Migration Letters

Volume: 21, No: S9 (2024), pp. 605-622

ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)

www.migrationletters.com

Nexus Between Public Debt And Economic Growth: A Time Series Analysis Of Pakistan

Muhammad Tariq[1], Dr. Sadia Anjum[2*], Muhammad Asif Idrees[3], Qazi Mouqaddas Rehman[3]

ABSTRACT

This study aims to analyze the relationship between Pakistan's public debt and economic development. The study employed the time series data from 1973 to 2021. Public debt, inflation, and gross fixed capital formation is used as explanatory variables, while GDP as dependent variable. According to the short-run regression results, an increase in public debt has a favorable impact on Pakistan's economy's short-term GDP growth. On the other side, inflation has a detrimental effect on GDP growth in the short term. The short-term growth of the economy is not sig[1]nificantly impacted by gross fixed capital formation. The long-term outcome demonstrated that Pakistan's public debt had a detrimental impact on economic growth. According to the results, public debt negatively affects economic growth, which is consistent with the findings of other studies. In order to address the problem of public debt and foster economic growth in Pakistan, the study emphasizes on reliable strategies to decline the debt. The study emphasizes the importance of implementing strategy methods to discourse the issue of public debt and promote economic growth in Pakistan.

***Key Words**: Public debt, Autoregressive distributed lag, ECT, Pakistan, Economic growth.*

Introduction

Public debt is often defined as "a type of borrowing by governments in order to finance their spending and operations." (Mishkin et.al. 2011) According to another author, "Public debt is the cumulative amount of money borrowed by the government from domestic and foreign sources to finance budget deficits and other government spending." (R. Mark Isaac et.al 1998). Economic growth is typically defined as an increase in a country's production capacity and ability to produce goods and services over time. "Economic growth" is defined by economist Robert Barro as "an increase in real national output, which can be measured by the gross domestic product (GDP) or the gross national product (GNP), adjusted for inflation." (Barro, 1997). According to David Weil, a development economist, "economic growth refers to an increase in a country's ability to produce goods and services, usually measured by growth in real gross domestic product (GDP) per capita" (Weil, and David N., 2013). A key macroeconomic indicator that represents a nation's position in the world market is the management of public debt. By gaining access to low-cost resources and lowering financial risk, nations can foster economic growth and stability by managing their public debt well (Saif

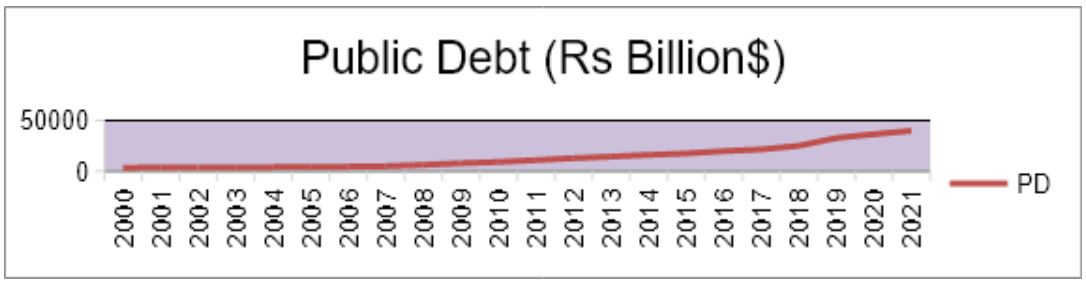
1. *Institute of Agri & Resource Economics, University of Agriculture, Faisalabad - Pakistan*
2. *Assistant Professor Department of Economics, University of Layyah - Pakistan*
3. *Department of Economics, University of Layyah - Pakistan*

**Corresponding Author: Dr Sadia Anjum*

et al., 2024). Governments use a variety of means, including taxation and public borrowing, to pay for their expenses.

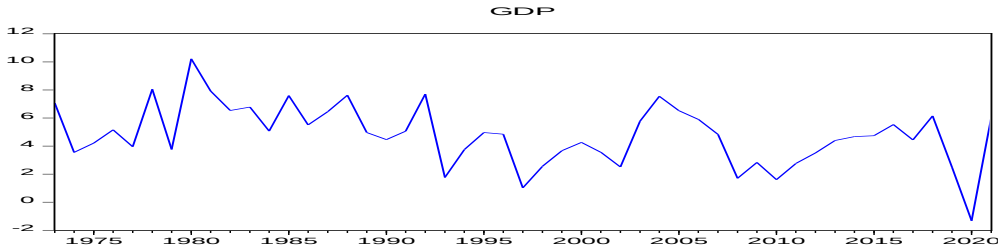
A government's overall debt to its creditors is represented by this debt. Governments may decide to print additional money in order to avoid paying interest on their debts. The State Bank of Pakistan (SBP) received an Rs 569 billion reimbursement from the government for its loan. Between July 2019 and March 2022, the government retired a total of Rs 2.3 trillion in debt that was outstanding to the SBP. The government successfully issued Shariah-compliant Sukuk instruments totaling over Rs 1.1 trillion in accordance with Pakistan's Medium Term Debt Management Strategy (2019/20 - 2022/23). The goal of this offering was to raise the percentage of Shariah-compliant securities in the stock of domestic debt. A total of $1,053 million was disbursed as a result of the sixth review of the IMF's Extended Fund Facility (EFF) being completed successfully. Multilateral and bilateral development partners continued to be important sources of finance for Pakistan's external debt, and in July 2021, Pakistan raised $1 billion by issuing Eurobonds with various maturities., Butkus and Seputiene (2018) contend that debt has a non-linear impact on economic growth.

The government successfully issued a US$ 1 billion International Sukuk in January 2022 with a 7-year maturity and a market-clearing price, drawing interest from investors in the Middle East and Europe. In recent decades, Pakistan has struggled with ongoing public debt issues that have hurt its ability to build its economy. This literature review's objective is to gather and summaries the available data on how Pakistan's public debt impacts economic growth. The amount of Pakistan's public debt increased significantly between 2000 and 2021. The overall public debt of the nation was about 31% of GDP in 2000; by 2021, it would be more than 80% of GDP.



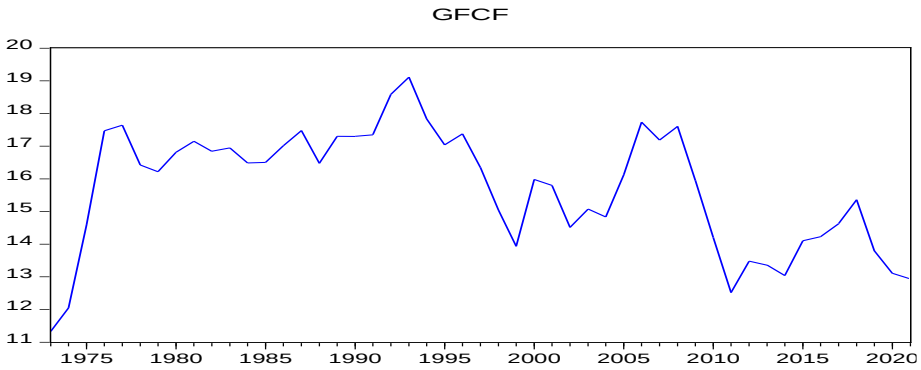
According to Pakistan's economic review for 2021–22, the country's national debt has lately increased. According to the survey, the total public debt, which includes both domestic and foreign debt, stood at Rs. 41.1 trillion, or around $255 billion, as of June 2021 (Economic Survey of Pakistan). A comprehensive picture of Pakistan's public debt trends from 2000 to 2021 based on information that was publicly accessible until the knowledge threshold of 2021. Since the beginning of the millennium, Pakistan's governmental debt has been increasing. The State Bank of Pakistan estimates that by June 2020, the overall public debt will have nearly doubled to PKR 15.9 trillion from its June 2000 level of PKR 2.6 trillion. Regarding the duration, the study break is taken into account. The gap between historical data and the most recent data has been revealed by the current investigation (Saif et al., 2024). A link between the specified variables in the 1973–2021 study will be estimated by the author. It is widely believed to be a major issue how governmental debt and deficits affect long-term economic growth.

GDP GROWTH:



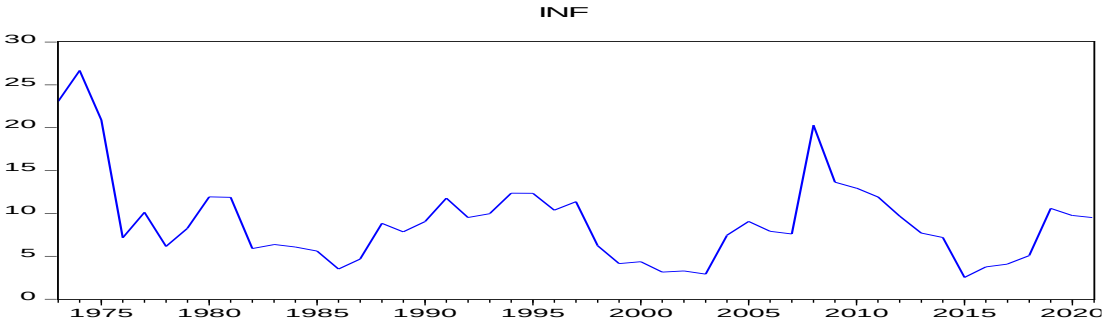
The statistics on Gross Domestic Product (GDP) supplied ranges from 1973 to 2021. When we examine the trajectory during this time span, we notice certain trends in economic growth. GDP began the 1970s strong, with a growth rate of 7.06% in 1973, but dropped sharply to 3.54% in 1974. The years that followed saw a minor recovery, with growth rates ranging from 4.21% in 1975 to 8.05% in 1978. However, the rate of increase fell to 3.76% in 1979. The 1980s were a time of rapid expansion, with GDP peaking at 10.22% in 1980. Despite a modest drop to 7.92% in 1981, the economy remained generally strong throughout the decade, ranging between 6.54% and 7.71%. As the 1990s progressed, GDP growth became more volatile. The annual growth rate ranged from 1.01% in 1997 to 7.71% in 1992. The growth rate fell dramatically to 1.76% in 1993, indicating a downturn. The early 2000s had moderate growth, with GDP rising at a rate ranging from 2.50% to 5.78% per year. In conclusion, the GDP trend from 1973 to 2021 shows a mix of periods distinguished by strong growth, slowdowns, and sporadic recession. While the 1990s and the early 2000s had modest development with significant swings, the 1980s saw high growth. The 2010s had slower growth rates, and the global pandemic-related decline in 2020 was particularly noticeable.

Gross Fixed Capital Formation



The information given illustrates the Gross Fixed Capital Formation (GFCF) development from 1973 to 2021. GFCF is a measure of economic investment and reflects the purchase of infrastructure, machinery, and other fixed assets. The following patterns can be seen when we examine the trends during this time. Early in the decade of the 1970s, GFCF began at a relatively modest level of 11.33% in 1973, but it soon began to rise steadily. It rose to 17.47% by 1976, indicating a large growth in investment, with that percentage. GFCF fluctuated over the course of the late 1970s and early 1980s, primarily between 16.21% and 17.47%. Investment levels were somewhat stable during this time, increasing slightly to a peak in the early 1980s. As the 1990s began, GFCF remained largely stable, with slight changes occurring annually. Overall, the GFCF trend between 1973 and 2021 points to a pattern of fluctuating and stable investment levels. While the 1990s saw occasional volatility, the 1970s and 1980s saw generally constant investment rates.

Inflation



The information given illustrates the inflationary tendency in the Pakistani economy from 1973 to 2021. The Consumer Price Index (CPI), which measures inflation, is a key indication of price changes over time and captures the broad increase in the cost of goods and services. When we examine the trend during this time, we may see different patterns in the inflationary pressures. Pakistan suffered relatively high levels of inflation in the early 1970s, with an inflation rate of 23.07% in 1973. According to Casares (2017), the economy may suffer if there is a high level of debt and the ratio of external debt to GDP rises. According to Panizza (2008), different loan kinds have varying default risks. Therefore, it is crucial to take into account both domestic and external debt separately when determining the overall governmental debt (Panizza, 2009).

Purpose of the Study

Numerous research studies have investigated the association between public debt and economic growth, both nationally and internationally. However, my study differs from others in that it uses time-series data for Pakistan and extends the study period beyond that of previous research. The primary aim is to inspect the link concerning public debt and economic growth in Pakistan, as well as to identify key indicators that impact the country's economic growth.

Literature Review

Perlo-Freeman and Webber (2009) demonstrated a study if government spending is focused into productive sectors such as education and healthcare, public debt can have a favorable impact on long-term economic growth. Investments in these areas can strengthen society's ability for self-improvement, boost productivity, and ultimately lead to higher production growth. Rising public debt levels and fiscal deficits have piqued the interest of researchers and politicians, who are looking for empirical data and ideas from established theories to manage fiscal difficulties.

Atique et al. (2012) examined in their study framework takes into account the national debt and economic development of a nation like Pakistan. The 1980–2010 time periods was used from WDI to create the time frame. Following the confirmation of the data's unit root, they used the Error Correction Model with ARDL Bound Test. The final debate looked at the connections between domestic debt, investment, inflation, and the labor force and GDP growth rate. The results indicated that debt and national growth may coexist.

Teles and Mussolini (2014**)** argued on public debt which can be harmful to long-term economic growth if government spending is mostly allocated towards unproductive and non-stimulating sectors such as social security and aid programmers. Various researchers have obtained conflicting empirical results across different studies when examining the asymmetric relationship between public debt and economic development.

Khan et al. (2016) examined time series data spanning from 1972 to 2013 to evaluate the relationship between Pakistan's state debt and economic development. The ARDL bound

testing model and the ECM Model were used to determine that the variables are stationary at mixed levels. The research found that although remote debt has a positive control on growth, the effect is not very large. Jebran et al. (2016) talked about the relationship between Pakistan's external debt and economic growth between the years 1072 and 2012. The ARDL method is employed to examine the connection between GDP and public debt, debt servicing costs, inflation, and trade openness. The study's concluding observations are that foreign debt greatly slows down economic growth.

Khan and Abbas (2019) examine the relationship between public debt and economic growth in Pakistan using the ARDL bounds testing approach. They use data from 1980 to 2017 and analyze the long-run relationship between public debt and economic growth. The study finds a negative impact of public debt on economic growth, suggesting that high debt levels can crowd out private investment and hinder economic expansion.

Raza and Shah (2019) employ a threshold analysis to examine the relationship between public debt and economic growth in Pakistan. They use data from 1980 to 2016 and apply econometric techniques to identify the threshold level of debt. The study finds a nonlinear relationship, indicating that the impact of public debt on economic growth depends on the level of debt.

Haq et al., (2020) Examined that Pakistan and other developing nations have depended on public debt to close budgetary shortfalls and fund spending. Traditional economists, however, contend that over time, private investment might be crowded out by state debt, which can impede economic progress. This study used empirical analysis to determine how Pakistan's public debt affects the country's ability to attract private investment and build its economy. The study discovered that governmental debt in Pakistan indirectly reduces economic development by driving out private investment using Autoregressive Distributed Lag (ARDL) and Error Correction Method (ECM) with time series data extending from 1972 to 2013. The study, however, did not discover any proof that public debt had a direct impact on the rate of economic growth.

Hameed et.al, (2021) Investigate the short- and long-term impacts of public debt on the economy of South Asian nations. For their econometric analysis, the researchers used panel data for the years 1990–2019 and the Fixed Effect Model and PMG/Panel ARDL. The major conclusions showed that public debt has a detrimental effect on the economies of the countries over the long and short terms. The study places a strong emphasis on the requirement for efficient management and utilization of borrowed funds in order to lessen the negative effects of public debt. The research's findings help to clarify the difficulties South Asian nations face in reaching desired rates of economic growth while managing their public debt well.

Musa et al. (2023) analyzed how public debt, governance, and economic growth relate to developing nations. The study addresses the ongoing argument over whether or not the public debt is beneficial and seeks to understand how governance functions in this context. The authors examine panel data from 44 developing nations covering the years 1990 to 2000 using a Quantile via Moments technique. The study addresses the scale and location attributes under various economic conditions while also accounting for the heterogeneity of the data. The findings of the study show that public debt has a negative impact on economic growth across all quintiles. This suggests that developing nations' economies are hindered by high public debt levels. The findings also demonstrate the significance of governance in determining this link, though. According to the authors, public debt can stimulate economic growth when there is excellent governance, especially in the middle and upper quintiles. By highlighting the importance of governance in fostering economic growth and lessening the negative effects of public debt, this study adds to the body of previous literature. The results highlight the necessity

of strong governance systems for controlling public debt and promoting sustainable economic growth in developing nations.

MATERIALS AND METHODS

This section includes theoretical framework data sources, empirical models, and econometric methods that were carried out for the analysis. It goes into great detail on all the resources used in the study as well as the steps that were taken to obtain the study goal. It is the most important section of the research to judge the overall quality of the study.

3.1 Variable Description

Variables	Label	Description	Unit of Measurement
Gross domestic product	GDP	GDP will be used as proxy for economic growth. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products	Per Capita
Public Debt	PD	Public debt refers to the entire amount borrowed by the government, which includes all liabilities and is utilized for financing development projects. .	Total
Inflation	INF	In economics, inflation (or less frequently, price inflation) is a general rise in the price level of an economy over a period of time. Inflation is a rise in the general price level. It is used as a control variable. The percentage form is also used.	% Percentage
Gross Fixed Capital Formation,	GFCF	Physical capital which is used in the production process.	% of GDP

Source: WDI, & Pakistan Economic Survey

The description of the variables employed in the current investigation is indicated above. The World Development Indicator (WDI) was used to derive data that was used as a proxy for growth, which is the gross domestic product per capita. The GDP per capita is expressed as a sum. We therefore adopt natural logarithmic form in the study for this reason. The following element is the total amount borrowed by the government, which includes all liabilities and is used to fund development programmers, is referred to as public debt.

A portion of a country's total debt is made up of external debt, which it borrows from foreign lenders like governments, international financial institutions, or commercial banks. The government, businesses, or people could be the debtors.

The sum of money that the government owes lenders within the same nation is referred to as domestic debt. It often consists of treasury bills, notes, and other government instruments, such as bonds and notes. Inflation and gross fixed capital creation are employed as the control variables. The percentages for both variables are utilized.

3.2 Model Specification

In above literature review many empirical studies discussed the time series analysis. To check association among public debt and economic growth of the economy, the current study utilizes the same approach as Akram et al. (2016) to investigate the correlation between public debt and economic growth. The study employs the Cobb-Douglas production function, which is an aggregate production function that relates output (Y) to the stock of capital (K) and labor force (L), and is expressed as Y = A*f(L, K), where A is the factor productivity and represents the level of technology.

Functional Form of the Model

- Y=f (PD, INF, GFCF)

PD= Public Debt

INF= Inflation

GFCF= Gross Fixed Capital Formation

$$\mathbf{GDP_{it} = \beta_0 + \beta_1 PD_{it} + \beta_2 INF_{it+} \beta_3 GFCF_{it} + \mu_t}$$

The given model represents a relationship between a country's Gross Domestic Product (GDP) and three independent variables: Public Debt (PD), Inflation (INF), and Gross Fixed Capital Formation (GFCF). The equation to estimate GDP is represented as:

$$GDPit = \beta 0 + \beta 1 PDit + \beta 2 INFit + \beta 3 GFCFit + \mu t$$

- β0, β1, β2, and β3 are the coefficients associated with each independent variable in the GDP equation. These coefficients determine the magnitude and direction of the impact of each variable on GDP. A positive coefficient indicates a positive relationship, meaning an increase in the variable will lead to an increase in GDP, while a negative coefficient suggests an inverse relationship.

- μt represents the error term or residual, which captures the unexplained variation in the model. It includes factors that are not explicitly accounted for in the equation but still influence GDP. These factors could be external shocks, policy changes, or other variables that affect the economy but are not included in the model.

The model allows for estimating the impact of changes in public debt, inflation, and gross fixed capital formation on a country's GDP. By analyzing the coefficients, one can determine the relative importance and direction of these variables' effects on economic performance. However, it's important to note that the model assumes a linear relationship between the variables and may not capture all the complexities and dynamics of the real-world economy.

3.3 Unit Root Test

The World Bank database WDI (2020) and the Economic Survey of Pakistan were used to compile the statistics for all variables. The unit root tests were applied to check the data's stationary. To determine whether the data is stationary or not. A statistical test called the Augmented Dickey-Fuller (ADF) test is used to find out whether a time series has a unit root,

which is a feature of non-stationary time series. A time series with a unit root has a stochastic trend, which means that its statistical characteristics change over time and are unpredictable. Because many time series models, like ARIMA, make this assumption, stationary is a key notion in time series analysis.

The autoregressive model of order p (AR(p)), on which the ADF test is based, asserts that a time series' value at a given point in time t is a linear combination of that point's previous values and a random error term. The first difference of the time series, or the difference between the value of the series at time t and its value at time t-1, is the first difference of the time series that the ADF test adds lags to. The first modification eliminates any seasonality or patterns in the time series, increasing the likelihood that it will be stable. The first difference of the time series is used to estimate the AR (p) model for the ADF test, and the test statistic that results is used to determine how strong the evidence is against the null hypothesis.

The null hypothesis can be rejected and the time series is deemed stationary if the test statistic is higher than the crucial value.

The time series is stationary and can be modeled using stationary time series models if the null hypothesis is rejected. If the null hypothesis cannot be ruled out, the time series is non-stationary and might need to undergo differencing or other modifications in order to become stationary. The ADF test is frequently employed in domains such as economics, finance, and others where time series analysis is significant, but it has requirements that must be fulfilled for the results to be reliable, including the lack of structural discontinuities in the time series and the independence of the error components.

- **Ho : Unit Root**
- **H1 : No Unit Root**

If P-value is less than 0.05 then we can reject the null hypothesis meaning that there is no unit root and data is stationary.

3.4 ARDL Model

A well-liked econometric model for examining the long-term relationship between two or more time series variables is the Autoregressive Distributed Lag (ARDL) model. The addition of lagged values for exogenous variables is made possible by a generalization of the conventional ARMA model. The ARDL model could be applied to Pakistan's time series data to look at the long-term relationships between various macroeconomic factors like GDP, inflation, public debt, and fixed capital formation. This is how the model can be described:

$$Yt = \beta 0 + \beta 1X1,t + \beta 2X2,t + ... + \beta kXk,t + \theta 1Yt-1 + \theta 2Yt-2 + ... + \theta pYt-p + \varepsilon t$$

where Yt is the dependent variable, X1, X2,..., Xk,t are the k independent variables, 1, 2,..., p are the autoregressive coefficients, 0, 1, 1,..., k are the independent variable coefficients, and t is the error term.

By looking at the coefficient estimates of the independent variables after the model has been estimated, the long-term relationship between the variables can be examined. If the coefficients have the predicted signs and are statistically significant, there may be a long-term relationship between the variables.

3.5 Serial Correlation Test

The correlation between a variable and its historical values is referred to as serial correlation (also known as autocorrelation). Serial correlation in econometric analysis violates one of the traditional assumptions of regression analysis, which is the absence of autocorrelation in the

residuals. This assumption is critical for getting unbiased and efficient regression coefficient estimations.

The Lagrange Multiplier (LM) test for serial correlation is a popular method for detecting autocorrelation in regression model residuals. Jean Lagrange proposed the LM test in 1875, and it has subsequently been improved and modified by various researchers, including Henry Daniels in 1954.

The LM test is a test of the null hypothesis that there is no serial correlation in a regression model's residuals. The test statistic is computed by regressing the squared residuals on their lagged values and then multiplying the resulting R-squared by the sample size. The resulting LM statistic has a chi-square distribution, and the null hypothesis is rejected if the LM statistic exceeds the chi-square distribution's critical value at the selected significance level.

The LM test is commonly used in time series analysis to detect the presence of autocorrelation in regression model residuals. It is a powerful method for finding violations of the premise of serial correlation absence, and it is regularly used.

3.6 Heteroscedasticity Test

The Breusch-Pagan test is a statistical test designed to detect heteroscedasticity, which is a typical problem in regression analysis when the variance of the errors varies between data. Trevor Breusch and Adrian Pagan proposed the test in their 1979 paper "A Simple Test for Heteroscedasticity and Random Coefficient Variation" published in the journal Econometrical.

The Breusch-Pagan test involves regressing the squared residuals of a regression model on the model's independent variables. The null hypothesis of the test is that the error variance is constant (homoscedasticity), while the alternative hypothesis is that the error variance is not constant.

Calculating the test statistic involves multiplying the R-squared from the regression of squared residuals by the sample size. The chi-square distribution with degrees of freedom equal to the number of independent variables in the model is then used to determine the test's p-value.

3.7 Stability Test

To determine if the data is regularly distributed, a normality test is utilized. The Shapiro-Wilk test is the most widely used test for normality. The data being regularly distributed is the test's null hypothesis; the alternative is that it is not. Based on the sample size and significance level, the test computes a W statistic and compares it to crucial values. If the estimated W statistic is smaller than the required amount, the null hypothesis cannot be rejected, and it is determined that the data are normally distributed.

3.8 Study Hypothesis

The hypothesis you have presented is as follows

H0: There is no association between public debt and economic growth.

H1: There is an association between public debt and economic growth.

Hypotheses are developed from an econometric perspective in order to assess the statistical relationship between variables. The hypothesis in this situation tries to look into the relationship between public debt and economic growth. According to the null hypothesis (H0), there is no observable relationship between public debt and economic growth. It implies that changes in a country's public debt levels have little impact on how quickly its economy is growing. This hypothesis states that any observed association between public debt and economic growth would be due to chance events or model-unaccounted variables. According to the alternative

hypothesis (H1), there is a connection between public debt and economic expansion. The alternative hypothesis (H1), that there is a link between public debt and economic growth, would be supported if the coefficient is statistically significant and has the predicted sign (positive or negative). The null hypothesis (H0) would not be rejected, however, if the coefficient is not statistically significant, indicating that there is no correlation between public debt and economic growth. The significance of the coefficient and whether the relationship between public debt and economic development is statistically significant or just the result of chance can be assessed using statistical tests like t-tests or F-tests..

4.1 RESULTS Descriptive Analysis

	GDP	PD	INF	GFCF
MEAN	4.7864	6527.408	9.1126	15.7117
MEDIAN	4.8328	1995.000	8.2670	16.2147
MAX.	10.2157	39886.00	26.6630	19.1122
MIN	-1.3295	60.0000	2.5293	11.3302
S.D.	2.1444	9934.733	5.1231	1.8369

Note. Author own calculation

Table 4.1

The table displays a statistical breakdown of four significant macroeconomic variables that have affected the Pakistani economy between 1973 and 2021.

First off, Pakistan's overall economic output over the time has been showing a positive trend, according to the mean and median GDP numbers. The minimum and highest figures, however, demonstrate large changes in the economic growth rate, demonstrating that Pakistan has throughout the past 50 years experienced both times of rapid economic expansion and economic instability.

The statistics on public debt also show a concerning upward trend in debt levels over time, with mean and median values of 6527.408 and 1995.000 billion Pakistani Rupees, respectively. This suggests that Pakistan has had difficulty controlling its debt levels, which could have a detrimental effect on future economic growth.

Thirdly, the figures on inflation show that the Pakistani economy is highly volatile, with a large range of values between the minimum and greatest values. The economy has been subject to ongoing inflationary pressures over the period, according to the mean inflation rate of 9.1126%, which can have a detrimental effect on consumers' and companies' purchasing power.

With a mean and median value of 15.7117% and 16.2147%, respectively, gross fixed capital formation figures show that Pakistan has had a relatively low level of investment in fixed assets over the period. The GDP's upward tendency, however, shows that there have also been periods of great economic growth, which can be encouraging for future progress.

4.2 Correlation Matrix Results

	LNGDP	PD	INF	GFCF

LNGDP	1.0000	-0.3088	-0.1548	0.2342
PD	-0.3088	1.0000	-0.1330	-0.5423
INF	-0.1548	-0.1330	1.0000	-0.2008
GFCF	0.2342	-0.5423	-0.2008	1.0000

Table 4.2

Author own calculation

The correlation matrix displays the correlation coefficients among several dataset variables. GDP, Public Debt, Inflation (INF), and Gross Fixed Capital Formation (GFCF) in Pakistan's economy from 1973 to 2021 are the variables in this scenario.

The correlation coefficient has a range of -1 to 1, with -1 denoting a perfect negative connection and 1 denoting a perfect positive correlation between two variables. There is no association between two variables when the value is 0.

With a correlation coefficient of -0.3088, the correlation matrix reveals a negative relationship between the GDP and the public debt. This shows that the GDP declines as the Public Debt rises.

Contrarily, there is a positive link between GDP and GFCF, with a correlation value of 0.2342, showing that as GDP rises, so does Gross Fixed Capital Formation. GDP and inflation (INF) do not significantly correlate, as seen by the correlation value of -0.1548.

4.3 Unit Root Test Results

Variables	**ADF**		
	Level	1st difference	
GDP PER CAPITA	-5.1073 (0.0001)*	-7.4223 (0.0000)	I(0)
Public Debt	-0.9661 (0.7577)	-5.3947 (0.0000)*	I(1)
Inflation	-3.6725 (0.0077)*	-7.5963 (0.0000)	I(0)
Gross Fixed Capital Formation(GFCF)	-2.6088 (0.0982)	-5.2820 (0.0001)*	I(1)

Table 4.3 Note. The three asterisks *',**& *** reveals the significance level at **1%, 5% & 10 %**

The table displays the outcomes of unit root analyses performed using the Augmented Dickey-Fuller (ADF) test on four economic variables, including GDP, public debt, inflation, and gross fixed capital formation (GFCF). When determining if a time series variable has a unit root and is non-stationary (I(1)) or has a unit root and is stationary (I(0)), the ADF test is utilized.

The ADF test statistic for the GDP variable at the level is -5.1073, which is significant at the 1% level and shows that the variable is stationary at the level.

The ADF test statistic is -3.6725 for the inflation variable at the level, which is significant at the 1% level and shows that the variable is stationary at the level. Inflation is therefore categorized as I(0) or a stationary variable at level.

The level ADF test statistic for the GFCF variable is -2.6088 at the level, which is not significant and shows that the variable is non-stationary there. The variable is stationary after taking into account the first difference, as seen by the test statistic for the first difference being -5.2820, which is significant at the 1% level. The ADF test results offer helpful information for econometric analysis, including selecting suitable models and estimating coefficients.

4.4 ARDL Model

Short Run Relationships with ECM

Variables	Co efficient	Std. Error	t-Statistic	Prob-value
GDP(-1)	-0.1935	0.1560	-1.2403	0.2236
GDP(-2)	-0.0033	0.1669	-0.0198	0.9842
GDP(-3)	0.1996	0.1465	1.3618	0.1825
LOGPD	-2.8057	4.4636	-0.6285	0.5340
LOGPD(-1)	-8.2919	6.6725	-1.2427	0.2227
LOGPD(-2)	10.1174	4.3919	2.3036	0.0277
INF	0.0359	0.0964	0.3722	0.7121
INF(-1)	0.0229	0.0926	0.2480	0.8056
INF(-2)	-0.1974	0.0836	-2.3613	0.0243
GFCF	0.2380	0.3229	0.7373	0.4661
GFCF(-1)	-0.5284	0.3972	-1.3303	0.1925
GFCF(-2)	-0.2425	0.2884	-0.8409	0.4064
C	23.5884	5.9212	3.9836	0.0004
Cointq(-1)= -0.99				
D.W.=1.89				

Table 4.4

The logarithm of public debt (LOGPD) has a positive coefficient of 10.1174 with a standard error of 4.3919 and a t-statistic of 2.3036, according to the results of the supplied regression analysis. However, the 5% level of significance (p-value = 0.0277) is the only one at which this effect is statistically significant. This outcome is in line with the hypothesis that, by raising government expenditure on social welfare and infrastructure, an increase in public debt might spur short-term economic development.

With a negative coefficient of -0.1974, a standard error of 0.0836, and a t-statistic of -2.3613, the inflation variable (INF) is unfavorable. At a 5% level of significance, this impact is statistically significant (p-value = 0.0243).

With a positive coefficient of 0.2380, a standard error of 0.3229, and a t-statistic of 0.7373, gross fixed capital formation (GFCF) is statistically significant. This implies a positive relationship between rising capital creation and the economy's short-term GDP growth, albeit this relationship is statistically insignificant because the p-value (0.4661) is higher than the standard significance level of 0.05.

The regression model's findings show the short-term association between the investigated variables and the error correction term (ECT). If the probability value is less than 5%, we can reject the null hypothesis and come to the conclusion that there is a short-run link. However, determining the long-term link between the factors is the primary goal of this study.

4.5 Bounds Test:

F-Statistic	**7.1629**	**K=3**
Bound's Critical value		
Significance	**I(0) Bounds (lower bounds)**	**I(1) Bounds (upper bound)**
10%	**2.37**	**3.2**
5%	**2.79**	**3.67**
2.5%	**3.15**	**4.08**
1%	**3.65**	**4.66**

TABLE 4.5

The bound test is a technique for determining if variables in an autoregressive distributed lag (ARDL) model have a long-term relationship. The boundaries test results are shown in a table along with the F-statistic, critical values, and significance level.

We may reject the null hypothesis that there is no long-run link between the variables since the F-statistic value of 7.1629 is more than the upper bound critical value at the 5% level of significance. As a result, we may say that the variables in the model have a long-term relationship.

For the significance levels of 10%, 5%, 2.5%, and 1%, the table also contains the I (0) lower limit values and I(1) upper bound values. The co integration of the variables can be assessed using these values. The variables are co integrated and there is a long-term link if the calculated coefficient is within the bounds.

4.6 Long Run Results

Variables	**Coefficient**	**Standard error**	**t- Statistics**	**Prob. Value**
LOGDBT	**-0.9829**	**0.2857**	**-3.4400**	**0.0016**
INF	**-0.1389**	**0.0896**	**-1.5501**	**0.0137**
GFCF	**0.5344**	**0.3537**	**-1.5105**	**0.0140**
C	**11.8565**	**1.4836**	**7.9913**	**0.0000**
R2 = 0.69 **D.W. 2.10**	**F- Statistics 3.65**		**Prob. (F- Statistics) =0.0015**	

TABLE .4.6

This section discusses long-term empirical analysis. We apply statistical and econometric criteria to interpret the coefficients. The long-term results show the relationship between the independent variables, namely public debt (LOGDBT), inflation (INF), and gross fixed capital formation (GFCF), and the dependent variable, GDP. The model also takes the intercept into account.

Given that the LOGDBT coefficient is negative (-0.9829), an increase in public debt will eventually have a detrimental effect on GDP. This is in line with the theoretical prediction that large public debt can prevent private investment, increase interest rates, and stunt economic growth. Additionally, the INF coefficient is negative (-0.1389), indicating that inflation has a long-term negative impact on GDP.

The result shows, an R2 value of 0.69 indicates that the independent variables in the regression model account for around 69% of the variance in the dependent variable. The independent and dependent variables appear to have a reasonably strong association, according to this. To evaluate the overall significance of the regression model, the F-statistic is employed. It contrasts the variance (residual variance) that cannot be explained with the variance (variance explained by the regression model). A more substantial correlation between the independent and dependent variables is shown by higher F-statistic values.

The regression model is statistically significant, according to the F-statistics value of 3.65. In other words, the dependent variable is significantly impacted by the model's independent variables taken as a whole. The p-value, also referred to as the probability associated with the F-statistic, is the possibility that the observed F-statistic was obtained by chance if the null hypothesis were true.

4.7 Heteroscedasticity Test Results

Breusch -Pagan-Godfrey

F- stat	**0.5142**	**Prob. (F) (3.23)**	**0.8903**
OBSERVED R2	**7.2464**	**Pob. Chi-sq.**	**0.8409**
Scaled explained SS	**3.1580**	**Prob. Chi-square**	**0.9943**

Table 4.7

Testing the Hypothesis

H0: The data is heteroscedasticity.

H1: The data is homoscedastic.

A statistical test called the Breusch-Pagan-Godfrey test can be used to determine if regression models contain heteroscedasticity. The null hypothesis for this test is homoscedasticity, which states that the variance of the mistakes is constant, while heteroscedasticity, which states that the variance of the errors is not constant, is the alternative hypothesis.

The F-statistic for the presented results is 0.5142, with a probability value of 0.8903. This shows that the homoscedasticity null hypothesis cannot be ruled out because the probability value is higher than the standard level of significance of 0.05. In addition, the scaled explained SS is 3.1580 with a probability of chi-square of 0.9943, whereas the observed R2 is 7.2464 with a probability of chi-square of 0.8409. Additionally, these findings imply that the model does not contain any indication of heteroscedasticity.

4.8 Normality Test

Figure 4.1

A statistical technique called the Jarque-Bera test is used to determine whether a dataset has a normal distribution. It is based on the dataset's skewness and kurtosis. Kurtosis measures the dataset's peakedness, whereas skewness measures the dataset's asymmetry.

Under the null hypothesis of normality, the Jarque-Bera test statistic has a chi-squared distribution with two degrees of freedom. Since the Jarque-Bera test statistic is less, it is more likely that the dataset is regularly distributed.

The Jarque-Bera test statistic in your example is 1.8046, and the probability value, also known as the p-value, is 0.40. If the null hypothesis is true (i.e., the dataset is normally distributed), the p-value indicates the likelihood that a test statistic will be as severe or more extreme than the one that was actually observed.

By comparing the p-value to a specified significance level (often set at 0.05) in order to interpret the findings. The null hypothesis cannot be rejected if the p-value is higher than the significance level (for example, p-value > 0.05), and it is therefore likely that the dataset is normally distributed. However, you would reject the null hypothesis and conclude that the dataset deviates from normality if the p-value was smaller than the significance level (for example, p-value 0.05).

Kurtosis gauges how heavy the distribution's tails are and how peaky it is in relation to a normal distribution. A normal distribution, also known as a mesokurtic distribution, has a kurtosis value of 0, or 0.

4.9 CUSUM & CUSUM SQUARE TEST

Figure 4.2

A statistical process control method called the CUSUM (Cumulative Sum) test can be used to find shifts or changes in the mean of a data set over time against assess whether the process is under control or out of control, cumulative sums of deviations from a reference value must be calculated. These cumulative sums are then compared against predetermined control limits (typically depicted by red lines).

The size and direction of the shifts in the cumulative sums should be taken into account when analyzing the findings of the CUSUM test. The blue lines may suggest an increase in the dataset's mean if they cross the upper red line, whereas crossing the lower red line may indicate a fall in the mean.

Fig 4.3

A statistical process control method called the CUSUM (Cumulative Sum) Square test is used to find changes in a dataset's variance over time. Determine if the process is under control or out of control by computing cumulative sums of squared deviations from a reference value and comparing these cumulative sums to predefined control limits (typically indicated by red lines).

5.1 Conclusion

In this section the study used Descriptive statistics, correlation matrix, and results of unit root tests for the four macroeconomic variables GDP, public debt, inflation, and gross fixed capital formation (GFCF) in the Pakistani economy from 1973 to 2021 are included in this section of the research's findings and discussion. First of we collected data from world development indicators. The time period was extracted from 1973 to 2021 for empirical analysis. Our main concern to check the effect of public debt in Pakistan Economy. Pakistan is a developing country. Now a day, it faces a lot of problems. In Every budget, he faces a lot of hurdles to assist the all sectors of the economy.

The mean, median, maximum, minimum, and standard deviation of each variable is shown in the study's descriptive analysis of these variables. The mean basically is an average value which

is calculated on the behalf of ratio between no of observation and sum of all values or observation given in the study. After that we check the median value of the data which is helpful to check the central point of the data. And the next thing is very important which check the range of the data. Basically it is difference between maximum value and minimum value. And in last we checked the standard deviation of the data. It is square root of variance of the data. Initially the variance is the speediness of the data.

The findings show that whereas Public Debt is stable at the first difference, GDP and inflation are stationary at the level. At the level with a trend, gross fixed capital formation is stationary.

The Breusch-Pagan-Godfrey Serial Correlation LM Test can be used to determine the presence of serial correlation or autocorrelation in the residuals of a regression model. The absence of serial correlation in the residuals is the null hypothesis in this case.

The F-statistic is calculated to be 0.6129 in this study, and the corresponding probability value is determined to be 0.5482. We do not have enough evidence to reject the null hypothesis because the probability value is greater than the standard significance level of 0.05.

On the other side, inflation has a detrimental effect on GDP growth in the short term. The short-term growth of the economy is not significantly impacted by gross fixed capital formation. However, the short-run regression results should be evaluated cautiously and used in conjunction with other variables that affect Pakistan's short-term economic growth.

According to the boundaries test, there may be a long-term connection between the variables of public debt, inflation, gross fixed capital creation, and GDP.

According to the long-run regression results, Pakistan's long-term GDP growth is negatively impacted by rising public debt. Long-term GDP growth is negatively impacted by inflation as well. On the other hand, GDP growth over the long run is positively impacted by gross fixed capital formation.

Overall, the study's findings and analysis indicate that Pakistan's economy has faced considerable difficulties in managing its debt levels, keeping inflation under control, and luring investment to upgrade its infrastructure.

5.2 Policy Implications

Based on the results and discussion of the study, some policy recommendations for Pakistan's economy are:

Debt management: According to the report, Pakistan's public debt has a detrimental effect on the country's long-term economic growth. Therefore, by cutting the budget deficit and putting into place efficient debt management techniques, policymakers should concentrate on controlling the nation's debt levels.

Controlling inflation: The study demonstrates that inflation has a detrimental effect on both the short-term and long-term growth of the economy. Therefore, policymakers should concentrate on limiting inflation by enacting suitable monetary and fiscal measures.

Infrastructure growth: According to the study, gross fixed capital formation contributes to the economy's long-term expansion. To encourage economic growth and draw in foreign investment, officials should give infrastructure development top priority.

Economic diversification: The analysis shows that Pakistan's economy has gone through both periods of rapid expansion and periods of instability. Policymakers should diversify the nation's economy by supporting other industries like agriculture, manufacturing, and services in order to foster long-term economic growth. Human capital development: The study contends that labor force education and skill levels have an effect on the long-term expansion of the economy. Therefore, through expanding access to high-quality education and skill-training programmers, authorities should place a higher priority on investments in human capital development.

In conclusion, Pakistan's officials should use a diverse strategy to tackle the issues the economy is facing and encourage long-term economic growth. Effective debt management, inflation control, infrastructure development, economic diversification, and human capital development should all be part of this strategy.

Second, governments ought to give top priority to initiatives that strengthen the labor, health, and education sectors and encourage private investment. This can be accomplished in a number of ways, such as putting in place an educational system that provides workers with technical skills in line with labor market demands, establishing labor-friendly regulations that lower frictional unemployment, implementing fiscal measures that incentivize employment, and providing guarantees from the government to encourage investment.

This study's main goal is to fill in some of the empirical gaps around the connection between debt and economic development. This study adopts a distinctive strategy by looking at the short- and long-term implications across multiple panel samples, in contrast to prior literature that mostly focuses on analyzing debt threshold levels. As a result, the possibility of a nonlinear relationship between debt and growth is not investigated in this study. As a result, it may be possible for future research to expand on this work and look at potential nonlinear consequences.

References:

1. Asghar, M. S. (2016). Effect of external debt on the economic growth of Pakistan. ABC Journal of Advanced Research, 5(2), 71-76.
2. Atique, R., & Malik, S. (2012). The domestic debt and economic growth in Pakistan. International Journal of Economics, Commerce and Management, 2(10), 1-12.
3. Barro, R. (1997). Determinants of economic growth: A cross-country empirical study. MIT Press.
4. Butkus, M., & Seputiene, J. (2018). The relationship between government debt and economic growth: A non-linear approach. Journal of Business Economics and Management, 19(5), 863-878.
5. Casares, M. (2017). Debt, inflation, and growth: Robust estimation of long-run effects in dynamic panel data models. Journal of Applied Econometrics, 32(4), 803-821.
6. Dombi, A. G., & Dedák, I. (2018). The burden of public debt: Empirical evidence from Hungary. Society and Economy, 40(1), 65-87.
7. Greer, A. (2013). Public Debt and Economic Growth. Congressional Research Service.
8. Haq, M., & Khan, M. A. (2019). Public Debt and Economic Growth Nexus: Evidence from Pakistan. Journal of Economic and Social Development, 6(2), 30-45.
9. Haq, S., Iqbal, J., & Mahmood, H. (2020). Public Debt and Economic Growth Nexus: Evidence from Pakistan. Theoretical and Applied Economics, 27(2), 95-112.
10. Jawaid, S. T., & Raza, S. A. (2017). Public Debt and Economic Growth in Pakistan: An Empirical Investigation. The Pakistan Development Review, 56(4), 525-541.
11. Khan, M. S., & Rehman, S. U. (2016). The relationship between public debt and economic growth in Pakistan. International Journal of Economics, Commerce and Management, 4(10), 34-44.
12. Makhoba et al. (2022). Asymmetric effects of public debt on economic growth: Evidence from emerging and frontier SADC economies. 10.2046323. http://doi.org/10.1080/23322039.2022.2046323
13. Makau, J. M. (2008). Public debt and economic growth in Kenya. African Development Review, 20(3), 473-486.
14. Mishkin, F. S., & Sergio, T. (2011). The economics of money, banking, and financial markets (10th ed.). Pearson
15. Panizza, U. (2008). Domestic and External Public Debt in Developing Countries. UNCTAD Discussion Paper, (188).
16. Panizza, U., & Presbitero, A. F. (2012). Public debt and economic growth: Is there a causal effect? Journal of Macroeconomics, 34(3), 569-580.
17. Perlo-Freeman, S., & Webber, D. J. (2009). Basic needs, government debt and economic growth. World Economy, 32(6), 965-994.

18. Teles, V. K., & Mussolini, C. C. (2014). Public debt and the limits of fiscal policy to increase economic growth. European Economic Review, 66(1), 1-15.
19. Zohaib, M. (2018). Public debt and economic growth: Empirical evidence from Pakistan [Master essay, Department of Economics, Joakim Westerlun].

Saif, S., Zameer, H., Wang, Y., & Ali, Q. (2024). The effect of retailer CSR and consumer environmental responsibility on green consumption behaviors: mediation of environmental concern and customer trust. Marketing Intelligence & Planning, 42(1), 149-167.