CHAPTER 6

RICARDIAN EQUIVALENCE AND TWIN DEFICIT IN INDIA

6.1 Introduction

The current fiscal and trade imbalance has confirmed the theory of the twin deficit. This assumption suggested the current balance often degrades any fiscal shock that aggravates the budget deficit (BD). This theory was used to describe America's experience in the 1980s.

Macroeconomic factors in several countries, including India, are the core issue of imbalances between BD and current-account deficit. In India the question of the twin deficit was largely raised during the 1989s as a consequence of the global meltdown and economies liberalization.

The purpose of this chapter is as follows: The first objective is to examine the linkage between BD and CAD in the macroeconomic context by applying Johansen cointegration and VECM. Secondly, we use Bernheim (1987) consumption function to validate Ricardian equivalence hypothesis by using Johansen cointegration method. Thirdly, we investigate the cause-and-effect relationship by applying Wald causality testing. Finally, a novel attempt is made to investigate the time way or (input and output behavior of the system) of these components and their responses to shocks from the selected macroeconomic variables. Based, on the Granger causality outcomes, policy makers cannot predict the future policy based on the present results. Secondly, these results can be clarified with sample tests that may give more explanation on the dynamic properties of this relationship Masih and Masih (1995). This approach requires the calculation of

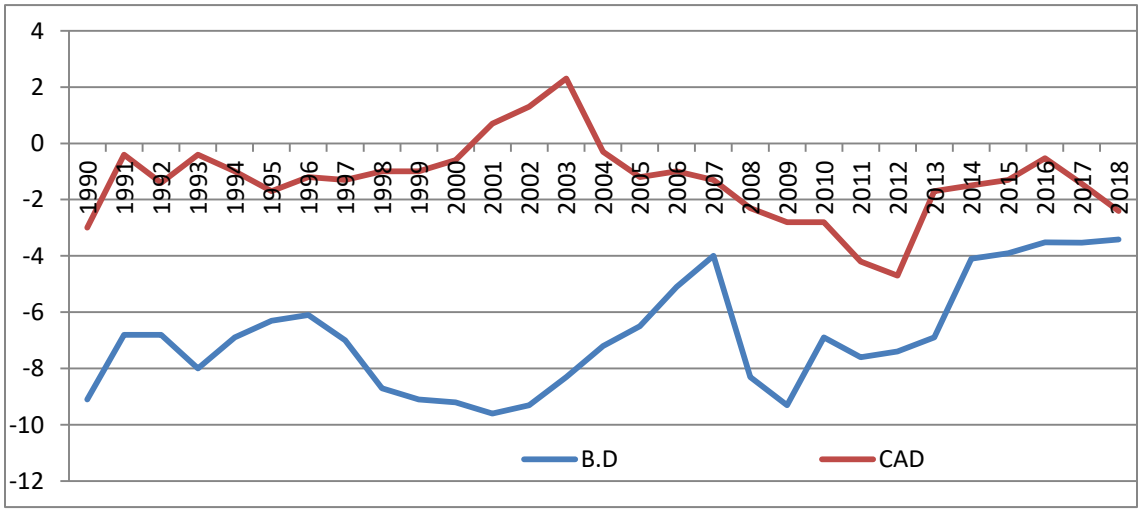
unexpected changes in time t in one variable X (the impulse) and the estimation of its effect on the other variable Y in time t, t1+t2+t3+t4...).

The following of the chapter are as: Section 6.2 provides a brief economic outlook of India with regard to twin deficit. Section 6.3 provides data and variable information. Section 6.4 gives methodological explanation. Section 6.5 provides empirical findings of the study. Section 6.6 gives Concluding remarks.

6.2 Brief economic outlook of India

Figure 6.1, depicts the relationship between CAD and BD for India over the period of 1990 to 2018.

Figure 6.1: Relationship between Current Account Deficit and Budget Deficit in India



Note: Author compilation

And during the 2008 financial recession, the current accounts deficit (CAD) soared from -1.3% in 2007 to -2.8% in 2009, with the budget deficit (BD) jumping from -4% in 2007 to -9.3% in 2009. With the global fluctuation, though, CAD and BD have shifted in recent years. The CAD was -4.7% and the BD was -7.4% in 2012, while the CAD was -

2.40% and the BD was -3.42% of GDP in 2018. The two deficits have a cyclic trend may be due to the influence of other macroeconomic variables like exchange rate and interest rate. However, after the implementation of Fiscal Responsibility and Budget Management (FERM Act 2003) the budget deficit decreased and reached lowest in 2007, but in 2008 global economies where hit by financial crises which again increases budget deficit and reaches lowest in 2009. However, from the mid-1990s to 2004, the CAD pattern was smaller, when oil prices increased from US$29 to US$124 per barrel as world oil prices escalated from 2004 to 2008.

6.3 Data and variable information

The date of the variables is collected from World Bank, Reserve Bank of India and Economic Trading.

As a proportion of GDP, we take CAD and BD. The M3-related money supply (MS) is averaged and exchange rate (REER) based on average annual dollar rate, and the INFs on the basis of wholesale price index (Interest Rate). Tax revenue (TAX) is levied on the additional income, profit, securities, services and ownerships on the basis of percentage of GDP, Private consumption (PC) is the household total consumption of good and services as the percentage of GDP and Government consumption (G) is the expenditure on social services as the percentage of GDP.

We check the dynamic linkage of the variables like BD, CAD and macroeconomic varibales over the period of (1990-2018).

The study estimates two models to testify this relationship, first is Keynesian hypothesis and second is Ricardian theorem which is as follows:

BD = f (CAD, INF, INT, REER, MS, TAX) (**Keynesian Preposition**) (1)

PC = f (G, TAX, BD) (**Ricardian hypothesis**) (2)

6.4 Methodological Explanation

6.4.1 Unit Root Test

The Augmented Dickey Fuller test is used to check the stationarity of the variables.

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \beta_2 Y_{t-1} + \sum_{j=2}^{q} \alpha_j \Delta Y_{t-j+1} + \varepsilon_t \quad (3)$$

Based on the above equation (3), where y_t is the variable, Δ is the first distinction, εt is the constant, ε_t is the white noise and is expected to be the same as zero mean and constant variance. Compared with the specific measured critical values, the unit root test is based on t-statistic coefficient variables.

6.4.2 Co-integration Test

To check the cointegration of the equation 1 and 2, we we applied Johansen cointegration method.

$$\Delta Y_t = \mu + A1 \quad Y_{t-1} + \ldots + Ap\, Y_{t-p} + \beta X_t + \varepsilon_t \quad (4)$$

The VAR form of the above equation is derived as:

$$\Delta y_t = \mu + \Pi\ Y_{t\_1} + \ldots + \sum_{i=1}^{p-1} \Gamma\ Y_{t\_p} + \beta X_t + \varepsilon_t \quad (5)$$

We have two equations (6) and (7) in the Johansen cointegration test expressed as trace and max metrics, if the trace and maximum statistics are higher than critical values, we should infer the correlation between different variables is longer.

$$Jtrace = -T \sum_{i=r+1}^{p-1} l\,n(1-\lambda_i) \quad (6)$$

$$Jmax = -Tl\,n(1-\lambda_{r+1}) \quad (7)$$

The VAR model extension is based on the Cholesky decomposing process, which provides a positive matrix A that can be decomposed into a specific lower triangular matrix L product. We referred to L as a Cholesky element of A and interpreted it as a square root of A generalized. The decomposing method requires elements of principal diagonals to be zero and system. The decomposition measures variance at various forecast horizons. The relative importance of shocks can be measured by the variant decomposition that provides us a description of the variable's proportions owing to their own shocks and the shocks of other variables.

6.4.3 Vector Error Correction Mechanism

If there is a long-run association, then we will apply VECM short-term and long-term association, and may be beneficial to include precise details on the dynamical connection between the variables and how the balance is transited after the initial separation. The VECM is written as:

$$\Delta Y_t = \alpha 0 + \sum_{i=1}^{p} \alpha 1,\ i\, Y_{t-i} + \sum_{i=1}^{p} \alpha 2, i\, X_{t-i} + \theta 1\ ECT_{t-i} + \varepsilon_{t1} \ldots\ldots\ldots (8)$$

$$\Delta X_t = \alpha 0 + \sum_{i=1}^{p} \beta 1,\ i\, X_{t-i} + \sum_{i=1}^{p} \beta 2, i\, Y_{t-i} + \theta 2\ ECT_{t-i} + \varepsilon_{t2} \ldots\ldots\ldots (9)$$

The short term ECT_{t-1} corresponds to the error correction term (α) and β in equation (9) which implies that speed convergence to equilibrium and the coefficient an are negatively important. The short-term link between the ECT_{t-1} terms is the error correction term for variables (X) and (Y). Heteroscedasticity, normality and autocorrelation checks should often be used to verify that the model is compatible with the concepts of homoscedasticity, normality or serial residual correlation. The stability test can be used after estimating the model to ensure the robustness of the performance.

6.4.4. Granger Causality

The causality analysis provides the mathematical idea of the relation between the variables. The approach provides us a causality path and assists us in recognizing the relationship between the variables.

$$\Delta CAD_t = \alpha_1 + \Sigma\beta_1\Delta BD_{t-i} + \Sigma\theta_1\Delta INF_{t-i} + \Sigma\gamma_1\Delta REER_{t-i} + \Sigma\delta_1\Delta INT_{t-i} + \Sigma\lambda_1\Delta MS_{t-i} + \Sigma\sigma_1\Delta TAX_{t-i} + \varepsilon_t \quad (10)$$

$$\Delta BD_t = \alpha_2 + \Sigma\beta_2\Delta CAD_{t-i} + \Sigma\theta_2\Delta INF_{t-i} + \Sigma\gamma_2\Delta REER_{t-i} + \Sigma\delta_2\Delta INT_{t-i} + \Sigma\lambda_2\Delta MS_{t-i} + \Sigma\sigma_2\Delta TAX_{t-i} + \varepsilon_t \quad (11)$$

$$\Delta INF_t = \alpha_3 + \Sigma\beta_3\Delta BD_{t-i} + \Sigma\theta_3\Delta CAD_{t-i} + \Sigma\gamma_3\Delta REER_{t-i} + \Sigma\delta_3\Delta INT_{t-i} + \Sigma\lambda_3\Delta MS_{t-i} + \Sigma\sigma_3\Delta TAX_{t-i} + \varepsilon_t \quad (12)$$

$$\Delta REER_t = \alpha_4 + \Sigma\beta_4\Delta BD_{t-i} + \Sigma\theta_4\Delta CAD_{t-i} + \Sigma\gamma_4\Delta INF_{t-i} + \Sigma\delta_4\Delta INT_{t-i} + \Sigma\lambda_4\Delta MS_{t-i} + \Sigma\sigma_4\Delta TAX_{t-i} + \varepsilon_t \quad (13)$$

$$\Delta MS_t = \alpha_5 + \Sigma\beta_5\Delta BD_{t-i} + \Sigma\theta_5\Delta CAD_{t-i} + \Sigma\gamma_5\Delta INF_{t-i} + \Sigma\delta_5\Delta INT_{t-i} + \Sigma\lambda_5\Delta REER_{t-i} + \Sigma\sigma_5\Delta TAX_{t-i} + \varepsilon_t \quad (14)$$

$$\Delta INT_t = \alpha_6 + \Sigma\beta_6\Delta BD_{t-i} + \Sigma\theta_6\Delta CAD_{t-i} + \Sigma\gamma_6\Delta INF_{t-i} + \Sigma\delta_6\Delta REER_{t-i} + \Sigma\lambda_6\Delta MS_{t-i} + \Sigma\sigma_6\Delta TAX_{t-i} + \varepsilon_t \quad (15)$$

$$\Delta TAX_t = \alpha_7 + \Sigma\beta_7\Delta BD_{t-i} + \Sigma\theta_7\Delta CAD_{t-i} + \Sigma\gamma_7\Delta INF_{t-i} + \Sigma\delta_7\Delta REER_{t-i} + \Sigma\lambda_7\Delta INT_{t-i} + \Sigma\lambda_7\Delta MS_{t-i} + \varepsilon_t \quad (16)$$

6.5 Empirical Findings

6.5.1 Results of unit-root

The results of ADF test are given below

Table 6.1: Results of Augmented Dickey-Fuller test

Variables	t-stat	ADF at 1% Level	ADF at 5% Level
CAD	-2.231	-3.740	-2.962
∆CAD	-5.5917	-3.7378	-2.9918
BD	-2.0672	-3.7240	-2.9862
∆BD	-4.6399	-3.7378	-2.9918
REER	-1.4811	-3.7240	-2.9862
∆REER	-6.6738	-3.7378	-2.9918
INF	-3.0989	-3.7240	-2.9862
∆INF	-8.5568	-3.7378	-2.9918
INT	-2.9164	-3.7240	-2.9862
∆INT	-6.3004	-3.7378	-2.918
MS	-2.5870	-3.7240	-2.9862
∆MS	-7.1816	-3.7378	-2.9918
TAX	-1.5477	-3.6891	-2.9718
∆TAX	-4.8290	-3.6998	-2.9762
PC	-1.7624	-3.6998	-2.9762
∆PC	-3.6021	-3.6998	-2.9762
G	-2.8598	-4.3393	-3.5875
∆G	-3.7645	-4.3393	-3.5875

We applied the ADF test and presented the findings in Tables 6.1. Therefore, for long-term relationship analysis we applied Johansen methodology.

6.5.2 Testing Ricardian equivalence hypothesis

Based on the above equation (2), the study first estimates the Ricardian equivalence preposition based on Bernheim (1987) consumption function which is as: PC = f (G, TAX, BD). The unit root results of this equation indicate that after first differentiation the variables became stationary. This indicates that we can use the Johansen's cointegration approach and VECM based on the following equation for short-run relationship (17).

$$PC_t = \beta_0 + \beta_1 G_t + \beta_2 TAX_t + \beta_3 BD_t + X_t\beta + \varepsilon_t \quad (17)$$

Where PC is the private consumption, G is the government consumption, TAX is the tax revenue and BD is the budget deficit. The results are given below in table (6.2).

The findings indicate that there is a substantial link between private consumption (PC), government spending and the budget deficit (BD). We do not, however, find short-run relationships between the variables. The ECM value, which calculates the speed of change in the long run, is very small. The whole system will get back to the equilibrium at the speed of 0.30 which means the higher budget deficit and government expenditure will diverge the country from equilibrium state due to change in tax structure, due to this phenomenon individual will reduce their consumption, lower demand, and private investment will shrink down and higher budget deficit which exactly is happening in India after change in tax slabs due to uncertainty in the market and decrease in income.

Table 6.2: Johansen Co-integration and VECM model for Bernheim (1987) consumption function Dependent variable (Private Consumption (PC))

Variables	Trace test	5% Critical Value	Prob
PC	67.40	47.85	0.00*
G	27.57	29.79	0.09***
TAX	7.39	15.49	0.53
BD	3.01	3.84	0.08***
Variables	**Max- Statistic**	**5% Critical Value**	**Prob**
PC	39.93	27.85	0.00*
G	20.07	21.13	0.06***
TAX	4.37	14.26	0.81
BD	3.01	3.84	0.08***
ECM (-1)	-0.30	---	0.02**
Short-Run F-Stat	0.94	---	0.50

Note: "*" "**" "***" denotes significance at 1%, 5% and 10%.

The coefficient of tax is insignificant meaning change has not hampered consumption which is consistent with Ricardian hypothesis. The Ricardian hypothesis may exist when we estimate tax impact on private consumption, because it is being said that India economy is primarily a consumption driven economy these forces can deviate this relationship, but the recent change in tax structure has hampered private consumption, which again needs to be investigated with quarterly or monthly date.

6.5.3 Results of Johansen's cointegration

The Johansen's test was used to analyses the cointegration association between BD and CAD. In Tables 6.3 and 6.4, the Johansen test results are focused on track and limit statistics. The results show that in the long term all variables are co-integrated at 5 percent, suggesting a linear connection between the BD and the CAD and a long-term transition. Grade 0 means that the variables are not coinciding, which indicates that our trace statistics must be more than 5% of the critical point, so we depart from our null hypothesis and accept alternate theories without conclusion throughout this situation. In this case, rank 1 implies a single co-integration; in order to refute the null hypothesis of no co-integration, our essential importance should be larger than trace statistics.

Table 6.3: Cointegration results for India (Trace Value Statistic)

Maximum	Trace Test	5% Critical Value	P-Value
BD	175.29	125.29	0.00*
CAD	115.45	95.71	0.00*
INF	65.11	69.81	0.01**
INT	38.31	47.85	0.28
REER	15.08	29.79	0.77
MS	5.80	15.49	0.06***
TAX	0.01	3.84	0.09*

Table 6.4: Cointegration results for India (Max-Eigen Value Statistic)

Maximum	Max-Eigen Statistic	5% Critical Value	P-Value
BD	59.83	46.23	0.00*
CAD	50.33	40.07	0.00*
INF	26.80	33.87	0.03**
INT	23.22	27.58	0.16
REER	9.27	21.13	0.80
MS	5.79	14.26	0.03**
TAX	0.01	3.84	0.04**

Note: "*" "**" "***" denotes significance at 1%, 5% and 10%.

The findings suggest that all variables are co-integrated, which indicates that, based on the Trace and the Max details given below, the BD, CAD, INF, INT, REER, MS and TAX are integrated over the long run.

The calculation is based on the equation (8 & 9) and the parameters for lag selection are based on the criteria for Akaike knowledge (AIC), since the AIC value is lowest, we have selected lag 1. In table 6.5, the VECM results accept cointegration among the variables. Goyal and Kumar (2018) and Ravinthirakumaran et al., (2016), for instance, discover India's long-run and causal relationship. No short-run association is found in the data. In the long run, the change speed is very slow; the whole system will return to equilibrium at a speed of 0.53.

Table 6.5: Results of VECM Model

Short-run	Coefficient	Probability
ECM	0.53	0.02
F-Statistic	0.46	0.85
Chi-Square	3.22	0.86

Note: Author compilation

6.5.4 Granger causality results

The causality of the factors as seen in Table 6.6. The findings suggest that there is a bidirectional causality between CAD and BD, as do Khalid and Guan (1999) and Anoruo and Ramchander (1998). The results indicate that the raise in the rate of taxes will raise the BD and CAD. The results suggest that the raise in the tax rate will exacerbate the spending and CAD. The results also indicate that India's current account and expenditure deficits are exacerbated by Miller's macroeconomic instability (1983). He maintains that budget deficits are inherently inflationary, independent of deficit monetization, and there are multiple channels whereby budget deficits are inflationary. He argues that deficits are inflationary by crowding of results, irrespective of whether or not the Central Bank adjusts deficits through growing the money supply/print. This is because non-monetized deficits raise debt costs and higher interest rates overwhelming business spending and reducing the inflationary growth rate. In order to measure the possible predictability and intensity of the factors, the IRF has been used to determine the consequences of one optimistic shock or innovation upon the independent variables and their influence on CAD and BD.

Table 6.6: Wald Granger Causality Test results

Null Hypothesis	Chi2	Prob	Direction of causality
BD to CAD	34.621*	0.000	Bidirectional
CAD to BD	41.544*	0.000	Causality
REER to CAD	61.287*	0.000	Bidirectional
CAD to REER	101.16*	0.000	Causality
INF to CAD	25.325*	0.000	Bidirectional
CAD to INF	39.067*	0.000	Causality
INT to CAD	14.561*	0.002	Bidirectional
CAD to INT	37.715*	0.000	Causality
MS to CAD	19.605*	0.001	Bidirectional
CAD to MS	54.829*	0.000	Causality
INT to BD	57.519*	0.000	Bidirectional
BD to INT	28.977*	0.000	Causality
REER to BD	4.2106	0.240	Unidirectional
BD to REER	26.888**	0.020	Causality
INF to BD	24.996*	0.000	Bidirectional
BD to INF	6.9838***	0.070	Causality
MS to BD	11.248 *	0.010	Bidirectional
BD to MS	26.888 *	0.000	Causality
TAX to BD	13.387*	0.004	Bidirectional
BD to TAX	11.865*	0.008	Causality
CAD to TAX	42.957*	0.000	Bidirectional
TAX to CAD	6.4989***	0.090	Causality

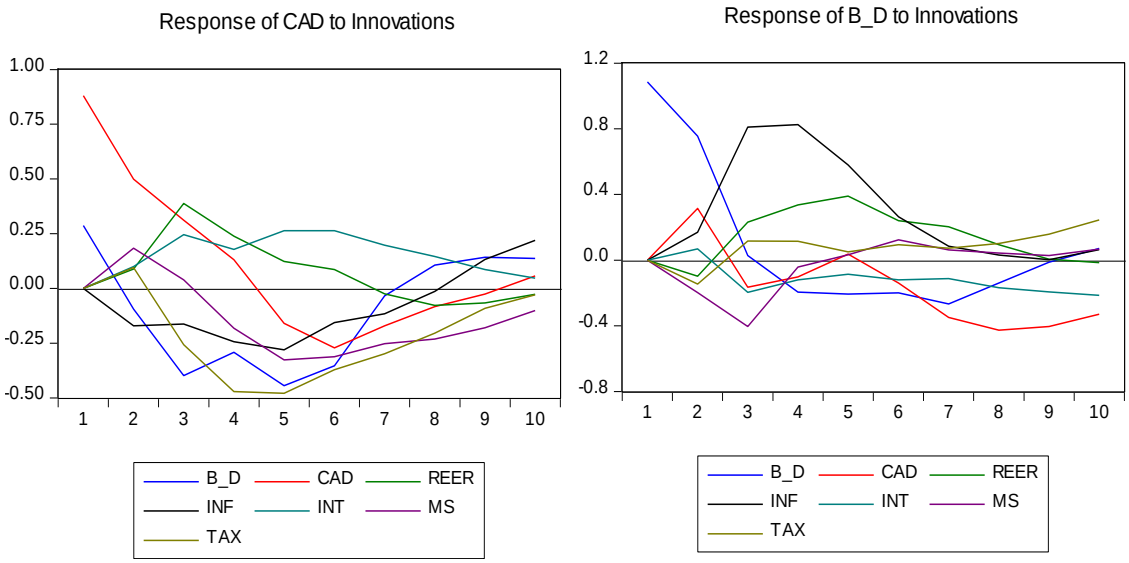
Note: "*" "**" "***" denote 1%, 5% and 10% significance level.

6.5.5 Cholesky Impulse Response Function

With the aid of the Cholesky feature, we further break down the model to find out the channels that trigger BD and CAD. We estimate the model for 10 periods, which starts from 1 to 10 periods. The first few periods can give us short-run relationship and end years can give us long-run relationship. Figure 6.2 provides one innovation to the effects of Cholesky, a shock or innovation to the budget deficit will give raise CAD in the long and short term, and a shock to CAD will also increase BD in the both the periods. The impulse to BD is diluted in the long-run and turns CAD positive after six years.

Tax, inflation, money supply and exchange rate shocks trigger both long and short-run current account deficits. It seems that the exchange rate might have a positive effect on CAD, but it will turn negative after six years.

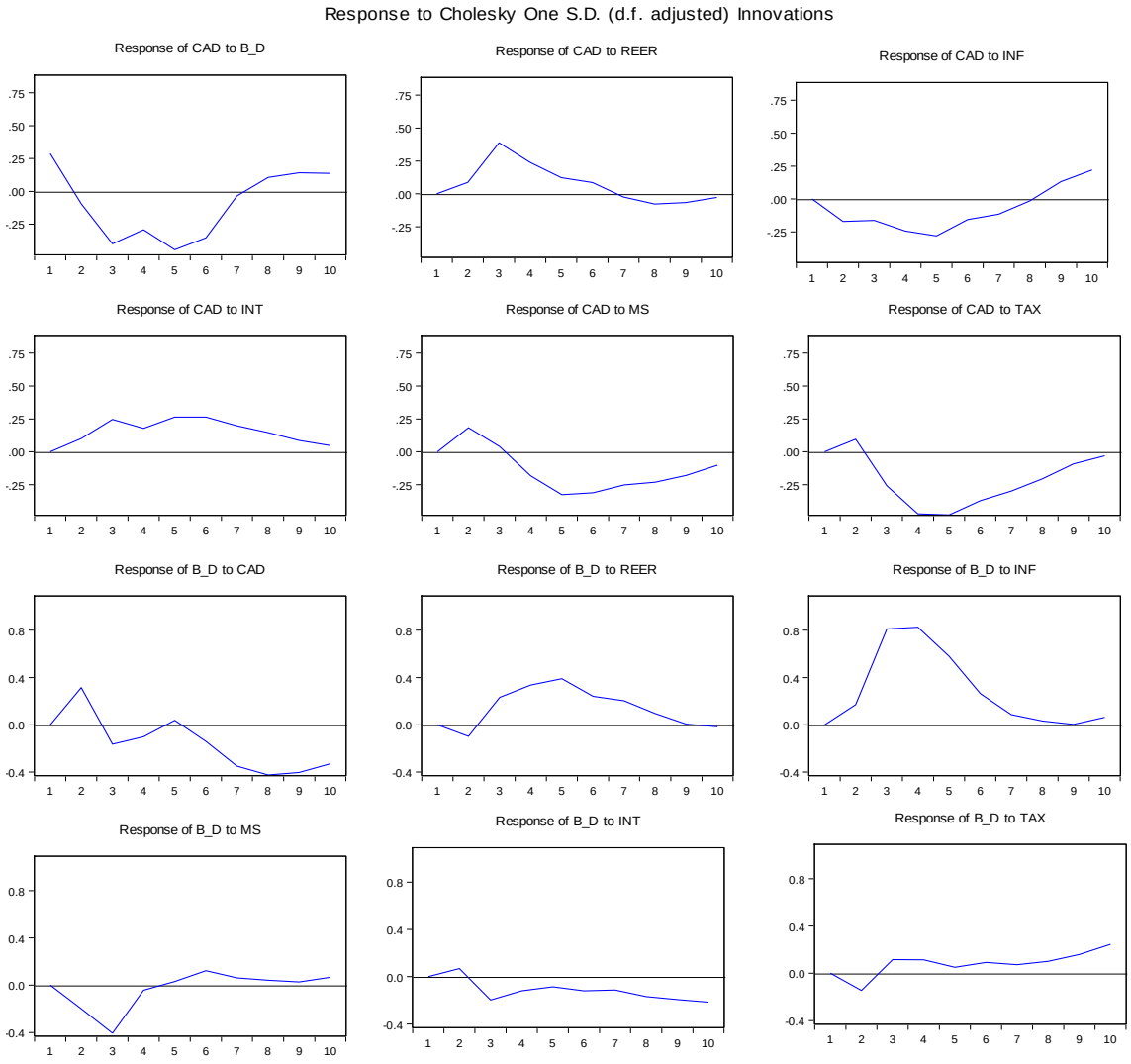
Figure 6.2: Impulse response function of BD and CAD



Note: Author compilation

The outcomes are the same as we find the channel from macroeconomic variables to BD and CAD in granger causality. Any disruption in the macroeconomic variable has consequences for CAD and BD. The findings demonstrate that economic growth can be accomplished by inflation management and currency volatility. The findings correspond to the Mundell-Fleming paradigm and the Granger Causality results.

Figure 6.3: Extended Experiments of Response to one Standard Innovation.



Note: The graph is based on above results of impulse response function.

The reverse causality can be explained from different ways. The inflow of capital stimulates real exchange rate appreciation and worsens the trade balance. India is having a different culture of taste which can lead exogenous shocks, may imbalance exports or increase imports. The imbalance in trade balance leads higher demand for imported goods, which has an adverse effect in domestic output (ceteris paribus) and decreases tax revenue which offsets fiscal balance.

Government expansionary fiscal policy contributes to an increase in government expenditures (including charges for transfer) that causes the fiscal balance to run into deficit. The growth in government expenditures allows overall demand to rise in the economy, contributing to an improvement in income/output. As the income level grows, imports of international products and services grow in a deficit. The trade imbalance refers to an open economy's current-account deficit. The economic gap thus contributes to a deficit in the current account. Any trade shock, however, may have a beneficial impact on the fiscal balance. Assume that the rise in autonomous exports contributes to change in the trade balance. This increases the equilibrium of current accounts by rising aggregate demand and therefore the economy's production / revenue ratio. The growth in revenue raises the government's tax income and boosts the fiscal position.

India is mounting with CAD with higher inflow of goods and decreased level of exports. It is the responsibility of the government and central bank to reduce the impact of CAD on domestic market. If CAD is slowing economic growth, the government will increase spending and reduces taxes which mean BD is not determining the CAD. However, the causation runs from CAD to BD. India is an oil importing country, with the increase in

oil imports and the rise in oil prices worsening the balance of trade and reducing government revenue by offsetting the balance of the budget.

The big risk is a spike of inflation which causes the application in exchange rate and promotes capital inflow of goods. Inflation dries investments; country is not in a state of investing in new factories and new roads their prior is to meet the demand for middle class. This will cause supply shock and prices will start booming. The fall in budget balance and investments, destabilize government and the channels away productive investments.

The spending habit is becoming the core cause of BD. The spending on welfare schemes such as (Rural Employment Guarantee Scheme) does not create productive incentives for formers. But looking to other counties like China they managed to absorb their labour forces into an economic miracle by migration from inland farmers to productive coastal cities.

The reverse causation can be linked with sterilization effect used by RBI against adverse external shocks which keeps money supply stable against the exogenous shocks and keeps equilibrium domestic interest rate. If the value of output remains same, the extra money increases the price level and causes inflation. The increase in inflation will decrease the household savings, and increase unproductive investments such as gold, which clearly shows the adverse effects of inflation on CAD. In India the increasing prices makes domestic market inept in the international market, which will not attract enough buyers and import of these product increases and causes current account deficit.

Some policy adjustments in the internal or external economic market would therefore have a beneficial impact on the other Indian sector. With the growth of the interest rate, however, the capital inflow is expected to increase, thus conflicting interest rate policy that accelerates the inflow of capitals on the one hand, and decreases the current account deficit by reducing the interest rate on the other. The devaluation of the local currency to correct CAD is in the general policy context. In the long-run, however, trivializing the currency has a mild effect on CAD (Thissen & Lensink, 2001). So, it does not seem logical to devalue our local currency to reduce CAD, because there is a reverse causality from CAD to BD. The Indian government can use fiscal policies to balance the economic cycle, but for sustainability, they need to circumvent debt hoarding.

6.6 Conclusion

The chapter examined the hypothesis of twin deficits and their correlations with different macroeconomic variables in India. The study indicates that BD and CAD are interconnected to each other, as logically clarified by Keynesian claims, which revolve around the Mundell-Flemings model.

The analytical findings of the co-integration model underpin India's twin deficit hypothesis. Since the findings of Johansen co-integrating with the Model VECM indicate that BD contributes to CAD and accept the Keynesian hypothesis. The results of Granger causality and the impulse function finds bi-directional relationship between the BD and the CAD. Furthermore, CAD is primarily determined by exchange rates and inflation.

Fiscal approaches are not a good way to sustain internal imbalances as a position for monetary policy as shocks arise because of the global economic scenario, because it is primarily CAD which triggers BD on a long-term basis. We find the two forms the causal link is established: the growth of BD contributes to CAD and the indirect change as the interest rate is increasing, our currency value grows and our current account deficit worsens.