CHAPTER 4

RICARDIAN EQUIVALENCE AND TWIN DEFICIT IN BRAZIL

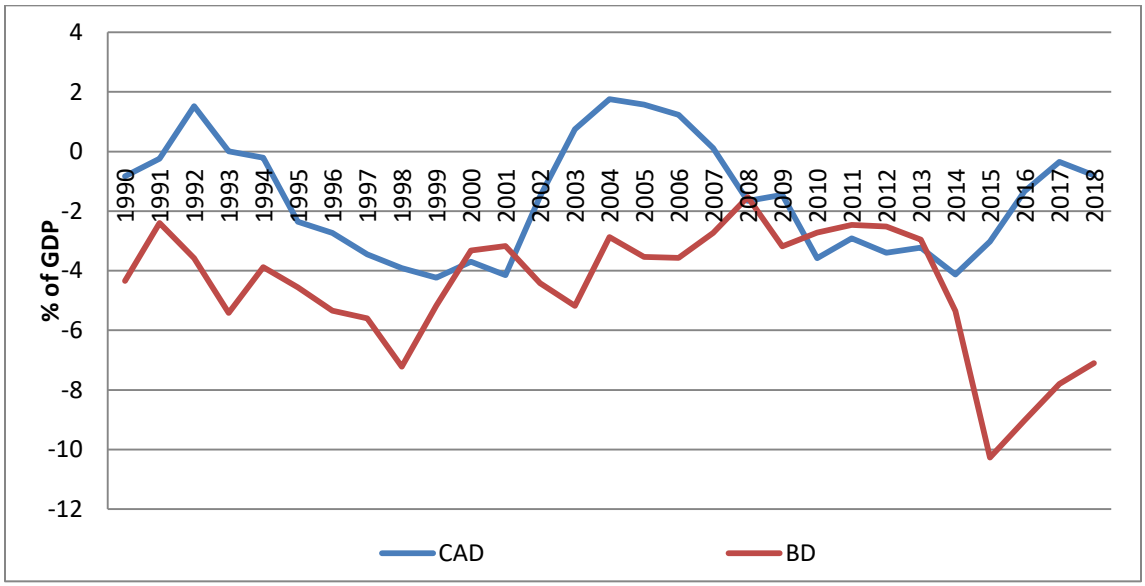
4.1 Introduction

Many developed countries have undergone major systemic reforms during the last two decades, with the goal of reducing the BD, the CAD and inflation and building a healthy macroeconomic environment. The BD and CAD remain complicated, however, as governments in several developing countries; including Brazil, have continued operating both the BD and the CAD.

In this chapter we investigate the linkage among BD, CAD and other macroeconomic variables using autoregressive distributed lag (ARDL) bound testing method (2001). Secondly, we use Bernheim (1987) consumption function to validate Ricardian equivalence hypothesis by applying ARDL bound testing approach. Thirdly, we investigate the causal relationship from x to y. 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...).

A figure 4.1 and 4.2 gives us a brief outlook of internal and foreign position of Brazil. From 1990 to 2017, the BD and CAD continue to rise. The fiscal deficit grew from -2.7% of GDP in 2007 to -7.10% of GDP in 2018. Macroeconomic policy in Brazil remains the major debate with increased inflation in the early 1990s and depreciation of the most effective, effective exchange rate in 2011. It meets J-curve trends, whether the currency is devalued and the current-account balance increases in 2002 and the current-account balance deteriorates while the currency is appreciated.

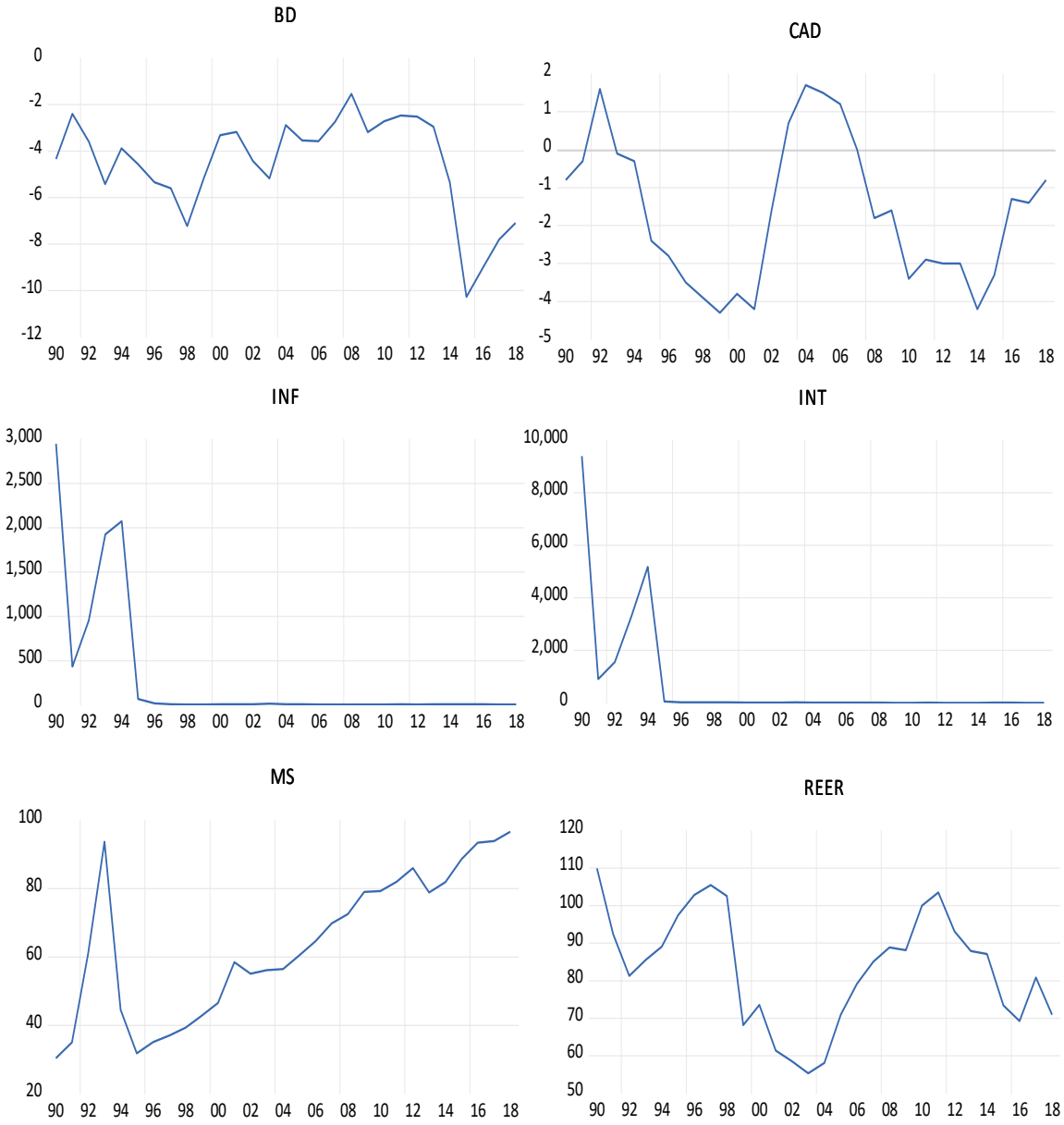
Figure 4.1: Trend of the Twin Deficits in Brazil



Note: Budget deficit and Current account from1990 –2018, this graph shows Budget deficit ("Bud Def/GDP") and the current account ("Cur Acct/GDP"), as % of GDP.

There has been a continuous fluctuation in budget deficit from 1990 to 2018, reaching -7.2 percent of GDP in 2018. However, current account deficit shows the healthier sign which reduces from -4.2 percent in 2014 to -0.82 percent of GDP in 2018.

Fig.4.2. Trend of some Macroeconomic variables in Brazil



Note: Author compilation.

However, the continuous increase in BD and CAD with macroeconomic instability in the form of higher inflation and volatility in exchange rate becomes dangerous and can cause the structural weakness and competitiveness in trading sector, which can offset private

consumption, investments, economic growth and employment. The researcher like Bernheim, B. D. (1987) studied United Kingdom, Canada, and West Germany, and also from a general cross-country correlation suggests that $1 increase in BD will increase $0.30 rise in current account deficit. For Mexico, the past association between current account balance and government deficit proposes that this impact is essentially bigger, may be $0.80 to a dollar. Interestingly, for Japan the data seems conflicting, that the BD altogether affects the CAD.

This segment is structured as follows. Section 4.2 provides data information. Econometric methodology is given in section 4.3. Empirical outcomes are discussed in section 4.4. Section 4.5 gives conclusion of the study.

4.2 Data set Information

This study focuses for Brazil over the period of 1990 to 2018; the source of our data is World Bank and trading economics for the following variables:

(a) The current account deficit (CAD) displays the value of products, services and investments and the value of imports versus exports on the basis of the GDP percentage.

(b) Budget deficit (BD) gives the difference between all receipts and expenditure in both capital and revenue account as the percentage of the GDP.

(c) Deposit interest rate (DIR) as the interest rate (INT) proxy, the rate paid for savings deposits by commercial banks.

(d) Broad money (BM) is a proxy of money supply (MS) a proportion of the cash supply that shows the measure of liquidity in the economy. It incorporates cash, coins,

institutional currency funds and other liquid assets dependent based on local currency (LCU) and exchange rate (RER).

(e) Inflation (INF) as estimated by the consumer price index, inflation (INF) takes into account the percentage rise in the price of goods and services. For estimation, the Laspeyres method is employed.

(f) Real effective exchange rate (REER) an extent of the estimation of money against a weighted normal of numerous different currencies, partitioned by a value deflator.

(g) Tax revenue (TR) includes taxes on income, earnings and capital gains of individuals and on corporate and company profits as a proxy of the tax rate (T).

(h) Private consumption (PC) consumption by the households.

(i) Government consumption (G) general government expenditure incorporates all public current expenditure on goods and services and compensation to employs on the basis of percentage of GDP.

4.3 Methodology

4.3.1 Unit Root Test

Before using the ARDL test, it is necessary to check the unit root properties of your data set to check the Ricardian equivalence application (Granger and Newbold, 1974). Various unit root experiments has been done to determine the unit root between the variables. We used a conventional Augmented Dickey-Fuller (ADF) root test (1981) and a PP test to verify the stationarity. However, the PP root tests vary fundamentally from the ADF tests in the manner in which similarity and heteroscedasticity are treated. Specifically, while parametric self-regression in the test hypothesis is used by ADF tests

to approximate the structure of ARMA, serial regression correlation is not used by the PP tests.

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta 1 \Delta y_{t-1} + \delta 2 \Delta y_{t-2} + u_t \qquad \text{ADF equation (1)}$$

$$\Delta y_t = \beta' D_t + \pi y_{t-1} + u_t \qquad \text{PP equation (2)}$$

Where α is the constant β is the coefficient and ut is the error term. In PP u_t error term corrects serial correlation and heteroskedasticity in the regression equation.

4.3.2 ARDL Bounds Testing Approach

Taking into account that the series does not have the same integration order, we further applied the autoregressive distributed lag (ARDL) model to verify cointergation between the variables. Pesaran, Shin and Smith (1997); Pesaran et al. (2001), with various advantages, produced this model. The key benefit of this technique is that it does not rely on the same integration order. In this manner, it isn't essential pre-testing the stationarity of the factors, which varies from alternate techniques where series ought to be of a similar order or in most first order I(1) as a condition for cointegration testing. Moreover, the ARDL technique gives better results for the smaller size of date set as contrasted and the FM-OLS and it takes a large number of lags for modeling. Additionally, when all variables are I(1), at that point for ascertaining the long run parameters, it isn't important to build the quantity of the explanatory variables so as to address the autocorrelation and

the issue with the endogenous variables. Moreover, we derive the value of ECM by simple transformation.

The ARDL solution involves two processes. The initial step is to analyse whether there is a long-term association between variables and then short-term and long-term coefficients. When we see co-integration in the first step, we take the second step. This defines the lag length for different variables. The equation provides the following ECM variant of the ARDL model:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{P-1} \alpha_i \Delta Y_{t-1} + \sum_{j=0}^{P-1} \alpha_j \Delta X_{t-j} + \beta_1 Y_{t-1} + \beta_2 X_{t-1} + \varepsilon_t \qquad (3)$$

When Yt is a dependent factor, Xt is the independent variable, and Xt is the word residual. α coefficient is a short-term relationship and β is a long-term relationship. In the second we have F-statistics relative to the critical importance of the upper and lower bounds. The null for ARDL is Ho = β1 + β2 = 0 means that the accurate and illustrative variables do no co-integration or long-term interaction. The rejection of H0, however, indicates that no less than one of the long-run coefficients is different than null meaning long-run relation between at least one independent and dependent variable. Equation 4 is described in the following equation based on the twin deficit autoregressive lag distribution (ARDL) specification.

$$\Delta BD_i = \alpha_0 + \alpha_{1i} + \sum_{i=1}^{n} \alpha_{2i} \Delta BD_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta CAD_{t-i} + \sum_{i=0}^{n} \alpha_{4i} \Delta INF_{t-i} + \sum_{i=0}^{n} \alpha_{5i} \Delta REER_{t-i}$$
$$+ \sum_{i=0}^{n} \alpha_{6i} \Delta INT_{t-i} + \sum_{i=0}^{n} \alpha_{7i} \Delta MS_{t-i} + \beta_1 BD_{t-i} + \beta_2 CAD_{t-i} + \beta_3 INF_{t-i}$$
$$+ \beta_4 REER_{t-i} + \beta_5 INT_{t-i} + \beta_6 MS_{t-i} + u_t \qquad (4)$$

The optimal lag length for ARDL model based on SBC for the long-run equilibrium was defined as (1,3,3,2,3,0), represented in the equation 5 and 6.

$$\mathrm{BD}_i = \alpha_0 + \sum_{i=1}^{1} \alpha_{1i} BD_{t-i} + \sum_{i=1}^{3} \alpha_{2i} CAD_{t-i} + \sum_{i=1}^{3} \alpha_{3i} INF_{t-i} + \sum_{i=1}^{2} \alpha_{4i} REER_{t-i} + \sum_{i=1}^{3} \alpha_{5i} INT_{t-i} + \sum_{i=1}^{0} \alpha_{6i} MS_{t-i} + u_t \quad (5)$$

$$\Delta\mathrm{BD}_i = \alpha_0 + \alpha_1 \Delta ECM_{t-1} + \sum_{i=1}^{1} \alpha_{2i} \Delta BD_{t-i} + \sum_{i=1}^{3} \alpha_{3i} \Delta CAD_{t-i} + \sum_{i=1}^{3} \alpha_{4i} \Delta INF_{t-i} + \sum_{i=1}^{2} \alpha_{5i} \Delta REER_{t-i} + \sum_{i=1}^{3} \alpha_{6i} \Delta INT_{t-i} + \sum_{i=1}^{0} \alpha_{7i} \Delta MS_{t-i} + u_t \quad (6)$$

4.3.3 Granger Causality

The causal link between the BD and CAD is one of the key focal points of our study. The Granger causality tests usually help to determine the causality of variables Granger (1969). The survey reflects on whether the connection between BD and CAD is bidirectional, unidirectional or not. As indicated by the Granger-causality test approach, if better predictions of Y can be determined by adding to the lagged value of Y and variable X, at that point X is said to Granger-cause Y. It is essential to specify that the temporal strategy does not implicit the cause-and-effect relationship, but rather setting up the exact methodological framework can be valuable to understanding the idea of the

twin deficit problem and formulate a policy to improve the fiscal and monetary situations. To estimate the causality among the variables, the model can be written as:

$$\Delta BD_t = \alpha_1 + \Sigma\beta_1\Delta CAD_{t-i} + \Sigma\theta_1\Delta INF_{t-i} + \Sigma\gamma_1\Delta REER_{t-i} + \Sigma\delta_1\Delta INT_{t-i} + \Sigma\lambda_1\Delta MS_{t-i} + \varepsilon_t \quad (7)$$

$$\Delta CAD_t = \alpha_2 + \Sigma\beta_2\Delta BD_{t-i} + \Sigma\theta_2\Delta INF_{t-i} + \Sigma\gamma_2\Delta REER_{t-i} + \Sigma\delta_2\Delta INT_{t-i} + \Sigma\lambda_2\Delta MS_{t-i} + \varepsilon_t \quad (8)$$

$$\Delta INF_t = \alpha_3 + \Sigma\beta_1\Delta BD_{t-i} + \Sigma\theta_1\Delta CAD_{t-i} + \Sigma\gamma_1\Delta REER_{t-i} + \Sigma\delta_1\Delta INT_{t-i} + \Sigma\lambda_1\Delta MS_{t-i} + \varepsilon_t \quad (9)$$

$$\Delta REER_t = \alpha_4 + \Sigma\beta_1\Delta BD_{t-i} + \Sigma\theta_1\Delta CAD_{t-i} + \Sigma\gamma_1\Delta INF_{t-i} + \Sigma\delta_1\Delta INT_{t-i} + \Sigma\lambda_1\Delta MS_{t-i} + \varepsilon_t \quad (10)$$

$$\Delta INT_t = \alpha_5 + \Sigma\beta_1\Delta BD_{t-i} + \Sigma\theta_1\Delta CAD_{t-i} + \Sigma\gamma_1\Delta INF_{t-i} + \Sigma\delta_1\Delta REER_{t-i} + \Sigma\lambda_1\Delta MS_{t-i} + \varepsilon_t \quad (11)$$

$$\Delta MS_t = \alpha_6 + \Sigma\beta_1\Delta BD_{t-i} + \Sigma\theta_1\Delta CAD_{t-i} + \Sigma\gamma_1\Delta INF_{t-i} + \Sigma\delta_1\Delta REER_{t-i} + \Sigma\lambda_1\Delta INT_{t-i} + \varepsilon_t \quad (12)$$

4.4 Empirical Results

This segment provides the empirical results for Brazil. First we began with the descriptive analysis of data to understand the qualities of data.

Table 4.1 gives the descriptive statistics that shows the mean value of budget deficit (BD) is 4.487 and 2.16 for current account deficit (CAD) which is very high. The mean value

of BD is greater than CAD, which means that Brazil is having higher budget deficit as compared to the CAD over the period of time. The value of standard deviation for BD is 2.18 and 1.347 for CAD which means there are fewer deviations from the average.

The mean values of inflation (INF), interest rate (INT), money supply (MS) and real effective exchange rate (REER). The mean value of all the variables is greater than median value meaning distribution is positively skewed and asymmetric. The standard deviation of INF and INT is very high which indicates the dispersion of data is very high which is further supported by higher value of Kurtosis 7.97 for INF and 13.06 for INT indicating the distribution is leptokurtic. There is a high variation in minimum and maximum value which indicates there is large dispersion in the data.

Table 4.1: Descriptive Statistics of Variables for Brazil

	BD	**CAD**	**INF**	**INT**	**TAX**	**MS**	**REER**
Mean	4.487	2.167	305.44	740.27	13.33	63.60	84.388
Median	3.729	1.750	6.855	17.413	13.53	60.67	84.461
Maximum	10.274	4.300	2947.7	9394.2	17.47	100.23	109.90
Minimum	1.533	0.100	3.196	7.807	9.529	30.39	55.322
Std. Dev.	2.184	1.347	750.30	2053.1	2.180	22.10	15.219
Skewness	1.240	0.062	2.494	3.241	-0.115	0.088	-0.3111
Kurtosis	3.869	1.757	7.979	13.06	2.067	1.746	2.2398
Jarque-Bera	8.064	1.820	57.96	167.24	1.076	1.868	1.126
Probability	0.017	0.402	0.000	0.000	0.583	0.392	0.569

Note: Calculations by Author.

4.4.1 Unit root test

Before applying the ARDL test to investigate the application of Ricardian Equivalence and Keynesian preposition. We first check the unit-root of the data set (Granger and Newbold, 1974). The results are given below in table 4.2:

Table 4.2: Unit root test results for Brazil

	Augmented Dickey-Fuller				**Phillips-Perron**			
Variable	**Intercept**		**Intercept and Trend**		**Intercept**		**Intercept and Trend**	
	I_0	**I_1**	**I_0**	**I_1**	**I_0**	**I_1**	**I_0**	**I_1**
BD	-1.3180	-5.1663	-1.4640	-5.116	-1.318	-5.2052	-1.5762	-5.1881
CAD	-3.7809	…	-3.5006	…	-2.017	-4.0454	-1.9858	-3.9866
MS	-1.5716	-4.9774	-2.8458	-4.875	-1.487	-6.7929	-2.8988	-7.1050
INF	-4.9823	…	-5.0518	…	-4.8507	…	-4.9195	…
REER	-2.2736	-4.4516	-2.1087	-4.3678	-2.466	-4.4400	-2.3285	-4.3539
INT	-7.5317	…	-7.7599	…	-6.975	…	-7.7599	…
TAX	-0.9712	-3.5298	-1.7716	-3.421	-0.971	-3.5298	-1.8988	-3.4212
PC	-2.0485	-4.8443	-2.0472	-4.731	-2.146	-4.8442	-2.1449	-4.7327
G	-3.5820	…	-3.9769	…	-3.571	…	-3.9838	…

The unit root finds five variables stationary after the first difference and other three variables are stationary at level. The ADF t-test can't reject the null hypothesis for BD, MS, REER, TAX and PC. However, other variables like CAD, INF, INT and G rejects

the null hypothesis of unit root test. However, in PP test the results accept the null hypothesis for six variables and rejects null-hypothesis for remaining three variables.

4.4.2 Testing Ricardian Equivalence

We begin by testing the Ricardian equivalence. REH literature is expanding on a regular basis. Much research focus on the reaction of private consumption to public spending's. The key focus of these studies is on the reduced form of the consumption equation or the Euler form. Bernheim (1987), which is the most used consumption function, will be employed in our research.

$$PC_t = \beta_0 + \beta_1 Y_t + \beta_2(TX_t - G_t - r_t GB_{t-1}) + \beta_3 G_t + X_t\beta + \varepsilon_t \qquad (13)$$

where PC is the private consumption, T is the tax revenue, G is the public consumption, r is the interest rate, X a vector of different exogenous factors and $(TX_t - G_t - r_t GB_{t-1})$ is the budget surplus can be written as:

$$PC_t = \beta_0 + \beta_1 TAX_t + \beta_2 BD + \beta_3 G_t + X_t\beta + \varepsilon_t \qquad (14)$$

The results of ARDL results reveal the cointegration association among the variables. This technique depends on bound testing approach and ECM value based on Schwarz Bayesian Criteria (SBC). The results are given in Table 4.3.

(a) The tax (T) coefficient is (-.26721) negative and (.015) statistically important, meaning that tax rises would have a negative effect on actual private consumption. The negative coefficient indicates that individuals are mindful of potential debt-implicit taxes.

Table 4.3: ARDL regression for Bernheim (1987) consumption function (PC)

Variables	Coefficient	t-value	Prob
TAX	-.26721	2.6247	.015**
G	.62533	2.4743	.021**
BD	-.091450	.88527	.385
ECM (-1)	-.12511	-1.7383	.096***

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

(b) The coefficient of budget deficit is negative but statistically insignificant meaning there is no positive impact of budget deficit on private consumption.

(c) The value of ECM (-.12511) is negative and (.096) significant, which means long-run cointegration among the variables and acceptance of Keynesian model and rejection of Ricardian equivalence.

4.4.3 ARDL Bounds Testing Results

The ARDL technique is composed of two steps. The initial step analyses the long-term and the final step is to determine the short-term and long-term coefficients. If we find the first step of cointegration, then we add the second step. The lag length for independent variables will be determined by this. ARDL regression results are shown in Table 4.4 and Table 4.5.

Table 4.4: Results of ARDL model of Brazil (BD)

Variables	Coefficient	t-value	Prob
BD(-1)	.38000	2.5177	.036**
CAD	.49060	1.7049	.127
CAD(-1)	.40348	1.3602	.211
CAD(-2)	-.44299	-1.4276	.191
CAD(-3)	.50158	2.0626	.073***
INF	.20055	4.6526	.002*
REER	-.073885	-2.4978	.037**
INT	-.017793	-.79755	.448
INT(-1)	.19143	3.1410	.014**
MS	.16241	4.1200	.003*

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

Table 4.5: Results of Cointegration Bounds test

Calculated F-statistic	95% LB	95% UB	90% LB	90% UB
***F*= 6.4606**	2.6235	4.1364	2.1214	3.4118

Note: When the F-value is greater than the lower and upper bounds value, we conclude variables are cointegrated**.**

The F-stat 6.4606 is above the crucial value of the upper limit of 4.1364 at the percentage stage centered on Table 4.5. The findings of the binding test indicate that the BD, CAD, interest rate, exchange rate, inflation and the provision of money are closely interlinked.

The long-run ARDL coefficient is seen in Table 4.6. Both calculated coefficients are considered to be important. The current-account balance (CAB) is substantially favorable and has a detrimental influence on the budget deficit. It ensures the fiscal shortfall deteriorates as the CAD rises and the decrease of the current-account deficit increases the surplus of the budget. The negative broad-money coefficient indicates that a rise in the supply of money would increase the long-term budget deficit and will therefore be inflationary in nature. However, in the short-run, the money supply coefficient has a positive sign, which means that a rise in money supply would lead to an inflationary situation by creating more demand for goods and services that will cause current account deficit. The negative interest rate connection would boost long-term and short-term budget deficits. The interest rate can substitute for the exchange rate by changing the nominal interest rate as specified by the sticky price model, to amend the short-term interest rate. However, the interest rate has a detrimental effect on the BD, which implies that a rise in interest rates would contribute to external inflows and an increase in the actual exchange rate, resulting in the CAD. The negative signed coefficient of inflation will increase the gap between saving and investments. High inflation declines the ability to save; much of the investments go into useless investments like gold and real estate. The negative effect of inflation is clear on current account deficit. Moreover, the negative sign acquired on the real effective exchange rate recommends that the domestic currency appreciation will increase current account balance. The higher inflation was the main

concern for the Brazil economy. The high-interest costs were the instrument used to reduce the effect of inflation. Meanwhile, exchange rate appreciation was not just undesirable for the monetary policy, but instead of price control strategy, has turned out to be clear in the years when the inflation targets were not met. As the result higher interest rate was the primary explanations behind lower economic growth in Brazil as compared to emerging countries. The exchange rate has seen a rising trend, since the difference between international and domestic interest rates leads to foreign capital inflows and the growth of the exchange rate in Brazil. The currency re-evaluation will boost imports and reduce exports, resulting in a current-account deficit.

The empirical investigation finds a long-term correlation between the BD and the CAD in Brazil. The analysis of the Keynesian hypothesis for the twin deficiency hypothesis is consistent with this result of (TDH). The REH, however, rejects that since there is no relation between the two; the cointegration among the variables could be because of the monetary transmission mechanism and their interdependency among all the variables.

The above equation 9 of ARDL model captures the short-run interaction among the variables. The short-run results find that is a significant correlation between the budget deficit and other variables. All the variables are significant, except the first two lags of current account deficit and first lag of interest rate. The value of ECM_{t-1} is -.62 , this implies after any shock the dependent variable will reach the equilibrium at a speed of 62% in the long-run. This empirical evidence gives further belief to the cointegration results as show in table 4.6. Increases in domestic income will raise the current account deficit, while exchange rate depreciation and financial growth that will decrease the

current account deficit. These results explicitly support the Keynesian proposition and refute the hypothesis of Ricardian equivalence.

Table 4.7 provides an objective overview of the diagnostic measures for the ARDL model. The value of (R2= 0.88) is very high and the model is predictively accurate. Normality is recognized by the Jarque-Bera (JB) LM residual test. The LM test proposes no connection between the residuals. The stability results are given in Figure 4.3 and confirm that the estimated model is stable on the basis of (CUSUM) and (CUSUMSQ) test.

Table 4.6: Long-run and short-run results of ARDL model of Brazil(∆BD)

	Variables	**Coefficient**	**t-statistic**	**P- Value**
Long Run	CAD	-.068111	-.43198	.067***
	REER	-.031851	-1.9772	067***
	INF	.012314	.099133	.009*
	INT	.17446	1.6947	.011**
	MS	-.029570	-1.7499	.010**
	ECM(-1)	-.62000	-4.1078	.001*
Short Run	∆ CAD	.49060	1.7049	.114
	∆ CAD(-1)	-.058589	-.20052	.844
	∆ CAD(-2)	-.50158	-2.0626	.061***
	∆ INF	.20055	4.6526	.001*
	∆ INF(-1)	-.22445	-2.4403	.031**
	∆ INF(-2)	-.20531	-3.9495	.002*

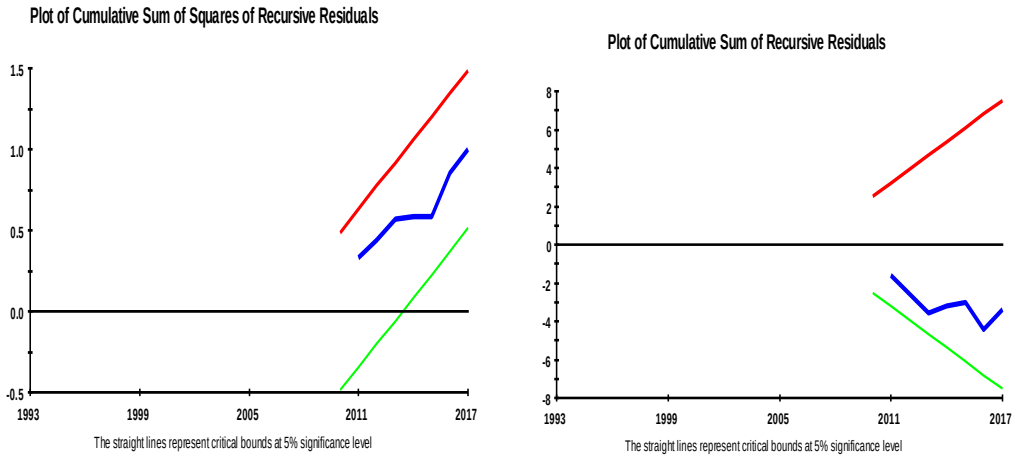
	Δ REER	-.073885	-2.4978	.028**
	Δ REER(-1)	.052247	1.7604	.104
	Δ INT	-.017793	-.79755	.441
	Δ INT(-1)	.10750	3.0656	.010**
	Δ INT(-2)	079917	4.0546	.001*
	Δ MS	.16241	4.1200	.001*
R-squared = 0.88630; F-Stat = 5.1967(.004); DW Stat = 2.5841				

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

Table 4.7: Diagnostic testing

Test Statistic	LM version	F version
(A) Serial correlation	3.4428 (.064)	1.1179 (.325)
(B) Normality	.17177 (.175)	
(C) Heteroscedasticity	32907 (.566)	.30678 (.585)

Figure 4.3: Results of CUSUM and CUSUMSQ stability test



4.4.4 Granger Causality Results

One of the principal focal points of our research is the causal relationship between the BD and the CAD. The confirmation of the ideal lag period of the variables is the fundamental element in causality. This is important because rejection and acceptance depend on the model's lag structure. We used Schwarz Bayesian Criteria (SBC) to define the ideal lag lengths. Table 4.8 provides the findings of the Granger causality test. The outcome gives unidirectional causality from CAD to BD. The outcome accepts the conventional economic theory of national accounting. The growing CAD and BD have increasing implications for three key major targets: inflation, interest rate and exchange rate. Inflation was a powerful mechanism for automatic increase in prices in the economy, as it empowered households to fuse past inflation into new agreements. The inflation inertial in an ordered economy, was based on the past inflation record, which was aggravated by higher variances between supply and demand which makes monetary policy ineffective and causes current account deficit. In Brazil interest rate was high in 2010; later the central bank has reduced the SELIC rate by 525 basis points. Higher interest rate is the cause of concern which is also related with higher consumer’s spending. This will give rise to interest rate in an open economy higher interest rate discourage domestic investments and encourage capital inflow from abroad and causes CAD. The inflow of capital would cause the exchange rate to appreciate, thereby raising the CAD. The depreciation of the exchange rate will decrease import demand and increase export demand. The real effective exchange rate deprecation is further supported by CAD to REER (see figure 3.4). Moreover, monetary policy is given the way that the world oil prices exogenously influence the

current account deficit, the fiscal management should try to actualize and keep up sound macroeconomic policies that give the reason for the expansion of export away from oil. Another reason for the unidirectional causality may be due to the sterilization effect, which prevents interest rate from falling and attracts foreign capital which will lead to current account deficit. In addition, the results found inflation, real effective exchange rate and money supply Granger causes budget deficit and current account deficit.

Table 4.8: Results of Granger causality test of Brazil

Equation	F-statistic	P-value	Null-Hypothesis	Causality
BD to CAD	2.05401	0.1594	Rejected	Unidirectional Causality
CAD to BD	2.87066	0.0755***	Accepted	
INF to BD	1.32094	0.0100**	Accepted	Unidirectional Causality
BD to INF	0.75557	0.6214	Rejected	
REER to BD	0.69185	0.6629	Rejected	No Causality
BD to REER	0.91150	0.5276	Rejected	
INT to BD	0.30950	0.9165	Rejected	No Causality
BD to INT	0.59387	0.7293	Rejected	
MS to BD	1.27894	0.0550***	Accepted	Unidirectional Causality
BD to MS	0.23050	0.9560	Rejected	
INF to CAD	1.22139	0.0599***	Accepted	Unidirectional Causality
CAD to INF	0.47763	0.8096	Rejected	

REER to CAD	1.88408	0.0887***	Accepted	Bi-directional Causality
CAD to REER	3.58579	0.0424**	Accepted	
INT to CAD	0.17130	0.9781	Rejected	No Causality
CAD to INT	0.36675	0.8826	Rejected	
MS to CAD	0.23828	0.9526	Rejected	No Causality
CAD to MS	0.39220	0.8665	Rejected	
REER to INF	2.67262	0.0897***	Accepted	Bi-directional Causality
INF to REER	2.58598	0.0969***	Accepted	

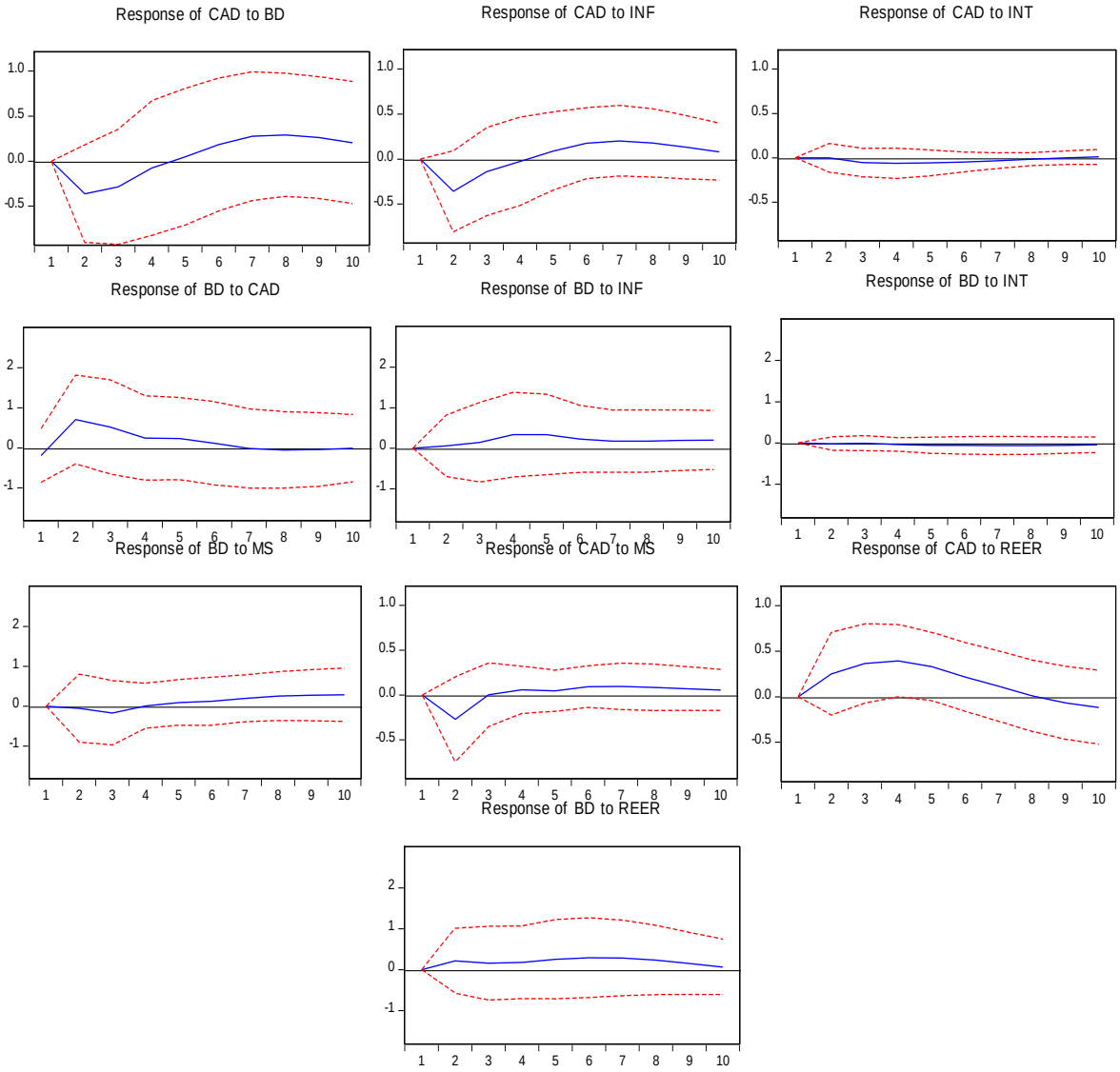
Notes: "*" "**" "***" indicates1%, 5%, 10% level of significance

4.4.5 Dynamic Simulations: Impulse Response Function (IRF)

The limitations in Granger causality test don't demonstrate the time way of these factors and their response to shocks from different variables. Second, these outcomes can be translated as inside example tests which may give little confirmation of the dynamic properties of the framework Masih and Masih (1995). So, we conducted Impulse Response Function (IRF) of Cholesky one standard deviation. The impulse response function gives a shock to a one variable and their impact on another variable in a future time Fischer, Hall & Taylor (1981).

Figure 4.4 gives the results of impulse response function with respect the innovation in BD, CAD, INF, INT, REER and MS over the period of ten years. The response to the one positive standard innovation to the BD, the CAD turns negative for the first five years.

Fig 4.4: Response to Cholesky One S.D. Innovations



The optimistic shock of the CAD lets the BD turn positive and negative after six years. For the most theoretical Standard Forecast models, this is true. For the first three years, the positive shock to inflation and money supply has a negative effect on the budget deficit and current account deficit, and then turns positive. A rise in the money supply would increase imports and trigger current account deficits, as per the Keynesian Preposition.

The positive interest rate shock has a negative impact on the CAD and BD. The interest rate response to the one standard innovation is consistent with the monetary contraction that decreases production, raises the budget deficit and contributes to an exchange rate appreciation. Lastly, the positive REER shock has had a positive effect on the 8-year BD and CAD, and then a negative impact on the current account deficit. The empirical evidence is consistent with the impact of the spending switch. The impulse response feature shows the existence of the J-curve, when the exchange rate is deprecated, the current account balance is increased, and the current account balance decreases when the exchange rate is appreciated. Nevertheless, the current account balance supports the J-curve trend. Engel & West are in line with the empirical proof (2004).

4.5 Conclusion

This chapter investigates the twin deficit hypothesis and Ricardian equivalence (RE) theorem for Brazil using autoregressive distributed lag model (ARDL), Granger causality and impulse response function.

The results reject the Ricardian equivalence hypothesis and show that the explanation for the divergence from REH is higher interest rates, higher tax rates and liquidity constraints. The results show that private consumption (PC) is related to taxation (T), the budget deficit (BD) and public consumption (PC) (G). The ARDL model confirms that the BD and TAX coefficients are negative and substantial, which means that increased taxes and budget deficits would reduce private consumption.

The ARDL methodology affirms the long-term association between the variables. The findings suggest that the budget debt and the current-account are linked. The findings indicate that increased inflation and the exchange rate generate a budget gap. However, rising money supply and reducing interest rates will decrease the fiscal gap in the long term. We have discussed the short-term complex interaction of budget deficit variables. Short-term outcome equations suggest that money supply and interest rates have a favorable influence on budget debt, while rising current-account deficits, inflation and exchange rate appreciation would slash budget deficits in the short term.

Granger's results indicate that causality occurs unidirectionally: the current account causes a fiscal gap in Brazil. However, the Impulse reaction results demonstrate that the spending gap creates the current account deficit for the next five years and thus turned out to be a good one (reduces current account deficit). In the findings of the ARDL-bound study, a long-term association between government deficit and the account balance is observed, thereby endorsing the Keynesian preposition and refuting the short and long-term Ricardian hypothesis of equivalence. We assume that the budget gap is guided by Brazil's current account deficit on the basis of causality observations and the answer feature.

The IRF investigation of BD to INF, CAD to REER and BD to REER reveals that central bank of Brazil (Monetary authority) can play an important role in bringing price stability and trade balance management. The deprecation in currency (lower value) will reduce imports and increase exports. The exchange rate deprecation will have a positive impact on both current account deficit and budget deficit (see figure 4.4). The J-curve reveals that the appreciation in exchange rate will cause CAD and

vice versa. The results reveal that inflation and exchange rate is the main concern for monetary authorities to bring macroeconomic stability in Brazil. However, a shift to floating exchange rate from the fixed exchange rate retained control by absorbing external shocks. The inflation was controlled by a higher interest rate by capturing the difference between domestic and foreign interest rate, which appreciates domestic currency and boosts the trade balance.

Moreover, the monetary authorities have got control on exchange rate but inflation should be the target variable. The increase in inflation would force central bank to increase interest rate aggressively and may cause instability. The strong countercyclical monetary policy is needed with the strong response to inflation and interest rate to respond to the financial and business cycle.