Testing Fiscal Sustainability Hypothesis for Pakistan

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ABSTRACT

Fiscal sustainability has always been a lingering concern for developing countries like Pakistan. This study intends to verify the sustainability hypothesis by estimating a long run relationship between fiscal variables in Pakistan for a period 1976-2016. Dickey and Fuller Generalized Least Square (DF-GLS) and Ng-Perron unit root tests were used to determine the order of integration. Three most significant structural breaks had also been identified by using Bai and Perron test. Further, Fully Modified OLS (FMOLS), Dynamic OLS (DOLS) and Auto-Regressive Distributive Lag (ARDL) cointegration techniques were employed to find the long run relation between public expenditures and revenues. After a long run analysis, the results depicted that fiscal policy was found to be weakly sustainable. Therefore, the present study suggests fiscal reforms to sustain the fiscal policy in the long run.

Keywords: Cointegration, fiscal policy, public expenditures, public revenue, sustainability hypothesis

INTRODUCTION

The sustainable fiscal policy is a basic requirement for a long run sustainable economic growth. The developed economies have a very strong concern for fiscal sustainability. For example, European countries are required to retain debt to Gross Domestic Product (GDP) ratio below sixty percent. They are also required to keep budget deficit to GDP ratio either below three percent or to keep the budget in balance or surplus. Fiscal sustainability issue emerges due to fiscal deficits and it may give rise to public debts in the economies. Pakistan, on account of its fiscal mismanagement, is no exception to fiscal unsustainability as it has been facing

budget deficits for many decades. This issue warrants attention of economists and policy makers in ensuring the fiscal sustainability. Hence, unsustainable fiscal policy is termed to be an impulse to unsustainable debt that may cause macroeconomic crisis to respond.

The theory of government Inter-Temporal Budget Constraint (ITBC) elaborates that budget surpluses in proceeding years in present value should match with stock of public debt to ensure the fiscal sustainability. Where, the existence of sustainability hypothesis means that the present fiscal policy is sufficient. In absence of it, a discretionary policy is required. Later condition is being evaluated on stance of inefficiencies in debt management as it tends to cause high interest payments endangering fiscal management being counterproductive in nature. Afonso (2005) investigated the fiscal sustainability hypothesis by estimating a cointegration between Public Expenditures (PE) and Public Revenues (PR). He stated that presence of sustainability hypothesis required a cointegration between the aforementioned variables. Nevertheless, the condition of unit slope on public expenditures was also required for a strong sustainability. He further argued that current fiscal policy was sufficient in case of a strong sustainability. Hence existing policy is acceptable and no fiscal adjustments are required. But, if coefficient of public expenditure is less than one, which signifies a weak sustainability, then fiscal reforms are required because public expenditures are increasing at greater rate than that of public revenues. If unsustainability hypothesis

stands true then a discretionary policy is mandatory.

The fiscal sustainability catches a greater importance in the recent macroeconomic literature due to dependency of fiscal policy on it. Majority of the empirical studies do not support sustainability hypothesis due to insufficient estimation techniques. Considering, structural breaks responsible for it, Quintos (1995) stated that ignoring structural breaks not only affected the empirical estimation but also misguided about the magnitude of their relationship. The present study aims to test the sustainability hypothesis for Pakistan. It includes the three most significant breaks in the cointegrating relationships of PE and PR. An ARDL cointegration technique, FMOLS and DOLS are further being used to get more reliable results to conclude about the sustainability hypothesis for the economy of Pakistan.

LITERATURE REVIEW

The previous literature exhibits two types of analysis for testing the sustainability hypothesis. The first stream of literature has shown concern with stationarity of public debt to ensure a sustainable fiscal policy (i.e. Baglioni & Cherubini, 1993; Wilcox, 1989). The recent studies work on cointegration between PR and PE under the ITBC. There has been a lot of literature on the second approach in the time series and panel data estimation. For example, Payne (1997) investigated the relationship between PR and PE for G-7 countries. He found an unsustainable fiscal policy in case of France,

Japan, and Italy. Fiscal policy of Germany was found strongly sustainable and a weak sustainability was found for the rest of countries. Afonso (2005) used the unit root, structural break and cointegration tests on fifteen EU countries for a period 1970-2003. A cointegration between PR and PE was found in most of countries but slope of public expenditures was found less than one. Therefore, he concluded that fiscal policy of these countries were weakly sustainable. By utilizing same country set, Afonso and Rault (2010) had applied Westerlund-Edgerton panel cointegration and structural break tests for a period 1970-2006. They asserted that sustainability hypothesis stood true in these countries in panel setting. Baharumshah and Lau (2007) investigated the fiscal sustainability of five East Asian countries by checking the degree of association between PR and PE after incorporating the dummies of structural breaks. They found an evidence of a strong sustainability in case of Korea, Singapore and Thailand and weak sustainability in case of Malaysia and Philippines.

Westerlund and Prohl (2010) used the quarterly data of eight OECD countries for a period 1977-2005. They claimed a strongly sustainable fiscal policy for these countries. They also incorporated the significant structural breaks in analysis and claimed that insufficient econometric techniques might become cause of inaccurate results. However, Afonso and Jalles (2012) analyzed this issue for all OECD countries with panel data estimation techniques and with a time series data technique for each country

separately. They did not find an evidence of fiscal sustainability with both analyses. Afonso and Jalles (2015) re-investigated this for eighteen OECD countries. They tested the unit root and cointegration between PR and PE. They reiterated an evidence of no sustainability within panel. Further, they found a one-way causality from public debt to primary surplus. Foregoing further, Camarero et al. (2015) investigated the fiscal sustainability of 17 OECD countries. They found a cointegration in PR and PE including structural changes in the model and concluded a fiscal sustainability. Hence, the structural changes have a great impact on the all parameters in the model as those changes help to find a weak sustainability in the model and suggest the fiscal adjustments. Therefore, they claimed the importance of structural breaks in analysis to conclude the true fiscal sustainability. Likewise, Afonso et al. (2011) used quarterly data of a mix panel of US and eight EU countries. They also analyzed fiscal shifts of public expenditures and revenues in each single country analysis. They claimed that fiscal shifts had a strong impact on a relationship between fiscal variables. While, fiscal sustainability had not been found in most of countries.

Christophe and Llorca (2017) investigated the fiscal sustainability of 20 central and Latin American Countries using a panel cointegration technique for a period 1990-2012. They found an evidence of weak sustainability. Tran (2018) explored the fiscal sustainability for the fourteen emerging countries using a threshold

technique and by utilizing a period 1999-2016. He corroborated the sustainability hypothesis in the short run with a threshold bound of 40-55% of GDP but fiscal policy was found as unsustainable in the long run path with rising debt levels.

The country-specific studies are also available in the fiscal sustainability literature. For example, Quintos (1995) probed sustainability hypothesis of US considering structural changes in analysis. He found a significant break in 1980 and tested cointegration between PE and PR. He found a cointegration between PE and PR before the time analysis of 1980 but failed to find cointegration after 1980. Berenguer-Rico and Carrion-i-Silvestre (2011) investigated the fiscal sustainability with multi-cointegration of PR, PE and public debt in US. They found a cointegration between PR and PE. Therefore, they concluded a fiscal sustainability in the presence of a structural break that signified the change in the equilibrium relationship.

Marinheiro (2006) investigated the fiscal sustainability for a long period of 1903-2003 of Portuguese economy by testing the relationship between PR and PE and found a sustainable policy. An investigation of sub-sample periods demonstrates that fiscal policy does not remain sustainable for the period of 1975-2003 due to heavy debt to GDP ratio. In the same line, Kirchgaessner and Prohl (2008) performed cointegration test on Swiss fiscal variables for a period 1900-2002. They included a structural break of Second World War in analysis and concluded an unsustainable fiscal policy.

Silvestrini (2010) delved into the fiscal sustainability for Poland using Bayesian analysis of cointegration of fiscal variables by using monthly data of a period 1997-2007 and found an evidence of a strong sustainability. Sakuragawa and Hosono (2011) tested the fiscal sustainability in dynamic stochastic general equilibrium model for Japan. They found a weak sustainability with coefficient less than one on government spending. Based on the simulation results, they found that debt to GDP ratio relied on the targeted economic growth rate and suggested that this ratio must increase in the bounds otherwise fiscal policy did not behold.

Fan and Arghyrou (2013) investigated the fiscal sustainability of UK by applying the cointegration test on public expenditures and revenues after incorporating the three structural breaks for the slope shift in analysis for a quarterly data of a period 1955-2006. They found a sustainable fiscal policy for the whole sample of analysis. But for the subsample analysis, UK fiscal policy did not prove sustainable during the period of 1973-1981 and they concluded that change in public expenditure corroborated a reason for the shift in fiscal regimes. Further, an adjustment in fiscal balance was observed through government revenues and it showed a nonlinear behavior because government did not respond to the small deficit quickly but showed abrupt action in removing the large deficit.

Chen (2016) investigated the cointegration between US government revenue and spending using a quantile

approach. He found the evidence of cointegration and causality in the quantile coefficients and suggested to control government spending to reduce fiscal deficit. Cassou et al. (2017) reinvestigated the asymmetric effect of fiscal policy in the USA during a period 1955-2013 by using a quarterly data. They found a sustainable policy during the good economic times and unsustainable during distress period. Nxumalo and Hlophe (2018) assessed the fiscal sustainability of Swaziland and reported that government spending was increasing faster than the government revenues. Therefore, deficits were found unsustainable in the medium term and weakly sustainable in the long term.

In case of Pakistan, Mahmood and Rauf (2012) investigated the debt sustainability for a period 1971-2011. They found an unsustainable debt through unit root test analysis. Further, they applied DOLS on the relationship between PR and PE and found unsustainable debt again. The reliability of their test may remain questionable as they had used ADF and PP unit root tests which were not efficient for small sample size and secondly for a long run relationship, they had used the fiscal variable without ratio of GDP. This analysis was ignoring the importance of country size as it had been strongly argued by Hakkio and Rush (1991) to normalize the fiscal variables. They also ignored the fact of separation of East Pakistan in 1971.

Considering the above state of the art, a literature gap has been identified in the Pakistan context as no comprehensive empirical study on the existence of sustainability hypothesis has been carried out yet. The underlining study fills in the above gap by applying most efficient unit root tests, structural break test and the cointegration tests.

ANALYTICAL FRAMEWORK

The present study utilizes the government ITBC to test the fiscal sustainability for Pakistan. The public budget constraint has a prerequisite to match the present values of future PR with a sum of present values of public debt and PE. A sustainability of fiscal policy may show an ability of government to pay its debts and is an ability of government to be financially solvent. Following the Afonso (2005), the flow budget constraint is given below:

$$ps_t + (1 + i_t)pd_{t-1} = pr_t + pd_t \qquad [1]$$

Where ps_t is primary public spending by excluding interest payment, pd_t is the public debt, pr_t is the public revenue, i is the real interest rate on debt and t is a time flow. Equation [2] is defining a variable of public expenditures (e_t) by assuming a stationary real interest rate i:

$$e_t = ps_t + (i_t - i)pd_{t-1} \qquad [2]$$

Solving [2] for ps_t:

$$ps_t = e_t - (i_t - i)pd_{t-1} \qquad [3]$$

Putting [3] into [1]:

$$e_t - (i_t - i)pd_{t-1} + (1 + i_t)pd_{t-1} = pr_t + pd_t \qquad [4]$$

Solving the [4] for pd_{t-1}:

$$pd_{t-1} = \frac{pr_t - e_t}{1+i} + \frac{pd_t}{1+i} \qquad [5]$$

Applying the summation and limit approximation to get the present value of budget constraint:

$$pd_{t-1} = \sum_{k=0}^{\infty} \frac{pr_{t+k} - e_{t+k}}{(1+i)^{k+1}} + \lim_{k \to \infty} \frac{pd_{t+k}}{(1+i)^{k+1}} \qquad [6]$$

In [6], if $\lim_{k \to \infty} \frac{pd_{t+k}}{(1+i)^{k+1}}$ approaches to zero at infinite time horizon then fiscal policy can be considered as sustainable by compensating the debt from present value of all future budget surplus. By using [2] and another definition of public expenditures with including interest payment, $pe_t = ps_t + i_t pd_{t-1}$, ITBC can be derived in the following form:

$$pe_t - pr_t = \sum_{k=0}^{\infty} \frac{\Delta pr_{t+k} - \Delta e_{t+k}}{(1+i)^{k-1}} + \lim_{k \to \infty} \frac{pd_{t+k}}{(1+i)^{k+1}} \qquad [7]$$

Again, $\lim_{k \to \infty} \frac{pd_{t+k}}{(1+i)^{k+1}}$ must be zero to ensure the sustainability of fiscal policy and pr_t and e_t should be stationary on the first difference or both must be cointegrated.

The fiscal sustainability condition can also be derived with fiscal variables as ratio of GDP as economies are growing in terms of GDP and normalizing fiscal variables are very important in this manner (Hakkio and Rush, 1991). For this purpose, we may divide [1] with gdp_t.

$$\frac{ps_t}{gdp_t} + \frac{(1+i_t)pd_{t-1}}{gdp_t} = \frac{pr_t}{gdp_t} + \frac{pd_t}{gdp_t} \qquad [8]$$

Here gdp_t can be expressed as $gdp_t=(1+g_t)gdp_{t-1}$. Where g is GDP growth rate in time t. Assuming real interest and economic growth rates constant, [8] can be expressed as:

$$\frac{ps_t}{gdp_t} + \frac{(1+i)}{(1+g)} * \frac{pd_{t-1}}{gdp_{t-1}} = \frac{pr_t}{gdp_t} + \frac{pd_t}{gdp_t} \qquad [9]$$

$$PE_t + \frac{(1+i)}{(1+g)} * PD_{t-1} = PR_t + PD_t \qquad [10]$$

Where, $PE_t = ps_t/gdp_t$, $PD_{t-1} = pd_{t-1}/gdp_{t-1}$, $PR_t = pr_t/gdp_t$ and $PD_t = pd_t/gdp_t$. Solving [10] for PD_{t-1}:

$$PD_{t-1} = \left[\frac{1+g}{1+i}\right](PR_t - PE_t) + \left[\frac{1+g}{1+i}\right]PD_t \qquad [11]$$

Applying the summation and limit to get the present value of budget constraint:

$$PD_{t-1} = \sum_{k=0}^{\infty} \left[\frac{1+g}{1+i}\right]^{k+1}(PR_{t+k} - PE_{t+k}) + \lim_{k \to \infty} PD_{t+k}\left[\frac{1+g}{1+i}\right]^{k+1} \qquad [12]$$

$\lim_{k \to \infty} PD_{t+k}\left[\frac{1+g}{1+i}\right]^{k+1}$ must be zero to verify the condition of fiscal sustainability and the present value of budget surplus as a proportion of GDP must also be equal to public debt as a proportion of GDP to ensure fiscal sustainability.

The public debt and its interest cannot be supported from the new debt for an infinite time period. Therefore, it must be paid from present value of all future budget surpluses. Alternatively, Ponzi game theory states that stationarity of public debt to GDP ratio ensures a long run balanced relationship in fiscal variables. However, in the non-Ponzi game theory, a cointegration between PR and PE with a similar level of integration is a necessary condition for a sustainable fiscal policy (Afonso, 2005). It can be checked with a simple equation given below:

$$PR_t = \alpha + \beta PE_t + \mu_t \qquad [13]$$

In [13], if the public expenditures and revenues ratio to GDP are not stationary at level then its long run relation should be stationary. In the residual based cointegration tests, if residual from [13] is stationary at level then a cointegration and fiscal sustainability can be claimed. Additionally, for the strength of analysis, ARDL, FMOLS and DOLS cointegration techniques have been utilized in the present paper to test the sustainability of fiscal policy of Pakistan.

METHODS

This section describes the empirical estimation techniques to confirm the fiscal sustainability in Pakistan. Firstly, we used Ng-Perron and DF-GLS tests to certify the level of integration in PR and PE. Secondly, we used Bai and Perron (2003) test to find three most significant breaks in the cointegration of PR and PE. Thirdly, ARDL co-integration test was estimated after incorporating the three most significant structural breaks in the relationship of PR and PE. And last but not the least, the magnitude of slope of PE had been checked and verified by using ARDL framework, FMOLS and DOLS to justify the strength of fiscal sustainability by using a period 1976-2016. Different cointegration tests were utilized to avoid any estimation biasness and data was sourced from World Development Indicators.

Following the theoretical background, the sustainability hypothesis can be tested by following function:

$$PR_t = f\,(PE_t) \qquad [14]$$

The structural breaks in fiscal variables' relationship are very natural. As, policy shifts and economic fluctuations may have a great role in determining the behavior of the relationship of fiscal variables. Therefore, it is pertinent to include the effects of these shifts in analysis. These shifts have captured through the dummy variables in the present study and have incorporated in the [14] in the following way:

$$PR_t = f\!\left(PE_t, \sum_{t=1}^{n} D_t\right) \qquad [15]$$

Where, D_t assumes zero before the break date and one afterward. This study calculates three most significant unknown structural breaks in the long run relationship of PR and PE. The inclusion of such breaks completes the information of policy shifts and any other types of fluctuations in the model. Further, this procedure may also ensure the reliability of estimated parameters to confirm the degree of fiscal sustainability.

For analysis, this study used DF-GLS unit root test by Elliott et al. (1996) which is an efficient version of ADF test. It used the following equation to check the stationarity in a variable.

$$\Delta z_t^d = \gamma z_{t-1}^d + \sum_{j=1}^{q} v_j \Delta z_{t-j}^d + \psi_t \qquad [16]$$

Here, z_t^d is a detrending of variable Z_t. The process of detrending is as follows:

$$z_t^d = z_t - \hat{\alpha}'_{\overline{\varphi}} D_t \qquad [17]$$

and

$$\hat{\alpha}_{\overline{\varphi}} = (D_{\overline{\varphi}} D'_{\overline{\varphi}})^{-1} D'_{\overline{\varphi}} z_{\overline{\varphi}} \qquad [18]$$

By using [16], Ng and Perron (2001) augmented the test statistics for sake of greater efficiency to deal with small sample size. The test statistics of this test are as follows:

$$MZ_\alpha^d = (T^{-1}(y_T^d)^2 - f_0)/2k \qquad [19]$$

$$MSB^d = (k/f_0)^{1/2} \qquad [20]$$

$$MZ_t^d = MZ_\alpha^d \times MSB^d \qquad [21]$$

$$MPT_T^d = ((\bar{c})^2 k + (1-\bar{c})T^{-1})(y_T^d)^2 / f_0 \qquad [22]$$

where

$$k = \frac{\sum_{t=2}^{T}(y_{t-1}^d)^2}{T^2}, \bar{c} = -13.5 \qquad [23]$$

and

$$f_0 = \sum_{j=-(T-1)}^{T-1} \theta(j).k(j/l) \qquad [24]$$

Structural breaks in long run relation may have a severe impact on the reliability of parameters. Bai and Perron (2003) proposed a methodology to find multiple unknown breakpoints in the long run relationship with *m* potential break points:

$$PR_t = \beta_j PE + \varepsilon_t \qquad [25]$$

j=1, 2, ..., m+1 for regime shifts.

Above test utilizes regression and its sum of square of residuals to find the possible break points. Sum of square of residuals is defined as:

$$S\left(\frac{\beta}{T}\right) = \sum_{j=0}^{m}\left(\sum_{t-T_j}^{T_{j+1}-1} PR_t - PE_t'\beta_j\right) \qquad [26]$$

This study is utilizing a Global Information Criteria (GIC) to find the possible most significant breaks. The target of this test is to find those break points that are minimizing the sum of square of residuals in the regression.

After checking the order of integration in the variables and possible unknown structural breaks, this study uses the ARDL cointegration bound testing technique proposed by Pesaran, Shin and Smith (2001). ARDL has a unique feature of capturing different lag length in auto-regressive process to save degree of freedom and it also improves the efficiency of cointegration analysis. A cointegration gives a long run equilibrium relation among variables of interest even after shock of short run disequilibrium. The ARDL equation for estimation is given below:

$$\Delta PR_t = \alpha + \gamma PE_{t-1} + \delta PR_{t-1} + \sum_{i=0}^{q}\varphi_i\Delta PE_{t-i} + \sum_{i=1}^{p}\phi_i\Delta PR_{t-1} + \varepsilon_t$$

$$[27]$$

where Δ shows the variables at difference. PR_t and PE_t are the ratio of public revenues and expenditures to GDP, *t* contains time dimensions, *i* contains optimum lags. Dummy variables of structural breaks will also be included in [27] after choosing optimum lag length by Akaike Information Criterion (AIC). The null hypothesis of [27] is of no cointegration i.e. ($\lambda = \delta = 0$).

Following the same ARDL methodology, thshort run results can be obtained from its Error Correction Model (ECM). It is as follows:

$$\Delta PR_t = o + \sum_{i=0}^{q}\mu_i\Delta PE_{t-i} + \sum_{i=1}^{p}\pi_i\Delta PR_{t-1} + \gamma ECT_{t-1} + \xi_t$$

$$[28]$$

Here, the ECM will use same lag length selected by [27]. ECT_{t-1} is lag of error correction term. After applying ARDL procedure, this study is confirming the reliability and consistency of our estimates through FMOLS and DOLS. Because, coefficient of PE_t is a major estimate which may confirm a weak or a strong sustainability therefore it is very pertinent to see whether the estimated results are technique biased or not.

RESULTS AND DISCUSSION

This section provides the all necessary empirical estimation required to test the sustainability hypothesis of Pakistan. Table 1 shows the unit root test statistics for the variables under consideration with individual intercept & trend. Results show that both public expenditures and revenues are non-stationary at level with both unit root tests' application. Nonetheless, both of the variables show stationary behavior after first differencing. DF-GLS test show that both variables show stationary behavior at 1% level of significance. Ng-Perron test shows that public expenditure is stationary at 5% and public revenue is stationary at 10% level of significance. Therefore, order of integration can be concluded one in case of both variables. Now, fiscal policy can further be tested for sustainability by applying a cointegration between PR and PE.

Before conducting a cointegration test between the public expenditures and revenues, Bai and Perron (2003) test had been applied to find the most significant unknown breaks. This test is calculated on the bases of GIC at 5% level of significance. The estimated results provide that three most significant structural breaks are found in the years 1989, 1997 and 2010. These points of structural breaks show the major fiscal policy changes in Pakistan. Therefore, these break points should be included while doing long run analysis to have true long run parameters.

Table 1

Unit root analyses

Variable	DF-GLS	Ng-Perron			
		MZa	MZt	MSB	MPT
Level of Variables					
PR_t	-2.6559(0)	-9.3091 (0)	-2.1562	0.2317	9.7961
PE_t	-2.2472 (0)	-7.8096 (0)	-1.9693	0.2522	11.6852
First Difference of Variables					
ΔPR_t	-8.1037*** (0)	-17.1420* (0)	-2.8829*	0.1618*	5.5828*
ΔPE_t	-6.3806*** (0)	-18.1078** (0)	-2.9792**	0.1645**	5.2113**

Note: Brackets contain optimum lag lengths. Δ is for differenced variables. *, ** and *** show the stationarity at 10%, 5% and 1% level of significance.

After conducting the unit root tests and multiple structural break points test, an ARDL has been applied on public revenues and expenditures as ratio of GDP after incorporating the three dummy variables to include the effect of structural breaks in the cointegration. Each dummy variable assumes the zero value before a time of break and one afterward. AIC is utilized to find the optimum lag lengths of PR and PE. The lag length of dummy variables is taken as zero because dummy variable cannot be lagged or differenced. The results of table 2 show that F-statistic of selected ARDL model with lag length (1,0,0,0,0) is 3.984 which is larger enough than that of upper bound F-value at 10% significance level. The diagnostic of serial correlation, normality, heteroscedasticity and functional form tests show the appropriateness of results and also prove that the model is out of any econometric problem. This whole process gives valid evidence for cointegration between PR and PE. Hence, fiscal sustainability holds true in Pakistan. Furthermore, it is pertinent to see whether this sustainability is strong or weak. This can be analyzed through the coefficient of PE on PR.

Table 2

ARDL bound test

Calculated F-value		Selected Lag Length	
3.984		1,0,0,0,0	
Sig. Level		Critical F-values	
		Lower Bound	Upper Bound
1%		4.94	5.58
5%		3.62	4.16
10%		3.02	3.51
Serial Correlation	Functional Form	Normality	Heteroscedasticity
0.0567 (0.9450)	0.0004 (0.9825)	2.9067 (0.2338)	0.4811 (0.2409)

Table 3 shows that the coefficient of PE on PR is found to be statistically significant which again provides evidence for fiscal sustainability in the analysis. However, the coefficient value of less than one signalizes a weak fiscal sustainability in case of Pakistan thus suggesting the need for fiscal reforms. It also shows that public expenditures are not productive enough to attract an equal amount of public revenues. The coefficient is found between 0.3-0.4 that is significantly deviating from Mahmood and Rauf (2012). Their study had found this coefficient between 0.83-0.92 due to biasness in estimation of cointegration between PR and PE without taking care of country size. The coefficients of dummy variables are also statistically significant. This confirms that structural breaks are shifting the intercept in the respective years

Table 3

Long-run and short-run results

Regressor	Parameter	Standard Error	t-statistic	P-value
ARDL: Long-Run				
PE_t	0.3555***	0.0802	4.4344	0.0001
D_{1t}	0.0086**	0.0039	2.1953	0.0353
D_{2t}	-0.0104*	0.0057	-1.7947	0.0819
D_{3t}	-0.0103**	0.0042	-2.4624	0.0192
Intercept	0.0771***	0.0196	3.9324	0.0004
ARDL: Short-Run				
ΔPE_t	0.3289***	0.0774	4.2471	0.0002
ECT_{t-1}	-0.8799***	0.1625	-5.4163	0.0001
FMOLS				
PE_t	0.3045***	0.0576	5.2829	0.0001
Intercept	0.0887***	0.0141	6.2737	0.0001
DOLS				
PE_t	0.3975***	0.0719	5.5281	0.0001
Intercept	0.0437**	0.0177	2.4660	0.0253

Note: *, ** and *** show the significant parameters at 10%, 5% and 1%.

of breaks and it further confirms reliability of long run parameters. Table 3 also presents the short run parameters of ECM based on selected ARDL model. The coefficient of differenced PE has a significant positive effect on PR in short run as well. Though, its impact is even smaller than that of long run impact. The co-efficient of ECT_{t-1} is negative and highly statistically significant. This confirms a short run relationship in our ARDL model. Its value depicts a high speed of adjustment (i.e. 88% in a year) from short run imbalance toward long run equilibrium. Further, the long run coefficient of PE has been confirmed by estimation of FMOLS and DOLS in table 3. The results show that this coefficient again remains between 0-1

and it is also statistically significant. This exercise confirms that our conclusion is out of any econometric technique biasness in the estimations. The coefficient of PE is less than one and greater than zero. Therefore, the estimates of FMOLS and DOLS are also corroborating a weak fiscal sustainability in Pakistan.

The coefficient of public expenditure (between 0-1) is not sufficient to generalize a weak fiscal sustainability in above estimations. Therefore, two competing hypotheses (i.e. slope = 0 and slope = 1) have been tested through Wald coefficient restriction test. The estimates in table 4 depict that abovementioned both hypotheses have been rejected for all estimates of

Table 4

Wald test

Estimators	ARDL	FMOLS	DOLS
Chi-Square (Slope=1)	145.5941*** (0.0000)	47.9172*** (0.0000)	59.802*** (0.0000)
Chi-Square (Slope=0)	27.9089*** (0.0000)	48.8484*** (0.0000)	31.6523*** (0.0000)

Note: *** shows the rejection of hypotheses (slope = 1 & slope =0) at 1% level of significance.

ARDL, FMOLS and DOLS. So, the slope is neither unit nor zero and is again confirming a weak sustainability of fiscal policy.

CONCLUSIONS

This paper aims to investigate the validity of the sustainability hypothesis in Pakistan by employing adequate econometric techniques. At first, DF-GLS and Ng-Perron unit root tests were carried out to test the stationarity of PR and PE. Our results confirm that both variables are integrated at order one. Further, three most significant structural breaks are found in the cointegration between PR and PE. An ARDL cointegration technique has been applied on the relationship of PE and PR after incorporating the dummy variables to complete information of structural breaks in the analysis. A cointegration is proven in the model. It is a confirmation for the existence of sustainability hypothesis in Pakistan. But, the long run coefficient of public expenditures is found to be less than one. Further, this coefficient has further been verified through FMOLS and DOLS. The Wald restriction tests on *slope = 0* and *slope = 1* have also been carried and this test is also seconding the result of a weak fiscal sustainability. Thus, indicating a weak

fiscal sustainability in Pakistan with all estimations.

Consequent to the analyses and results of our study, fiscal reforms by the government of Pakistan has been recommended. This may be sought through a policy of broadening the tax base or by creating more sources of public revenues. Further, it is suggested that public expenditures should be spent in productive way which may help the government to generate more public revenues to cover the public debt and to sustain the fiscal policy of Pakistan in the long run.

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