

## Empirical Analysis of Fiscal Sustainability and Optimal Level of Debt in Pakistan

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### Abstract

Through the current study it's been tried to discuss that how fiscal sustainability is impacted by the debt which is taken by countries in order to push their economy towards prosperity and growth in Pakistan. Because the economy is considering vulnerable in terms of Public debt due to huge fiscal deficit in the economy. The ARDL approach is being applied by taking GDP as dependent variable while public debt, total revenues, government expenditures and interest rate are been taken as independent variable. The findings of the study suggested that there is strong and significant relationship exist between focused variables. Public debt is negatively associated with GDP in both short run and long run, while government expenditure give positive and significant relationship with GDP and interestingly total revenue give negative significant relationship in long run that supported the argument that the high revenues in developing nations inversely affects the investment that is pillar of GDP, so it adversely affected. The interest rate is positively significant in long run but in short run its negatively related with GDP because it affects cost of capital. The findings of study attract the attention of policy makers that we need either debt reduction strategies or either to minimize the gap between public revenues and public expenditures to promote sustain economic growth in the economy.

### Keywords

fiscal sustainability; public debt; total revenues; govt expenditures; ARDL approach



## I. Introduction

There is a particular debt to GDP ratio which calculates how the debt will impact the economic growth of the country. It also shows the turning point of the economic growth which is based on debt (Akram N., 2011). When a country faces tension in terms of public finance, then a country becomes at risk which looms over the economic growth of the country. It is important for a country or a state to be stable. This stability and sustainability can be achieved through the implementation of fiscal policies. When the debt to GDP ratio is low, it is at that moment the economic growth is in bloom. Contrary to this, when the public debt is very high, the economic growth is seriously in a terrible state and the danger looms over the economic growth of the country. However, this happens when a certain line is crossed. It means that when public debt is controlled, the danger is much less and it might not affect the state in the worst way (Chandia & Javid, 2013). The limited amount of literature which is available all points out towards the theoretical framework which generates the result that the relationship between these two i.e. public debt and economic

growth is always negative (Akhrum, 2015). This framework is usually based on the empirical evidence. These evidences usually focused on the external debt and its impact on the countries which are under development. External debt also has a great effect on the interest rates in long-term. When the public debt increases it severely impact in a negative way the economy of a country. The policies, specifically fiscal policy, suggests that when the public debt impact economic growth negatively then the people and government work hard to reduce the debt and work on it by taking help of fiscal policies (Baum, Checherita, & Rother, 2013).

When we talk about public debt and its relation to economic growth, there is a well-known term that enters the equation. It is known as 'debt-to-equity ratio (D/E)'. The meaning of this debt-to-equity ratio is that it indicates the equation in which a country's or state's equity and debt must work. The proportion must be the balance between a country's equity and its debt to strongly finance a country's assets. Another name which is used to address this ratio is 'financial leverage' (Bhardwaj, 2018). This debt-to-equity ratio is the main factor which can help to judge a state's financial equation. This leads a state towards the 'Optimal debt level' or 'Optima capital structure' state. When a debt-to-equity ratio is considered, it is only judged on the best level for a state to maximize the benefits when the debt level is optimal. The optimal capital structure is the structure which helps in maximizing a state's capital cost by balancing the debt-to-equity ratio of the country. A country's risk increases when the debt is increased. Discussing in theoretical terms, financing debt is generally preferred when the capital's cost is on the lowest because of the deduction of tax (Ahmad, 2000). In terms of Pakistan, it is considered best when the GDP is higher than the public debt. It is at that moment when GDP is higher that Pakistan's economic growth is well managed and moves towards a positive goal. In Pakistan, the sustainability of debt can be only measured through the reaction of fiscal function which happens to sustain a positive relationship among the two most famous ratios i.e. surplus-to-GDP ratio and debt-to-GDP ratio. There is a very minor coefficient portion in debt-to-GDP. This coefficient indicates that there is a weakness in the debt-to-GDP ratio.

In this paper, we are going to discuss how fiscal sustainability is impacted by the debt which is taken by Pakistan to push their economy towards prosperity and growth.

The main research question of this study is.

- What is the impact of debt on the GDP of Pakistan?

## **II. Research Methods**

### **2.1 Theoretical Framework**

The concept of sustainability can be distinguished from the notion of solvency. Sustainability concerns the consistency of a state's financial policy and primarily characterizes a given fiscal policy and the policy's future ramifications (Mahmood & Ahmad, 2017). Furthermore, the concept portrays a state which is solvent without requiring any fiscal adjustment. Whereas Solvency describes the financial health of the state and a state's ability to meet its commitments, regardless of the way this is achieved. Public finances that are not on a sustainable path do not necessarily lead to insolvency but rather indicate that fiscal reforms are necessary to ensure solvency (Zinaz & Khatoon, 2009). Concluding that a state is insolvent is interpreted as default on public debt. This situation could lead to a major financial crisis which in turn could lead to an economic recession (Al Gifari, 2015). Throughout the years, debt financing for public investment was rationalized by the need of a growing public sector to maintain welfare states but this has led to large liabilities and a real

danger of public debt finance instability. In the last decade, it has become clear that fiscal policies that will ensure a manageable debt burden will have to be implemented. Empirical studies confronted that high public debt hampers economic growth through to the channel in the possibility of increase in inflation, long run higher interest rates, expected growth in dostoratory taxation, lower private investment and slower growth enhancing primary spending while in some cases the unsustainable growth in public debt to Gross Domestic product ration may cause an out flow of capital from a country (Mupunga & Roux, 2014). Public debt dynamics are usually linked to questions related to public liquidity situations and its solvency where the government solvent when the value of discounted current and future balance budget surpluses higher than the summation of originating stocks of public debt and the discounted value of its future budget deficit (Iqbal & Sattar, 2003). While theoretically the initial point of analysing public debt dynamics is the dynamics of budgets constraints i.e. Total expenditure with total revenues that can be explained with inter temporal budget deficits. By concluding the highlighted discussion, we can summarise that

$$GDP=f(PD, TR, GEXP, IR) \quad 2.1$$

Where GDP is gross domestic product, PD is Public debt, TR show total revenue, GEXP is Government Expenditures and IR is interest rate.

## 2.2 Econometric Estimation Technique

The objective of the current study is to seek the impact of public debt on economic growth with different set of independent variables i.e. government expenditures, total revenue, and interest rate. The nature of the variables are different i.e. Public debt, GDP, total revenue and government expenditures are being take as level variables and interest rate is been taken as ratio variables and these variables have different integration orders where in the presence of unit root in the data may cause biased and inefficient results that will lead to spurious regression. (Burke & Hunter, 2005) argued that because of the non-stationary problems the estimates of the equations become spurious. The given stationary equation is as follows.

$$\Delta Y_t = \rho Y_{t-1} + \epsilon_t \quad 2.2$$

Where  $\Delta$  show the difference level of variable, " $\rho$ " highlight the coefficient have for unit root problem if is equal to 1, while  $t-1$  is the lag values and " $\epsilon_t$ " is the disturbance term. So the nature of unit root can represent the errors term as combo of disturbance term process for that the general equation showing relationship can be seen in simple regression.

$$GDP = \beta_1 + \beta_2 PD + \beta_3 TR + \beta_4 GEXP + \beta_5 IR + \epsilon_t \quad 2.3$$

Where GDP denotes dependent variable which in our case is Gross Domestic Product, while in right hand side PD denotes public debt, TR is total revenue, GEXP is government expenditures, IR is interest rate and  $\epsilon_t$  denotes the error term and  $\beta_1$  intercept and  $\beta_2, \beta_3, \beta_4, \beta_5$  are coefficient values. Therefore, if there is unit root than the relationship is spurious and to solve it, we take the difference of the data to make them stationary.

$$\Delta GDP_t = \beta_0 + \beta_1 \Delta PD + \beta_2 \Delta TR + \beta_3 \Delta GEXP + \beta_4 \Delta IR + \epsilon_t \quad 2.4$$

The above equation is simplified form of difference equation that tell us about short run relationship among variables through differencing them, but in the current study we are interested in both short run and long run relationship, therefore we need to look out both short and long run relationship and since the time series have different set of integration order. (Ademola, 2012) (Ahmad, 2000) (Zahoor, 1988) (Khan & Saqib, 1993) argued that if the data are different in orders of integration, ARDL approach is best suitable method because

$$H0: \beta_0 = \alpha = \Phi_1 = \Phi_2 = \Phi_3 = 0$$

$$H1: \beta_0 \neq \alpha \neq \Phi_1 \neq \Phi_2 \neq \Phi_3 \neq 0$$

$$\Delta GDP = \beta_0 + \beta_1 \Delta PD + \beta_2 \Delta TR + \beta_3 \Delta GEXP + \beta_4 \Delta IR + \beta_5 \epsilon_t - 1 + \epsilon_t \quad 2.5$$

The equation (2.5) has now the advantage of both short run and long run information. In the given equation  $\beta$ 's shows the coefficient values of variables between dependent and independent variable in short run while the parameter of  $(\epsilon_t - 1)$ , shows the speed of adjustment with null hypothesis

$$H0: \beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$$

$$H1: \beta_0 \neq \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$$

### III. Discussion

#### 3.1 Correlation Matrix

Correlation shows the degree of association among variables. Sometimes the time series data are highly correlated with each other that cause to have inefficient estimator because of the presence of multi-collinearity. Multi-collinearity is data problem that need to tackle before proceeding to estimation of the econometric results because its presence makes inefficient or indeterminate the coefficient. In time series usually we are dealing with data which are mostly depending on their lag values so we shouldn't get worry if even we have high correlation but in case of very high correlation its problematic, so these variables either need to remove or replace with some other instrumental variables or either they are need to construct a new variable that is comprise of proportional share of the variable and the new constructed variable to be treat an index that represents all the correlating variables.

**Table 1.** Correlation Matrix

	<b>LGDP</b>	<b>LPD</b>	<b>LGEXP</b>	<b>LTR</b>	<b>IR</b>
<b>LGDP</b>	1.00000				
<b>LPD</b>	-0.441	1.00000			
<b>LGEXP</b>	0.111	-0.415	1.00000		
<b>LTR</b>	0.247	-0.828	0.662	1.00000	
<b>IR</b>	0.223	-0.163	0.275	0.126	1.00000

We can see that most of the variables except public debt have normal correlation with GDP while public debt is negatively correlated with GDP. There is strong negative correlation exists between public debt and GDP where the association is -0.828 that is highly correlated but as we know the nature of time series data and behavior of the variable in Pakistan where there is huge gap exists between government expenditures and revenue and to fill this gap; government tend to borrow from international market. Same as the association between public debt and total revenue there exists strong positive relationship between total revenue and government expenditures. That confirms the positive association between total revenue and total expenditures. On the basis of findings of correlation matrix and variables nature, we can say that our data is free of collinearity problem. We can apply further econometrical tools and techniques to check the behavior of relationship between focused variables.

### 3.2 Unit Root Analysis

Before preceding any econometric estimation, it is important to highlight the degree of integration of focused variables because sometimes econometric estimations give significant results without have real relationship. (Burke & Hunter, 2005)confront that in most of the variables with time series behavior are non-stationary by level, and in the presence of unit root problem the estimations through convention method become spurious. Therefore, it's important to highlight the order of integration of variables, but since we are using ARDL approach where it is not necessary to find the integration order, but here we are analyzing it only for the possibility of simple approaches. The unit root results of Appendix A show the unit root analysis of given variables. We can see that most of the variables are first order integrated only interest rate is level stationary variable, (Rahman, 2019) found that out of 55 countries 33 countries GDP's have unit root problem and Pakistan is also one of them. The null hypothesis of there is unit root been accepted at 5% significance level in level analysis while been rejected in first difference.

**Table 2.** Unit Root Analysis

Variable	Level		First Difference		Integration Order
	t-stat	Probability	t-stat	Probability	I(0), I(1)
GDP	0.487671	1.7839	-5.70917	0.0000	I(1)
Public Debt	-1.28271	0.6262	-5.68581	0.0000	I(1)
Government Expenditures	-1.17912	0.8323	-5.31473	0.0001	I(1)
Total Revenue	-2.00597	0.2831	-6.71476	0.0000	I(1)
Interest Rate	3.642872	0.009			I(0)

### 3.3 Bound Test

The below table is showing stability bound test of co-integration among the variables. The results indicate that the null hypothesis of no level relationship is being rejected at 5%, showing that there is level relationship among the taken variables. So, we can see that the estimates of ARDL model is following cointegration among the variable set in long run. Therefore, we can say that the estimates of ARDL model is associated with long run

relationship between GDP (as dependent) while government expenditures, government revenue, public and interest rate as independent variables.

**Table 3. F-Bound Test**

ARDL Bounds Test		
Included observations: 34		
Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	K
F-statistic	4.34549	4
Critical Value Bounds		
Significance	I <sub>0</sub> Bound	I <sub>1</sub> Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

### 3.4 ARDL Long Run Estimations

To check the co-integration we have different approaches have been suggested by different researchers i.e. ( Ahmad, 2000); (Ademola, 2012) argued that Johansen co-integration is good because of its simple estimation nature and strong linkage possibilities while (Khan M. I., 2011); (Mahmood & Ahmad, 2017); (Siddique, 2006); (Mathew & Patrick, 2017) (Nikoloski, 2020); favored that Johansen Julius Cointegration test suggests the co-integrating vectors confirming how many of the variables are co-integrated with dependent variables while (Rahman, 2019) stated that ARDL is most advanced than the previous one because it captures the trends, shocks and variations in the data set and show the lag dependence on both dependent and independent variables and in time series it's one of basic features of the data that it have significant impact of its lag value. Therefore we are focusing on ARDL estimates to check the behavior of relationship between GDP, Government expenditures, government revenue, worker remittances and public debt, focusing on public debt as moderating and influencing variable because most of the developing nations face high revenue expenditure gap (Chowdhury, 2001) that let them to borrow from international market and in the repayment of these debt and interest over these cause the "Crowding Out Hypothesis" phenomenon affecting the investment in the economy (Akram N. , 2011). Therefore, our considered variable in independent side is Public debt.

The below given table highlights the estimations of ARDL where the lag length selection is been based on Aikeke Info Criterion (AIC) and Schwartz Info Criterion (SIC) while the fitness of the model been observed through F-statistics and probability of F-statistics, R<sup>2</sup> and adjusted R<sup>2</sup> is being focused to see the behavior of variations in dependent variable because of changes/ variations in independent variables.

**Table 4. ARDL Analysis**

## Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LTR	-2.265***	0.538	-4.206	0.000
LPD	-0.286***	0.056	-5.033	0.000
LGEXP	0.842**	0.410	2.053	0.052
IR	0.061***	0.020	2.958	0.007
C	7.466***	1.408	5.300	0.000

Note: \*\*\*, \*\* and \* denotes the significant values at 1%, 5% and 10% respectively.

**Diagnostic Tests**

R-squared	0.967	Mean dependent	5.08
Adj R-squared	0.956	Akaike Information	-3.2
		Criteria	
S.E. of regression	0.042	Schwartz Criteria	-2.77
Log Likelihood	6.391	HQC	-3.06
F-statistic	101.8	Durbin-Watson	1.96
Prob(F-statistic)	0.000		

Note: \*\*\*, \*\* and \* denotes the significant values at 1%, 5% and 10% respectively.

From the coefficient value of Total Revenue we can see there is inverse relationship between total revenue and GDP and that is significant at 1% showing that 100% increase in total revenue will cause to lay down the GDP by 2.26% that is against the neo-classical theory of growth (Ram, 1988) while (Iqbal, Din, & Ghani, 2017)) propped that since in Pakistan the economy is struggling to promote investment sector and the share of revenue in government expenditures is like a tiny part and in such circumstances to promote total revenue the biggest source is indirect taxes in developing economies that directly associated with investment on consumption goods and increase in indirect taxes have inverse effect on investment that will bring down the investment in the economy and investment is directly associated with GDP, therefore the GDP drops significantly because of the fall in investment. Government expenditure play a significant role in total GDP because higher will be the expenditures higher will be the GDP (Zinaz & Khatoun, 2009) (Ram, 1988). From the above table we can see that Government expenditure give positive significant relationship with GDP, showing that when there is one percent increase in government expenditures there is possibility to increase 0.842% on average with a significant value at 1%.

Since government expenditures and government revenues are backbone of the economy and most of the developing economies suffer expenditure revenue deficit (Kharusi & Ada, 2018) and this deficit let the economies to borrow from international market (Azam, 2020). There are two different schools of thoughts regarding the significance of public debt with GDP. From the findings of our study we can see that Public debt have negative relationship with GDP in Pakistan. The figures suggest that 1% increase in government debt will cause to reduce the GDP by 0.286% with a significant level at 1%. So in short run there may exists negative relationship between interest rate and GDP but in long run the price stability and export performance make less dependence the investors to interest rate that let to promote positive relationship between interest rate and GDP.

The diagnostic test shows the significance of variables, variations in the dependent variable because of changes in independent variables, minimum AIC and SIC values with Durban Watson Autocorrelation diagnostics. The  $r^2$  show that there is 96% comes in dependent variable i.e. GDP because of variation in total revenue, government expenditures, public debt and interest rate. The F-statistics suggest the significance of the model and from our estimations we can see that F-statistics value is 101.835 with probability 0.000, showing that over all model is significant. The findings of Durban Watson in current study is  $d=1.96$  that is near to 2, showing no problem of autocorrelation. The robustness of the model is being exclusion of irrelevant variables from the model i.e. lags that are insignificant in the study.

### 3.5 Short Run Estimations

**Table 5.** Short Run Co-Efficient Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP(-1))	0.608***	0.217	2.794	0.010
D(LTR)	-4.145***	1.330	-3.11	0.005
D(LPD)	-3.272**	1.429	-2.28	0.032
D(LPD(-1))	1.366	1.825	0.748	0.462
D(LPD(-2))	-2.546**	1.226	-2.07	0.050
D(LGEXP)	1.542*	0.867	1.777	0.090
D(IR)	-0.013	0.017	-0.782	0.442
D(IR(-1))	-0.048**	0.018	-2.643	0.015
D(IR(-2))	-0.029	0.018	-1.571	0.131
CointEq(-1)	-0.338 *	0.117	-2.877	0.000

Note: \*\*\*, \*\* and \* denotes the significant values at 1%, 5% and 10% respectively.

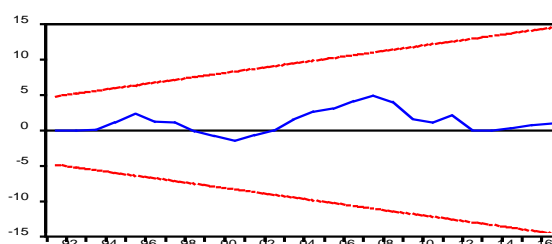
#### Diagnosics Tests

R-squared	0.927	Mean dependent var	5.089
Adjusted R <sup>2</sup>	0.916	Akaike info criterion	-9.222
S.E. regression	0.122	Schwarz criterion	-8.778
Log likelihood	-26.391	Durbin-Watson stat	2.004
F-statistic	11.835	Prob(F-statistic)	0.000

The above tables show the relationship between lag of GDP, total revenue, public debt and its lags with government expenditures and interest rate and error terms. We can see that lag of GDP and government expenditures give positive significant relationship with GDP in short run at 1% and 10% respectively while total revenue and public debt have negative significant impact on GDP in short run at 10% and 5% respectively. The Coint Eq(-1) have significant negative impact on GDP and CointEq(-1) show speed of adjustment in long run due to variation or changes occurred in GDP because of structural breaks or policy changes. The negative sign indicates the convergent impact of getting back to original position because of the policy change and structural breaks or shocks. We can say that on average CointEq (-1) 0.33873 units yearly changes impacts occur in GDP because of the changes in focused variables. The overall significance of the model suggests that there is strong relationship exists among the data set (Azam, 2020).

The diagnostic test tells about the significance, autocorrelation problem and the variation in GDP in short run. The  $r^2$  show that 92% variations in GDP in short run is because of variation and changes in independent variables. The F-statistic's probability indicates that the overall model of coefficient estimations in short is significant and showing the authenticity of overall model. The Durban Watson statistics show there is no problem of autocorrelation while AIC and SIC show the minimum value of auto when the lag length is 3.

### 3.6 CUMSUM Stability



*Figure 1. CUSUM Stability*

The CUMSUM stability curve finds inside the upper and lower bound of standard deviation of the 5% significance level, so we can say that the estimates of long run and short run through ARDL approach are stable.

## IV. Conclusion

There is a particular debt to GDP ratio which calculates how the debt will impact the economic growth of the country. It also shows the turning point of the economic growth which is based on debt. The limited amount of literature which is available all points out towards the theoretical framework which generates the result that the relationship between these two i.e. public debt and economic growth is always negative. The current study was an attempt to seek the relationship between Gross Domestic Product and Public debt in case of Pakistan from 1983-2019 by applying ARDL Cointegration approach. The findings of the study showed that there is strong negative relationship exist between Public debt and GDP in Pakistan in both short and long run. The coefficients suggest 1% increase in public debt will cause to lay down the total GDP by 0.25% in short run and 2.256% in long run. In short run the impact is being found less in volume, it may be because in short run the acquired debt make the local currency stable and public expenditures increases while in long run the velocity or association is very high; it is because that the government have to repay both interest and principal amount after maturity time that directly affect GDP. Therefore, public debt's impact in long run is more than as compare to short run.

The following recommendations are made to attract the attentions of policy makers.

1. Since government debt is adversely related with aggregate investment and productivity, government can use a good and proper debt decreasing policy.
2. Government bow down towards international borrowing because of the budget deficit, therefore through minimizing the budget deficit the government can bring down its dependence on public debt.
3. By decreasing unnecessary expenditures and promoting long term development projects from the public debts, the government can increase its revenue to repay the interest and principal amount of loan

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