GOVERNMENT EXPENDITURE AND TAX REVENUE
CAUSALITY AND COINTEGRATION;

The experience of Pakistan
1972-2007

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**Introduction:**

The main objective of Pakistan’s fiscal policy is sustained economic growth in unison with declining debt services, poverty alleviation, the creation of job opportunities & investment in human & physical infrastructure. Notwithstanding all lackluster and half hearted attempts to reform tax administration and procedure, the tax to GDP ratio fluctuated in a narrow band of 10 to 11% for almost one decade. On the revenue side, tax-GDP & hence, revenue to GDP ratios either remain stagnant or secular decline, owing mainly to structural deficiencies in the tax system and administration both at the federal and provincial government level. The expenditure of the government in relation to GDP exhibits a similar pattern, with total expenditure showing, an overall decline since the beginning if 1980.

In the short run, fiscal policy can be considered expansionary (contractionary) when public expenditures exceed (fall short of) public revenues and the resulting deficit can be interpreted as a means to finance additional government expenditures. If these expenditures are considered growth enhancing, then a government deficit exhibits an indirect effect on long-term economic growth. In a Ricardian world, however, where agents view the deficit simply as taxes delayed, there should be no difference between tax and deficit finance of government expenditures, as long as the tax structure remains unchanged in the future (Ludvigson (1996)). On the other hand, if the economy is non-Ricardian, due to credit constraints or overlapping generations, then public deficits can change the private incentives to accumulation and thus directly influence the rate of growth of the economy. As argued by Araújo and Martins (1999), running a debt-financed deficit can induce the government to absorb additional resources from the private sector, which could have been used instead for the accumulation of private physical capital. If the revenue raised in that fashion is spent in a less productive way than it would be by the private sector, the overall growth effect would be negative.

In Pakistan, higher level of current budget deficit are financed to a significant extent by government borrowing these, adds to the interest burden pushing up future expenditure as well as leading to expectation of higher taxes. Thus the modality of financing the budget deficit is an important variable in the nexus between tax revenue and expenditure. Several empirical studies have attempted to shed light on the consequence of fiscal deficit rather than the causes. Although the relationship between revenue and expenditure is still an unsettled issue, the main purpose of the present study is to visualize the relationship between tax revenue and expenditure variables in the Pakistan context.

The various estimate to test the revenue/tax-expenditure nexus are examined in context to different countries, despite the diversified nature of the conclusion, this study attempts to investigate the causality between government expenditure and tax revenue in Pakistan but it differ from earlier studies on the following aspects.
Firstly, it examines two-hypothesis tax-spend or spend-tax by granger causality test verification in context of Pakistan. Secondly, it investigates for short run or long run relationship between both of the variables with current data.

**Conceptual framework and theoretical**

The relationship between tax and spending is typically discussed in the literature within the framework of four competing hypotheses, namely the tax-and-spend hypothesis, the spend-and-tax hypothesis, the fiscal synchronization hypothesis, and the institutional separation hypothesis. In this section, we begin with a brief explanation of these four hypotheses and then we go on to present the empirical evidence.

**The tax-and-spend hypothesis:**

According to the tax-and-spend hypothesis championed by Friedman (1978), the level of spending adjusts to the level of tax revenues available. Thus, an increase in tax will not lead to lower budget deficits. This hypothesis implies a positive relationship between tax changes and the spending changes that will follow. On this basis, Friedman favors a reduction in taxes to force subsequent spending cuts.2

Buchanan and Wagner (1977, 1978) put forward an alternative version of the tax-and-spend hypothesis. In contrast to Friedman (1978), they argue that tax increases would lead to spending reductions. The building block of the Buchanan and Wagner (1977, 1978) version of the tax-and-spend hypothesis is that taxpayers suffer from fiscal illusion. According to the authors, tax cuts lower the perceived price of government provided goods and services by the public, which in turn boosts the public demand for these goods and services. However, the public may actually incur even higher costs. One reason for this is the indirect inflation taxation that results if the government resorts to excessive money creation. Another reason is higher interest rates associated with government debt financing may crowd out private investment. To reduce expenditures, Buchanan and Wagner favor limiting the ability of the government to resort to deficit financing. In sum, while tax changes as before drive spending changes, the relationship between the two is a negative one.

**The spend-and-tax hypothesis:**

According to the spend-and-tax hypothesis, the level of spending is first determined by the government and then tax policy and revenue are adjusted to accommodate the desired level of spending. A version of this hypothesis is suggested by Roberts (1978), and Peacock and Wiseman (1979) according to whom crisis situations (due to for example wars, natural disasters, or deep recessions) justify temporary increases in expenditures and taxes to pay for them. However, tax increases may become permanent; reflecting an upward adjustment in the level of tax tolerance of the citizens and their attitude towards the proper size of the government after the crisis has passed. This in turn allows for a permanent increase in the level of government expenditures.
Another version of this hypothesis is based on the works of Barro (1974, 1979, 1986). In his tax smoothing hypothesis, government spending is considered as an exogenous variable to which taxes adjust. Moreover, the intertemporal budget constraint requires that an increase in current expenditures be matched by higher future taxes. Barro, therefore, rejects the notion that the taxpayers suffer from fiscal illusion. Quite the contrary, within the framework of the Ricardian equivalence theorem, he maintains that taxpayers are sophisticated, or rational, enough to see that an increase in the current debt in nothing but a delayed form of taxation. Taxpayers are, therefore, expected to fully capitalize the future tax liability.

As pointed out by von Furstenberg et al. (1992), changes in spending can precede changes in taxes if a political majority raises pre-election expenditures, which are then paid for by subsequent post-election tax increases, or if they cut taxes as a compensation for earlier decisions to restrain expenditures. Since it is changes in expenditures that drive changes in taxes in this scenario, the preferred approach to fiscal deficit reduction relies on cutting expenditures.

**The fiscal synchronization hypothesis:**

Reflecting the traditional theories for the demand for public goods (Musgrave, 1966; Meltzer and Richard, 1981), the fiscal synchronization hypothesis states that changes in taxes and expenditures occur concurrently. It is postulated that the desired level of public expenditures and the level of taxation needed to support it are jointly determined by the electorates based on appraisal and comparisons of the marginal costs and benefits associated with alternative packages of government spending programs. The implication of this hypothesis is that causal relationship between government revenue and spending is bidirectional.

**The institutional separation hypothesis:**

A major advocate of this view is Wildavsky (1988) who maintains that separate institutions such as the executive and legislative branches of the US government participate in the budgetary process to determine the level of taxation and spending. Budgeting can be incremental and adjustments can be made on the margin if these separate institutions reach a consensus on the fundamentals.

**Literature review:**

For finding the hypothesis and causality between government expenditure and tax revenue previous studies that took place include (k. dhanasekaran, 2001), (s. Hussein), Friedman (1972-1978), Blakely (1986), Marlow (1986), Barro (1999), Wiseman (1979), Owoye (1995) worked on quantity this issue.

The so-called hypothesis tax-spend postulates that government raises tax revenues ahead of engaging in new expenditures (Friedman, 1978; Buchanan and wagner, 1974; Blakely, 1986; Marlow and Manage, 1987; Owoye, 1995).

The spend-tax hypothesis in the other hand, predict that governments spend first and then increase tax revenues to finance their expenditures (Peacock and Wiseman, 1979; Barro,
There is also the fiscal synchronization hypothesis that suggests that governments take decisions about revenues and expenditure simultaneously (Musgrave, 1996; Meltzer and Richard, 1981).

Lastly, there is the possibility of independence as regards the decision to spend and raise revenues (Baghestani and Mcnown, 1994).

This issue has been investigated for a number of countries, but a consensus has not been reached about the nexus between government revenues and expenditures. Ewing and Payne (1998) have examined the case of five Latin American countries finding mixed results for the countries in their sample. Park (1998) looked at the case of Korea and found supporting evidence for the tax-spend hypothesis. The case of India has been recently examined by Dhanasekaran (2001) who found evidence in support of the spend-tax hypothesis. It is evident, therefore, that the question remains empirically unsettled. He concludes for absence of co-integration between both of the variables, and unidirectional causality exist in case of India.

For instance, Friedman (1972, 1978) supports the view that increasing taxes means that one would have just as large a deficit but at a higher level of government expenditures. To him, the direction of causality is from tax revenues to government spending. Buchanan and Wagner (1977) also substantiate this result. Manage and Marlow (1986) find the unidirectional causality running from federal receipts to expenditures. Marlow and Manage (1987) studied this relationship in state and local government finances of the United States. The Granger test detects that tax receipts cause expenditure for state governments. However, there is no significant relationship found between these two variables in local governments. Owode (1995) conducted a study of G7 countries and finds that the direction of causality runs from tax revenues to government expenditures in the case of Japan and Italy. Cheng (1999) in a study of eight Latin American countries detects a similar direction for Columbia, the Dominican Republic, Honduras and Paraguay. On the contrary, Barro (1974), Peacock and Wiseman (1979) support the other view that increased taxes and borrowings are due to increased government expenditures. Pakistan apparently face this situation. Moreover, continuous need for social sector reforms also requires increased development expenditures. Furthermore, Manage and Marlow (1986) find the presence of bidirectional causality between U.S. federal revenues and expenditures for 1929-82. This bidirectional causality is found in more than half the states. Joulfaian and Mookerjee (1990) also support both tax-and-spend & spend-and-tax hypotheses. Owode (1995) confirms this result in G7 countries excluding Japan and Italy.

DATA:

Data that use here taken from 1972-2007 various issues of economic survey of Pakistan, international financial statistics, fifty years of hand book of Pakistanis’ economy and WDI, data choice depend on the availability of data and time period effect after separation of Pakistan.
**Methodology and model:**

**I; THE UNIT ROOT TEST**

A test of stationary (or no stationary) that has become widely popular Over the past several years is the **unit root test**.

\[ Y_t = \rho Y_{t-1} + ut \quad -1 < \rho < 1 \]  \tag{1}

Where \( ut \) is a white noise error term.

if \( \rho = 1 \), that is, in the case of the unit root, it become a random walk model without drift, which is a no stationary stochastic process. Therefore, simply regress \( Y_t \) on its (one period) lagged value \( Y_{t-1} \) and find out if the estimated \( \rho \) is statistically equal to 1? If it is, then \( Y_t \) is no stationary. This is the general idea behind the unit root test of stationary.

For theoretical reasons, Subtract \( Y_{t-1} \) from both sides of equation 1 obtain:

\[ Y_t - Y_{t-1} = \rho Y_{t-1} - Y_{t-1} + ut = (\rho - 1) Y_{t-1} + ut \]

This can be alternatively written as:

Where \( \dot{a} = (\rho - 1) \) and as usual, is the first-difference operator.

In practice, therefore, we test the (null) hypothesis that \( \dot{a} = 0 \). If \( \dot{a} = 0 \), then \( \rho = 1 \), that is we have a unit root, meaning the time series under consideration is no stationary.

Before we proceed to estimate, if \( \dot{a} = 0 \), equation 1 is now

\[ \Delta Y_t = (Y_t - Y_{t-1}) = ut \]

Since \( ut \) is a white noise error term, it is stationary, which means that the first differences of a random walk time series are stationary,

Now first differences of \( Y_t \) and regress them on \( Y_{t-1} \) and if the estimated slope coefficient in this regression (\( \dot{a} \)) is zero or not.

If it is zero, we conclude that \( Y_t \) is no stationary. But if it is negative, we conclude that \( Y_t \) is stationary. The only question is which test we use to find out if the estimated coefficient of \( Y_{t-1} \) is zero or not. Dickey and Fuller have shown that under the null hypothesis that \( \dot{a} = 0 \), the estimated \( t \) value of the coefficient of \( Y_{t-1} \) follows the \( \hat{\dot{a}} \) (tau) statistic.

The actual procedure of implementing the DF test involves several decisions.

a random walk process may have no drift, or it may have drift or it may have both deterministic and stochastic trends. To allow for the various possibilities, the DF test is estimated in three different forms, that is, under three different null hypotheses.

**\( Y_t \) is a random walk:** \( Y_t = \dot{a} Y_{t-1} + ut \) \tag{2}

**\( Y_t \) is a random walk with drift:** \( Y_t = \dot{a} 1 + \dot{a} Y_{t-1} + ut \) \tag{3}

**\( Y_t \) is a random walk with drift around a stochastic trend:** \( Y_t = \dot{a} 1 + \dot{a} 2 t + \dot{a} Y_{t-1} + ut \)
where \( t \) is the time or trend variable. In each case, the *null hypothesis* is that \( \hat{a} = 0 \); that is, there is a unit root—the time series is no stationary. The alternative hypothesis is that \( \hat{a} \) is less than zero; that is, the time series is stationary.

If the null hypothesis is rejected, it means that \( Y_t \) is a stationary.

**The Augmented Dickey–Fuller (ADF) Test**

In conducting the DF test, it was assumed that the error term \( u_t \) was uncorrelated. But in case the \( u_t \) are correlated, Dickey and Fuller have developed a test, known as the *augmented Dickey–Fuller (ADF)* test. This test is conducted by “augmenting” the preceding three equations by adding the lagged values of the dependent variable

\[
Y_t = \hat{a}_1 + \hat{a}_2 t + \hat{a}Y_{t-1} + \sum \hat{a}_i \Delta Y_{t-i} + u_t
\]

where \( \hat{a}_i \) is a pure white noise error term and where \( \Delta Y_{t-i} = (Y_t - Y_{t-1}), \Delta Y_{t-2} = (Y_t - Y_{t-2}), \) etc. The number of lagged difference terms to include is often determined empirically, the idea being to include enough terms so that the error term is serially uncorrelated. In ADF we still test whether \( \hat{a} = 0 \) and the ADF test follows the same asymptotic distribution as the DF statistic, so the same critical values can be used.

**COINTEGRATION:**

We have warned that the regression of a no stationary time series on another no stationary time series may produce a spurious regression. we will find that they both are \( I(1) \); that is, they contain a unit root. Suppose, then, that we regress \( tr \) on \( ge \) as follows:

\[
TR_t = \hat{a}_0 + \hat{a}_1 GE_t + ut
\]

\[
ut = T|R - \hat{a}_1 - \hat{a}_2 GE_t
\]

if \( ut \) is stationary on level, there is co integration and long run relationship is present between both of the variable.

**ERROR CORRECTION MECHANISM; (ECM)**

If \( ge \) and \( tr \) are co integrated; that is, there is a longterm, or equilibrium, relationship between the two. Of course, in the short run there may be disequilibrium. Therefore, one can treat the error term as the “equilibrium error.” And we can use this error term to tie the short-run behavior to its long-run value.

\[
TR_t = a_0 + a_1 \Delta GE_t + a_2 ut-1 + et
\]

where \( \Delta \) as usual denotes the first difference operator, \( et \) is a random error term, ECM equation states that \( \Delta GE \) depends on TR and also on the equilibrium error term. If the latter is nonzero, then the model is out of equilibrium. Suppose \( GE \) is zero and \( ut-1 \) is positive. This means TR is too high to be in equilibrium, Since \( a_2 \) is expected to be
negative, the term $a_2 u_{t-1}$ is negative and, therefore, $TR_t$ will be negative to restore the equilibrium. That is, if $TR$ is above its equilibrium value, it will start falling in the next period to correct the equilibrium error; hence the name ECM.

**GRANGER CAUSALITY TEST:**

The Granger causality test assumes that the information relevant to the prediction of the respective variables, $TR$ and $GE$, is contained solely in the time series data on these variables. The test involves estimating the following pair of regressions:

$$TR = \sum a_1 GE_{t-1} + \sum a_2 TR_{t-1} + u_t$$

$$GE = \sum a_1 TR_{t-1} + \sum a_2 GE_{t-1} + u_t$$

here it is assumed that the disturbances $u_{1t}$ and $u_{2t}$ are uncorrelated. In passing, note that, since we have two variables, we are dealing with bilateral causality.

1. Unidirectional causality from $GE$ to $TR$ indicated if the estimated coefficients on the lagged $GE$ statistically different from zero as a group and the set of estimated coefficients on the lagged $TR$ statistically different from zero.

2. Conversely, unidirectional causality from $TR$ to $GE$ exists if the set of lagged $TR$ coefficients is not statistically different from zero and the set of the lagged $GE$ coefficients is statistically different from zero.

3. Feedback, or bilateral causality, is suggested when the sets of $TR$ and $GE$ coefficients are statistically significantly different from zero in both regressions.

4. Finally, independence is suggested when the sets of $GE$ and $TR$ coefficients are not statistically significant in both the regressions.

**EMPIRICAL FINDINGS:**

**1. GRANGER CAUSALITY RESULT:**

<table>
<thead>
<tr>
<th>Null Hypothesis:</th>
<th>Obs</th>
<th>F-Statistic</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR does not Granger Cause GE</td>
<td>33</td>
<td>1.16467</td>
<td>0.32669</td>
</tr>
<tr>
<td>GE does not Granger Cause TR</td>
<td></td>
<td>6.12618</td>
<td>0.00621</td>
</tr>
</tbody>
</table>

In case of Pakistan, tax revenues are not cause to government expenditure but $GE$ are cause to $TR$ that shows in Pakistan tax revenue determine after $GE$ and unilateral causality verify the spend than tax hypothesis.

The reader may also presume that since in this study $GE$ is not found to be
dependent on \( TR \), only increasing the tax revenues may tend to reduce the budget deficit. This is rather a difficult question to answer as well as a very strong assumption that could not be suggested only considering the causal relationship between these two variables, which is the basic element of this study. What we need is the ‘effect’ analysis of all the expenditures and revenues separately and in aggregate. Precisely, we need proper cost benefit analyses of any changes in taxation and expenditures if we are to address the problem of the federal deficit.

2. **UNIT ROOT TEST:**

1) First we will check stationary by applying Unit Root, DF/ADF

Null Hypothesis: D(GE) has a unit root  
Exogenous: Constant  
Lag Length: 0 (Automatic based on SIC, MAXLAG=0)

<table>
<thead>
<tr>
<th>Augmented Dickey-Fuller test statistic</th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-6.579640</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Test critical values:  
1% level -3.646342  
5% level -2.954021  
10% level -2.615817


The result shows that GE (government expenditure) is stationary at 1\(^{st}\) difference.

Now for TR (Tax Revenue) Unit Root test results are

Null Hypothesis: D(TR) has a unit root  
Exogenous: Constant

<table>
<thead>
<tr>
<th>Augmented Dickey-Fuller test statistic</th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-9.645681</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Test critical values:  
1% level -3.646342  
5% level -2.954021  
10% level -2.615817

The result shows that TR (Tax Revenue) is stationary at 1\(^{st}\) difference.
3. ENGEL GRANGER COINTEGRATION:

After checking the stationary in order to check long run relationship find out by applying Angle Granger test

<table>
<thead>
<tr>
<th>Augmented Dickey-Fuller test statistic</th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-6.138278</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.639407
- 5% level: -2.951125
- 10% level: -2.614300

The result is significant shows that there exists long run relationship between the tax revenue and government expenditure.

4. ECM:

To check short run relationship between we have applied ECM (Error Correction Model).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.214262</td>
<td>0.363038</td>
<td>-0.590193</td>
<td>0.5598</td>
</tr>
<tr>
<td>D(TR(-1))</td>
<td>0.372438</td>
<td>0.172365</td>
<td>2.160757</td>
<td>0.0394</td>
</tr>
<tr>
<td>D(GE)</td>
<td>1.780839</td>
<td>0.354243</td>
<td>5.027167</td>
<td>0.0000</td>
</tr>
<tr>
<td>D(GE(-1))</td>
<td>0.724903</td>
<td>0.401885</td>
<td>-1.803755</td>
<td>0.0820</td>
</tr>
<tr>
<td>R(-1)</td>
<td>1.402720</td>
<td>0.250800</td>
<td>-5.592974</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

The results are significant shows that there is disequilibrium present between GE and TR in the short run, it will restore for equilibrium in the long run by speed of 140.
CONCLUSION AND POLICY IMPLICATION:

In this study, the causal relationship between Total Expenditures and Tax Revenue has been analyzed. In general, our results support the hypothesis that government expenditure causes revenues. The result that TR does not cause GE can best and only be explained by the political economy of Pakistan where the main expenditures are the outlays chiefly determined politically by bureaucratic and military influence (defense, debt servicing, general administration). Most of these consumption expenditures pose self and/or group interests rather than overall welfare. Although debt servicing is a liability transfer from previous periods, it is included here too because the debts taken have not been reflected in increased development and other investment expenditure over the years and have arguably been used for self interests rather than communal welfare by politicians.

For that matter, a major portion of development expenditure in Pakistan is the residual amount left over from different consumption expenditure heads in provincial accounts (Net Capital Receipts, Net Public Account Receipts, for instance). Whenever the political need (or greed) of consumption expenditure is higher, there is little left as residual to self-finance the development expenditure by provinces.

There is also a long run and short run relationship present between both of the variables.

Furthermore, seeing that our tests can not guarantee the final benchmark resolution of the issue of reducing the deficit, we can obviously not support increasing tax revenues over decreasing expenditure. Only reducing the expenditures can not solely be acclaimed; rather, what we need primarily is (i) reduction in the size of large consumption outlays and their shifting towards development and other investment expenditures, thereby moving towards Pareto optimal solutions. In addition, the presence of and dependence on the political factors in determining the preferences for expenditures can interrupt any step taken to correct for the revenue-expenditure gap. Therefore (ii) in determining the new outlays, economic efficiency should be preferred over political determination. In addition, as is the focal point of this paper, results suggest that besides the Tax & Tariff Reform programme of the government which emerged and was enhanced during the 90s, we strongly need an expenditure reform curriculum in which comprehensive cost-benefit analyses should be conducted for government expenditures together with the analyses of adopting optimal approach for gradual shifting and reformation. This whole scenario should be scrutinized in a general equilibrium framework so that the effect and distributional consequences of any expenditure could be spread over the entire economy. Besides considering only the revenue generation from Tax and Tariff reforms, expenditure reforms analysis should be considered as the task that will determine the direction and deployment of revenue raised from Tax and Tariff Reforms. Once the optimal expenditures are identified, it will be 'economically efficient' to set targets for tax collections and revenue utilization.
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