Twin Deficits Hypothesis: An Empirical Analysis in the Context of India

Papia Mitra, Gholam Syedain Khan
Research Fellows, University of Calcutta-Calcutta Stock Exchange
Centre of Excellence in Financial Markets (CUCSE-CEFM), Department of Commerce
University of Calcutta, Kolkata, West Bengal, India

ABSTRACT

The twin deficits hypothesis says that the current account deficit and the fiscal deficit move together, at least in long run. This paper analyses the twin deficits hypothesis in India covering the period April, 1994-95 to July, 2013-14. In order to fulfil the objectives, the paper starts with a descriptive statistics to check the presence of normality in the frequency distribution followed by unit root test of non-stationarity. The presence of short run and long run relationship among the concerned variables, current account balance and fiscal balance has been tested by applying Cointegration Test followed by Error Correction Mechanism, Wald test and Granger-Causality Test. Finally, it ends with the estimation of growth rate of the variables over the period applying simple regression model. The Wald Test and Granger-Causality Test results claim that there exists bi-directional causality among the variables in short run whereas, the Cointegration Test and Error Correction Mechanism results claim unstable long run equilibrium. Moreover, there has been a positive growth of both the variables with the fiscal balance growing at a higher rate. Hence, the twin deficits hypothesis is confirmed in India in the post-liberalization period.

Keywords: Twin deficits, Unit Root Test, LM Test, Cointegration Test, Error Correction Model, Wald Test, Impulse Response Function, Granger-Causality Test.

I. INTRODUCTION

An economy that experiences both the current account and fiscal deficits is termed as Twin Deficit Economy. Under this situation, the country needs both the domestic and foreign savings to manage its deficits. The twin Deficits hypothesis says that the current account deficit and fiscal deficit move together, at least in long run. This paper tries to test for the validity of twin deficit hypothesis in Indian context using monthly data from April, 1994 to July, 2013. The highly volatile current account deficit (CAD) over the period of analysis induced the economy to experience two financial crisis in two consecutive decades. Also the fiscal deficit had been quite high. When both the deficits increase in high magnitude, it is quite obvious to test for the twin deficits hypothesis in Indian context.

Theoretically, there are may exist four different relationship between current account balance and fiscal balance. They are as follows:

1. There is bi-directional relationship between current account deficit and fiscal deficit.
2. Current account deficit causes fiscal deficit.
3. Fiscal deficit causes current account deficit.
4. No relationship among the two variables.

As per the Mundell-Fleming Model of open macroeconomics, fiscal deficit causes current account deficit. Fiscal deficit is caused due to government’s expansionary fiscal policy. The tools with which the policy can be implemented are: increase in government expenditure and decrease in tax rate. In all these situations, the aggregate demand in the economy gets expanded followed by rise in National
Income. This rise in national income further induces the import to increase, thereby, leading to trade deficit and current account deficit.

In twin deficits framework, rise in fiscal deficit in an open economy will induce the domestic rate of interest to rise above the world rate of interest causing capital inflows into the domestic economy. Hence, the exchange rate gets appreciated leading to trade deficit and current account deficit. However, in many situations, Current account deficit causes fiscal deficit. Current account deficit of high magnitude leads to financial crisis in the economy. Hence, in order to come back out of this crisis, the government opts for expansionary fiscal policy leading to fiscal deficit (Burnside, 2004). This may again further lead to current account deficit implying a ccbi-directional causality among the variables.

Under the Ricardian Equivalence Hypothesis (REH) based on Permanent-Income-Life-Cycle Hypothesis, there prevails no relationship among current account deficit and fiscal deficit. An increase in government deficit will not affect the lifetime income of the household sector. Thereby, there will be no change in equilibrium levels of current account, interest rates, consumption and investment. Barro’s Debt Neutrality Hypothesis claims that rise in government deficit will be fully offset by the rise in private savings leading to no change in national savings (Barro, 1988).

II. TRENDS AND PATTERNS OF TWIN DEFICITS IN INDIA

India has been experiencing twin deficits since 1980-81. The fiscal deficit of the central government has remained at 5.8 percent on an average during the period 1980-2010. The main reason behind the financial crisis of 1991 was the inability to finance the high current account deficit via capital inflows leading to BOP crisis. However, later in 1990s, the researchers investigated that it was the financial crisis in mid 1980s that led to BOP crisis in the next decade. In the first half of the 1980s, the fiscal deficit was around 6 percent to 7.5 percent whereas, it rose to 9 percent in the next half. However, the investment that was financed by the external borrowing turned out to be inadequate. The confidence in economy went down leading to BOP crisis. This BOP crisis acted as a catalyst for a wider crisis realised in future. However, much-needed reforms were initiated but still the fiscal deficit continues to persist in high magnitude. The series of economic reforms had been launched to bring about macroeconomic stabilization and implement structural measures to push up growth.

The high and persistent fiscal deficit remains the main cause of worry for the policymakers. However, the current account deficit was lesser in magnitude. The fiscal deficit turned out to be driven more by the revenue deficit in the 90s. By 1990s, the fiscal deficit and current account deficit rose at 9.4 percent and 3.5 percent respectively. The economic reforms helped the fiscal deficit to get reduced. In the new century, however, the revenue deficit constitutes as much as one-third of the fiscal deficit. This was mainly due to the introduction of Fiscal Responsibility and Budget Management Act (FRBM) introduced in 2003-04. The Act has reduced the fiscal deficit by 0.3 percent per year to a level of 3 percent. The targets were to be achieved by 2008-09. However, the combined fiscal deficit fell to 4.2 percent in 2007-08 (well below the targeted 6 percent). The combined deficit (state government fiscal deficit+ central government deficit) came down to 4.2 percent of GDP in 2007-08. However, it had increased suddenly in the next two years. The main reasons for this rise in fiscal deficit was the implementation of social security schemes under National Rural Employment Guarantee Act (NREGA), subsidies for food, fertilizers and petroleum and the Sixth Pay Commission Award. It rose to 8.9 percent in 2008-09. High government expenditure improved the domestic demand of the economy, especially in the rural sector. This has prevented the domestic demand from falling with the contraction of Indian exports. However, 2009-10 experienced fiscal deficit of more magnitude. Moreover, the debt obligation of the central government is a significant part of the fiscal
deficit. In 1980-81, the debt-burden accounted to about one-third of the fiscal deficit which had increased over to 50 percent in 1990-91.

The current account deficit also started to widen with the recovery of the economy. The most important part of the current account balance is the balance of trade. Hence, a current account deficit is associated with the trade deficit. A negative net export is the main contributor of current account deficit. India imports crude oil and gold in huge amount. These are the biggest contributors to the trade gap. In addition to the oil and gold import, the other contributors of trade deficit are factor income paid to abroad, government grants made to the foreigners, direct investment outflow and bank loans to the residents of the country. During the financial crisis in 1991, the current account deficit was above 3 percent. However, various structural reforms made the current account to run in surplus between 2001-02 and 2003-04. Again 2004-05 onwards, the current account experienced deficit in high magnitude. The merchandise trade deficit had increased from 2.1 percent in 2002-03 to 10.2 percent in 2011-12. This percentage rise in the first decade of the 21st century was the highest in magnitude among all the decades in the post-independence period.

The CAD in India is mainly financed by the short-term flows like ECB, FII and short term trade deficit etc. However, the pattern of trends was similar in the pre-reform and post-reform period, though CAD in the post-reform period included debt flows as well as equity flows leading to widening of CAD.

**Figure 1: Trends in India’s Current Account Deficit and Fiscal Deficit (April 1994-July 2013)**

III. LITERATURE REVIEW

The twin deficits hypothesis continued to be one of the most interesting parts of macroeconomic theory among the researchers since 1980s. This was due to the large deficits in the fiscal balance and current account balance realised in many economies across the globe including the United States. The twin deficits hypothesis claims that there exists a significant long run relationship between the current account deficit and fiscal deficit. Yanik (2006), Zengin(2000) and Iyidigan (2013) tried to test the hypothesis in Turkish context using various econometric tests. Yanik (2006) incorporated some estimates of the cyclical and structural components and some related macroeconomic variables like real exchange rate and real interest rate. However, the cointegration claims the presence of long run relationship among the variables. Fiscal deficit (Current Account Deficit) turned out to be statistically insignificant in the cointegration equation to explain Current Account Deficit (fiscal deficit). The ECM model claims that the error correction terms significantly get deviated from the long run equilibrium. In short run, current account deficit granger causes fiscal deficit but the converse is not true. Zengin (2000) through granger-causality test concluded that fiscal deficit directly causes CAD.
The treasury interest rates have direct impact on fiscal and current account balances. The variance decomposition test supports the twin deficits hypothesis. However, the direction of causality runs from fiscal deficit to current account deficit. Iyidogan (2013) tried to test the hypothesis covering the period 1987-2005 employing Zivot Andrews test of stationarity and Toda Yamamato test of causality. The results claim that the financial crisis in 2001 turned out to be a statistically significant structural break in terms of the twin deficits. However, there was fund a reverse causality running from current account deficit to fiscal deficit in Turkey.

Mukhtar et al. (2007) and Saeed S & Khan A (2012) investigated twin-deficits hypothesis in Pakistan employing Granger-causality tests, error correction model and cointegration test. However, both the paper claims the presence of twin deficits in Pakistan. Fiscal deficit has positive and significant long run causal effect on CAD. However, the reverse causality is higher in magnitude.

Anoru & Ramchander (1998) and Bose and Jha (2011) investigated the twin deficits hypothesis in Indian context. Jha tried to find out the existence of any such causal relationship between the two deficits within a multi-dimensional system with interest rate and exchange rate acting as interlinking variables. However, the results claimed that the causal linkage could be established between fiscal deficit and interest rate and exchange rate. However, none of the variables statistically significantly cause the current account deficit. The direction of causality is seen to run unambiguously from oil prices to the current account deficit to fiscal deficit. Moreover, oil price is seen to cause significant influence in short run on all other variables in the system. Anorus and Ramchander (1998) analysed the twin deficits hypothesis of SEACEN countries including India using panel VAR framework covering the period 1957-1993. The results supported the presence of unidirectional reverse causality from CAD to fiscal deficit with inflation, interest rate and exchange rate playing the role of interlinking variables.

Merza et al. (2012) examined the twin deficits hypothesis for Kuwait covering the period 1993:4-2010:4 incorporating Cointegration test, estimation of VAR model, Impulse Response Funtion and Granger-Causality test. However, Kuwait suffered from unidirectional causality that runs from current account balance to fiscal balance in short run. However, in long run there prevailed negative significant relationship among the two deficits, thereby, rejecting the twin deficits hypothesis. However, Nigerian economy experienced a statistically significant short run and long run bidirectional relationship among the two deficits during the period 1970-2008. Hence, appropriate policy measures that will reduce the fiscal deficit can also play an important role in reducing the current account deficit as well.

IV. OBJECTIVES OF THE PAPER

The paper tries to find out

1. The presence of short and long run causal relationship between the current account balance and fiscal balance in the context of India by applying Cointegration test, Error correction mechanism, Granger-Causality test and Wald Test.

2. Measurement of unexpected changes in one variable and predicting its effects on the future values of the other variables through Impulse Response Function (IRF).

3. The growth rate of Fiscal Balance (FB) and Current Account Balance (CAB) over the entire period of analysis.
V. DATA AND METHODOLOGY

The study is entirely based on secondary data considering two variables, Current account balance (CAB) and Fiscal Balance (FB). The objectives of the study are examined by using time series data covering the period from April 1994-95 to July 2013-14. Relevant data for the study are obtained from the official website of the Reserve Bank of India (RBI).

(a) Twin Deficits Hypothesis: The Theoretical Basis

The relation between fiscal balance and current account balance can be derived from the national income identity:

\[ Y = C + I + G + (X - M) \] ............ (1)

where Y, C, I and G stand for National Income, Private Consumption Expenditure, Investment Expenditure and Government Expenditure respectively. (X-M) is the net exports on goods and services.

The current account balance (CAB) can then be defined as:

\[ \text{CAB} = (X - M) + Z \] ............ (2)

‘Z’ is the net income and transfer flows. Thus the current account also includes income received and paid abroad as well as the unilateral transfers. We have assumed here that ‘Z’ is very negligible and hence, can be omitted.

The current account reflects the size and direction of international borrowing. A country experiences a current account deficit when it imports more than it exports. This deficit is financed by borrowing from abroad. Hence, a country facing the current account deficit will increase its net foreign debt by the amount of the deficit.

As per National Income Accounting, national savings (S) of an open economy is defined as:

\[ S = (Y - C - G) + \text{CA} \] 
\[ \Rightarrow S = I + \text{CA} \] ............ (3)

National savings (S) is the sum of Private Savings (Sp) and Government Savings (Sg). Numerically,

\[ S = S_p + S_g \] ............ (4)

‘Sp’ is the disposable income (Yd) minus the private consumption expenditure (C).

\[ S_p = (Y - T) - C \] ............ (5)

‘Sg’ is the difference between the government revenue, i.e. the taxes (T) and the sum of government expenditure (G) and Transfer Payments (R).

\[ S_g = T - (G + R) = T - G - R \] ............ (6)

Hence, the National Savings (S) can be written as:

\[ S = S_p + S_g = (Y - T - C) + (T - G - R) \] 
\[ \Rightarrow S = I + \text{CA} \] ............ (7)

\[ \Rightarrow S_p + S_g = I + \text{CA} \] 
\[ \Rightarrow S_p = I + CA - S_g = (I + CA) - (T - G - R) \] 
\[ \Rightarrow CA = S_p - I + (T - G - R) \] 
\[ \Rightarrow CA = S_p - I - (G + R - T) \] ............ (8)
The term in the parenthesis is called Fiscal Deficit or Public Savings preceded by a negative sign. It measures the magnitude of the government borrowing to finance its expenditure.

From the last equation, we claim for the possibility of two extreme cases. If we can say that the difference between private savings and investment expenditure is stable overtime, then the fluctuation in fiscal deficit will be entirely translated to the current account and the hypothesis will hold. The second extreme case is the ‘Ricardian Equivalence Hypothesis’ which states that the change in fiscal deficit is fully offset by the change in savings. This holds because, a household’s lifetime income remains unaltered after the tax cut. This is because a rise in current private savings is same in magnitude as the fall in future government savings due to debt obligations to compensate the initial tax cut. Hence, the fiscal deficit would not cause a twin deficit.

(b) Research Methodology

In order to fulfill the objectives of the paper, some statistical tests are used.

1. Finding out the Descriptive Statistics of all the data series (CAB and FB). This is done in order to find out the presence of normality in the frequency distribution.
2. Test for the stationarity of the data series by applying Augmented Dicky-Fuller (ADF) Test.

The models in which ADF test is applied are as follows:-

\[ \Delta \text{CAB}_t = \alpha_1 + \beta_1 t + \delta_1 \Delta \text{CAB}_{t-1} + \ldots + \delta_{p-1} \Delta \text{CAB}_{t-p+1} + \epsilon_t \ldots (1) \]

\[ \Delta \text{FB}_t = \alpha_2 + \beta_2 t + \delta_1 \Delta \text{FB}_{t-1} + \ldots + \delta_{p-1} \Delta \text{FB}_{t-p+1} + \epsilon_t \ldots (2) \]

Here, \( \alpha_s \) are the constants, \( \beta_s \) are the coefficients of the trend term (t) and \( p \) is the lag order of the autoregressive process.

The following null hypothesis is tested:

\[ H_0: \gamma_i = 0 \text{ against } H_1: \gamma_i < 0 \]

In order to find test the above hypothesis, a computed t-statistic has been formulated as

\[ \text{ADF}_\tau = \frac{\gamma_i}{\text{SE}(\gamma_i)} \]

If the absolute value of the computed ADF test statistic turns out to be greater than that of its critical value at 5% level of significance, we reject our null hypothesis where the null hypothesis is the presence of unit root or absence of stationarity. If the original series turns out to be non-stationary then we again go for unit root test at first difference. This process will continue until and unless the series turns out to be stationary.

3. To find out the optimal lag-length of the Vector Auto-regression (VAR).

The lag length determination is important as when the lag length differs from its true value, the estimates of a VAR turn out to be inconsistent, so are the impulse response functions (Braun & Mittnik, 1993). The optimal lag length is chosen using an explicit statistical criterion such as Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) & Hannan-Quin Information Criterion (HIC) defined as:-

\[ \text{AIC} = \log \sum i + (2k^2p)/T \]

\[ \text{SIC} = \log \sum i + (k^2p \log T)/T \]

\[ \text{HIC} = \log \sum i + (2k^2p)/T \log(\log T) \]

Where \( k = \) no. of variables in the model, \( p = \) no. of lag terms in the model, \( T = \) no. of observation.
4. To find out long run relationship between CAB and FB applying Cointegration test.

Cointegration analysis is inherently multivariate, as a single time series cannot be cointegrated. If two time series data are non-stationary, i.e. they have trend and their pattern of trend is also similar, then we say that their linear combination, i.e. the error term is stationary. Hence, we can perform any econometric test on the non-stationary process itself. In that case, the two variables are cointegrated. In other words, if the two variables are non-stationary but they are cointegrated then we can say that their linear combination is stationary and hence, any econometric test can be applied on the non-stationary series itself. Hence, if the two time-series variables are integrated of same order, then they must be cointegrated.

The following hypothesis is tested in order to find out the cointegration between the variables:

- **H₀**: No cointegration (r=0) against
- **H₁**: presence of cointegration (r>0)

‘r’ implies cointegration relation.

In order to test for the above null hypothesis, we formulate two statistics, Eigen value and trace statistic defined as:

**Trace statistic**: \( \text{Trace} = -T \sum \log (1-\lambda_i) \)  
\( t=r+1, \ldots, p \)

Where \( \lambda_{r+1} \), \ldots, \( \lambda_p \) are (p-r) no. of estimated eigen values.

**Maximum eigen value statistic**: \( \lambda_{\text{max}} (r, r+1) = -T \log (1-\lambda_{r+1}) \)

If the absolute value of the computed trace statistic is greater than its critical value, then we reject our null hypothesis and claim that there exists at least one way cointegration relation between the variables at 5% level of significance. Again we apply the same logic for the Eigen value as well. In some cases Trace and Maximum Eigen value statistics yield different results. In that case, the results of trace test should be preferred. If the null hypothesis is rejected we can claim that there prevails at least one cointegrating relation. In that situation, we go for testing the following hypothesis:

- **H₀**: presence of one cointegration relation (r=1) against
- **H₁**: presence of more than one cointegration relation among the variables (r>1).

Again based on the value of the computed trace statistic and the Eigen value, null hypothesis is either accepted or rejected.

5. As per Engel and Granger (1987), if the variables are cointegrated, then there must prevail an error correction mechanism (ECM). This implies that the changes in explained variables are the functions of the level of disequilibrium in the cointegrating relation, which is reflected by the error correction term and the changes in other explanatory variables. ECM is appropriate to find out the short run dynamics.

\[
\Delta FB_t = \mu_1 + \sum \alpha_i \Delta FB_{t-1} + \sum \beta_i \Delta CAB_{t-1} + \sum \delta_i ECM_{t-1} + \epsilon_3 t, \ldots \tag{3}
\]

\[
\Delta CAB_t = \mu_2 + \sum \alpha_i \Delta FB_{t-1} + \sum \beta_j \Delta CAB_{t-1} + \sum \delta_i ECM_{t-1} + \epsilon_4 t, \ldots \tag{4}
\]

\( i = 1, 2, \ldots, m; j = 1, 2, \ldots, n \)

\( r = \text{no. of cointegration relation} \)

6. Wald Test of joint significance of the lagged values of the variables to explain the explained variable.

The Wald Test is here applied to test for the joint significance of the lagged values of one variable to explain the variation in the other variable.
The following hypotheses are tested-

(a) Impact of joint significance of the lagged values of CAB on the present value of FB.

\[ H_0: \beta_{11} = \beta_{12} = \ldots = \beta_{1n} = 0 \text{ against } H_1: \text{At least one of the } \beta \text{s not equal to zero.} \]

(b) Impact of joint significance of the lagged values of FB on the present value of CAB.

\[ H_0: \alpha_{21} = \alpha_{22} = \ldots = \alpha_{2m} = 0 \text{ against } H_1: \text{At least one of the } \alpha \text{s not equal to zero.} \]

In order to test for the null hypothesis, we have computed an F-statistic defined as:

\[ F = \frac{(RRSS - URSS)/k}{URSS/ [n-(k+1)]} \sim F_{k,n-(k+1),\lambda} \]

If the estimated F-statistic turns out to be statistically significant then the null hypothesis is rejected at 5 percent level of significance and we claim that the lagged values of the concerned variable jointly statistically significantly predict the present value of the explained variable.

7. Measuring unexpected changes in one variable (the impulse) in t-th period and its effect on the future values of the other variable (the responses).

The impulse response function (IRF) measures the response of the explained variable in the VAR model to the shocks in the error terms. It detects the effect of one period shock on the current and future values of the endogenous variables.

(c) **Unrestricted VAR Model**

\[ FB_t = \alpha_{10} + \beta_{11}FB_{t-1} + \ldots + \beta_{1(p-1)}FB_{t-p} + \gamma_{11}CAB_{t-1} + \ldots + \gamma_{1(p-1)}CAB_{t-p} + \epsilon_{1t} \ldots (5) \]

\[ CAB_t = \alpha_{20} + \beta_{21}FB_{t-1} + \ldots + \beta_{2(p-1)}FB_{t-p} + \gamma_{21}CAB_{t-1} + \ldots + \gamma_{2(p-1)}CAB_{t-p} + \epsilon_{2t} \ldots (6) \]

Where ‘p’ denotes the optimum lag length.

In this paper, there are two variables (FB and CAB) such that the IRF would be:-

\[ \Delta FB_t = \alpha_1 + \epsilon_{FB,1} + \mu_1\epsilon_{FB,1} + \mu_2\epsilon_{FB,2} + \ldots + \mu_i\epsilon_{FB,i} + \ldots \ldots (7) \]

\[ \Delta CAB_t = \alpha_2 + \epsilon_{CAB,1} + \gamma_1\epsilon_{CAB,1} + \gamma_2\epsilon_{CAB,2} + \ldots + \gamma_i\epsilon_{CAB,i} + \ldots \ldots (8) \]

The above equations represent the response of the dependent variable, FB or CAB, to the previous innovations that had occurred to the endogenous variables included in the unrestricted VAR model (\(\epsilon_{FB,i}\)’s and \(\epsilon_{CAB,i}\)’s). The coefficients (\(\mu\)’s and \(\gamma\)’s) present the amount of responses.

8. Finding out the causal relationship among the aforesaid variables applying Granger-Causality test where the following Vector Autoregressions (VAR) are tested.

\[ \Delta FB_t = \sum a_i \Delta FB_{t-i} + \sum \beta_{1j} \Delta CAB_{t-j} + U_{1t} \ldots \ldots (9) \]

\[ \Delta CAB_t = \sum \lambda_j \Delta CAB_{t-j} + \sum \delta_{1j} \Delta FB_{t-j} + U_{2t} \ldots \ldots (10) \]

The error terms are uncorrelated. We jointly test for the estimated lagged coefficients \(\sum a_i\) and \(\sum \lambda_j\) are different from zero by running an F-test. When the null-hypothesis of insignificance of the model is rejected at 5% level of significance, we claim that there prevails causal relationship among the variables. However, it is a short run approach.
9. To find out the growth rate of the variable over the period. For that we compute a simple linear regression model as:

\[ \Delta \text{FB}_t = a_1 + b_1 t + u_3 \]  
\[ \Delta \text{CAB}_t = a_2 + b_2 t + u_4 \]

where, ‘t’ is the trend term which is treated as an explanatory variable and \( \Delta \text{FB} \) and \( \Delta \text{CAB} \) are the fiscal balance and current account balance in difference form since, the both the data series are stationary at first difference. We perform a simple regression analysis and estimate the model by OLS method. In order to find out the growth rate, we multiply the estimated slope coefficient of the trend term (t) by 100.

VI. EMPIRICAL FINDINGS – (A) Descriptive Statistics

<table>
<thead>
<tr>
<th>Table 1: Descriptive Statistics</th>
<th>CAB</th>
<th>FB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>221.5171</td>
<td>174.0115</td>
</tr>
<tr>
<td>Median</td>
<td>67.995</td>
<td>106.455</td>
</tr>
<tr>
<td>Maximum</td>
<td>1111.12</td>
<td>985.04</td>
</tr>
<tr>
<td>Minimum</td>
<td>-11.06</td>
<td>-607.11</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>277.4536</td>
<td>220.8332</td>
</tr>
<tr>
<td>Skewness</td>
<td>1.40461</td>
<td>1.079508</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>3.999637</td>
<td>5.088699</td>
</tr>
<tr>
<td>Jarque-Bera</td>
<td>85.94624</td>
<td>87.23213</td>
</tr>
<tr>
<td>Probability</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Observations</td>
<td>232</td>
<td>232</td>
</tr>
</tbody>
</table>

The above table summarizes the descriptive statistics of the two data series: CAB and FB. The mean and median values differ from each other for both the data series. However, CAB is relatively volatile compared to FB which is clear from their standard deviations. Both the variables are positively skewed indicating lack of normality in the frequency distribution. The value of the Kurtosis (greater than 3) also reveals absence of normality in the frequency distribution for both the variables. Moreover, the Jarque-Bera test of normality has been applied which claims that the frequency distributions of both the variables are not normal.

(B) Unit Root Test

<table>
<thead>
<tr>
<th>Table 2: Unit Root Test</th>
<th>Intercept and Trend (Level)</th>
<th>Intercept and Trend (First Difference)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
<td>Est.Value</td>
<td>P-Value</td>
</tr>
<tr>
<td>CAB</td>
<td>-2.59</td>
<td>0.28</td>
</tr>
<tr>
<td>FB</td>
<td>-1.59</td>
<td>0.79</td>
</tr>
</tbody>
</table>

The above table represents the unit root test for all the concerned data series. Both the variables are non-stationary at level. Hence, we go for testing the presence of stationarity at first difference. Both the variables turn out to be stationary at first difference. Hence, they are integrated of order one [I(1)], i.e. their patterns of trend are the same such that we further go for testing long run relationship among the variables.

(C) Optimal Lag Length & Test for Autocorrelation

<table>
<thead>
<tr>
<th>Table 3: Determination of Optimal Lag Length</th>
<th>Table 4: LM Test of Autocorrelation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lag</td>
<td>AIC</td>
</tr>
<tr>
<td>------</td>
<td>-----------</td>
</tr>
<tr>
<td>0</td>
<td>27.34647</td>
</tr>
<tr>
<td>1</td>
<td>25.17759</td>
</tr>
<tr>
<td>2</td>
<td>25.09903</td>
</tr>
<tr>
<td>3</td>
<td>24.81522</td>
</tr>
<tr>
<td>4</td>
<td>24.81147</td>
</tr>
<tr>
<td>5</td>
<td>24.7409</td>
</tr>
<tr>
<td>6</td>
<td>24.56585</td>
</tr>
<tr>
<td>7</td>
<td>24.48453*</td>
</tr>
<tr>
<td>8</td>
<td>24.49917</td>
</tr>
</tbody>
</table>

* indicates significance at 95% confidence level.
The optimal lag length is determined as to be 7 as per SIC, AIC and HIC criterion. However, the problem of autocorrelation for the optimal lag length is also tested using LM test of autocorrelation. The null hypothesis of no autocorrelation is accepted for the optimal lag length 7 at 5 percent level of significance.

(D) Co-integration Test

The table below shows the long run causality among the variables. Both the test statistics indicate that there prevail one cointegrating relations among the variables at 1 and 5 percent levels of significance.

<table>
<thead>
<tr>
<th>Table 5: Cointegration Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesized no. of cointegrating relations</td>
</tr>
<tr>
<td>Eigen Value</td>
</tr>
<tr>
<td>None*</td>
</tr>
<tr>
<td>At most 1</td>
</tr>
</tbody>
</table>

* denotes rejection of the hypothesis at the 0.05 level.

The result confirms the existence of one cointegration relationship among the variables and that there exists stationary linear combination between the two variables. The normalized cointegrating equation is

\[ \text{CAB} = 1.91\text{FB} \]

This implies in long run there exists a positive relation between CAB and FB. The equation claims that a 1% rise in fiscal balance will increase the current account balance by 1.91%, i.e. more than proportionately. Moreover, the absolute value of the estimated t-statistic, given in parenthesis turns out to be greater than 2 implying that FB is a statistically significant variable to explain variation in CAB. This suggests the validity of Twin Deficits Hypothesis in Indian context. Now we will use the co integrating equation and check it for Vector Error Correction to detect the stability of the long run relationship.

(E) Error Correction Mechanism (ECM)

The aforesaid table represents the estimated coefficients of the error correction term (long run impact) and the lagged values of all the time series data (short run impacts). All the variables have been converted in difference form by the software itself. There is presence of one cointegrating equation among the variables. Hence, for each explained variable, there is one error correction term. For D (CAB), the coefficient of the error correction term though is negative but statistically insignificant implying that the error correction term does not adjust itself to move towards the long run equilibrium. However, out of 14 lagged explanatory variables, only 5 turn out to be statistically significant. However, the overall ECM model turns out to be statistically insignificant which is clear from the R-squared and Adjusted R-squared statistics. The coefficient of the error correction term for the variable FB though is statistically significant, still its coefficient is non-negative implying a divergence from the long run equilibrium. However, among 14 lagged explanatory variables, 6 of them are statistically significant. The overall model is moderately significant (Adjusted R-squared = 0.59)

<table>
<thead>
<tr>
<th>Table 6: Error Correction Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error Correction:</td>
</tr>
<tr>
<td>CointEq1</td>
</tr>
<tr>
<td>[-1.74185]</td>
</tr>
<tr>
<td>D(CAB(-1))</td>
</tr>
</tbody>
</table>
The equations (13) and (14) represent the ECM models where both the variables are treated as the explained variables. Overall there are 32 coefficients. Among them, 11 are statistically significant which clear from their respective t-statistics and p-values. C(1) and C(17) are coefficients of the error correction terms. These coefficients must be negative and statistically significant for the convergence of the error correction model to long-run equilibrium. C (1) turns out to be negative but statistically insignificant implying divergence of the ECM from the long run equilibrium.

Hence, the long run equilibrium is dynamically unstable. C(2),..., C(15) are the coefficients showing the short run impacts in model I out of which 5 are statistically significant. C(16) is the intercept term. C(18),..., C(31) are the coefficients showing the short run impact in model II out of which 6 are statistically significant. C(32) is the intercept term. The presence of autocorrelation is very moderate in both the models (D-W close to 2) such that the econometric tests will not produce any misleading results.

(F) Wald Test

| Null Hypothesis: C(9) = C(10) = C(11) = C(12) = C(13) = C(14) = C(15) = 0 |
|---------------------------------|----------------|----------------|----------------|
| Test Statistic | Value | Degrees of Freedom | Probability |
| F-statistic | 9.43 | 7 | 0.00 |
| Chi-square | 66.03 | 7 | 0.00 |

Table 7: Wald Test

| Null Hypothesis: C(18) = C(19) = C(20) = C(21) = C(22) = C(23) = C(24) = 0 |
|---------------------------------|----------------|----------------|----------------|
| Test Statistic | Value | Degrees of Freedom | Probability |
| F-statistic | 8.89 | 7 | 0.00 |
| Chi-square | 62.24 | 7 | 0.00 |
The results of the Wald Test claim that the lagged values of CAB jointly statistically significantly predict the present value of FB. Similarly, the lagged values of FB also jointly statistically significantly predict the present of CAB as well. Hence, we can say there exists bi-directional causality among the variables in short run as per Wald test. However, it does not clarify the sign of the change in one variable due to change in other variable.

(G) Impulse Response Function

IRF checks the presence of any such relationship between the fiscal balance (FB) and current account balance (FB). IRF shows the impact of one-period shock to one of the innovations on current and future values of the endogenous variables (CAB and FB).

![Impulse Response Function](image)

The upper panel of figure 2 represents the impulse response of CAB to CAB and FB. However, we are more concerned about the response of CAB to FB to find out the direction of causality among the variables. When the impulse is CAB, every response of FB is positive except in the second month when the response turns out to be negative. This implies that an improvement in the current account balance, probably due to improvement in trade balance will cause the fiscal balance to be in surplus. Hence, there exists a positive relationship between the CAB and FB. Hence, the direction of causality is going from the current account balance to fiscal balance.

Now let us consider the lower panel. The lower panel represents the response of FB to CAB and FB. However, we are more concerned about the left figure. When the impulse is FB, the response of CAB is positive except in the third, fifth and sixth months, where the response turns out to be negative. Except in these three months, in all the other months, there prevail positive relationship between FB and CAB and that FB causes CAB.

This implies that an improvement in FB, probably due to the contractionary fiscal policy opted by the government, induces the aggregate demand in the economy to contract leading to fall in output/income level. This will reduce the import expenditure of the domestic economy, improving the trade balance and thereby, the current account balance. The IRF results claim that there prevails bi-directional causality among the variables FB and CAB and the causality is definitely positive accepting the twin deficits hypothesis in the Indian context.

(H) Granger-Causality Test

<table>
<thead>
<tr>
<th>Null Hypothesis (H₀):</th>
<th>Observations</th>
<th>F-Statistic</th>
<th>P-Value</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB does not Granger Cause CAB</td>
<td>225</td>
<td>9.23</td>
<td>0.00</td>
<td>REJECT H₀</td>
</tr>
<tr>
<td>CAB does not Granger Cause FB</td>
<td>225</td>
<td>12.76</td>
<td>0.00</td>
<td>REJECT H₀</td>
</tr>
</tbody>
</table>

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The Granger-Causality result shows that there prevails bi-directional causality among CAB and FB. The p-value turns out to be lower than 0.05 such that the null hypothesis of no granger-causality is strictly rejected at 5 percent level of significance in both the situations. This result is consistent with the IRF result. This proves that an improvement in CAB will induce the fiscal balance to improve and vice-versa as proven in the results of IRF.

(I) Growth Analysis

The growth rate of FB in the period of our analysis is 0.05 x 100 = 5% and that of CAB is 0.03 x 100 = 3%. This implies that the growth rate of FB is higher than that of CAB.

Table 9: Granger-Causality Results (Direction of Causality)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Granger-Causality</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAB</td>
<td>FB</td>
</tr>
</tbody>
</table>

The estimated model equation is as follows:

\[
\Delta FB_t = 3.10 + 0.05t
\]

\[
\Delta CAB_t = 3.15+ 0.03t
\]

So from the empirical results of the paper, we can conclude that the twin deficits hypothesis is confirmed in Indian context over the period of our analysis.

VII. CONCLUSION AND POLICY IMPLICATIONS

The main objective of the paper is to analyze the existence of any short run and long run relationship between Current Account Balance (CAB) and Fiscal Balance (FB) in Indian context covering the period April, 1994-95 to July, 2013-14. The paper starts with the normality test of the frequency distributions, followed by non-stationarity test, cointegration test of the existence of long run relationship, Error Correction Mechanism to find out whether there is any divergence of the error correction terms towards the long run equilibrium, Wald Test of joint significance of all the past values of a variable to predict the present value of the other variable, Impulse Response Function that reveals response of lead values of a variable to a shock given on the present value of the other variable. Finally, it ends with the Granger-Causality test that shows the existence and direction of causality among the variables in short run.

The empirical results prove the existence of long run relationship among FB and CAB. This relation was found to be positive, implying that a positive shock given to CAB affects FB positively, as is clear from the IRF result. However, the IRF result claims bi-directional causality among the variables. Any shock given to FB will positively affect the CAB. This result is also confirmed by the Wald test and Granger-Causality test. As per Wald test, all the four null-hypotheses of joint insignificance of the lagged values of any of the variable are rejected at 5 percent level of significance. This implies that the past values of any one variable jointly can statistically significantly predict the present value of the other concerned variable. Granger-Causality test shows bi-directional causality among the variables in short run. However, the Error Correction Mechanism claims that both the two error correction terms deviate from the long run equilibrium. However, the economic implication of the paper is that any change in any of the variables
lead to a change in the other variable. Moreover, the growth rate of FB is higher than CAB though both the variables rise confirming the hypothesis. Hence, while formulating any governmental policy, the government has to take into account how the policy changes will affect FB and thereby, CAB.

An expansionary fiscal policy by the government leads to rise in government expenditure (including transfer payments) will induce the fiscal balance to run in deficit. This rise in government expenditure leads to increase in aggregate demand in the economy inducing the income/output level to increase. With this rise in income level, the import of foreign goods and services rises such that the trade balance runs into deficit. This trade deficit leads to current account deficit in an open economy. Hence, fiscal deficit leads to current account deficit. On the other hand, any trade shock will positively affect the fiscal balance. Suppose, the autonomous export rises inducing the trade balance to improve. This will improve the current account balance leading to rise in aggregate demand and thereby, the output/income level in the economy. The rise in income level will increase the tax revenue of the government thereby improving the fiscal balance. Thus, any policy changes by the internal or the external sector of the economy will positively affect the other sector in Indian context. An expansionary fiscal policy leads to unfavourable current account balance and a favourable trade shock leads to a favourable fiscal balance in the economy. This clarifies the existence of twin deficits hypothesis in Indian context.

REFERENCES


