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ON MINIMIZING THE WELFARE COST OF FISCAL POLICY: Pakistan's Case

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This study analyzes the continued and separate fiscal policy options regarding taxes, expenditures and public debt for Pakistan. It evaluates the plausibility of an important hypothesis that seeks to maintain a balance between raising resources, increasing expenditures and contracting public debt – i.e., the tax smoothing hypothesis. The study determines whether Pakistan has adopted a tax smoothing policy to overcome fiscal deficit and if so, what forms such policy has taken. The Wavelet Transformation is used for the first time to decompose the expenditure rate series into the permanent and transitory parts. The graphical and empirical analyses presented here reveal that Pakistan has tried to minimize the welfare cost of taxation but these policies have not followed best practices in tax smoothing elsewhere. The paper also makes some useful recommendations in this regard. It shows that in order to minimize the welfare cost of taxation the government should finance its permanent expenditure by increasing the tax rate while transitory shocks to the expenditures or output should be financed by creating public debt. The debt, so incurred, should, however, be contingent upon an emergency situation and retired when that emergency ends. It is asserted that if Pakistan's fiscal policies are reformed along the lines suggested in this study it would lead to efficient and equitable policies which are based on robust theoretical and empirical foundations.

I. Introduction

Fiscal policy primarily deals with regulating the level and composition of revenues, expenditures and the public debt with a view to achieving a modicum of fiscal sustainability over a period of time. It incorporates numerous basic policy issues, such as, determination of proper size and role of the government, ensuring social development and redistributing the benefits of economic development. The objectives of these policies are to reduce the extent of inequalities in income and wealth and ensure efficiency by promoting an optimum allocation of resources. This is a tall order and, among other factors, sufficient resources are required to achieve these objectives. Pakistan needs to address the problem urgently.[1] The country requires much higher government expenditure-to-GDP ratio than what is it at the present level. Over the years Pakistan's ability to meet these challenges has been

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[1] Akram, et al. (2009).

curtailed as sufficient resources have not been earmarked for development expenditures while non-development expenditures have not been successfully constrained; nor has a proper balance been kept between expenditure and burden of public debt. To add to the problems Pakistan's budget has been constrained by low-revenues. The country continues to depend on indirect taxes, has a high budget deficits and a huge public debt.

Tax increases may be less problematic as compared to reducing expenditures if the current level of tax revenue has a low base; but non-lump-sum taxes distort economic incentives and impose excess burden on the economy by changing the pattern of economic behavior, which in turn causes taxpayers to move out of taxed activities toward activities that are not being taxed, or are taxed at lower marginal rates [Musgrave (1959)]. Consequently, such a substitution effect reduces economic welfare. Cutting development expenditure negatively affects development. The other option is to lift the constraint on resource mobilization by contracting public debt but that merely shifts the burden of taxation from the present generation to future generations, and can lead to inflation if certain limits are not observed. Notwithstanding these problems each of these policy instruments must be employed to finance rising needs of economic development, and doing without taxes is unfeasible. Hence, the dilemma for policy makers is how to finance indispensable government expenditure while keeping welfare cost of additional taxation comparatively low. The tax smoothing hypothesis (TSH), which originated in the work of David Ricardo and has recently been revived by Barro (1979), offers a way out. The present study does a systematic, empirical analysis of this hypothesis in Pakistan's context. Though other studies exist on the subject, the present study includes a few novel features.

The paper is organized in the following way. A brief review of theoretical and empirical literature is presented in Section II with a view to identifying the research gaps. Section III highlights the fiscal dilemma that Pakistan has faced. Section IV presents theoretical modeling. Section V discusses data sources and estimation techniques. Finally, Section VI gives a few plausible policy prescriptions that follow from the analysis.

II. Review of the Literature

Barro (1979) used the TSH originally to determine the optimal level of public debt. In this regard the argument is that if government spending requirements fluctuate over time, the government should keep tax rates invariable and let the changes in the level of debt absorb the fiscal impact of exogenous shocks. Regarding the debt structure, the argument is that a government minimizing the welfare cost of fiscal policy should manage its debt with the intention of diminishing the risk caused by fluctuations in the tax rate. However, the tax rate should be changed later in response to changes in the state of the economy. Barro (1986) also proposed the random walk test of tax rate series to check the presence of tax smoothing behavior.[2] Following, Barro's, study many studies that focused only on the random walk test were conducted. However, there are many reasons to proceed beyond the random

[2] The random walk theory predicts that tax rate changes have the same distribution and are independent of each other, therefore the past movement or trend of tax rate cannot be used to predict its future movement. The unit test is conducted to see whether the changes in the tax rate are predictable or not.

walk test.[3] First, the random walk of the tax rate can also be caused by non-economic factors, unrelated to any government effort to conform to tax smoothing behavior. Second, it is difficult to assess the economic significance of statistical rejection of random walk. Third, there are useful time series properties that are not explored when focusing exclusively on the random walk test. In view of these reasons, Campbell (1987), Campbell and Shiller (1987) and Bohn (1990) provided the theoretical and empirical basis on which Huang and Lin (1993) and Ghosh (1995) devised a new test for testing the TSH by constructing vector autoregressive approach (VAR) between tax rate and budget surplus. The VAR approach is considered an improvement on earlier tests of random walk. The VAR approach also focused on tracing out the optimal path of budget surplus.

The presence of tax smoothing behavior has also been tested by Serletis and Schorn (1999), Cashin, et al. (1998), Huang and Lin (1993), Ghosh (1995), Cashin, et al, (2003), Strazicich (2002), Adler (2006) and others by applying the vector autoregressive approach (VAR) between tax rate and budget surplus. The model used in most tax smoothing studies is essentially an indirect method. It focuses on the budget surplus due to the difficulty in measuring permanent government expenditure. However, Sahasakul (1986) used the direct approach for this purpose focusing on the behavior of tax and the government permanent expenditure rates. In this context, non-defense expenditures were considered as permanent expenditure. Later on, Abeysinghe and Jayawickrama (2006) concluded that considering non-defense expenditure as permanent expenditure would not be a valid procedure and proposed decomposition of total expenditure rate. Cashin, et al, (2003) have analyzed the data for Pakistan for this purpose, essentially using the Ghosh (1995) approach to test the TSH. Ihtesham (2009) has sought to verify the TSH in the context of Pakistan, India and Sri Lanka using essentially to Sahasakul's approach but making some important statistical improvements over the earlier studies.

III. Pakistan's Fiscal Dilemma

Pakistan, like many developing countries, has an inherent tendency to let government expenditures run ahead of government's ability to raise the necessary resources to finance them. Consequently, the rates of central, provincial and local tax rates have to be raised and the tax base broadened. Fiscal deficits can be financed through additional taxes, by creating debt and through printing money. Each of these options has its own policy implications. Tax increases with a low tax base have serious distortionary effects on investment incentives; printing money in excess creates inflation; and accumulation of debt accompanied by the accrual of excessive burden of debt servicing limits the fiscal space required for achieving development. Efforts in Pakistan have not succeeded in achieving the dual objectives of growth and fiscal sustainability, partly because policies have not been fully consistent with the best practices of tax smoothing. The graphical and empirical analyses presented in the following sections reveal that, Pakistan has indeed tried to minimize the welfare cost of taxation. According to the so-called 'Golden Rule'[4] debt can be created only for development expenditures; and according to the 'Tax Smoothing Hypothesis'

[3] Campbell (1987).

[4] The Golden Rule says that over the economic cycle, the government should borrow only for investment and not to fund the current spending. On an average, over the economic cycle the government should only borrow to pay for investment (development expenditure) that increases economic development.

it may be created to finance the transitory expenditures only. Pakistan's success in each of these respects has been mixed and the matter has been made difficult by a lack of political will to take decisive steps to bring new taxpayers - especially, the vast agriculture and services sectors (lawyers and doctors) into the tax net and put a restraint on non-development expenditures and keep borrowing activity focused on development.

This sub-section of the paper briefly highlights the fiscal dilemma that Pakistan has faced and the manner in which it has struggled to minimize the welfare cost of taxation. As a beginning trends in taxation, expenditure and borrowing are reviewed.

1. Taxes, Expenditures and Fiscal Deficits

Raising the tax and expenditure rates is important for maximizing economic growth and keeping fiscal deficits within limits. Table 1 shows the medium-to-long term trends of the rates of taxes and expenditures and shows that, on an average, taxes, expenditures and deficit remained 13.32 per cent, 16.72 per cent and 6.66 per cent of GDP, respectively during the period 1965-2007. Pakistan's low revenue-to-GDP ratio, even by developing country standards, do not fulfill its expenditure requirements.[5] To overcome gravity of the fiscal deficit a wide range of reforms were launched by Federal Board of Revenue (FBR) in 2000. The reforms aimed at ensuring fiscal transparency, reducing tax rates, expanding the tax base to bring untaxed and under-taxed sectors into the tax net, and shifting the incidence of taxation from imports and investment to consumption and income. These reforms have improved the quantum of government revenues in the early years of current decade with an increase of 81 per cent in the FBR collection from 2000-01 to 2006-07 but the pace of reforms has not been maintained over the years. Even with revenue enhancing measures, government revenues do not fulfill the expenditure requirements resulting in a failure to keep the budget deficits within reasonable limits on a long-term basis.

TABLE 1

Descriptive Statistics (1965-2007) (%age of GDP)

	Revenue	Expenditure	Deficit
Mean	13.32	16.72	06.66
Median	13.48	16.46	06.79
Maximum	15.99	20.75	10.31
Minimum	10.29	12.75	01.77
Std. Dev.	01.47	02.52	01.92

Source: International Financial Statistics [(2006), (2008)].

[5] The expenditure as percentage of GDP was 14.5, 14.5, 17.9, 21.9 and 20.8 while revenue as percentage of GDP was 19.3, 22.2, 19.1, 25.1 and 25.0 in 2007 for China, Hong Kong, Indonesia, Malaysia and Korea, respectively, which are fast growing Asian countries.

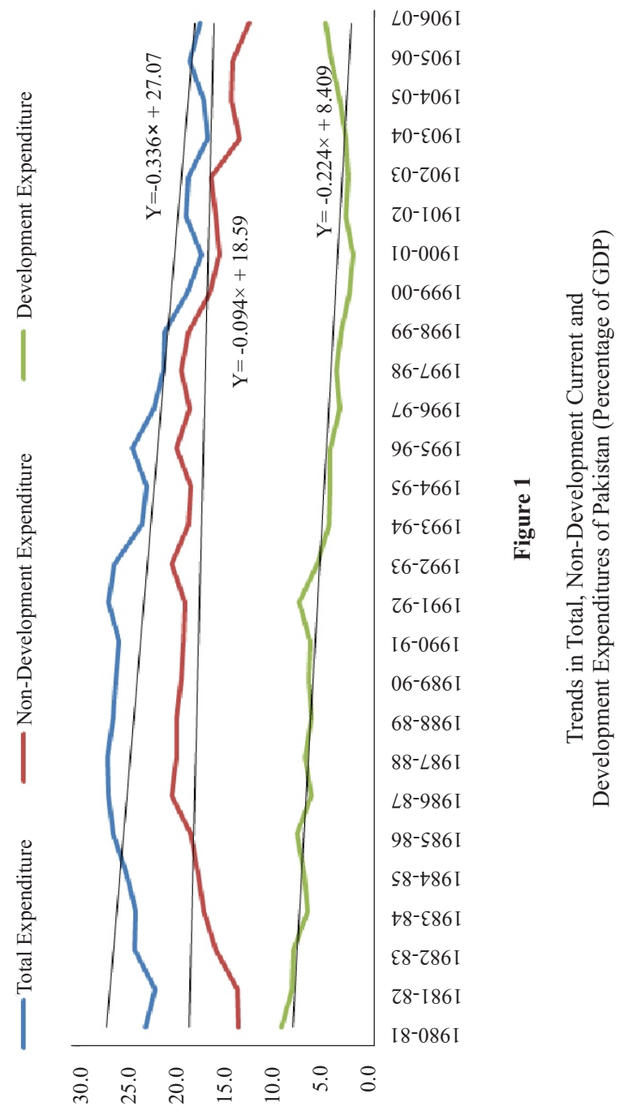

Figure 1

Trends in Total, Non-Development Current and Development Expenditures of Pakistan (Percentage of GDP)

2. *Total Expenditures, Development and Non-development Expenditures*

Public expenditure requirements in Pakistan have grown with leaps and bounds due to an increase in population, growth of state activities, modernization of defense services, provision of public utility services, expansion in social services, technological advancement, political and social factors, inclusion of new activities in the domain of welfare responsibilities, growth of employment and economic development. However, the public expenditure-to-GDP ratio, has in fact, decreased over time. Figure 1 explains this, very clearly. The trend line in Figure 1 also reveals that the total expenditure has declined over time. Even more important, development expenditures have suffered the most by the fiscal adjustments and expenditure rationalizations done in the decades of the 1980s and the 1990, as part of the IMF's Structural Adjustment Program. Non-development expenditures have also declined over time but the decrease is very small. The development expenditure was 7.2 per cent of the GDP in the 1980s but declined to 4.7 per cent of GDP in the 1990s and reached lowest ever level of 2.2 per cent of GDP in 2000-01. The reduction of development expenditure had serious implications for socio-economic development in Pakistan during the 1990s. In particular, it adversely affected growth rates and their stability over time.

3. *Trends in Public Debt*

Pakistan's public debt was over 100 per cent of the GDP in 1999-2000 and debt servicing accounted for over half of the current revenues. From this, one can imagine the seriousness of financial problems at the beginning of this decade. The World Bank had classified Pakistan as a severely indebted country in 2001. Due to its inability to service external debt, a major debt rescheduling was successfully negotiated, which considerably decreased the burden of debt servicing. Domestically, the government has resorted to printing currency, and creating debt from domestic resources at any cost, without proper analysis of the consequences of such acts. International Monetary Fund (IMF) has been the major source of financing which imposes strict conditions and gives costly and short-term loans. Figure 2 shows the trend of the debt burden (debt as a percentage of GDP) over time.

The figure shows that the efforts to reduce the burden of debt have borne fruit after its rescheduling in 2001 in terms of GDP but in absolute terms it has increased over time. The total public debt was Rs.3510 billion in 2002 which increased to Rs.4363 billion in 2006 and Rs.7268 billion in 2009. As can be seen, the public debt doubled over a seven year period, which indicates financial irresponsibility. Since the growth rate and the development expenditure have both declined , the rising debt indicates that it is financing non-development expenditure - which goes against the principle of Tax Smoothing Hypothesis. Although, Pakistan has put a restraint on debt generation safeguarded social sector expenditures through "Fiscal Responsibility and Debt Limitation Act 2005" (FRDL), but it has yet to fully comply with it.

It appears from the above, that the government's success in riding out the fiscal dilemma, has been limited, if not altogether ineffective. The main reason for this has been the limited political will. A long-term and lasting solution to the problem requires a major reorientation of the fiscal effort. This paper proposes that the government follow the prescriptions of the Tax Smoothing Hypothesis.

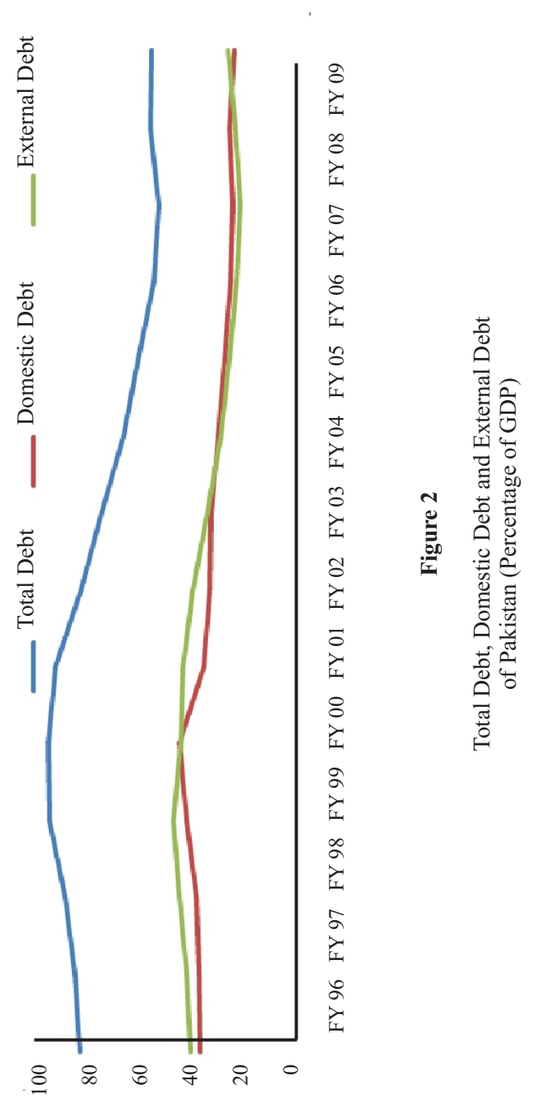

Figure 2

Total Debt, Domestic Debt and External Debt of Pakistan (Percentage of GDP)

IV. Theoretical Modeling

In this section a model is developed that outlines an optimal fiscal policy for Pakistan - one that achieves a balance between additional taxation, and borrowing with a view to meeting its development requirements. The TSH assumes that the individuals' efforts to reduce average tax burden impose social welfare cost on the society and that this cost would increase if it is not minimized by a policy of tax rate smoothing. The representative agent and the government share a common time horizon, and the agent's utility function remains unaltered by the provision of public goods. The government expenditures are exogenously given and distortion in taxes involves a social welfare loss such as collection cost. The taxes create a motivation for taxpayers to substitute away from taxed activities toward non-taxed activities, or towards those that are taxed at a lower marginal rate. Furthermore, the government seeks to reduce the distortions caused by taxation that are likely to increase more than proportionally with the increase in revenues. The models of Bohn (1990), Ghosh (1995) and Abeysinghe and Jayawickrama (2006) assume that distortionary costs are approximately proportional to the square of the revenue raised. Therefore, the welfare cost (dead-weight loss) of taxation per unit of output is defined as:

$$z(\tau_t) = \frac{\tau_t^2}{2} \tag{1}$$

where τ is the tax rate, the quadratic deadweight loss function assures that $z'(\tau_t) > 0$ and $z''(\tau_t) > 0$. In a stochastic environment, the deadweight loss is determined by the expectations of future tax rates. Since a single tax rate is assumed for the whole economy, therefore the total dead-weight loss of the whole economy is obtained by multiplying Equation (1) by income Y_t.

The government minimizes the present value of distortions of raising revenue subject to the constraint that present value of its revenues is not less than some specific level. Because of the increasing marginal distortionary costs of raising revenue through raising taxes, the government will choose a smooth path for taxes. The government's objective function is given as:

$$V = Min \frac{1}{2} \Sigma_{i=0}^{\infty} \rho^t E_t(\tau_{t+i}^2) Y_{t+i} \tag{2}$$

where E_t represents expectations at time t. The dynamic budget constraint faced by government is given by:

$$D_t = (1 + r) D_{t-1} + G_t - T_t \tag{3}$$

where r, the real interest rate related to ρ discount rate as $\rho = 1/(1 + r)$, D_t is government debt, G_t is government non-interest expenditure and T_t is tax revenue.

When expectations and non-ponzi game condition on debt are imposed, Equation (3) is transformed into:

$$\sum_{i=0}^{\infty} \rho^i E_t(G_{t+i}) + D_{t-1} = \sum_{i=0}^{\infty} \rho^i E_t(T_{t+i}) \tag{4}$$

[6] The no-ponzi game condition rules out unlimited lending or borrowing by the government.

Dividing Equations (2) and (4) by Y_{t+i} and solving the constrained optimization problem;

$$E_t \tau_{t+i} = \tau_t \text{ for all } i = 1, 2, 3, \ldots \tag{5}$$

This gives the time path of taxes that minimizes present value of the welfare costs subject to the requirement that it satisfies the overall budget constraint. It states that changes in the tax rate cannot be predicted. That is, tax rate follows a martingale (random walk).[7] It is the basic implication of TSH that its presence can be considered a necessary condition to analyze the presence of tax smoothing. To obtain a sufficient condition Gosh (1995) extends the model by putting Expression (5) into (4) to obtain an optimal tax rate as;

$$\tau_t = \left(\frac{1-\psi}{\psi}\right) d_t + \left(\frac{1-\psi}{\psi}\right) \sum_{i=0}^{\infty} \psi^i E_t g_{t+1} \tag{6}$$

where $\Psi = [(1 + r)/(1 + n)]$, n represent long-run output growth rate and d_t, is debt rate, g_t represents expenditure rates and τ_t are tax rates. Ψ is assumed < 1, (i.e., $n < r$ which assures dynamic efficiency of an economy).

According to Equation (6) the only martingale that satisfies the TSH is that which sets the tax rate exactly equal to the annuity value of the sum of government debt and the present discounted value of the expected government expenditure. Its right hand side represents the constant flow of expenditure which is expected to sustain the remaining government's time horizon. It is made up of all the long-run components of permanent government expenditures and is symbolized by g_t^p. Therefore, Equation (6) becomes:

$$\tau_t = g_t^p \tag{7}$$

Plugging Equation (7) into Equation (5) we get,

$$E_t(\tau_{t+1}) = g_t^p \tag{8}$$

There should be no effect of exogenous variables on the tax rate other than the permanent expenditure when fully complying with the TSH. For perfect tax smoothing only permanent government expenditure should prompt additional taxes but in the reverse case there is no tax smoothing.[8] Conversely there may be two additional situations: one, if both causes each other; and, second, when none of the two causes each other. In former situation, there is weak tax smoothing and in the latter it does not exist. However, if any other exogenous variable with permanent expenditure also has a significant effect (may be positive or negative) on taxes then there will be a weak tax smoothing.

In the following sections we empirically estimate, using the model outlined, to ascertain the presence (absence) of tax smoothing behavior in Pakistan. To this end, discussion on the data and estimation issues in Pakistan's context is taken first.

[7] A martingale is a stochastic process (i.e., a sequence of random variables) such that the conditional expected value of an observation at some time is equal to the observation at that earlier time.

[8] If only changes in tax rate cause permanent expenditure then there would be no tax smoothing.

V. Data and Estimation Techniques

The data for Government Revenue, Government Expenditure, Gross Domestic Product (GDP) and Money have been obtained from the International Financial Statistics (2009) for the period 1965-2007. Ideally, average marginal tax rate should be computed using changing weights. However, computation of average marginal tax rate is difficult due to the unavailability of data. Therefore, average tax rate, revenue-to-GDP ratio is a better proxy for the effective tax rate than a fixed-weighted average marginal tax rate.[9] Another reason to use revenue-to-GDP ratio is that governments are directly concerned with total revenues and, not just tax revenue, when deciding on expenditures. The expenditure rate is total government expenditure-to-GDP ratio. Permanent and transitory expenditure rates are formed by decomposing the expenditure rates by two different techniques, namely: Beveridge-Nelson (1981) Decomposition (BN) and Wavelet Transformation (WT), [Daubechies (1992)].

The next sub-sections present the detailed empirical analysis of the Pakistan's fiscal policy in the context of tax smoothing. The major econometric techniques used for the analysis are the ADF unit root tests which explore the characteristics of the time series used for the analysis. It also helps in determining whether necessary conditions for tax smoothing behavior hold or not. For the decomposition of expenditure series into transitory and permanent components BN and WT techniques are used. To determine the short-run and long-run relations between expenditures and tax rates graphical and co-integration techniques are used in the analysis.

1. Integration Analysis

For analysis of the tax smoothing behavior the usual first step is to check for the unit root in the tax rate series as suggested by Barro (1986) and Trehan and Walsh (1988). According to them, the presence of unit root in the tax rate series of a country argues for the TSH. Table 2 reports the Augmented Dicky and Fuller [(1979), (ADF)] unit root test results for tax rate, expenditure rate and money growth rate series for Pakistan. It shows clearly that the null hypothesis of non-stationarity cannot be rejected for tax and expenditure rates, but the series of growth rate of money is stationary. The results reveal that all variables having unit root for level are stationary in first difference.

Many of the tax smoothing studies check only the unit root in tax rate series and decide about tax smoothing behavior of a country on that basis [for example, Barro (1986), Trehan and Walsh (1988), Strazcich (2002) and Scott (1999) have taken this route in their studies]. However, the unit root in the tax rate series is only a necessary condition to hold for presence of the tax smoothing behavior. It is by no means a sufficient one. Table 2 shows ADF-unit root test results in the tax rate series for

[9] There are several reasons to choose the total revenue-to-GDP ratio as a proxy of tax-to-GDP ratio. First, the data of taxes for selected countries are not available for reasonable long period for empirically valid results. Second, the present study is concerned with enhancing government's ability to minimize the budget deficit and reduce fluctuation in it - and also to reduce the incidence of public debt which is directly related to total public revenue rather than the taxes. Taxes form a major proportion of total revenue. Third, Ghosh (1995), Ashworth and Evans (1998), Adler (2006) and many others consider the average tax rate calculated as total revenue-to-GDP ratio a better proxy for average marginal tax rate.

Pakistan. The unit root in the tax rate series shows that it is a martingale, indicating that changes in the tax rate are permanent. The results are consistent with the findings of Cashin, et al. (2003). However, Ashworth and Evans (1998) did not find unit root in the tax rate series for Pakistan. On that basis they conclude that there has been no significant tax smoothing, although both studies used data for almost the same period.[10] However, the present study shows that this result too is inconclusive. The problem lies with their method of analysis for the presence or absence of tax-smoothing. However, their results do show that no firm conclusion can be drawn by just using the unit root test on tax rate series only.

TABLE 2

ADF Unit Root Test Results

Unit Root Test in	Exogenous	Tax Rate	Expenditure Rate	M1Growth Rate
Level	Constant	-2.2188	-1.3078	-5.2037*
	Const. & Trend	-2.6204	-0.1652	-5.3862*
	None	-0.0978	-0.6003	0.1414
First Difference	Constant	-5.9960*	-7.8430*	-
	Const. & Trend	-5.8740*	-8.0830*	-
	None	-6.7690*	-7.9650*	-

* Indicates stationarity at 5% level.

2. Decomposition of the Total Expenditure Rate Series

To have precise estimates about tax smoothing in Pakistan, the total expenditure series needs to be decomposed into permanent and transitory components. The main reason for this decomposition is that, contrary to what Barro asserts, a random walk in the tax rate does not necessarily indicate tax smoothing.

Sahasakul (1986) developed a direct test of the TSH by relating the tax rate to the permanent component of the government expenditure rate. On this criterion, permanent government expenditure rate and the tax rate series should move together to establish the tax smoothing behavior. However, since the permanent expenditure rate data are not available, two different techniques have been used; namely, the BN-Decomposition and the WT-Transformation; to decompose the total expenditure rate series into the permanent and transitory components. Both these techniques are cumbersome and laborious. The BN is based on the ARIMA estimation whereas the

[10] Time period of Ashworth and Evans (1998) was 1955-1994 while Cashin et.al. (2003) was 1956-1995.

WT is new in economics and is a non-parametric technique. In the case of BN-decomposition, there is a loss of initial values of the series, which vary depending upon the best fit ARIMA (p, d, q). In WT-decomposition there is a problem in initial and end values however, this is covered by padding appropriate data before the initial value and after the last value in actual series before transformation. As opposed to the BN-decomposition, the WT-transformation does not need to make the series stationary before decomposition.

The best fit ARIMA (p, d, q) model for BN-decomposition of expenditure rate is ARIMA (1,1,0). The decomposed components of the government expenditure rate series of using both techniques are presented in Figure 3. The visual examination

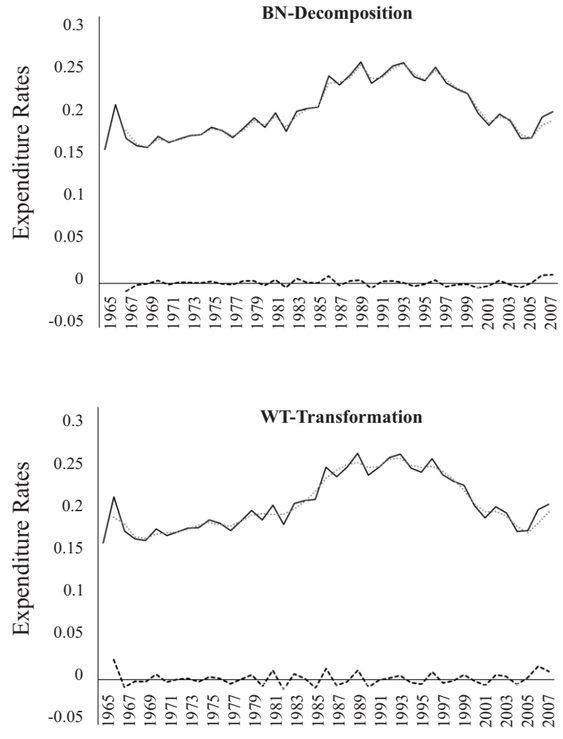

FIGURE 3

Decomposition of Expenditure Rate Series into Permanent and Transitory Parts (Pakistan)

of the graphical representation of both types of decomposed series is that both techniques provided almost similar results. However, the smoothed series obtained by the WT-transformation has less sharp peaks than the smoothed series obtained by the BN-decomposition. Moreover, the government's transitory expenditures are shown to be negligible for most of the economic history of Pakistan.

3. Graphical Analysis

Figure 4 shows that, with the exception of the early 1970s, there has been a close correspondence between movements of tax rate and the permanent expenditure rate (i.e. both moved in the same direction during the respective period) in Pakistan. Main reasons for deviation between the two series in 1970s seem to be political instability and high defense expenditures in that period. High and a sudden increase in tax rate as compared to expenditure rate shows that Pakistan had to finance War (which was a transitory increase in expenditures). Thus, it is clear that in that period Pakistan did not follow the principle of tax smoothing.

In other words, the government did not try to minimize the welfare cost of taxation by keeping the tax rate constant in that period. In such a situation, it would have been better to create debt to finance such transitory expenditures and then retire it to normalcy return. However, with this exception, the movements in both series are in the same direction and have close correspondence. The gap between the two series in 1990s indicates that Pakistan has not tried to balance its budget. However, this fiscal gap decreased after 2002, indicating greater fiscal responsibility. A close association between the movements in the tax rate and rate of permanent part of the expenditure over the whole sample period implies that Pakistan tried to minimize distortions in the tax rate when is permanent change in its expenditures was expected, though not completely. Lack of fiscal space, unnecessary expenditures, difference between actual and expected expenditure and revenue have been some of the reasons behind such imperfect behavior.

4. Co-integration Analysis

It may be noted that moving together of the tax rate and the government permanent expenditure rate may indicate, as Grilli (1989) has also argued, that there exists a co-integrating relationship. In the preceding section it was shown that tax rate series is I(1) while both BN- and WT-permanent components of the expenditure rate series are also I(1) by definition. Since both series are non-stationary and integrated at order one, it follows that the ECM can be estimated in accordance with the procedure described by Engle-Granger (1987). Table 3 presents the OLS estimates of β from the regression obtained from Equation (9). The empirical form of the estimated regression is as follows:

$$\tau_t = \beta g^p_{t-1} + \mu_t \qquad (9)$$

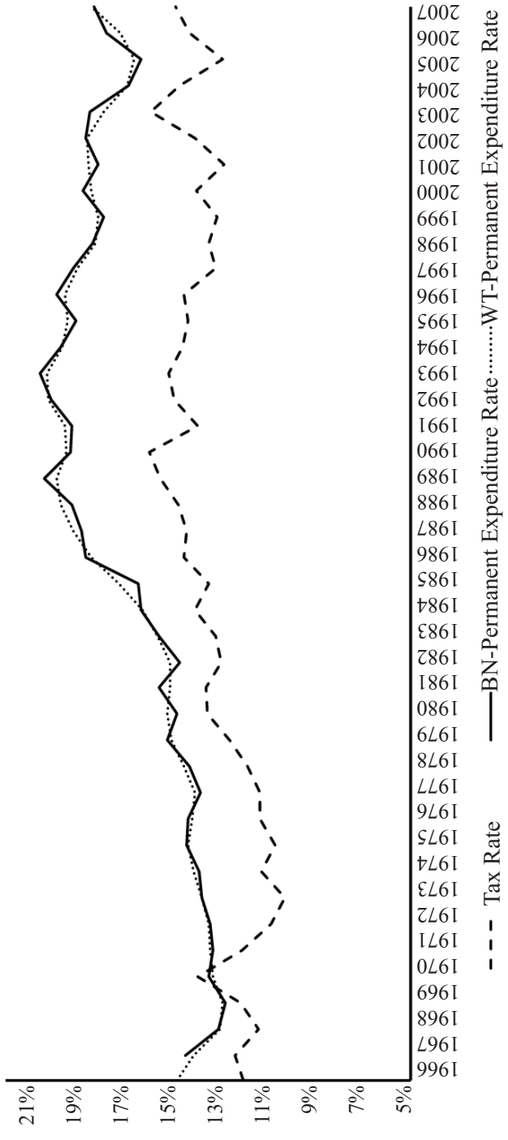

Figure 4

The Correspondence between Tax Rate and Permanent Expenditure Rate Series (Pakistan)

Here $\beta = 1$, $\mu_t = \sigma\mu_{t-1} + \varepsilon_t$ is assumed to be zero-mean white noise process. The equilibrium errors are represented by, μ_t, obtained from Equation (9). Co-integration exists between the two I(1) variables, if μ_t series is I(0). Standard student t-statistics are not valid to check stationarity of the residuals. Appropriate tables for this purpose are provided by Engle Granger. If the residuals are stationary, then co-integration exists between them.

Table 3 presents the OLS estimates of equation (9) based on both BN and WT measures of the permanent expenditure rate. The ADF unit root estimates of residuals obtained from the regression are stationary. It indicates that tax rate and permanent expenditure rate series are co-integrated. In simple words, they both move in the same direction in the long-run. The estimates of β are very similar under both measures at 0.79, implying that 79 per cent of the changes in permanent expenditures have been reflected in the taxes. The test also supports insights derived from the unit root in tax rate. It also validates the graphical analysis of Figure 4 that the changes in permanent expenditure have been reflected in the tax rate changes. Moreover, it shows that Pakistan has done tax rate smoothing overtime but not perfectly.[12] The residuals exhibit both autocorrelation and Autoregressive Conditional Hetero-Skedasticity effects in BN-method but only autocorrelation in WT-method. Although, ARCH effects do not violate the TSH, residual autocorrelation does violate the strong version of the hypothesis. Therefore, the study proceeds with the WT-permanent expenditure rate component for further analysis based on the ECM.

TABLE 3

Co-integration Analysis (Dep. τ_t)

	BN Series	WT Series
$g^p_{t(-1)}$	0.79189 (71.83)	0.7910 (72.45)
DW stat.	0.560570	0.649432
Rho(ρ)	0.711388	0.674238
ARCH	4.770059 [0.035555]	2.665285 [0.111042]
AR(2)	18.56362 [0.000003]	15.61524 [0.000012]
ADF test of residuals	-3.652*	-3.889*

Note: DW values are greater than 1% critical value (0.511) indicating that the series are co-integrated at 1% level. ADF Critical value is -3.38 at 10% level. *denotes significant at the 10% level of significance.

[12] It is interesting to note that although we have applied a more direct approach, our findings are similar to Cashin, et.al., (2003) who used the indirect approach. The findings of Sahasakul (1986) are just the opposite who could not find tax smoothing using the direct approach for the US.

5. *Error Correction Model (ECM)*

Cointegration between the tax rate and the permanent expenditure rate shows a long-run equilibrium relationship between the two, though, there may be disequilibrium in the short-run. To analyze such a situation following the Error Correction Model between the tax rate series and permanent part of the expenditure series is estimated as:

$$\Delta\tau_t = \gamma_1 + \Sigma\gamma_2 \Delta\tau_{t-1} + \Sigma\gamma_3 \Delta g^p_{t-1} + \Sigma\gamma_4 x_{t-1} + \alpha_1 EC_{t-1} + \varepsilon_t \qquad (10)$$

$$\Delta g^p_t = \sigma_1 + \Sigma\sigma_2 \Delta\tau_{t-1} + \Sigma\sigma_3 \Delta g^p_{t-1} + \Sigma\sigma_4 x_{t-1} + \alpha_2 EC_{t-1} + \varepsilon_t \qquad (11)$$

All variables are stationery in the both models. The EC_{t-1} term is the lagged residual, obtained from regression Equation (9), and has been introduced in the ECM as error correcting term. The x_t term is the additional I(0) exogenous variables; γ'*s* and σ's capture the short-run effects of exogenous and lagged dependent variables on dependent variables; α_1 and α_2 capture the rate at which the tax rate adjusts to the equilibrium state after a shock i.e., it captures the speed of error correction. All the I(1) variables are in difference forms and EC_{t-1} is also I(0), therefore, the ECMs are estimated with OLS. The values of α_1 and α_2 directly related to the characteristics roots of the difference equation system. The convergence necessitates that α_1 be negative and α_2 be positive and at least one of these should be significant.

The ECM analysis is presented in Table 4 (Model 1), with $\Delta\tau_t$ and Δg^p_t as as dependent variables. The error correction term coefficients are significant and have the expected signs indicating that in the short-run, taxes and permanent expenditure have moved together in the same direction. The estimated lagged error correction term also suggests that error correction does take place in the model. The feedback coefficient (Error Correction Term) suggests that approximately 29 per cent of disequilibrium in the previous year has been corrected in the current year.[13]

These results reveal that in the short-run current taxes are significantly affected by previous period's permanent expenditures but not by previous taxes. While, the current permanent expenditures are significantly influenced by previous period's permanent expenditures as well as taxes. The results indicate that short-term variables affect taxes. This shows that factors other than permanent expenditures might also have caused changes in the tax rate. Therefore, it can be concluded from the above discussion that there has been weak tax smoothing in Pakistan over the sample period. The findings are similar to those of Cashin, et.al., (2003).

Perhaps the most important implication of the analysis presented so far is that, although the tax rate and permanent expenditure rate are co-integrated, yet there is a big gap between them. This indicates that budget deficits are a persistent characteristic of Pakistan's fiscal scene. The analysis also has the important policy implication that Pakistan should meet all or most of its permanent expenditures from taxes;

[13] Residual-based model selection and stability tests indicate that there is no serious problem of Autocorrelation, Normality and Auto-Regressive Conditional Hetero-Skedasticity in the models. Ramsey Regression Specification Error Test indicates that models are stable with no specification error. The residual-based results have not been presented here but can be provided on request.

and only the transitory shocks to the economy should be financed by debt creation. Such financing should be contingent and should be retired when the shock is over and normal conditions return.

TABLE 4

Error Correction Analysis

Variables	Model 1 ECM		Model 2 With I(0) Variables	
Dependent	$\Delta\tau_t$	Δg^p_t	$\Delta\tau_t$	Δg^p_t
Explanatory	Coefficient [t-Stat.]	Coefficient [t-Stat.]	Coefficient [t-Stat.]	Coefficient [t-Stat.]
C	0.000631 [0.413165]	0.000654 [1.23108]	-0.0021 [-0.57551]	0.001482 [1.28232]
EC_{t-1}	-0.29195* [-2.09576]	0.103653* [2.139955]	-0.30878* [-2.17411]	0.099083* [2.202895]
Δg^p_{t-1}	0.863931* [2.223016]	0.905727* [6.702593]	-0.7466** [-1.85437]	0.924133* [7.322933]
Δg^p_{t-2}	-0.6931** [-1.7711]	-0.38775* [-2.84932]	-0.010933 [-0.05456]	-0.36598* [-2.87046]
$\Delta\tau_{t-1}$	-0.08787 [-0.49073]	-0.20682* [-3.32206]	0.929447* [2.332442]	-0.14527* [-2.28930]
m_{t-1}	-	-	0.01781 [0.803654]	-0.00615 [-0.87602]
g^t_{t-1}	-	-	-0.224877 [-0.64629]	-0.29464* [-2.67391]

Note: The t values are given in parenthesis * and ** indicate significance at 5% and 10% level.

6. *Error Correction Analysis with Additional Exogenous Variables*

Transitory components other than the permanent expenditure, tend to force the observed average tax rate to change. In this regard additional I(0) variables, growth rate of M1(m_{t-1}) and transitory component of government expenditure, are introduced in the ECM to check if they have any significant impact on changes in the tax rate. The growth rate of M1(m_{t-1}) captures both the inflation and seignorage effects, which are

expected to be positive because higher inflation and higher nominal incomes push individuals into higher nominal tax brackets. However, the government's transitory expenditure (g^{t}_{t-1}) might have positive as well as negative effects. A significant effect of both or any one of these variables would point to weak or no tax smoothing. To sort out these matters, the ECM with additional I(0) variables is presented in Table 4, (Model 2).

It may be noted that the ECM results involving additional I(0) exogenous variables remain same as they were without introduction of the exogenous variables. The coefficient of money has expected positive sign but is insignificant in both models. This probably indicates that seignorage and inflation via higher nominal incomes does not push individuals into higher tax brackets. Insignificance of both additional I(0) variables shows that they do not have an independent effect on tax changes. This result is consistent with Evans and Amey (1996), which estimated the extended tax smoothing model for a significant number of OECD countries and found that seignorage has not been used for tax smoothing.[14] Ashworth and Evans (1998) worked on the same for 32 developing countries and did not find the rate of taxation to grow with the increase in nominal income. They argue that the governments tried to keep the growth of government's debt constant with respect to inflation to raise revenue from taxation and reduce the real value of the debt. This is in accordance with the hypothesis that reductions in the burden of government debt can be obtained through money creation.

The second included exogenous variable in the ECM is the transitory component of government expenditure to test the impact on tax rate changes. The coefficient of transitory expenditures is insignificant, which indicates that tax rates in Pakistan have not responded to transitory changes in government expenditures; indicating the presence of tax smoothing in Pakistan.[15] The insignificant impact of transitory expenditure on tax rate changes may be because of their negligible share in total government expenditures. Another possible reason for his result may be that transitory expenditures are financed through issue of bonds.

VI. Conclusions and Policy Implications

The general conclusions that emerge from the present analysis is that Pakistan has not been smoothing its tax rate perfectly over the sample period and that there has been presence of weak tax smoothing. Two specific and important conclusions can be drawn from these results. One, Pakistan has been facing difficulties in arranging revenue requirements to finance transitory shocks to its expenditures from borrowing. Hence, it has found difficult to smooth tax rate to finance its transitory expenditure (but Figure 3 shows that there has been almost negligible transitory expenditure in the sample period). Second, the discussion in preceding sections show that Pakistan has been unable to fully accomplish even its non-

[14] The extended tax smoothing model implies that tax rates and the rate of inflation moves together in the same direction.

[15] Contrary to our findings Sahasakul (1986) finds that tax rate responds significantly not only to the permanent government expenditure rate but also to the transitory component in the US.

development expenditure financing. Hence, these expenditures (which are almost a permanent part of the government expenditure) were met through borrowing on by increasing tax rates. For example in the present global recession period Pakistan is facing serious liquidity constraints. In such a situation the government is forced to collect additional revenue through other sources; for example, by not reducing oil prices in spite of significant reduction in the international market, increasing tax rates on telecommunication, etc. The non-tax government revenue has also been raised by frequently increasing the utility prices. The other fact is that the government cannot (and perhaps should not) adjust the marginal income tax rates and corporate tax rates so frequently in response to changes in expenditure requirements. This shows that temporary departures of the effective tax rate from the permanent government expenditure rate have been quite common in Pakistan. The presence of such departures should not be considered as a severe violation of the TSH. The government is again repeating its previous history for creation of foreign debt by creating short-term loans with strict conditions by the IMF. That has pulled down the major part of the lower middle class under the poverty line - for example, the frequent change in prices of government provided utilities (e.g., gas, fuel and electricity, etc.,) and has kept the inflation rate in double digits.

A number of policy implications flow from the findings. At least to some extent, the severe debt crises that Pakistan has faced can be attributed to its failure to do tax smoothing in a systematic fashion and to its inability to synchronize its spending and taxing and borrowing decisions. It follows that the government of Pakistan would probably be better off if it utilizes its revenues for necessary and economically fruitful projects and minimize its non-development expenditures. In this regard a prompt action program of expenditure rationalizing should be initiated. Furthermore, an analysis should be carried out to determine what part of the government expenditure is permanent and what part of it is transitory. In the light of such analysis, a conscious permanent expenditure should be made by increasing the tax rate; and if there are transitory shocks to the expenditure or output these should be financed by creating public debt. However, such debt should be contingent and retired when the 'good days' are back.

The desired tax rate should be decided in such a way that the government's intertemporal budget constraint is not violated. Thus, to finance the budget, the government may use debt and tax instruments simultaneously. For example, in response to an unexpected increase in the government expenditure and/or decrease in output the government should neither produce debt mountains nor unduly push up tax rates and the utility prices - as per its past practice. Instead, an analysis should be carried out to analyze what part of this increase is going to become a permanent part of the government spending. Then, permanent part of the spending should be financed through an increase in tax rates and the remaining through rise in public debt.

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APPENDIX

The welfare cost (dead-weight loss) of taxation per unit of output is defined as:

$$z(\tau_t) = \tau_t^2/2 \qquad \text{(A-1)}$$

where τ is the tax rate, the quadratic deadweight loss function assures that $z(\tau_t) > 0$ and $z''(\tau_t) > 0$. The dead-weight loss of the whole economy can be obtained by multiplying Equation (A-1) by income y_t The government's objective function to minimize the present value of distortions from raising revenue is given as:

$$V = Min\ \tfrac{1}{2}\sum_{i=0}^{\infty} \rho^i\, E_t\, \tau_{t+1}^2\, Y_{t+1} \qquad \text{(A-2)}$$

The dynamic budget constraint faced by the government is as follows:

$$D_t = (1+r)\, D_{t-1} + G_t - T_t \qquad \text{(A-3)}$$

where *"r"*, the real interest rate, D_t is the government debt, is government's non-interest expenditure and T_t is the government tax revenue. The values of *G, D* and *T* are in real terms. When expectations are taken into account and no-ponzi game condition on debt is imposed then Equation (A-4) gives

$$\sum_{i=0}^{\infty} \rho^i\, E_t\, G_{t+1} + D_{t-1} = \sum_{i=0}^{\infty} \rho^i\, E_t\, T_{t+i} \qquad \text{(A-4)}$$

Dividing expressions in Equation (A-2) and Equation (A-4) by y_t and solving the constrained optimization problem

$$E_t\, \tau_{t+1} = \tau_t \quad for\ all\ \ i = 1, 2, 3, \ \ldots \qquad \text{(A-5)}$$

It gives the time path of taxes that minimizes the present value of the welfare costs subject to the requirement that it satisfies the overall budget constraint. It states that changes in tax rate cannot be predicted. Even though expression equation (A-5) nicely captures the tax smoothing hypothesis; yet, for many reasons, Huang and Lin (1993) and Ghosh (1995) went beyond the unit root test. To continue beyond the unit root test, the instantaneous borrowing constraint of the government is given in Equation (A-5). Putting this into Equation (A-4) optimal tax rate is obtained as:

$$\tau_t = \left(\frac{1-\psi}{\psi}\right) d_t + \left(\frac{1-\psi}{\psi}\right) \sum_{i=0}^{\infty} \psi^i\, E_t\, g_{t+1} \qquad \text{(A-6)}$$

where $\psi = (1+r)/(1+n)$ and n represent long-run output growth rate and d_t, g_t and τ_t are the debt rate D_t/y_t expenditure rate (G_t/Y_t), and tax rate (τ_t/y_t), respectively, and assuming $\psi < 1$. i.e. $n < r$ which assures dynamic efficiency of an economy). The right hand side of Equation (A-6) is the constant flow of expenditure that is expected to sustain for the remaining government's time horizon. It is made up of all the long-run components of permanent government expenditure rate and is symbolized as(g_t^p)

$$\tau_t = g_t^p \qquad \text{(A-7)}$$

Plugging equation (4-7) into equation (4-5) we get,

$$E_t \tau_{t+1} = g_t^p \qquad \text{(A-8)}$$

Equation (A-8) can be emperically estimated testing for the tax smoothing hypothesis.