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Budget Balance through Revenue or Spending Adjustment: Evidence from Pakistan

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1. INTRODUCTION

Government cannot roll over the debt forever (ponzi game is not allowed). In the long run, inter-temporal budget constraint has to be satisfied, which is possible either through government spending adjustment or increasing government revenues. So current budget deficit calls for adjustment, in the future, in spending or revenues. There are four hypotheses, in the literature, in this regard: the tax-and-spending hypothesis, the spending-and-tax hypothesis, bi-directional causality between government revenues and government expenditures, and independence of taxes and expenditures hypothesis. The last hypothesis, however, have negative implications, in the long run, in terms of debt sustainability and inflation.

The empirical literature give mixed result on the intertemporal relationship between government expenditures and taxes due to various time periods analysed, lag length specifications, and methodology used in the study. Manage and Marlow (1986), Blackley (1986), and Ram (1988) support 'the tax and spending' hypothesis. Anderson, Wallace, and Warner (1986), Von Furstenberg, Green, and Jeong (1986) and Jones and Joulfaian (1991) support 'the spending-and-tax' hypothesis. Miller and Russek (1989) find bi-directional causality, whereas Baghestani and McNown (1994) find that government expenditures and taxes are not affected by budget deficit.

Most of the studies available, in this regard, have focused on the experiences of developed economies and the issue has not been investigated for the case of developing countries. So this study aims at testing the four hypotheses, stated above, in the context of inter-temporal budget constraint for the case of Pakistan using data over the period 1961 to 2008. For this, reaction of fiscal policy instruments to lagged fiscal deficit has been estimated. More specifically, it is investigated how government adjusts taxes, government expenditures and/or total debt in response to fiscal deficit.

While estimating government's fiscal policy response to budget deficit, econometric issues related to non-stationarity of taxes, government expenditures and debt are important. Most of the times, data on government expenditures, taxes and debt are non-stationary. On the other hand, intertemporal budget constraint requires stationarity of

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primary deficit—transversality condition must hold. This suggests estimating model as Vector Error Correction Model (VECM)—the methodology we have used in this study, as we impose the intertemporal budget constraint. The main result we obtain is that in case of Pakistan budget is balanced either through raising debt or monetising deficit. Neither revenues nor government expenditures are adjusted in response to increased fiscal deficit. We also find that the behaviour of government expenditures and that of taxes are independent of each other.

Rest of the study proceeds as follows. Section 2 briefly describes the literature regarding historical behaviour of intertemporal budget constraint and the empirical issues in the study of intertemporal budget constraint. Section 3 discuses the theoretical model and econometric methodology used in the study. The fourth section is regarding the data and variables construction. In fifth section results are discussed. Section 6 concludes the study.

2. LITERATURE REVIEW

2.1. Intertemporal Budget Constraint

The Intertemporal budget balance put constraint on the behaviour of government. It implies that government with high debt must run high future surplus in term of present value and it can be generated through adjustments in taxes, government expenditure or seigniorage [Buiter (2002)]. Researcher and economist have done alot of work to solve the deficit problem and suggest different ways to resolve the long run primary deficit problem. Best approach to solve the problem depends on the intertemporal relationship between government expenditure and tax. Huge research has been done to study empirically this relationship. But interestingly most of the papers have focused on the experiences of US economy and a few examine budget deficit situation in OECD country. On the other hand there have been almost negligible studies to focus on the situation of developing countries.

2.2. Tax and Spending Debate

There are four main hypotheses on the relationship between government expenditure and revenue i.e. Tax-and-spend hypothesis, Spend-tax hypothesis, Bi-directional causality between government revenue and government expenditure and Taxes and expenditure are independent from each other.

The tax-and-spend hypothesis suggests that changes in government revenue are followed by changes in government expenditure. Friedman (1978), Blackely (1986) Ram (1988) and Buchanan and Wagner (1977, 1978) show that increase in government revenue will cause to increase in government expenditure and therefore this approach will not play any role in reducing budget deficit.

The spend-tax hypothesis suggests that changes in government expenditure are followed by changes in government revenue. According to Peacock and Wiseman (1979) argued that temporary increase in government expenditure due to emergency purposes lead to increase in permanent increase in government taxes or other type of revenue. Barro (1974, 1978) argue that the result given by Buchanan-Wagner between government expenditure and tax due to fiscal illusion does not exist. Barro uses Ricardian equivalence

proposition. According to Barro if government fulfills his expenditure through borrowing, then this will result an increase in tax liabilities in future. Anderson, et al. (1986) used granger causality test and argued that change in government expenditure lead to change in total revenue. Jones and Joulfaian (1991) and Ross and Payne (1996) showed the same result by applying Engle-Granger error correction method and Johansen-Juselius multivariate co integration ARCH model respectively.

The third hypothesis states that there is bi-directional causality between government revenue and government expenditure. Musgrave (1966), and Meltzer and Richard (1981) suggests the fiscal synchronisation hypothesis. They compare the marginal benefit and marginal costs of the services provided by the government, to make appropriate decision regarding the level of government expenditure and government revenue. Manage and Marlow (1986) applied Granger causality test and found that there is bi-directional causality between taxes and expenditure.

The fourth hypothesis states that taxes and expenditure are independent from each other. Baghestani and McNown (1994) apply Johansen-Juselius multivariate cointegration and found that there is no long run cointegration between taxes and expenditure.

Tehran and Walsh (1988) used Johansen-Juselius multivariate co-integration method and provide evidence which reject the tax smoothing hypothesis and unable to reject the hypothesis of Intertemporal budget balance. Bohn (1991) use Error correction model and concluded that about 65–70 percent of budget deficit due to high government spending and about 50–65 percent budget deficit due decrease in taxes have been eliminated by step wise decreased in government spending and the remainder is eliminated by step wise increased in tax revenue.

The bulk of empirical literature on the tax-spend debate has focused on the US budget deficit situation with a few exceptional papers. Provopoulos and Zambaras (1991) studied Greece budgetary process by applying granger causality test and analysed that government expenditure have lag effect on taxes. Owoye (1995) applied Engle-Granger error correction method and found that the historical behaviour of budget deficit for Canada, France, Germany, UK and US support the fiscal synchronisation hypothesis. And in case of Italy and Japan there is ui-directional causality between tax and government expenditure. Payne (1996) used the Johansen-Juselius multivariate cointegration procedure and error correction model. He found that budget imbalance situation is corrected by changes in government expenditure. Darrat (1998) used bivariate and multivariate model and suggested that optimal policy to solve the budget deficit problem is to raise taxes. He found negatively uni-directional causality which stems from taxes to government expenditure for Turkey.

2.3. Empirical Literature

The empirical literature discussed above give us mixed result on the intertemporal relationship between government expenditure and taxes. Because these studies used a variety of different procedures which give us conflicting and contradictory result. For example Lutkepohl (1982, 1993) discussed that bivariate Granger causality models have a problem of omission-of-variable bias. In bivariate setting if a variable is not found to cause another variable, so inferences on the bases of such model will not be correct in the

context of a larger economics system which included other important variable. Bivariate granger causality model is used by Manage and Marlow (1986), Anderson, *et al.* (1986) and Ram (1988) etc. Lutkepohl (1982, p.367) writes, "This conclusion is a consequence of the well-known problem that a low dimensional sub process contains little information about the structure of a higher dimensional system." In order to solve this problem von Furstenberg, Green, and Jeaon (1986) and Anderson, Wallace and Warner (1986) etc. have incorporated other important variables and used multivariate Granger causality models.

Another source of mixed result is that such standard Granger causality tests ignore other sources of causality stemming from long-run relationships among the variables. This problem is taken into account by Miller and Russek (1990) and Owoye (1995) by using error correction model. But unfortunately there models are of bivariate nature i.e. they just check the relationship between government expenditure and taxes. Miller (1991) and Darrat (1994) etc. has shown that problem of omission-of-variables bias is not only related with bivariate standard causality tests, but it also effect the result derives from the bivariate error correction model. Another objection to empirical analysis is that simple regression analysis or unrestricted VAR is used. Demopoulos, Katsembris, and Miller (1987) used simple regression analysis or unrestricted VAR to study granger causality which ignore information about the long-run behaviour of taxes, debt and seigniorage that is implied by intertemporal budget balance. Intertemporal budget balance implies a cointegration relationship between deficit and debt and this link restrict the behaviour of expenditures, taxes and seigniorage. This fact implies that multivariate vector error correction model should be used to the study the behaviour of expenditures, taxes and seigniorage. Bohn (1991) used multivariate vector error correction model. But he does not treat seigniorage separately. Bohn (1991) is used methodology in this paper and but seigniorage is treated both separately and together with total revenue.

3. THEORY AND ECONOMETRIC METHODOLOGY

3.1. Theoretical Framework

As intertemporal budget constraint has to be satisfied, a government cannot sustain long term primary deficit. The intertemporal budget constraint consists of tax revenues, seigniorage revenues, government expenditures, interest payments, and government debt. Budget equation is given as:

$$B_{t+1} = G_t - T_t + (1+r)\, B_t + \varepsilon_{t+1} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

Where, T_t denotes tax revenues including seigniorage revenues and G_t denote government expenditures net of interest payments.[1] Interest payments are excluded from the variable G because we are interested in primary deficit to study intertemporal budget constraint.[2] B_t is used for government debt and r is the interest rate on total debt. Finally, ε_{t+1} is the error term. The error term shows that tax revenues, government expenditures and government debt do satisfy exact linear relationship in given time period. Barro (1979) and Tehran and Walsh (1988) assume that expected real return on government debt is

[1]But later on to check the robustness of results, seigniorage will be taken separately.

[2]For reference, see McCallum (1984).

constant, in which case, error term is uncorrelated with right hand side variables. If, on the other hand, r is not constant then error term may have correlation because of the mistake in approximating the real return. Equation (1) can also be written as

$$G_t + (1+r)\, B_t = T_t + B_{t+1} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Where error term is assumed to be zero. In this case equation suggests that the budget constraint is satisfied each period. Dividing Equation (2) by aggregate output in the economy we get the following equation.

$$g_t + (1+r^*)b_{t-1} = t_t + b_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

Where g_t, t_t, and b_t are, respectively, the ratio of government expenditures (excluding interest payments), tax revenues including seigniorage revenues, and the ratio of total government debt to aggregate measure of output. r^*_t is the real interest rate net of economic growth rate. As budget is balanced each period, we can write the intertemporal budget constraint, by performing the forward substitution, for period $\tau = t$ to $\tau = T$, as.

$$b_{t-1} = \sum_{\tau=t+1}^{\infty} \left[\frac{1}{1+r^*)^{\tau-1}} S_{\tau-1} \right] + \lim_{\tau\to\infty} \left[\frac{1}{1+r^*)^{\tau-1}} b_{\tau-1} \right] \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

Where s_t is primary budget surplus and is given as, $s_t = t_t - g_t$. The stability of fiscal policy depends on the second term of Equation (4). According to the literature the path of second term is very important for the condition of sustainable fiscal policy. In projecting future policy variable, it is important to recognise that government budget constraint restrict the joint movement of fiscal variables. If transversality condition holds then the change in fiscal variables is subject to intertemporal budget constraint. Transversality condition and then resultant intertemporal budget equation can be written as,

$$\lim_{\tau\to\infty} \left[\frac{1}{(1+r^*)^{\tau-1}} b_{\tau-1} \right] = 0 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

$$b_{t-1} = \sum_{\tau=t+1}^{\infty} \left[\frac{1}{(1+r^*)^{\tau-1}} S_{\tau-1} \right] \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

Equation (6) will be satisfied if the growth rate of government debt is less than the interest rate—'*No Ponzi Game Condition*'.

Empirical literature proposes different methods to check the sustainability of above conditions. To check whether the transversality condition holds, testing for stationarity of primary budget surplus is suggested in the literature. Hamilton and Flavin (1986) derive the testable hypothesis as,

$$b_{t-1} = \sum_{\tau=t+1}^{\infty} \left[\frac{1}{(1+r^*)^{\tau-1}} S_{\tau-1} \right] + \left[\frac{1}{1+r^*)^{-1}} A_0 \right] \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

Intertemporal budget constraint will be violated if A_0 is greater than zero. The market value of government debt will be equal to the sum of the discounted future budget surpluses, if

and only if A_o in the above equation is equal to zero i.e. stationarity of primary budget deficit is sufficient condition for sustainable fiscal policy. It means if primary deficit is stationary at first difference, then intertemporal budget balance holds only if primary deficit and government debt are cointegrated of order 1. Wilcox (1989) suggests that the discounted value of government loan must go to zero in infinite future when interest rate is not constant for a sustainable fiscal policy. According to Quintos (1995) and Hakkio and Rush (1991), transversality condition holds if Δt_τ and Δg_τ are stationary.

There is an alternative method to test whether or not intertemporal budget equation holds. If primary budget deficit and government debt are non-stationary, intertemporal budget constraint requires studying the cointegration relationship between primary budget deficit and public debt. Macdonald (1992) subtracted $(1/r)\ s_{t-1}$ from both sides of Equation (6) and get the following Equation (8)

$$b_{t-1} = -\frac{1}{r*} S_{t-1} = \sum_{\tau=t+1}^{\infty} \left[\frac{1}{(1+r*)^{\tau-1}} (S_{\tau-1} - S_{\tau-2}) \right] \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

Where, $s_{\tau-1} - s_{\tau-2} = \Delta s_{\tau-1}$. So equation implies that testing of stationarity of $\Delta s_{\tau-1}$ is similar to the testing of linear combination of $r^* b_{t-1} - s_{t-1}$. By using the Engle-Granger (1987) definition, on the basis of Equation (8), the cointegration implies that the linear combination $s_t - r^* b_t = \varepsilon_t$ is stationary at levels because of the existence of r^* parameter. It means that primary budget deficit and public debt are cointegrated. So the equilibrium relation is given as:

$$S_t - r^* b_t = \varepsilon_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

Where the cointegrating vector $\beta = (1, -r^*)$.

Similarly according to the Granger representation theorem, the co-integration between public debt and budget deficit can be discussed by using the error-correction representation as given below.

$$\Delta S_t = \alpha + \lambda(S_{t-1} - r^* b_{t-1}) + \delta_s \Delta S_{t-1} + \delta_b \Delta b_{t-1} + u_t \quad \ldots \quad \ldots \quad \ldots \quad (10)$$

In the cointegration model $s_{t-1} - r^* b_{t-1}$ is the equilibrium error. Equation (10) tells about the short run behaviour of budget deficit and public debt. In statistical sense, $s_{t-1} - r^* b_{t-1}$ is the speed of adjustment and show that budget deficit and public debt are cointegrated. Error correction model show that in short run public debt and budget deficit may diverge, but in the long run they will converge.

To study the behaviour of intertemporal budget constraint non-stationary behaviour of time series data is a critical and important. Augmented Dickey-Fuller test is used, to test whether variables are stationary or not. Schwartz criterion is used for lag length selection in unit root test equation. ADF equation is given as,

$$\Delta X_t = \alpha_0 + (1-\beta) X_{t-1} + \alpha_1 t + \sum_{i=1}^{p} \beta_i \Delta X_{t-1} + \varepsilon_t \quad \ldots \quad \ldots \quad \ldots \quad (11)$$

Where X_t denote variable (government expenditures, total tax revenues, total debt, seigniorage etc), "Δ" is used for first difference, "ε_t" is error term or covariance stationarity random term and "p" show the number of lag.

So if variables are non-stationary at level but stationary at first difference, then long run relationship can be established by testing for the presence of cointegration. For this, we apply Johnson Cointegration approach instead of the Engle-Granger approach (EG). EG approach is easy to understand and to implement. However recent literature [e.g. Davidson and MacKinnon (1993); Noriega-Muro (1993); Kramers, Ericson, and Dolado (1992); and Inder (1993)] has shown that there are important shortcomings of Engle-Granger methodology.

The system of equations in Johansen methodology can be written as

$$\begin{pmatrix} \Delta T_t \\ \Delta G_t \\ \Delta W_t \end{pmatrix} = \Gamma_1 \begin{pmatrix} \Delta T_{t-1} \\ \Delta G_{t-1} \\ \Delta W_{t-1} \end{pmatrix} + \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \\ a_{31} & a_{23} \end{pmatrix} \begin{pmatrix} \beta_{11} & \beta_{21} & \beta_{31} \\ \beta_{12} & \beta_{22} & \beta_{32} \end{pmatrix} \begin{pmatrix} T_{t-1} \\ G_{t-1} \\ W_{t-1} \end{pmatrix} + \varepsilon_t \quad \ldots \quad (12)$$

The objective of this study is to analyse how the values of fiscal variables react to lagged changes in deficit. In order to tell about the future fiscal policy variable it is important to note that the intertemporal budget constraint satisfy the standard-transversality condition as discussed in theoretical framework. For intertemporal budget constraint to be satisfied, it is necessary that government debt is stationary at first difference, which imposes restriction on the cointegration relationship of variables in vector X_t. The linear combination of budget deficit is given as

$$DEF_t = Gt - Tt + r.\, B_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (13)$$

Combining Equations (12) and (13) we get the following error correction model:

$$A\,(L)\,\Delta Xt = -\alpha.\beta' X_{t-1} + u_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (14)$$

Where $DEF_{t-1} = \beta' X_{t-1}$. As $\beta' Xt-1$ is the error correction term i.e. primary budget deficit and it contains (n–1) vectors, Equation (14) becomes:

$$A\,(L)\,\Delta Xt = -\alpha.DEF_{t-1} + u_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (15)$$

We use this equation as error correction model for estimation.

4. DATA DESCRIPTION AND VARIABLES' CONSTRUCTION

In this study the period of analysis is 1961 to 2008. Three main variables used in the study are government outlays net of interest payments; government receipts or total revenues including seigniorage revenues; and total debt. All variables are deflated by GDP. Following Bohn (1991), we have subtracted interest payments from government expenditures, but we our variable of government revenues include seigniorage revenues. Arby (2006) has constructed series for seigniorage but the duration of the data is from 1973 to 2005, whereas requirement is from 1961 to 2007. So series of seigniorage is calculated for M2 and reserve money (M_O) as: Seigniorage from M2 = (M2 of 2000-M2 of 1999)/GDP deflator of 2000 and Similarly for M_0 = (M_O of 2000- M_0 of 1999)/ GDP deflator of 2000.

Primary budget deficit is calculated as given in the following equation, [see McCallum (1984)].

$$DEF_t = G_t - T_t$$

Where DEF_t is the primary budget deficit, G_t is the government expenditures without interest payments and T is the total taxes.

Data on primary budget deficit, domestic debt, foreign debt, interest payments by the government, GDP deflator, government expenditures, total taxes, M2, reserve money (Mo) and GNP are obtained from various issues of Economic Survey of Pakistan, World Development Indicators 2008 and from International Financial Statistics 2009.

5. RESULTS AND DISCUSSION

To estimate the government response to budget deficit it is important to first check the stationarity of taxes, government expenditures, and debt and budget deficit. Augmented Dickey-Fuller test is used to test the stationarity of data. The lag length is selected on the basis of Schwarz information criterion. Results in Table 1 show that each variable is non-stationary at level, because the null hypothesis of unit root cannot be rejected but all variable are stationary at first difference i.e. variables are I(1).

Table 1

Results of Augmented Dickey Fuller Test

	Level		First Difference		
Variable	P-Value	Lag Length	P-Value	Lag Length	Result
TR_Y	0.2227	0	0.0000**	0	I(1)
TRWSM2_Y	0.2207	0	0.0000**	0	I(1)
TRWSRM_Y	0.2216	0	0.0000**	0	I(1)
SM2_Y	0.2047	2	0.0000**	2	I(1)
SRM_Y	0.3727	1	0.0000**	0	I(1)
TD_Y	0.6197	1	0.0122**	0	I(1)
DD_Y	0.1964	1	0.0228**	0	I(1)
GENDS_Y	0.3968	0	0.0000**	1	I(1)
DEF_Y	0.4207	0	0.0000**	0	I(1)

The next important step is to test the presence of cointegration because if the variables are cointegrated then they have long run equilibrium relationship. Johansen cointegration test is used to find the number of cointegration vectors. In the first step we test cointegration among total revenues including seigniorage revenues, government expenditures, and total debt and results of this base case are given in Table 2. Then we have done the same in a number of different settings: taking domestic debt instead of total debt, taking seigniorage revenues only from reserve money, taking government revenues and seigniorage revenues as two different variables, (results of these other specifications are given in Appendix).

Table 2

Results of Cointegration Test

No of CE(s)	Trace Statistics	5% Critical Value	Max. Eigen Statistics	5% Critical Value
None *	45.62207	35.19275	30.79129	22.29962
At most 1	14.83078	20.26184	11.14421	15.89210
At most 2	3.686569	9.164546	3.686569	9.164546

Series: TRWSM2_Y, GENDS_Y &TD_Y.

Results in Table 2 and in appendix show that both Trace Statistics and Max Eigenvalue Statistics indicate one cointegrating vector at 5 percent level of significance. It means that there exist long run relationship between total revenues, government expenditures and debt.

Table 3 displays results of error correction model. Again we have estimated error correction model with different specifications; results of base case are given in the text while that of other specifications are given in appendix. While estimating error correction model we have taken lagged value of primary deficit as exogenous variable. The objective is to estimate the response of fiscal policy instruments, government expenditures, government revenues and total debt, to the lagged value of primary deficit. Our results show that lagged deficit has insignificant effect on government revenues and expenditures, but the response of debt to deficit is positive and significant. Thus, in Pakistan, budget is balanced by increasing liabilities; it is neither financed by increasing total revenues, nor by adjusting government expenditures. So a deficit does not generate long run stabilising effect on total revenues and government expenditures.

Moreover, results in Table 3 make it clear that total revenues have inertia factor. Total revenues are not followed by changes in government spending, but revenues have significant and negative effect on debt. So it is clear that 'spend-and-tax' hypothesis does not hold in case of Pakistan. Furthermore, it is found that changes in government expenditures are not followed by changes in total debt. It is also found that lagged values of total debt have significant and positive effect on total revenues and government expenditures. These results show that total revenues and government expenditures do not respond to budget deficit directly. In Pakistan, most of the times, budget deficit is financed through raising debt. Moreover, neither 'spend-and-tax hypothesis' nor 'tax-and-spend hypothesis' is valid.

Table 3

Results of Error Correction Model with Total Debt

	ΔTRWSM2_Y	ΔGENDS_Y	ΔTD_Y
ΔTRWSM2_Y(–1)	–0.334687	–4.89E–05	–3.022350
	(–1.80413)	(–0.00011)	(–3.59955)
ΔTRWSM2_Y(–2)	–0.441870	–0.079860	–0.933256
	(–2.33925)	(–0.18245)	(–1.09158)
ΔTRWSM2_Y(–3)	–0.210913	–0.2365588	–1.394202
	(–1.15175)	(–0.55755)	(–1.68211)
ΔGENDS_Y(–1)	0.129961	0.046788	0.227757
	(1.66911)	(0.25932)	(0.64628)
ΔGENDS_Y(–2)	–0.010080	–0.326772	0.250576
	(–0.14001)	(–1.95882)	(0.76900)
ΔGENDS_Y(–3)	0.048400	0.059699	0.351861
	(0.65122)	(0.34664)	(1.04598)
ΔTD_Y(–1)	–0.030557	–0.124572	0.439044
	(–0.92023)	(–1.61900)	(2.92127)
ΔTD_Y(–2)	0.066052	0.175228	0.058368
	(1.77371)	(2.03066)	(0.34629)
ΔTD_Y(–3)	0.003483	–0.020537	0.347252
	(0.09041)	(–0.23002)	(1.99115)
DEFC_Y(–1)	0.010818	–0.036498	0.196987
	(0.60648)	(–0.88303)	(2.44000)

To check the robustness of the above results we estimate vector error correction model with different specifications and results are given in appendix. The results do not change when domestic debt rather than total debt is used as one of the variable. Again debt is the only variable that responds to lagged values of deficit; adjustment takes place neither in revenues nor in expenditures. Same results hold when other specifications are estimated. As pointed out by Walsh (2003), Bohn (1991) does not differentiate between the effects of deficit on Seniorage revenues and on other revenues.

In this study we have done this to look at separate effects of budget deficit on two types of revenues. We get very interesting results in this case. Results in Table 4 show that deficit has positive and significant effect on revenues from seigniorage and debt. It means in case of Pakistan budget deficit is financed through printing of money i.e. monetisation of deficit and through borrowing by selling bonds. However, as shown in the appendix, the effect is found to be low when total debt instead of domestic debt is used as one of the endogenous variables.

Table 4

Results of Error Correction Model (Total Revenues, Seigniorage, Government Expenditures and Domestic Debt)

Error Correction	Δ(TRC_Y)	Δ(GENDS_Y)	Δ(SM_Y)	Δ(DD_Y)
CointEq1	–0.268416	–0.065588	0.009777	2.160811
	[–1.32824]	[–0.15365]	[3.39549]	[3.65816]
D(TRC_Y(–1))	–0.357451	–0.281878	–0.001322	0.668592
	[–1.96928]	[–0.73519]	–[0.51097]	[–1.26018]
D(TRC_Y(–2))	–0.364949	0.230862	–0.004982	–0.170757
	[–2.09195]	[0.62649]	[–2.00426]	[–0.33487]
D(TRC_Y(–3))	–0.262922	–0.368893	–0.008034	0.588983
	[–1.61568]	[–1.07319]	[–3.46511]	[1.23826]
D(GENDS_Y(–1))	0.162287	0.228386	0.001028	–0.531629
	[1.79708]	[1.19729]	[0.79894]	[–2.01406]
D(GENDS_Y(–2))	0.043592	–0.392602	–3.07E–05	0.105448
	[0.56788]	[–2.42131]	[–0.02811]	[0.46997]
D(GENDS_Y(–3))	0.071298	0.152993	0.001259	–0.418773
	[0.90683	[0.92122]	[1.12385]	[–1.82224]
D(SM_Y(–1))	–18.73020	–31.11492	–0.166965	240.0038
	[–0.91703]	[–0.72120]	[–0.57372]	[4.02011]
D(SM_Y(–2))	–2.879966	1.026279	–0.041367	178.9205
	[–0.17371]	[0.029311]	[–0.17512]	[3.69218]
D(SM_Y(–3))	3.778299	–32.63954	0.066509	120.9209
	[0.31993]	[–1.30843]	[0.39525]	[3.50301]
D(DD_Y(–1))	–0.034021	–0.201559	–0.001157	0.427441
	[–0.67873]	[–1.90369]	[–1.62056]	[2.91746]
D(DD_Y(–2))	0.053981	0.017371	0.00842	–0.130671
	[0.99377]	[0.13856]	[2.17844]	[–0.75324]
D(DD_Y(–3))	0.093013	0.89854	–0.000718	0.254302
	[1.67401]	[1.61764]	[–0.90656]	[1.56583]
DEFC_Y(–1)	–0.032258	–0.051575	0.001857	0.342614
	[–0.84597]	[–0.64032]	[3.41754]	[3.07398]

6. CONCLUDING REMARKS

This study investigates the historical behaviour of intertemporal budget constraint for Pakistan from 1961 to 2008. We test four hypotheses, i.e. First Tax-and-spend hypothesis, second spend-tax hypothesis, third that there is bi-directional causality between government revenues and government expenditures, and fourth taxes and expenditures are independent of each other.

Our analysis shows that in case of Pakistan budget deficit and debt have close relationship. Budget deficit is financed through borrowing; it has effect neither on government expenditures nor on taxes. So a deficit does not generate long run stabilising effect on total revenues and government expenditures. Government expenditures have insignificant effect on future taxes and similarly lag value of taxes has no effect on future taxes. So neither 'spend-and-tax hypothesis' and nor 'tax-and-spend hypothesis' is satisfied. It means in case of Pakistan we found that taxes and spending decision are taken independently and there is no long run cointegration between taxes and expenditures.

Next we estimate error correction model by taking total revenues and seigniorage separately. In both cases we estimate the model with total debt first and then with domestic debt. In this case we get another interesting result that in case of Pakistan budget imbalances are reduced either through borrowing or through monetisation of debt. Results show that budget deficit has no impact on the behaviour of government expenditures and taxes. Moreover change in taxes is not followed by change in government expenditures and vice versa. It means there is no cointegration between taxes and spending. So historical behaviour of Pakistan's intertemporal budget constraint show that taxes and spending decisions are independent of each other.

APPENDIX

List of Variables

Symbol	Variable
TRWSM2_Y	Total revenues, including seigniorage revenues calculated from M2, as ratio of GDP
TRWSRM_Y	Total revenues, including seigniorage revenues calculated from reserve money, as ratio of GDP
GENDS_Y	Government expenditures, net of debt servicing, as ratio of GDP
DD_Y	Domestic debt as ratio of GDP
TD_Y	Total debt as ratio of GDP
TRC_Y	Total government revenues, net of seigniorage revenues, as ratio of GDP
SM_Y	Seigniorage revenues calculated from M2, as ratio of GDP
SRM_Y	Seigniorage revenues calculated from reserve money, as ratio of GDP
DEF_Y	primary deficit as ratio of GDP
FD_Y	Foreign debt, as ratio of GDP
DGE_Y	Developmental government expenditure, as ratio of GDP
NGENDS_Y	Non-developmental governmental expenditure, as ratio of GDP

Table 5

Results of Cointegration Test

No of CE(s)	Trace Statistics	5% Critical Value	Max. Eigen Statistics	5% Critical Value
None *	29.96288	29.79707	24.13832	21.13162
At most 1	5.824565	15.49471	5.794939	14.26460
At most 2	0.029626	3.841466	0.029626	3.841466
Series: TRWSM2_Y GENDS_Y & DD_Y				
No of CE(s)	Trace Statistics	5% Critical Value	Max. Eigen Statistics	5% Critical Value
None *	23.95788	24.27596	21.03970	17.79730
At most 1	2.918172	12.32090	2.174876	11.22480
At most 2	0.743296	4.129906	0.743296	4.129906
Series: TRWSRM_Y , GENDS_Y & TD_Y				
No of CE(s)	Trace Statistics	5% Critical Value	Max. Eigen Statistics	5% Critical Value
None *	41.22606	35.19275	29.77811	22.29962
At most 1	11.44795	20.26184	6.934601	15.89210
At most 2	4.513351	9.164546	4.513351	9.164546
Series: TRWSRM_Y, GENDS_Y &DD_Y				
No of CE(s)	Trace Statistic	Prob	Max statistic	Eigen Prob
None*	63.4917	0.0058	39.06797	0.0016
At most 1	24.42620	0.4356	14.39919	0.4261
At most 2	10.02701	0.6372	6.756837	0.6991
At most 3	3.20172	0.5314	3.270172	0.5314
Series: TRC_Y GENDS_Y SM_Y TD_Y				
No of CE(s)	Trace Statistic	Prob	Max statistic	Eigen Prob
None*	67.45065	0.0021	48.83018	0.0000
At most 1	18.62046	0.8079	9.166689	.8939
At most 2	9.453774	0.6932	6.128683	0.7734
At most 3	3.3325091	0.5218	3.325091	0.5218
Series: TRC_Y GENDS_Y SM_Y DD_Y				
No of CE(s)	Trace Statistic	Prob	Max statistic	Eigen Prob
None*	65.99949	0.0030	33.13326	0.0122
At most 1	32.86624	0.0873	20.94666	0.764
At most 2	11.91958	0.4560	7.693533	0.5846
At most 3	4.226049	0.3795	4.226049	0.3795
Series: TRC_Y, GENDS_Y, SRMY_Y, DD_Y				
No of CE(s)	Trace Statistic	Prob	Max statistic	Eigen Prob
None*	66.08399	0.0030	44.67940	0.0002
At most 1	21.40459	0.6354	10.75020	0.7724
At most 2	10.65439	0.5756	6.205074	0.7646
At most 3	4.449313	0.3493	4.449313	0.3493
Series: TRC_Y, GENDS_Y, SRMY_Y, DD_Y				

Table 6

Results of Error Correction Model (Total Revenue with Seigniorage of Reserve Money, Government Expenditure Net of Debt Services and Domestic Debt

	ΔTRWSRM2_Y	ΔGENDS_Y	ΔDD_Y
ΔTRWSRM2_Y(–1)	–0.351953	0.397701	[–2.17444]
	[–1.36714]	[0.76790]	–1.533776
ΔTRWSRM2_Y(–2)	–0.312734	0.165544	0.692800
	[–1.43555]	[0.37773]	[–1.16068]
ΔTRWSRM_Y(–3)	–0.250465	–0.150345	–0.377855
	[–1.31089]	[–0.39114]	[–0.72177]
ΔTRWSRM_Y(–4)	–0.130263	0.235840	–0.519420
	[–0.72341]	[0.65103]	[–1.05278]
ΔGENTS_Y(–1)	0.141539	–0.018285	–0.235251
	[1.56530]	[–0.10052]	[–0.94954]
ΔGENTS_Y(–2)	0.024942	–0.288259	0.007453
	[0.28952]	[–1.66322]	[0.03157]
ΔGENTS_Y(–3)	0.073663	0.171380	–0.063969
	[0.92077]	[1.06483]	[–0.29183]
ΔGENTS_Y(–4)	0.013582	–0.057411	0.10134
	[0.16952]	[–0.35618]	[0.46068]
ΔDD_Y(–1)	–0.027164	–0.203596	0.336447
	[–0.47853]	[–1.78279]	[2.16314]
ΔDD_Y(–2)	0.043725	–0.105754	–0.018009
	[0.70583]	[–0.84857]	[–0.10610]
ΔDD_Y(–3)	0.071057	0.106105	0.258094
	[1.16965]	[0.86818]	[1.55055]
ΔDD_Y(–4)	0.008712	0.183695	0.172818
	[0.11175]	[1.17125]	[0.80905]
DEFC_Y(–1)	–0.054831	–0.364970	0.913589
	[–0.52814]	[–1.04744]	[3.21169]

Table 7

Results of Error Correction Model (Total Revenue, Seigniorage of M2, Government Expenditure Net of Debt Services and Total Debt)

Error Correction	D(TRC_Y)	D(GENDS_Y)	D(SM_Y)	D(TD_Y)
D(TRC_Y(–1))	–0.441228	0.572400	0.002062	–4.308401
	[–53831]	[1.01463]	[0.46085]	[–4.08018]
D(TRC_Y(–2))	–0.654187	0.455214	–0.007918	–2.618640
	[–2.19021]	[0.77486]	[–1.69967]	[–2.38145]
D(TRC_Y(–3))	0.260954	0.226348	–0.010466	–2.269430
	[–1.01644]	[0.44825]	[–2.61396]	[–2.40114]
D(TRC_Y(–4))	–0.335501	0.004227	–0.004890	–1.445685
	[–1.23151]	[0.00789]	[–1.15084]	[–1.44145]
D(GENDS_Y(–1))	0.045697	0.113882	0.000588	–0.492162
	[0.42789]	[0.54215]	[0.35298]	[–1.25179]
D(GENDS_Y(–2))	0.007814	–0.343560	0.001900	0.432062
	[0.07705]	[–1.72238]	[1.20143]	[1.15726]
D(GENDS_Y(–3))	0.002540	0.013603	0.001974	–0.141124
	[0.02654]	[0.07226]	[1.32256]	[–0.40055]
D(GENDS_Y(–4))	0.002196	0.009959	0.002124	0.342801
	[0.02415]	[0.05567]	[1.49754]	[1.02378]
D(SM_Y(–1))	20.74560	–37.48728	–1.046000	177.3903
	[1.11032]	[–1.02007]	[–3.58951]	[2.57889]
D(SM_Y(–2))	9.105571	–36.09849	–0.826406	151.0856
	[0.43675]	[–0.88031]	[–2.54156]	[1.96847]
D(SM_Y(–3))	11.39129	–81.60653	–0.350687	148.8383
	[0.60383]	[–2.19932]	[–1.19191]	[2.14306]
D(SM_Y(–4))	–2.298891	–52.98199	–0.188221	7.839990
	[–0.16058]	[–1.88159]	[–0.84299]	[0.14875]
D(TD_Y(–1))	–0.047742	–0.064347	–0.000733	0.336876
	[–1.13165]	[–0.77545]	[–1.11469]	[2.16900]
D(TD_Y(–2))	0.084097	0.087831	0.000403	0.079787
	[1.84895]	[0.98179]	[0.56852]	[0.47650]
D(TD_Y(–3))	–0.017609	–0.066158	4.09E–05	0.359114
	[–0.39235]	[–0.74945]	[0.05843]	[2.17346]
D(TD_Y(–4))	0.038754	–0.010551	0.000580	0.339852
	[0.76582]	[–0.10601]	[0.73441]	[1.82422]
DEFC_Y(–1)	0.068231	–0.078262	0.000940	0.879550
	[1.20758]	[–0.70422]	[1.06689]	[4.22842]

Table 8

Results of Error Correction Model (Total Revenue, Seigniorage of Reserve Money, Government Expenditure Net of Debt Services and Total Debt)

Error Correction	D(TRC_Y)	D(GENDS_Y)	D(SRM_Y)	D(DD_Y)
CointEq1	0.195962	0.027059	0.008214	2.957854
	[0.89518]	[0.05692]	[2.01372]	[3.74523]
D(TRC_Y(–1))	–0.422595	0.305812	–0.011192	–4.150749
	[–1.64009]	[0.54651]	[–2.33112]	[–4.46511]
D(TRC_Y(–2))	–0.614986	–0.214473	–0.009306	2.630864
	[–1.988386]	[–0.31931]	[–1.61477]	[–2.35773]
D(TRC_Y(–3))	0.264299	0.068661	–0.002089	–1.987083
	[–1.04447]	[0.12494]	[–0.44301]	[–2.17660]
D(TRC_Y(–4))	–0.188469	0.088174	–0.003703	0.214152
	[–0.81580]	[0.17575]	[–0.86030]	[0.25694]
D(GENDS_Y(–1))	0122390	0.127546	0.002014	0.024655
	[1.32352]	[0.63512]	[1.16887]	[0.06491]
D(GENDS_Y(–2))	0.006359	–0.292331	–0.002374	0.692252
	[0.06528]	[–1.38193]	[–1.30786]	[1.96986]
D(GENDS_Y(–3))	0.060435	0.037289	0.001317	0.066830
	[0.65936]	[0.18733]	[0.80274]	[0.20210]
D(GENDS_Y(–4))	–0.038555	–0.109401	0.000275	0.109570
	[–0.44312]	[–0.57897]	[0.23103]	[0.34905]
D(SRM_Y(–1))	10.9112	–20.7534	0.04158	86.84958
	[0.66382]	[–0.58140]	[0.04623]	[1.46456]
D(SRM_Y(–2))	11.9209	9.956785	0.135938	59.45282
	[0.86499]	[0.35434]	[0.56384]	[1.27361]
D(SRM_Y(–3))	10.32392	18.57157	0.114252	130.7490
	[0.82222]	[0.68108]	[0.48834]	[2.88632]
D(SRM_Y(–4))	13.47381	–2.175212	0.021475	73.80717
	[1.23680]	[–0.09194]	[0.10579]	[1.87788]
D(TD_Y(–1))	–0.038882	–0.095054	–0.001119	0.279150
	[–0.82535]	[–0.92911]	[–1.27483]	[1.64245]
D(TD_Y(–2))	0.074207	0.193640	0.00046	0.076192
	[1.56564]	[1.88124]	[0.50524]	[0.44557]
D(TD_Y(–3))	–0.002368	–0.096740	–0.000982	0.274681
	[–0.04989]	[–0.93830]	[–1.110311]	[1.60371]
D(TD_Y(–4))	–0.010136	0.018558	0.003138	–0.019589
	[–0.23174]	[0.19558]	[3.85004]	[–0.12414]
DEFC_Y(–1)	0.027306	–0.031992	0.001440	0.471968
	[0.70528]	[–0.38050]	[1.99667]	[3.37895]

Table 9

Results of Error Correction Model (Total Revenue, Seigniorage of Reserve Money, Government Expenditure Net of Debt Services and Domestic Debt)

Error Correction	D(TRC_Y)	D(GENDS_Y)	D(SRM_Y)	D(DD_Y)
CointEq1	–0.246975	0.121981	0.010145	2.017235
	[–1.26858]	[0.26496]	[2.22951]	[–0.999907]
D(TRC_Y(–1))	–0.257703	–0.314573	–0.009056	–0.999907
	[–1.35036]	[–0.69706]	[–2.03019]	[–1.67422]
D(TRC_Y(–2))	–0.249801	–0.167031	–0.003513	–0.324387
	[–1.35387]	[–0.38282]	[–0.81448]	[–0.56179]
D(TRC_Y(–3))	–0.141128	–0.264345	0.001930	–0.001648
	[–0.85041]	[–0.67360]	[0.49750]	[–0.00317]
D(GENDS_Y(–1)	0.157722	0.013310	0.002658	–0.123073
	[2.15099]	[0.07676]	[1.55070]	[–0.53633]
D(TRC_Y(–2))	0.007541	–0.237097	–0.001398	0.189006
	[0.09972]	[–1.32587]	[–0.79087]	[0.79856]
D(TRC_Y(–3))	0.065224	0.022351	0.000326	–0.204458
	[0.86903]	[0.12594]	[0.18587]	[–0.87048]
D(SRM_Y(–1))	–16.76806	–30.66098	–0.172070	81.59525
	[–1.77107]	[–1.36949]	[–777756]	[2.75386]
D(SRM_Y(–2))	–4.072221	–4.512423	0.302883	61.65837
	[–0.38728]	[–0.18148]	[1.23240]	[1.87376]
D(SRM_Y(–3))	–4.383064	8.774189	0.142874	66.79731
	[–0.51127]	[0.43281]	[0.71303]	[2.48976]
D(DD_Y(–1))	–0.031944	–0.247028	5.14E–06	0.331604
	[–0.58063]	[–1.89880]	[0.00400]	[1.92601]
D(DD_Y(–2))	0.082719	0.033071	0.001318	–0.128964
	[1.30845]	[0.22122]	[0.89181]	[–0.65184]
D(DD_Y(–3))	0.075697	0.214737	–0.002013	0.197850
	[1.30661]	[1.56745]	[–1.48623]	[1.09126]
DEFC_Y(–1)	–0.045506	–0.018452	0.002469	0.460230
	[–0.92660]	[–0.15889]	[2.15083]	[2.99446]

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