CHAPTER 5

RICARDIAN EQUIVALENCE AND TWIN DEFICIT IN RUSSIA

5.1 Introduction

A cohesive monetary and fiscal strategy plays a decisive position in macroeconomic stability. The theory presuming a connection between the BD and CAD is known as double deficit. Russia's economy has been marked over the past few years by an increasing budget gap, lower economic development and a shrinking current-account surplus. Many scholars doubt that these characteristics are causally or directly linked.

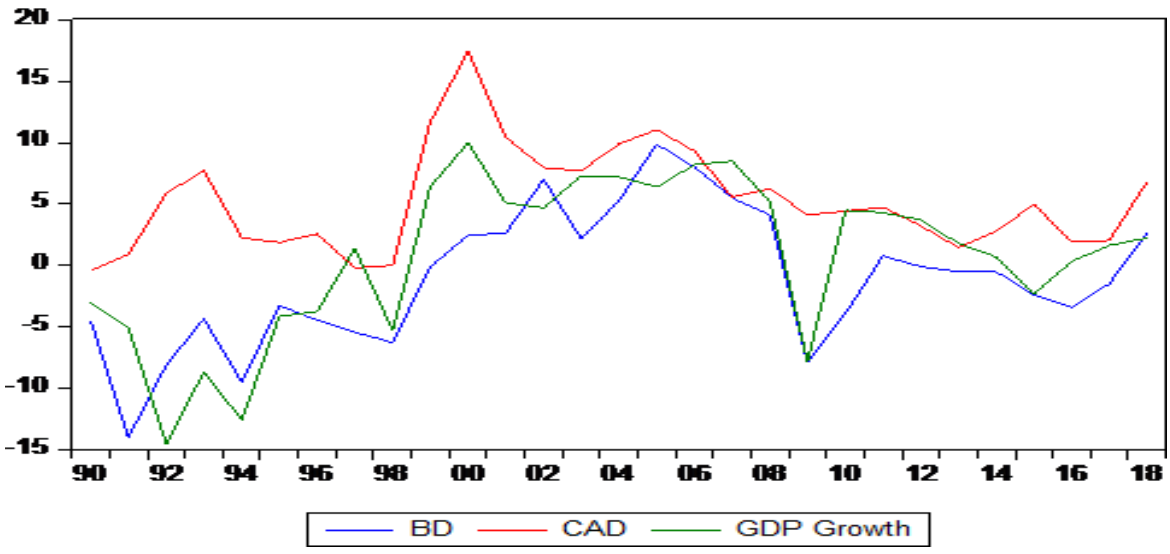
The budget deficit increases sharply in Russia after the Global Financial Crisis (GFC) indicating a budget deficit (BD) will deteriorate the current account balance or vice versa. Oil shocks influence the two deficits, as do GDP growth rates, so the impact of one deficit on the other must be set on by controlling for these factors. The decline in global oil prices has been a major cause of slowdown in Russia’s economy. Russian government revenue is adversely influenced due to the drop in oil revenue, yet additionally as a result of the decrease in tax revenue, which incurs a budget deficit of 8% of GDP for the first time. Russia has additionally influenced by the global credit crunch that apparently started with the expansion of subprime mortgages in the United States and the consequent burst of the real estate bubble. Since low-rate credit was not accessible locally, numerous Russian firms and banks relied upon foreign loans to back investments. As credit fixed, foreign loans became difficult to acquire.

Russia has the world's eighth biggest oil reserves and is the world's second biggest oil exporter (alongside Saudi Arabia). It has the world's biggest gas and coal reserves and is

the largest exporter of gas. These assets, especially oil, have been a main impetus of the Russian economy for long economic wellbeing. Therefore, large oil exports are the main reason for the current account surplus in Russia's economy. The income generated from oil reserves has a notable contribution through the multiplier impact on economic growth. As indicated by the IMF, the Russian central government has a budget surplus equal to 4.6% of GDP in 2007; however, if oil-related incomes are not excluded, the government would have 4.7% of the budget deficit.

There are many particular occasions of countercyclical changes between BD and economic growth. As the BD increased in 1993, Russia's economic growth rate tumbled to -14.5 percent, in contrast to -3 percent in the last year.

Fig: 5.1 Interrelationship between budget, current account deficit and economic growth in Russia



However, in the following years, BD turns positive 2.47 percent the economic growth jumps to 10.07 percent in 2000. Further widening of the BD in 2009, the economic

growth turns negative -7.79 percent. The growth in total demand like investments, consumption also declines and exchange rate starts creeping up.

As against this, the CAD was 4.42 percent of GDP in 2010, a time of high real effective exchange rate, lower inflation, and economic growth turn positive as compared to the last year 4.5 percent. It can be seen from the Figure 5.1 that both economic growth and budget deficit moves together, when the country incurs higher budget deficit, economic growth declines. However, when the BD decreases, economic growth increases. However, the cyclical movement also needs to establish in a dynamic macroeconomic framework.

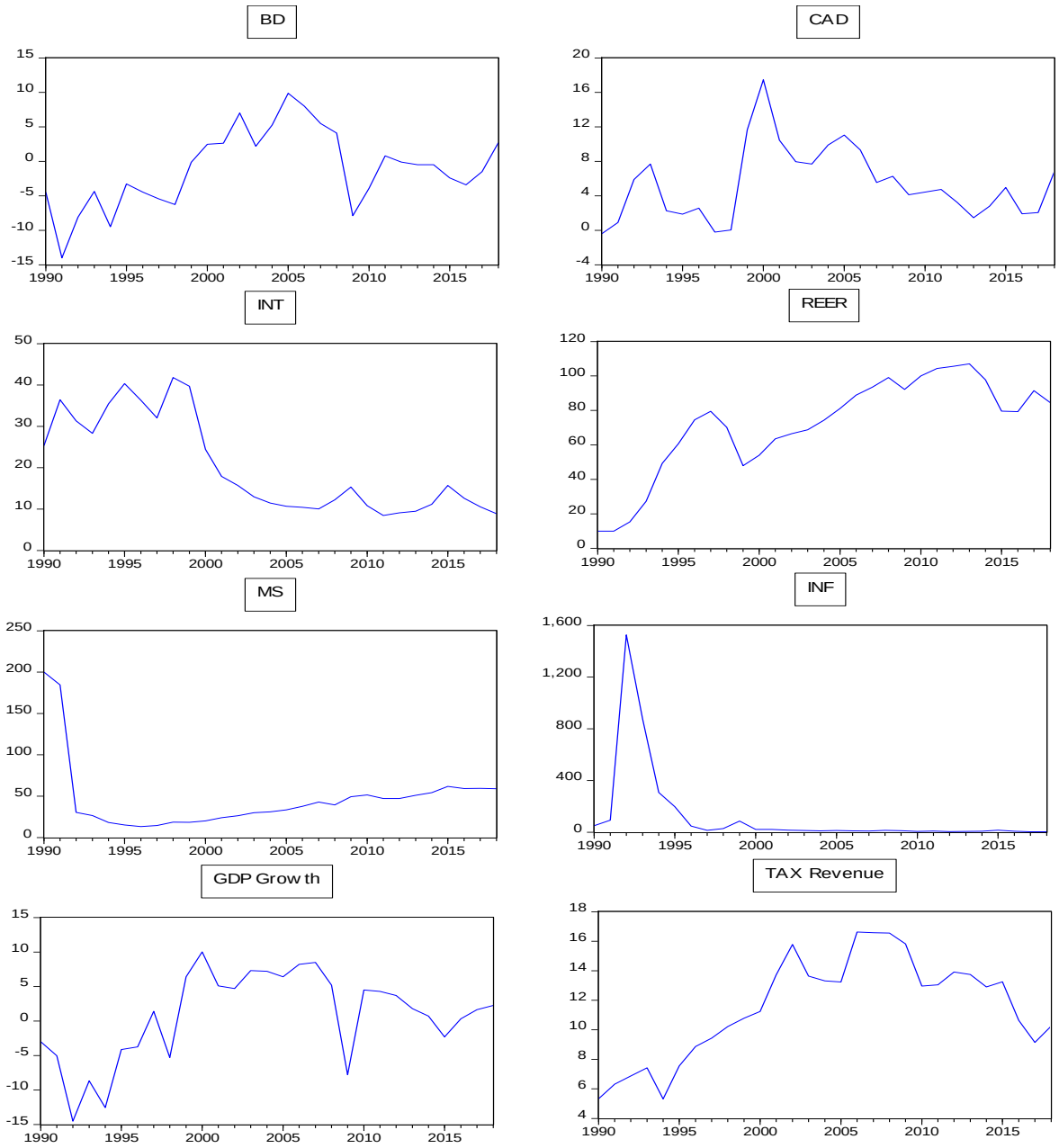
The purposes of this chapter are as follows: firstly, in the macroeconomic structure we will examine the relationship between the BD and CAD. Secondly, we use Bernheim (1987) consumption function to validate Ricardian equivalence hypothesis by applying ARDL bound testing approach. Thirdly, we investigate the linkage between the variables by applying Granger causality Wald 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 involves evaluating unexpected changes in time t in one variable X (the impulse) and estimating its effect on time t in the other variable Y, t1+t2+t3+t4...).

The rest of the chapter is defined as: Section 5.2 provides a description of the economy of Russia. Data and model requirements are discussed in Section 5.3. The analytical approach used to assess the association between the BD and the CAD is discussed in section 5.4. The key outcomes are summarized in Section 5.5. Section 5.6 concludes with the study's policy implications.

5.2 Economic environment of Russia

The economic factors explaining the combined performance of the CAD and the BD are presented in this section. It is worth noting the internal and external factors applicable to developing economies, such as the actual effective exchange rate, inflation, interest rates, taxation, and the supply of capital. The problem behind the persistence of a huge budget deficit in Russia from 1992 and 1997 is due to the striking decrease in tax income. In the same period, the economic growth and budget deficit was negative from 1990 to 1998. It is been seen that when the country is having budget surplus the economic growth also shows healthy sign. Russia's current account balance is in surpluses to a great extent because of huge oil reserves and natural gas. From 1990 to 2018 Russia's current account balance was in surplus and reaches the highest 17.47 percent of GDP in 2000. However, the current account balance suffered a serious shock in 2013 as a fall in oil prices, offsets due to fall in imports of the country and raises inflation and deprecates exchange rate. As the ruble began to slide against the dollar due to falling oil costs and greater investor vulnerability, in order to offer stability, the Central Bank decided to continue interceding in the exchange rate market.

Figure 5.2: Macroeconomic behavior of variables in Russia (1990-2018)



Note: Macroeconomic behavior of some variables from (1990-2018).

The currency was stabilized at many times within 40 to 70 RUB per USD in the year 1999 to 2004 and in the first half of 2015. The exchange rate of Russia began falling in the year 1993 and further ruble gets weak and reaches 80 RUB per USD in the year 1997,

as the nation was intensely influenced by feeble financial development, high geopolitical dangers and the episode of war in Ukraine. In the year 2008, the rubble reaches 100 RUB to USD, due to severe impact of global financial crises. Although, it was with the breakdown of oil prices in 2014 when the ruble couldn't resist gravity and started its free fall against the U.S. dollar and reaches RUB 91 to USD in 2017.

The fall of the Ruble and signs of serious inflationary pressures in the 1990 to 2005 with negative economic growth and lower tax revenue 5.32 percent of GDP in 1994 (see Figure 5.2). In the beginning of 1990, the inflation was the serious problem in Russia. By the end of 1991 hyperinflation has become apparent. At the end of 1991 economy was running out of control and shock remedial measures where started to find the solution of the problem (budget deficit -8.1% of GDP, economic growth -14.51 and inflation 1526.5). Inflation is triggered by the rise in the money supply in 1990. The rise in the velocity of money raises the availability of money and then costs. At the moment where inflation raises the level of liquidity and the pace of inflation is attributed to the volume of money supply rise and money speed. Finally, owing to reduced tax income, the larger budget gap may be triggered. As fiscal output is decreased, with negative economic growth the budget deficit rises and when tax revenue increases the budget deficit and economic performance changes positively.

5.3 Data information and model specification

This section presents data-related details and estimation techniques to evaluate the parameters of the ARDL Bound Testing Method and Impulse Response Function over the period of 1990 and 2018 the primary determinants of the positive relationship between

the BD and CAD. The variable-related information is obtained from the World Bank, Economic Trade and Russia's Central Bank. The detailed data on the variables is given below:

(a) Current account deficit (CAD) measures the trade balance as a percentage of the GDP. It includes trade of goods and services, investment income and transfer payments.

(b) Budget deficit (BD) occurs when spending is higher than revenue. Budget deficit is a combination of fiscal deficit, revenue deficit and primary deficit. It is measured on the basis of percentage of the GDP.

(c) As an interest rate (INT) proxy, the lending interest rate (LIR) is the bank rate that matches the private sector's short-and medium-term funding.

(d) Inflation (INF) is calculated on the basis of the index of consumer prices (CPI), which gives the basket of goods and services an annual percentage change. In calculating the CPI, the Laspeyres index is used.

(e) Broad money (MS) it is the combination of currency, demand deposits, time savings, foreign currency deposits and securities as the percentage of GDP.

(f) Real effective exchange rate (REER) is the weighted average currency divided by price deflator in relationship with various baskets of currencies.

(g) Tax revenue (TR) is levied on the additional income, profit, securities, services and ownerships on the basis of percentage of GDP.

(h) Private consumption (P) is the household total consumption, which include market value of all goods and services as the percentage of GDP.

(i) Government consumption (G) is the expenditure on education, capital, current and transfer as the percentage of GDP.

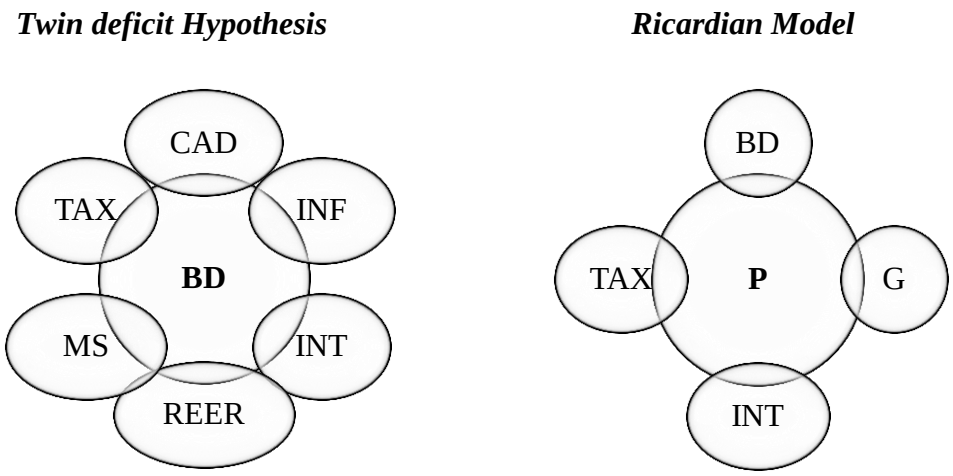
5.3.1 Model specification

In order to discuss Russia's twin deficit theorem, this section presents a model framework, the CAD, BD, inflation, interest rate, actual effective exchange rate, money supply, tax revenue and economic growth. Based on the open economy model of Mundell/Fleming with greater global capital mobility, the association between the CAD and BD can happen directly through higher absorption capacity or indirectly by monetary shocks. The below equation (1) represents the twin deficit model:

$$BD_t = \alpha_{0+} \alpha_1 CAD_t + \alpha_2 INF_t + \alpha_3 INT_t + \alpha_4 REER_t + \alpha_5 MS_t + \alpha_6 TAX_t + e_t \quad (1)$$

Where BD_t is the budget deficit, CAD_t is the current account deficit, INF_t is inflation, REER is the real effective exchange rate, MS_t is money supply, TAX_t is tax revenue, INT_t is the interest rate and e_t is a white random process. Based on the macroeconomic theory, estimation of α_1; α_2; α_3; α_5; α_6 and α_7 are supposed to be positive. This means that budget deficit, inflation, interest rate, money supply, tax revenue and GDP growth may deteriorate current account balance. However, the impact of α_4 real effective exchange rate may have a positive or negative relationship because the exchange rate is characterized as per US dollar. The depreciation in the exchange rate will raise the value of the foreign currency, it will increase the demand for domestic money and α_4 will have a positive relationship. On the other hand, if the exchange rate depreciates more, consumers would keep more foreign currencies than domestic currencies, and alpha-4 will be negative. Based on the equation (4) we have estimated two models to find out the causality between CAD and BD and vice versa as given below in figure 5.3.

Figure 5.3: Benchmark model for estimation of twin deficit hypothesis (TDH) and Ricardian proposition for Russia



Note: Current account deficit (CAD), budget deficit (BD), inflation (INF), interest rate (INT), real effective exchange rate (REER), money supply (MS), tax revenue (TAR), Government expenditure (G) and private consumption (P).

5.4 Methodology employed

5.4.1 Unit Root Test

The data series for all the variables needs to be stationary for the cointegration test because the non-stationary variables may give spurious results (Granger and Newbold, 1974). For making non-stationary variables statinary we have to differentiate them. We applied ADF and PP test for unit root. The ADF equation can be written as:

$$y_t = \alpha D_t + \gamma Y_{t-1} + \sum_{i=1}^{k} \beta i \, \Delta \, Y_{t-k} + \varepsilon_t \qquad (2)$$

where D_t is a vector of trend and constant, k differenced lagged term, $Yt-k$ is the ARMA structure and εt is error term.

$$Y_t = \mu^A + \theta^A DU_t(\lambda) + \beta^A{}_t + a^A Y_{t-1} + \sum_{j=1}^{k} c^A{}_j \Delta Y_{t-j} + \varepsilon_t \qquad (3)$$

$$Y_t = \mu^B + \beta^B{}_t + \gamma^B DT_t(\lambda) + a^A Y_{t-1} + \sum_{j=1}^{k} c^B{}_j \Delta Y_{t-j} + \varepsilon_t \qquad (4)$$

$$Y_t = \mu^C + \theta^C DU_t(\lambda) + \beta^C{}_t + \gamma^C DT_t(\lambda) + a^C Y_{t-1} + \sum_{j=1}^{k} c^C{}_j \Delta Y_{t-j} + \varepsilon_t \quad (5)$$

The null hypothesis is α = 0, which proposes that (Y-t) has a unit root with drift and no structural break. If α < 0 it just implies that the variable has trend stationery with a break at an obscure purpose of time. DT_t is the dummy with shift, where DU_t=1 and DT_t = t-TB if t > TB; 0 otherwise and εt is error term. If the sample size is small the distribution of test statistic can drift substantially Zivot and Andrews (1992).

5.4.2 Ricardian equivalence hypothesis

We used Bernheim (1987) equation to test the Ricardian equivalence for South Africa. Most of the empirical literature estimate Euler equation or reduced form of the consumption equation. But we applied the reduced form of the consumption function as given below:

$$P_t = \beta_0 + \beta_1 G_t + \beta_2 BD_t + \beta_3 TAX_t + \beta_4 INT_t + X_t\beta_t + \varepsilon_t \qquad (6)$$

Where P is private consumption, G is government borrowing, BD is the deficit in the budget, Tax is tax revenue, and the interest rate is INT. For long-run relationships, we

applied the ARDL bound research technique. The ARDL model for Equation (6) is given as below.

$$\Delta P_i = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta G_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta BD_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta TAX_{t-i} + \sum_{i=0}^{n} \alpha_{4i} \Delta INT_{t-i} + \beta_1 G_{t-i} + \beta_2 BD_{t-i} + \beta_3 TAX_{t-i} + \beta_4 INT_{t-i} + \varepsilon_t \quad (7)$$

5.4.3 Cointegration ARDL Bounds testing approach

The expanding prevalence of ARDL modeling with regards to cointegrating long-run association has prompted the expansion of switching models. In this chapter autoregressive distribution lag (ARDL) model will be used.

The ARDL model offers both short-run and long-run association in a single equation with a different integration order. This is important for the stationary test because other variables at the level are stationary and some become stationary after first differentiation. The ECM value of the short-run single equation is also given by this method. The ARDL method is based on a bound test methodology that is co-integrated when F-Statistics is higher, implying the variables are co-integrated. The following equation can be used for writing the ARDL model (see Pesaran et al 2001).

$$BD_i = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} CAD_{t-i} + \sum_{i=1}^{n} \alpha_{2i} BD_{t-i} + \sum_{i=1}^{n} \alpha_{3i} INF_{t-i} + \sum_{i=1}^{n} \alpha_{4i} REER_{t-i} + \sum_{i=1}^{n} \alpha_{5i} MS_{t-i} + \sum_{i=1}^{n} \alpha_{6i} INT_{t-i} + \sum_{i=1}^{n} \alpha_{7i} TAX_{t-i} + u_t \quad (8)$$

The ECM value of the ARDL model is derived by the first difference of lagged values. In ARDL approach the first approach gives long-run relationship and the second approach gives long-run, short-run and ECM value.

The first model we estimate is a Ricardian theory based on the model of private consumption, and the second model we determine is the hypothesis of twin deficits. As discussed in the theoretical background on the basis of national income accounting, budget deficit and current account deficit either have bidirectional, unidirectional or neutral relationship. The study attempts to test the authenticity of a Ricardian theorem and Keynesian proposition for Russia. However, the other macroeconomic variables which influence the BD and CAD are also taken in the model like; the impact of exchange rate depreciation can cause the current account deficit. The increase in interest rate will cause an inflow of funds and deteriorating current account balance (CAB), a decrease in tax revenue or tax rate will cause the budget deficit. The increase in money supply can bring inflation with more demand for goods and services which will further deteriorate CAB. An increase in growth rate can have a positive impact on the CAB; by increasing exports (see; Hoffmaister and Roldos, 1997).

You can write the ARDL model for equation (1) as below:

$$\Delta \mathrm{BD}_i = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta BD_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta CAD_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta INF_{t-i} + \sum_{i=0}^{n} \alpha_{4i} \Delta REER_{t-i} + \sum_{i=0}^{n} \alpha_{5i} \Delta INT_{t-i} + \sum_{i=0}^{n} \alpha_{6i} \Delta MS_{t-i} + \sum_{i=0}^{n} \alpha_{7i} \Delta TAX_{t-i} + \beta_1 BD_{t-i} + \beta_2 CAD_{t-i} + \beta_3 INF_{t-i} + \beta_4 REER_{t-i} + \beta_5 INT_{t-i} + \beta_6 MS_{t-i} + \beta_7 TAX_{t-i} + \varphi EC_{t-1} + \varepsilon_t \quad (9)$$

5.4.4 Granger Causality

Granger (1969, p. 430) causality test includes the estimation of the regression equations as pursues: if y_t contains past information that aides in the forecast of x_t, meaning y_t causes x_t. This association between causality and monotony drove Granger to express direct causality in a parametric structure, based on traditional time series data. It is important to check statinarity and lag structure before applying Granger causality. Causality analysis is sensitive to lag selection; we applied the AIC for optimum lag length. The auto regression model used for measuring the impact of *y* on *x* and vice versa is given below:

$$\Delta BD_t = \alpha_1 + \Sigma\beta_1\Delta CAD_{t-i} + \Sigma\theta_1\Delta INF_{t-i} + \Sigma\gamma_1\Delta REER_{t-i} + \Sigma\delta_1\Delta INT_{t-i} + \Sigma\lambda_1\Delta MS_{t-i} + \Sigma\partial_1\Delta TAX_{t-i} + \varepsilon_t \quad (10)$$

$$\Delta CAD_t = \alpha_2 + \Sigma\beta_2\Delta BD_{t-i} + \Sigma\theta_2\Delta INF_{t-i} + \Sigma\gamma_2\Delta REER_{t-i} + \Sigma\delta_2\Delta INT_{t-i} + \Sigma\lambda_2\Delta MS_{t-i} + \Sigma\partial_2\Delta TAX_{t-i} + \varepsilon_t \quad (11)$$

$$\Delta INF_t = \alpha_3 + \Sigma\beta_3\Delta BD_{t-i} + \Sigma\theta_3\Delta CAD_{t-i} + \Sigma\gamma_3\Delta REER_{t-i} + \Sigma\delta_3\Delta INT_{t-i} + \Sigma\lambda_3\Delta MS_{t-i} + \Sigma\partial_3\Delta TAX_{t-i} + \varepsilon_t \quad (12)$$

$$\Delta REER_t = \alpha_4 + \Sigma\beta_4\Delta BD_{t-i} + \Sigma\theta_4\Delta CAD_{t-i} + \Sigma\gamma_4\Delta INF_{t-i} + \Sigma\delta_4\Delta INT_{t-i} + \Sigma\lambda_4\Delta MS_{t-i} + \Sigma\partial_4\Delta TAX_{t-i} + \varepsilon_t \quad (13)$$

$$\Delta INT_t = \alpha_5 + \Sigma\beta_5\Delta BD_{t-i} + \Sigma\theta_5\Delta CAD_{t-i} + \Sigma\gamma_5\Delta INF_{t-i} + \Sigma\delta_5\Delta REER_{t-i} + \Sigma\lambda_5\Delta MS_{t-i} +$$

$$\Sigma\partial_5\Delta TAX_{t-i} + \varepsilon_t \qquad (14)$$

$$\Delta MS_t = \alpha_6 + \Sigma\beta_6\Delta BD_{t-i} + \Sigma\theta_6\Delta CAD_{t-i} + \Sigma\gamma_6\Delta INF_{t-i} + \Sigma\delta_6\Delta REER_{t-i} + \Sigma\lambda_6\Delta INT_{t-i} +$$

$$\Sigma\partial_6\Delta TAX_{t-i} + \varepsilon_t \qquad (15)$$

$$\Delta TAX_t = \alpha_7 + \Sigma\beta_7\Delta BD_{t-i} + \Sigma\theta_7\Delta CAD_{t-i} + \Sigma\gamma_7\Delta INF_{t-i} + \Sigma\delta_7\Delta REER_{t-i} + \Sigma\lambda_7\Delta INT_{t-i} +$$

$$\Sigma\partial_7\Delta MS_{t-i} + \varepsilon_t \qquad (16)$$

ε_t is the error correction term. Note here that association itself doesn't really suggest a development in the forecast. Relationship is a proportion of coupling quality, which can start from both causation and reliance on normal causes. Granger causality is a proportion of coupling, with directionality. Thus, it depends on forecast errors instead of linear relationships among the variables.

5.5 Empirical results

In order to test the Ricardian theorem and twin deficit hypothesis for Russia, first we understand the features of data with the help of descriptive statistics given in table 5.1 below.

It is important to draw the conclusion with better understanding what exactly the data is telling. This will help us to understand, summaries and presentations of results based on the data information.

Table 5.1: Descriptive Statistics of Variables for Russia

Statistics	BD	CAD	INF	INT	TAX	MS	REER	GDP Growth
Mean	-1.02	5.32	118.2	19.96	11.53	47.05	71.59	0.77
Median	-0.50	4.74	14.11	15.30	12.90	37.62	79.25	1.800
Maximum	9.88	17.47	152.5	41.79	16.62	200.00	107.00	10.00
Minimum	-14.0	-0.40	2.87	8.45	5.32	13.12	10.00	-14.53
Std. Dev.	5.57	4.21	318.8	11.33	3.42	43.10	28.08	6.42
Skewness	-0.10	0.84	3.59	0.68	-0.26	2.69	-0.89	-0.72
Kurtosis	2.67	3.52	15.25	1.91	2.03	9.76	2.95	2.70
Jarque-Bera	0.15	3.77	243.8	3.68	1.46	90.48	3.88	2.60
Probability	0.91	0.15	0.00	0.15	0.48	0.00	0.14	0.27

Note: Author's Calculations.

The descriptive analysis shows that the mean value of CAD (5.32) is greater than BD (-1.02) because the Russia is having budget deficit most of the years and CAD is in surplus, it can be also seen from minimum and maximum values of BD and CAD. This means the value of our data is not around mean, mode and medium. The value of

Skewness is negative Skewed for BD which further gives explanation for negative mean and medium. However, the value of Skewness is positive for CAD because the Russia is having current account surplus with positive mean and medium.

The mean value of all the variables is greater than median value meaning distribution is positively skewed and asymmetric.

The standard deviation of INF, MS and REER is high which indicates the dispersion of data is high, which is further supported by higher value of Kurtosis 15.25 for INF, 9.79 for MS and 3 for REER indicating the distribution is leptokurtic. There is also a significant variation in minimum and maximum value which further indicates there is large dispersion in the data.

5.5.1 Results of Unit Root test

We first examine the stationarity of the data for further study to validate the analytical model. The standard approach is used to assess the stationarity of data by Augment Dickey-Fuller (1979) and the Phillips-Perron test (1988). This is accompanied by the single structural split test by Zivot and Andrews as given below.

Table 5.2: Unit root test results for Brazil								
	Augmented Dickey-Fuller (ADF)				**Phillips-Perron (PP)**			
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	-2.20	-6.73	-2.39	-6.77	-2.06	-6.91	-2.42	-7.38
CAD	-1.75	-6.13	-1.73	-5.92	-2.60	-5.55	-2.49	-5.34
INF	-9.47		-9.57		-2.94		-3.60	
INT	-0.90	-8.93	-2.87	-4.76	-1.02	-4.57	-2.21	-4.42
REER	-2.38	-3.43	-2.60	-4.14	-2.46	-3.29	-1.49	-3.53
MS	-4.74		-4.68		-5.05		-18.2	
TAX	-1.91	-4.64	-0.98	-4.67	-1.90	-4.61	-0.63	-5.29
PC	-3.28		-3.41		-2.53	-7.18	-2.79	-9.28
G	-4.37		-4.27		-4.10		-4.02	

Note: Author compilation

The results find all the variables became stationary after first differencing except inflation (INF), money supply (MS), private consumption (PC) and government consumption (G). The results of PP unit test also give the same results and accept null-hypothesis for six variables and rejects for four variables.

Table 5.3 gives the structural one break test. The results find that all the variables have at least one structural break. The structural break for BD, REER and G may be due to global financial crises. The breaks in CAD, PC, INT and G may be due to collapse of stock market, bond and financial market. Another cause may be the Asian crises 1997, which

speculates rubble and loses about 6$ billion foreign exchange reserves. Another financial crisis in 2014 to 2017 in Russia is due to collapse of rubble. The fall in oil prices decline export earnings from mid-2014 to December-2014 may be the cause of break in INF and MS. The inflation starts increases to 15.53 percent and money supply increases 61 percent of GDP.

Table 5.3: Zivot and Andrews one structural break test

Variable	CAD	BD	REER	MS	INT	INF	TAX	PC	G
Test-stat (α)	-6.06	-6.04	-4.02	-47.12	-6.08	-15.42	-4.33	-8.71	-5.92
Time of Breakdown	1999	2009	2010	2014	2000	2014	2006	2000	1999
Lags (k)	2	0	1	1	0	2	0	1	0

Note: Structural breaks are based on both trend and intercept and lag structure AIC.

5.5.2 Testing Ricardian equivalence

The above ARDL specification to test the Ricardian equivalence hypothesis based on the equation (6). The results of Ricardian hypothesis are given in table 5.4 below.

In this model we estimate Bernheim (1987) consumption function where PC is dependent variable and TAX, G, BD and INT are the independent variables in the model. We find that all the variables TAX, G and INT have both long-run and short-run cointegration.

This was revealed by F = 4.75 which is greater than lower and upper bound statistics. The ECM value is negative and significant -.32910 meaning the whole economy will come back to the equilibrium at a slow speed.

Table 5.4: ARDL model to test the Ricardian hypothesis (PC)

Variables	Long-run Coefficient	t-value	Prob	Short-run Coefficient
TAX	.21422	.62280	.043**	-.190(098)***
G	2.5728	8.7621	.000*	.846(.000)*
BD	-.30882	-1.1714	.260	-.101(.228)
INT	.19117	2.0962	.053***	.245(.004)*
F-Value		**Lower-Bound**	**Upper-Bound**	
F-statistic	4.7535	2.6774	4.1103	
ECM (-1)	-.32910	-6.4607	.000*	

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

a) The tax revenue coefficient (TAX) is positive and statistically significant, which means that a reduction in the tax rate would lead to a rise in real private spending, which means that citizens do not save any money for implicit future taxation.
b) The coefficient of G and INT is positive and statistically significant meaning there is significant cointegration.
c) The BD coefficient (-.30) is negative, but insignificant, meaning that private spending will decline as the budget deficit rises.
d) The ECM (-.32910) value is negative and (.000) important, indicating long-term cointegration and acceptance of the Keynesian preposition between the variables.

5.5.3 ARDL Cointegration test for twin deficit

The results of the co-integration of ARDL are provided in table 5.5 below. The ARDL model is based on the knowledge criterion for Schwarz (SIC).

Table 5.5: Results of ARDL model of Russia (BD)

Variables	Coefficient	t-value	Prob
BD(-1)	.95351	4.5143	.003*
BD(-2)	.93462	3.6702	.008*
CAD	1.5068	5.2626	.001*
CAD(-1)	.72863	.32537	.060***
CAD(-2)	2.6239	.51992	.001*
INF	-.02072	-1.1903	.273
INF(-1)	.01316	1.9802	.088***
INF(-2)	-.009296	-2.0967	.074***
INT	-.14430	-2.1903	.065***
REER	-.22913	-2.3496	.051***
REER(-1)	.60442	3.6387	.008***
REER(-2)	.48163	3.6505	.008***
TAX	-3.9083	-3.7620	.007***
TAX(-1)	-1.8796	-5.4319	.001*
MS	-.84645	-3.2815	.013**
MS(-1)	.24167	2.2738	.057***

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

We calculate the following equation in this model in which BD is a dependent variable and the independent variables in the model are CAD, INF, INT, REER, MS and TAX. The model results indicate that the all coefficients have a significant relationship with the variables. All of the variables have a negative but statistically significant coefficient. The CAD coefficient is 1.5068 and the budget deficit will turn positive statistically slightly if the current account balance is in surplus. The coefficient of tax -3.9083 is having a significant impact on BD because with the decrease in tax rates the tax revenue will get declined and expenditures will rise on the other side and widens budget deficit. The outcomes propose that Keynesian preposition and the Ricardian equivalence hypothesis does not prevail in Russia.

The Keynesian preposition suggests that the method of financing fiscal deficit matter for the economic performance of the country in the long-run. In table 5.7 below, the results of the model reveal that all the variables have significant long-run relationship among the variables. The coefficient of CAD -5.4715 is negative and significant; meaning with the increase in CAD, will bring negative impact in budget deficit.

Table 5.6: Results of Cointegration Bounds test

Calculated F-statistic	**95% LB**	**95% UB**	**90% LB**	**90% UB**
***F*= 10.3198**	2.4784	4.0609	2.0209	3.3589
W- Statistic = 82.5588	19.8271	32.4874	16.1672	26.8709

The results are reliable because the Russia is oil exporting country, there is a marginal contribution of oil and gas in the current account balance, when the oil prices decline it significantly impacts current account balance which spill over to the budget deficit. The F= (10.3198) statistics also reveals that there exists the long-run relationship among the variables.

Table 5.7: Long-run and short-run results of ARDL model (ΔBD)

Long-Run	**Variables**	**Coefficient**	**t-statistic**	**P-Value**
	CAD	-5.4715	-3.6606	.008*
	INF	.018987	1.2257	.060***
	INT	.16248	1.8492	.107
	REER	-.96487	-3.7685	.007*
	TAX	6.5170	3.5722	.009*
	MS	1.5036	5.1518	.001*
	ECM(-1)	-.88812	2.1560	.050**
Short-Run	ΔBD	-.93462	-3.6702	.003*
	ΔCAD	1.5068	5.2626	.000*
	ΔCAD(-1)	-2.6239	-5.0468	.000*
	ΔINF	-020726	-1.1903	.255
	ΔINF(-1)	.009296	2.0967	.056***
	ΔINT	-.14430	-2.1903	.047**
	ΔREER	-.22913	-2.3496	.035**
	ΔREER(-1)	-.48163	-3.6505	.003*
	ΔTAX	-3.9083	-3.7620	.002*
	ΔMS	-.84645	-3.2815	.006*
R-squared = 0.9840; F-Stat = 22.6610(.000); DW Stat = 3.0961; Normality: 2.2954(.704); Heteroscedasticity: .31658 (.574)				

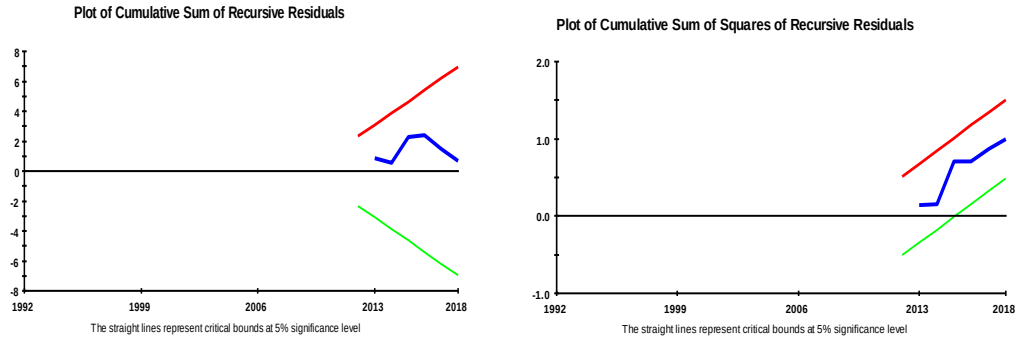
Note: '*'**'***" denotes significance at 1%, 5% and 10%.

The error correction term (ECM) provides the correction speed. The value of ECM is negative (- 88812) and significant at 1%, suggesting that the model would hit balance by 88%. The results reveal all the variables have significant short-run relationship. The coefficient of CAD is negative and statistically significant meaning a 1% increase in CAD will increase budget deficit by -2.6239%.

The results define that budget deficit can't be used as a monetary policy for retaining internal equilibrium because when a cyclic variation in the domestic market is due global economy and rubble crises. The above results are based on the fact when BD and CAD are negatively associated. The reason for sustainable fiscal is not the oil and gas reserves but the low revenue from these sectors hampers the growth in Russia. Factors including the exchange rate, the tax rate and the interest rate are adversely and significantly related to the BD, which means that the interest rate, tax, money supply and exchange rate will rise by 1 percent, causing -.14430, -3.9083, -.84645 and -.22913 in BD.

The overall findings are consistent with the Algieri (2013) which also accepts Keynesian preposition and refute the Ricardian preposition that no connection exists between the two deficits. The following portion of Table 5.7 provides diagnostic statistics in the form of Jarque-Bera normality test confirming model normality, Durbin Watson test confirming no serial correlation, Breusch-Pagan-Godfrey confirming absence of heteroscedasticity and Figure 5.4 providing (CUSUM) and (CUSUMSQ) confirming that the model is stable.

Figure 5.4: Stability test (CUSUM and CUSUMSQ)



5.5.4 Granger causality test results

We used the Granger Causality examination. Before assessing causality, we must verify that all the variables remain stationary after differentiation. To check the causality between the BD and CAD, we checked seven equations. The Granger causality results are seen in Table 5.8 below. The findings show that the BD and CAD have two-way relationship. This suggests that the spike in the BD induces the shortfall in the CAD and that the increase in the gap in the CAD causes the BD. Strengthening monetary policies will also decrease the budget gap, while at the same time reducing private consumption, government expenditures, rising unemployment and decreasing Russia's economic development. The fall in oil prices and Russia's dependence on energy profits to boost discretionary revenues contributes to a rethinking of fiscal policy. In 2015, the Russian Ministry of Finance adds the fiscal law to limit expenditures. The tax policy law prohibits oil proceeds from being wasted and shifted to the allocated funds or rainy-day funds. The coefficient of tax is statistically significant, we find bidirectional causality between tax to budget deficit, budget deficit to tax and tax and CAD, CAD to tax.

Table 5.8: Results of Granger causality Wald test

Equation	Chi^2-test	P-Value	Null-Hypothesis	Direction
CAD to BD	9.4329	0.024**	Accepted	Bidirectional Causality
BD to CAD	4.4572	0.016**	Accepted	
BD to REER	8.4324	0.038**	Accepted	Bidirectional causality
REER to BD	25.369	0.000*	Accepted	
BD to INF	20.477	0.000*	Accepted	Unidirectional causality
INF to BD	1.3263	0.723	Rejected	
BD to INT	1.6999	0.637	Rejected	Unidirectional causality
INT to BD	93.163	0.000*	Accepted	
BD to TAX	14.046	0.003*	Accepted	Bidirectional causality
TAX to BD	12.159	0.007*	Accepted	
BD to MS	8.1533	0.043**	Accepted	Bidirectional causality
MS to BD	49.146	0.000*	Accepted	
CAD to REER	13.465	0.004*	Accepted	Bidirectional causality
REER to CAD	51.17	0.000*	Accepted	
CAD to INF	23.176	0.000*	Accepted	Unidirectional causality
INF to CAD	2.613	0.455	Rejected	
CAD to INT	30.752	0.000*	Accepted	Bidirectional causality
INT to CAD	35.909	0.000*	Accepted	
CAD to TAX	40.002	0.000*	Accepted	Bidirectional causality
TAX to CAD	35.481	0.000*	Accepted	
CAD to MS	9.079	0.028**	Accepted	Bidirectional causality
MS to CAD	32.41	0.000*	Accepted	

Note: Granger Causality; "*" and "**" indicates significance 1% and 5% levels.

The results suggest that increase in tax rate will decrease budget deficit and demand for import goods due to reduction in the disposable income. However, on the other hand it will crowd out private investment and shrink down economic growth. The real effective

exchange rate and money supply has bidirectional causality with CAD and budget deficit. The results are consistent with Algieri (2013) and Brissimis et al., (2012) find that exchange rate has a causal association with BD. However, the macroeconomic imbalances may lead to current account deficit due to sharp alterations in exchange rate and inflation and many other factors (Forbes, Hjortsoe, and Nenova 2017).

The sluggish demand for exports is a structural danger to the current account balance, as exports are struggling to get momentum and maintain pace with global trade and decline in oil and gas prices. The demand for exports and productivity is not gaining momentum in Russia. This leads to devaluing rubble crises, especially in energy and mining sector. The depreciation in currency value reflects poor integration with the global economy, and uncertainty discourages investments. It leads to lower invocation transfer of technology and fewer imports of technology-intensive goods. CAD can also be triggered by higher inflation in Russia; our findings indicate that there is unidirectional causality from CAD to inflation and from BD to inflation. Higher inflation will increase the price of good and services domestically; meaning domestic market becomes less competitive as compared to the global market and worsens current balance. The debt crises in 1998, a favorable energy sector prices and a weak ruble and fiscal measures lead control on budget deficit till 200 to 2018 until hit by financial crises.

The results of our study favor Keynesian preposition than Ricardian Equivalence theorem in the light of above data. All the variables (inflation, real effective exchange rate, interest rate, money supply, tax) causes' budget deficit and CAD. The results are consistent with (Abell, 1990; Afonso et al., 2018; Banday and Aneja, 2017; Holmes, 2011 and Rault and Afonso, 2009).

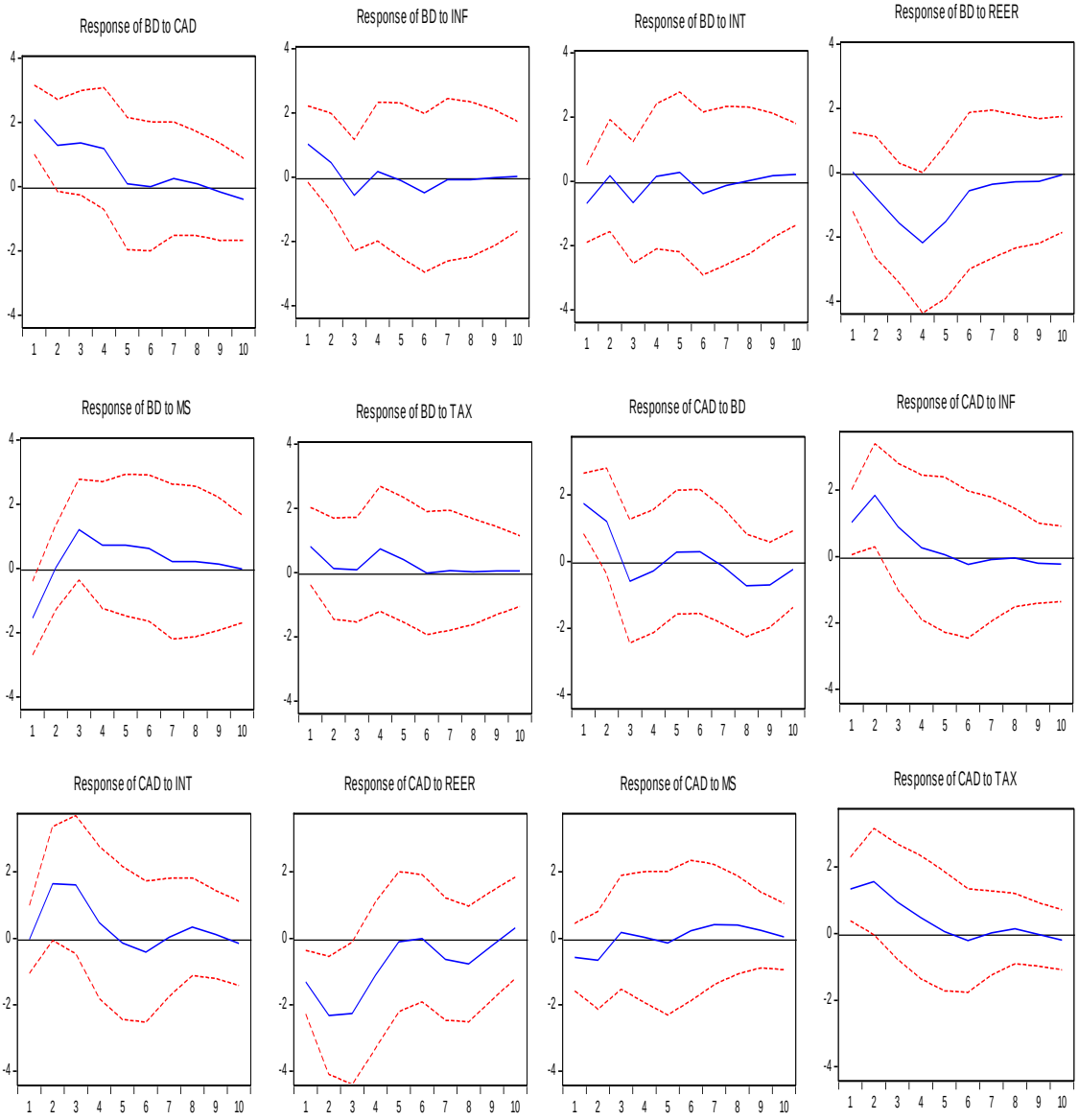
5.5.5 Generalized Impulse Response for Russia

The outcome of G-causality results can be clarified with sample tests that may give more explanation on the dynamic properties of this relationship Masih and Masih (1995). We apply to generalize response functions (GIR) which investigates the time impacts of a one-time shock to every factor Fischer, Hall & Taylor (1981). Figure 5.5 shows the GIR response of BD to CAD, INF, INT, REER, MS, TAX and the second GIR response of CAD to BD, INF, INT, REER, MS and TAX for 10 years horizon.

The budget deficit worsens for the first 4 years, after a positive shock to the CAD, and then improves the budget deficit over the next 6 years. On the other hand, the current account deficit, a positive shock to the budget deficit, is gradually worsening. This is reliable with most hypothetical models' standard theorems and compatible with Granger causality results. When inflation has been given a positive shock, the BD worsens for the first 4 years and then the BD increases. The CAD, on the other hand, initially improves over 5 years, and then worsens for a year and demonstrates improvement again. Positive interest rate shocks have a positive effect on the BD.

The shock to interest has negative effect on the CAD, which contributes to an increase in the interest rate and then money supply to exchange rate, inevitably contributing to a CAD. The positive impacts on budget deficits over the first three years and then the budget gap for the following six years of the real effective exchange rate have worsened. The negative influence of the exchange rate on the CAD in the first four years suggests a turnaround over the next three years and consequently negative outcomes.

Figure 5.5: Response to Generalized one S.D. Innovation



The positive effects of MS on the BD for the first 5 years and then worsen the budget deficit for the next 5 years. On the other hand, for several years, the negative effect of the supply of money on the current account deficit has been constant. Finally, the tax shock on the budget deficit has shown a positive impact for the first 4 years and then worsens for the next six years. The positive relationship for the first few years may be due to the change in tax structure which has increased the government revenue and reduces the

deficit for the first few years. However, the relation between taxation and the CAD is negative, which implies that the balance of the CAD will degrade with the raise in the tax rate.

5.6 Conclusion

This chapter explores the association between the BD and CAD in the macroeconomic context for Russia. The research utilizes ARDL, the Granger causality test and the response function to assess and evaluate the connection between the twin deficits and the Ricardian hypothesis.

The findings first test the Ricardian equivalence hypothesis, the results derived from the consumption function show that the tax revenue coefficient (TAX) is positive and statistically important, implying that lowering the tax rate would lead to a rise in real private consumption, meaning that citizens do not save any of the money implicitly for the potential tax. There is a significant relationship between long-run and short-run variables with the positive and statistically significant G and INT coefficients. The results do not confirm the Ricardian theory, since taxation, interest rates and government consumption have a large influence on private consumption.

The effects of the ARDL model demonstrate that these variables are linked to the variables in a long period. The coefficients of CAD -5.4715 are negative and important, which suggest an increase in CAD that could negatively affect the budget shortfall. Variables like interest rate, tax, money supply and exchange rate have a negative and significant association with deficits, meaning an increase of 1 percent, culminating in -.14430, -3.90083, -.84645 and -.22913 increase in deficits. The effect is a negative and large deficit ratio. The relationship between inflation and the short-term budget gap is

constructive and critical. The overall findings are compatible with Keynesian preposition and invalidate Ricardian preposition that BD and CAD are not connected to each other.

The Granger causality effects indicate that the BD and the Russian CAD have bidirectional linkage. This indicates that the rise in the BD triggers the CAD and the increase in the CAD causes the BD. Bidirectional causality of the exchange rate and capital supply is the current account imbalance and the BD. However, the macroeconomic imbalances may lead to current account deficit due to sharp alterations in real effective exchange rate and inflation and many other factors (Forbes, Hjortsoe, and Nenova 2017).

Finally, we check the input and out relationship by giving a positive shock to independent variable and their impact on dependent variable. In the first four years of the fiscal deficit worsens due to shock in current-account deficit and in following six years, the budget deficit improved. The CAD, on the other side, is steadily deteriorating, due to shock in the budget deficit. This is reliable with the standard theorems of most hypothetical models and compliant with the causal effects of Granger. Transmission networks occur between those variables where the optimistic shock on the current-account interest rate, exchange rates, monetary and inflationary gap is adversely affected, implying that a rise in the interest price contributes to capital inflows and a real exchange rate spike that eventually causes the current-account deficit and makes Mundell Fleming. The second channel derivation is based on absorption strategies, where demand for products and services grows as the money supply rises, and countries have to buy goods in order to fulfill internal demand and raise the balance of their current account.