CHAPTER 3
THEORETICAL FRAMEWORK AND RESEARCH METHODOLOGY OF STUDY

3.1 Introduction.

This section presents the theoretical framework and method of research to be employed in this research work. This will show the theory that provides the framework for the analysis of the causal link between the budget deficit and the current deficit of India. Also, explained here is the model to be used, technique of estimation, data sources and measurement.

3.2 Theoretical Framework.

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

$$Y = C + I + G + (EX - IM), \qquad (1)$$

where Y stands for national income, C- private consumption, I- real investment spending in the economy such as spending on building, plant, equipment etc., G- government expenditure on final goods and services, EX – export goods and services and IM – import goods and services.

We define current account (CA) as

$$CA = EX - IM + Net, \qquad (2)$$

where "Net" stands for net income and transfer flows. So, in addition to goods and services balance, the current account includes also income received from abroad or paid abroad and unilateral transfers. For simplicity, here we assume that unilateral transfers and net income from abroad are not large items in the current account. Although it is worth mentioning here, that if country has big foreign debt and high debt servicing payments, its income paid abroad is a large negative item.

The current account shows the size and direction of international borrowing. When a country imports more than its exports, it has CA deficit, which is financed by borrowing from foreigners. 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 CA 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 in the open economy equals:

$$S = Y - C - G + CA \qquad (3)$$

Where $Y - C - G = I$ and I - stands for investment, so in an open economy we have:

$$S = I + CA \qquad (4)$$

It is worth to look at national saving more carefully and differentiate between saving decisions made by the government and saving decisions made by the private sector. We have:

$$S = Spr + Sgov \qquad (5)$$

Where Spr is defined as the part of disposable income or income, after taxes that is saved rather than consumed. In general we have:

$$Spr = Y - T - C \qquad (6)$$

Where “T” stands for taxes collected by the government. Government saving is defined as difference between government revenue and expenditures which is done in form of government purchases, G, and government transfers, Tr,

$$Sgov = T – G – Tr \quad (7)$$

From definition of national saving we have:

$$S = Y – C – G = (Y – T – C) + (T – G - Tr) = Spr + Sgov = I + CA \quad (8)$$

We can rewrite identity (8) in a form, which is useful for analyzing the effects of government saving decisions on an open economy.

$$Spr = I + CA – Sgov = I + CA – (T – G - Tr) \quad (9)$$

And rearranging (9) we have:

$$CA = Spr – I – (G + Tr - T) \quad (10)$$

Where an expression (G + Tr – T) is consolidated public sector [1] budget deficit (BD), 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 (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 +Tr –T).

Looking at the macroeconomic identity (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 twin deficit hypothesis will hold. The second extreme case is known as Ricardian Equivalence Hypothesis (REH), which assumes that change in the budget deficit will be fully offset by change in savings. The real world is more complex than these two cases and to identify the circumstances in which the twin deficit hypothesis may hold one has to look at the channels by which government deficit influences the economy.

[1] Public sector includes general government (local and central) and non-financial public enterprises (state enterprises like railroads, public utility and other nationalized industries)

According to economic theory, the budget deficit itself influences private saving, investment and current account balance. The final impact of budget deficit on saving, investment and current account depends, in part, on how the deficit is financed. There are several possible ways of financing budget deficit:

1. by increasing money supply and collecting seigniorage
2. by domestic borrowing
3. by using foreign exchange reserves
4. by foreign borrowing
5. by receipts from privatization of state enterprises
6. by running government budget arrears (not payment of government obligations as a specific way of borrowing, so called forced borrowing). It may be considered as a specific case of domestic borrowing to finance budget deficit in the transition economy.

Examining the first four ways of budget deficit financing brings to light the different kinds of macroeconomic imbalances the deficit can cause in the economy.

Printing money excessively shows up as inflation. By printing money, the government collects seigniorage. Seigniorage can be decomposed into a "pure seigniorage" component and an "inflation tax" component. (Quanes and Thakur, 1997, p.64). The pure seigniorage component is the change in real cash balances. It comes about because of real growth of the economy or a favorable shift in the demand for money. The inflation tax component is equal to the inflation rate that acts in this case as the "tax rate" times the stock of real cash balances held by the public (which constitutes the tax base). In the absence of inflation, the inflation tax will obviously be zero, but seigniorage is still being collected unless there is no growth in real cash balances. As a way of budget deficit financing seigniorage revenue has a certain limit. As inflation becomes very high, households may use foreign currency for transactions and dollarization occurs. In such a situation seigniorage collection becomes impossible any more.

Domestic borrowing is considered to be a non-monetary way of BD financing only if borrowings from the banking system are not financed by central bank rediscounts. The credit is being

controlled by the government otherwise be available to the private sector, putting pressure on domestic interest rates. Even if the interest rates are restrained, domestic borrowing leads to credit rationing and crowding out effect of private sector investment. If the economy is well coordinated with international capital markets, government domestic borrowing will incline to push the private sector into borrowing more abroad. It does not have any macroeconomic effect with the composition of public borrowing between foreign and domestic sources.

The connection between budget deficit and current account deficit is closer if running down foreign exchange reserves and foreign borrowing are used to finance budget deficit. Excessive use of foreign reserve leads to a crisis in the balance of international payments in an economy with a fixed exchange rate regime. In case of using foreign exchange reserves for budget deficit financing, appreciation of exchange rate takes place. This option has a clear limit: capital flight and balance of payment crisis follows, since exhaustion of reserves will be associated with currency devaluation in case of fixed exchange rate regime.

In order to understand what effects on the economy foreign borrowing as a way of budget deficit financing may have, we will analyze effects of financing a budget deficit by foreign borrowing in the small open economy with different exchange rate arrangements and different degrees of capital mobility.

It is interesting to look at budget deficit in the light of the Mundell- Fleming model. This model was developed at the 1960-s by Robert Mundell and J.Marcus Fleming[2]. The model presupposes a small open economy with full international capital mobility. The main assumption is that capital flows move faster than trade flows because international investors arbitrage differences in interest rates across countries to take advantage of unrealized profit opportunities. Thus, differences in interest rates between two countries generate massive flows of capital that tend to reduce or eliminate the differences. In contrast, trade flows respond much more slowly to changes in underlying economic conditions. So, the key assumption of Mundell- Fleming model

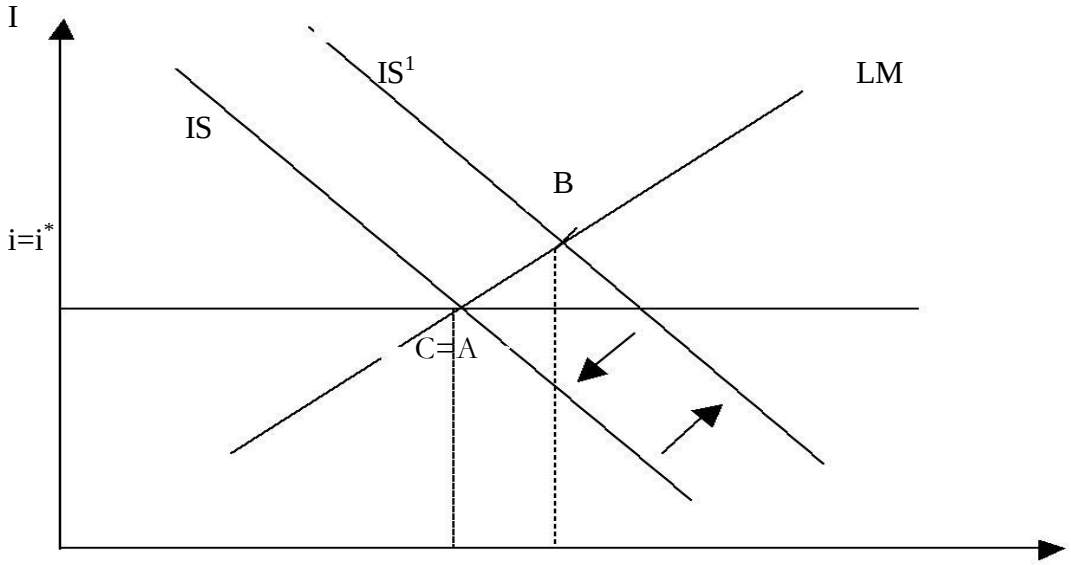
[2] Mundell, R. (1963) Capital Mobility and Stabilization under Fixed and Flexible Exchange Rates. Canadian Journal of Economics and Political Science. November, 1963 and Fleming J. Marcus (1962). Domestic Financial Policies under Floating Exchange Rates. International Monetary Fund Staff Papers, November 1962.

is that interest rate is the same in the world economy, except in cases where capital controls exist. In fact, interest rates may not be equal throughout the world because of expectations of exchange rate movement. And Mundell- Fleming assumption about interest rate may not hold in reality because of political risk of the country, macroeconomic instability, capital controls and so on.

Let us look at an increase in government spending (budget deficit increase) using three simple models of a small open economy with floating and fixed exchange rate and full capital mobility and with very limited capital mobility in case of fixed exchange rate[3].

Figure 2 shows an increase in government expenditures in a small open economy with a floating exchange rate and full capital mobility. We assume that an initial equilibrium is in the point A, where the domestic interest rate and world interest rates are equal.

Figure 2 an increase in government expenditures in the small open economy with flexible exchange rate and full capital mobility IS- LM model.



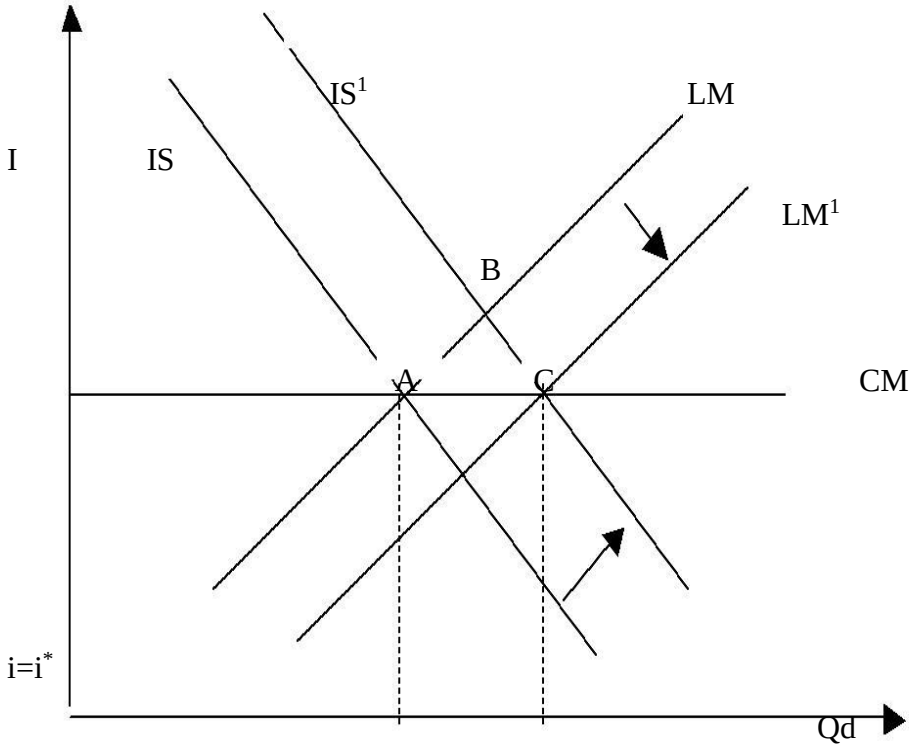
In case of floating exchange rate and full capital mobility, an increase in government expenditures raises an interest rate in the domestic economy. Because a domestic interest rate is

[3] Sachs, Jeffer D. and Larraine, Filipe B. (1993). Macroeconomic in the Global Economy, Prentice - Hall, Inc, Englewood Cliffs, New Jersy.p.404-420.

higher than world interest rate, capital inflow occurs at the point B in the figure 2 and exchange rate appreciates. As a result, imports rises and export falls, current account deteriorates. It provokes IS curve to shift back in the initial position in the figure 2. As a result, the interest rate becomes the same in the domestic and in the world economies (as argued by Mundell-Fleming model), domestic aggregate demand does not increase, domestic currency appreciates and current account is in the deficit.

Figure 3 an increase in the government expenditures in a small open economy with full capital mobility and fixed exchange rate IS-LM model.

In case of fixed exchange rate and full capital mobility, an increase in the government spending (a shift of IS-curve in the position IS1 in figure 3) causes domestic interest rate to rise and capital inflow occurs. As a supply of foreign currency rises and an exchange rate is fixed, economic agents start exchange foreign currency for domestic one because more domestic currency is needed for increased volume of transactions. In such a situation domestic money supply increases (LM curve moves to the left in the position LM1 in the figure 3).



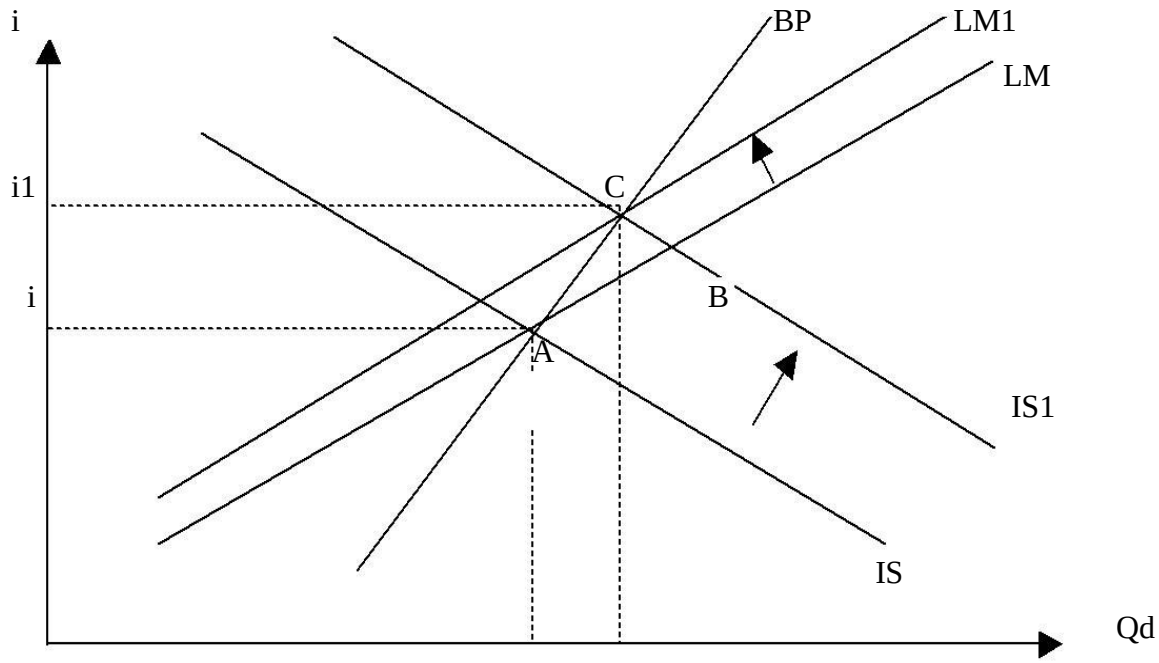
Although the exchange rate is fixed, an increase in aggregate demand will increase demand for import and the trade balance deficit occurs even in the short run, moreover, trade balance may

deteriorate in the long run as real appreciation of domestic currency occurs. As consequence, we have the same interest rates in the world and in the home economies, aggregate demand increases and current account deteriorates.

Perfect capital mobility does not always exist in the real world. So, it is very useful to analyze the case of very limited capital mobility. In the figure 4 we present IS-LM analysis for the case of limited capital mobility and fixed exchange rate. We draw a balance of payment line, denoted by BP, steeper than the LM-curve, which denotes very limited capital mobility. Assume that economy is in the initial equilibrium at point A. As government spending increases, the IS curve shifts to the right in the position IS1. The intersection with LM curve occurs in the point B below the balance of payment line. At the point B, a current account deficit takes place. As exchange rate is fixed, the central bank loses its foreign exchange reserves in the process of defending the exchange rate and pressure for devaluation exists. Domestic money supply falls because domestic residents demand more foreign exchange in the economy with fixed interest rate. As money supply is reduced, the LM curve shifts in the position LM1 and new equilibrium is restored at point C, where balance of payment is in equilibrium. In the point C domestic interest rate is higher than the initial and aggregate demand increases, so trade balance deteriorate and current account is in the deficit.

Figure 4 an increase in government expenditure in a small open economy with limited capital mobility and fixed exchange rate IS-LM Model.

So, we can see that if capital mobility is limited, an increase in the budget deficit causes a rise in the domestic interest rate, which, in turn, crowds out private investment in the economy. If foreign investors lose confidence in the economy, BP-line may become almost vertical and all foreign capital will leave the country. And if it happens, the domestic interest rate rises even further, an aggregate demand has returned to its former level, but its composition has changed government spending has increased at the expense of private investment and consumption.



As can be seen from IS-LM models in figures 2-4, budget deficit financing in an open economy inevitably has its impact either on exchange rate or on interest rate or on both, depending on a degree of capital mobility in the economy and on exchange rate arrangements. In an economy with full capital mobility and floating exchange rate foreign borrowing causes appreciation of exchange rate, damaging export and encouraging imports. In case of fixed exchange rate an increase in aggregate demand increases import and current account deteriorates even if the exchange rate does not change. If domestic borrowing is limited, which especially is the case in some developing countries, the connection between the budget deficit and external borrowing is more likely to be close. In such a case fiscal adjustment through cutbacks in government expenditures can substantially improve the current account.

So far we assumed that saving rate is given if an economy is in full employment. So, an increase in BD results in either a reduction in investment or in an increase in the CAD. In fact, different assumptions with respect to saving can be made. In the present work we assume that rate of saving is determined by the long run level of disposable income and do not focus on the possible link between the BD and saving. We assume that saving decisions taken by private sector of the economy are independent of government saving decisions or of government budget deficit.

The alternative point of view is known as Ricardian Equivalent Hypothesis (REH) first introduced by Barro in 1974)[4]. The main point is that under a very specific set of assumptions lump sum changes in taxes would have no effect on consumer spending. A cut in taxes that increases disposable income would automatically be paid by an identical increase in saving. So, according to REH (Sachs, Larraine, 1993, p.201) the budget deficit and taxes are equivalent in their effect on consumption. Current consumption can be affected by the expected income of the future generation. As REH states, the time path of taxes does not matter for the households' budget constraint as long as the present value of taxes is not changed. 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, Spr, rises when taxes fall (or accordingly BD rises): households save the income received from the tax cut in order to pay for the future tax increase. Hence, a BD would not cause a twin deficit.

In practice, limits for REH exist. For example, public sector may have a longer borrowing horizon than households have and today's households would regard the current tax cut as a real windfall. Such a tax cut would produce a rise in consumption and a fall in national saving inasmuch as private saving would not rise fully to compensate for fall in government saving. So, according to (2.10) the current account would tend to deteriorate.

The other reasons for REH limitation in the real world may be barriers for borrowing. Households may be unable to borrow against future income because of imperfections in the financial market and especially if the financial market is underdeveloped. Uncertainty is one more powerful factor that undermines the case for REH. In the present work we do not believe that REH may be relevant for real economy in transition. Some authors present quite strong evidence against REH[5].

As can be understood from the said above, the mechanisms of linkage between BD and CAD are quite complex. We can see that government financing decisions may affect private saving,

[4] Barro, Robert J. (1974). Are Government Bonds Net Wealth? Journal of Political Economy. 81(December), pp. 1095-1117.

[5] Bernheim, Douglas ((1987). Ricardian Equivalence: An Evaluation of Theory and Evidence. NBER Macroeconomic Annual, vol. 2, pp.263-303.) presents evidence that weakens REH.

private investment and current account. The macroeconomic framework and existing institutions framework have to be taken into account to identify the exact channels through which BD and CAD are connected in the economy. In particular, we have to take into account existing exchange rate arrangements, degree of openness of the economy, existing business cycle, expected and current profitability of investment in the economy. In addition to the macroeconomic setting, one has to take into account what institutions exist in the economy and how they work. For example, if the financial sector in the economy is weak, national savings will be low and domestic resources will be unavailable for government to finance its budget deficit. If property rights are poorly defined, private investment will be very low and in such a situation government may increase budget expenditures to invest in the economy. On the other hand, private investment may be further reduced because of crowding out effect.

We expect that, if BD is financed by running down foreign reserves or by foreign borrowing, the twin deficit relationship have to be stronger. In both cases appreciation of exchange rate occurs which worsens current account balance by rise in import and fall in export. If exchange rate is fixed and excessive running down of foreign reserves occurs, private sector agents, expecting future depreciation, fly capital abroad, which also deteriorate current account. Foreign borrowing, as a way of financing budget deficit, will be most likely used if the domestic financial sector of the economy is weak. In case of full capital mobility an inflow of capital causes exchange rate appreciation, in case of floating exchange rate, and expansion in aggregate demand, in case of fixed exchange rate, which in both cases leads to trade deficit. If foreign borrowing occurs in a country with very limited capital mobility, an increase in government expenditures causes an increase in domestic interest rate and a rise in aggregate demand, which deteriorate the trade balance and the current account.

3.3 Method of Research

3.3.1 Introduction

This shows the model to be adopted for this study which is based on previous empirical literature. The methodology consists of model and analytical framework and econometric techniques. Also, the technique of estimation to be employed, data sources and measurement is discussed.

3.3.2 Model Specification.

Following the theoretical literature and methodology of previous empirical studies, a model can thus be specified for this study that current account deficits of India depends on budget deficits, inflation, interest rate and exchange rate. The relationship between the twin deficits can be presented in an implicit form to give this equation:

$$CAD_t = f(BD_t, INT_t, INF_t, RER_t) \quad \ldots\ldots (11)$$

The explicit form of the model showing the linear relationship between current account deficit and budget deficit is given as follows:

$$CAD_t = \alpha_o + \alpha_1 BD_t + \alpha_2 INT_t + \alpha_3 INF_t + \alpha_4 RER_t + e_{t1} \quad \ldots\ldots (12)$$

Where CAD_t is current account balance as a percentage of GDP; BD_t is budget balance as a percentage GDP; INF_t on the basis of WPI; INT_t on the basis of call money rate; ER_t is the exchange rate and e_t is a white noise disturbance. α_1, α_2, α_3 and α_4 are the unknown parameters.

3.3.3 Technique for Estimation

The econometric analysis of the relationship between the fiscal and current account deficits usually involves the application of Granger causality (Chang and Hsu, 2006, Ganchev, 2010) and Vector Autoregressive Models (Hashemzadeh and Wilson, 2006). Thus, in line with most empirical work on twin deficit hypothesis, this study tests for the long run equilibrium relationship and direction of causality between budget and current account deficit. In doing this, the study will carry out a stationarity test, co-integration test and multivariate Granger causality test. The stationarity test is to help determine if the time series are stationary or not as empirical literature has argued that estimation of time series data that have unit root will produce a spurious result.

Also, the co-integration procedure will explore the possible long run relationships among the variables in the model and interpret the evidence of this relationship as the interdependence between the variables. The Granger causality test which is the main purpose of this work will be carried out within the multivariate framework as against the bivariate framework that is commonly used. This will help to determine the direction of causality and feedback among the variables.

3.3.3.1 Unit Root Test (Test for Stationarity).

One of the assumptions of the standard regression analysis is the condition that the variables being tested are stationary. However, many macroeconomic time series variables are often not found stationary, they trend up and down over time. Therefore, before regression analysis can be carried out on time series variables, test for stationarity must be done to avoid getting bias estimates or spurious results. According to Nkang et al (2006), stationary series is one where /ρ/<1. The series have a finite variance, transitory innovations from the mean and a tendency for the series to return to their mean value. In other words, a stationary series has a mean, variance and autocorrelation that are constant over time, implying that the error structure is time invariant. On the other hand, a non-stationary series is one where /ρ/> 1. It has a variance which is asymptotically infinite (the series rarely crosses the mean and innovations to the series are permanent). So any stochastic shock may not return to a proper mean level. A non-stationary series is however a random walk where absolute value of ρ= 1(that is ρ is unity). It can then be said that such variable has a "unit root". This study carries out the unit root test for stationarity by using the Augmented Dickey Fuller (ADF) test to examine each of the variables for the presence of unit root(or non- stationarity) or otherwise. This is based on the regression equation in the form:

$$\Delta yt = \alpha 0 + \alpha 1\, \beta yt - 1 + T + \sum_{j=1}^{m} \beta j\, \Delta Yt - k + \varepsilon t \ldots\ldots\ldots\ldots (13)$$

Where Y_t is the time series, Δ is the first difference operator, T is the linear trend, α is a constant and ε_t is the error term. The null hypothesis of existence of unit root is β is 0.

The significance of ρ will be tested against the null (ρ=0) based on t-stat on ρ obtained from the OLS estimates of the above two equations. Thus, if the null hypothesis of non-stationarity cannot be rejected, the variables are differenced until they become stationary. It is after this is done that we will proceed to test for co-integration.

3.3.3.2 Co-integration Test.

It is known that if the variables are non-stationary, they should be differenced before being used in the regression model to avoid a spurious regression. If the variables are co-integrated or there is a stable long run equilibrium relationship between them over time, then they could be used in the regression model in the level forms without leading to a spurious regression. There are numerous tests that were acknowledged in the literature for co-integration analysis such as the Co-integrating regression Durbin- Watson test, Engle-Granger Co-integration test and Johansen Co-integration test. We will use Johansen test to test for co-integration between the variables in the empirical model because it has an advantage over other previously mentioned tests as it takes into consideration the possibility of multiple co-integrating vectors.

Engle and Granger (1987) also pointed out that a linear combination of two or more non-stationary series may be stationary. If such stationary linear combination exists, the non-stationarity time series are said to be co-integrated. The purpose of a co-integration test is to determine whether groups of non-stationary series are co-integrated or not. This study tests for the presence of long run equilibrium relationship between current account balance and its determinants with the multivariate Johansen co-integration approach.

Unlike the two-step residual-based test for co-integration developed by Engel and Granger (1987) and the bounds testing procedure for co-integration suggested by Pesaran et al (2007), the multivariate Johansen Juselius co-integration approach is not sensitive to the choice of dependent variables as it assumed that all variables are endogenous. The study employed the Johansen Co integration test and the starting point of the Johansen Co integration methodology is said to begin with a VAR order of p given by:

$$\Delta Y_t = \mu + A1\ Y_{t-1} + ... + Ap\ Y_{t-p} + \beta\ X_t + \varepsilon_t \quad \text{..... (14)}$$

Where Y_t is a k-vector of the I (1) variables, X_t is a vector of the deterministic variables and ε_t is an identically and independently distributed error term.

This VAR can be re-written as

$$\Delta yt = \mu + \Pi Yt-1 + \ldots + \sum_{i=1}^{p-1} \Gamma Yt-p + \beta Xt + \varepsilon t \ldots\ldots\ldots\ldots\ldots (15)$$

3.3.3.3 Vector Error Correction Model (VECM)

If the variables included in the empirical model are co-integrated, it will be useful to use a **Vector Error Correction Model (VECM)** to understand the relationship between the variables both in the short run and also in the long run, which will be useful to have comprehensive information concerning the dynamic relationship between the variables and how the adjustment toward the equilibrium position occurs after the initial divergence. The VECM could be represented by the following equations:

$$\Delta Yt = \alpha 0 + \sum_{i=1}^{p} \alpha 1, i\, Yt-i + \sum_{i=1}^{p} \alpha 2, i\, Xt-i + \theta 1\, ECT\, t-1 + \varepsilon t1 \ldots\ldots\ldots\ldots (16)$$

$$\Delta Xt = \mu + \sum_{i=1}^{p} \beta 1, i\, Xt-i + \sum_{i=1}^{p} \beta 2, i\, Yt-i + \theta 2\, ECT\, t-1 + \varepsilon 2t \ldots\ldots\ldots\ldots.. (17)$$

In equations **(1) and (2)** the parameters α and $\boldsymbol{\beta}$ capture the short run relationship between the variables **(X) and (Y),** the term $\mathbf{ECT\ t-1}$ refers to the error correction term which indicates the speed convergence to equilibrium and the coefficient $\boldsymbol{\theta}$should be negative and significant.

The lag length of the model should be determined by certain information criteria, we will choose the number of lags that can minimize Akaiakie and Schwartz information criteria. After estimating the model, stability test should be used to guarantee the robustness of the results, also tests of Heteroskedasticity, normality and autocorrelation will be used to ensure that the model

satisfies the assumptions of homoscedasticity, normality and no serial correlation of the residuals.

3.3.3.4 Granger Causality Test

The co-integrating relationship indicates the existence of causal relationship but it does not indicate the direction of causal relationship among the variables. The Granger causality test thus helps to determine the direction of causality between the current account deficits and the budget deficit.

$$\mathrm{Yt} = \alpha 0 + \sum_{i=1}^{p} \alpha 1,\ \mathrm{i\ Yt} - \mathrm{i} + \sum_{i=1}^{p} \beta 2, \mathrm{i\ Xt} - \mathrm{i} + \varepsilon 1\mathrm{t} \ldots\ldots\ldots\ldots\ldots\ldots (18)$$

$$\mathrm{Xt} = \mu + \sum_{i=1}^{p} \delta 1,\ \mathrm{i\ Xt} - \mathrm{i} + \sum_{i=1}^{p} \theta 2, \mathrm{i\ Yt} - \mathrm{i} + \varepsilon 2\mathrm{t} \ldots\ldots\ldots\ldots\ldots\ldots (19)$$

This study however employs an alternative methodology for testing the causality direction between the twin deficits for India, which is the multivariate Granger-causality rather than the bivariate framework. The results of the multivariate framework are said to be more informative and reliable than the results of the bivariate framework. Also, the Granger causality tests with the bivariate framework are likely to be biased owing to the omission of relevant variables that affects the relationship between the two deficits and their interacting variables.

The basic idea of the Granger causality is that one variable or time series can be called “causal” to another if the ability to predict the second variable is improved by incorporating information about the first. (Barret et al, 2010, In other words, variable Y granger-causes X if in a statistically suitable manner, Y assists in predicting the future of X beyond the degree to which X already predicts its own future. The idea Granger causality can be extended to the conditional case as well where Y is said to Granger cause Y conditional on Z if Y assists in predicting the future of

X beyond the degree to which X and Z together already predict the future of X. This conditional Granger causality is what is termed multivariate Granger causality testing.

The Granger causality test will be performed with annual data of budget deficit, current account deficit data and the interacting variables between the two deficits. The Augmented form of the Granger causality test involving the ECM is formulated in a multivariate path order Vector Error Correction (VEC) model and is given below:

The equations can be written in the following form:

- $\Delta CAD_t = \alpha_1 + \Sigma\beta_1\Delta CAD_{t-i} + \Sigma\theta_1\Delta BD_{t-i} + \Sigma\delta_1\Delta INF_{t-i} + \Sigma\lambda_1\Delta INT_{t-i} + \Sigma\rho_1\Delta RER_{t-1} + \Pi ECM_{t-1} + \varepsilon_t$ .....(20)

- $\Delta BD_t = \alpha_2 + \Sigma\beta_2\Delta BD_{t-i} + \Sigma\theta_2\Delta CAD_{t-i} + \Sigma\delta_2\Delta INF_{t-i} + \Sigma\lambda_2\Delta INT_{t-i} + \Sigma\rho_2\Delta RER_{t-1} + \Pi ECM_{t-1} + \varepsilon_t$ .....(21)

- $\Delta INF = \alpha_3 + \Sigma\beta_3\Delta CAD_{t-i} + \Sigma\theta_3\Delta BD_{t-i} + \Sigma\delta_3\Delta INF_{t-i} + \Sigma\lambda_3\Delta INT_{t-i} + \Sigma\rho_3\Delta RER_{t-1} + \Pi ECM_{t-1} + \varepsilon_t$ .....(22)

- $\Delta INT_t = \alpha_4 + \Sigma\beta_4\Delta CAD_{t-i} + \Sigma\theta_4\Delta BD_{t-i} + \Sigma\delta_4\Delta INF_{t-i} + \Sigma\lambda_4\Delta INT_{t-i} + \Sigma\rho_4\Delta RER_{t-1} + \Pi ECM_{t-1} + \varepsilon_t$ .....(23)

- $\Delta RER_t = \alpha_5 + \Sigma\beta_5\Delta CAD_{t-i} + \Sigma\theta_5\Delta BD_{t-i} + \Sigma\delta_5\Delta INT_{t-i} + \Sigma\lambda_5\Delta INT_{t-i} + \Sigma\rho_5\Delta RER_{t-1} + \Pi ECM_{t-1} + \varepsilon_t$ .....(24)

3.3.3.5 Impulse response function

This technique involves measuring unexpected changes in one variable X (the impulse) in time t and predicting its effect on the other variable Y in time t, t+1, t+2, etc... (the responses). The impulse response function (IRF) defines the response of the dependent variable in the VAR model to shocks in the error terms. In other words, the IRF detects the impact of a onetime shock

in one of the innovations on current and future values of the endogenous variables. The general form for the IRF would be:

$$Yt = \alpha + \varepsilon t + \Theta 1 \varepsilon t\text{-}1 + \Theta 2 \varepsilon t\text{-}2 + \ldots + \Theta i \varepsilon t\text{-}i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (25)$$

Where yt is a vector of the considered dependent variables, α is a vector of the constants, εi is a vector of innovations for all variables that have been included in the VAR model, and Θi is a vector of parameters that measure the reaction of the dependent variable to innovations in all variables included in the VAR model.

However, in case of two variables (Yt and Xt), the form for the IRF would be:

$$Yt = \alpha 1 + \varepsilon Y,t + \eta 1 \varepsilon Y,t\text{-}1 + \eta 2 \varepsilon Y,t\text{-}2 + \ldots + \eta i \varepsilon Y,t\text{-}i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (26)$$

$$Xt = \alpha 2 + \varepsilon X,t + \varphi 1 \varepsilon X,t\text{-}1 + \varphi 2 \varepsilon X,t\text{-}2 + \ldots + \varphi i \varepsilon X,t\text{-}i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (27)$$

Equations 16 and 17 express how the dependent variable, Yt or Xt, responds to previous innovations that happened to the endogenous variables included in the VAR model (εX's and εY's). However, the coefficients (φ's and η's) present the amounts of responses.

3.3.4 Data Sources and Measurement.

The study has used the annual data of India from the time period 1990 to 2013 (24 years) of variables such as current account deficit (proxy of trade deficit) as a percentage of GDP, gross fiscal deficit (proxy of budget deficit) as percentage of GDP, inflation rate on the basis of WPI, interest rate (using call money rate as proxy) and real exchange rate. Also, data used for this study is sourced from the Reserve Bank of India (RBI) Statistical Bulletin (2013 edition) and the World Bank Developmental Indicators (WDI) for the period from 1991 to 2013.

3.4. Variables used in the Study.

1) Current Account Deficit as a percentage of GDP (CAD): This represents the sum of imports of goods and services, exports of goods and services plus net income from abroad and is measured as percentage of GDP.

2) Budget Deficit as a percentage of GDP (BD): This represents the excess of government expenditure over revenues for different years measured as percentage of GDP. When the sale are

critical than the forecast it leads the down turn of the economy. It is expected to have a positive sign as increases in government budget deficit will lead to a deterioration of the current account balance while reduction in budget deficit will improve the current account balance.

3) Interest Rate (INT): This is the Prime lending rate which is the interest rate charged by the national government and central banks. Interest rate fluctuates due to many reasons like lower interest rates gives economy short run boast. Major two types of interest rates are, real interest rate (which measures the purchasing power of interest receipts and is calculated by adjusting nominal interest rate charged to take inflation into account) nominal interest rate is the amount in money terms of interest payable. In macroeconomics Interest rates is considered as the main source of investment. If interest rate increases investment decreases and fall in national income. This is expected to be negatively signed as increases in domestic interest rate which is as a result of increases in aggregate demand will increase imports and worsen the current account balance in the long run.

4) Exchange Rate (ER): This is the official exchange rate at which the local currency which is the Rupee exchanges for a dollar. It is expected to have a negative sign as the appreciation of the domestic currency will worsen the current account balance in the long run and vice versa.

5) Inflation Rate (INF): inflation represent continuous rise in prices level. Inflation is measured by using WPI for my study. The upward shift of price level decreases purchasing power of money. Inflation decreases in purchasing power of money- and reduces the value of medium of exchange in the economy. The main determinant of price inflation is inflation rate annualizes percentage change in general price level. The effect of inflation can be either positive or negative for the economic growth. A negative effect reduces the real value of money. Inflation demoralize investment and reduces overall economic productivity rates. Money supply increase in market, add inability in the market. Positive effect is debt relief. Debtors who have debt with fixed nominal rate of interest pay less interest rate, as inflation rate rises.