AN EMPIRICAL INVESTIGATION FOR THE TWIN DEFICITS HYPOTHESIS IN PAKISTAN

Tahir Mukhtar, Muhammad Zakaria and Mehboob Ahmed*

Pakistan constitutes a valuable case study for investigating the dynamics of persistently high rates of budget and current account deficits. In this paper an attempt has been made to empirically test the twin deficits hypothesis in Pakistan using quarterly time-series data for the period 1975 to 2005. The co-integration results indicate the existence of a long-run relationship between the deficits, while the Granger-causality test shows that bi-directional causality runs between the two variables. This finding casts doubt on the validity of the use of single-equation approach to analyze the twin deficits hypothesis. This implies that a more fruitful inquiry into the relationship between budget and current account deficits should be performed in the context of a simultaneous-equation model.

1. Introduction

Like most developing countries a steady budget deficit in Pakistan is considered to be the primary cause of all major ills of the economy. It has varied between 2.4 to 8.8 percent during the last two and half decades. On the other hand, the current account deficit varied between 0.7 to 7.2 percent during the same period. It remains a controversial issue that variations in fiscal policy can lead to predictable developments in an open economy’s performance on current account. An important aspect of this issue concerns what is termed as the twin deficits hypothesis, according to which budget deficits and current account balances are very closely related so that reductions in the former are both necessary and sufficient conditions to obtain improved performance

* The authors are respectively Ph.D Scholars at the Department of Economics, Quaid-i-Azam University, Islamabad and Assistant Professor, Department of Economics, Allama Iqbal Open University, Islamabad.
in the later. The question about causality between the government budget balance and the current account balance is very important to investigate. If it is the case that an unbalanced budget causes predicted changes in current account then fiscal policy should be more prudent.

More elaborate explanations in support of the twin deficits hypothesis draw upon the quantitative perspectives provided in the context of the famous Mundell - Fleming framework of 1960s, Blanchard’s (1985) overlapping generations model and ensuing versions put forth by Auerbach and Kotlikoff (1987) and other researchers who have attempted to resolve the question through complex mathematical simulations.

An examination of the representative literature on the underlying association of the twin deficits renders four alternative causal hypotheses as follows: (1) budget deficits cause current account deficits, (2) current account deficits cause budget deficits, (3) there is a bi-directional causality between the two variables, and (4) the two deficits are not casually related. Only hypothesis (1) is consistent with the conventional view that higher budget deficits are the main cause of higher current account deficits, though all four hypotheses are equally plausible on a priori theoretical grounds. For example, hypothesis (2) contends that the falling off of net exports, caused by factors other than the budget deficits, may impose increasing pressures on the government to expand its various spending programs. It is of course widely believed that during 1980s large current account deficits in the United States had harmed domestic manufacturing industries leading to unemployment and losses in foreign market shares. The agricultural sector also faced serious financial crises due to the weak trade performance. These deleterious economic and financial consequences of the current account deficits were understandably viewed with much concern in the United States by the business community, by labor leaders and, perhaps as a result, also by government officials. Government spending programs, therefore, might have been consciously expanded to aid farming sector and several manufacturing industries. Not only had government spending been increased, but government revenues had also declined due to depressed business activities in the export sector, and due to the automatic stabilizing aspect of fiscal policy. Under this scenario, therefore, it would be inappropriate to characterize the observed strong correlation between
budget and current account deficits as one in which the former causes the latter in the United States. Of course, should causality be at least in part from current account deficit to budget deficit, as hypothesis (2) contends, then most previous studies in this area would suffer from simultaneous-equation bias rendering them biased and inconsistent.

Although the conventional view implies a significant association between the two variables, so do alternative hypotheses with quite different policy implications. If large budget deficit has not in fact caused high current account deficit, then focusing on measures to reduce budget deficit will not resolve the problem and, moreover, will divert attention from more relevant and urgently needed policy options that address productivity, competitiveness in foreign markets, and export promotion programs.

The persistent existence of budget deficit and current account deficit has been an important issue for policy makers in Pakistan. Moreover, given the emphasis on free trade, decentralization and growth, there is a need to understand the connection of fiscal and current account imbalances in Pakistan economy. For this purpose, the present study employs cointegrating technique, error correction model and causality test to investigate twin deficits phenomenon in Pakistan.

The rest of the paper is organized as follows. Section 2 provides literature review. Analytical framework is presented in section 3. Data description and empirical findings are given in section 4. The final section concludes the study.

2. Literature Review

The question of relationship between budget and current account deficits started to draw researchers’ attention in the 1980’s. At that time record budget deficit (BDEF) and current account deficit (CAD) emerged in many countries, including the United States. The twin deficits hypothesis asserts that an increase in budget deficit will cause a similar increase in current account deficit. But results of testing this hypothesis turned out different for different countries. Moreover, the results differ even in case of using different econometric techniques and model specifications for the same country data.

Although the present study does not include all studies of the twin deficits problem, we can see that the topic is interesting and different results for different countries may be got. Therefore, we want to investigate whether the statistical relationship between the government budget deficit and current account deficit in Pakistan is unidirectional, bi-directional or the two variables do not influence each other. To identify the relationship between the two time-series, cointegration and Granger causality tests are employed.

3. Analytical framework

3.1. Theoretical Basis for the Twin Deficits Hypothesis

Economic reasoning for connection between budget deficit and current account balance may be traced from the national income identity,

\[ Y = C + I + G + (X - M) \]  \hspace{1cm} (3.1)

where Y, C, I and G stands for national income, private consumption, investment spending and government expenditures respectively; while X
and M represents exports and imports of goods and services respectively. We define current account (CA) balance as:

$$CA = (X - M) + F$$

where $F$ stands for net income and transfer flows. Thus, in addition to goods and services balance, the current account also includes income received from abroad or paid abroad and unilateral transfers. For simplicity, here we assume that net income form abroad and unilateral transfers are not large items in the current account. Therefore, the term $F$ from the above equation can be excluded.

The current account shows the size and direction of international borrowing. When a country imports more than its exports, it has current account deficit, which is financed by borrowing from abroad. Such borrowing may be done by government (credits from the other governments, the international institutions or from private lenders) or by private sector of the economy. Private firms may borrow by selling equity, land or physical assets. So, a country with current account deficit must be increasing its net foreign debt (or running down its net foreign wealth) by the amount of the deficit. A country with current account deficit is importing present consumption and/or investment (if investment goods are imported) and exporting future consumption and/or investment spending.

According to the national income identity, national saving (S) in an open economy equals:

$$S = Y - C - G + CA$$

Alternatively the above equation can be written as:

$$S = I + CA$$

where $Y - C - G = I$ and $I$- stands for Investment.

It is worth to look at national saving more closely. We distinguish national saving between saving decisions made by the private sector ($S_p$) and saving decisions made by the government ($S_g$). Mathematically, we have,
\[ S = S_p + S_g \] (3.5)

\( S_p \) is that part of personal disposable income (i.e. income after tax) that is saved rather than consumed. In general we have:
\[ S_p = Y_d - C = (Y - T) - C \] (3.6)

where \( Y_d \) is personal disposable income, and \( T \) is tax collected by the government. Government saving \( (S_g) \) is defined as difference between government revenue collected in the form of taxes \( (T) \) and expenditures which is done in form of government purchases \( (G) \) and government transfers \( (R) \). Mathematically, we have
\[ S_g = T - (G + R) = T - G - R \] (3.7)

Now equation (3.5) in an identity form can be written as:
\[ S = S_p + S_g = (Y - T - C) + (T - G - R) = I + CA \] (3.8)

In order to analyze the effects of government saving decisions in an open economy, the above identity can be written as:
\[ S_p = I + CA - S_g = I + CA - (T - G - R) \] (3.9)

or alternatively we can have:
\[ CA = S_p - I - (G + R - T) \] (3.10)

where the term in parenthesis is consolidated public sector budget deficit \( (BDEF) \), that is, as government saving preceded by a minus sign. The government deficit measures the extent to which the government is borrowing to finance its expenditures. Equation (3.9) states that a country’s private saving can take three forms: investment in domestic capital \( (I) \), purchases of wealth from foreigners \( (CA) \), and purchases of the domestic government’s newly issued debt \( (G + R - T) \).

Looking at the macroeconomic identity (3.10), we can see that two extreme cases are possible. If we assume that difference between private savings and investment is stable over time, the fluctuations in the public
sector deficit will be fully translated to current account and the twin deficits hypothesis will hold. The Public sector includes general government (local and central) and non-financial public enterprises (state enterprises like railroads, public utility and other nationalized industries). The second extreme case is known as Ricardian Equivalence Hypothesis, which assumes that change in the budget deficit will be fully offset by change in savings. The explanation is the following: a tax cut does not affect households’ lifetime wealth because future taxes will go up to compensate for the current tax decrease. So, current private saving \((S_p)\) rises when taxes fall (or accordingly budget deficit rises): households save the income received from the tax cut in order to pay for the future tax increase. Hence, a budget deficit would not cause a twin deficit.

3.2. Econometric Methodology

3.2.1. Cointegration Test

The concept of cointegration was first introduced by Granger (1981) and elaborated further by Engle and Granger (1987), Phillips and Ouliaris (1990) and Johansen (1991), among others. Engle and Granger cointegration (i.e. long run relationship) test requires that

- Time-series, say \(Y_t\) and \(X_t\), are non-stationary in levels but stationary in first differences i.e. \(Y_t \sim I(1)\) and \(X_t \sim I(1)\).

- There exists a linear combination between these two series that is stationary at levels i.e. \(\nu_t = Y_t - \hat{\alpha} - \hat{\beta}X_t \sim I(0)\).

Thus, the first step for cointegration is to test whether each of the univariate series is stationary or not. If they both are stationary say at first difference i.e. they are \(I(1)\), then we may go to the second step to verify the long run relationship between them.

Augmented Dickey Fuller (ADF) test is usually applied to test stationarity. It tests the null hypothesis that a series \((Y_t)\) is non-
stationary by calculating a $t$-statistics for $\beta = 0$ in the following equation:

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \gamma_i + \sum_{k=2}^{n} \delta_k \Delta Y_{t-k} + \varepsilon_i$$  \hspace{1cm} (3.11)$$

where $\Delta Y_t = Y_t - Y_{t-1}$, $\Delta Y_{t-k} = Y_{t-k} - Y_{t-k-1}$ and $k = 2,3,\ldots,n$. While $\alpha$, $\beta$, $\gamma$ and $\delta$ are the parameters to be estimated and $\varepsilon_i$ is white noise error term.

If the value of the ADF statistic is less than the critical value at the conventional significance level (usually the five per cent significant level) then the series ($Y_t$) is said to stationary and vice versa. If $Y_t$ is found to be non-stationary then it should be determined whether $Y_t$ is stationary at first differences i.e. $\Delta Y_t = Y_t - Y_{t-1} \sim I(0)$ by repeating the above procedure. If the first difference of the series ($\Delta Y_t$) is stationary then the series ($Y_t$) may be concluded as integrated of order one i.e. $Y_t \sim I(1)$. Now we can move to the second step to check cointegration.

In order to test cointegration, we will apply two-step residual based test of Engle and Granger (1987). In the first step we apply OLS to the following regression equation in which all variables are found to be integrated of the same order [e.g. $I(1)$].

$$Y_t = a + bX_t + \nu_t$$  \hspace{1cm} (3.12)$$

The second step involves testing whether the residual term $\nu_t$ from the cointegrating regression equation (2) is stationary [i.e.$\nu_t \sim I(0)$] using a modified ADF test

$$\Delta \nu_t = \theta \nu_{t-1} + \sum_{k=2}^{n} \theta_k \Delta \nu_{t-k} + \mu_t$$  \hspace{1cm} (3.13)$$

where $\nu_t$, $\nu_{t-1}$, $\nu_{t-k}$ and $\nu_{t-k-1}$ are, respectively, residuals at time $t$, $t-1$, $t-k$ and $t-k-1$. While $\theta$ and $\theta_k$ are parameters to be estimated and $\mu_t$ is the residual term.
The constant and the time trend are omitted from the ADF test because the residual from the cointegrating regression will have a zero mean and be de-trended. The null hypothesis of $\vartheta = 0$ is tested to check the stationarity of the residual. If the value of $t$-statistic of the $\vartheta$ coefficient is less than the critical value then the null hypothesis of non-stationarity is rejected and the residual is found to be stationary at levels. This, in turn, leads to the conclusion that long-run cointegration holds between two time-series.

### 3.2.2. Error Correction Model (ECM)

If time-series are $I(1)$, then one could run regressions in their first differences. However, by taking first differences, we lose the long-run relationship that is stored in the data. This implies that one needs to use variables in levels as well. Advantage of the Error Correction Model (ECM) is that it incorporates variables both in their levels and first differences. By doing this, ECM captures the short-run disequilibrium situations as well as the long-run equilibrium adjustments between variables. An ECM formulation, which describes the relationship between $tY$ and $tX$, can be presented as

$$
\Delta Y_t = \omega_1 + \omega_2 \Delta X_t - \rho \hat{\nu}_{t-1} + \nu_t 
$$

In this model, $\omega_2$ is the impact multiplier (the short-run effect) that measures the immediate impact that a change in $X_t$ will have on a change in $Y_t$. On the other hand, $\rho$ is the feedback effect or the adjustment effect that shows how much of the disequilibrium is being corrected, that is the extent to which any disequilibrium in the previous period affects any adjustment in the $Y_t$ period.

### 3.2.3. Granger Causality Test

If a pair of series is cointegrated then there must be Granger-causality in at least one direction, which reflects the direction of influence between series. Theoretically, if the current or lagged terms of a time-series variable, say $X_t$, determine another time-series variable, say $Y_t$, then
there exists a Granger-causality relationship between $X_t$ and $Y_t$, in which $Y_t$ is Granger caused by $X_t$. From the above analysis, the model is specified as follows.

$$
\Delta Y_t = \theta_{1t} \Delta Y_{t-1} + \ldots + \theta_{nt} \Delta Y_{t-n} + \theta_{2t} \Delta X_{t-1} + \ldots + \theta_{2n} \Delta X_{t-n} - \gamma_1 (Y_{t-1} - \alpha X_{t-1} - \delta) + \epsilon_{1t} \\
(3.15)
$$

$$
\Delta X_t = \theta_{3t} \Delta X_{t-1} + \ldots + \theta_{3n} \Delta X_{t-n} + \theta_{4t} \Delta Y_{t-1} + \ldots + \theta_{4n} \Delta Y_{t-n} - \gamma_2 (Y_{t-1} - \alpha X_{t-1} - \delta) + \epsilon_{2t} \\
(3.16)
$$

The following two assumptions are tested using the above two models to determine the Granger causality relationship between prices.

$$
\theta_{21} = \cdots = \theta_{2n} = \cdots = \gamma_1 = 0 \text{ (no causality from } X_t \text{ to } Y_t) \\
\theta_{41} = \cdots = \theta_{4n} = \cdots = \gamma_2 = 0 \text{ (no causality from } Y_t \text{ to } X_t) 
$$

4. Data, Estimation and Interpretation of Results

The study uses quarterly observations for the period 1975 to 2005. The main focus of this paper is on government budget deficit (BDEF) and current account deficit (CAD). The data, seasonally unadjusted and expressed in nominal terms, is obtained from various issues of *International Financial Statistics*, International Financial Corporation and *Economic Survey*, Government of Pakistan. Both the BDEF and CAD are expressed as ratios of the nominal GDP.

Economic time-series data are often found to be non-stationary, containing a unit root. Ordinary Least Squares (OLS) estimates are efficient if variables included in the model are stationary of the same order. Therefore, first we need to check the stationarity of BDEF and CAD. For this purpose we apply Augmented Dickey-Fuller (ADF) test. Table 1 gives the results of ADF tests. Based on the ADF tests, BDEF and CAD appear to be stationary at levels but non-stationary at first difference. Thus, we may conclude that these variables are integrated of order one i.e. $I(1)$. 

Table 1. Augmented Dickey-Fuller (ADF) Test on the Levels and on the First Difference of the Variables (1975Q1 – 2005Q4)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Level</th>
<th>First Difference</th>
<th>Mackinnon Critical Values for Rejection of Hypothesis of a Unit Root</th>
<th>Decision</th>
<th>Order of Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budget Deficit (BDEF)</td>
<td>-0.8135</td>
<td>-13.1953</td>
<td>-2.5824 -1.9425 -1.6171</td>
<td>Nonstationary at level but stationary at first difference</td>
<td>I (1)</td>
</tr>
<tr>
<td>Current Account Deficit (CAD)</td>
<td>-0.1360</td>
<td>-7.9625</td>
<td>-2.5824 -1.9425 -1.6171</td>
<td>Nonstationary at level but stationary at first difference</td>
<td>I (1)</td>
</tr>
</tbody>
</table>

Now we test cointegration between BDEF and CAD in Pakistan. This would help us to identify, if there exists, an equilibrium relationship between these two variables. Results of regression equation (3.12) and ADF test for the residual, $\nu_t$, are presented in Tables 2 and 3 respectively. We can see that the residual is stationary at level that is it is integrated of order zero. This validates our proposition that BDEF and CAD are indeed cointegrated that is a long-run relationship between them holds.

Table 2. Empirical Findings of the Model (1975Q1-2005Q2)

<table>
<thead>
<tr>
<th>Dependent Variable: Current Account Deficit (CAD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>-2.5133</td>
</tr>
<tr>
<td>(-1.5864)</td>
</tr>
<tr>
<td>Budget Deficit (BDEF)</td>
</tr>
<tr>
<td>0.8164</td>
</tr>
<tr>
<td>(10.6123)*</td>
</tr>
<tr>
<td>AR (1)</td>
</tr>
<tr>
<td>0.5196</td>
</tr>
<tr>
<td>(6.6313)*</td>
</tr>
<tr>
<td>$R^2$</td>
</tr>
<tr>
<td>0.7052</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
</tr>
<tr>
<td>0.6917</td>
</tr>
<tr>
<td>DW</td>
</tr>
<tr>
<td>2.0993</td>
</tr>
<tr>
<td>F-Stat</td>
</tr>
<tr>
<td>138.9012</td>
</tr>
<tr>
<td>Prob (F-Stat)</td>
</tr>
<tr>
<td>0.0000</td>
</tr>
<tr>
<td>Number of Obs.</td>
</tr>
<tr>
<td>123</td>
</tr>
</tbody>
</table>

Note: Values in parentheses show t-statistics. The statistics significant at 5 % level of significance are indicated by *. 
Table 3. Augmented Dickey-Fuller Test for the Residuals

<table>
<thead>
<tr>
<th>Estimated Residuals</th>
<th>1%</th>
<th>5%</th>
<th>10%</th>
<th>Decision</th>
<th>Order of Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \nu_t )</td>
<td>-11.9684</td>
<td>-2.5825</td>
<td>-1.9426</td>
<td>-1.6171 Stationary at level</td>
<td>( I(0) )</td>
</tr>
</tbody>
</table>

In order to check stability of long-run relationship between BDEF and CAD, we estimate Error-Correction Model. The results are presented in Table 4. The short run effect of BDEF on CAD is insignificant, while the long run adjustment impact of BDEF on CAD is significant. The adjustment parameter \( \rho \) appears with negative value indicating the long-run convergence. The ECM estimation reveals that 72% of the disequilibrium in CAD produced by BDEF would be adjusted in every quarter. Thus, there is a stable long-run relationship between BDEF and CAD.

Table 4. Empirical Findings of Error Correction Model

<table>
<thead>
<tr>
<th>Dependent Variable: ( D(\text{CAD}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>D(BDEF)</td>
</tr>
<tr>
<td>( \rho )</td>
</tr>
<tr>
<td>( R^2 )</td>
</tr>
<tr>
<td>Adjusted ( R^2 )</td>
</tr>
<tr>
<td>DW</td>
</tr>
<tr>
<td>F-Stat</td>
</tr>
<tr>
<td>Prob(F-Stat)</td>
</tr>
<tr>
<td>Number of Obs.</td>
</tr>
</tbody>
</table>

Note: Values in parentheses show t-statistics. The statistics significant at 5% level of significance are indicated by *. 
To check the causal relationship between the variables we have applied Granger-causality test using lag length up to four periods. The following four hypotheses are tested.

1. BDEF Granger causes CAD
2. CAD Granger causes BDEF
3. Causality runs in both directions
4. BDEF and CAD are independent

The results are filed in Table 5. The results show that the hypothesis that BDEF does not Granger cause CAD is rejected. This, of course, accords with the conventional hypothesis (1). But, one should immediately note that in the same table the null hypothesis that CAD does not Granger-cause BDEF is also rejected. It validates the reverse hypothesis (2). These results, taken together, support hypothesis (3) and suggest that while budget deficit has caused current account deficit, strong significant feedback does exist which in effect makes causality between the two variables rather bi-directional. Consequently, the high association between budget and current account deficits observed in last two and half decades in Pakistan appears to be at least partly the outcome of the government’s preoccupation with the size of the current account deficit. This finding additionally implies that any investigation of the impact of budget deficit on current account deficit should be performed within a simultaneous-equation model. Consequently, one may argue that previous studies in this area that a priori assume budget deficit to be exogenous could be biased and inconsistent.

Table 5. Causality Patterns

<table>
<thead>
<tr>
<th>Lagged Years</th>
<th>Null Hypothesis</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No causality from BDEF to CAD rejected</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No causality from CAD to BDEF rejected</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>No causality from BDEF to CAD rejected</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No causality from CAD to BDEF rejected</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>No causality from BDEF to CAD rejected</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No causality from CAD to BDEF rejected</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>No causality from BDEF to CAD rejected</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No causality from CAD to BDEF rejected</td>
<td></td>
</tr>
</tbody>
</table>
5. Conclusions

Pakistan constitutes a valuable case study for investigating the dynamics of persistently high rates of budget deficit and current account deficit. The aim of this paper is to examine empirically the conventional argument that the budget deficit significantly affect current account deficit in Pakistan. Generally, empirical support for this proposition in an economy has been primarily based either on direct observation of the data or on some correlation-based analyses. Such an approach is clearly inadequate to identify the nature of the causal linkage between budget and current account deficits. Indeed, analyses of this type cannot discriminate between four alternative but equally plausible hypotheses, each with different policy implications. These are that budget deficits cause current account deficits (the conventional view), that current account deficits cause budget deficits, that there is a bi-directional causality between the two variables and finally that both variables (although highly correlated) are causally independent. The causality approach, therefore, provides a useful means of discriminating among these alternative hypotheses.

The present study uses quarterly data for Pakistan for the period 1975 to 2005 on budget deficit and current account deficit and is based on cointegration analysis, ECM strategy and Granger causality tests. The empirical results only partially support the conventional view that budget deficit has positive and significant long run causal effect on current account deficit in Pakistan. We do find evidence of budget deficit-to-current account deficit causality, but also find, perhaps an equally stronger, evidence of current account deficit-to-budget deficit causality. Such bi-directional causality link is consistent with the third alternative hypothesis and is of course suggestive of a simultaneous determination of these two key variables. If true, this finding casts serious doubt on the validity of the use of single-equation approach to empirically test the twin deficits hypothesis. Indeed, this implies that a more fruitful inquiry into the relationship between budget and current account deficits should be performed in the context of a simultaneous-equation model.
References


