The Lahore Journal of Economics
24: 2 (Winter 2019): pp. 1–23

A Fan Chart Approach to Debt Sustainability in Pakistan*

Mehak Ejaz and **Kalim Hyder*****

Abstract

Pakistan's economy has experienced relatively high growth of above 4.5 percent during FY2014-18. Meanwhile external liabilities and domestic debt have increased by almost 50 percent over the same period. This substantial increase in the external and domestic debt is a major issue for policymakers concerned about debt sustainability in Pakistan. With the objective of analyzing debt sustainability in Pakistan, this study applies a probabilistic approach to project the debt path from FY2019 to FY2025. In this approach, projections of the primary balance are derived from the estimated fiscal reaction function while the density forecast of external debt is derived from various statistical and structural models. The forecasts of the primary balance and the external debt along with the shocks of real GDP growth, real exchange rate and real interest are incorporated in the debt accumulation identity. This procedure provides a fan chart of the total debt-to-GDP ratio, which represents the appropriate uncertainty associated with the projections. The key finding of the paper is that external debt is reasonably sustained; however, the situation of the total debt is alarming. External debt may witness a declining trajectory in FY2019-20 and then remain stable within the range of 20-30 percent of GDP. However, the total debt-to-GDP ratio is rising throughout the projection period, which starts from around 100 to 175 percent of GDP in FY2020 and FY2025 and is higher than any sustainable threshold level. Therefore, policy makers need to contain fiscal deficits by domestic resource mobilization and the adoption of austerity in spending on a priority basis.

Keywords: Pakistan, public debt, external liabilities, debt sustainability, probabilistic approach.

JEL Codes: F34, F47, H63, H68.

---

* The views expressed in this paper are those of the authors and not of their institutes.

** Assistant Professor at Department of Economics, Shaheed Zulfikar Ali Bhutto Institute of Science and Technology (SZABIST), Pakistan.

*** Senior Economist, Monetary Policy Department, State Bank of Pakistan.

1. Introduction

It is the responsibility of the government to provide public goods and services and honor both its current and future debt obligations. The solvency condition is met if the government has the ability to meet its financial obligations on time. Solvency refers to the sustainability of public debt. In other words, the present value of primary balances of the government should be equal to the existing debt. the analysis of debt sustainability is concentrated on the relationship between the primary balance and debt. Mendoza and Oviedo (2004) explain sustainability as the strategy of the government to satisfy its inter-temporal budget constraint. In addition, the debt sustainability and solvency conditions require forecasts of economic fundamentals, which are not typically accurate. Therefore, the computation of sustainability and solvency involves informed judgments since, for instance, seigniorage is not considered in the computations of the primary balance. Therefore, point forecasts without consideration and discussion of the uncertainty involved provide a number needing careful interpretation. Hence, debt sustainability analysis requires forecasts of the debt along with the uncertainty associated with it so that appropriate judgments can be made.

Debt sustainability analysis (DSA) is a medium-term framework of the debt dynamics of a country, which the International Monetary Fund (IMF) uses for sustainability analysis. A declining trend of the debt-to-GDP ratio is considered a good indicator, whereas an increasing trend raises concerns in this regard. On the basis of these, the IMF prescribes stabilization measures for debt management and the reduction of debt in the medium-term. In order to consider the uncertainty in the deterministic approach, bounds tests are used in DSA to compare the alternative debt paths by means of simulations. These simulations use a variety of assumptions of economic growth, interest rates, the exchange rate and primary balances. Further, country specific exogenous shocks to debt such as "circular debt" (such as the fiscal pressures associated with liabilities due to unpaid electricity bills in Pakistan) and others are also incorporated to simulate the debt path. Celasun et al. (2006) suggest considering the coherence or covariance structure among these shocks for better calculations. Uncertainty regarding future fiscal policy and macroeconomic conditions creates doubt for the DSA. Therefore, there is a need to consider a probabilistic approach for DSA. Our paper considers the methodology of Melou et al. (2014) and Celasun et al. (2006) for the debt sustainability analysis of Pakistan. In the literature on DSA, our value addition is the application of the probabilistic approach to analyze the debt

sustainability of Pakistan. Further, we derive the probabilistic projections of external debt whereas Melou et al. (2014) and Celasun et al. (2006) assume a constant share of external and domestic debt in total debt for the projected period. Pakistan is a foreign exchange-constrained economy and this is the reason behind relaxing the assumption of a constant share of external debt. We consider the uncertainties of economic fundamentals and fiscal policy to derive the future probabilistic path of debt for debt sustainability analysis.

This article begins with the determination of fiscal behavior by estimating the fiscal reaction function. In addition, the external debt from a variety of statistical and structural models is forecasted and finally, the probabilistic medium-term path of the debt-to-GDP ratio is presented. The fiscal reaction function represents the fiscal policy pattern in which the primary balance is explained by using the previous levels of the debt and the output gap along with other control variables. We forecast the external debt by univariate, bivariate and multivariate VAR models and represent the probabilistic forecast of the external debt with a fan chart. Finally, we use the conventional stock flow identity to derive the debt-to-GDP path for the medium term.

After the introduction, sections 2 and 3 present the literature review and stylized facts related to fiscal behavior and the external sector soundness of Pakistan relative to the rest of the world. Section 4 discusses the approaches of debt sustainability, and the theoretical and methodological framework. Data sources are given in section 5 and the results are discussed in section 6 while section 7 concludes the article.

2. Literature Review

Daniel et al. (2003), Ostry and Abiad (2005), Garcia and Rigobon (2004), Penalver and Thwaites (2004), Celasun et al. (2006), Celasun and Kang (2006), Celasun et al. (2006), and Melou et al. (2014) are important studies which conduct debt sustainability analyses. These studies consider the fiscal reaction function and perform a stochastic analysis of debt. Daniel et al. (2003) introduce the concept of over borrowing, that is, when debt is higher than the specific threshold level. The estimates of the threshold level of debt vary amongst the studies. The IMF (2002) estimates a threshold of 40 percent of GDP, Schimmelpfennig et al. (2003) estimate a threshold of 50 percent of GDP, while Reinhart et al. (2003) suggest a threshold in the range of 15-20 percent of GDP for the countries that have a history of multiple defaults. The issue of debt sustainability becomes a major concern

when the debt-to-GDP ratio exceeds the threshold level. Better estimation of the fiscal reaction function, threshold level and debt forecast for the medium-term are important for DSA. Ostry and Abiad (2005) introduce political and institutional variables in the estimation of the fiscal reaction function and explore the determinants of over-borrowing, and they find that the impact of fiscal reforms and institutional changes on debt levels. Melou et al. (2014) and Celasun et al. (2006) combine the fiscal policy reaction functions suggested by Ostry and Abiad (2005) with the stochastic analysis of debt in in Garcia and Rigobon (2004) and Penalver and Thwaites (2004). Another strand of the literature discusses debt sustainability in conjunction with Dynamic Stochastic General Equilibrium models. Fournier (2019) examines debt sustainability issue using the buffer stock model in which the public debt limit concept is incorporated. The public debt limit is a sort of threshold level beyond which governments may lose market access. The concept of the buffer stock model is similar to the cash buffer concept of Deaton (1989) and Carroll (1997). Bohn (2007) suggests lenders may impose additional bounds on debt or deficits, and a new stream of literature provides model-based debt limits (Bi, 2012; Ghosh et al., 2013; Fournier & Fall, 2017). The risk of losing market access might also arise if liquidity risks constrain solvent governments (Cole & Kehoe, 2000). Chandia and Javid (2013) estimate the fiscal reaction function in order to analyze the debt sustainability issue in the economy of Pakistan.

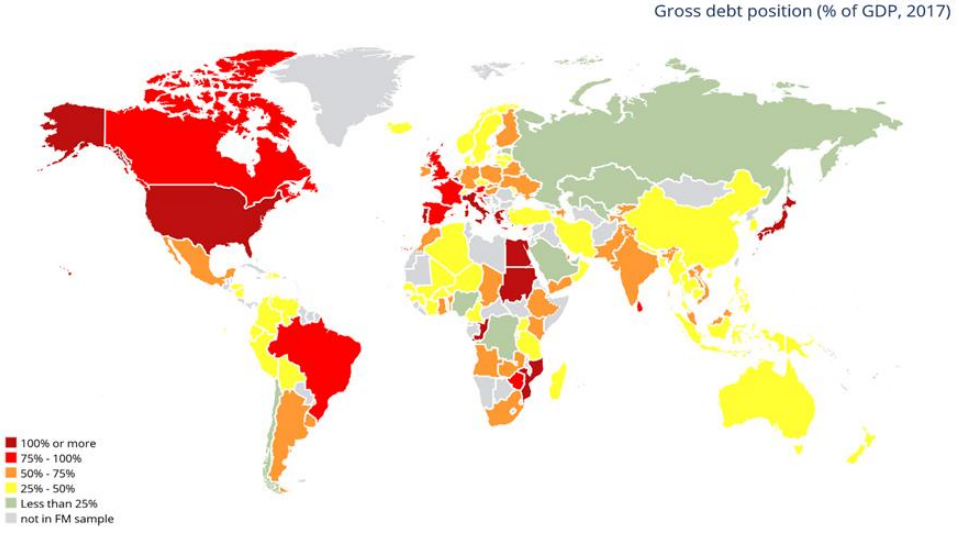
3. International Comparison: Debt Sustainability in Pakistan

This section presents an international comparison of public debt position, fiscal capacity, external savings and future debt paths of Pakistan's economy relative to other countries. We rely on IMF data for the comparisons presented in this section. Pakistan's economy is currently maintaining a fairly average position relative to the rest of the world regarding its debt burden, which is between 50-70 percent of GDP. However, its overall as well as its primary deficits on fiscal accounts along with a low level of foreign exchange reserves and ballooning current account deficits raises concerns regarding the sustainability of debt in the medium term. Figure 9 and 10 present the projections of the IMF regarding the debt burden of Pakistan. In the projection period, a rising trajectory of net as well as gross debt-to-GDP ratio are indicating deteriorating debt sustainability in Pakistan. Nonetheless, according to the IMF's own data in 2017, the debt position of Pakistan seems reasonable. Figure 1 indicates that Pakistan's gross debt as a percent of GDP is between 50-70 percent, which is higher than the threshold of 40-50 percent estimated by IMF (2002) and Schimmelpfennig et al. (2003), respectively. However, the threshold level

for the Pakistan's economy should be lower than the estimates for emerging economies. The reason for such a strict threshold is because of the restructuring of public debt (Asonuma, 2016).

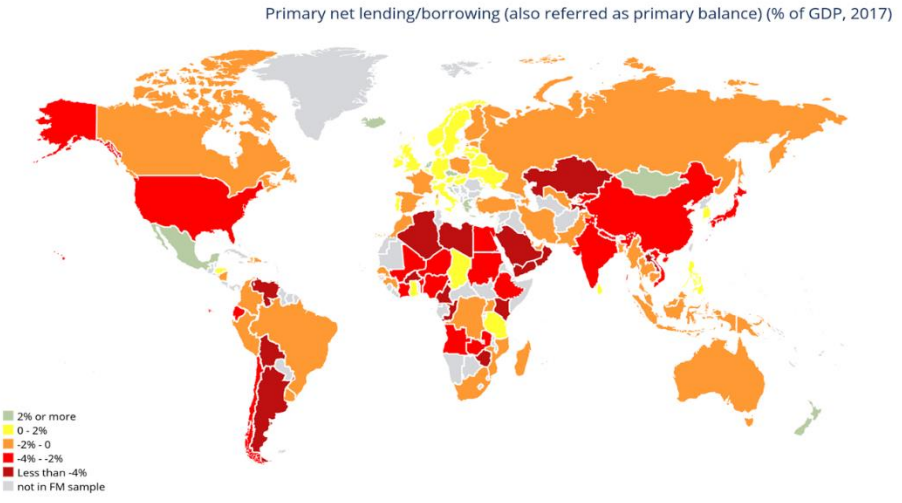
The primary budget balance-to-GDP ratio of Pakistan is between 0 and -2 percent, and ideally should be zero or less than zero. This core indicator of debt sustainability indicates that if the debt stock accumulation is on an increasing path then fiscal dis-savings will add to the debt burden. Figure 3 reflects a similar situation, where the overall deficit exceeds 4 percent of the GDP. The gap between spending and revenues is widening over time. The primary and overall fiscal deficit indicate that the government is following a debt accumulating path, hence domestic and external borrowing are required to finance the expenditures and repayments.

Figure 1: Gross Debt Percent of GDP



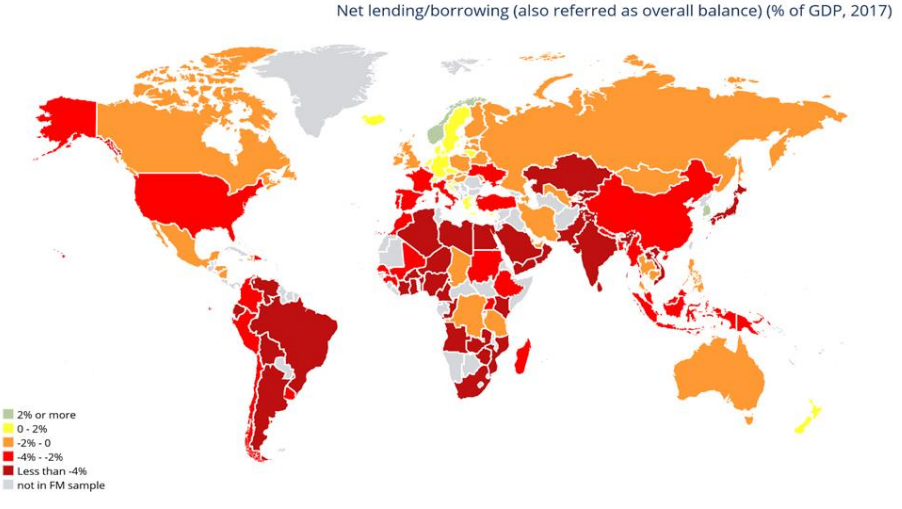
Source: Fiscal Monitor (October 2018).

Figure 2: Primary Budget Balance Percent of GDP



Source: Fiscal Monitor (October 2018).

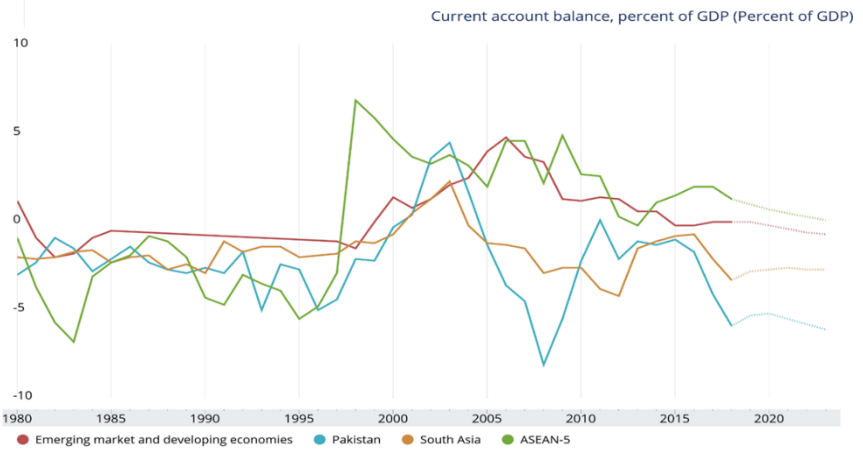
Figure 3: Overall Balance Percent of GDP



Source: Fiscal Monitor (October 2018).

On the external front, the deteriorating current account position, relative to other emerging economies, indicates that Pakistan's economy continues to rely on external resources to finance its current account deficits. This further adds to the burden of external debt. In contrast, the current account balance of ASEAN, emerging and other developing countries follows a smoother, more sustainable path as compared to Pakistan. The current account balance of the ASEAN countries has tended to be in surplus.

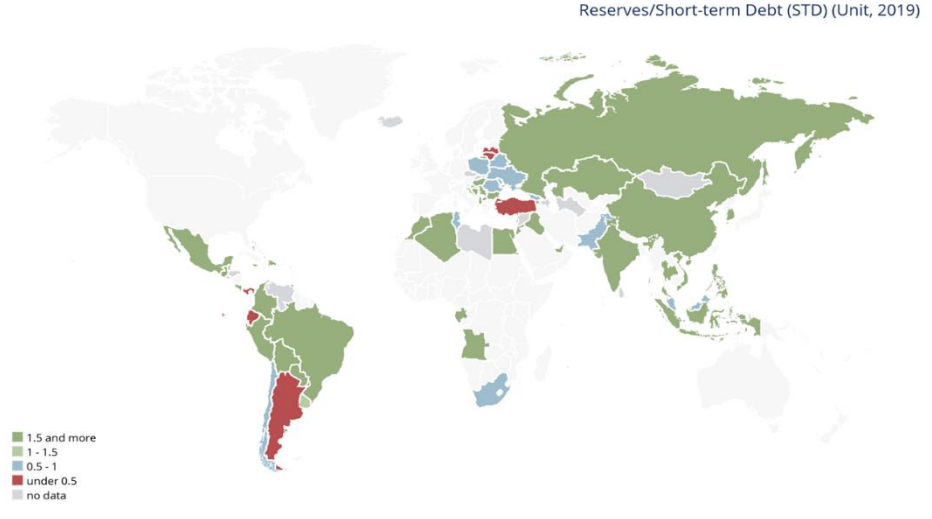
Figure 4: Current Account Balance percent of GDP



Source: World Economic Outlook (October 2018).

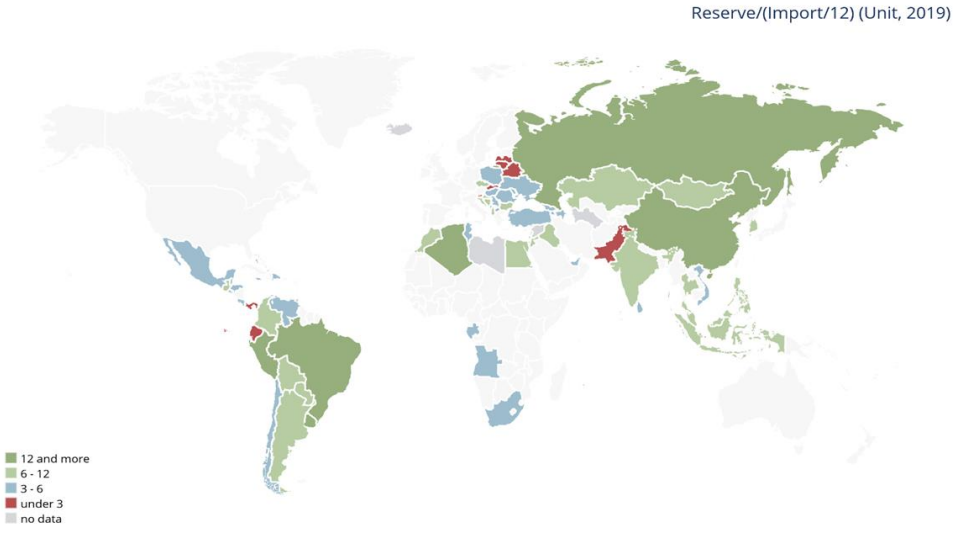
Figures 5 to 7 present Pakistan's foreign exchange reserve position. The ratio of reserves to short term debt falls in the range of 0.5-1.0. The reserves are less than three months of imports and the reserve to broad money ratio is less than 0.5. This indicates that the foreign exchange reserves of Pakistan are low according to a standard threshold. Therefore, an increase in the current account deficit requires external borrowing since the reserves do not provide any cushion to support ballooning external deficits.

Figure 5: Reserves to the Short Term Debt



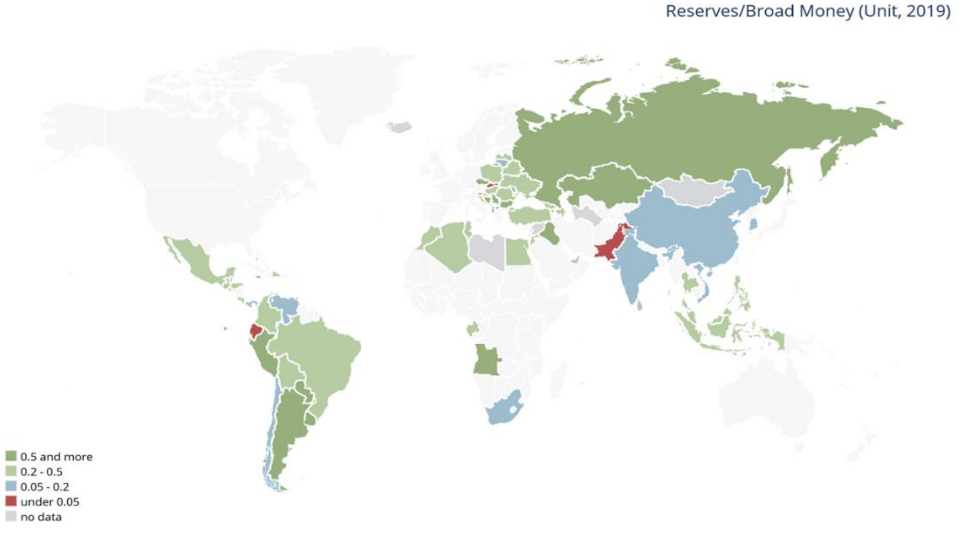
Source: Assessing Reserve Adequacy - ARA

Figure 6: Reserves to Imports



Source: Assessing Reserve Adequacy - ARA

Figure 7: Reserves to Broad Money

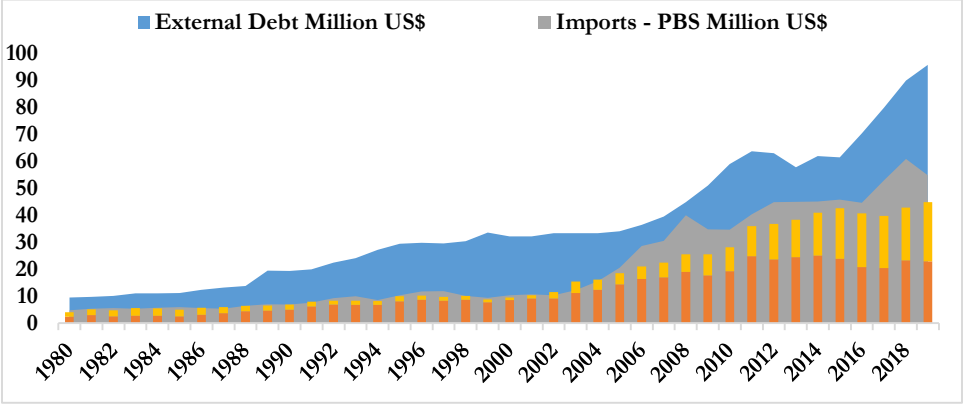


Source: Assessing Reserve Adequacy - ARA

The inflows of foreign exchange from exports and remittances is less than the outflow of the foreign exchange through imports (Figure 8). This indicates that the stock of external debt is accumulating. The sum of exports and remittances is less than the imports by $13.14 billion and $18.02 billion in Fiscal Year 2018 and 2019, respectively. Massive depreciation of

the domestic currency can be considered as a solution but this will add capital losses to debt and increase the burden of debt servicing.

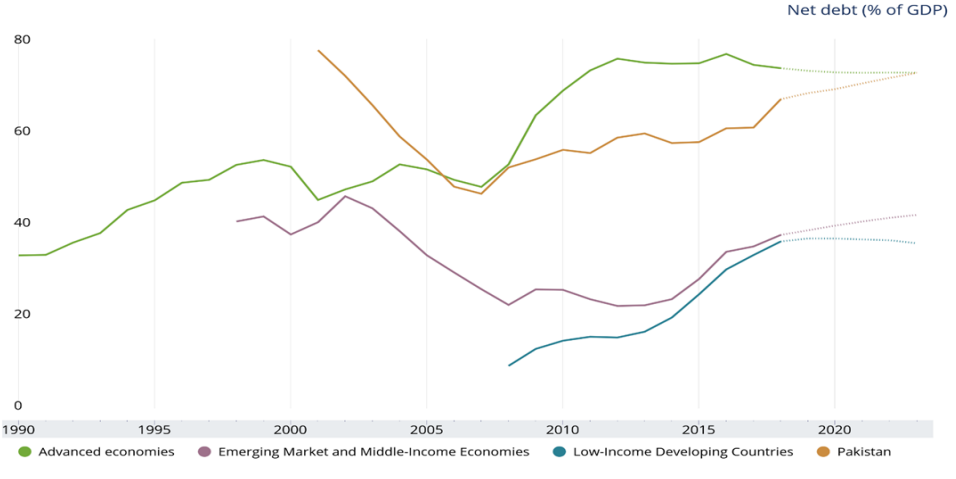
Figure 8: External Debt, Imports, Exports and Remittances Flows to Pakistan



Source: State Bank of Pakistan.

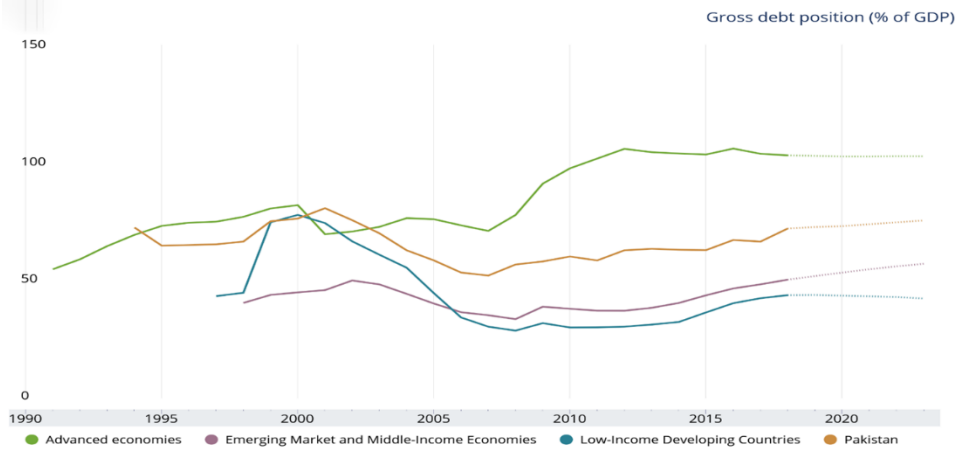
The current position of external and domestic debt raises concerns about their sustainability due to emerging deficits in the fiscal and external accounts. Figures 9 and 10 present these projections in the dotted lines. IMF projections indicate that net debt is increasing at a higher rate relative to that of emerging economies.

Figure 9: Net Debt Percent of GDP



Source: Fiscal Monitor (October 2018).

Figure 10: Gross Debt Percent of GDP



Source: Fiscal Monitor (October 2018).

Stylized facts indicate that expansionary demand management policies leading to higher fiscal and current account deficits may cause debt sustainability. Therefore, there is a need to analyze the situation further. We require a medium-term projection of the debt-to-GDP ratio for this purpose. In addition, in order to improve decision making, the uncertainty around the debt path is also to be estimated.

4. Theoretical and Methodological Framework

The main question that arises in this context is why should we project the probabilistic path or why do we forecast a debt path? The reason is that there prevails uncertainty as regards to the future condition of the economy. Celasun et al. (2006) and Melou et al. (2014) conclude that these uncertainties may arise due to increasing deficits, declining growth patterns, oil price shocks and global recessions. The point forecast of the debt-to-GDP ratio does not consider such changes. Therefore, the main objective of this study is to provide a forecast of the debt (external and total) and incorporate the projected uncertainties into it. The uncertainties can be considered in one of two ways: "deterministic" and "probabilistic". Generally, the IMF considers the deterministic approach in debt sustainability analysis (IMF, 2018). The deterministic approach is based on scenarios, and the projection of debt-to-GDP ratio is based on the fiscal policy directions and macroeconomic fundamentals. It has been observed that a declining trend of debt-to-GDP ratio is a good indicator. However, an increasing trend raises concerns (Daniel et al., 2003).

The Deterministic Approach: In this approach, the trajectory of the debt-to-GDP ratio is simulated by assuming different scenarios of economic growth. For instance, the trajectory of the debt-to-GDP ratio is conditional on economic growth of 5 percent and 2 percent. Debt Sustainability Analysis (DSA) by Daniel et al. (2003) is a deterministic approach in which the debt path is projected based on assumptions with regard to economic fundamentals (variables such as growth, interest rates, exchange rate and others). Alternative paths are projected by varying the assumptions regarding fiscal and macroeconomic variables such as low growth, high interest rates, lower primary balances and exogenous shocks to debt increase coming from depreciation of the currency or off-budget obligations. The IMF provides the bands-of-debt path by considering different scenarios and checks these by bounds testing. The main criticism of this approach is the lack of consideration of uncertainties in a stochastic way.

The Stochastic Approach: The stochastic or probabilistic approach provides the measure of uncertainty around the debt forecasts by considering shocks to the explanatory variables. It provides the probability of change in the debt path due to uncertainties in the economic variables. For instance, growth fluctuates around its average owing to its variance. How does this distribution of growth change the debt projection and what is the probability of change in debt projection? The stochastic approach is also utilized by the IMF as introduced by Celasun et al. (2006). This approach comprises three steps: estimation of the fiscal behavior, estimation of shocks in macroeconomic variables and finally incorporating the two in a debt identity. This gives a forecast of the debt path and uncertainties associated with the forecast by considering the shocks in the economic variables and fiscal behavior.

The probabilistic approach of debt sustainability considers the inherent uncertainties of the economic fundamentals, whereas the deterministic approach is based on the exogenous path of these fundamentals. For instance, the scenarios of the debt path in the deterministic approach are derived from the assumed trajectory of economic growth, interest rates and the twin deficits. However, being a small open economy, Pakistan's economy is vulnerable to external and domestic shocks. Therefore, the probabilistic approach is preferable as it considers stochastic movements in the economic fundamentals. Further, seigniorage is not considered in the computations of the primary balance. Hence, point forecasts without consideration and discussion of uncertainty give a number that requires careful interpretation. Hence, debt sustainability analysis requires a forecast of the debt along with the uncertainty associated with it

so that judgments can be made in an appropriate way. The stochastic approach suggested by Celasun et al. (2006) and Melou et al. (2014) assume a fixed share of domestic and foreign debt in the projections of total debt. However, the share of domestic and external debt may vary in the forecasted period due to the varying impact of external and domestic factors. We introduce varying projected shares of external and domestic debt in the projection of public debt for the medium term.

Primarily, debt sustainability analysis has been developed by the IMF and most of the work related to DSA is undertaken by the IMF (Daniel et al., 2003; Celasun et al., 2006; Ostry & Abiad, 2005; Melou et al., 2014). Therefore, the methodology of our study is based on the IMF framework. This section presents the methodology of forecasting external and total debt by using the probabilistic approach. We start with the specification of the fiscal reaction function that explains the behavior of the primary surplus by using debt, output gap and other control variables. After the estimation of the fiscal reaction function, we specify various models for the determination and forecasting of external debt. These models are based on a statistical technique and structural relationships. In order to identify the shocks in the economic fundamentals, the VARX of endogenous variables of real GDP growth, real exchange rates, and real interest rates and primary fiscal deficits and exogenous variables of world GDP growth and foreign real interest rates are included. The fiscal reaction function, probabilistic forecast of external debt along with the shock generated from the VARX will be incorporated into the debt motion equation. This provides the density forecast of the debt-to-GDP ratio in the fan chart. Daniel et al. (2003) Celasun et al. (2006), Ostry and Abiad (2005), and Melou et al. (2014) assume a constant share of external and domestic debt in the overall public debt, which indicates that the countries are not constrained in foreign exchange. However, we consider that the external debt accumulation depends on the its determinants such as the current account deficit and other external inflows and fiscal discipline.

Following Celasun et al. (2006) Melou et al. (2014), we specify the fiscal reaction function as follows:

$$pb_t = \alpha + \beta_1 \ d_{t-1} + \beta_2 \ Gap_t + \Gamma_t \ X_t + \epsilon_t \quad (1)$$

Where pb_t is the primary surplus-to-GDP ratio, d_{t-1} is the lag of total debt, Gap_t is output gap and X_t is a vector of control variables. The fiscal reaction function is estimated by using simple OLS. However, there is a possibility that the output gap can cause endogeneity. Therefore, we consider

estimating the fiscal reaction function with 2SLS and GMM. GMM yields more efficient and consistent estimates as compared to the estimates of 2SLS. The choice of a better instrument in the case of such a technique is an important issue. We include international oil prices, US interest rates and lagged values of the output gap in the list of instrumental variables. LIML estimations are also considered for robustness in the case of weak instruments. Further, dummy variables for political regimes and IMF programs are included as control variables.

The second step of the methodology is to find out the density forecast of external debt. Unconditional mean, random walk with drift, random walk with drift and trend, autoregressive, moving average, autoregressive and moving average models are estimated in the category of univariate statistical models. Bivariate vector autoregressive models are estimated by considering the current account deficit, gross foreign borrowing and real exchange rate as determinants of external debt. Multivariate vector autoregressive models consider the real exchange rate, real exports, real imports, trade balance, current account balance, fiscal deficit, primary deficit, economic growth, foreign exchange reserves, international oil prices, interest payments, amortization and gross foreign borrowing to determine the external debt. These exogenous and endogenous variables are used to construct various VAR models to forecast external debt. In addition, international oil prices, world inflation and world growth are used as exogenous variables in the estimations of VAR models. The details of the models are presented in Table 1. These models provide the forecast of external debt for the medium term. The probability of the forecast of each model is used to derive the fan chart of the external debt.

Table 1: Statistical and Structural Models of External Debt

Models	Specification	Exogenous Variables
Univariate Models	Unconditional Mean	$\Delta Ln(D_t^f) = \alpha + \mu_t$
	Random Walk with Drift	$\Delta Ln(D_t^f) = \alpha + +\beta \Delta Ln(D_{t-1}^f) + \mu_t$
	Random Walk with Drift and trend	$\Delta Ln(D_t^f) = \alpha + +\beta \Delta Ln(D_{t-1}^f) + \gamma * t_t + \mu_t$
	AR	$\Delta Ln(D_t^f) = \alpha + \sum \beta_i AR_{(t-i)}$
	MA	$\Delta Ln(D_t^f) = \alpha + \sum \beta_i MA_{(t-i)}$
	ARIMA	$\Delta Ln(D_t^f) = \alpha + \sum \beta_i AR_{(t-i)} + \sum \gamma_i MA_{(t-i)}$
Bivariate VAR Models	CA and External debt Trade balance and External debt Gross foreign borrowing and External debt Real exchange rate and External debt Real exchange rate, current account deficit and External debt Real exports and External debt Real Imports and External debt Foreign exchange reserves and External debt	$\begin{bmatrix} \Delta Ln(D_t^f) \\ \Delta Ln(X_t) \end{bmatrix} = \Gamma \begin{bmatrix} \Delta Ln(D_{t-i}^f) \\ \Delta Ln(X_{t-i}) \end{bmatrix}$
Multivariate VAR Models	CA, real exchange rate and External debt Trade deficit, real exchange rate and External debt Real exports, real imports, real exchange rate and External debt Real exports, real imports, real exchange rate and External debt Real exports, real imports, real exchange rate, inflation in consumer prices and External debt	$\begin{bmatrix} \Delta Ln(D_t^f) \\ \Delta Ln(Y_t) \\ \Delta Ln(X_t) \end{bmatrix} = \Gamma \begin{bmatrix} \Delta Ln(D_{t-i}^f) \\ \Delta Ln(Y_{t-i}) \\ \Delta Ln(X_{t-i}) \end{bmatrix}$

International oil prices, US real interest rates, gross foreign borrowing, remittances, US inflation in consumer prices and US real GDP along with the dummy variables for IMF programs, rescheduling and democracy are considered as exogenous variables.

Source: Authors.

In the third step, the VARX is estimated using the real GDP growth ($\Delta(real\ GDP)_t$), real interest rate on domestic debt ($\Delta\left(real\ r^d\right)_t$), real interest rate on foreign debt ($\Delta\left(real\ r^f\right)_t$) and real exchange rate ($\Delta(real\ e)_t$) as endogenous variables whereas global GDP growth (ΔY_t^f), real global interest rate ($\Delta\left(real\ r^{f*}\right)_t$) and global oil prices ($\Delta(Oil_t)$) are used as exogenous variables.

$$Y_t = \Gamma Y_{t-i} + \phi_1 X_{t-i} + E_t\ , \tag{2}$$

$$Y_t = \begin{bmatrix} \Delta(real\ GDP)_t \\ \Delta\left(real\ r^d\right)_t \\ \Delta\left(real\ r^f\right)_t \\ \Delta(real\ e)_t \end{bmatrix}, \mathrm{X_t} = \begin{bmatrix} \Delta Y_t^f \\ \Delta\left(real\ r^{f*}\right)_t \\ \Delta(Oil_t) \end{bmatrix}$$

Finally, the shocks in the endogenous variables of the VARX along with the shocks to the primary balance from the fiscal reaction function and density forecast of external debt, are used in the debt accumulation identity to construct probabilistic projections of the public debt-to-GDP ratio.

Melou et al. (2014) presents the specification of the debt accumulation identity as follows:

$$D_t = D_{t-1} + \left(i_t^d \frac{D_{t-1}^d}{D_{t-1}} + i_t^f \frac{D_{t-1}^f}{D_{t-1}}\right) D_{t-1} + \Delta e_t \left(1 + i_t^f\right) D_{t-1}^f - PB_t + S_t \tag{3}$$

D_t, $D_t^d$and D_t^f are the total public debt, domestic debt and external debt, respectively. i_t^d and $i_t^f$are the nominal interest rate on domestic debt and external debt, respectively. Δe_t is the rate of depreciation of the nominal exchange rate, PB_t is the primary balance, and S_t is the adjustment of flows. Following Melou et al. (2014), we divide both sides of the equation by nominal GDP, which after rearranging gives:

$$d_t = \frac{1}{1+g_t}(d_{t-1} + \left(i_t^d \frac{d_{t-1}^d}{d_{t-1}} + i_t^f \frac{d_{t-1}^f}{d_{t-1}}\right) d_{t-1} + \Delta e_t \left(1 + i_t^f\right) d_{t-1}^f - pb_t + s_t \tag{4}$$

where d_t, d_t^d, d_t^f, pb_t and s_t are total public debt, domestic debt, external debt, primary balance and adjustment of flows as fraction of nominal GDP, respectively.

5. Data Sources

We collect data from 1973 to 2018 from various issues of the Pakistan Economic Survey (2018) and Annual Reports of the State Bank of Pakistan (2018). In the case of international variables, we use the online data base of Haver Analytics (2005) and the International Financial Statistics of the IMF (2018).

Table 2: Variable Description

Variables	Symbols	Source
Domestic Debt	D_t^d	State Bank of Pakistan
External debt & liabilities	D_t^f	State Bank of Pakistan
Output Gap	Gap_t	Constructed by HP filter
Dummy for IMF programs	IMF_t	IMF
Dummy for democracy	DEM_t	Constructed
Dummy for Rescheduling	$RESC_t$	IMF
Primary balance	PB_t	Economic Survey of Pakistan
Fiscal Balance	FB_t	Economic Survey of Pakistan
Real GDP	Y_t	Economic Survey of Pakistan
Foreign Exchange Reserves	$FOREX_t$	State Bank of Pakistan
Gross total debt	GD_t	State Bank of Pakistan
Net total debt	ND_t	State Bank of Pakistan
current account balance	CA_t	State Bank of Pakistan
short term debt	D_t^S	State Bank of Pakistan
real Imports	IMP_t	Economic Survey of Pakistan
remittances	REM_t	Economic Survey of Pakistan
Real exports	EXP_T	Economic Survey of Pakistan
broad money	$M2_t$	State Bank of Pakistan
Real exchange rate	ER_t	State Bank of Pakistan
real interest rate	R_t	State Bank of Pakistan
CPI	CPI_t	Economic Survey of Pakistan
US interest rates	R_t^{US}	Haver
trade balance	TB_T	State Bank of Pakistan
Global oil prices	Oil_t	Haver
Domestic debt servicing	DS_t^d	State Bank of Pakistan
External debt servicing	DS_t^f	State Bank of Pakistan
gross foreign borrowing	GFB_t	State Bank of Pakistan
world inflation	π_t^f	Haver
world growth	g_t^f	Haver

Source: Authors.

6. Results

This section starts with the discussion of the estimates of the fiscal reaction function. The forecast of the primary balance is derived from the GMM estimates of the fiscal reaction function. Further, the stochastic

forecast of the external debt is computed from the univariate, bivariate and multivariate models. These forecasts of external debt yield the fan charts for the external debt. Then, VARX is estimated to find out the shocks of real economic growth, real exchange rate, and real interest rate. Finally, the forecast of the primary balance, external debt and shocks to the economic fundamentals are incorporated in the debt accumulation identity to derive the probabilistic projected path of the public debt-to-GDP ratio.

The fiscal reaction function specified in Equation 1 is estimated using OLS, 2SLS and GMM. Instrumental variable techniques are used to tackle the issue of endogeneity due to the output gap. LIML is preferable to GMM estimates in the case of weak instruments; therefore, the results of the LIML are also reported in Table 1. The estimates of the fiscal reaction function are consistent with the same reported by Celasun et al. (2006). The estimation results are robust across 2SLS, GMM and LIML techniques. GMM yields more efficient and consistent estimates than 2SLS. As it turns out, the parameter estimates of LIML are consistent with GMM estimates, thereby confirming that there is no issue of weak identification in the estimations. Based on the within-sample root mean square error (RMSE), we consider GMM results to forecast the primary balance-to-GDP ratio. In the instrumental variable specifications, the Sargan J statistics - with null hypothesis that the over-identifying restrictions are valid, fail to reject the null hypothesis, thus confirming that the over-identifying restrictions are maintained.

Table 3: Estimates of Fiscal Reaction Function

Variables	OLS	2SLS	GMM	LIML
Constant	-0.090	-0.100	-0.100	-0.110
d_{t-1}	0.080	0.090	0.100	0.094
Gap_t	0.210	0.341	0.372	0.383
IMF	0.010	0.010	0.010	0.012
Dem	-0.002	-0.002	-0.002	-0.002
Resc	0.014	0.013	0.011	0.008
DW	1.910	1.880	1.800	1.840
J-Stat	-	4.060	4.210	-
Prob	-	(0.14)	(0.12)	-

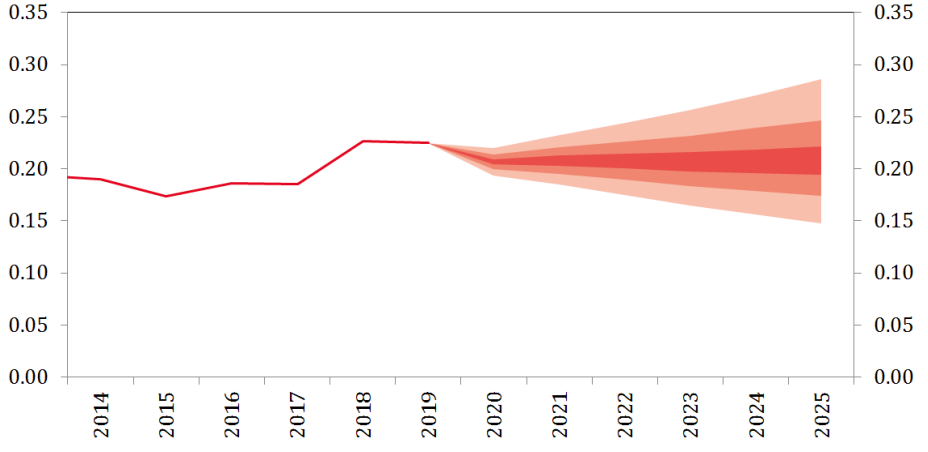
Source: Authors' calculations.

Notes: Dependent variable is the primary balance-to-GDP ratio. All variables are significant at 5% level.

After estimation of the fiscal reaction function and the forecasting of primary balance-to-GDP ratio, the external debt is forecasted from a variety of statistical and structural models. Univariate, bivariate and multivariate models are used to formulate the density forecast of the external debt-to-

GDP ratio. Figure 11 presents the fan chart of external debt projections from FY2019 to FY2025. It indicates that the external debt relative to GDP witnesses a declining trajectory during FY2019 and FY2020 and then becomes stable around 20 percent. A 95 percent confidence interval indicates that the external debt-to-GDP ratio will be in the range of 18 to 28 percent in FY2025. This stability in the trajectory of the external debt-to-GDP ratio is due to the recent implementation of stabilization efforts of the government and the IMF program.

Figure 11: Fan Chart of External Debt (as percent of GDP)



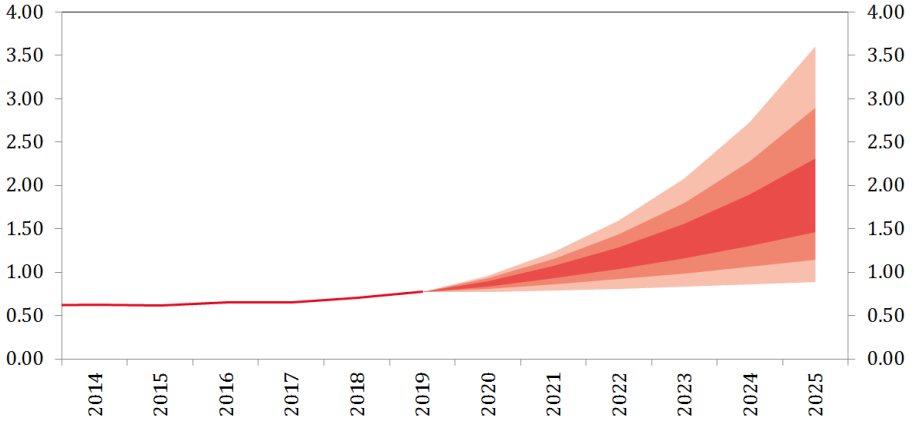
Source: Authors' calculations.

The projections of the primary balance-to-GDP ratio and the external debt-to-GDP ratio along with the shocks to economic growth, real interest rate and real exchange rate derived from VARX, are incorporated in the debt accumulation identity to produce the probabilistic projections of the overall debt-to-GDP ratio. The fan chart in Figure 12 of the probabilistic projections of the total debt-to-GDP ratio is raising concerns about debt sustainability in Pakistan. In the medium term, FY2019 to FY2025, total debt relative to GDP follows a rising trajectory. It starts to rise from almost 100 percent in FY2019 to 200 percent in FY2025. Not only is the projected level of debt-to-GDP increasing, but the amount of uncertainty associated with these projections is also widening over time. This indicates an alarming situation and requires urgent policy actions to avoid crisis.

The results suggest that the external debt is reasonably sustained but the situation of total debt is alarming. It is in contradiction with the basic Keynesian proposition in macroeconomics, the twin deficits

hypothesis, that there is a strong causal link between a nation's government budget balance and its current account balance. On the contrary, Ricardian equivalence proposes that the twin deficits are not related. Further, validity of the twin deficits hypothesis depends mainly on the exchange rate regime of the country. In the case of a flexible exchange rate, the link between the fiscal deficit and current account deficit becomes weaker. Anoruo and Ramchander (1998), Kim and Roubini (2008) and Grubisic et al. (2018) confirm that the fiscal deficit has no impact on the current account deficit, but that the current account deficit has an impact on the fiscal balances. In the case of Pakistan, Aqeel and Nishat (2000), Saeed and Khan (2012) and Yasmin (2015) present mixed results about the validity of the twin deficit phenomenon.

Figure 12: Fan Chart of Overall Debt (as percent of GDP)



Source: Authors' calculations.

7. Conclusion

This paper aims at providing the framework for the debt sustainability analysis by presenting the probabilistic projections of external and total debt-to-GDP ratio of Pakistan. The IMF developed the debt sustainability framework to provide the policy advice to the countries that approach the IMF. Initially, the IMF introduced the deterministic framework for the analysis of debt sustainability. But in order to capture uncertainty regarding the macroeconomic fundamentals and policy actions, simulations are performed on the basis of different paths of economic growth, real interest rates and the real exchange rate. Later, the stochastic or probabilistic approach is developed to better incorporate the uncertainty. Our contribution in this regard is the application of the

probabilistic approach to project the debt-to-GDP ratio for Pakistan. In addition, Pakistan's economy faces foreign exchange constraints. Hence, we relax the assumption of a fixed share of domestic and external debt-to-GDP ratio in the debt accumulation identity. For this purpose, we require a probabilistic forecast of the external debt-to-GDP ratio, and so for this purpose we develop a reasonable number of forecasting models of the external debt-to-GDP ratio. Finally, the forecast of the primary balance-to-GDP ratio and projections of the external debt-to-GDP ratio are incorporated in the debt accumulation identity that yields the fan chart of a debt-to-GDP ratio. In order to introduce appropriate uncertainty into these projections of total debt, we derive the shocks in economic growth, real exchange rate and real interest rates on domestic and external debt.

This study presents the projections of total debt-to-GDP ratio in the medium term (FY2019-FY2025). Along with the future trajectory of the debt-to-GDP ratio, it also presents the uncertainty associated with these projections by computing the probabilistic forecasts. The key finding of this study suggests that the external debt is reasonably sustained; however, the situation of total debt is alarming. External debt may follow a declining trajectory in FY2019-20 and then remain stable within the range of 20-30 percent of GDP. But the total debt-to-GDP ratio is currently following a rising trajectory throughout the projection period, and is above sustainable threshold levels. Therefore, there is a need for policy actions to contain the fiscal deficits by domestic resource mobilization and the adoption of fiscal austerity on a priority basis.

References

Analytics, H. (2005). Haver Analytics®. *IMF International Financial Statistics IMF Information Notice System (INS) IMF International Financial Statistics*.

Anoruo, E., & Ramchander, S. (1998). Current account and fiscal deficits: Evidence from five developing economies of Asia. *Journal of Asian Economics*, *9*(3), 487-501.

Aqeel, A., Nishat, M., & Qayyum, A. (2000). The twin deficits phenomenon: Evidence from Pakistan [with comments]. *The Pakistan Development Review*, 535-550.

Asonuma, M. T. (2016). *Sovereign defaults, external debt, and real exchange rate dynamics*. International Monetary Fund.

Bi, H. (2012). Sovereign default risk premia, fiscal limits, and fiscal policy. *European Economic Review*, *56*(3), 389-410.

Bohn, H. (2007). Are stationarity and cointegration restrictions really necessary for the intertemporal budget constraint? *Journal of Monetary Economics*, *54*(7), 1837-1847.

Carroll, C. D. (1997). Buffer-stock saving and the life cycle/permanent income hypothesis. *Quarterly Journal of Economics*, *112*(1), 1-55.

Celasun, O., & Kang, J. S. (2006). *On the properties of various estimators for fiscal reaction functions* (No. 6-182). International Monetary Fund.

Celasun, O., J.D. Ostry, and X. Debrun (2006). Primary surplus behavior and risks to fiscal sustainability in emerging market countries: A 'fan-chart' approach. *IMF Staff Papers, 53* (3), 401–425.

Chandia, K. E., & Javid, A. Y. (2013). An analysis of debt sustainability in the economy of Pakistan. *Procedia Economics and Finance*, *5*, 133-142.

Cole, H. L., & Kehoe, T. J. (2000). Self-fulfilling debt crises. *The Review of Economic Studies*, *67*(1), 91-116.

Daniel, J., Callen, T., Terrones, M. E., Debrun, X., & Allard, C. (2003). Public debt in emerging markets: Is it too high? *World Economic Outlook*, 113.

Deaton, A. (1989). *Saving and liquidity constraints* (No. w3196). National Bureau of Economic Research.

Fournier, J.M. (2019). *A buffer - stock model for the government balancing stability and sustainability*. International Monetary Fund.

Fournier, J.M., & Fall, F. (2017). Limits to government debt sustainability in OECD countries. *Economic Modelling*, *66*, 30-41.

Garcia, M., & Rigobon, R. (2004). *A risk management approach to emerging market's sovereign debt sustainability with an application to Brazilian data* (No. w10336). National Bureau of Economic Research.

Ghosh, A. R., Kim, J. I., Mendoza, E. G., Ostry, J. D., & Qureshi, M. S. (2013). Fiscal fatigue, fiscal space and debt sustainability in advanced economies. *The Economic Journal*, *123*(566), F4-F30.

Grubišić, Z., Kamenković, S., & Zdravković, A. (2018). Impact of government balance and exchange rate regime on current account during the economic cycle: Evidence from CEE countries. *Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu*, *36*(1), 309-336.

International Monetary Fund (2002). *Assessing sustainability*. Technical Report, Washington, (D.C.).

International Monetary Fund (2018). *International financial statistics database*. International Monetary Fund.

Kim, S., & Roubini, N. (2008). Twin deficit or twin divergence? Fiscal policy, current account, and real exchange rate in the US. *Journal of International Economics*, *74*(2), 362-383.

Melou, M. K., Sumlinski, M. A., & Geiregat, C. (2014). *An application of the "Fan-Chart Approach" to debt sustainability in post-HIPC low-income countries* (No. 14-102). International Monetary Fund.

Mendoza, E. G., & Oviedo, P. M. (2004). *Public debt, fiscal solvency and macroeconomic uncertainty in Latin America: The cases of Brazil, Colombia, Costa Rica, and Mexico* (No. w10637). National Bureau of Economic Research.

Miller, S. M., & Russek, F. S. (1989). Are the twin deficits really related? *Contemporary Economic Policy*, *7*(4), 91-115.

Ostry, M. J. D., & Abiad, M. A. (2005). *Primary surpluses and sustainable debt levels in emerging market countries* (No. 5-6). International Monetary Fund.

Pakistan Economic Survey (2018). *Pakistan Economic Survey*. Ministry of Finance, Islamabad, Government of Pakistan.

Penalver, A. and G. Thwaites (2004). *Analysing sovereign debt sustainability*: A new probabilistic approach. *Unpublished, London, Bank of England*.

Reinhart, C. M., Rogoff, K. S., & Savastano, M. A. (2003). *Debt intolerance* (No. w9908). National Bureau of Economic Research.

Saeed, S., & Khan, M. A. (2012). Twin deficits hypothesis: The case of Pakistan 1972-2008. *Academic Research International*, *3*(2), 155.

Schimmelpfennig, M. A., Roubini, N., & Manasse, P. (2003). *Predicting sovereign debt crises* (No. 3-221). International Monetary Fund.

State Bank of Pakistan (2018). *Annual Report*. State Bank of Pakistan.