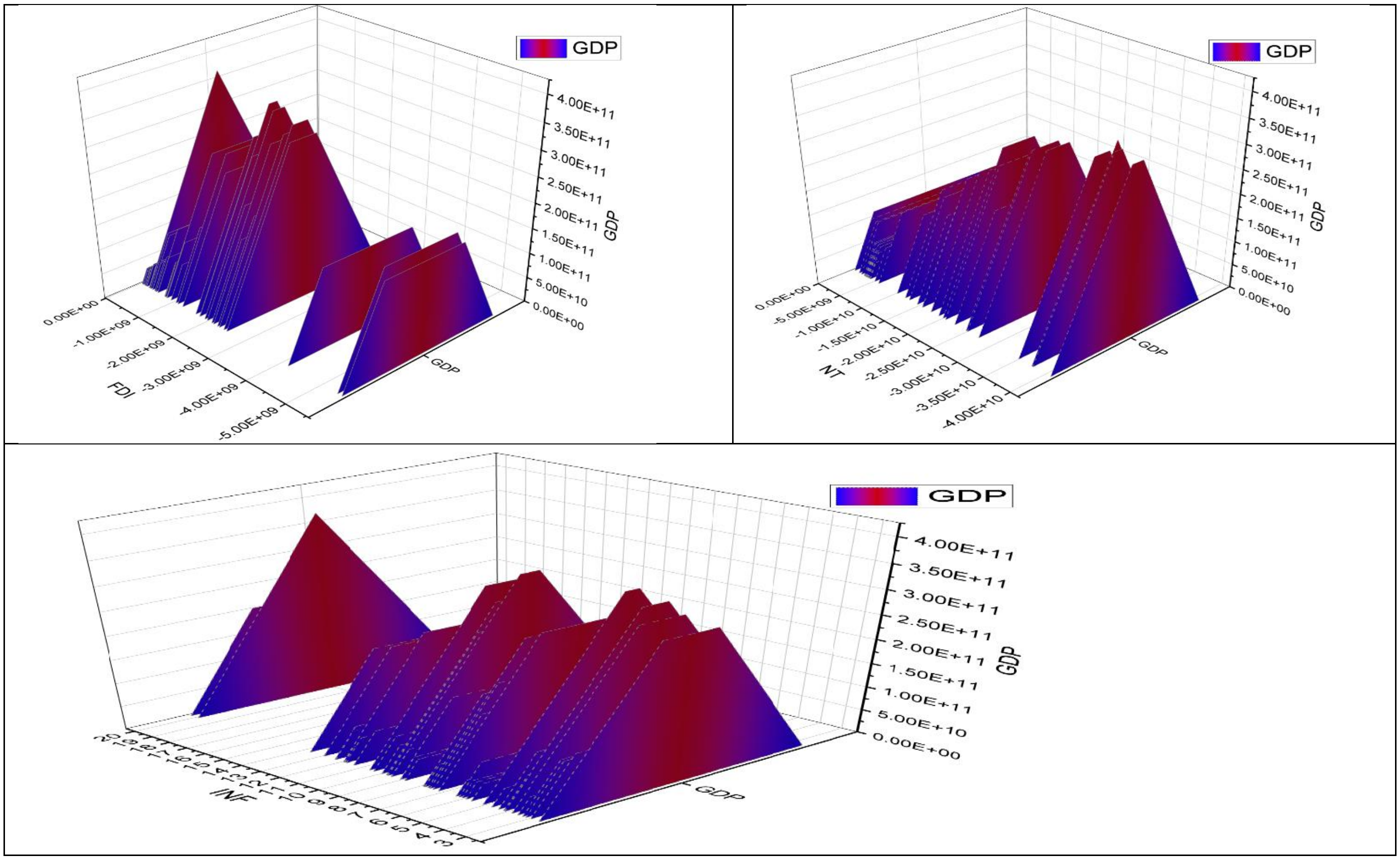


5.3. 3D Bars for All Variables

This section explains the 3D bars for all variables that are shown in figure 3. The x-axis shows all input variables and y-axis shows the outcome variable which is GDP growth. The GDP growth is affected by different variables that are represent in six 3D bar plots. In the first plot indicates the value of GDP increases quickly as the rates of other variable increases.it mean this factor has a positive and strong effect on the economy. The second plot shows that only in specific situations at certain points the value of GDP only goes up. The uneven ups and downs in third plot indicate the impact of GDP on variables is not steady. The surface of fourth plot is smooth that showing this variable supports the growth of GDP in a consistent way. The few tall bars on fifth plot shows some certain values of variable help the GDP to increase, while most do not increase the value of GDP. Finally, the spread bars of sixth plot showing that the affects of variable on GDP in a balanced way. Overall, each plot helps us to understand how economic growth differently influence different inputs variables.

Figure 3: 3D Bars for All Variables





Source: Authors' Estimation

5.4. Stationarity Test

Augmented Dickey-Fuller has been used to confirm for existence of the unit root of the apprehensive chronological parameters. The ADF Unit Root test (1979) provides a way of testing the stationarity of the selected variables. Data stationarity is necessary which is used for estimation to recognize the order of integration, which confirms methodology. Furthermore, the variable is also stationary on the level, first and second difference. The lag length criteria of the ADF unit root test are admitted with the assistance of the Schwarz criterion (SC), Hannan- Quinn criterion (HQ) as well as Alaike Information Criterion (AIC). if the stationarity of data is on level, the Johansen Co-Integration technique is used. if the stationarity of data is on 1st difference, the Auto Regressive Distributed Lag (ARDL) is used if the ADF Unit Root test results are varied like level and 1st difference. The information is presented in the form of chronological data in a given table.

Table 3: ADF Test Statistics

Variable	**Augmented Dickey-Fuller**				**Results**
	Level		**1st difference**		
	Intercept	**Trend & intercept**	**Intercept**	**Trend & intercept**	
GDP	1.86 (0.99)	-1.81 (0.67)	-5.97 (0.00)	-6.95 (0.00)	**I(1)**
ED	3.43 (1.00)	0.35 (0.99)	-3.65 (0.00)	-4.12 (0.01)	**I(1)**
DS	3.00 (1.00)	-1.67 (1.00)	-6.70 (0.00)	-7.45 (0.00)	**I(1)**
FDI	-2.65 (0.09)	-2.88 (0.17)	-4.16 (0.00)	-4.15 (0.01)	**I(1)**
NT	-0.74 (0.99)	-2.08 (0.53)	-6.99 (0.00)	-7.41 (0.00)	**I(1)**
INF	-5.19 (0.01)	-5.36 (0.05)	-6.73 (0.00)	-6.85 (0.00)	**I(1)**

Source: Authors' Estimation

The stationary nature of variables is assessed by the application of the unit root test. In the preceding estimation, all variables are stationer at level I (1) that's why we use Johansen Co-integration techniques for estimation.

5.5. Co-Integration Process

The process of co-integration has four steps that are analyzed for the estimation of public debt as well as sustainable economic growth variables.

1. Lag Length Selection
2. Unrestricted Cointegration Rank Test
3. Johansen Long Run Estimate
4. Johansen Short Run Estimate

5.6. Lag Length Selection

After findings stationarity of all variables, the subsequent task is to determine the suitable lag duration. To achieve this objective, we use several criteria for selecting the lag order.

Table 4: Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4996.0	NA	3.76	244.0	244.2	244.09
1	-4784.2	351.4	7.20	235.4	237.1*	236.06
2	-4728.3	76.35*	3.06*	234.4*	237.71	235.64*

Note: * Indicates lag order selected by the criterion like LR, FPF, HQ as well as AIC

According to these results, we select 2 lags for the next estimation step because lag 2 has 4 selected criteria. The next step after deciding the lag length is to identify the number of cointegration vectors. Hence, Eigin value of statistics as well as the trace of statistics are adopted within the framework.

5.7 Unrestricted Cointegration Rank Test

Once the lag length has been selected, the next step is to ascertain the quantity of cointegration vectors. This research utilizes both eigenvalue statistics and trace statistics, and the findings are shown in Tables 5 as well as 6.

Table 5: Results of Trace Statistics

Hypothesized -CE	Eigen-value	Trace Statistics	Critical-V0.05	Probi.**
None *	0.76	167.52	103.84	0.00
At most one *	0.59	109.49	76.97	0.00
At most two *	0.53	73.02	54.07	0.00
At most three *	0.45	42.32	35.19	0.00
At most four	0.25	17.87	20.26	0.10
At most five	0.13	5.97	9.16	0.19

Note: Four cointegrating eqn(s) at the 0.05 level Trace test indicates

Table 6: Results of Max- Eigenvalue

Hypothesized -CE	Eigen-value	Max-Eigen statis	Critical-V0.05	Probi.**
None *	0.76	58.03	40.95	0.00
At most one *	0.59	36.46	34.80	0.03
At most two *	0.53	30.70	28.58	0.02
At most three *	0.45	24.44	22.29	0.02
At most four	0.25	11.90	15.89	0.19
At most five	0.13	5.97	9.16	0.19

Note: Four cointegrating eqn(s) at the 0.05 level Max-eigenvalue test indicates

According to Eigenvalue statistics and trace statistics, 4 co-integration equations in both tests show the appearance of long run relation in the model. This shows that each of the variables in our model has a sustained relationship with one another.

5.8 Johansen Long Run Estimate (Dependent GDP)

The long-run estimate of the Johansen co-integration approach is provided in Table 7.

Table 7: Johansen Long Run Estimate

Variables:	Coefficient:	Std error:	T- Statistics:	Conclusion
C	1.81	5.4	0.03	……
ED	24.6	3.48	7.07	Significant
DS	-162.0	30.7	-5.26	Significant
FDI	-2.66	18.9	-0.14	Insignificant
NT	6.13	4.96	1.23	Insignificant
INF	4.67	5.2	0.89	Insignificant

Source: Authors' Estimation

The dependent variable GDP is used as Gross domestic product in our model. Positive and also negative symbols of the coefficient show, the influence of explanatory variables on the dependent variables. It is an indication that a 1 percent increase in the performance on the component of external debt lifts the economic growth by 24 percent. 6. The results have also provided evidence in support of the studies conducted by Mansoor et al. (2020). That means that every 1 percent rise in the performance of debt service declines the economic growth by 162. 01. This evidence also corroborates the study of H. Ali (2017), H. Ali and Zafar (2017) and Akram (2017) This implies that a rise in the FDI inflows by one percent of the GDP reduces economic growth by two percent. 66. These results are also in line with the conclusions drawn by the author of H. Ali, Farooq, Sardar, and Bhutta (2019) and Akram (2017). If the trade increases by 1 percent, then this 1 percent increases the economic growth by 6.13. It is also on par with the studies made by Mansoor et al. (2020). This is in agreement with the fact that each one percent increase in the inflation rate leads to the enhancement of economic growth by 4. 67. The results are also similar to those of H. Ali et al. (2016) and Salman and Ali (2022) within the same investigation.

5.9 Johansen Short Run Estimate (Error Correction Model)

The error correction approach is used in cases when there exists a persistent relationship between the variables. This process quantifies the speed at which the system reverts to its equilibrium state over an extended period after temporary disruptions. Table 8 displays the findings of the ECM.

Table 8: Johansen Short Run Estimate (ECM)

Variable	Coefficient	Std.Error	t-statistic
CointEq1	-0.06	0.01	-3.71
D -GDP(-1)	-0.07	0.24	-0.32
D- GDP(-2)	-0.36	0.24	-1.47
D- ED (-1)	-0.95	0.93	-1.01
D- ED (-2)	-2.84	0.89	-3.18
D-DS (-1))	3.76	2.12	1.77
D-DS (-2)	0.54	1.88	0.29
D-FDI(-1)	-2.03	3.44	-0.59
D-FDI (-2)	-2.95	3.52	-0.83
D-NT (-1)	-0.89	0.81	-1.09
D-NT (-2)	1.40	0.93	1.49
D-INF (-1)	-1.23	6.5	-1.89
D-INF (-2)	1.63	7.5	0.21

Source: Authors' Estimation

If there is a long-term correlation among the parameters, we verify the ECM before moving on. Since the long run has the same conditions, we employ the second lag length criterion. The short run has a significant t-statistic and a negative coefficient. The Cointegration (Coint) term is -0.06 with a t-statistic of -3.71, indicating strong statistical significance and suggesting convergence toward long-run equilibrium. Most differenced variables, including D(GDP(-1)), D(GDP(-2)), D(ED(-1)), and D(FDI(-1 and -2)), have negative coefficients but are statistically insignificant. D(ED(-2)) is an exception, with a negative and statistically significant coefficient. D(DS(-1 and -2)) have positive but insignificant coefficients. D(NT(-1 and -2)) and D(INF(-1 and -2)) show mixed signs but remain statistically insignificant.

5.10. Granger Causality Test

The expected outcome of Granger causality is shown and explained in Table 9. The results are intriguing and have practical policy implications. This test is very useful for policymakers since it verifies the causal relationship between variables. The conclusion of this is that there is strong evidence that trade, not external debt, foreign direct investment, debt servicing, or inflation, is what drives GDP.

Table 9: Results Test Granger of Causality

Null Hypothesis:	Obs.	F-Statistic	Prob.
ED does not GDP Granger Cause	41	0.47	0.62
GDP does not ED Granger Cause		16.6	8.0
DS does not GDP Granger Cause	41	1.78	0.18
GDP does not DS Granger Cause		1.23	0.30
FDI does not GDP Granger Cause	41	0.43	0.64
GDP does not FDI Granger Cause		0.51	0.60
NT does not GDP Granger Cause	41	7.50	0.00
GDP does not NT Granger Cause		7.79	0.00
INF does not GDP Granger Cause	41	1.81	0.17
GDP does not INF Granger Cause		1.80	0.17
DS does not ED Granger Cause	41	1.89	0.16
ED does not DS Granger Cause		4.21	0.02
FDI does not ED Granger Cause	41	3.12	0.05
ED does not FDI Granger Cause		3.80	0.03
NT does not ED Granger Cause	41	7.22	0.00
ED does not NT Granger Cause		3.31	0.04
INF does not ED Granger Cause	41	0.57	0.56
ED does not INF Granger Cause		2.24	0.12
FDI does not DS Granger Cause	41	1.28	0.28
DS does not FDI Granger Cause		0.74	0.48
NT does not DS Granger Cause	41	3.37	0.04
DS does not NT Granger Cause		2.15	0.13
INF does not DS Granger Cause	41	0.08	0.91
DS does not INF Granger Cause		1.84	0.17
NT does not FDI Granger Cause	41	1.89	0.16
FDI does not NT Granger Cause		1.31	0.28
INF does not FDI Granger Cause	41	4.96	0.01
FDI does not INF Granger Cause		2.60	0.08
INF does not NT Granger Cause	41	1.48	0.23
NT does not INF Granger Cause		2.69	0.08

Source: Authors' Estimation

In Granger causality analysis, Ho means no causality, H1 means causality exists. There is no causality between ED and GDP, DS and GDP, FDI and GDP, and INF and GDP. However, a bidirectional relationship exists between NT and GDP. ED and DS have a unidirectional link from ED to DS. FDI and ED, as well as NT and ED, show bidirectional causality. INF and ED have no relation. There is no relation between FDI and DS, and INF and DS, while NT and DS show unidirectional causality. FDI and NT show no link. INF and FDI, and NT and INF are bidirectionally and unidirectionally related, respectively.

5.11 Stability Diagnostic

The CUSUM test assesses the model's stability for policy relevance. At a 5% significance level, the graph stays within critical bounds, indicating no structural variance. This confirms the model's consistency and suitability for policy application.

Figure 4: CUSUM Test

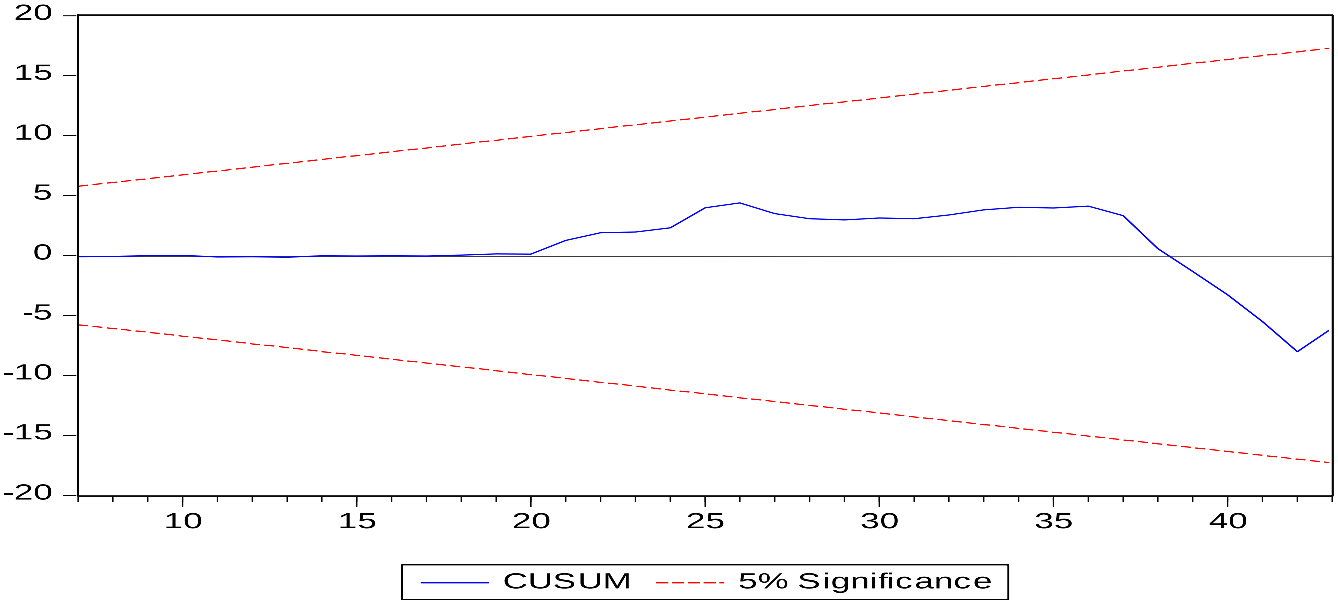


Figure 4 depicts the CUSUM test, where the blueline is positioned within the critical boundaries shown by the red lines, which are located at a significance level of 5%. Therefore, it may be concluded that the parameters are stable. Thus, we may infer that the H_0, which states that the parameters are stable, is accepted.

6. Conclusion

The descriptive study of this research was conducted based on data from time series from 1980 to 2022 to establish the correlation between Pakistan's public debt and sustainable economic growth. Through econometric tools such as the ADF test determine if the data used in the tests is stationary or not. Estimation of the model employs a co-integration technique. In this study, the research seeks to determine the given topic by deploying the GDP that is outcome variable to analyze the impact of public debt on growth of economy. Other explanatory variables include net trade, inflation, debt service, FDI, as well as external debt. The influence of public debt is assessed through debt service or external debt. The results of analysis, while the impacts of debt service and FDI are adverse in the long run for Pakistan's GDP, on the other hand, the qualities of net trade, inflation, as well as external debt are positive. Therefore, while vectors such as inflation, FDI, external debt, and debt payment could positively correlate with GDP, it does not mean that they are caused by it. Trade and GDP, however, are correlated in both directions.

7. Policy Implications

• To achieve rapid growth, developing countries should adopt policies that reduce their debt burden or ensure it remains manageable.
• Recognizing the link between GDP and public external debt. It is essential to address the crowding-out effect caused by debt servicing. Policies should reduce debt burdens to free resources for sustainable, productive investments.
• Policymakers should focus on boosting export revenues and domestic savings to reduce reliance on external debt
• To improve growth prospects strong debt management and close monitoring are vital to prevent the misuse of external funds.
• Pakistan's economy depends heavily on foreign aid, remittances, and FDI, but these are not reliable indicators of true economic progress to minimize further debt accumulation.
• Meeting future debt servicing obligations will become increasingly difficult without implementing structural reforms. It is imperative to undertake comprehensive changes to ensure fiscal sustainability and avoid escalating financial risks.
• To close the fiscal gap, the country must build a strong economic base by developing its industrial and agricultural sectors and ensuring political stability.

• Reducing trade imbalances through modernization and improved productivity is essential to ease external debt pressure.

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