A Comparative Study of Twin Deficit Hypothesis for BRICS Countries

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CERTIFICATE

This is to certify that the thesis titled "A Comparative Study of Twin Deficit Hypothesis for BRICS Countries" which is submitted by Mr. Umer Jeelanie Banday, Department of Economics, Central University of Haryana, in partial fulfillment of the requirements for the award of the degree of Doctor of Philosophy in Economics, is an original contribution with existing knowledge and faithful record of research carried out by him under my guidance and supervision.

To the best of my knowledge, this work has not been submitted in part or full for any Degree or Diploma to this University or elsewhere.

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DECLARATION

I, Mr. Umer Jeelanie Banday, student of economics hereby declare that the thesis titled "**A Comparative Study of Twin Deficit Hypothesis for BRICS Countries**" which is submitted by me to Department of Economics, Central University of Haryana, in partial fulfillment of the requirement for the award of the degree of Doctor of Philosophy in Economics, is a record of original research work done by me under the supervision of Dr. Ranjan Aneja, Associate Professor, Department of Economics, Central University of Haryana. The thesis has been subjected to Plagiarism check and the work is submitted for consideration of award of PhD Economics. The content of this thesis has not been submitted for award of any Degree, Diploma, Fellowship or other similar title of recognition in any other institution.

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CHAPTER 1

INTRODUCTION

Fiscal and monetary strategies, when executed lucidly, assume a conclusive part in general macroeconomic stability. The macroeconomic theory which assumes an ideal relationship between budget (or fiscal) deficit and current account (or trade) deficit is known as twin deficit hypothesis. The debate on the issue of twin deficit hypothesis has been revived in the previous decade by the ongoing global breakdown, and the resultant episodes of simultaneous budget deficit (BD) and current account deficits (CAD) in numerous countries, which have tempted significant consideration from researchers and policymakers in both developing and developed countries. As indicated by OECD (2011), the worldwide current account gap enlarged particularly in the years prior to the worldwide financial crises. Similarly, the crises itself lead its wake a renewed profundity of financial sin over the developing and developed countries. The unprecedented increase of the BD and the widening of CAD in the United States (US) in 1980s led to recognizing this situation as the "twin deficits" issue as both empirical methods and economic theory recommended an association between the two deficits. The worry is centered on the degree to which fiscal change can add to settling current account imbalances, particularly when it is persistent.

The relation in the economic literature between the BD and CAD continues to be questionable and unresolved. The Keynesian paradigm indicates that there is a significant association between these two deficits. Deficit expansion will contribute to internal absorption, thus rising domestic sales, contributing to a rise in imports and a widening of the current account deficit. The Mundell-Fleming model (Fleming 1962; Mundell 1963)

is the cornerstone of the Twin Deficit Hypothesis, which implies that an improvement in the BD will contribute to an increase in the interest rate and the exchange rate. The spike in interest rates makes it easier for investments in the domestic sector to lure foreign investors. This raises internal demand and contributes to currency appreciation, that, in fact, makes imports cheaper and exports more costly. However, the domestic exchange rate will raise imports and cause a CAD (Leachman and Francis, 2002; Salvatore, 2006). However, the Ricardian theorem didn't support the Keynesian theory. He argues that there is no connection between the two deficits in an open economy and that the former does also not affect the latter. In other terms, tax reform will have little effect at all on interest rates and expenditure (Barro 1989; and Neaime, 2008). The inference here is that the patterns of customer consumption will be focused on the life cycle model established by Modigliani and Ando (1957), which means that current consumption relies not on the current income as indicated by the Keynesian model, but on the lifetime income expected. In addition, Milton Friedman's 1957 theorem of permanent wealth notes that private spending can only rise with a permanent increase in income. This suggests that a transient rise in revenue fueled by tax cuts or public investment funded by deficits would raise private investments rather than consumption (Barro, 1989:39; Hashemzadeh & Wilson 2006).

Monetary and fiscal policy has been subject to persistent debate in (Brazil, Russia, India, China and South-Africa) BRICS countries for a very long time, being an arm of macroeconomic strategy impacted by its perceived capacity to influence real economic activities and prices. The economic sustainability of the countries depends on fiscal and monetary balance. Various economies have indicated that the prolongation of

macroeconomic instability can be described by budget and current account deficit. During the 2008-09 global economic crises, decline in government revenue and countercyclical spending reduces budget surplus and widens the deficits.

The following section (1.1) gives an economic overview of the BRICS countries over the past three decades. Section 1.2 will discuss the motivation of the research for this thesis. Section 1.3 gives the research objectives, which incorporate the hypothesis to be tested. Section 1.4 will give the statement of the original contribution to the empirical literature. Section 1.5 will give the organisation of the thesis.

1.1 Overview of the BRICS countries

BRIC are the four distinct emerging counties coined by Jim O'Neill, then of Goldman Sachs, in 2001. Jim O'Neill was searching for an approach to convey the fact that a significant part of the world's financial development would come from Brazil, Russia, India and China. The theory behind the grouping was that by 2050, China and India would become dominant producers of products and services for production and Russia and Brazil would dominate the supply of raw materials. In 2010 BRIC expanded to BRICS after including South-Africa as a fifth nation.

At present, more than 40 percent of the total population is represented by the five BRICS nations. Regardless of their current decline, over the last 10 years, Brazil, Russia, India, China and South Africa have accounted for half of the world's economic growth. The BRICS nations have also been recognized as one of the world's fastest emerging economies and the engine of global economic recovery, which underlines the evolving position of these economies on the globe (McGranahan and Martine, 2014; Lin and

Rosenblatt, 2012; Li and Carey, 2014). At the G20, they were powerful in shaping macroeconomic policies as a result of the continuing financial and economic crises. China is the biggest economy in the current decade, followed by India, among the five developing BRICS economies. Between 1980 and 2009, the Chinese economy expanded at a typical annual rate of 9.9 percent worldwide. After the global financial crises of the 1990s, the economic performance of Russia and Brazil basically improved. The economic success of the BRICS countries over the previous decade was further improved by ongoing economic reforms with macroeconomic stability (IMF, 2011). However, the BRICS economies' impressive highlights are their massive land and population size. It is widely seen that all BRICS economies have immense potential to create a thriving middle-income population that fills society as a stabilizing force. In the BRICS countries, the middle-income group is growing at varying rates, but the middle-income group will continue to rise both in size and sales, offering a solid base for continued expansion.

The five emerging BRICS countries participate in the global economy in numerous ways. Brazil and Russia make up 36.1 percent of their overall exports and 22.3 percent of their total finished goods exports. Russia's exports are largely dominated by oil and mineral exports (67.4 percent), but Brazil's exports account for 61 percent of oil, mines and agricultural products. Total consumer goods exports account for 94.3% for China, 68.4% for India and 40.6% for South Africa. The increasing demand for manufactured goods in South Africa's has improved export performances and added to its economic development (See table 1.1). The rapid growth rate in five emerging countries (BRICS) since 1990s has been changed due to the global financial crises 2008.

Table 1.1: Composition of Exports in BRICS countries (2015)

Country	Merchandise Exports ($ billion)	Share in World Total Export	Commodities Share			
			Agriculture	Manufacturing	Fuel & Mining	Others
Brazil	191.1	1.2	41.9	19.1	36.1	3.0
Russia	340.3	2.1	8.0	67.4	22.3	2.3
India	267.1	1.6	13.2	15.7	68.4	2.7
China	2,775.0	13.8	3.2	2.4	94.3	0.1
South-Africa	81.7	0.5	11.7	29.8	40.6	17.9

Source: WTO Statistics Database.

Table 1.2 clearly shows the impact of financial crises 2008 on economic growth, the positive economic growth in 2006 followed with negative economic growth in Brazil (-0.12), Russia (-7.79) and South Africa (-1.53) in 2009. After 2010, BRICS countries have faced difficulties in their economic advancement due to economic external imbalances. After 2012, Russia has undergone a rapid fall in the rate of growth. In 2015, the economy shrank by -2.30 percent. With the economy contracting -3.5 percent in 2015, Brazil has undergone stagflation and followed up with optimistic growth of 1.11 percent in 2018. The development pace of South Africa has dropped under 2 percent since 2014 (See table 1.2).

Despite the fact that it is nice to see a relative high growth rate in China and India, both of them face structural and cyclical fluctuations. The BRICS economies' remarkable highlights, however, are their vast land and population scale, especially in China and India.

Table 1.2: GDP growth rate of BRICS countries annual percentage

Country	1991	1994	1997	2000	2003	2006	2009	2012	2015	2018
Brazil	1.51	5.33	3.39	4.38	1.14	3.96	-0.12	1.92	-3.54	1.11
Russia	-5.04	-12.56	1.39	10.0	7.29	8.20	-7.79	3.70	-2.30	2.25
India	1.05	6.65	4.04	3.84	7.86	8.06	7.86	5.45	7.99	6.98
China	9.29	13.05	9.23	8.49	10.03	12.71	9.39	7.85	6.90	6.60
South-Africa	-1.01	1.23	2.60	4.20	2.94	5.60	-1.53	2.21	1.19	0.78

Source: World Bank Database: data.worldbank.org

All the BRICS markets are generally seen to have enormous potential to create a prosperous middle-income community that fills society as a stabilising force. The middle-income group is rising at different rates in the BRICS countries, but the middle-income group will continue to rise both in size and income, providing a strong foundation for continued growth. With the worldwide financial downturn and the changes in the US Federal Bank's monetary policy system, export demand has become fragile internationally and a significant amount of investment is coming back to the US from emerging economies. Investment in R&D, fostering business and trade by tax reduction, it is crucial that BRICS nations shift their focal points back to their home economies and direct structural reforms.

Current account balance fluctuates noticeably among BRICS countries. This is largely attributed to the country's demand for imports and the increase in oil and mineral prices. Emerging countries (Brazil, India, and South-Africa) have experienced a widening of

current account deficits due to increasing oil prices, macroeconomic instability and investment-driven growth in imports. On the other hand, Russia and China have current account surplus, the main reason for current account surplus is Russia is their 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, the key explanation for the current account surplus in Russia's economy is the strong exports of oil. By multiplying the effect on economic development, the revenues produced from oil reserves make a notable contribution. The obvious reason for the external surplus is that, by rising FDI inflows, the economy follows an export-driven growth model. China's demographic boom has created an economic miracle in the increasing tide of economies, enabling them to invest in education and skilled workers that will accordingly benefit the economy.

Table 1.3 gives the current account position of BRICS countries, it can be seen from the table 1.3 that Brazil, India, and South-Africa have current account deficits for most of the years from 1990 to 2018. These emerging countries mainly Brazil, India, and South-Africa got affected by the global financial crises 2008, the global economic slowdown and exports start declining which keep widening current account deficit.

It can be seen from the above table1.3 that after strong wind fall effect of financial crises, current account deficit increases more than 5 per cent of GDP in India, and South-Africa and above 3 per cent in Brazil. Another reason may be due to the rising oil prices and cyclical movement in the form of inflation and exchange rate volatility. The budget deficit (BD) has been expanding in emerging economies globally.

Table 1.3: Current account balance in the BRICS countries (Percentage of GDP)

Country	1991	1994	1997	2000	2003	2006	2009	2012	2015	2018
Brazil	-0.3	-0.3	-3.5	-3.8	0.7	1.2	1.6	-3	-3.3	-0.8
Russia	0.9	2.2	-0.2	17.4	7.6	9.3	4.1	3.2	4.9	6.8
India	-1.5	-0.5	-0.7	-0.9	1.4	-0.9	-1.9	-5.0	-1.1	-2.5
China	3.4	1.3	3.9	1.7	2.6	8.5	4.8	2.5	2.8	0.4
South-Africa	1.2	0.02	-1.5	-0.14	-0.9	-4.5	-2.7	-5.1	-4.6	-3.7

Source: World Bank Database: data.worldbank.org

In spite of the fact that the BRICS economy relies on oil exports, natural resources and foreign direct investment (FDI) for balanced economic growth. The budget deficit in Brazil increases continuously from 1990 to 2018. The budget deficit increases from -2.7 % of Gross Domestic Product (GDP) in 2007 to -7.2 % of GDP in 2018. In Russia budget deficit was increasing at a fast speed from 1990 onwards. Russia's economic growth rate tumbled to -14.5 percent, in contrast to -3 percent in the year 1991. However, in the following years, BD turns positive 2.47 percent the economic growth jumps to 10.07 percent in the year 2000. Further widening of the BD in 2009, the economic growth turns negative -7.79 percent. However, in the year 2017-18 the budget deficit continuously reduced (-7.79 to -1.5 % of GDP) from the year 2009 to 2017. In India the global economic fluctuation causes a drastic change in BD in recent years. In India, the budget deficit amounted to -6.8% of GDP in 1991 and dropped to -3.42% of GDP in 2018. It can be shown from table 1.4 below that there is an ongoing budget deficit in India from 1990 (-9.1% of GDP) to (-3.4% of GDP) in 2018. Despite the introduction of the FRBM Act

2003 aimed at strengthening fiscal positions, however, the Indian economy has continued to fight the fiscal deficit even today.

It was stated in the Chinese print media in the early 1990s that while the Chinese economy was rapidly expanding, deficits still existed. The budget deficit will rise from -2.6% of GDP in 1990 to -4.2% of GDP in 2018. The surplus in the current account grew to 9.23% of GDP, while the fiscal deficit was at its lowest (-0.41 percent of GDP in 2008). The negative shock of the BD raises the CAD and vice versa. Since 1990 to 2018, the BD and CAD have been gradually rising. The federal deficit is below 5% of GDP, and 60% of the domestic debt is below GDP. Low revenue collection and increasing expenditure in South Africa keep on moving the budget deficit higher than anticipated. The weak economic execution in South Africa has reduced export growth, increasing import growth and deterioration of exchange rate. The budget deficit has constantly increased from 1990 (-3.2) % of GDP to (-4.4) %of GDP in the year 2018.

Table 1.4: Budget deficit in the BRICS countries (Percentage of GDP)

Country	**1991**	**1994**	**1997**	**2000**	**2003**	**2006**	**2009**	**2012**	**2015**	**2018**
Brazil	-2.40	-3.87	-5.60	-3.32	-5.17	-3.57	-3.18	-2.52	-10.2	-7.10
Russia	-14	-9.5	-5.45	2.47	2.2	8.03	-7.9	-0.1	-2.4	2.7
India	-6.8	-6.9	-7	-9.2	-8.3	-5.1	-9.3	-7.4	-3.9	-3.42
China	-3.05	-2.3	-1.9	-2.8	-2.2	-0.8	-2.8	-1.5	-3.4	-4.2
South Africa	-3.9	-5.1	-3.8	-1.4	-2.2	0.6	-6.3	-5	-4.1	-4.4

Source: Data of each respective country is collected from Ministry of Finance.

The increasing government activities are affecting the macroeconomic stability of an economy has expanded noticeably throughout the years, as is understandable from the

growing budget deficit figures for the BRICS counties reported in table 1.4. The rising budget deficit will crowd-out private investment, increase debt, interest rate, higher inflation, and eventually hampers economic growth. Increasing the current account deficits will give rise to exchange rate crises, exhaustion of worldwide reserves and transfer of wealth to other countries (IMF, 2015).

1.2 Research Motivation

In recent times, various countries have left on major structural changes in order to decrease BD, CAD, control inflation and stable macroeconomic condition conducive for growth. Despite these changes the government still inherit both the BD and CAD in many developing and developed countries, a positive budget and current account deficit remain difficult. The way in which deficits persist in a large number of nations is included in a reconsideration of the causal connection between the BD and the CAD.

Current account deficit has got significant importance in the ongoing occasions and has made the thought of current account sustainability gain strategy centrality with regards to the latest macroeconomic instability. Miller and Russek (1989) contend that the import/export imbalances infer a transfer of wealth to and reduce the standard of living and burden on future generations. In addition, the increasing CAD is considered to be one of the key factors influencing the volatility of the exchange rate (Edwards, 2005) and its related problems. It is claimed that the fiscal gap and CAD are counterproductive to the exchange rate, creating high interest rates, crises in the financial market and investment rates (Barro, 1989). The main aim of this thesis is the debate with respect to whether the fiscal or government policy markedly affects the CAD and whether the macroeconomic

instability will cause budget and current account deficit in BRICS countries. In an open economy where there is perfect capital mobility, to revive the balance between savings and investments is met by the higher inflow of capital. Higher demand for assets brings an appreciation in the exchange rate. If capital mobility is imperfect, the reduction in deposits will lead to higher interest rates, lower domestic consumption and higher capital inflows will lead to domestic currency appreciation. Higher exchange rates cause a weakening of the current account balance in all cases.

The first linkage derived from Mundell-Fleming assumes that an increase in BD will give rise in interest rate, there will be an inflow of money and the exchange rate will grow and cause the CAD. The Keynesian absorption hypothesis assumes that a rise in the government's deficit will raise the domestic consumption, therefore growing imports and worsening the CAD. Contrary to the Keynesian preposition, the BD and the CAD are different in view of the fact that fiscal policies prompt inter-temporary redistribution of savings, interest rates, and assets sustain unchanged current account deficits (Barro, 1976). Indeed, no adjustment in the exchange rate and interest rate is caused by the fiscal deficit (Garcia and Ramajo, 2004) and, therefore, there is no effect on the current account balance. However, the rational consumer knows that if there is a decrease in tax this year, in coming years it will be increased. Hence, the fiscal policy remains comparatively ineffective in its ability to impact the macro-economy.

1.3 Objectives of the study

The key purpose of this analysis is to determine, as a countercyclical policy instrument, the adequacy of fiscal and monetary policy in the BRICS. The research investigates why

an increase in the budget deficit allows the interest rate to increase, leading to the inflow of capital and the appreciation of the exchange rate and the current account deficit as described by the Keynesian absorption hypothesis, or contrary, whether fiscal policy behaves in a same manner that is consistent with Ricardian Equivalence (and there is no correlation between BD and CAD). The specific objectives of the study are as follows:

- To test the relationship between budget deficit and current account deficit in BRICS countries.
- To determine the extents to which this relationship is reliable with the Ricardian hypothesis or the twin deficit hypothesis.
- To assess the transmission mechanism between budget deficit and current account deficit via macroeconomic variables for BRICS countries.

The linkage between these two deficits is measured in the macroeconomic context for BRICS countries in order to achieve these objectives. This thesis considers the model based on Bernheim (1987) which is the most used consumption equation to test Ricardian equivalence hypothesis (REH). Additionally, independent variables have been considered based on the economic theory (Keynesian proposition and Ricardian equivalence). These variables are inflation, interest rate, money supply, exchange rate, tax revenue, private consumption and public consumption.

However, the thesis attempts to explore the relationship on a comparative basis, examining it separately for all the constituent countries of the block. The explanation behind comparative is on the grounds that these economies vary significantly from developed nations in different manners including market structure, monetary policies,

economic and financial path etc. Indeed, even inside the BRICS nations, there is heterogeneity in exchange rate regime, capital control, policy targets and others.

Secondly, it also takes into consideration that BRICS countries have different macroeconomic regimes, which obviously impact the relationship between BD and CAD. For instance, some countries follow inflation-target regimes with flexible exchange rates, others have fixed exchange rates and specific rules for setting the governmental interest rate; they have different laws regarding public spending and investment etc.

The time period for the study is 1990-2018, based on the availability of data. The empirical model is based on the cointegration framework, employing Johansen's cointegration method or autoregressive distributed lag (ARDL) model for short-run and long-run estimation, Granger causality for causal relationship and Impulse response function for forecasting and to check the robustness of results.

1.4 Contribution of the study

The study conducted in this thesis facilitates an exploration of the feasibility of the twin deficit theory in BRICS countries. In the macroeconomic context for BRICS nations, there is a lack of empirical work on the twin deficit hypothesis. Also, most analytical work concentrating on the twin deficit hypothesis and Ricardian hypothesis was taken into account in the early 1990s. In this thesis, we have investigated Ricardian theorem by two ways, the first one is based on the direct relationship between BD and CAD and the second one is based on the Bernheim (1987) consumption function.

The study uses time-series data from 1990 to 2018. However, it is important to highlight that the BRICS nations have gone through structural changes over this time. From 1960

onwards these economies were largely regulated, with business subject to inflation control, fixed exchange rate regime, tariff protection, and trade barriers. But, the period from 1980s onwards were witnessed a huge reform, with floating exchange rate, credit creation mechanism, interest rate, removal of trade barriers, Liberalization Privatization and Globalization (LPG), foreign direct investment, foreign trade inflows, subsidies and lower tariffs.

With the development of international trade, economies became more integrated into worldwide markets in the course of recent decades especially capital markets. As international trade and public expenditure have increased-with macroeconomic instability, the countries would either more exports or imports or higher expenditure than revenue. If the country has more import than exports means current account deficit and if the country has more expenditure than revenue implying a budget deficit. In this situation one may notice twin deficit or Ricardian manner. It is expected that the estimation results from the sample indicates whether BD and CAD or vice versa. Further, the light is shed on whether other independent variables have become more or less significant determinants of twin deficits.

The ongoing development in the time series data has perceived that structural breaks can provide biased cointegration results. While Augment Dickey-Fuller (1979) and the Phillips-Perron test (1988) test for unit root are applied, further advanced Zivot and Andrews (1992) one structural break unit root test is applied to those countries who have greater variation in data. This will give us more information about the timing of the break in the economies.

1.5 Organisation of the study

The thesis is structured as. Chapter 2 comprises of six sections, segment 2.2 gives the evolution of the twin deficit hypothesis. Section 2.3 gives the twin deficit theory based on the national income accounting method, subsection considering twin deficit and Keynesian proposition. Section 2.4 discusses the Mundell Fleming approach for twin deficit, followed by the Ricardian hypothesis in section 2.5. Section 2.6 includes the number of subheadings, the empirical literature on twin deficit hypothesis, Ricardian equivalence, and studies related to BRICS countries. Final section 2.7 gives conclusion of that chapter.

Chapter 3 discusses the model specification and methodology that will be used in the thesis. The first section will give model specification and the second part will give the detail about the methodology used in the study.

The thesis will give separate chapters for each country (Brazil, Russia, India, China & South Africa), which consists of introduction, theoretical foundation, macroeconomic variables, data information, econometric model, methodology and results.

Chapter 4 discusses the twin deficit hypothesis and Ricardian equivalence for Brazil. It gives introduction, trend analysis for variables, data information, econometric methodology and results. Chapter 5 discusses the twin deficit hypothesis and Ricardian equivalence for Russia. It gives introduction, trend analysis for variables, data information, econometric methodology and results. Chapter 6 discusses twin deficit hypothesis and Ricardian equivalence for India. It gives introduction, trend analysis for variables, data information, econometric methodology and results. Chapter 7 discusses twin deficit hypothesis and Ricardian equivalence for China. It gives introduction, trend

analysis for variables, data information, econometric methodology and results. Chapter 8 discusses twin deficit hypothesis and Ricardian equivalence for South Africa. It gives introduction, trend analysis for variables, data information, econometric methodology and results. Chapter 9 gives comparison of the result among the BRICS countries and then summarises the thesis. After reviewing the results, policy implication arises and further research are suggested.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

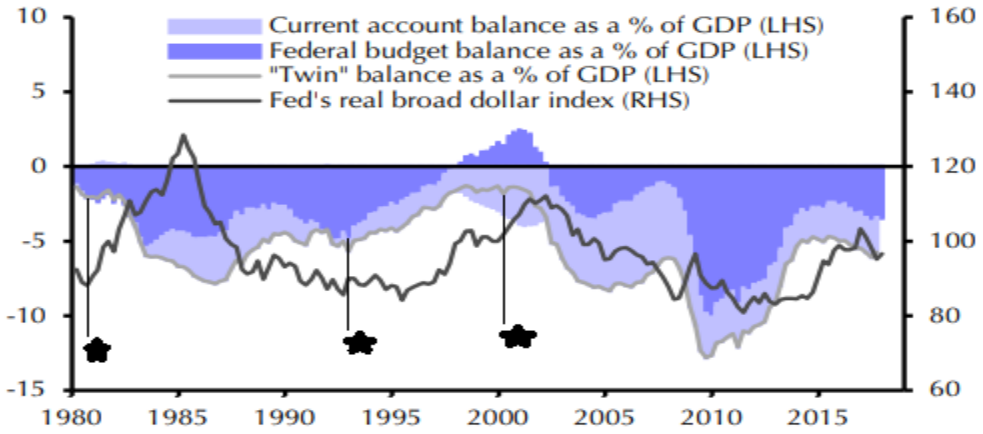
After beginning with a chapter covering the economic theories for this study and empirical model that will be utilized, it is important to overview the past studies that is pertinent to this work. To assess the feasibility of the twin deficit theory, the literature will also include previous research on the viability of the twin deficit.

This chapter comprises of six sections, segment 2.2 gives the evolution of the twin deficit hypothesis. Section 2.3 gives the twin deficit theory based on the national income accounting method, subsection considering twin deficit and Keynesian proposition. Section 2.4 discusses the Mundell Fleming approach for twin deficit, followed by the Ricardian hypothesis in section 2.5. Section 2.6 includes the number of subheadings, the empirical literature on twin deficit hypothesis, Ricardian equivalence, and studies based on BRICS countries. Section 2.7 gives summary and conclusion of this chapter.

2.2 Evolution of twin deficit hypothesis

During the late 1980s and early 1990s, empirical work on fiscal policy focused mainly on the budget deficit and public debt as a source of balance of payment problems (twin deficit). Figure 2.1 show that the twin deficit relationship appears to be possible. The widening of BD and CAD in the United States during the 1980s led many researchers and policy makers to believe that the deficits are closely associated. Martin Feldstein was the policy advisor of the Reagan Administration, is one of the leading economists who has popularized the twin deficit phenomenon.

Figure 2.1: United States current account and budget balance (per cent of GDP)



Sources: Thomson Reuters, CE

In the first half of the 1980s, the Reagan Administration executed an expansionary fiscal measure through a tax cut, which was not supplemented by monetary policies. There was one-sided stress on the US interest rate, which triggered capital inflows and a stronger dollar. This appreciation in dollar brought about a disintegration of the United States' intensity on world markets, and aggravates the CAD. In spite of these factors, the CAD shortfall appeared to "twin" the fiscal deficit in the United States. Martin Feldstein (1986) later expressed that the weakening in the US current account balance during the 1980s was brought about by high-interest rates (because of budget deficit) that causes appreciation in the US dollar. This as indicated by Feldstein ought to be treated as a one-time situation and not as a sign of any long-run situation.

However, Hervey and Merkel (2000) sketched out three-wide reasons to clarify the causes of deficits in the United States. The first one was a known as *consumption boom hypothesis*, which suggests that consumers have changed their preferences from saving to consumption.

The Asian currency crises, Brazil and Russia have contributed inflow of funds in US markets during mid of 1990s. The increase in capital inflow makes it difficult to export technology to the poorer nations, and an appreciation of dollar causes imports to rise. The increasing capital inflow from the foreign market diminishes from the productive and consuming capacity of these economies. This was called as *safe haven hypothesis* (Hervey and Merkel, 2000).

Finally, the technological shift in the US may be another cause of current account deficit, which was termed as *technological change hypothesis*. The increase in output due to the innovation has returned US investments. Investments increase due to technological change, which causes inflow of foreign capital to make the new investments (Hervey and Merkel, 2000).

2.3 Twin deficit hypothesis based on national income accounting method

The linkages between fiscal deficit and trade deficit began to attract consideration in the 1980s, during Reagan's administration, the US experience higher budget and current account deficit which were termed as twin deficit hypothesis. This theory states that presuming an unaltered gap between private savings and investments over some time, a decrease in the BD equals to the changes in the CAD. The twin deficit theory is governed by the national income accounting system. (y) the estimated national income dependent on the Gross Domestic Product (GDP), (c) private consumption, I private spending, (g) public spending and (x-m) exports and imports shall be listed under net exports.

$$Y = C + I + G + X – M \qquad (1)$$

On the other hand, equation (1) can be written as Y = C + S + T (S) saving, (T) taxes paid and (F) net factor income payment made to foreigners.

$$Y = C + S + T \qquad (2)$$

After rearranging Equation (2), private savings form a part of the non-consumed disposable income that can be recorded as:

$$S = Y – F – T – C \qquad (3)$$

After combining (1) and (3) equations we obtain

$$(T – G) = (X – M – F) + (I – S) \qquad (4)$$

In equation (4) (T – G) gives government savings also known as budget surplus, if G exceeds T therefore creating budget deficit, (X – M) represents current account balance, when (M) imports increases (X) exports therefore creating current account deficit, (I – S) is private savings. The overall savings of the nation are given by the amount of public and private savings. The CAD is equal to the investment savings surplus and the difference between tax revenue and goods and services expenditure.

Equation (4) further recommends that the current account surplus is equal to budget surplus plus private savings and domestic investments. If the government reduces the taxes (T) and do not change the spending (G), meaning generating a deficit. However, the impact of budget deficit falls on current account balance (X – M) or investment saving gap (I – S) needs to be investigated. There are two situations under which fiscal policy will only impact I – S and keep exports unaltered. If world capital markets were completely nonexistent, the primary situation will arise. Then it would be necessary to

fund all the investments domestically. Private savings will be equal to private investment and government expenditure in this case. An expansion in the deficit will proportionately increase S – I, and X – M would stay unaltered. The second situation would emerge if taxpayers didn't accept that higher income because of the budget deficit. If the taxpayers realize that deficits defer taxes, either if they know that they have to pay the higher taxes in the future, then they will save additional disposable income for the future obligation. Therefore, an increase in savings will be equal to the deficit, any adjustment in (T) will change S, and will keep investment (I), exports (X) and imports (M) unaltered. In most of the developing nations, to reduce spending is very difficult due to political reason. Additionally, the extent of considerably increasing tax rates is restricted due to the predominance of poverty and tax collection (Egwaikhide, 1999).

The twin deficit theorem is based on the Mundell-Flemings traditional model. As reported, an increase in the BD would increase the exchange rate and lead to capital inflows under the flexible exchange rate and perfect capital mobility. However, if budget deficit happens due to tax reduction or by issuing bonds, this will increase money supply and increases demand for imports, which causes current account deficit. The increase in capital inflow results increase in exchange rate, which crowds out exports and worsens current account deficit.

Over the period 1980-2012, Ravinthirakumaran et al. (2016) tested the (SAARC) twin deficit hypothesis using cointegration methods, error correction mechanism and causality for Granger. The results affirm the causality of the BD to the CAD and accept the preposition of Keynesian for Sri Lanka, Pakistan and the reverse causality of Nepal and India and the short-term association between CAD and BD for Bangladesh.

A TVAR model was applied by Çatık et al. (2015) to find the validity of the twin deficit for Turkey using time series data over the 1994-2012 periods. The findings indicate that twin deficits can cause macroeconomic uncertainty. The twin deficit is true when a higher regime and divergent movements and a lower regime function in the economy.

Feldstein and Horioka (1980) recommended that investments and savings are correlated and in equation (4) investment deficit is constant. This suggests capital is immobile and opposing Mundell-Flemings model of twin deficit. Even Feldstein and Horioka do not inevitably say savings and investments are associated (Nguyen and Pagan (1990).

Banday and Aneja (2019) uses time series data over the period of 1985-2016 and applied ARDL model and Zivot and Andrew (ZA) structural break model for Chinese economy to estimate the association between BD and CAD. The results of ARDL model find long-run association among the variables and accepts Keynesian preposition for China. The results of Granger causality accept twin deficit hypothesis.

The twin deficits noted in the writing have different hypotheses. Sachs (1982) is credited with the Investment Theory, which clarifies that if the nation is an attractive force for foreign investment due to anticipated substantial returns due to the market climate, democracy, creative changes or a general increase in profitability, the investment inflows create a financial account overflow that is connected to the current account balance.

The Bachman Danger Prime Theory (1992) suggests that an exchange rate appreciation improves buying power as regards foreign goods, thereby raising the valuation of property and other financial practices. This pattern would increase spending and reduce savings, creating a deficit in the current account. This means that by changing the average cost of the non-tradable, the exchange rate will also affect the twin deficits. Enormous

government spending on non-tradable, for example, administrations or land area can actuate an appreciation which thus surges consumption toward tradable along these lines prompting current account deficits.

Korsu (2009) likewise contended that fiscal deficits affect the trade deficit through the money supply. He contends that expansion in budget deficit pushes upwards money supply when the deficits are financed by methods for seigniorage. Expansion in the money supply increases the prices of goods, which causes exchange rate appreciation and worsen the CAD.

Sargent and Wallace propose the subsequent connection (1981). They claim that seigniorage is the key to the funding of the deficit; the deficit would be required to be adopted by the national bank. Such an adjustment results in a rise in the supply of money and the rate of inflation. Sargent and Wallace (1981) subsequently agree that the origin is from budget deficits to the supply of money and then from the supply of money to inflation.

Another explanation is given by Miller (1983). He contends that budget deficit is fundamentally inflationary regardless of the monetization of deficits because there are various channels through which budget deficit causes inflation. He argues that regardless of whether the Central Bank doesn't change its deficits by raising the money supply/print, the deficits are inflationary by disproportionately. This is attributed to non-monetary deficits rising debt prices and rising interest expectations entering private capital and lowering inflation.

2.3.1 Keynesian preposition and twin deficits

The twin deficit problem is regularly viewed as being to some extent Keynesian in its way to find the impact of fiscal policy on the current account balance. Bernheim (1989) write down that based on the Keynesian perceptive of budget deficit, a large portion of population are short-sighted or have liquidity limitations, and have high proclivity to consume based on their current disposable income. In view of this, a reduction in tax will have instant and significant effect on demand. However, the fiscal policy has significant impact on output; the Keynesian perspective assumes that the government can adjust fiscal policy to bring macroeconomic stability. This perception affected the fiscal policy in both BRICS and United States in the starting of 1980s and early of 1990s, with the tightening of fiscal policies executed with the objective of decreasing current account balance.

In comparison to the Keynesian short-run, the neoclassical states that the intake of the consumer is based on the theory of the life cycle as proposed by Modigliani and Ando in (1957). However, the Milton Friedman in 1957 permanent income hypothesis asserts that increase in permanent income increases private consumption. Further, the increase in income due to tax reduction, spending's gives rise to savings not spending (Barro, 1989:39). The increase in the fiscal deficit will give rise to household consumption by shifting the tax burden to a future generation. However, if the economy operates at full capacity, consumption will give rise to savings and interests rate will go up to bring equilibrium in the financial market. Bernheim (1989) argues increasing fiscal deficit crowds out capital accumulation. Based on the neoclassical persecution, people react just

to change in a lifetime income. They believe people layout extra assets over their lifetime with the goal that the quick effect of assets on consumption is little.

2.4 Mundell Fleming approach to the twin deficit

The Mundell-Fleming Model (MFM) depicts how in an open economy to world trade in goods and money market operates, and gives a structure to fiscal and monetary investigation Marcus Fleming (1962) and Robert Mundell (1963). The (MFM) is an augmentation of IS-LM model. Scacciavillani and Knight (1998) noticed that the improvement of the MF model during the 1960s mirrored the certainty of the capacity of macroeconomic strategies to accomplish both inward and outer stability. This model is based on a fixed price and shows the linkage between the money and the good market. The IS curve represents equilibrium in good markets and LM curve constitute equilibrium in money market. The balance of payment (BOP) curve in Mundell-Fleming (MF) model is the combination of real income and interest rate at which BOP is equal to zero. The Mundell-Fleming Model is a short-run open economy model, where bonds and domestic market is treated as substitute for money, and labour being a part of the (MF) model based on the belief that demand brings change in output.

The Mundell-Fleming (MF) model has two separate investigations; one is under fixed and second flexible exchange rate. Under the fixed exchange rate, monetary policy has less scope but, fiscal policy may have a significant impact. However, under the flexible exchange rate regime, monetary extension prompts an increment in output while fiscal

policy has no impact on employment and output level. The assumptions for full employment under the Mundell-Fleming (MF) model are as:

- Domestic and foreign goods are imperfect substitute.
- Fixed domestic prices
- Output is not constant
- Mobility in international capital

The output (*y*) is determined by merging IS-LM and BOP curve; (*r*) is the interest rate; (*e*) is the real exchange rate and (BOP) is the balance of payment. In MF model balance of payment issue is solved when there is fixed exchange rate. However, MF model solves exchange rate under floating under exchange rate, in this situation exchange rate has a zero (BOP) Dornbusch (1997). This model is important to draw policy framework for interest rate, output and balance of payment under floating and fixed exchange rate.

The balance of payment curve represents the current account balance model in the Mundell-Fleming (MF) model. The balance of payment (BOP) model is equal current account balance (CAB) + capital account (CA) which is represented as: BOP = CAB + CA = 0

The BOP curve can be written as below:

$$BOP = (e_0 - m_0) + k(r - r^*) = 0 \qquad k > 0 \qquad (5)$$

Where *e* is exports, *m* is imports, *r* is interest rate, *r** gives world interest rate and k is the parameter which shows capital mobility in response to the change in interest rate (*r – r*)*.

On the other hand, we can write above import equation (5) in the simple linear function $e_0 = m_0 + mp'y$, as below:

$$BOP = (e_0 - m_0 - mp'y) + k(r - r^*) = 0 \quad (6)$$

The marginal propensity of import out of total income is given by *mp'y.* From the equation (6) we make domestic interest rate (*r*) as a dependent variable which gives:

$$r = \{(r^* - (1/k)(e_0 - m_0)\} + (mp'/k)y \quad (7)$$

This is a simple linear equation of balance of payment curve is given as *(mp'/k)* in the equation (7). When the capital is imperfect mobile, the lenders treat assets and the world capital market is not perfect substitutes. On the other hand, perfect capital mobility can arise when assets and the world capital market are perfect substitutes. With the removal of free trade restrictions in the money market during the 1980s and 1990s world market capital market is probably going to move close to perfect capital mobility. The mobility in capital defines the slope of balance of payment curve. When there is imperfect capital mobility domestic interest rate may change from the world interest rate. Meaning the domestic and foreign goods is imperfect substitute and balance of payment curve has a positive slope. However, when domestic and world interest rates are same the capital mobility will be perfect.

The three curves under the Mundell-Fleming (MF) model and their slopes are significant for comprehension and surveying the effect of different policies on the current account balance. For instance, under a flexible exchange rate and high capital adaptability, the M-F model presumes that beginning from the current account balance, fiscal policy will increase output and which increases demand for imports. This will, therefore, lead to

current account deficit, due to rise interest rate and application in exchange rate causes inflow of funds in the domestic market which cause current account deficit. Comparative with the underlying situation of the economy, the expansionary fiscal approach has brought about a marginal increment in output with the higher interest rate. The CAD is equivalent to the surplus in the capital account. This short-term associations are themselves the explanation for the Mundell-Fleming double-deficit theory. Although under a flexible exchange rate, a lower interest rate would depreciate the exchange rate. Depreciation of the exchange rate raises the country's exports. In this respect, the expansionary monetary strategy will either lead to an increase or a decrease in the CAD.

The major criticism of the static models, the growing world oil prices in the 1970s bring attention to building a complete model of the current account balance. The growing oil prices all over the world raised the issue of optimal responses for controlling external instability/shocks (Obstfeld and Rogoff, 1995). The critiques of the Mundell-Fleming model focus on the short run and the representation of current account are static. It also neglects the effect of investments on current account balance and productive capital. However, the new dynamic model for current account has been developed which gives cointegration in the CAD. The most used model is intertemporal model for current account.

2.5 Ricardian equivalence theorem

The criticism received by a Keynesian proposition from the Neo-classical perception about the budget deficit for disregarding the "crowding out effect". The expansionary government fiscal policy raises interest rate and shrinks the business activities. Robert

Barro presented another analysis of government fiscal policy. The change in budget deficit may affect private savings based on rational expectations. An increase in budget deficit implies that I am going to have more taxes in the future, so I will start saving for the repayment of higher taxes.

The idea of the Ricardian equivalence hypothesis emerges in the nineteenth century by David Ricardo (1951) in his article Funding System. In which he discussed the impact of deficit financing on the economy. They assume that the country is free from debt, if the country fought a war and had a budget deficit. Based on Ricardo that higher fiscal deficit will be financed by higher income tax, which constitutes a little portion of an income rather than large irregular expenses to finance the budget deficit. Ricardo asserts that it is difficult to make understand individuals that both the taxes are undesirable. The individual might know that a small income tax would be paid by the future generation, not by a person. However, if the individual leaves a lump sum amount to their successor, it might be contended that the person would be apathetic regarding the income tax diminishing the sum passed on to the succeeding age. Ricardo further argues if the person was required to pay a one single amount tax; the person will attempt to save the entire of it from their income.

The Ricardian proposition theorem states that a reduction in tax is due to deficit financing leads to higher taxes for the future generation (Barro; 1989). Obstfeld (1986), Sachs (1982) and Frankel (1986) have discussed the productivity of the world capital market. It presently gives the idea that international capital markets are incorporated to a vast extent, and this consolidation is somehow unsound. The degree to which people expect and put something aside for future tax liabilities, with most of the discussion

concentrating on Barro's (1974) idea of Ricardian equivalence. Ricardian theorem is based on the inductive reasoning of permanent life cycle hypothesis (Seater; 1993).

The conventional theory of Keynesian is challenged by the (REH) of Barro (1974, 1989). Ricardian theorem expresses that a fiscal deficit that is financed by a tax reduction and bond deals would be considered to be tax liabilities in future to benefit and withdraw the debt obligations. The economic agents who want to maximize their next generation welfare would increase savings instead of consumption in anticipation of future tax (Barro, 1989; Hashemzadeh & Wilson 2006; Sachs and Lorraine, 1993). The main doctrine of Ricardian equivalence is that changes in government deficit will have no impacts on consumption, savings, investments, inflation and interest rate.

The below model for Ricardian equivalence is based on Barro (1974, 1989) and Seater (1993).

$$G_0 - T_0 + r_{-1}GD_{-0} = GD_0 - GD_{-1} \quad (8)$$

$$G_1 - T_1 + r_{-1}GD_{-1} = - GD_0 \quad (9)$$

Where *G* is the government spending, *T* is the taxes paid by the individuals, *r* is the interest rate, *GD* is the government debt, *BG** is the private debt, *C* is the private consumption, *P* is the price, *Y* is the income, *h, u, c, f, e* and *z* is the real value of variables, 1 represents the present period, 0 is the given condition and +1 is the future period.

In equation (8) and (9) gives the budget deficit and interest payment. By dividing equation (8) by P_0 and equation (9) P_1 we get:

$$h_0 - u_0 + (1 + r_{-1})\, P_{-1}/P_0\, GD_{-1}/P_1 = GD_0 \quad (10)$$

$$h_0 - u_0 = -(1 + r^*_0)\, P_0/P_1\, GD_0/P_0 \quad (11)$$

r^* is the real interest rate

After substituting equation (10) and (11) we get:

$$h_0 - u_0 + (1 + r^*_0)^{-1} + (1 + r^*_{-1})c_{-1} = u_0 + u_1(1 + r^*_0)^{-1} \quad (12)$$

Equation (12) states that government debt and spending's must be equal to tax revenue.

The budget constraint of the private sector for the period of 0 to 1 is:

$$C_0 = Y_0 + GD^*_0 - (1+ r_{-1})\, GD^*_{-1} - T_0 \quad (13)$$

$$C_0 = Y_1 - (1+ r_0)\, GD^*_0 - T_1 \quad (14)$$

Combining equation (13) and (14) we get:

$$f_0 + f_1 (1+r^*_o)^{-1} = z_0 + z_1(1+r^*_0)^{-1} - h_0 - h_1(1+ r^*_0)^{-1} - (1+ r^*_{-1})e_{-1} \quad (15)$$

Equation (15) gives the private sector inter-temporal budget constraint. The spending of private sector should be equal to (net income – debt). (f_0, f_1) is the consumption of individuals which can be maximised by U(f_0, f_1).

$$f_0 + f_1 (1+r^*_o)^{-1} = z_0 - h_0 + (z_1 - h_1)(1+ r^*_0)^{-1} \quad (16)$$

This assumption holds that in a closed economy, private savings must be equal to public debt ($e = -c$). The government expenditure (h_0, h_0) and tax debt ($c_0 - u_0$) this will give equilibrium of price and quantity based on government budget constraint. This shows that

public debt and taxes do not affect private consumption. Under the Ricardian equivalence hypothesis, decrease in government saving counterbalance private saving and hence there will be no change in countries savings. Thus, a decrease in present tax is an indication for increase in future tax and a change in government expenditure. As long as economies continue to save, the interest rate in a closed economy does not adjust to establish a compromise between savings and investments (Barro: 1989).

However, in an open economy the interest rate is decided by the world markets. The 'R' denoted the interest rate and individuals in the economy can borrow the money at that rate. The results both the economies (closed economy and open economy) yield the same results.

$$f_0 + f_1 (1+r^*_o)^{-1} = z_0 - h_0 + (z_1 - h_1)(1 - r^*_0)^{-1} - (1 + r^*_0)(e_{-1} + c_{-1}) \qquad (17)$$

Equation (17) tells us that decrease in tax will increase government debt but there will be no impact on private consumption. The consumption expenditure of present economy must be equal to present available resources to private sector minus external debt in the economy. However, the given value of debt in an economy, nor taxes and foreign borrowings impacts wealth, which is only affected by government expenditure (h_0, h_1). With this assumption, current account will not get impacted because private savings are high to avert borrowing from abroad (Barro: 1989). The idea of Ricardian theorem is grounded with neoclassical method, they argue that the individuals are farsighted and arrange their consumption on the basis of life cycle hypothesis.

2.6 Empirical literature

As seen in previous chapter, observational government economic management research in the 1980s indicates that the budget deficit generates a current account deficit and (these are twins). The Keynesian premise suggests that a larger budget gap raises interest cost, exchange rate inflation, and the CAD. The Keynesian contradiction claims that the BD and the CAD are unrelated. Changes in taxes have no association with interest rate and demand as given by Ricardian hypothesis. As shown below, the following section discusses the empirical relationship between the twin deficit hypothesis and Ricardian equivalence:

2.6.1 Twin deficit hypothesis

Abell (1990) used different monthly data for US over the period of 1979 to 1985 by using vector auto regression model. The thesis focuses on the macroeconomic system of money flow, fiscal deficit, trade deficit, GDP, inflation, interest rates and the exchange rate. The results found that fiscal deficit causes a trade deficit. There is a transmission mechanism from governmental deficit to interest rate, to foreign direct investments and change in exchange rate and finally current account deficit.

Bernheim, B. D. (1987) the UK, Canada and West Germany, and the general cross-country connection, indicate that $1 rise in the revenue gap would increase the current account deficit by up to $0.30. For Mexico, the historical history between the CAD and the BD indicates that this effect is largely larger, can vary from $0.80 to a billion. Interestingly, for Japan, the evidence is inconsistent since the revenue shortfall impacts the current-account deficit entirely. Miller and Russek (1989) used VAR methods for the

duration 1946-1987 to evaluate the relationship between BD and CAD. Causality from the exchange rate channel to current account deficit is observed in the results.

An increase in BD will cause foreign inflows and apricates exchange rate, potentially triggering the current account deficit (see, Kouassi, Mougou'e and Kymn, 2004, Blanchard, 1985, Leachman and Francis, 2002, and Salvatore, 2006) in the sense of the Mundell flamenco model (Flaming, 1962; Mundell, 1963). Growing budget deficits will stimulate national absorption on the basis of the Keynesian absorption theory (increased demand for products and services), further increasing imports and contributing to increased CADs. The dilemma of twin deficits is connected to the degree of global mobility of capital and Feldstein and Horioka puzzles. If there is no clear correlation with high capital mobility between expenditure and savings, all deficits should move to that extent.

Enders and Lee (1990) develop a model based on optimization method over the period of 1947 to 1987 by employing VAR methodology. The VAR results find that government spending causes current account deficit. But, when the model was restricted on the basis of Ricardian hypothesis, which show how government debt impact interest rate and consumption, the results accept the hypothesis.

Rosensweig and Tallman (1993) used the VAR analysis for US. The model integrates the rate of trade, the interest rate and the nominal GDP of the economy. The findings indicate that the causality of the budget disparity increases the exchange rate and thus the trade deficit.

Kim and Roubini (2008) uses VAR model to test the twin deficit hypothesis for United States. The results find the fiscal shock improves trade balance and deprecates exchange

rate know as twin divergence. The conclusion finds private savings increase with the decline in investment via the interest rate channel because of crowding out effect.

Corsetti and Muller (2006) develop a VAR model to study impact of fiscal shock on twin deficit for Australia, Canada, United States and United Kingdom. Results find with the increase in openness in trade twin deficit increase and fiscal shock reduces the twin deficit. For Canada and United Kingdom twin deficit hypothesis is accepted. In Australia and United States, the author does not find strong evidence of twin deficit. In Australia fiscal shock does not have an impact on CAD.

Badinger et al., (2017) examines the linkage between fiscal and external balances for 73 nations from 1985 to 2012. Their results confirm the twin deficits hypothesis. Litsios & Pilbeam (2017) investigates Greece, Portugal and Spain using ARDL model. The empirical results suggest negative association between saving and CAD in all three countries.

Khalid and Guan (1999) analyzed five developed and five emerging countries and found cointegration and bidirectional linkage between the variables. However, the findings are unidirectional in developing countries.

Branson and Henderson (1985) assert that when the government reduces taxes, taxpayers react by expanding consumption. However, if the economy is at full employment, country savings must decline. Nation reserves are then lacking to cover all gainful investments at the current interest rate in addition to public borrowings. The variation between supply and demand will put an upward force on an interest rate. Increasing interest rates will reduce investments and increase savings. However, if there is no full employment in the economy, tax reductions may increase production due to increase in

demand. This will increase both private savings and net national income. Therefore, national savings may decrease significantly less than the full employed economy. As resources are unemployed, the effect of the BD on the CAD is negligible. There are numerous mechanisms by which these deficits are related. The change in deficits induces adjustments in the CAD by interest rate and exchange rate relationships.

Banday and Aneja (2017) investigates the relationships between the BD and CAD will be analysed for the period 1990 to 2016 in the context of the implementation of the cointegration mechanism of Johansen, Granger causality and the reaction feature Impulse. The findings of Johansen's cointegration are long-term, Granger causality shows two-directional causality and supports the Keynesian hypothesis and finds little proof in favor of the hypothesis for Ricardian equivalence.

Ketenci (2010) employs cointegration and ECM to analyses the effect of variables on Russia's current-account deficit from 1995 to 2008. The findings indicate that the CAD is diverged by mineral assets.

Baharunshah et al: 2006) explores the twin deficit hypothesis for 4 ASEAN countries using a single Zivot and Andrews (1992) systemic break test and cointegration test of 4 ASEAN countries. In Malaysia, Thailand, Indonesia and the Philippines, the findings of co-integration found long-term relationships with a single structural break. Authors find unidirectional causality via interest rate and exchange rate, BD to CAD.

Leroy (1984) analyses the United States and 58 advanced economies and developing countries, the BD and the CAD have a significant relation in developing countries and the budget deficit triggers trade imbalances.

Mukhtar et al., (2007) embraces the twin deficit theory, and develops a model to test the link between BD and CAD and reveals cointegration among the variables. The causality suggests bidirectional causality between the BD and CAD.

The VAR model was developed by Tallman and Rosensweig (1991) to assess the relation among variables using the US budget deficit and trade balance. Many macroeconomic considerations, including interest and exchange rates, were included to create a strong partnership. This results in a constructive relationship between the revenue surplus and the trade imbalance embraces and rejects the Keynesian plan.

Ghatak and Ghatak (1996) are using multiple variables to evaluate their theory of Ricardian equivalence for the span of 1950 to 1986: usage, spending, salaries, taxation, private property, government bonds, government expenditures, investments, government expenditures and interest on bonds. The thesis used multi-cointegration analysis and a realistic expectation calculation, and the two studies dismissed the REH, suggesting that tax cutbacks induce consumption. The findings thus invalidate the REH for India.

Bhat and Sharma (2018) are studies India using the NARDL model between 1970-71 and 2015-16. The findings accept the Keynesian hypothesis and dismiss the Ricardian hypothesis. The findings establish long-term associations between CAD and BD.

Goyal and Kumar (2018) investigated quarterly data for the Indian over the period 1996Q2 to 2015 Q4. The study employs the structural vector auto regression model between external imbalance, budget deficit, and the exchange rate. The results reveal the impacts of oil imbalances and consumption effects causing current account deficit and rejects REH.

Darrat (1988) examined the causal relation between government deficits and trade deficits using the US multivariate Granger causality test. There is a two-way correlation between trade gap and government deficit.

To check the linkage between BD and CAD for Nigeria and the accessible oil-based economy were investigated between 1970 and 2001 by Onafowora and Owoye (2006) using the role of vector error correction, granger causality and stimulus response. The results indicate that the current account deficit's budget deficit is a one-sided cause. The findings favor the Keynesian suggestion and contradict Ricardian hypothesis.

Vamvoukas (1997) employs an ECM and causality analysis to test link between BD and CAD. Unidirectional causality from BD to CAD and the result are consistent with the conventional Keynesian theory.

2.6.2 Ricardian equivalence theorem

The standard Keynesian hypothesis is questioned by Barro's (REH) (1974, 1989). Ricardian principal notes that a fiscal shortfall funded by decreased revenues and securities sales will be deemed tax burdens to gain and withdraw debt commitments in the future. When citizens see the real valuation of their taxes growing, it just compensates for deficit spending; this liability does not become part of the overall savings. The economic agents who want to maximize their next generation welfare would increase savings instead of consumption in anticipation of future tax (Barro, 1989; Hashemzadeh & Wilson 2006; Sachs and Lorraine, 1993). The main doctrine of Ricardian equivalence is that changes in government deficit will have no impacts on consumption, savings, investments, inflation and interest rate.

Barro (1989) evaluates Ricardian proposition of budget deficit and outlines the motive of this hypothesis. Income and future tax are not certain; no perfection in capital market; taxes do not matter to individuals because no one lives forever. Barro makes a point that various studies on interest rate, savings, consumption and current account deficit support Ricardian hypothesis. But various studies have problems related data and their identifications which makes Ricardian preposition biased. Buchanan (1976) was the first who find close association between Ricardo and Barro proposition. However, many researchers like Bailey (1971), Ricciuti (2003) and Patinkin (1965) also find the means of funding debt do not fret.

Seater (1993) studies Ricardian preposition with both direct and indirect method. He found Ricardian method is correct logically, but there are lots of problems to hold it. Seater argued we need to develop a strong econometric model to confirm the Ricardian hypothesis. Roubini (1988) also find that there is no linkage between CAD and BD.

Afonso et al., (2018) studied 193 countries over the period of 1980-2016 using fixed effect model and system GMM model. The findings reveal that the fiscal policy will reduces the effect of BD on CAD. When there is an absence of fiscal policy rule twin deficit hypothesis exists.

To find out the relationship between BD and CAD for South Africa for the duration 1994-2016, Ncanywa and Letsoalo (2019) implemented an autoregressive distribution delay strategy and Granger causality test. The findings support the short-term interaction, but may not imply that the theory of Ricardian is recognized. The policy vector for expenditure cuts and current account deficits should be inflation.

Algieri (2013) tests GIIPS countries (Greece, Ireland, Italy, Portugal, and Spain) and uses Granger causality and Toda-Yamamoto for the 1980Q2 through 2012Q2 quarterly. The findings demonstrate that the debt and current account deficit are not causal and endorse theorem of Ricardian equivalence. They see conservative monetary strategies that do not impair the balance of the current account. Fixing fiscal policies will, however, boost budget deficits and economic development.

Chihi and Normandin (2013) study the linkage between BD and CAD for 24 developing countries from 1960 onwards by applying VAR structure. The results find positive correlation between external balance and budget deficit. The model is evaluated for every nation to such an extent that the anticipated second moments of the budget deficit and external balance and specifically the covariance between these deficits are near to these countries. The results for US reveal that budget deficit have insignificant relationship with external balance and accepts Ricardian equivalence hypothesis for US.

Gale and Orszag (2004) studies consumption and saving approach, which is based on reduced form of consumption function in United States. They include interest rate, private savings and real effective exchange rate. These studies conclude we could not reject Ricardian hypothesis but accept it partially. Yi (2003) investigates the relationship between exchange rate, CAD, consumption and BD for South Korea. The analysis finds no-cointegration relations among the variables and accepts Ricardian hypothesis.

Christopher Walker (2002) studies Japanese economy by considering huge budget deficit and large private savings. He employed VAR methodology and conclude the tax have negative sign to change in output and accept Ricardian hypothesis. Further, suggests private savings counterbalances budget policies.

The fiscal deficit doesn't prompt any changes in the exchange rate and interest rate (Garcia and Ramajo, 2004), and consequently no effect on CAD. However, the rational consumer knows that if there is a decrease in tax this year, in coming years it will be increased. Hence, the rational agent saves today for future tax liabilities.

Giorgioni and Holden (2003) investigates the Ricardian hypothesis for the countries (India, Pakistan, Nigeria, Burundi, Sri Lanka, Zimbabwe, Ethiopia, Honduras, morocco and El Salvador) by applying Bernheim consumption function. The results find that there are some evidences for Ricardian preposition but due to limitations of data you need to very caution regarding the variable identifications. Reitschuler (2008) also investigates Ricardian hypothesis in EU-11 member countries and results conclude, we could not accept Keynesian preposition but accepts Ricardian hypothesis.

Magazzino (2012) discusses GMM and Granger causality in European countries in relation to current account deficits, expenditure deficits and private consumption. The findings are mixed, with 1% growth in the BD raising the CAD by 0.21%. The GMM estimator findings align with the Ricardian hypothesis.

The link between fiscal policy and government debt for 17 OECD countries has been analyzed by Berben and Brosens (2007), using the ARDL method. The findings suggest that the relationship between consumption and individual income and wealth is favorable. Debt has a major relationship, though, which ensures that monetary measures are overshadowed by a reduction in demand. Evans and Karras (1996) also have a partial approach to Ricardian.

Some of the studies are based on Euler consumption function, Gale and Orszag (2004) gives the advantages of Euler consumption function which includes rational expectation

method and utility maximization method. Blanchard (1985) concludes in favor of both Ricardian and non- Ricardian approach. Evans (1993) has found no evidence in favor of Keynesian preposition and accepts Ricardian hypothesis.

Enders and Lee (1990) are using Vector Auto-Regression (VAR) modeling to analyze quarterly results for the United States 1947:111 to 1987:1. He used factors such as consumption, government expenditure, deficit, foreign currency, interest rate, and the balance of current accounts. The findings agree that the budget gap should not trigger commercial deficits and accept the theory of Ricardian equivalence.

2.7 Summary and Conclusions

Chapter 2 has given the broad outlook of the theories regarding the twin deficit hypothesis (Keynesian preposition and Ricardian equivalence theorem). The linkage between the BD and the CAD in the US contributed during the late 1980s and early 1990s that the deficits have bidirectional causality. The Reagan Administration executed an expansionary fiscal measure through a tax cut, which was not supplemented by monetary policies. The one-sided policy exerted from interest rate and more imports and increase the value of the dollar. This appreciation in dollar brought about a disintegration of the United States' intensity on world markets, and a worsening of the trade balance. Under these conditions, the CAD seems to reflect the budgetary position, which prompts to popularize the twin deficit hypothesis. The discussions were not confined to the US, where fiscal and monetary policy in BRICS countries was concentrated around the current account deficit and increasing foreign debt.

The Keynesian stance claims that the large budget deficit raises interest costs, currency appreciation, and the current-account balance deteriorates. The next segment presents Mundell-twin-deficit Fleming's theory solution. This model demonstrates why the expansionary monetary strategy of the government worsens the balance of the current account. However, this paradigm has only a short-term effect on the CAD as a consequence of fiscal policies. The model is unable to estimate the long-term relationship that develops with stock and flow interlinks age. The critique of a Keynesian proposition on the neoclassical view of the budget deficit to ignore "crowding out effect" The expansionary fiscal policy of the government will contribute to an increase in the cost of interest and decrease business activities. Ricardian principal notes that a fiscal shortfall funded by decreased revenues and securities sales will be deemed tax burdens to gain and withdraw debt commitments in the future. When citizens see the real valuation of their taxes growing, it just compensates for deficit spending; this liability does not become part of the overall savings. The economic agents who want to maximize their next generation welfare would increase savings instead of consumption in anticipation of future tax (Barro, 1989). Based on the theory, the chapter defines the model for this study. The thesis uses reduced form of consumption function based on Bernheim (1987) to test Ricardian equivalence.

As written in the preceding section, the difference in empirical results on twin deficit hypothesis and Ricardian equivalence is due to differences in econometrics techniques, data, and sample size. Econometric strategies have likewise shifted particularly with the improvement of new estimation techniques setting an extra degree of variety in results from past work. Past research has given little consideration to the issue of structural

change, and this thesis looks to make a distinctive contribution to the writing by addressing this issue. The study will include different econometrics methods (ARDL, Impulse response functions, and causality analysis) that will give a wide contemporary investigation on the cause-and-effect relationship between BD, CAD and macroeconomic variables in BRICS countries.

CHAPTER 3
MODEL SPECIFICATION AND ECONOMETRICS METHODOLOGY

3.1 Introduction

Before estimating the empirical models in the next chapter, we will discuss a brief about the methodology. The study will develop the model based on the theoretical framework, as given the previous chapter. The research utilizes data from different macroeconomic indicators and BD and CAD for BRICS countries from 1990 to 2018. The methodological research was conducted to analyse the interaction between the variables. A serious attempt has been made by the author to discuss all the objectives for each country in their respective chapters (chapter 4 to 8) while keeping up an overall progression of the perspective all through the thesis. To achieve the objectives of the study, various econometric methods have been employed keeping into consideration the objective of the study. In defining the variables, considerable attention has been given to the units/denominations to prevent any fallacious or deceptive effects.

The first section 3.2 will give model specification. Section 3.3 belongs to methodological of the study. The methodological section has four sub-sections. The first sub-section gives Augmented Dickey-Fuller (ADF) (1981) and Phillips-Perron (PP) (1988) unit root in sections 3.3.1. The cointegration estimation of autoregressive distributed lag (ARDL) system provide the next segment of 3.3.2. Another 3.3.3 sub-section would include the methodology of causality estimation. This will assist us in understanding the causality trajectory between the variables. Final sub-section 3.3.4 will discuss impulse response

function. This technique will give us input and output relationship with the respect one positive shock.

3.2 Model Specification

The model for the study is calculated, according to the theoretical literature and methodology of previous analytical studies, the Indian current account deficits are focused on budget deficits, inflation, rate of interest and exchange rate. The relationship between twin deficits can be defined in an implied form to provide this equation:

In order to explore the relationship between BD and CAD in the macroeconomic framework (twin deficits theorem) for BRICS, this segment introduces a tractable open economy by including current account deficit, budget deficit, inflation, interest rate, exchange rate, supply of money and tax revenue based on past literature review and theoretical framework. There may be an issue of concurrence between the current account deficit and real exchange rate. However, all the variables are incorporated in order to catch the transmission mechanism of the twin deficit as described by Kim and Roubini (2008), Miller & Russek (1989) and Barro's (1974). 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:

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

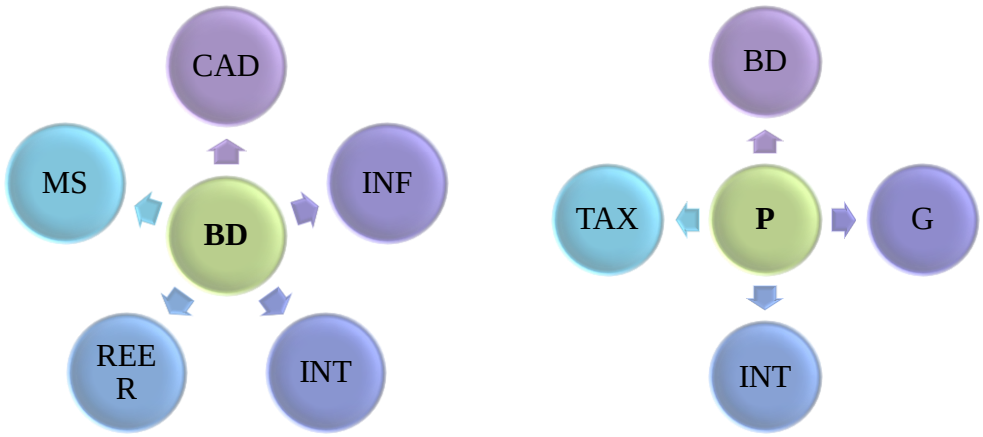
Where BD_t is the budget deficit, CAD_t is the current account deficit, INF_t is inflation, REER is the real effective exchange rate, MS_t is money supply, INT_t is the interest rate and e_t is a white random process. Based on the macroeconomic theory, estimation of α_1; α_2; α_3; and α_5 are supposed to be positive. This means that budget deficit, inflation, interest rate and money supply, 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. However, the depreciation in the exchange rate, people will hold more foreign currency as compared to domestic currency and α_4 will be negative.

The model 2 will estimate Ricardian Equivalence hypothesis based on Bernheim (1987) consumption equation. Most of the empirical literature estimate Euler equation or reduced form of the consumption equation. But, in this study we will apply the reduced form of the consumption function as given below:

$$P_t = \beta_0 + \beta_1 Y_t + \beta_2 G + \beta_3 BD_t + \beta_4 TAX_t + \beta_5 INT_t + X_t\beta + \varepsilon_t \qquad (2)$$

Where P is the private consumption, G is the government expenditure, BD is the budget deficit, Tax is the tax revenue and INT is the interest rate. We applied ARDL bound testing approach for long-run relationship. Based on equation (1 and 2) we have estimated two models the first one is twin deficit hypothesis and the second one is Ricardian equivalence hypothesis as given below in figure (3.1).

Figure 3.1: Model estimation twin deficit hypothesis (TDH) and Ricardian theorem



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

3.3 Econometric Methodology

Different econometric methods have been used to estimate the linkage between the variables. Therefore, in accordance with other analytical studies on the twin-deficit theory, the study tests the long and short-term relationship and the course of the causality between the two deficits. We will render the variables stationary before estimating the model. Because empirical literature has argued that calculating time-series with unit root will show questionable results, the stationarity test can help to assess whether or not the time-series are stationary.

The co-integration approach will also analyse the possible long-term and short-term connections between model variables and the coefficient degree of significance. The Granger causality test, which is the main objective of this work, is performed in

comparison to the generally utilised bivariate framework within the multivariate framework. This helps to determine the course of causality and input among the variables.

3.3.1 Unit root test

Until estimating empirical models, it is necessary to check and estimate the time series properties of the results. The test of the stationary data is important as the F-test and t-value are null if the sequence is not stationary. Several function root checks were done for the integration and root class of the variables. Unit root tests for Augmented Dickey-Fuller (ADF) in 1981 and Phillips-Perron in 1981 were conducted (PP 1988). The ADF test is based on the ARMA framework where you are AR defined (1). However, the Phillips-Perron (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. Augment Dickey-Fuller (ADF) and Phillips-Perron (PP) claim that I(1) is a time series and I is an alternative hypothesis I(0).

In the other side, a non-stationary series is one in which /ρ/> 1. Any stochastic shock then cannot return to the right average stage. A non-stationary series is, therefore, a random phase in which the absolute value is equal to 1 (that is, unity). Such a vector could then be named "unit root" Nkang et al (2006). The ADF and PP test was used to verify the variables stationarity.

$$y_t = \alpha D_t + \gamma Y_{t-1} + \sum_{i=1}^{k} \beta i \, \Delta Y_{t-k} + \varepsilon_t \ldots\ldots\ldots\ldots (3)$$

Where Yt is the time sequence, Δ is the first difference operator, T is the linear pattern and α is a constant. The null hypothesis that the unit root remains is β.is 0.

3.3.2 Autoregressive distributed lag model (ARDL)

There are different types of cointegration methodology like Johansen Juselius (1990), Johansen (1991), Engel and Granger (1987) and Gregory and Hansen (1996). The Johansen process, therefore, is more commonly used, but it also has drawbacks such as low ability in limited samples and includes order (1) variables. The research uses the Autoregressive-Distributed Lag (ARDL) model to analyse the twin-deficit relationship in the macroeconomic system and Ricardian equivalence centered on the consumption function of Bernheim (1987). Pesaran et al., (2001) sponsored the (ARDL) boundary checking method has more value than others. Thirdly, we have overlapping short-term and long-lasting relations between variables. The low and upper limit importance is suggested by the co-integration technique of ARDL. We accept that co-integration between the variables occurs where the F-statistics are larger than the upper limit. If F data are lower than the upper limit, we embrace zero non-cointegration hypotheses (Pesaran et al., 2001). This study is based on the above attributes, with simple incorporation order and small sample size, as the most efficient approach. There are four phases to test an ARDL model. The first step explores the long-term partnership by utilising the Bound Test method (Pesaran and Pesaran 1997; Pesaran et al., 2001). In the second and third steps, we measure the long-term and short-term coefficients. Finally, in

the context of (CUSUM) and (CUSUMSQ), the model provides stability performance. The ARDL model can be written by the following equation.

$$\partial(\mathrm{L},\mathrm{p})y_t = a_0 + \sum_{i=1}^{k} n_i\,(L, q_i)x_{it} + \lambda' w_t + \varepsilon_t \qquad (4)$$

Where

$$\partial(\mathrm{L},\mathrm{p}) = 1 - \partial_1 \mathrm{L} - \partial_2 L^2 - \ldots - \partial_p L^p \qquad (5)$$

$$n_i(L, q_i) = n_{i0} + n_{i1}L + n_{i2}L^2 + \cdots + n_{iq}L^{qi} \qquad (6)$$

Where the dependent variable is $y_{t,,}$ constant is $a_{0,}$ L defines the lags, w_t is deterministic trend of vectors. The long-run estimates of the ARDL model is as:

$$\emptyset_i = \frac{n_i\,(1, q_i)}{\partial(1,\mathrm{p})} = \frac{n_{i0} + n_{i1} + \cdots + n_{iq}}{1 - \partial_1 - \partial_2 - \cdots - \partial_p} \qquad (7)$$

Where q_i is the estimator of long-run coefficient in the ARDL model

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.

$$\Delta \mathrm{y}_t = \Delta \mathrm{a}_0 - \partial(1,\mathrm{p})ECM_{t-1} + \sum_{i=1}^{k} n_{i0}\Delta x_{it} + \boldsymbol{\lambda}'^{\Delta x_t} - \sum_{j=1}^{p-1} \partial j \Delta y_{t-1} - \sum_{i=1}^{k}\sum_{j=1}^{qi-1} n_{ij}\,\Delta_{1,t-j} + \varepsilon_t \qquad (8)$$

We assume x_t is not co-integrated and ε_t is the error term. The first model we estimate is Ricardian proposition based on private consumption model and the second model we estimate is to twin deficit hypothesis. The F-Statistics is contrasted with upper and lower limits. The ARDL equation model (1 and 2) can be written as follows:

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

3.3.3 Granger causality

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 BRICS. 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).

Granger causality approach is to find out the link between the variables. 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. To estimate the causality, the equations for the model can be specified as:

$$x_t = \gamma_1 + \sum_{j=1}^{p} \alpha_{1j}\, x_{t-j} + \sum_{j=1}^{p} \beta_{1j}\, y_{t-j} + \varepsilon_{1t} \qquad (10)$$

$$y_t = \gamma_2 + \sum_{j=1}^{p} \alpha_{2j}\, x_{t-j} + \sum_{j=1}^{p} \beta_{2j}\, y_{t-j} + \varepsilon_{2t} \qquad (11)$$

k is the maximum lag and d is the order of integration and ε_{1t} is the error term. The null hypothsis for equation (10) will be $H_o = \beta_{1j} = \beta_{1j+1} = \beta_{1k} = 0$ which means no causlaity from y_t to x_t and vice versa.

This association between causality and monotony drove Granger to express direction of causality in a parametric structure, based on traditional time series data. It is important to check stationarity 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 based on the equation (10 and 11) can be written in the below form for estimating the relationship between the variables:

$$\Delta BD_t = \alpha_1 + \Sigma\beta_1\Delta CAD_{t-i} + \Sigma\theta_1\Delta INF_{t-i} + \Sigma\gamma_1\Delta REER_{t-i} + \Sigma\delta_1\Delta INT_{t-i} + \Sigma\lambda_1\Delta MS_{t-i} + \Sigma\partial_1\Delta TAX_{t-i} + \varepsilon_t \quad (12)$$

$$\Delta CAD_t = \alpha_2 + \Sigma\beta_2\Delta BD_{t-i} + \Sigma\theta_2\Delta INF_{t-i} + \Sigma\gamma_2\Delta REER_{t-i} + \Sigma\delta_2\Delta INT_{t-i} + \Sigma\lambda_2\Delta MS_{t-i} + \Sigma\partial_2\Delta TAX_{t-i} + \varepsilon_t \quad (13)$$

$$\Delta INF_t = \alpha_3 + \Sigma\beta_3\Delta BD_{t-i} + \Sigma\theta_3\Delta CAD_{t-i} + \Sigma\gamma_3\Delta REER_{t-i} + \Sigma\delta_3\Delta INT_{t-i} + \Sigma\lambda_3\Delta MS_{t-i} + \Sigma\partial_3\Delta TAX_{t-i} + \varepsilon_t \quad (14)$$

$$\Delta REER_t = \alpha_4 + \Sigma\beta_4\Delta BD_{t-i} + \Sigma\theta_4\Delta CAD_{t-i} + \Sigma\gamma_4\Delta INF_{t-i} + \Sigma\delta_4\Delta INT_{t-i} + \Sigma\lambda_4\Delta MS_{t-i} + \Sigma\partial_4\Delta TAX_{t-i} + \varepsilon_t \quad (15)$$

$$\Delta INT_t = \alpha_5 + \Sigma\beta_5\Delta BD_{t-i} + \Sigma\theta_5\Delta CAD_{t-i} + \Sigma\gamma_5\Delta INF_{t-i} + \Sigma\delta_5\Delta REER_{t-i} + \Sigma\lambda_5\Delta MS_{t-i} + \Sigma\partial_5\Delta TAX_{t-i} + \varepsilon_t \quad (16)$$

$$\Delta MS_t = \alpha_6 + \Sigma\beta_6\Delta BD_{t-i} + \Sigma\theta_6\Delta CAD_{t-i} + \Sigma\gamma_6\Delta INF_{t-i} + \Sigma\delta_6\Delta REER_{t-i} + \Sigma\lambda_6\Delta INT_{t-i} + \Sigma\partial_6\Delta TAX_{t-i} + \varepsilon_t \quad (17)$$

$$\Delta TAX_t = \alpha_7 + \Sigma\beta_7\Delta BD_{t-i} + \Sigma\theta_7\Delta CAD_{t-i} + \Sigma\gamma_7\Delta INF_{t-i} + \Sigma\delta_7\Delta REER_{t-i} + \Sigma\lambda_7\Delta INT_{t-i} + \Sigma\partial_7\Delta MS_{t-i} + \varepsilon_t \quad (18)$$

G-causality gives four possible outcomes, unidirectional causality from BD to CAD, unidirectional causality from CAD to BD, bidirectional causality from BD to independent variables and no-causality among the variables. 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.

3.3.4 Impulse response function

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 includes calculating abrupt shifts in time t in one variable X (the impulse) and estimating its impact on the other variable Y in time t, t+1, t+2, etc... (the answers). The IRF explains how the dependent variable reacts to the error shocks of the VAR model. In other terms, in one of the developments, the IRF detects the influence of a particular shock on existing and future values of endogenous variables. The basic structure for the IRF will be:

$$Y_t = \alpha + \varepsilon_t + \Theta 1\ \varepsilon_{t-1} + \Theta 2\varepsilon_{t-2} + \ldots + \Theta i\varepsilon_{t-i} \qquad (19)$$

Where yt is a function of dependent variables, ε is a function of shock for all VAR models and Θi is a vector parameter, which measures the dependency variable's responses to developments in all the VAR model variables.

For two variables (Yt and Xt), however, the IRF form will be:

$$Yt = \alpha 1 + \varepsilon Y,t + \eta 1\varepsilon\ Y,t\text{-}1 + \eta 2\varepsilon Y,t\text{-}2 + \ldots + \eta i\varepsilon Y,t\text{-}I \quad (20)$$

$$Xt = \alpha 2 + \varepsilon X,t + \varphi 1\varepsilon\ X,t\text{-}1 + \varphi 2\varepsilon X,t\text{-}2 + \ldots + \varphi i\varepsilon X,t\text{-}I \quad (21)$$

Equations 20 and 21 describe how the predictor variables, Yt or Xt, reacts to past developments that occurred in the VAR model's dependent variable (εX's and εY's). The quantities of responses are, however, presented by the coefficients (φ's and π's).

In this study we use generalize impulse response functions (GIR) which investigates the time impacts of a one-time shock to every factor as given below.

$$\Theta \frac{g}{i} = \emptyset_i \sigma_{jj} - \frac{1}{2}\sum, \quad (22)$$

Both structural and symmetrical impulse functions are compelled either by finding the correct order of factors or by the distinguishing proof of the evaluated structural parameters. Koop et al. (1996) propose an alternate sort of impulse function, called generalised impulse responses (GIR). The functions are independent of the order of variables since they combine the impacts of different shocks out of the responses. σ_{jj} is the variance of the jjth variable.

CHAPTER 4

RICARDIAN EQUIVALENCE AND TWIN DEFICIT IN BRAZIL

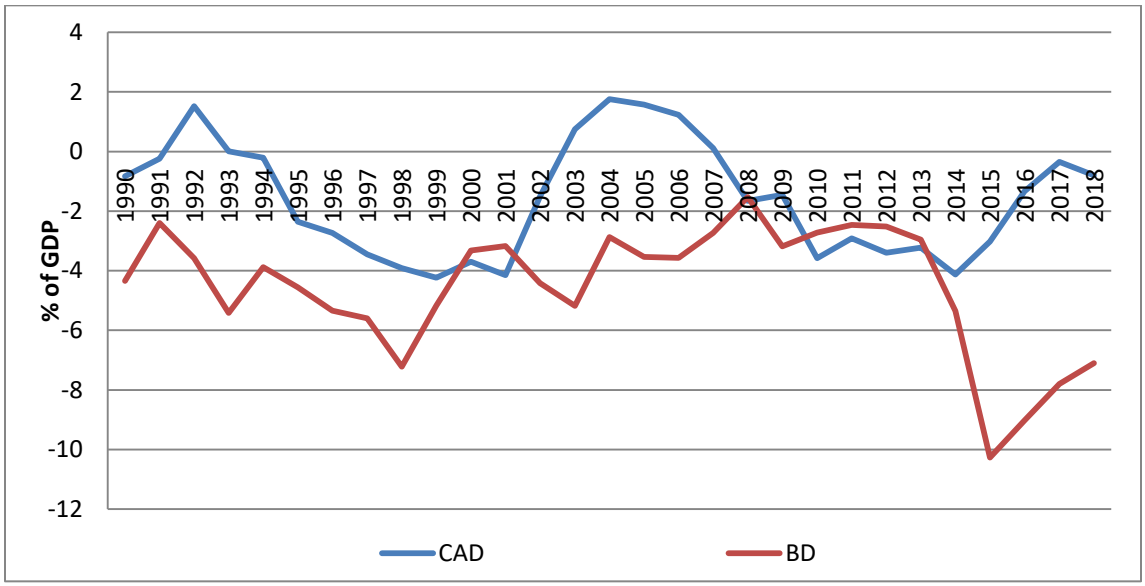
4.1 Introduction

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.

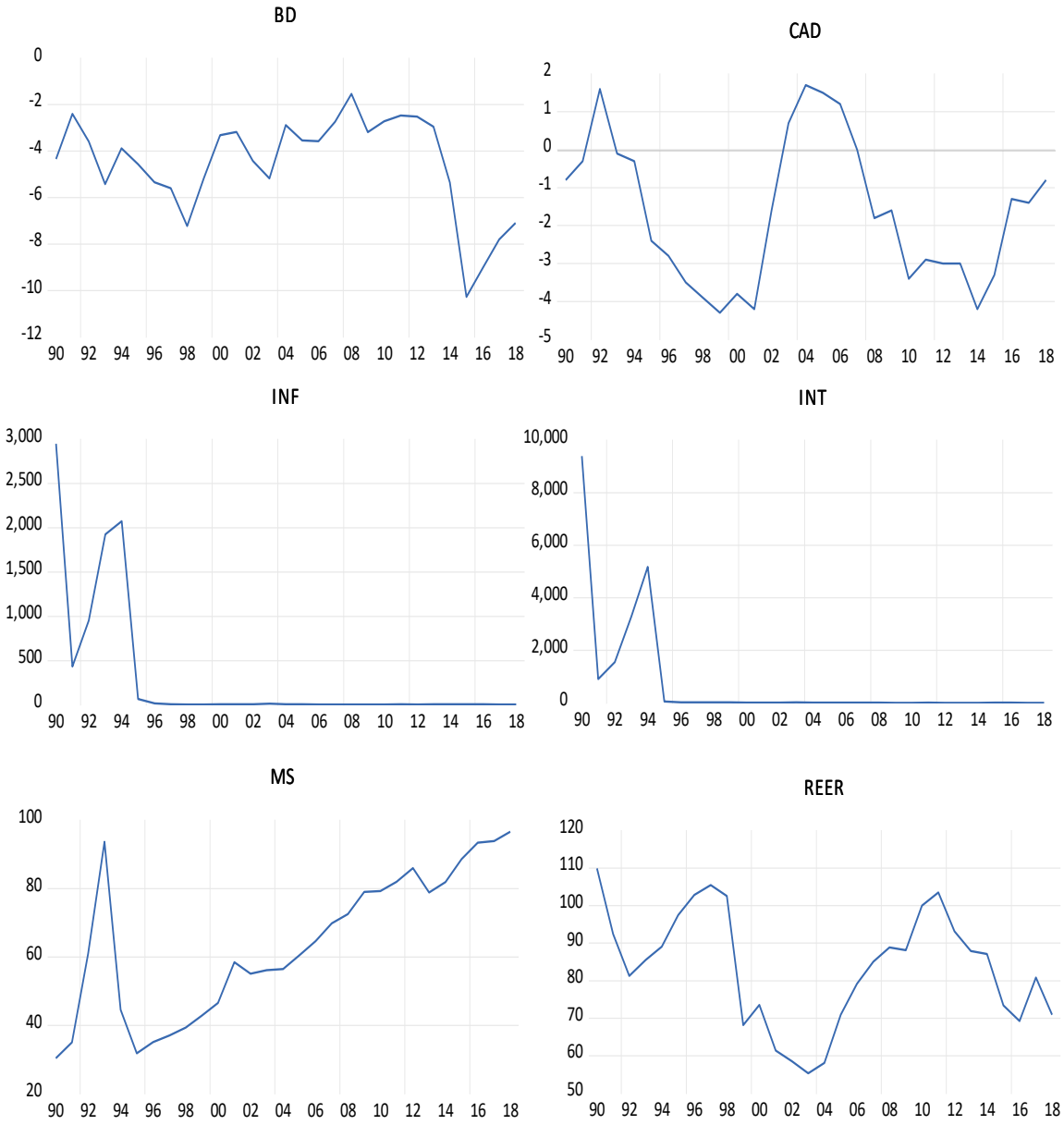
Figure 4.1: Trend of the Twin Deficits in Brazil



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*

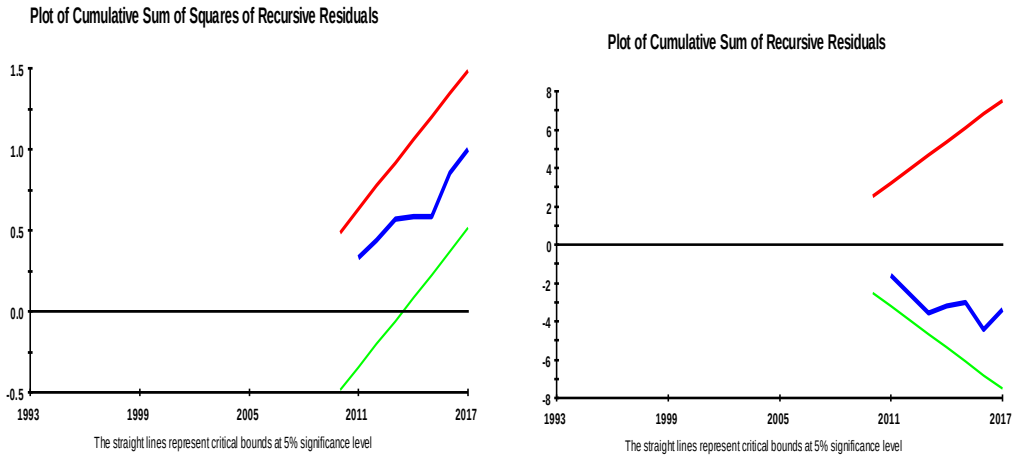
	Δ REER	-.073885	-2.4978	.028**
	Δ REER(-1)	.052247	1.7604	.104
	Δ INT	-.017793	-.79755	.441
	Δ INT(-1)	.10750	3.0656	.010**
	Δ INT(-2)	079917	4.0546	.001*
	Δ MS	.16241	4.1200	.001*
R-squared = 0.88630; F-Stat = 5.1967(.004); DW Stat = 2.5841				

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	

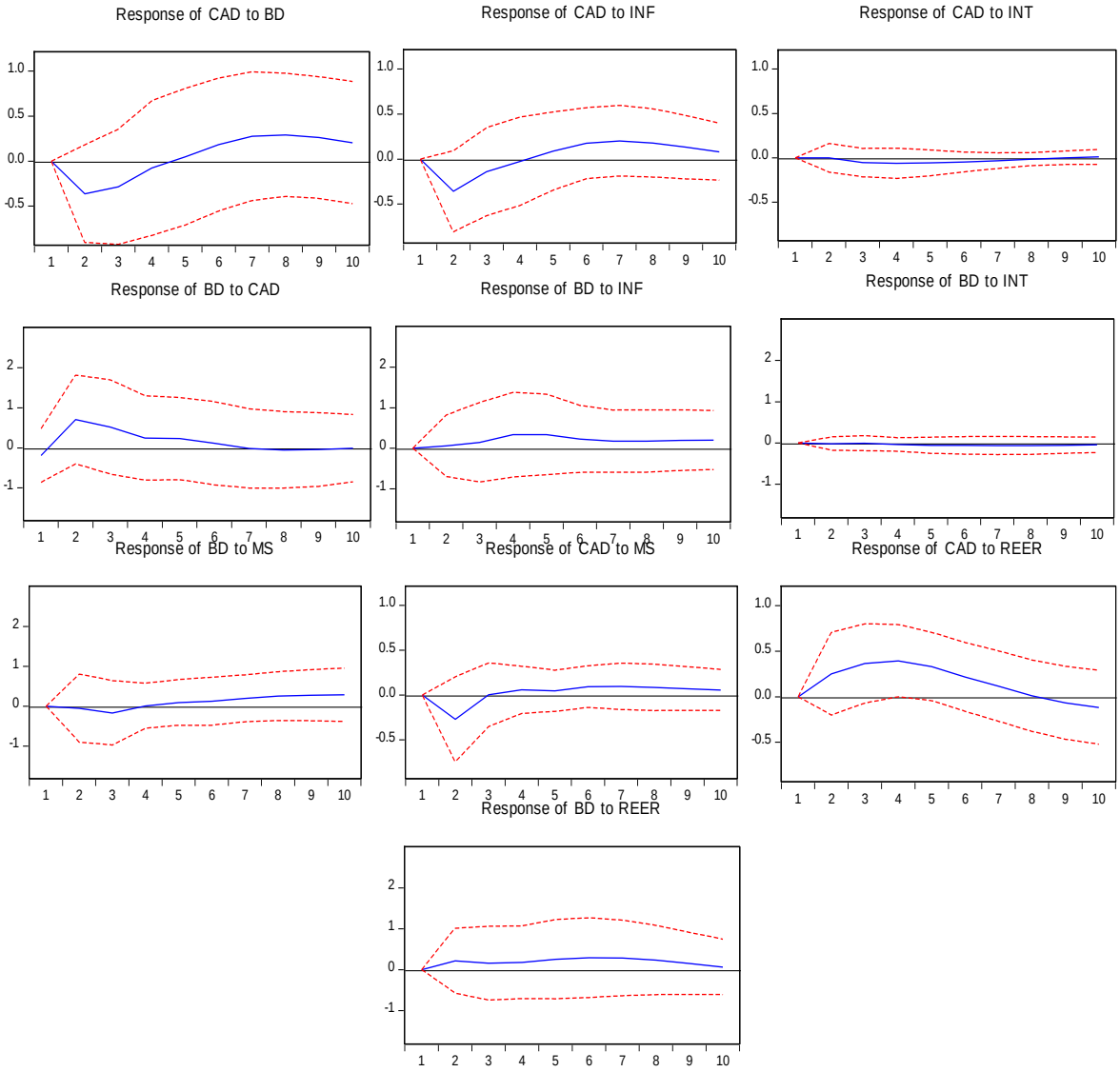
Notes: "*" "**" "***" indicates1%, 5%, 10% level of significance

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.

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.

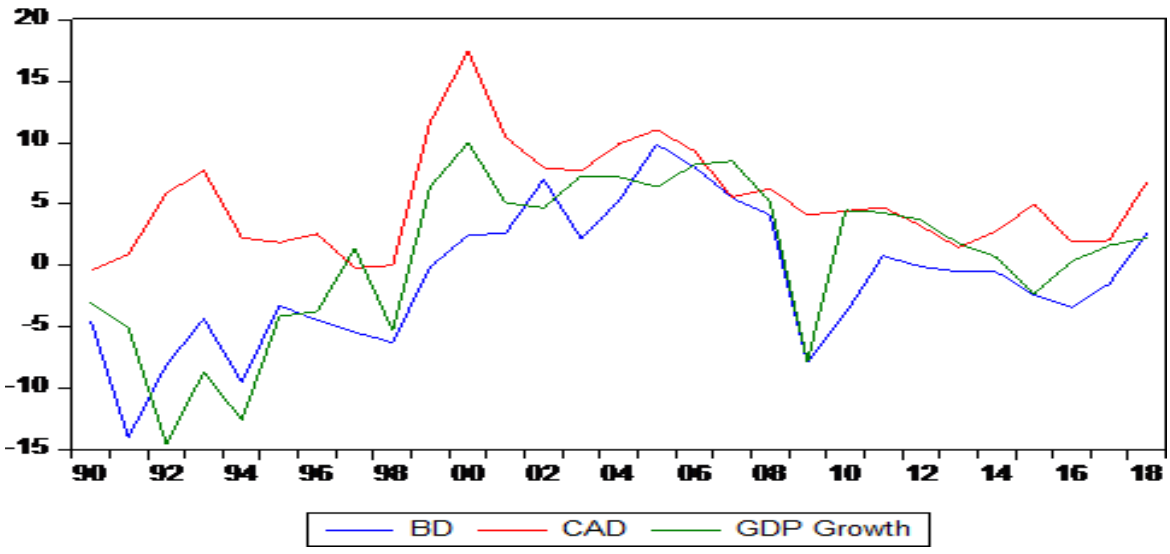
The budget deficit increases sharply in Russia after the Global Financial Crisis (GFC) indicating a budget deficit (BD) will deteriorate the current account balance or vice versa. Oil shocks influence the two deficits, as do GDP growth rates, so the impact of one deficit on the other must be set on by 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.

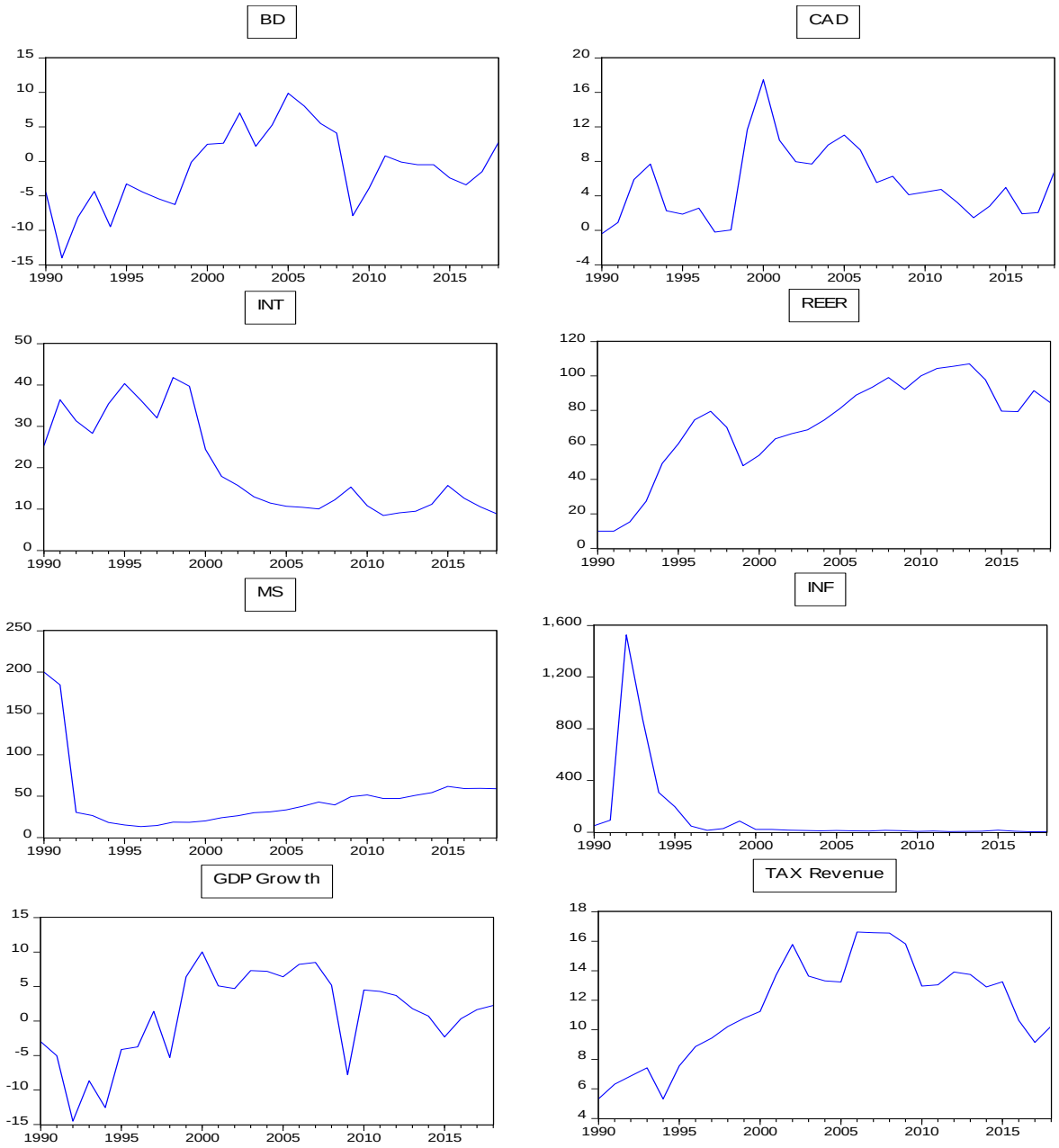
The purposes of this chapter are as follows: firstly, in the macroeconomic structure we will examine the relationship between the BD and CAD. Secondly, we use Bernheim (1987) consumption function to validate Ricardian equivalence hypothesis by applying ARDL bound testing approach. Thirdly, we investigate 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.

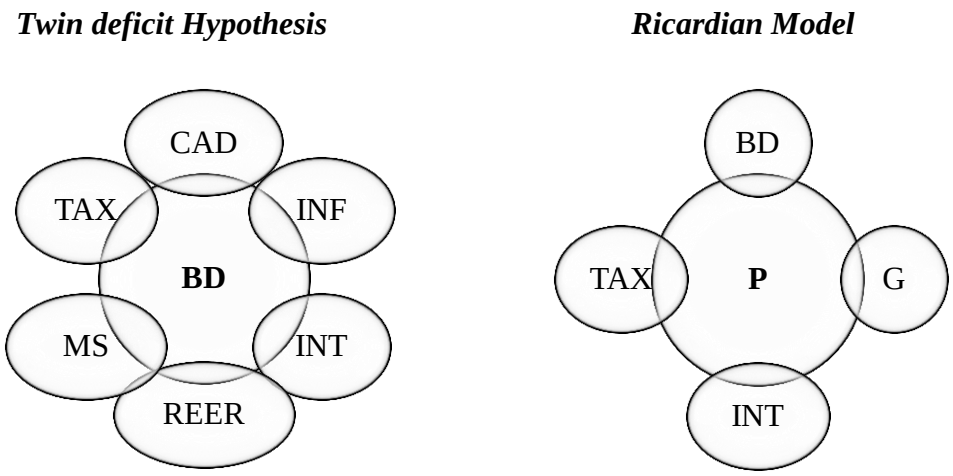
5.3.1 Model specification

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)				

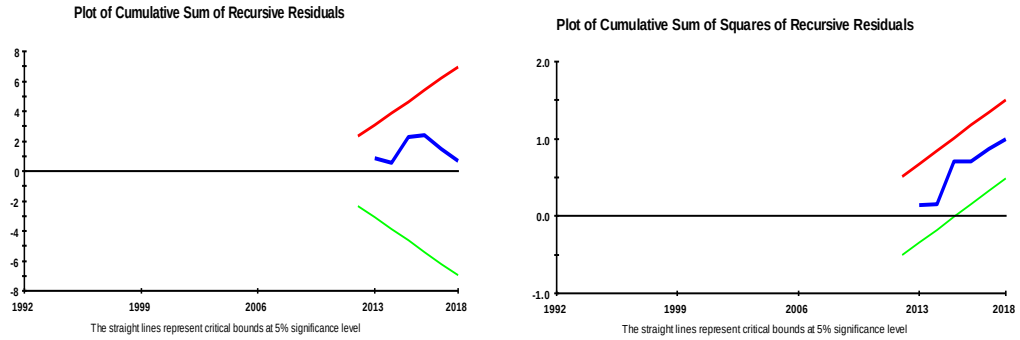
Note: '*'**'***" denotes significance at 1%, 5% and 10%.

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).

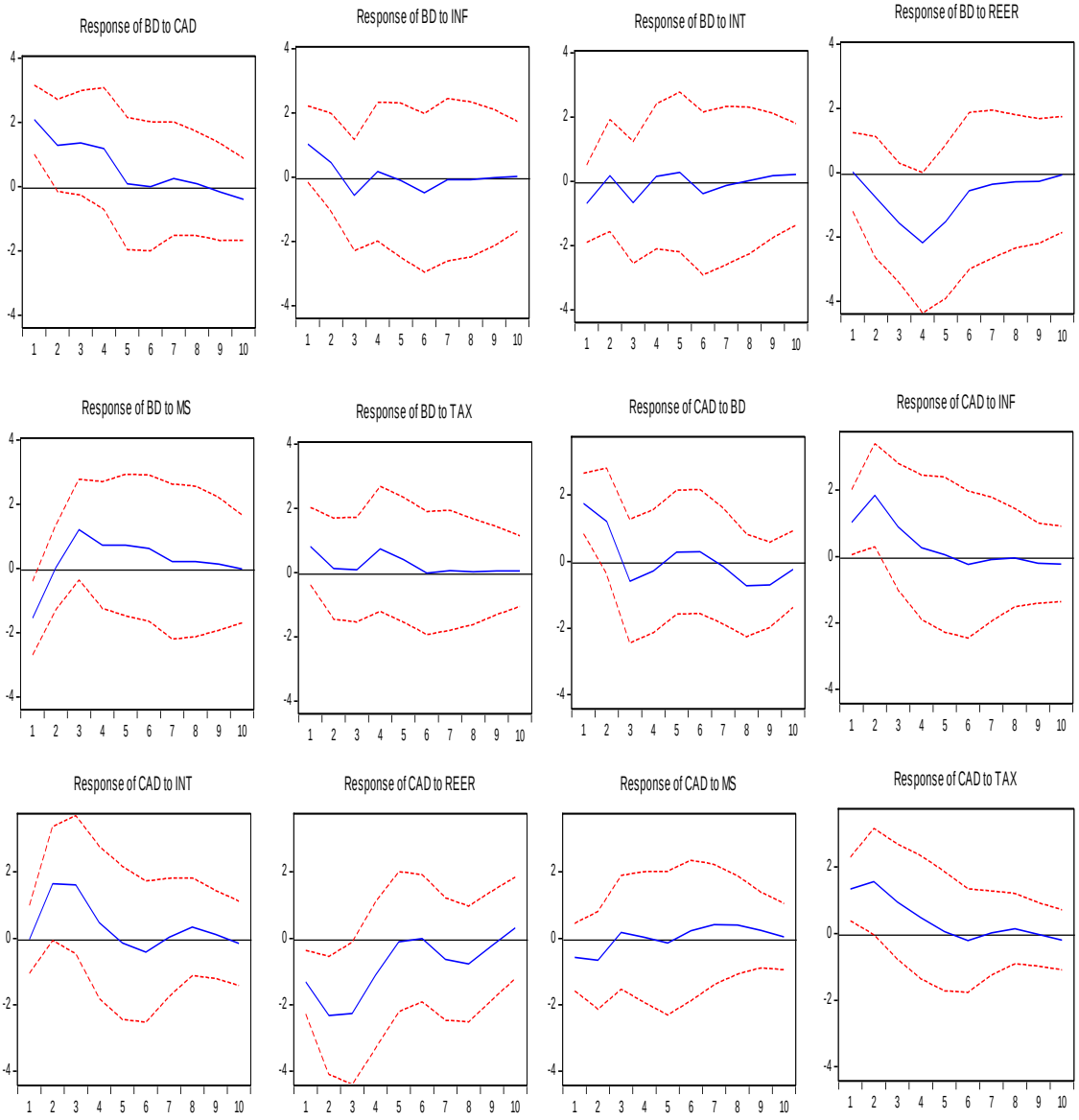
5.5.5 Generalized Impulse Response for Russia

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.

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

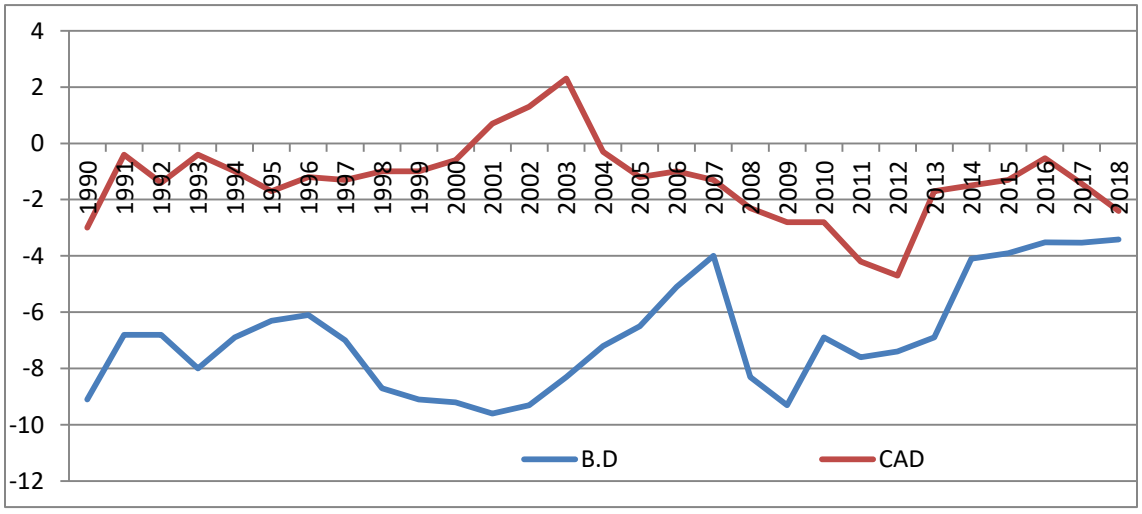
unexpected changes in time t in one variable X (the impulse) and the estimation of its effect on the other variable Y in time t, t1+t2+t3+t4...).

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

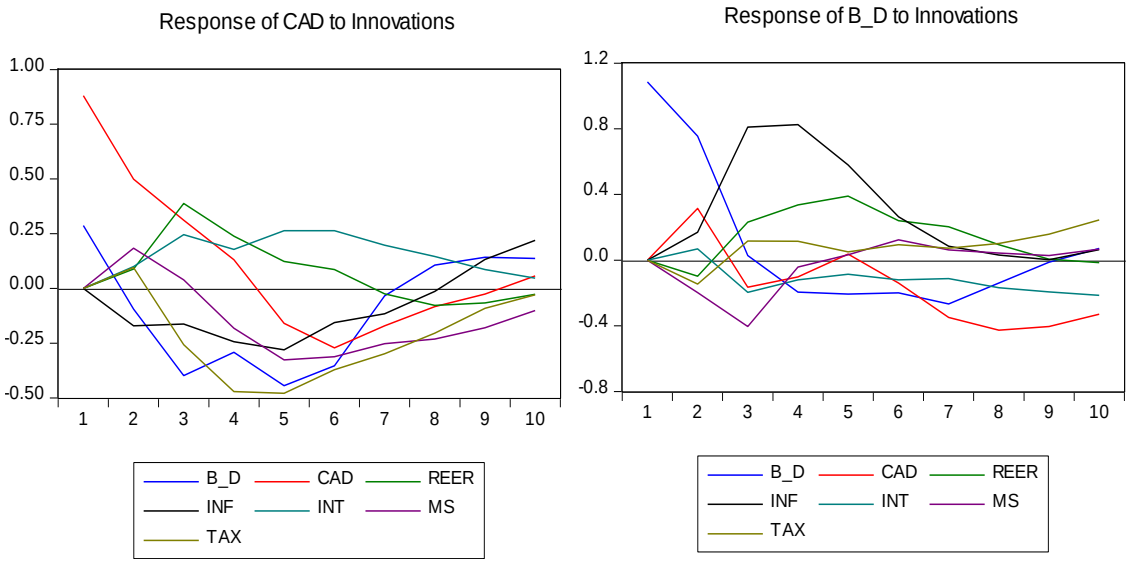
Note: "*" "**" "***" denote 1%, 5% and 10% significance level.

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.

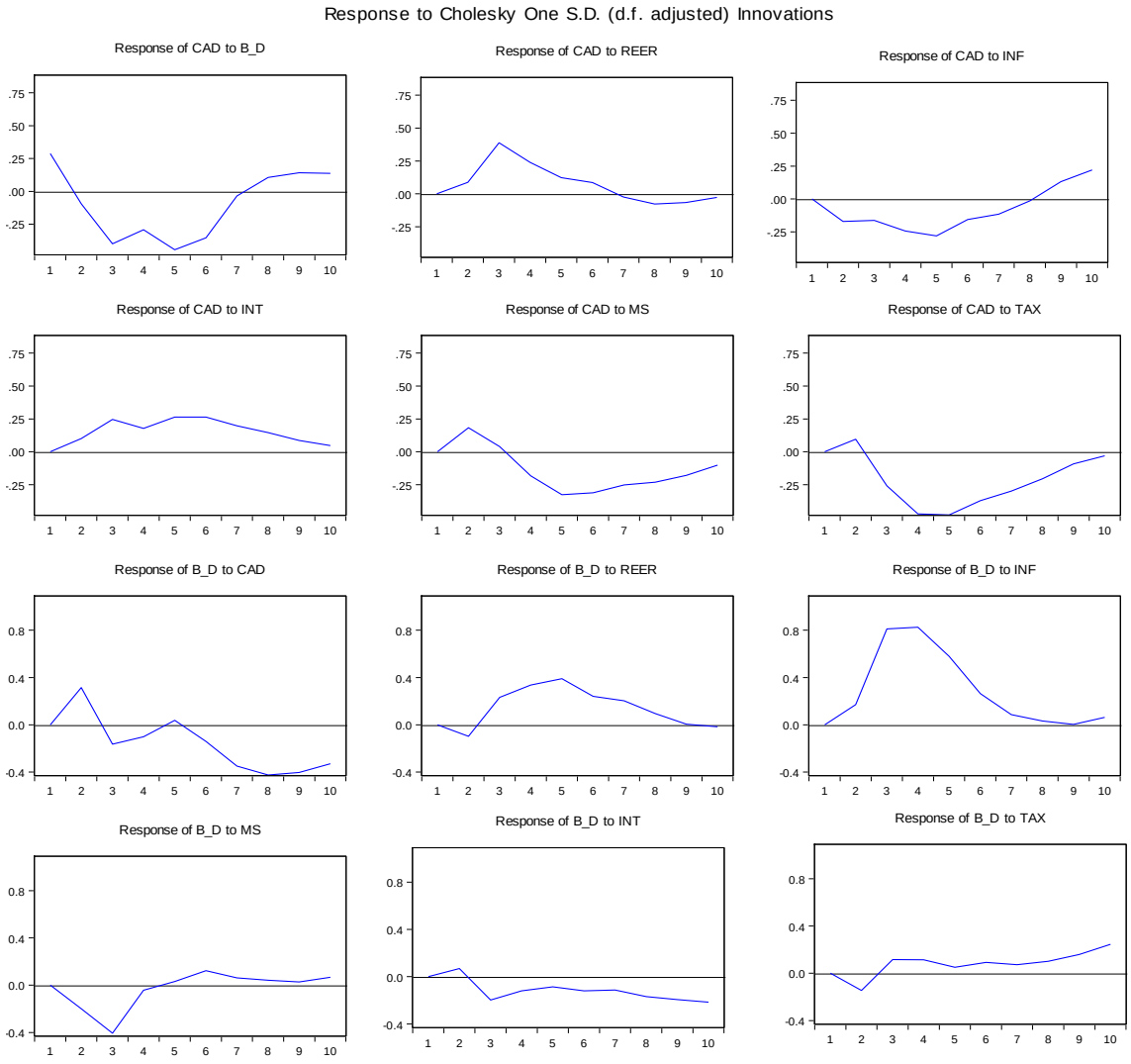
Figure 6.2: Impulse response function of BD and CAD



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.

CHAPTER 7

RICARDIAN EQUIVALENCE AND TWIN DEFICIT IN CHINA

7.1 Introduction

Fiscal and monetary strategies, when executed lucidly, assume a conclusive part in general macroeconomic stability. The macroeconomic theory which assumes an ideal connection between budget (or fiscal) deficit and trade balance is known as twin deficit hypothesis. Researchers such as Kim & Roubini (2008), Darrat (1998), Miller & Russek (1989) and Banday & Anaja (2019) have theoretically and empirically researched the growing literature on the twin deficit hypothesis (TDH).

However, majority of the countries are facing both BD and CAD. An imperative problem for policy makers in China has been the rising budget deficit. In addition, there is a need to understand the relation between the BD and CAD in the Chinese economy, given the importance of free trade, decentralization and growth.

A national income accounting identity may reflect the theoretical linkage between BD and CAD:

$$(S_p - I) + (IM-EX) = (G+TR-T) \quad (1)$$

where IM stand for imports, EX for exports, S_p for private savings, I for real investments, G for government expenditure, T for taxes and TR for transfer payments. When *IM* is greater than *EX,* the country has CAD. From the right-hand side of the equation, when (G+TR-T) is greater than 0, the country is running a BD.

$$(S_p - I) = (G+TR-T) - (IM-EX) \quad (2)$$

The objectives of this chapter are as following: Firstly, we analyse the association among the variables like BD, CAD and some macroeconomic variables by using ARDL approach. Secondly, we use Bernheim (1987) consumption function to validate Ricardian equivalence hypothesis by applying ARDL bound testing approach. 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) 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 technique is based on Impulse response function, that a shock to one variable and predicting its effect on the other variable for the future time period.

The other sections follow as: Section 7.2 gives Macroeconomics aspects of the Chinese Economy. Section 7.3 describes data and model specifications. Section 7.4 provides methodology for this chapter. Section 7.5 gives empirical results. Section 7.6 concludes the chapter.

7.2 Macroeconomics Aspects of the Chinese Economy

The Chinese economy has encountered an unmatched development rate in the course of recent many years, with increments in export growth, investment and free market changes from 1979 and a yearly GDP development pace of 10%. The Chinese economy has

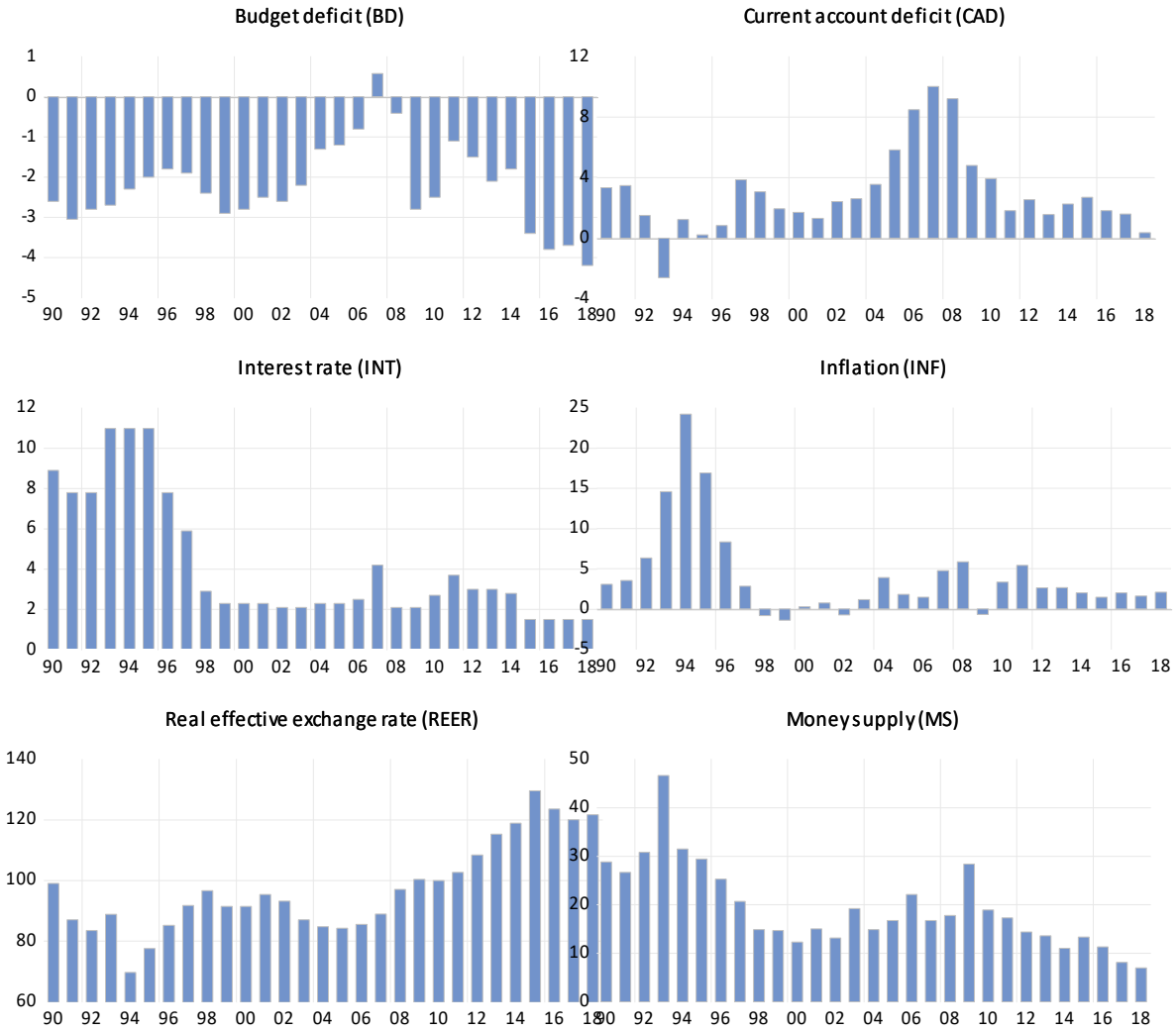
developed as the world's biggest economy in terms of manufacturing, construction and foreign exchange reserves.

In 2008, the worldwide monetary emergency gravely influenced the Chinese economy, bringing about a decrease in exports, imports and FDI and loss of jobs. Figure 7.1 shows that China's CAB has dropped significantly from its boom during 2007-08 financial crises. After the financial crisis, China's exports fell by 25.7% in February 2009. Further, the exclusive demand for Chinese goods in the international market pushed up current account surplus to 11% of the GDP in 2007, in a global economy (Schmidt & Heilmann, 2010). It is said that China has done better than other countries to cope up 2008 crisis with a greater fiscal stimulus in terms of tax reduction, infrastructure and subsidies when compared to the OECD countries (Herd et al., 2011; Morrison, 2011).

As the budget deficit was marginal (- 0.41% of GDP in 2008), as seen in Figure 7.1, the current account surplus increased to 9.23% of GDP. The budget deficit is raised by the negative shocks of the CAD and vice versa.

However, the stability in the exchange rate defines the flow of trade which finally improves the CAD. The negative shift in the current account is due to structural and cyclical forces. Cyclical factors are seen from a business point of view: the growing costs of Chinese imports, such as oil and semiconductors, are dragging down the current account balance. The structural change, is visible from financial side, that impacts Chinese finances and savings. Investment has decreased to 40% and residential investments have decreased from 50% to 40% of GDP.

Figure 7.1: Behaviour of some macroeconomic variables in China



Note: Overview of the variables from 1990 to 2018.

7.3 Data and Model specifications

We use the World Bank and the international trade data to perform the analytical analysis on the basis of the following variables over the duration 1990 to 2018.

(a) Based on the percentage of GDP, the current account deficit (CAD) shows the amount of the goods, services and investments imported as opposed to exports.

(b) The budget deficit (BD) demonstrates financial health in which spending, as a percentage of GDP, exceeds revenue.

(c) Deposit interest rate (DIR) as an interest rate proxy (INT) The sum paid by the creditor to the borrower on the basis of the principal percentage.

(d) Inflation (INF) is calculated on the basis of an index of consumer prices, representing an annual percentage rise in the cost of goods and services.

(e) Broad money (MS) a measure of the money supply that indicates the amount of liquidity in the economy. It includes currency, coins, institutional money market funds and other liquid assets based on annual growth rate and real effective exchange rate (REER).

(f) PC is private consumption; y is the gross national product (GDP), g is government spending expenditure and r is the interest rate, and T is the Tax in GDP percentage.

7.3.1 Model Specifications

The model will estimate the relationship among BD, CAD, INF, INT, REER and MS is as follows:

$$CAD = f\,(BD, REER, INF, INT, MS) \qquad (3)$$

The second one is based on Buiter and Tobin (1979) consumption function to test Ricardian equivalence hypothesis (REH) as given below in equation 4 and 5.

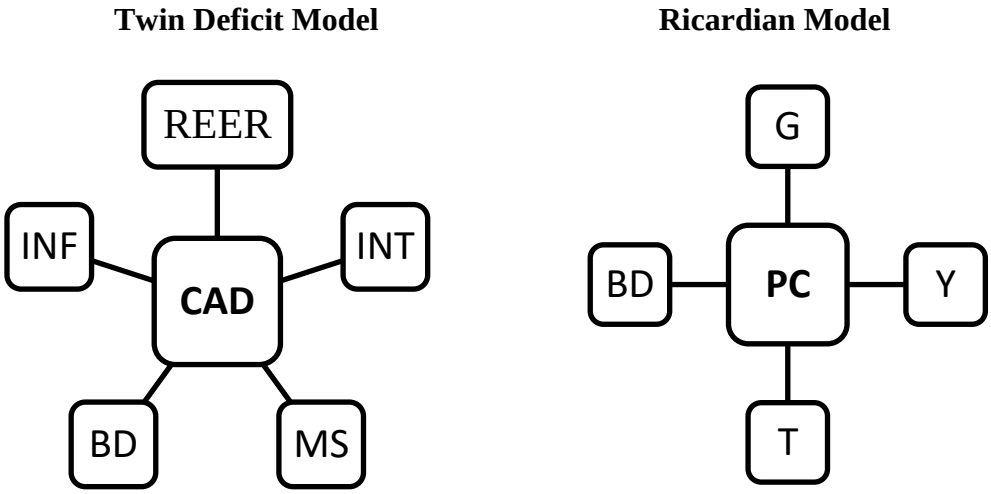
$$PC_t = a_0 + a_1 Y_t + a_2 G_t + a_3 T_t \qquad (4)$$

$$PC_t = a_1 Y_t + a_2 T_t + a_3 BD_t \qquad (5)$$

Both the equations (4 and 5) estimates Ricardian equivalence theorem.

Based on equation (3, 4 and 5) we have estimate twin deficit hypothesis and Ricardian equivalence given the above equations as given in figure 7.2 below.

Figure 7.2: Estimating Twin Deficit Hypothesis (TDH) and Ricardian Hypothesis



7.4 Methodology

7.4.1 Unit Root Test

The analysis part starts with the ADF and PP unit root test and followed by (Zivot and Andrews, 1992). With three models based on Perron, the Zivot and Andrews (ZA) unit root test begins with (1989). The ZA model is as described below:

$$Y_t = \mu^A + \theta^A DU_t(\lambda) + \beta^A{}_t + a^A Y_{t-1} + \sum_{j=1}^{k} c^A{}_j \, \Delta Y_{t-j} + \varepsilon_t \qquad (6)$$

$$Y_t = \mu^B + \beta^B{}_t + \gamma^B DT_t(\lambda) + a^A Y_{t-1} + \sum_{j=1}^{k} c^B{}_j \Delta Y_{t-j} + \varepsilon_t \qquad (7)$$

$$Y_t = \mu^C + \theta^C DU_t(\lambda) + \beta^C{}_t + \gamma^C DT_t(\lambda) + a^C Y_{t-1} + \sum_{j=1}^{k} c^C{}_j \Delta Y_{t-j} + \varepsilon_t \qquad (8)$$

From the equations above, $DU_t(\lambda)$ = 1, if t >Tλ, 0 otherwise: $DT_t(\lambda) =$ t − Tλ if t >Tλ, 0 otherwise. For equations (6) to (8), the null hypothesis is alp = 0, which means that (Y t) includes a drift unit root and excludes any structural breakpoints. When alpha < 0, it simply means that the series has a structural break with a trend-stationary phase that occurs at an unknown time point. DT_t is a dummy variable that means that shift occurs at TB time, whereDT_t=1 and DT_t = t-TB if t > TB; 0 otherwise. The ZA test (1992) indicates that the distribution of small sample sizes will deviate, ultimately producing asymptotic distribution.

7.4.2 Testing Ricardian theorem

I will set out the standard model before setting up the Ricardian approach. Two kinds of consumption models are used to assess the REH in writing. The initial one relies on the consumption work of Buiter and Tobin (1979). The subsequent one depends on the rational hypothesis of expectation, which was based on the premises of ideal fiscal approach data. Such model is used to comprehend the reasons for failure of REH. In any case, there are various investigations based on REH which attempt to discover the association between BD and CAD. But our investigation will utilize Buiter-Tobin model to test the RE speculation for China as given in condition 9 and 10 below:

$$PC_t = a_0 + a_1 Y_t + a_2 G_t + a_3 T_t \qquad (9)$$

$$PC_t = a_1 Y_t + a_2 T_t + a_3 \mathrm{BD}_t \qquad (10)$$

7.4.3 ARDL cointegration bounds testing approach

To verify the co-integration by comparing F-statistics against the critical values, we applied the ARDL boundary testing approach. This approach has significant advantages than other method of cointegration because we can estimate the model with any order of integration Pesaran et al. (2001). The results are calculated by using Microfit which defines bounds test critical values as "k".

The ARDL model for the equation (3) can be written in this form:

$$\mathrm{BD}_i = \theta_0 + \sum_{i=1}^{q} \theta_{1i} CAD_{t-i} + \sum_{i=1}^{q} \theta_{2i} BD_{t-i} + \sum_{i=1}^{q} \theta_{3i} INF_{t-i} + \sum_{i=1}^{q} \theta_{4i} REER_{t-i} + \sum_{i=1}^{q} \theta_{5i} MS_{t-i} + \sum_{i=1}^{q} \theta_{6i} INT_{t-i} + u_t \qquad (11)$$

$$\Delta \mathrm{BD}_i = \theta_0 + \theta_1 \Delta ECM_{t-1} + \sum_{i=1}^{q} \theta_{2i} \Delta CAD_{t-i} + \sum_{i=1}^{q} \theta_{3i} \Delta BD_{t-i} + \sum_{i=1}^{q} \theta_{4i} \Delta INF_{t-i} + \sum_{i=1}^{q} \theta_{5i} \Delta REER_{t-i} + \sum_{i=1}^{q} \theta_{6i} \Delta MS_{t-i} + \sum_{i=1}^{q} \theta_{7i} \Delta INT_{t-i} + u_t \qquad (12)$$

The equation (11 and 12) gives long-run and short-run results based on Schwarz Bayesian Criteria (SBC) optimized over 20000 replications. The lagged error correction term (ECM) is estimated which should be negative and significant.

7.4.4 Granger causality

We have estimated the causality between X_t to Y_t in this chapter, and vice versa. This association between causality and monotony drove Granger to express direct causality in a parametric structure, based on traditional time series data (see Box and Pierce 1970), for example, autoregressive models. Before applying Granger causality, it is important to verify statinarity and lag structure. The model can be written as: in order to estimate the causality among the variables.

$$\Delta BD_t = \alpha_1 + \Sigma\beta_1\Delta CAD_{t-i} + \Sigma\theta_1\Delta INF_{t-i} + \Sigma\gamma_1\Delta REER_{t-i} + \Sigma\delta_1\Delta INT_{t-i} + \Sigma\lambda_1\Delta MS_{t-i} + \varepsilon_t \quad (13)$$

$$\Delta CAD_t = \alpha_2 + \Sigma\beta_2\Delta BD_{t-i} + \Sigma\theta_2\Delta INF_{t-i} + \Sigma\gamma_2\Delta REER_{t-i} + \Sigma\delta_2\Delta INT_{t-i} + \Sigma\lambda_2\Delta MS_{t-i} + \varepsilon_t \quad (14)$$

$$\Delta INF_t = \alpha_3 + \Sigma\beta_3\Delta BD_{t-i} + \Sigma\theta_3\Delta CAD_{t-i} + \Sigma\gamma_3\Delta REER_{t-i} + \Sigma\delta_3\Delta INT_{t-i} + \Sigma\lambda_3\Delta MS_{t-i} + \varepsilon_t \quad (15)$$

$$\Delta REER_t = \alpha_4 + \Sigma\beta_4\Delta BD_{t-i} + \Sigma\theta_4\Delta CAD_{t-i} + \Sigma\gamma_4\Delta INF_{t-i} + \Sigma\delta_4\Delta INT_{t-i} + \Sigma\lambda_4\Delta MS_{t-i} + \varepsilon_t \quad (16)$$

$$\Delta INT_t = \alpha_5 + \Sigma\beta_5\Delta BD_{t-i} + \Sigma\theta_5\Delta CAD_{t-i} + \Sigma\gamma_5\Delta INF_{t-i} + \Sigma\delta_5\Delta REER_{t-i} + \Sigma\lambda_5\Delta MS_{t-i} + \varepsilon_t \quad (17)$$

$$\Delta MS_t = \alpha_6 + \Sigma\beta_6\Delta BD_{t-i} + \Sigma\theta_6\Delta CAD_{t-i} + \Sigma\gamma_6\Delta INF_{t-i} + \Sigma\delta_6\Delta REER_{t-i} + \Sigma\lambda_6\Delta INT_{t-i} + \varepsilon_t \quad (18)$$

7.5 Empirical results

In order to test the Ricardian theorem and twin deficit hypothesis for China, first we check the stationarity among the variables which will help us to define the appropriate methodology for the above defined data set.

7.5.1 Unit root test

The unit root results reveal that nine out of eleven variables are non-stationary at the level and two variables are stationary at the level given in below table 7.2.

Table 7.1: Results of unit root tests for China

	ADF		**PP**	
Variables	**Intercept**	**Intercept-Trend**	**Intercept**	**Intercept-Trend**
CAD(I_0)	-2.485(0.12)	-2.453(0.34)	-2.528(0.11)	-2.56(0.29)
CAD(I_1)	-5.107(0.00)[a]	-5.072(0.00)[a]	-5.636(0.00)[a]	-5.33(0.00)[a]
BD(I_0)	-1.987(0.28)	-2.013(0.56)	-2.567(0.12)	-2.562(0.29)
BD(I_1)	-3.702((0.00)[a]	-3.618(0.04)	-7.0231(0.00)[a]	-7.692(0.00)[a]
REER(I_0)	-4.042(0.00)[a]	-4.074(0.01)	-3.965(0.00)[a]	-4.380(0.00)[a]
REER(I_1)	-6.094(0.00)[a]	-6.146(0.00)[a]	-6.577(0.00)[a]	-14.72(0.00)[a]
MS(I_0)	-2.402(0.14)	-2.99(0.15)	-2.443(0.12)	-3.127(0.11)
MS(I_1)	-6.749(0.00)[a]	-6.656(0.00)[a]	-6.803(0.00)[a]	-6.682(0.0)[a]

INF(I_0)	-3.031(0.04)[a]	-4.140(0.014)[a]	-2.25412(0.19)	-2.374(0.38)
INF(I_1)	-4.938(0.00)[a]	-4.9259(0.00)[a]	-7.70762(0.0)[a]	-7.3585(0.0)[a]
INT(I^0)	-0.995(0.75)	-1.993(0.58)	-1.03964(0.72)	-2.166(0.49)
INT(I^1)	-4.438(0.00)[a]	-4.369(0.00)[a]	-4.54219(0.00)[a]	-4.311(0.00)[a]
TAX(I^0)	-0.571(0.86)	-3.18(0.12)	-0.6249(0.84)	-1.6475(0.74)
TAX(I^1)	-3.00(0.04)[a]	-3.621(0.04)[a]	-2.9555(0.05)[a]	-5.0507(0.00)[a]
PC(I^0)	-1.68(0.438)	-0.8451(0.94)	-1.6571(0.440)	-1.4401(0.82)
PC(I^1)	-2.54(0.06)[a]	-4.0069(0.02)[a]	-2.8354(0.06)[a]	-6.3774(0.00)[a]
G(I^0)	-1.57(0.49)	-3.0538(0.11)	-1.5050(0.5153)	-1.5109(0.79)
G(I^1)	-6.4578(0.00)[a]	-6.3198(0.01)[a]	-6.5028(0.000)[a]	-6.3610(0.00)[a]
Y(I^0)	-1.6618(0.43)	-0.8451(0.94)	-1.6571(0.44)	-1.4401(0.82)
Y(I^1)	-2.8354(0.06)[a]	-4.0069(0.02)[a]	-2.8354(0.06)[a]	-6.3774(0.00)[a]
r(I^0)	-2.3224(0.17)	-2.3278(0.40)	-2.7428(0.0806)	-2.7732(0.21)
r(I^1)	-3.1797(0.03)[a]	-4.5433(0.00)[a]	-5.1414(0.00)[a]	-5.0087(0.00)[a]

Note: 'a', gives 1% significance level.

The structural break test reveals five breaks in Model A. The first, in 1992, may be due to inflation caused by privatisation; the second, in 1994 and 1995 may be due to higher inflation which caused the consumer price index to shot up by 27.5 % and imposition of a 17% value-added tax on goods.

The third may be due to a 48% fall in state-owned enterprises in 2003, as trade barriers, tariffs and regulations have been lowered and the banking sector has been reformed, while the fourth may be due to the global financial crisis in 2008.

Table 7.2: Results of one structural break Zivot and Andrews

Variable	CAD	BD	REER	MS	INT	INF	TAX	PC	G	Y
Test-stat (α)	-3.17	-2.54	-3.15	-3.07	-3.22	-4.92	-3.86	-2.23	-2.81	-3.64
Time of Break	2008	2008	1992	1994	2003	2003	1995	2012	2012	2008
Lags (k)	0	2	2	0	0	0	1	1	2	0

Note: Structural breaks are based on breaks in trend and lag structure by AIC.

The fifth in 2012 is due to decreasing domestic consumption rate, the market for real estate was unstable, and population was ageing and inefficient central banking policy. The ZA test with one structural break, as all six variables are non-stationary at a 1% level.

7.5.2 Testing Ricardian theorem based on Buiter and Tobin (1979) consumption function

We applied Engle & Granger (1987) two step cointegration method to test Ricardian Equivalence hypothesis for China. In our study we used Buiter & Tobin (1979) model subject to budget constraints, based on the maximization function. The model results are given in table 7.3.

For China, the results based on empirical research contradict the RE theorem. In several cases, the results of equation (7) refute the RE theorem:

Table 7.3: Results of REH for China

Variables and Equation no.	Coefficient (2)	t-Stats (3)	R^2 and DW Stats (4)
9. PC = f (Y, G, T)			
Constant	17.9746	4.6763	0.9992
Y	-0.1744	-3.7303	1.2532
G	0.5554	11.1833	
T	-0.3831	-6.7673	
∆PC = f (∆Y, ∆G, ∆T) ECM without intercept			
∆Y	-0.1174	-2.4738	0.9228
∆G	0.9642	11.5025	1.3559
∆T	-0.1848	-1.5722	
10. PC = f (Y, T, BD)			
Constant	58.3644	29.1334	0.9363
Y	-0.4225	-4.1561	1.2824
T	-0.9240	-15.0909	
BD	-0.4561	-1.4245	
∆PC = f (∆Y, ∆T, ∆BD) ECM without intercept			
∆Y	-0.2769	-2.1850	0.3503
∆T	-0.5109	-1.5375	1.6843
∆BD	0.0057	0.0146	

a) Private spending (c) consists of per capita income (Y), public expenditure (G) and taxes (T).
b) The tax variable has a negative association with private consumption, which is statistically important (C).

The RE theorem is denied by the calculation of the Buiter-Tobin equation subject to the coefficient restriction. Subject to constraints, the calculation of equation (8) with intercept rejects the RE theorem on different grounds:

(a) A negative and statistically important Y coefficient will decrease by a rise of one percent in the Y-coefficient (-0,422) of real private consumption.

(b) The tax rate is negative and statistically significant for an improvement of one per cent of actual private demand by the tax rate decrease (-0,924). The coefficient of taxes is negative and statistically significant; a rise of 1% of TAX would decrease actual private spending (-0.924) percent.

(c) The BD coefficient is of negative value and statistically significant, with the 1% growth in BD being a reduction in real private consumption (-0.456).

(d) A1 = a2 constraints are not reached.

(e) The ECM demonstrates the interaction between the short and long-term dynamics of the variables. The ECM value for Y and T is negative and statistically meaningful for private use and denies China's RE theorem

7.5.3 Results of ARDL Bound testing

The ARDL model first gives the coefficient results and F statistics. The F = 9.439 is more than the crucial upper bound value of 3.99 at 5%. The results show that the variables have a long-term association. The ARDL model are presented in Table 7.4.

Table 7.4: Results of ARDL model of China (BD)

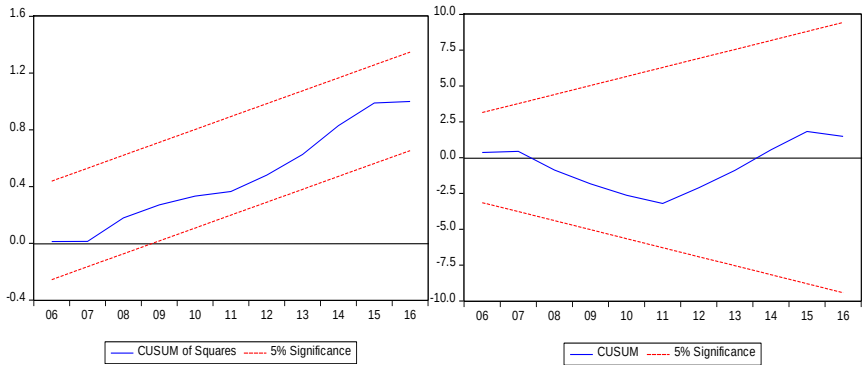
Variables	**Coefficient**	**t-value**	**Prob**
BD(-1)	.52504	4.3020	.001*
BD(-2)	-.47852	4.4321	.000*
CAD	.13298	4.6230	.000*
DIR	.22922	3.0986	.007*
INT(-1)	-.14730	1.5119	.150
INT(-2)	-.38099	4.6848	.000*
INF	.009286	.4124	.685
INF(-1)	.041560	1.6862	.111
INF(-2)	.057117	2.5665	.021**
INF(-3)	.084059	3.5271	.003*
MS	-.010333	.78506	.444
REER	.0013332	.18609	.855
REER(-1)	-.017791	2.1974	.043**
Calculated F-statistic		***F*= 9.439**	
90% LB	90% UB	95%	95% UB

		LB	
2.05	3.33	2.51	3.99
Serial correlation: .01999 (.964); **Normality:** .94082 (.625); **Heteroscedasticity:** .58695 (.444)			

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

The test results indicate that all the variables have a co-integration relationship. We have done an autocorrelation, normality and heteroscedasticity test and the F-statistic is higher than the critical upper limit value.

Figure 7.3: CUSUM and CUSUMSQ stability tests



The results are shows stability based on the respective P-values and the CUSUM and CUSUMSQ tests are given in Figure 7.3.

7.5.4 Results of ARDL Cointegration

The findings identify a cointegration relationship with the help of the bound test between the variables. We estimate the model with long-run and short-run relationships among the

variables after finding the cointegration. Table 7.5 provides the results of equations (11) and (12).

Table 7.5: Results of ARDL long-run and Short-run of China (∆BD)

	Variables	Coefficient	t-statistic	Prob
ADJ(ECM)	BD(-1)	-0.95348	9.4018	0.000*
Long Run	CAD	0.13946	4.905	0.000*
	INT	-0.31366	2.924	0.010*
	INF	0.20139	3.6196	0.002*
	MS	-0.010837	.77795	0.448
	REER	-0.017262	9.9136	0.000*
Short Run	∆BD (-1)	0.47852	4.432	0.000*
	∆CAD	0.13298	4.6230	0.000*
	∆INT	0.22922	3.0986	0.006*
	∆INT(-1)	0.38099	4.6848	0.000*
	∆INF	0.00928	-0.4125	0.685
	∆INF(-1)	-0.14118	4.2123	0.000*
	∆INF(-2)	-0.084059	3.5271	0.002*
	∆MS	-0.010333	0.7850	0.442
	∆REER	0.001332	0.1860	0.854
R-squared = 0 .8326 ; F-Stat = 16.815 (.000); DW Stat = 1.9049				

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

The model finds evidence in support for twin deficit for China. Thus, our study upholds the empirical validity of the Keynesian proposition for China, while rejecting the Ricardian equivalence hypothesis. For BD, CAD, INF and INT, the short-run coefficients are significant, indicating that a slight deviation in the BD has a significant impact on

CAD; similarly, most macroeconomic variables have a significant impact on the CAD. The value of ECM is negative (-0.95348) which shows the speed of adjustment is higher and is converging towards equilibrium, with the exogenous shocks and endogenous shocks.

One of the world's most interconnected economies, the Chinese economy has emerged as a dominant player in the global economy. In the early 1990s, it was reported in the Chinese print media that although the Chinese economy was expanding rapidly, the deficits still existed. This was primarily referred to as 'hard deficits' because they were funded by raising the money and increases inflation in the economy. Deficit financing will also raise interest rates because the government may allow investors and businesses to purchase more government bonds until the monetary accommodation of the deficit is ruled out. If government bond sales do not rise immediately in relation to the increase in the debt, additional funds may be lent by the government. This, in fact, affects the formation of private investment. The Congressional Budget Office has, summarized such a reduction in the need for resources from the private sector as a "modestly negative" effect of tax cuts or federal deficit expenditure on long-term economic growth.

This analysis shows that in interest rate has a notable impact on BD and CAD. Chinese banks are growing interest rates on home loans that were previously very low, but this is causing serious economic problems due to its economic bubble, especially in the real estate sector. This is similar to the American bubble, in which most people were unable to repay loans, creating a financial crisis. Still, China must work within the existing bubble, even though it creates a lack of investments and can cause trouble for economies worldwide. The debt bubble is due to the elimination of loan quotas for banks in an

attempt to increase small business. These companies are still struggling to repay that debt, which is almost half the amount of GDP of both private and public debt (The Economist, 2015).

While empirical research shows a statistically significant relationship between BD and interest rates, there are differences on the magnitude of the impact. Chinese needs to take care of lower interest rate rather than higher interest rate especially on home loans which was very low; in real estate market which has created a serious trouble in the economy.

It is also important to note that the concept of the deficit includes hard and soft deficits. The “hard” part of the deficit, being financed by printing money, is inflationary. But these deficits are under reported in the Chinese economy. Moreover, hard deficits and consequent inflation increases capital inflows (to prevent interest rates from rising) and causes current account deficit.

Shen and Chen (1981) said that the bottle-necks in few of the sectors could be lead a higher impact on growth such as energy, communications and transport sectors that are of vital importance for the long-term growth of China. However, given the reluctance of the non-government investors to venture into such low pay-back sectors, the government policy to balance budget by cutting its capital expenditure can severely restrict the development of these sectors (Colm & Young, 1968).

The obvious reason for the external surplus, however, is that, by rising FDI inflows, the economy follows an export-driven growth model. China's demographic boom has produced an economic miracle in the growing tide of economies, enabling them to invest in education and skilled workers that will support the economy as a result. Our results suggest that there cointegration relation among the variables.

7.5.5 Granger Causality

The G-causality approach is used to test the association between BD and the CAD. We need to ensure that all the variables after differentiation should be stationary before checking causality. The lag option is based on the criterion for knowledge from Akaike (AIC). The Granger causality findings are summarized in Table 7.6 below.

Table 7.6: Results of Granger causality Wald test

Equation	Chi^2-test	P-Value	Null-Hypothesis	Direction
CAD to BD	6.6633	0.036**	Accepted	Bidirectional causality
BD to CAD	14.461	0.001*	Accepted	
BD to REER	.91584	0.633	Accepted	No-causality
REER to BD	.73626	0.692	Accepted	
BD to INF	20.562	0.000*	Accepted	Unidirectional causality
INF to BD	.0443	0.978	Rejected	
BD to INT	41.229	0.000*	Rejected	Unidirectional causality
INT to BD	.88837	0.641	Accepted	
BD to MS	21.341	0.000*	Accepted	Unidirectional causality
MS to BD	1.2322	0.540	Rejected	
CAD to REER	.01713	0.991	Accepted	No-causality
REER to CAD	1.3946	0.498	Accepted	
CAD to INF	4.8845	0.087***	Accepted	Unidirectional causality
INF to CAD	1.0292	0.598	Rejected	

CAD to INT	9.4179	0.009*	Accepted	Unidirectional causality
INT to CAD	.57516	0.750	Rejected	
CAD to MS	10.077	0.006*	Accepted	Bidirectional causality
MS to CAD	7.5888	0.022**	Accepted	

Note**:** "***" "**" "*" indicates significance 10%, 5% and 1% levels.

Table 7.6 lists the outcomes of the Granger causality test. The findings indicate that the BD and the CAD have inverse causality. There is, however, a unidirectional causality from BD to other parallel variables and the CAD to other parameters of the formula, but true successful exchange rate variables are negligible. The unidirectional causality from budget gap to inflation and interest rate may have major negative consequences. The interest rate bubble and higher inflated housing prices are becoming a challenge for the Chinese economy, as they are now nearing the prices of the US bubble before the financial crisis popped it. For example, if the US increases interest rates, the money will flow out of the Chinese market, which could cause a similar crisis in China. It will be a challenge for the monetary authority to bring stability in China where inflation, interest rate bubble and exchange rate volatility are of primary concern. Due to a rise in domestic demand, increasing inflation will dramatically increase capital inflows; this can lead to a current account deficit, as it now accounts for more than half of GDP. Economic indebtedness is at its height, which can crush the financial cycle and start a financial crisis.

Thus, the results of Granger causality give us more evidences in support of the Keynesian proposition for China in the light of above data. The reverse causality was not apparent

because Chinese economy is one of the most integrated economies with higher capital outflows, export-led growth and export promotion due to market liquidity and flexible governmental policies. While the capital inflow determines a tight fiscal policy to avoid overheating of economy (see Castillo and Barco (2008) and Rossini et al. (2008).

7.5.6 Generalized Impulse Response of China

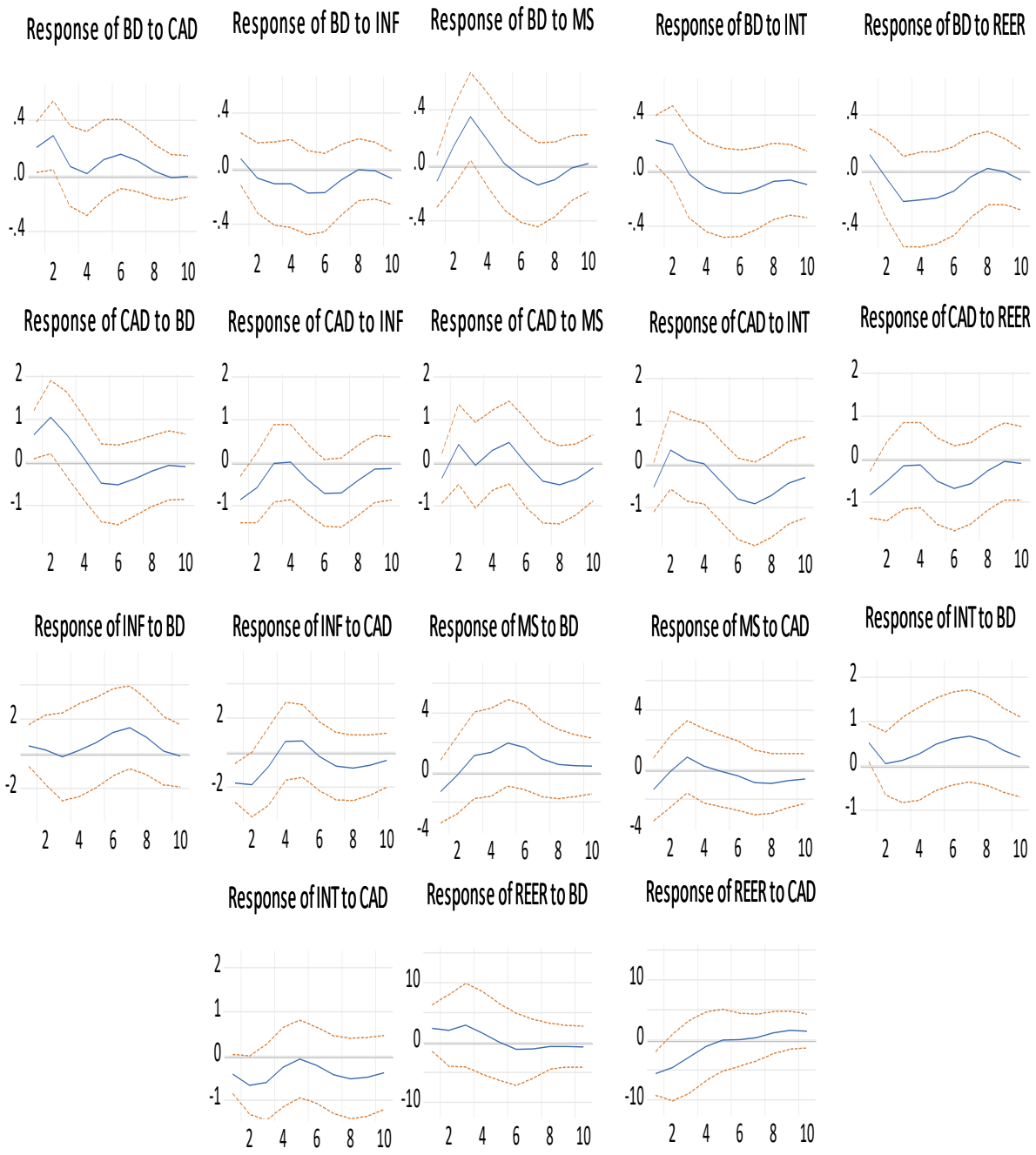
Based, on the Granger causality outcomes, policy makers cannot predict the future policy based on the present results. Secondly, these results can be clarified with sample tests that may give more explanation on the dynamic properties of this relationship Masih and Masih (1995). We apply to generalize response functions (GIR) which investigates the time impacts of a one-time shock to every factor. Koop et al. (1996) propose an alternate sort of impulse function, which are independent of the order of variables and are known as generalized impulse responses (GIR). σ_{jj} is the variance of the jjth variable.

$$\Theta \frac{g}{i} = \emptyset_i \sigma_{jj} - \frac{1}{2} \sum, \qquad (19)$$

Figure 7.4 gives the GIR functions among the variables with regard to the one standard innovation to CAD, BD, INF, INT, REER and MS for the future 10 years.

The results seem more reliable because Chinese economy follows an export-driven growth model by increasing FDI inflows, which may be the reason for positive response of BD to CAD. The positive inflation shock deteriorates both BD and CAD, over the future 10 years. The positive interest rate shock has had a positive effect on both the budget deficit and the current account deficit for the first three years, and has turned negative over the last seven years.

Figure 7.4: Response to Generalized one S.D. Innovation



The adversely effect of interest rate on CAD and BD, implying that it will boast inflow of trade and then appreciation of the real currency, which would inevitably lead to a surplus and have a negative effect on the budgetary deficit as well as development of the Chinese economy.

The positive shock of the effective real exchange rate suggests that both BD and CAD will be negative over the whole duration. The optimistic influence of the money supply on the budget balance over the first four years and the budget deficit over the next six years has deteriorated. In the other side, in cyclical fashion, the money supply has a favorable influence in the first 5 years of the current account deficit and then a negative impact in the last 5 years. Finally, the positive shock of the current-account deficit, inflation, currency and interest rate is negative, which shows CAD is going to be negatively affected by these variables if they are not controlled.

7.6 Conclusions

The dubious opinion on the twin deficit is based on two contending hypotheses: the Keynesian and the Ricardian hypothesis. This chapter examined the linkage between BD and CAD with a concentration on the effect of macroeconomic factors on the two deficits.

The study finds long-term association among the variables. The results find both CAD is and BD are closely associated. Our results indicate that rising money supply and the exchange rate raises the BD and then the CAD. The findings accept the Mundell-Fleming paradigm and to the Keynesian preposition. The influence of the CAD and the exchange rate is deemed exogenous. A long-lasting, stationary association between BD and CAD, interest rates, inflation, money supply and exchange rate has been developed for China. Granger's causal tests demonstrated bidirectional causality between the two deficits and macroeconomic factors to BD and CAD.

The IRF's finding reveals that a favorable interest-rate shock has had a positive influence on the budget deficit. The interest rate, though, has a detrimental effect on the current-account deficit, which implies that an interest-rate rise contributes to capital inflow and an acceleration of the actual exchange rate, which ultimately leads to a CAD and correlates to the Mundell Fleming model. The true solution to the dilemma of BD and CAD resides in a cohesive fiscal and monetary package. It must rely on a steady interest rate; inflation goal and monetary position complement budget cuts.

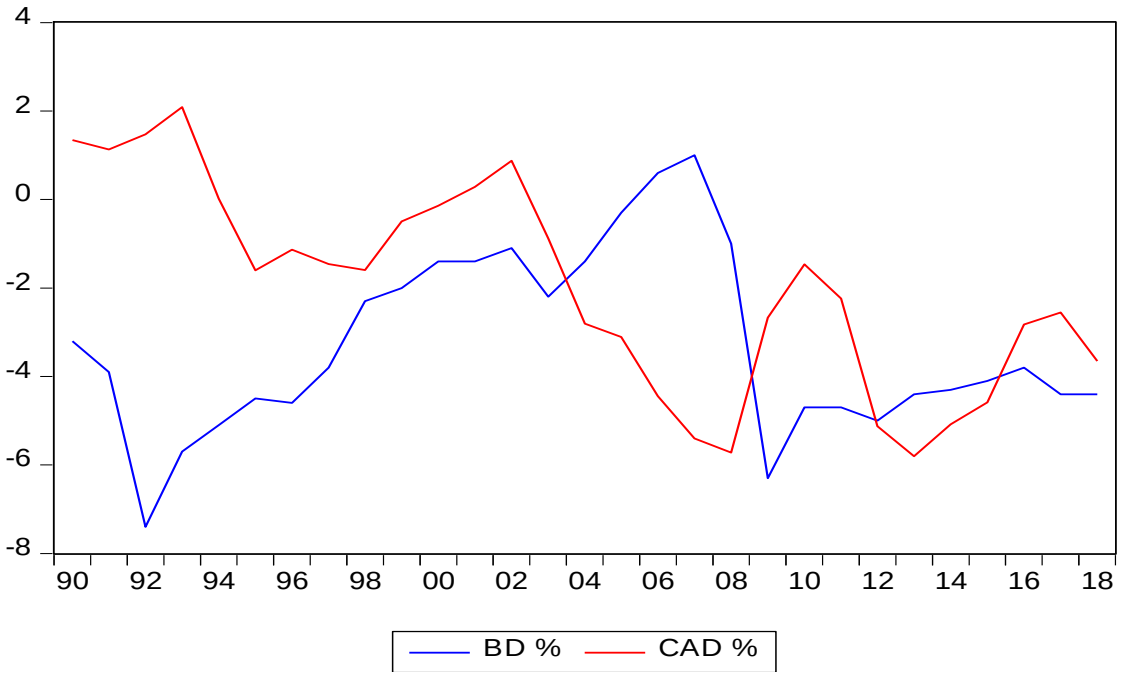
CHAPTER 8

RICARDIAN EQUIVALENCE AND TWIN DEFICIT IN SOUTH AFRICA

8.1 Introduction

South Africa, with a fragile and vulnerable economy, is a significant chance to test a dynamic interaction between BD and CAD. The presence of both the deficits illustrates South Africa's domestic and external stability. The gap between these deficits rose between 1990 and 2018 (see figure 8.1 below).

Figure 8.1: Trend of BD and CAD in South Africa



Note: Author Compilation

The budget deficit is below 5% of GDP, and 60% of the domestic debt is below GDP. South Africa's low tax collection and rising spending continue to drive the budget deficit higher than expected. The CAD raises to 2.9% of GDP in 2018, from 2.1 percent in 2017. South Africa's poor economic output has decreased export growth, increased import growth and deteriorated exchange rates.

The objectives of this chapter are as: The first objective is to explore the linkage in the macroeconomic context between the BD and CAD by applying ARDL approach. Secondly, we use Bernheim (1987) consumption function to validate Ricardian equivalence hypothesis by applying ARDL bound testing approach. Thirdly, we investigate the cause-and-effect association from y to x with the help of Wald causality. 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...).

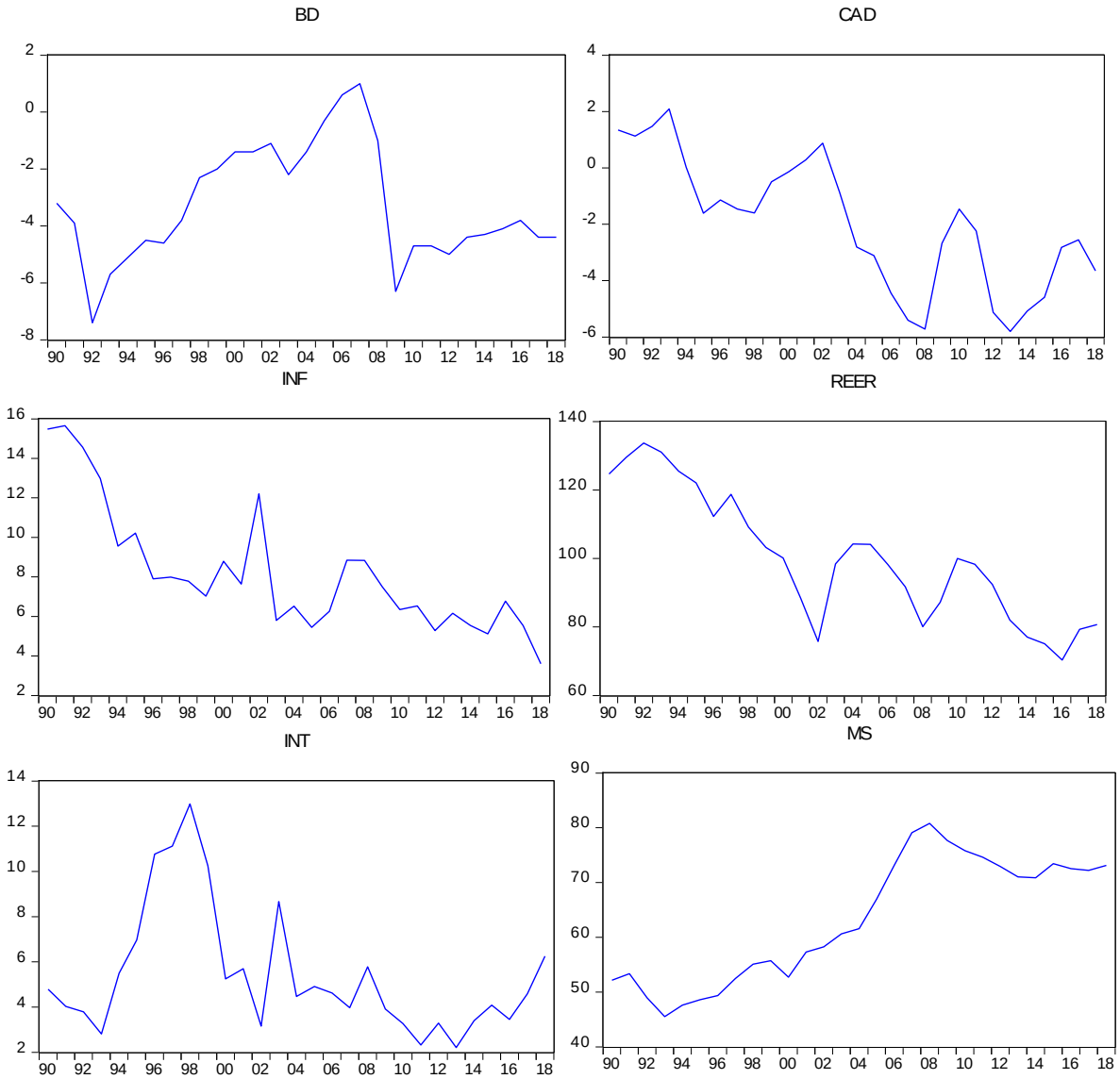
The remainder of chapter 8 is arranged as: Section 8.2 gives economic outlook for the South Africa. Section 8.3 gives data related information. Section 8.4 gives methodology for this chapter. Section 8.5 provides empirical results. Section 8.6 gives conclusion.

8.2 An economic outlook of South Africa

The slow economic growth in South Africa is due to the constrained investment, unemployment, poverty integrated with weal global chain in the form of trade and innovation. Growth in GDP rose from 1.3% in 2017 to 1.4% in 2018. Over the years from 1990 to 2018, South Africa has seen high budget deficits combined with high current account deficits. Figure 8.2 provides an overview of South Africa's internal and external role. From 1990 (-3,2) percent of GDP to (-4,4) percent of GDP, the budget deficit has continuously increased. On the other hand, in 1990 (1.34) per cent of GDP, the CAB was in surplus. The current account balance starts moving in deficits from 1995 onwards and reached maximum (-5.72) percent of GDP in 2008 may be due to the strong wind fall effect of financial crises. The current account balance widened to (-3.65) percent of GDP in 2018 compared to the (-2.55) percent of GDP in 2017. The increase in budget deficit will reduce the rate of economic growth, and higher current account deficit will reduce export, reduction in investment for innovation and lower foreign exchange rate reserves. Macroeconomic policy remains a main debate in South Africa with higher inflation of 15.47 and real effective exchange rate of 124.66 in 1990.

However, the steady rise in BD and CAD is dangerous and may contribute to structural weakness and trade in-competitiveness, which can compensate for private spending, savings, weaker economic growth and unemployment. Continuously raising the budget deficit increases national debt and reduces productivity. Figure 8.2 indicates that the current account balance would deteriorate from 2009 if the actual effective exchange rate appreciates.

Figure 8.2: Behavior of some Macroeconomic variables in South Africa over the period of 1990 to 2018



Note: Author compilation

8.3 Data information

To achieve the goals of the thesis, this analysis uses time series data from 1990 to 2018. The budget deficit and the current account deficit have been specifically taken into

account as a proportion of GDP. World Bank and economic trade data on all the variables are collected; the detailed information on the variables is given below.

(a) The current account deficit (CAD) displays the value of imported goods, services and investments as a proportion of GDP relative to exports.

(b) Budget deficit (BD) indicates the spending's and revenue of the government, if expenditure increase than revenue know as budget deficit as a percentage of the GDP.

(c) Real interest rate (RIR): the lending interest rate calculated by the GDP deflator and adapted to inflation is the real interest rate (RIR) as an interest rate proxy (INT).

(d) Inflation (INF) shows the price change of good and services in the economy, it is based on consumer price index.

(e) Broad money (MS) relates to the volume of liquidity in the economies in the form of foreign currency; to the reserves of demand, the time, savings and foreign currency and coins on which the percent of GDP is centered.

(f) The weighted average value of different currencies, separated by the price deflator, is the actual effective exchange rate (REER).

(g) Tax revenue (TR) is the income earned by government on additional income, fines, penalties and social securities as the basis of percentage of GDP.

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

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

8.4 Methodology

8.4.1 Model specification

We test the dynamic relationship in the macroeconomic framework between the two deficits and the Ricardian equivalence hypothesis for South Africa over the period 1990-2018. The study estimates two regression models; the first model is based on Bernheim (1987) consumption function to estimate Ricardian theorem as given: C = f (TR, BD, G, INT)

Where C is the private consumption, BD is the budget deficit, TR is the tax revenue and G is the government consumption. The second regression is to test the twin deficit hypothesis based on the theories reviewed, and the equation is given as: BD = f (CAD, REER, INF, INT, MS).

8.4.2 Unit root test

We need to apply the unit root test for the entire data series before applying econometric models to verify cointegration and causality, since stationarity is the problem with time series. If the sequence is non-stationary, the Gujarati & Porter regression results would be spurious (2009). We need to separate the variables to create uniform stationery. Specifically, while the ADF tests use parametric autoregression in the test hypothesis to estimate the ARMA structure, the PP tests do not take serial regression correlation. The equation for ADF and PP is given below.

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

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

α is constant β is coefficient and u_t is the term of error. Serial correlation and heteroskedasticity in the regression equation is corrected in the PP u_t error word.

8.4.3 ARDL model

Due to its ability to consolidate small series, the ARDL bound testing method. Secondly, the ARDL strategy can be applied to the series with distinct integration order (Pesaran and Pesaran 1997). Thirdly, we get both short-run and long-run ties among the factors at the same time. The most effective methodology for this analysis is based on the above qualities of this approach with distinct integration order and limited sample size. In order to assess an ARDL model, there are four stages. The first phase examines the cointegration with the help of bound test approach. The ECM version of ARDL model can be as.

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

The dependent variable is Y_t, the independent variable is X_t, and the residual term is ε_t. The ECM for the equation 3 is given below:

$$\Delta \mathrm{BD}_i = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta BD_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta CAD_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta INF_{t-i} + \sum_{i=0}^{n} \alpha_{4i} \Delta REER_{t-i}$$

$$+ \sum_{i=0}^{n} \alpha_{5i} \Delta INT_{t-i} + \sum_{i=0}^{n} \alpha_{6i} \Delta MS_{t-i} + \beta_1 BD_{t-i} + \beta_2 CAD_{t-i} + \beta_3 INF_{t-i}$$

$$+ \beta_4 REER_{t-i} + \beta_5 INT_{t-i} + \beta_6 MS_{t-i} + \varphi ECt - 1$$

$$+ \varepsilon_t \qquad (4)$$

8.4.4 Granger causality

The Causality Method examine the linkage between the BD and CAD and certain macroeconomic variables. Results of Granger causality explain that the change in one variable is attributable to another variable's change. One of the three possible outcomes is given by the results of the model: bidirectional causality, unidirectional causality and no causality. Whether the causality is from the BD and CAD, meaning the acceptance of the Keynesian proposal, or from the CAD to BD, meaning the acceptance of the Ricardian preposition, meaning compliance with the national accounting principle, and whether no causality exists. The model can be written as.

$$\Delta \mathrm{BD}_t = \alpha_1 + \Sigma\beta_1 \Delta \mathrm{CAD}_{t-i} + \Sigma\theta_1 \Delta \mathrm{INF}_{t-i} + \Sigma\gamma_1 \Delta \mathrm{REER}_{t-i} + \Sigma\delta_1 \Delta \mathrm{INT}_{t-i} + \Sigma\lambda_1 \Delta \mathrm{MS}_{t-i} + \varepsilon_t$$

(5)

$$\Delta \mathrm{CAD}_t = \alpha_2 + \Sigma\beta_2 \Delta \mathrm{BD}_{t-i} + \Sigma\theta_2 \Delta \mathrm{INF}_{t-i} + \Sigma\gamma_2 \Delta \mathrm{REER}_{t-i} + \Sigma\delta_2 \Delta \mathrm{INT}_{t-i} + \Sigma\lambda_2 \Delta \mathrm{MS}_{t-i} + \varepsilon_t$$

(6)

$$\Delta INF_t = \alpha_3 + \Sigma\beta_3\Delta BD_{t-i} + \Sigma\theta_3\Delta CAD_{t-i} + \Sigma\gamma_3\Delta REER_{t-i} + \Sigma\delta_3\Delta INT_{t-i} + \Sigma\lambda_3\Delta MS_{t-i} + \varepsilon_t \quad (7)$$

$$\Delta REER_t = \alpha_4 + \Sigma\beta_4\Delta BD_{t-i} + \Sigma\theta_4\Delta CAD_{t-i} + \Sigma\gamma_4\Delta INF_{t-i} + \Sigma\delta_4\Delta INT_{t-i} + \Sigma\lambda_4\Delta MS_{t-i} + \varepsilon_t \quad (8)$$

$$\Delta INT_t = \alpha_5 + \Sigma\beta_5\Delta BD_{t-i} + \Sigma\theta_5\Delta CAD_{t-i} + \Sigma\gamma_5\Delta INF_{t-i} + \Sigma\delta_5\Delta REER_{t-i} + \Sigma\lambda_5\Delta MS_{t-i} + \varepsilon_t \quad (9)$$

$$\Delta MS_t = \alpha_6 + \Sigma\beta_6\Delta BD_{t-i} + \Sigma\theta_6\Delta CAD_{t-i} + \Sigma\gamma_1\Delta INF_{t-i} + \Sigma\delta_6\Delta REER_{t-i} + \Sigma\lambda_6\Delta INT_{t-i} + \varepsilon_t \quad (10)$$

8.5 Empirical results

In order to test the Ricardian theorem and twin deficit hypothesis for South Africa, first we understand the features of data with the help of descriptive statistics given in table 8.1 below.

The descriptive analysis reveals that the mean value of BD (-3.30) is greater than CAD (-1.98) because the most of the series of BD is negative and greater than CAD. The mean value of BD is more than CAD, which means South Africa should more focus on fiscal management. The standard deviation of BD (2.056) and CAD (2.344) is greater than 2 meaning that the data observations are spread out. The maximum value of CAD (2.08) is greater than BD (1.00) and minimum value of BD (-7.40) is greater than CAD (-5.80) is due to the fact that BD series is negative most of the years as compared to the CAD.

Table 8.1: Descriptive Statistics of Variables for South Africa

	BD	CAD	INF	INT	TAX	MS	REER
Mean	-3.303	-1.985	8.204	5.389	24.63	63.23	99.77
Median	-3.900	-1.603	7.504	4.580	24.38	61.59	98.38
Maximum	1.000	2.087	15.65	12.99	27.56	80.79	133.6
Minimum	-7.400	-5.804	3.604	2.208	20.62	45.50	70.35
Std. Dev.	2.056	2.344	3.179	2.792	1.954	11.27	18.81
Skewness	0.330	-0.044	1.106	1.332	-0.111	-0.045	0.273
Kurtosis	2.450	1.946	3.322	3.830	2.000	1.480	1.954
Jarque-Bera	0.892	1.351	6.045	9.412	1.254	2.800	1.683
Probability	0.639	0.508	0.048	0.009	0.533	0.246	0.431

Note: Author's Calculations.

8.5.1 Unit root

We used unit root test (ADF and PP) to verify the level of stationarity. It helps to apply a suitable method for estimating outcomes. ARDL is the effective method for robustness of outcomes if they are implemented at level and first difference, Pesaran et al., (2001).

The findings of the ADF and PP unit suggest that when we take intercept and pattern in ADF, some of the variables such as (CAD, INF and TAX) are stationary as given in table 8.2. However, often the outcomes of ADF and PP. differ, the outcomes of ADF are reliable over the outcomes of PP in view of the fact that Arltova and Fedorova (2016) "ADF is a dependable choice for unit root testing," and they further emphasize that its

results are superior to any other procedures for unit root testing, particularly because of the greater number of observations.

Table 8.2: Results of unit root test for South Africa								
	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	-1.89	-4.87	-1.84	-4.80	-1.89	-4.87	-1.84	-4.80
CAD	-2.29	-4.43	-4.18	-	-1.51	-3.33	-1.65	-7.07
MS	-0.99	-3.24	-2.26	-4.49	-0.87	-3.24	-1.66	-7.21
INF	-2.34	-7.77	-4.19		-2.23	-7.72	-3.12	
REER	-1.32	-4.54	-3.19	-4.49	-1.07	-4.63	-2.20	-5.06
INT	-2.16	-6.19	-2.33	-6.07	-2.16	-6.13	-2.42	-6.01
TAX	-1.14	4.62	-3.58	-	-1.22	-4.62	-2.99	-4.52
PC	-1.35	-4.50	-3.11	-4.33	-1.45	-4.32	-2.54	-4.13
G	-1.40	-4.62	-1.43	-4.64	-1.59	-4.62	-1.61	-4.65

Overall, the ADF test results suggest that the variables have different degrees of integration and can proceed with the method of ARDL.

8.5.2 Ricardian equivalence

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 apply the reduced form of the consumption function as given below in table 8.3.

$$PC_t = \beta_0 + \beta_1 BD + \beta_2 TAX_t + \beta_3 G_t + X_t\beta + \varepsilon_t \quad (11)$$

BD is the budget deficit, tax is the tax revenue, and G is the government spending, where PC is the private consumption. For long-run relationships, we applied the ARDL bound research technique. David Ricardo's point was that while governments attempt to fund their deficits, private spending is not affected.

Table 8.3: Results of REH for South Africa (Private Consumption (PC))

Variables	Coefficient	t-value	Prob
TAX	.40828	1.7523	.094***
TAX(-1)	-.65044	-2.5200	.019**
G	2.0294	2.9529	.007*
BD	.52695	2.5396	.019**

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

The findings show that there is a substantial relationship between BD and government spending on private consumption, based on the above statement (PC). The variable TAX is significant and coefficient is negative, meaning that with the increase in TAX private consumption will decrease which is consistent with the findings of Leiderman and Assaf Razin (1986), Mika Arola (1996), Ghatak and Ghatak (1996) and Tagkalakis (2008).

8.5.3 ARDL Bounds testing results

First, the implementation of the ARDL regression includes the selection of lags based on the Akaike Knowledge Criterion (AIC). The following stage is to measure the presence of the variables of the long-run association. The F = 7.1978 statistics is larger than upper bound 4.0647 and lower bound 2.6139, suggest cointegration association.

Table 8.4: Results of Cointegration Bound test

Calculated F-statistic	95% LB	95% UB	90% LB	90% UB
***F*= 7.1978**	2.6139	4.0647	2.0947	3.3557
W- Stat = 43.18	15.6832	24.3883	12.5685	20.1343

After discovering evidence of cointegration using the ARDL method, in Tables 8.5 and 8.6 the long-run coefficients are shown. The findings show a strong long-term association between the BD and CAD.

These results recommend twin deficit holdings in South Africa in the long term. This indicates a detrimental and significant association between the two deficits and some other macro-economic indicators in the long term. The Keynesian forecasts indicate that the method to fund the fiscal deficit is important to the country's long-run economic efficiency. The coefficient of interest rates, which is optimistic and significant, indicates that the rise in budget deficits would bring greater pressure on interest rate and increase capital inflow and exchange rate appreciation, contributing to a current-account deficit. This line focuses on Keynesian absorption theory. The exchange rate coefficient -.031851 is negative and significant, meaning that the actual balance reduces as the exchange rate

deteriorates. The inflation coefficient .11522 is optimistic and important, indicating that an inflation rise would minimize long-term budget deficits. Money supply has a negative -.029570 coefficients and a clear budget deficit connection implies a rise in the money supply would increase the long-term budget deficit.

Table 8.5: Results of ARDL model of South Africa (BD)

Variables	Coefficient	t-value	Prob
BD(-1)	-.18118	-.94779	.358
BD(-2)	.24549	1.9550	.069***
CAD	-.49520	-2.5523	.022**
CAD(-1)	.43147	2.6385	.019**
INT	-.31927	-3.4965	.003*
INT(-1)	. 11223	1.0567	.307
INT(-2)	.37027	3.7125	.002*
INF	.11522	1.9916	.092***
MS	.40768	5.4145	.000*
MS(-1)	-.17499	-1.1538	.267
MS(-2)	-.26035	-2.0817	.055***
REER	-.029803	1.9785	.067***

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

The short-run results are given in table 8.6. All the variables have major short-run relationships, the results find. The CAD coefficient is negative and important, which means that a 1% rise in CAD would increase the budget deficit by -.49520%. As cyclical

fluctuations in the domestic market are due to the global economy and stained financial growth, the budget deficit cannot be used as a replacement for monetary policy to maintain internal balance.

Table 8.6: Results of ARDL Long-run and Short-run (ΔBD)

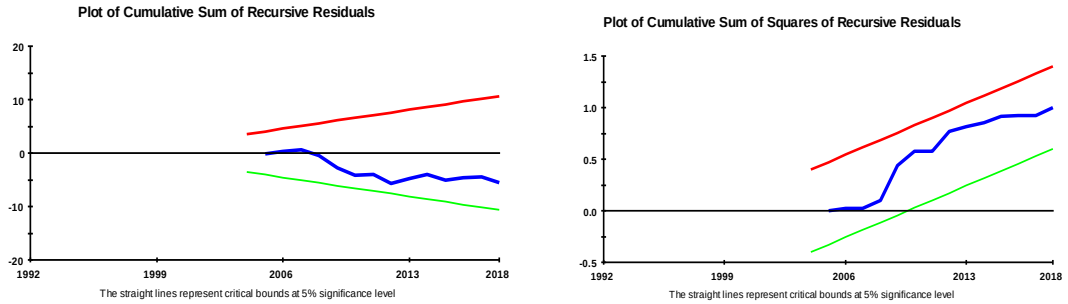
	Variables	Coefficient	t-statistic	P- Value
Long Run	CAD	-.068111	-.43198	.067***
	REER	-.031851	-1.9772	.067***
	INF	.012314	.099133	.009*
	INT	.17446	1.6947	.011**
	MS	-.029570	-1.7499	.010**
	ECM(-1)	-.93569	-6.4264	.000*
Short Run	Δ BD	-.24549	-1.9550	.066***
	Δ CAD	-.49520	-2.5523	.020**
	Δ INT	-.31927	-3.4965	.003*
	Δ INT (-1)	-.37027	-3.7125	.002*
	Δ INF	.11522	.99161	.092***
	Δ MS	.40768	5.4145	.000*
	Δ MS(-1)	.26035	2.0817	.052***
	Δ REER(-1)	-.029803	-1.9785	.063***
R-squared = 0.8628 F-Stat = 11.7955(.000) DW Stat = 2.5457 Serial Correlation: 8.277(.121) Normality: .7017(.704) Heteroscedasticity: 10.96 (.145)				

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

The above findings are based on the fact that there is a negative correlation between the BD and the CAD. Variables such as the actual effective exchange rate and interest rate have a negative and important relationship with the budget deficit, meaning an interest rate rise of 1 percent and the exchange rate would increase the budget deficit by -.31927 and -.029803, which is consistent with the Keynesian preposition hypothesis. The supply of inflation and money has a supportive and critical relationship with the BD in the short-run.

The results are compatible with the Keynesian preposition and remove the Ricardian premise that the BD is not associated with CAD. The adjustment speed is given by the error correction term (ECM); the negative value with P-value significance will converge rapidly towards equilibrium. The ECM value at 1 percent level is (-.93569) negative and important, meaning that at a rate of 93 percent the model will reach equilibrium. The below part of table 8.6 below gives diagnostic statistic in the form of Jarque-Bera normality test confirm normality of the model, Durbin Watson test confirms no Serial correlation, Breusch-Pagan–Godfrey confirm there is an absence of Heteroscedasticity and figure 8.3 gives (CUSUM) (CUSUMSQ) model confirm that the model is stable.

Figure 8.3: Stability test (CUSUM and CUSUMSQ)



8.5.4 Granger Causality

We reviewed 6 Granger causality test equations for South Africa. However, the key justification for this analysis is to evaluate the route of causality between variables. The findings show that there are two-way causalities from BD to CAD (Table 8.7). The results find that the surge in the budget deficit triggers the trade deficits and the increase in the CAD.

Table 8.7: Results of causality Wald test for South Africa

Equation	Chi^2-test	P-value	Null-Hypothesis
CAD to BD	5.1822	0.075***	Accepted
BD to CAD	2.5782	0.054***	Accepted
INF to BD	49.437	0.000*	Accepted
BD to INF	1.7876	0.409	Rejected
INF to CAD	11.166	0.004*	Accepted
CAD to INF	.04017	0.980	Rejected
REER to BD	9.1979	0.010**	Accepted
BD to REER	.62162	0.733	Rejected
REER to CAD	5.4645	0.065***	Accepted
CAD to REER	1.1003	0.577	Rejected
INT to BD	9.6599	0.008*	Accepted
BD to INT	.41863	0.811	Rejected
INT to CAD	9.2154	0.010**	Accepted
CAD to INT	.48656	0.784	Rejected
MS to BD	14.928	0.001*	Accepted
BD to MS	26.59	0.000*	Accepted
MS to CAD	2.5105	0.285	Rejected
CAD to MS	13.426	0.001*	Accepted
REER to INF	6.4794	0.039**	Accepted

INF to REER	4.9957	0.082***	Accepted
INT to INF	8.0757	0.018**	Accepted
INF to INT	36.467	0.000**	Accepted
MS to INF	12.264	0.002*	Accepted
INF to MS	30.054	0.000*	Accepted
INT to REER	2.3044	0.316	Rejected
REER to INT	6.1284	0.047**	Accepted
MS to REER	.3931	0.822	Rejected
REER to MS	20.545	0.000*	Accepted
MS to INT	8.3539	0.015**	Accepted
INT to MS	33.231	0.000*	Accepted

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

The results suggest that increase in tax rates will decreased budget deficit and import demand due to reduction in the disposable income. Therefore, tightening fiscal policy can reduce the budget deficit but, on the hand, will reduce private investments, reduction in government spending's, increase in unemployment and lower economic growth in South Africa. However, the macroeconomic imbalances may lead to current account deficit, due to sharp alterations in real effective exchange rate, domestic demand, 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. The demand for exports and productivity is not gaining momentum in South Africa. This leads to a devaluing exchange rate, especially in manufacturing 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. A difference in productivity between the world and South Africa makes capital goods more expensive for both consumers and industries based on exchange rate deprecating approach. Higher inflation can also cause CAD, and our findings show unidirectional impact from inflation to CAD.

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 (e.g., Turkey where inflation was 9% and CAD 5% of GDP).

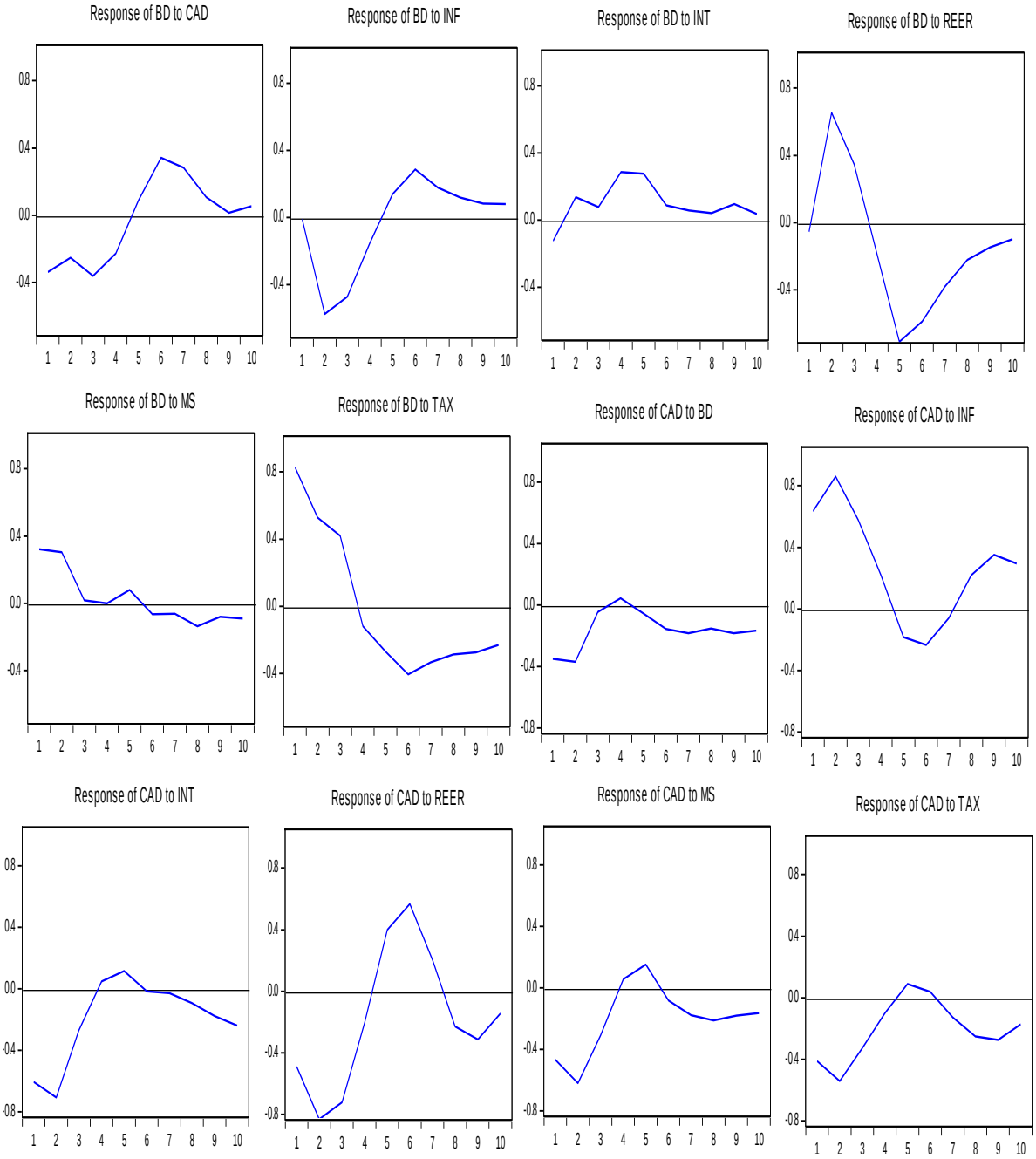
The results of our study favor Keynesian preposition than Ricardian Equivalence theorem in the light of above data. All the variables (inflation, real effective exchange rate, interest rate, money supply) causes' BD and CAD at 5% level of significance. The results are consistent with Ahmad and Aworinde (2015), Abbas et al. (2011), Badinger et al. (2017) and Afonso et al., (2018).

8.5.5 Generalized Impulse Response of South Africa

Based, on the above results, it is imperative to take note that there are restrictions in Granger causality tests, especially for policymaking purposes. These outcomes don't demonstrate the future time impact over the variables. Second, these outcomes can be explained within sample tests which may give little clarification on the dynamic properties of the framework Masih and Masih (1995). We applied to generalize response functions (GIR). The GIR investigation is a procedure that follows through time the impacts of a one-time shock to every factor in the framework Fischer, Hall & Taylor (1981). Figure 8.4 gives 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, TAX for 10 years horizon.

Figure 8.4: Response to Generalized OBD S.B. Innovations



The budget deficit worsens for the first 4 years, a positive blow to the CAD, and then improves the BD over the next 6 years. A positive shock to the BD, CAD is gradually worsening. This is reliable with most hypothetical models' standard theorems and compatible with Granger causality results.

The optimistic inflation shock worsens the budget deficit for the first 4 years and then boosts the budget deficit. However, the current-account gap improves first for five years, then worsens for a year and indicates further improvements. The positive impact of interest rate shocks on the budget gap is positive. However, the interest rate affects the current-account deficit negative, which implies that an interest rate increase contributes to foreign inflows and the actual exchange rate appreciation, eventually culminating CAD. The optimistic impact on the budget gap for the first 3 years from actual successful exchange rates and then deepens the budget deficit for the next 6 years. Nevertheless, over the first four years, the detrimental impact of a successful real exchange rate on the current account gap indicates stabilization over the next three years and adverse effects afterwards. The beneficial effects of the allocation of money on the budget deficit for the first five years and then on the budget deficit for the next five years have deteriorated. On the other hand, for several years, the negative effect of the supply of money on the current account deficit has been constant. Finally, for the first 4 years, the tax shock on the budget deficit showed a positive effect and then worsened for the next six years. The positive relationship over the first few years may be attributed to the improvement in the tax system that has raised government revenue and decreased the deficit over the first few years. However, negative association between taxes and CAD, which means that the CAD will worsen with the rise in the tax rate.

8.6 Conclusion

This chapter tests the twin deficit hypothesis and Ricardian equivalence theorem in a macroeconomic framework. We investigate direct impact of BD on CAD in the macroeconomic framework. Secondly, we also test Ricardian hypothesis by using Euler consumption function. Thirdly, we check the causal association between the variables and their direction. Finally, we applied impulse response function to check input and output relationship for policy making and robustness of results.

As all the variables (tax, budget deficit and government expenditure) had a substantial relationship with private consumption, the findings do not support the Ricardian hypothesis.

The findings from the ARDL model support the long-term co-integration between the two deficits and embrace the Keynesian preposition and do not seek any evidence based on this in the Ricardian equivalence hypothesis. Due to liquidity pressures and decreasing market resilience, the main motivation for such a differential effect of BD and CAD may be anticipated in a developing world such as South Africa. The other variables used in this model (CAD, INF, INT, REER, MS and TAX) considered to be both long-lasting and short-lasting.

Granger causality findings suggest two-way association between the two deficits. The Granger causality gives unidirectional causality of BD and CAD to INT, REER and INF. However, the macroeconomic imbalances may lead to current account deficit, due to sharp alterations in real effective exchange rate, domestic demand, 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. The demand for exports and productivity is not gaining momentum in South Africa. This leads to devaluation in exchange rate, especially in manufacturing and mining sector. The depreciation in currency value reflects poor integration with the global economy, and uncertainty discourages investments.

The result of Impulse response supports the results of Granger causality and found exchange rate, inflation and tax causes both BD and CAD for the future 10 years. Based on the results if causality and Impulse, we can say low inflation and stability in exchange rate is important to reduce CAD. From the fiscal point of view, there should be a balance tax structure which should not hamper consumption and government revenue. Based on these policy measures, it will reduce the uncertainty in investment, which will boost consumer demand, business, and exports, that will improve current account balance and fiscal balance.

CHAPTER 9

CONCLUSION AND POLICY RECOMMENDATIONS

The budget deficit and current-account deficit have been a major debate for decades in BRICS countries, as stated in chapter 1, being a cornerstone of macroeconomic policies influenced by the apparent capacity of government to control economic activities and prices. The unprecedented increase in BD and the increase in CAD led to the recognition of this condition as the issue of "twin deficits" in most nations, particularly the United States (US) in the mid-1980s. The worry is centered on the degree to which fiscal change can add to settling current account imbalances, particularly when it is persistent. Monetary and fiscal policy has been subject to persistent debate in (Brazil, Russia, India, China and South-Africa) BRICS countries for a very long time. The economic sustainability of the countries depends on fiscal and monetary balance. Various economies have indicated that the prolongation of macroeconomic instability can be described by budget and current account deficit. During the 2008-09 global economic crises, decline in government revenue and countercyclical spending reduces budget surplus and widens the deficits. The thesis also considers that whether the private savings behave in the Ricardian way. The inference here is that market spending trends would be focused on the Modigliani and Ando (1957) life cycle model, which implies that existing consumption relies on the predicted lifetime earnings instead of the current income as suggested by the Keynesian model, or if the results are compatible with the theory of a twin deficit.

A comparison among the BRICS countries is done in section 9.1. Conclusion of the thesis is written in section 9.2, which also includes contribution to the literature. In section 9.3

policy recommendations are written and in final section 9.4 future research directions are discussed.

9.1 Comparative status of twin deficit hypothesis among BRICS countries

Prior to interpreting of the table 9.1, it is important to bring comparison among the BRICS countries based on the results. Here we provide the just of the thesis and the results are classified as:

Table 9.1: Summary of results for twin deficits hypothesis in the BRICS countries

Countries	Keynesian Preposition	Ricardian Hypothesis	Causality	Policy Variables
Brazil	Acceptance of Keynesian preposition	Rejection of Ricardian equivalence	Unidirectional causality	Interest rate, inflation and exchange rate
Russia	Acceptance of Keynesian preposition	Rejection of Ricardian equivalence	Bidirectional Causality	Interest rate, exchange rate, tax, and inflation
India	Acceptance of Keynesian preposition	Rejection of Ricardian equivalence	Bidirectional Causality	Interest rate, exchange rate and tax
China	Acceptance of Keynesian preposition	Rejection of Ricardian equivalence	Bidirectional Causality	Interest rate, money supply, and exchange rate
South Africa	Acceptance of Keynesian preposition	Rejection of Ricardian equivalence	Bidirectional Causality	Exchange rate, interest rate, money supply and inflation (Absorption Theorem)

The BRICS countries display a significant association between BD and CAD, which has a much greater external impact. The table indicates that the BD and CAD has a significant long-ruin and short-run association with the macroeconomic variables. The results favor the Keynesian theorem and oppose the Ricardian theory for the BRICS nations. With the support of the Consumption Function, we estimated Ricardian hypothesis based on the consumption function the results didn't accept the Ricardian theorem for BRICS countries.

The Granger causality finds two-way causality between the BD and CAD in Russia, India, China and South Africa and a unidirectional causality from CAD to BD for Brazil. The results are the same as explained by the Mundell-Fleming model, which reveals that an extension of the budget deficit would raise interest rate stress, cause capital movements and the exchange rate increase. Appreciation lowers exports and boosts imports, which contributes to a current account deficit.

Finally based on the results of ARDL, granger causality and impulse response function interest rate, exchange rate, inflation and tax can be the policy variable. The results find that the transmission mechanism is running from interest rate and exchange which puts pressure on money supply and inflation and hence CAD. The results are consistent with Mundell Fleming model, it is viable that a given budget deficit may have distinct effects on interest rate; widening of budget deficit gives rise to interest rate, which brings capital inflow and appreciates exchange rate and causes current account deficit. However, in South Africa there exist an imperfect market/underdeveloped market structure where change might be asymmetrical and unknown. The second channel is when there is a change in tax the real private consumption has a negative coefficient which means when

there is an increase in tax rate the peoples reduce their consumption due to less disposable income. The results are consistent to the Seater (1993), observation that the country which are carrying higher debt, will lead the country towards joblessness, trade deficit, inflation, higher interest rate and unsatisfactory feature of economic performance.

The five main contact channels are indicated by the transmission mechanism. The Keynesian absorption hypothesis seems to exist between the variables based on ARDL and the effects of causality, the first and most direct relationship, and then proven by the function of impulse response. They claim that a rise in the fiscal deficit would trigger a higher degree of domestic absorption, which would lead to higher imports and hence a current-account deficit. The second channel is based on the Bachman (1992) theory of the domestic currency appreciation raising the purchasing power of imports of commodities, growing the valuation of real estate and financial assets, increasing demand and reducing domestic reserves, reducing the productivity of the world economy and causing current account deficits. This implies that by adjusting the overall cost of non-tradable, the exchange rate will likewise influence the twin deficit hypothesis. For example, massive government spending on non-tradable real estate can trigger appreciation, which increases demand for tradable goods and creates a deficit in the current account. The third theoretical explanation is the potential of the capital supply. The effects of the granger causality and impulse response functions as modelled on Korsus describe bidirectional or unidirectional causality from money supply to budget deficit and current account deficits (2009). He states that raising the budget shortfall would improve the provision of funding if the deficiencies were financed through seigniorage strategies.

The fourth set of writing on BD and inflation introduced by Sargent and Wallace (1981) suggests that seigniorage is a crucial factor for funding the debt; the deficit will have to be implemented by the central bank. Monetization, though, contributes to a rise in money supply and inflation rates. Then Sargent and Wallace (1981) conclude that the causal path runs from BD to inflation, accompanied by money supply to inflation. The findings of Granger causality find the same results for China and Russia, as proposed by Sargent and Wallace, where causality shifts from the budget deficit to inflation and is consistent with the results of Anoruo and Ramchander (1998), Miller and Russek (1989) and Mukhtar et al. (2007), where unidirectional causality occurs as in Brazil and South Africa, shifting from inflation to the budget deficit. The reason for such relationship in Brazil is reliable because hyperinflation was the main concern for the Brazil economy for a long period of time and in India, we find bidirectional causality. The reverse causation can be linked with monetization, tax cuts which boost the consumption and causes inflation and crowding out effect.

Finally, the explanation given by Miller (1983) shows that budget deficit is fundamentally inflationary regardless of the monetization of deficits because there are various channels through which budget deficit causes inflation. He maintains that regardless of whether the Central Bank doesn't change its deficits by raising the money supply/print, the deficits are inflationary by fundamentally. This is because non-monetary deficits raise debt costs and higher interest rates congestion private spending and lower the inflation rate. The results of the analysis are compatible with this Miller hypothesis. We find a causal link between the availability of funds in all countries and the fiscal deficit and current account deficit. The findings are similar to those from Miller and

Russek (1989), Leachman and Francis (2002) and Salvatore (2006). However, it is necessary to remember that in all nations, such as Russia, India and South Africa, inflation is often bidirectional, with budget deficit causality, where we see bidirectional causality from monetary supplies to budget deficits. However, we find unidirectional causality in Brazil and China, varying from money supplies to the budget deficit or budget deficit to money supplies, and the budget deficit often has a unidirectional causality from growth or inflation to the budget deficit. It is worth stressing the connectivity between the factors, since any financial disruption/shock influences inflation and creates a budget deficit, and vice versa.

9.2 Summary and Conclusion of the Study

Chapter 2 continues with the evolution of the twin-deficit theory in the late 1980s. A fiscal reduction, not complemented by monetary policies, was added to the expansionary fiscal step of the Reagan administration. The unilateral approach raises US interest rate and the subsequent capital inflows and raised the dollar's value. The dollar appreciation contributed to the breakdown of America's intensity of global markets and a strengthening of the balance sheet. Under these terms, the current account deficit tends to represent the fiscal scenario, which contributes to the twin deficit theory being popularized.

Section 2.3 states that the presuming an unaltered gap between private savings and investments over some time decreases the BD will be equal to the changes in the CAD. The twin deficit hypothesis is obtained based on the national income method as given below:

$$Y = C + I + G + X – M$$

If the current account surplus is equal to budget surplus plus private savings and domestic investments. If the government reduces the taxes (T) and do not change the spending (G), meaning generating a deficit. However, the impact of budget deficit falls on current account balance (X – M) or investment saving gap (I – S) needs to be investigated.

The twin deficit hypothesis is based on Keynesian preposition. Bernheim (1989) write down that based on the Keynesian perceptive of budget deficit, a large portion of population are short-sighted or have liquidity limitations, and have high proclivity to consume based on their current disposable income. In view of this, a reduction in tax will have instant and significant effect on demand. The Keynesian only give short-run impact, while the neoclassical gives long-run impact of deficits on consumption and capital accumulation. The neoclassical argues that the consumer's consumption is based on the life cycle hypothesis as formulated by Modigliani and Ando in (1957). However, the Milton Friedman in 1957 permanent income hypothesis asserts that increase in permanent income increases private consumption. Further, the increase in income due to tax reduction, spending's gives rise to savings not spending (Barro, 1989:39). The increase in the fiscal deficit will give rise to household consumption by shifting the tax burden to a future generation.

Section 2.4 discusses the balance of payment curve represents the current account balance model in the Mundell-Fleming (MF) model. The balance of payment (BOP) model is equal current account balance (CAB) + capital account (CA) which is represented as: BOP = CAB + CA = 0. The balance of payment (BOP) curve in Mundell-

Fleming (MF) model is the combination of real income and interest rate at which BOP is equal to zero. The Mundell-Fleming Model is a short-run open economy model, where bonds and domestic market is treated as substitute for money, and labour being a part of the (MF) model based on the belief that demand brings change in output. The M-F model presumes that beginning from the current account balance, fiscal policy will increase output and which increases demand for imports. This will, therefore, lead to current account deficit, with the increase in interest rate and appreciation of exchange rate causes inflow of funds in the domestic market which cause current account deficit. The critiques of the Mundell-Fleming model focus on the short run and the representation of current account are static. It also neglects the effect of investments on current account balance and productive capital.

The criticism received by a Keynesian proposition from the Neo-classical perception about the budget deficit for disregarding the "crowding out effect" was discussed in section 2.5. The expansionary government fiscal policy can lead to an increase in the interest rate and shrinks the business activities. Robert Barro presented another analysis of government fiscal policy. The change in budget deficit may affect private savings based on rational expectations. An increase in budget deficit implies that I am going to have more taxes in the future, so I will start saving for the repayment of higher taxes. The Ricardian theorem claims that a budget deficit funded by tax cuts and bond deals will in future be viewed as tax liabilities to benefit from and withdraw debt obligations. This debt is not part of overall assets as individuals see a rise in the present value of their taxes that only counterbalances deficit spending. The economic agents who want to maximize

their next generation welfare would increase savings instead of consumption in anticipation of future tax Barro (1989).

Chapter three of the thesis discusses methodology and model specification for the estimation of twin deficit hypothesis and Ricardian hypothesis. The study applies unit root (ADF and PP) to check stationarity and non-stationarity of the variables. We also employed Zivot and Andrews (1992) one break test in two countries because in those two counters we find a series of structural break (China and Russia). The ARDL strategy offers both short-run and long-run relationships in a single equation with a different integration order. The long-run estimate of the results is based on the autoregressive distribution lag approach to boundary testing. However, for India, we applied Johansens method and VECM methodology because all the variables became I(1) after differencing. After ARDL model, Granger (1969, p. 430) causality test was employed which 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. Based, on the Granger causality outcomes, it is basic to observe that there are confinements in Granger causality tests, particularly for policymaking purposes. Finally, we apply generalize response functions (GIR) which investigates the time impacts of a one-time shock to every factor.

The thesis includes separate chapters (four to eight) for each country (Brazil, Russia, India, China and South Africa) which include the introduction, econometric model/methodology, findings and conclusion.

We first study the time series features of the variables using the ADF and PP test to check the stationarity among the variables for intercept and trend. The Improved Dickey-Fuller and Phillip-Perron test findings also identified several variables where stationary

thresholds and others were stationary until first separation for Brazil, Russia, China and South Africa. However, after the first variations, for India the entire sequence became stationary.

After checking the properties of the data, we began our model estimation. We first estimate the Bernheim (1987) consumption function to test Ricardian equivalence hypothesis for (Brazil, Russia, India, China and South-Africa). The results of the model are given below.

For Brazil, the tax coefficient (T) is negative and statistically positive, meaning that tax rises would have a negative effect on actual private spending, meaning that citizens are conscious of potential taxes implied in debt. The coefficient of BD is negative but statistically insignificant meaning there is no positive impact of budget deficit on private consumption. The ECM value (-.12) is negative, indicating long-term co-integration and rejection of Ricardian equivalence among the variables. The results are consistent with Kim and Ghatak and Ghatak (1996), Aschauer (1985) and Seater and Mariano (1985).

The tax revenue coefficient (TAX) is positive and statistically relevant for Russia, which means that decreases in the tax rate would lead to a rise in real private consumption. The coefficient of G and INT is positive and statistically significant meaning there is significant relationship among the variables. These results provide some evidences of Ricardian Equivalence prevailing in Russia. But, the coefficient of BD (-.30) is negative but insignificant, which means with the increase in budget deficit private consumption will decrease. The ECM value (-.32) is negative and important (.000), which indicates long-term co-integration between variables and acceptance of the Keynesian approach to absorption.

The findings for India show significant association between private consumption (PC), government spending and the budget deficit (BD). However, as suggested by the Keynesian model, we do not find short-run relationships between variables. The ECM value (-0.30) is small, which tests that the change speed is slow to achieve equilibrium. As suggested by Ricardian, this shift in the framework of government tax would not have any effect on real interest rates, savings or real interest rates. The results reveal the tax have no impact on private consumption both in short-run and long-run and accepts Ricardian hypothesis.

The findings reject the RE theorem for China on different grounds. Private usage (c) is integrated with revenue (Y), government spending (G), and taxes (T). Secondly, tax variables have a substantial correlation with (C). The findings of the situation (1.a) refute the hypothesis of RE under which we drop wealth (W) on the grounds that per capita income (Y) and wealth (Y) are the issue of multicollinearity (W). However, the findings suggest that the tax has a detrimental influence on per capita income. The crowding hypothesis that the results suggest an insignificant connection with private use is evaluated under condition (11).

However, the variable (r) is negative and the rise (r) would have a negative effect on private investment. The findings are consistent with (Khalid (1996), Siddiki (2010) and Himarios (1995)), the after-effects of the RE hypothesis are accurate.

The findings indicate that there is a substantial relationship between the budget deficit (BD) and private consumption in South Africa (PC). The variable tax is significant and coefficient is negative, meaning that with the increase in tax, private consumption will decrease (Tagkalakis, 2008). The overall findings indicate that fiscal policy has a greater

long-term effect on the real economy, even though households have cash constraints and are in line with the Keynesian model.

In the next stage we determine the long-term and short-term coefficient association between the factors, employing the ARDL bound test methodology and the cointegration process used by Johansen, after estimating the Ricardian equivalence hypothesis.

The empirical results for Brazil find long-term link between the variables. The results suggest that a 1% increase in the CAD will lift the CAD (-.068). Such findings are compatible with the Keynesian absorption analysis and the twin deficiency hypothesis method by Mundell Fleming (TDH). However, the Ricardian equivalence theory opposes the fact that since no association between the two; the co-integration between variables may be attributed to the monetary transmission and its interconnectivity among the variables.

The short-term structural relationship findings revealed that the budget deficit has a short-term association with other factors. Both factors are important with the exception of the first two lags of the CAD and the first lag in the rate of interest. The value of ECM is (-.62) significant and implies divergence from the budget deficit equilibrium is corrected by 66%.

For Russia, the results find significant long-run association among the variables. The coefficient of CAD -5.4715 is negative and significant; that is, with the rise in CAD, the budget deficit will have a negative effect because Russia is an oil and gas exporting country, there is a marginal contribution of oil and gas to the current account balance, and when oil prices decrease, it will have a significant impact on the current account balance, which will further affect the CAD. The F= 10.3198 statistics also indicate that the long-

run association among the variables. The adjustment speed is given by the error correction term (ECM); the negative value with P-value significance will converge rapidly towards equilibrium. The ECM value at 1 percent level is -.88812 negative and important, indicating that the model would hit the balance at a speed of 88%.

The findings indicate that the budget deficit should not be used as a replacement for monetary policy to preserve an internal balance 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 unsustainable fiscal balance is not due to the oil and gas reserves but the low revenue from these sectors which hampers the growth in Russia. Variables such as the actual effective exchange rate, tax and interest rate have a negative and important relationship with the BD, which means that a 1 percent rise in interest rate, tax, money supply and exchange rate would trigger a short-term increase in the BD of -.14430, -3.9083, -.84645 and -.22913. Inflation has a positive and critical relationship with the short-term BD. The findings accepts the Keynesian preposition and invalidate the Ricardian preposition that no connection exists between the BD and CAD.

The results for India suggest that both factors are co-integrated at 5% level in the long term. The results find long-run association among the variables based on Max and Trace statistics. The speed to equilibrium is slow; the whole system can return to equilibrium at a speed of 0.53. 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 outcome for China depends on the F = 9,439 statistics which is greater than the upper bound 3.99. The results suggest that the variables have a long-term association and that the invalid speculation of no cointegration is invalid. The findings of the bound test show that there is a direct correlation between the BD, CAD and other independent variables in the model. The findings also indicate an important short-term association between the five percent for all variables. This indicates that the CAD is being influenced greatly by a marginal change in the fiscal deficit, with the additional impacts on the current account deficit of most macroeconomic variables.

The negative (-0.95348) ECM coefficient and the high speed of adjustment brought equilibrium to the economy, with the exogenous shocks and endogenous shocks restoring it after a long period. The results reveal that a higher interest rate significantly affects the BD and CAD in both the short-run and long-run. Chinese banks are increasing interest rates on home loans that had previously been very low; however, it has turn to be an economic bubble, especially in the real estate market, which has created serious trouble in the economy. This, in turn, crowds out private investment.

The results for South-Africa accept the cointegration relationship between BD and CAD. These outcomes recommend twin deficit holds in South Africa in the long-run. The result implies that the budget deficit has a significant relationship with CAD and other variables. The coefficient of CAD is negative and significant meaning a 1% increase in CAD will increase budget deficit by -.49520 %. The budget deficit should not be used to replace monetary policy in order to preserve internal equilibrium, since when cyclic

variations in the domestic market is due global economy and stained financial development. The above results are based on the fact when BD and CAD are negatively associated. Variables such as the actual effective exchange rate and interest rate have a negative and important relationship with the budget deficit, meaning an interest rate rise of 1 percent and the exchange rate would increase the budget deficit by -.31927 and -.029803, which is consistent with the Keynesian preposition hypothesis. Inflation and money supply have positive and significant relationship with budget deficit in the short-run. The ECM_{t-1} is (-.93) significant and implies divergence from the budget deficit equilibrium is corrected by 93%. It also tells us that the adjustment process of the variables is very fast to reach the equilibrium. The findings are compatible with the Keynesian premises, invalidating the Ricardian assumption that the BD is unrelated to the CAD. The above findings are also derived by Ahmad and Aworinde (2015), Dornbusch (1997), Çatık et al. (2015), Goyal and Kumar (2018), Enders and Lee (1990) and Bernheim, B. D. (1987).

The study utilizes the Granger causality method to evaluate the association between cause and effect and check the causality between the variables. The results for Brazil illustrate the unidirectional sources of the current account deficit and revenue deficit. At 5%, the causality of the current-account gap to the fiscal deficit cannot be disputed. The conclusion accepts the traditional national accounting economic theory and is the same as Mukhtar et al., (2007). The increasing debt and budget deficit have increased ramifications on three main objectives: inflation, interest rate and exchange rate. Inflation was an effective tool for immediately rising economic costs, allowing households to mix old inflation with new agreements. The problem was triggered by the higher interest rate:

according to Mundell-open Fleming's economy model, higher interest rates deter domestic investment and foster foreign capital influx, triggering CAD.

The results for Russia suggest that the BD and CAD are bidirectionally causal and compatible with Miller and Russek (1989). This means that the rise in the BD triggers the CAD and that the increase of the CAD causes the BD. Fiscal policy tightening can help in decreasing the budget deficit, but on the other side it may decrease private consumption, reduce government expenditure, raise unemployment and decrease economic development in Russia. The decrease in oil prices and the dependency of Russia on energy revenue to raise budget revenue leads to rethink fiscal policy. 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, it would crowd out private investment, on the other hand, and shrink economic growth. The coefficient of the effective real exchange rate and supply of money has bidirectional causality with CAD and 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).

India's findings suggest that there is a bi-directional causality from CAD to BD and vice versa and the same results are mentioned by Banday and Aneja (2016) and Bhat & Sharma (2018). The results reveal the increase in tax rate will widen the BD and CAD and vice versa. 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 causing 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 current account deficit. 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 channels away from productive investments.

In view of the fact that the budget deficit causes Granger to the current account deficit and is consistent with the findings of the findings of China's results, reverse causality exists (See, Banday and Aneja (2019), Rosensweig and Tallman (1993) and Goyal and Kumar (2018). The results of Granger causality give us more evidences in support of the Keynesian proposition for China in the light of above data. The reverse causality was not apparent because Chinese economy is one of the most integrated economies with higher capital outflows, export-led growth and export promotion due to market liquidity and flexible governmental policies. A similar movement of the BD and the CAD is the thing that one would expect when there are cyclic shocks to output. Detailed empirical findings highlight that the interest rate bubble and higher inflated housing prices are becoming a challenge for the Chinese economy, as they are now nearing the prices of the US bubble before the financial crisis popped it. The findings also find that unidirectional causality shifts from the budget deficit to the interest rate, as government interest rate rises would be accompanied by current account deficit appreciation in the exchange rate. The results

are compatible with the Mundell-Flemings model. If the US increases interest rates, the money will flow out of the Chinese market, which could cause a similar crisis in China. It will be a challenge for the monetary authority to bring stability in China where inflation, interest rate bubble and exchange rate volatility are of primary concern. Expenditure reduction for low payback sectors, such as energy and communication, in the future, this could also be a problem. Due to a rise in domestic demand, increasing inflation will dramatically increase the inflow of money, which can lead to a current account deficit, as it is now more than half of the GDP. The indebtedness in the economy is at its peak, and this can crush the financial cycle and may cause financial crisis.

Finally, the South African findings show that there is bidirectional causality between the budget deficit and the South African current account deficit. 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. The demand for exports and productivity is not gaining momentum in South Africa. This leads to a devaluing exchange rate, especially in manufacturing 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. A difference in productivity between the world and South Africa makes capital goods more expensive for both consumers and industries based on exchange rate deprecating approach, which pushes them to import from the other countries which increase their current account deficit. A higher inflation can also cause current account deficit, this channel is derived from money supply, when the central bank increase money supply, the demand for goods and services increase which

gears up inflation and current account deficit. The results are consistent with Keynesian absorption approach.

Finally, we attempt 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 for the robustness and policy framework of the results.

The result of the impulse tends to be collaboration between budget deficit and current account deficit. If a shock is given to budget deficit and CAD increases in all the BRICS countries and vice versa. The effects of the impulse reaction function correspond to the cause and effect of Granger.

The interest rate has a detrimental effect on budget deficits in both nations, which implies that a spike in interest rate contributes to capital inflow and a real exchange rate appreciation that can inevitably contribute to CAD. The findings match the Mundell-Fleming model.

The money supplies have a negative impact on budget deficit in all the countries and at the same time inflation also have negative impact on inflation. There may be two channels as suggested by the Sargent and Wallace (1981) and Korsu (2009). First the causality is running from budget deficits to Inflation and then money supply to inflation.

The second one shows that expansion in the budget deficit will increase the money supply when the deficiencies are financed by methods for seigniorage. Expansion in the money supply increases the prices, and then exchange rate appreciation finally current account deficit.

9.3 Policy Recommendations

The results of the study have important policy suggestions in reducing the twin-deficit in BRICS countries. It is being observed that the stability in the current account deficit can help in controlling or managing the budget deficit in BRICS countries.

- The results provide us an insight that can be helpful in reducing the current account deficit and can aid to reduce the budget deficit. However, the BRICS countries depend upon the oil sector, agricultural sector, tourism, and others. Most of the services are exportable and can possibly contribute to foreign reserves which can bring stability to the exchange rate and reduces the current account deficit.
- The central banks of BRICS countries should come up with a policy that will reduce the interest rate and depreciates the exchange rate; this will help them to improve their trade balance.
- It is important to give incentives to small-medium enterprises (SME) in the form of tax credits for research and development. The policies should be made to boost foreign direct investment (FDI) in the major sectors by presenting different fiscal stimuli like tax rebates and corporate tax. These policies will improve the current account balance by encouraging export promotion.
- The production competitiveness should be focused from the perspective of cost and quality.
- The trade-in specialized sector should be focused like China has dominance in electronics and manufacturing, Indian and Brazil has dominance in agricultural

sectors and Russia has dominance in the oil sector, these policies will increase our foreign reserves and improves overall trade.

- The support of sound macroeconomic approaches that give impetuses through expansion away from oil and natural resources needs to be supported. The investment should be made in low-pay back sectors like agriculture, industries, and financial sectors.
- The effective functioning of free trade zones for boosting exports.
- Another approach suggestion is fiscal limitations. Despite the fact that it is more difficult than one might expect that the government should reduce their expenditure because all these countries especially Brazil, India, and South Africa development path depend upon government expenditure in infrastructure, roads, health, and poverty alleviation schemes. Moreover, government consumption ought to be spent on productive sectors or on those sectors which are expected to be gainful in near future, as the majority of these are white elephant projects which don't yield returns
- There is a need to boost growth by taking a number of measures: bringing down the cost of production; new technologies to boost agriculture output; new sources of energy resources such as solar, hydroelectricity, electric cars which will reduce the consumption of oil and reduce greenhouse gases, pullout structural bottleneck in growth, improvement in private investment and macroeconomic stability in the form of (Inflation, Exchange rate, and Interest rate) to improve current account balance and economic growth.

- In most of the BRICS countries the fiscal policy rule has shifted from short to medium term. The decline in debt ratio in BRICS countries has created space for policy makers to boost growth. But fiscal policy rule can lead a serious impact on macroeconomic stability through government policy by changing tax rates or government expenditure to boost economic growth. The increase in tax rates in most of the countries like Brazil, India and South-Africa has find it difficult to boost private consumption, investment, savings and economic growth. The first step of my analysis finds that there is a negative association between private consumption and taxes in both short-run and long-run in BRICS countries. The results find household does not behave in the Ricardian way, the results show that households anticipate higher/lower taxes, which will counterbalance thought lower/higher saving. While current fiscal policies with these results can be considered for policy debate in BRICS countries.
- In Brazil, monetary shock in the form of (Inflation and Exchange rate) has a significant impact on current account balance. It is vital important to control appreciation in exchange rate which causes current account deficit.
- In Russia 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 inflation and exchange rate control may be useful to control current account deficit and budget deficit in the long-run, but

also needs a stabilization program to bring pace in economic growth and stability in demand to counter unemployment.

- In India 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.
- In China the interest rate bubble and higher inflated housing prices are becoming a challenge for the Chinese economy, as they are now nearing the prices of the US bubble before the financial crisis popped it. It will be a challenge for the monetary authority to bring stability in China where inflation, interest rate bubble and exchange rate volatility are of primary concern. Expenditure reduction for low payback sectors, such as energy and communication, could also be a worry in the future.
- In South-Africa 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. The demand for exports and productivity is not gaining momentum in South Africa. This leads to a devaluing exchange rate, especially in manufacturing 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.

To sum up all the above policy measures for achieving internal and external stability the following polices should be considered.

I. Interest rate and exchange rate target approach;

II. Tax reforms;

III. Diversification in other sectors;

IV. Monetary approach for controlling Inflation and money supply;

V. Boosting production in special sectors;

VI. Technological and investment promotion in exporting sectors.

9.4 Limitations and Directions for Future Research

There is a great promise in this area as different countries or a different group of countries can be examined.

- Most of the studies in this area use time series data, as i have used for the BRICS countries. A more detailed and insight analysis is possible by using quarterly data for all the variables.
- The data constraints for some of the variables (like budget deficit and money supply) have been a serious problem for some of the BRICS countries (like Russia and China).
- The current limitations in the empirical analysis based on the structural break in the ARDL technique using dummy. The more advanced technique of cointegration method that can oblige numerous breaks, and a mix of the diagnostic system considered here.

- Regardless of the long-term and short-term research allowed by the ARDL system. Nevertheless, the dynamic connections between variables are evaluated utilizing modern techniques, such as structural vector auto regression (SVAR), Nonlinear Autoregressive Distributed Lag techniques (NARDL) and a dynamic stochastic general equilibrium model (DSGE). For this sort of analysis, the Global Integrated Monetary and Fiscal Model may be quite helpful.

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Twin deficit hypothesis and reverse causality: a case study of China

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ABSTRACT This paper analyses the causal relationship between budget deficit and current account deficit for the Chinese economy using time series data over the period of 1985–2016. We initially analyzed the theoretical framework obtained from the *Keynesian* spending equation and empirically test the hypothesis using autoregressive distributed lag (ARDL) bounds testing and the Zivot and Andrew (ZA) structural break for testing the twin deficits hypothesis. The results of ARDL bound testing approach gives evidence in support of long-run relationship among the variables, validating the Keynesian hypothesis for the Chinese economy. The result of Granger causality test accepts the twin deficit hypothesis. Our results suggest that the negative shock to the budget deficit reduces current account balance and positive shock to the budget deficit increases current account balance. However, higher effect growth shocks and extensive fluctuation in interest rate and exchange rate lead to divergence of the deficits. The interest rate and inflation stability should, therefore, be the target variable for policy makers.

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Introduction

Fiscal and monetary strategies, when executed lucidly, assume a conclusive part in general macroeconomic stability. The macroeconomic theory which assumes an ideal connection between budget (or fiscal) deficit and trade balance is known as twin deficit hypothesis. The growing literature on twin deficit hypothesis (TDH) has been theoretically and empirically researched by researchers like Kim and Roubini (2008), Darrat (1998), Miller and Russek (1989), Lau and Tang (2009), Abbas et al. (2011), Bernheim and Bagwell (1988), Lee et al. (2008), Corestti and Muller (2006), Altintas and Taban (2011), and Banday and Aneja (2016).

A study by Tang and Lau (2011) found that a 1% increase in budget deficit causes 0.43% increase in current account deficit in the US from 1973 to 2008. After the currency crises and Asian financial crises, various countries simultaneously experienced budget deficit and current account deficit. Lau and Tang (2009) confirmed the twin deficits hypothesis for Cambodia based on cointegration and Granger causality testing. Banday and Aneja (2016) and Basu and Datta (2005) confirmed the twin deficits hypothesis for India by applying cointegration and Granger causality testing. Kulkarni and Erickson (2011) found that, in India and Pakistan trade deficit was driven by the budget deficit. Thomas Laubach (2003) found that for every one percentage increase in the deficit to GDP ratio, long-term interest rates increase by roughly 25 basis points. The recent study by Engen and Hubbard (2004) found that when debt increased by 1% of GDP, interest rate would go up by two basis points. China needs to take care of lower interest rate rather than higher interest rate especially on home loans which is very low in real estate market and has created a serious trouble in the economy.

The literature identifies that the FDI "crowding in effect" as an important source of China's current account surpluses. In fact, the World Developmental Report (1985) demonstrated that a country can promote growth using FDI and technology transfers. China employed such strategies to a remarkable effect on foreign exchange reserves which increased from US$ 155 billion in 1999 to US$ 3.8 trillion by the end of 2013. Since then, there has been a sharp decline in the capital account surplus. The data from the State Administration of Foreign Exchange (SAFE) showed that in 2015, China recorded a deficit of US$142.4 billion on the capital and financial account. However, it posted a current account surplus of US$ 330.6 billion.

However, majority of the countries are facing both budget deficit and current account deficit. The increasing budget deficit alongside with current account deficit has been an imperative issue for policy makers in China. Besides, given the importance on free trade, decentralization and development there is a need to understand the association between budget deficit and trade imbalance in Chinese economy. Few researchers like Burney et al. (1992), Banday and Aneja (2015), Lau and Tang (2009), Corsetti and Müller (2006) and Ghatak and Ghatak (1996) have emphasized the issue emerged because of growing budget deficit and its relationship with macroeconomic factors likes interest rate, exchange rate, inflation, and consumption.

In the economic literature there are two distinct theories that show the linkage between budget deficit and current account deficit. The first theory is based on the traditional Keynesian approach, which postulates that current account deficit has a positive relationship with budget deficit. This means that an increase in budget deficit will lead to a current account deficit and a budget surplus will have a positive impact on the current account deficit. The increase in budget deficit will lead to domestic absorption and, thus, increase domestic income, which will lead to an increase in imports and widen the current account deficit. The twin deficits hypothesis is based on the Mundell-Fleming model (Fleming, 1962; Mundell, 1963), which asserts that an increase in budget deficit will cause an upward shift in interest rate and exchange rate. The increase in interest rates makes it attractive for foreign investors to invest in the domestic market. This increases the domestic demand and leads to an appreciation of the currency, which in turn causes imports to be cheaper and exports costlier. However, the appreciation of domestic currency will increase imports and lead to a current account deficit (Leachman and Francis, 2002; Salvatore, 2006). Conversely, the Ricardian Equivalence Hypothesis (REH) disagrees with the Keynesian approach. It states that, in a setting of an open economy, there is no correlation between the budget and current account deficits and hence the former would not cause the latter. In other words, a change in governmental tax structure will not have any impact on real interest rate, investments or consumption (Barro, 1989; and Neaime, 2008). The assumption here is that consumption patterns of consumers will be based on the life cycle model, formulated by Modigliani and Ando in 1957, which suggests that current consumption depends on the expected lifetime income, rather than on the current income as proposed by the Keynesian model. Furthermore, the permanent income hypothesis developed by Milton Friedman in 1957, states that private consumption will increase only with a permanent increase in income. This means that a temporary rise in income fueled by tax cuts or deficit-financed public spending will increase private savings rather than spending (Barro, 1989, p. 39; Hashemzadeh and Wilson, 2006). As private savings rise, the need for a foreign capital inflow declines. In this situation a current account deficit will not occur (Khalid and Guan, 1999, p. 390).

This paper attempts to find out how strong is the relationship between budget and current account deficits in China? Addressing this question is relevant for both policy and academic perspectives. Policymakers would like to know to what extent fiscal adjustment contributes to addressing external disequilibria, especially in the case of increasing external and fiscal imbalances. Secondly, we examined the effects of budget deficit on the current account in the multivariate framework, and also have derived the general relationship among those variables. The study is based on ARDL model to investigate twin deficit hypothesis for china both in short-run and long-run. Further, we analyze the direction of causality if such a relationship exists. We utilize econometric methods for example, ARDL bound testing approach and Granger causality test to achieve these goals. In section "Theoretical Background and Literature Review" we explore the theoretical foundation of the twin deficits hypothesis. Section "Macroeconomics Aspects of the Chinese Economy" will give Macroeconomics Aspects of the Chinese Economy. Section "Data and Empirical results" describes data and empirical results. Section "Results and Discussion" provides empirical results and section "Conclusions", provides conclusion to the study.

Theoretical background and literature review

The theoretical relationship between budget deficit and current account deficit can be represented by the national income accounting identity:

$$\left(S_p - I\right) + (IM - EX) = (G + TR - T) \quad (1)$$

where IM stand for imports, EX for exports, S_p for private savings, I for real investments, G for government expenditure, T for taxes, and TR for transfer payments. When IM is greater than EX, the country has current account deficit. From the right-hand side of the equation, when (G + TR − T) is greater than 0, the country is running a budget deficit. The difference between

budget deficit and current account deficit must equal the private savings and investments which are shown below.

$$\left(S_p - I\right) = (G + TR - T) - (IM - EX) \quad (2)$$

In the literature, various studies attempt to find the relationship between budget deficit and current account deficit for different countries or groups of countries using various methods depending upon the sample size and pre-testing of the data. The researchers have generally focused on the U.S economy because of its simultaneous budget and current account deficit since 1980s (Miller and Russek, 1989; Darrat, 1998; Tallman and Rosensweig, 1991; Bahmani-Oskooee, 1992). However, researchers from different countries have studied twin deficit hypothesis and obtained different results for different countries (Like India, U.S and Brazil) ((Bernheim, 1988; Holmes, 2011; Salvatore, 2006; Mukhtar et al. 2007; Kulkarni and Erickson, 2011; Banday and Aneja, 2016; Ganchev, 2010; Lau and Tang, 2009; Rosensweig and Tallman, 1993; Fidrmuc, 2002; Khalid and Guan, 1999)). These studies do not support the REH but rather accept the Keynesian traditional theory, finding that budget deficit does have an impact on current account deficit in the long run. There are studies that support the Ricardian equivalence theorem which denies any correlation between budget deficit and current account deficit (Feldstein, 1992; Abell, 1990; Kaufmann et al. 2002; Enders and Lee, 1990; Kim, 1995; Boucher, 1991; Nazier and Essam, 2012; Khalid, 1996; Modigliani and Sterling, 1986; Ratha, 2012; Kim and Roubini, 2008; Algieri, 2013; Rafiq, 2010). These contradictory results may be due to differences in the sample period and the methods of measuring variables, which use different econometric techniques.

Khalid (1996) researched 21 developing countries from the period of 1960–1988, taking three variables into consideration: real private consumption, real per capita gross domestic product (GDP) as a proxy of real disposable income and real per capita government consumption expenditure as a proxy of real public consumption. This was done using Johansen cointegration (1988) and full information maximum likelihood (FIML) for parameter estimates. The model gives us restricted and unrestricted parameter estimations when restricted parameters are used, meaning that parameter estimation is non-linear when testing the REH for the sample countries. The results did not reject the REH for twelve of the countries, but the remaining five countries do diverge from the REH. The rejection of Ricardian equivalence in the latter group of countries demonstrates lack of substitutability between government spending and private consumption. Ghatak and Ghatak (1996) studied variables such as private consumption, government expenditure, income, taxes, private wealth, government bonds, government deficits, investments, government spending and interest on bonds to test the Ricardian Equivalence hypothesis for India for the period from 1950 to 1986. The study employed multi-cointegration analysis and rational expectation estimation, and both the tests rejected the REH, finding evidence that tax cuts induce consumption. Thus, the results invalidate the REH for India.

Ganchev (2010) rejected the Ricardian equivalence theorem for the Bulgarian economy using monthly time series data for the period 2000–2010. The long-run results of the vector error correlation model (VECM) showed evidence of the structural gap theory, which states that fiscal deficit influences current account deficit. However, vector autoregression (VAR) results did not show any evidence of a short-run relationship between budget deficit and current account deficit. The study, therefore, found that fiscal policy should not be used, in the Bulgarian economy, as a substitute for monetary policies in maintaining the internal equilibrium.

Nazier and Essam (2012) studied the Egyptian economic data from 1992 to 2010. The data included five variables: GDP, government budget deficit (as primary deficit), current account deficit, real lending interest rate (RIR) and real exchange rate (RER). The study used structural vector autoregression (SVAR) analysis, which also gave an impulse response function (IRF) to capture the impact of budget deficit on current account deficit and real exchange rate. The findings support the twin divergence hypothesis. This contradicts the theoretical framework, which finds that a shock given to a budget deficit leads to an improvement in the current account deficit and exchange rate. Sobrino (2013) investigated the causality between budget deficit and current account deficit for the small open economy of Peru for the period 1980–2012 using the Granger causality and Wald tests, generalized variance decomposition and the generalized impulse-response function. The study found no evidence of a causal relationship between budget deficit and current account in the short run.

Goyal and Kumar (2018) investigates the connection between the current account and budget deficit, and the exchange rate, in a structural vector autoregression for India over the period 1996Q2 to 2015 Q4. The impact of oil stuns and the differential effect of consumption and venture propose compositional impacts and supply stuns rule the conduct of India's CAD, directing the total request channel. Ricardian hypothesis is not supported.

Afonso et al. (2018) studied 193 countries over the period of 1980–2016 using fixed effect model and system GMM model. The results find the existence of fiscal policy reduces the effect of budget deficit on current account deficit. When there is an absence of fiscal policy rule twin deficit hypothesis exists.

Bhat and Sharma (2018) examines the association between current account deficit and budget deficit for India over the period of 1970–1971 to 2015–2016 using ARDL model. The results accepts Keynesian proposition and rejects Ricardian equivalence theorem. The results find long-run relationship between current account deficit and budget deficit. Rajasekar and Deo (2016) find the long-run relationship and bidirectional causality between the two deficits in India. Garg and Prabheesh (2017) investigate the twin deficit for India by using ARDL model and confirm the twin deficit hypothesis. Badinger et al. (2017) investigated the role of fiscal rules in the relationship between fiscal and external balances for 73 countries over the period of 1985–2012. Their results confirm the twin deficits hypothesis. Litsios and Pilbeam (2017) investigates Greece, Portugal and Spain using ARDL model. The empirical results suggest negative relationship between saving and current account deficit in all three countries.

It is clear that the research so far has not yielded any concrete evidence regarding the causal relationship between budget deficit and current account deficit. As such there is a disagreement on the causality between the two deficits. In this paper we test the theory with the support of autoregressive distributed lag (ARDL) bounds testing approach using data for the emerging country China.

Macroeconomics aspects of the Chinese economy

The Chinese economy has experienced an unparalleled growth rate over the past few decades, with increases in exports, investments and free market reforms from 1979 and an annual GDP growth rate of 10%. The Chinese economy has emerged as the world's largest economy in terms of purchasing power parity, manufacturing and foreign exchange reserves.

In 2008, the global economic crisis badly affected the Chinese economy, resulting in a decline in exports, imports and foreign direct investments (FDI) inflow and millions of workers losing

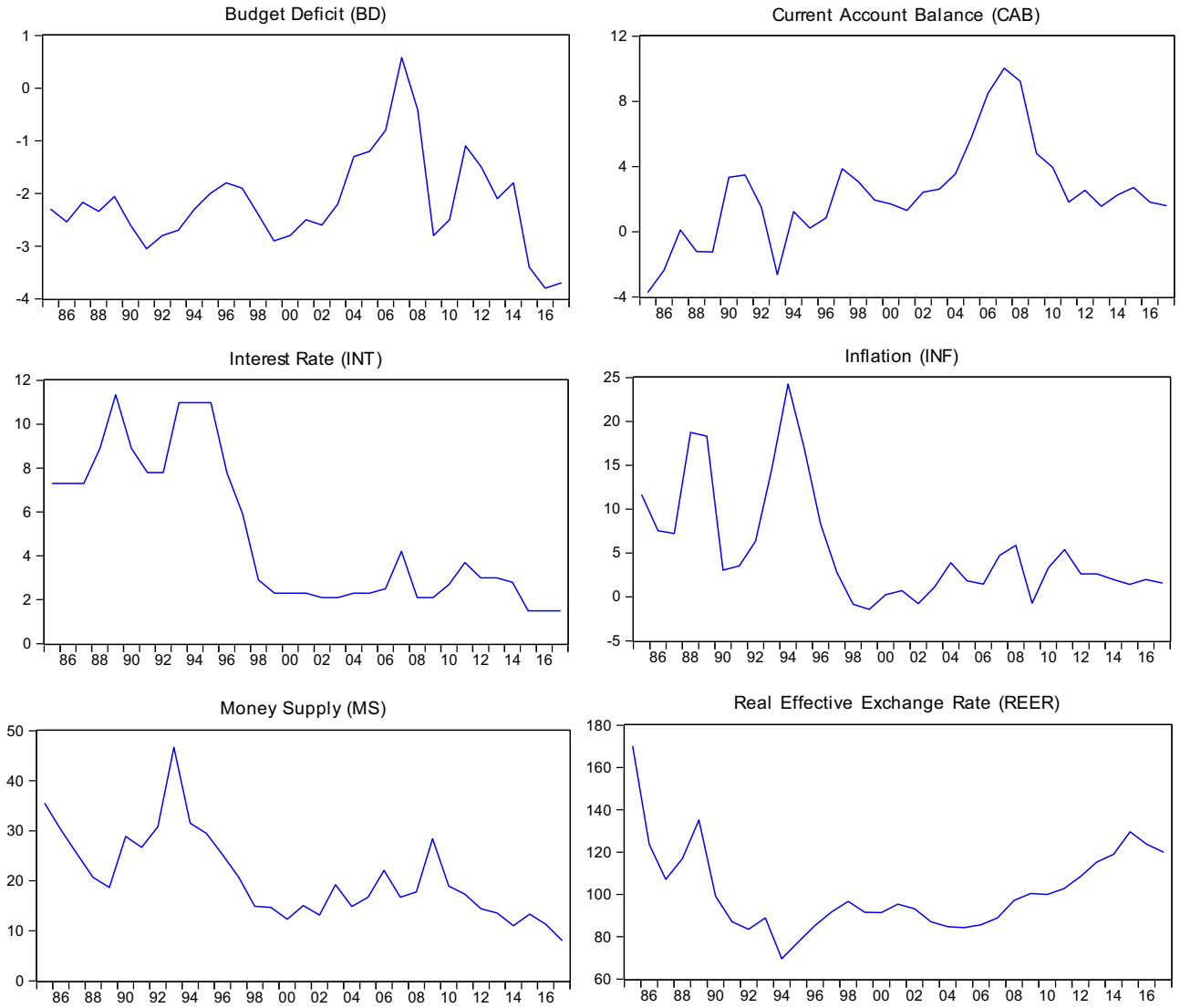

Fig. 1 Behavior of Macroeconomic variables. Overview of Budget Deficit (BD), Current Account Balance (CAB), Interest Rate (INT), Inflation (INF), Money Supply (MS) and Real effective Exchange Rate (REER) from 1985 to 2017. Source: Compiled based on data taken from the World Bank. BD and CAB are expressed as percentage of GDP

their jobs. It is visible from the Fig. 1 that China's current account surplus has dropped significantly from its boom during 2007–2008 financial crises. After the financial crisis, China's exports fell by 25.7% in February 2009. Further, the exclusive demand for Chinese goods in the international market pushed up current account surplus to 11% of the GDP in 2007, in a global economy (Schmidt and Heilmann, 2010). It is said that China responded to the 2008 crisis with a greater fiscal stimulus in terms of tax reduction, infrastructure and subsidies when compared to the Organization for Economic Co-operation and Development (OECD) countries (Herd et al., 2011; Morrison, 2011).

However, we draw an important inference from the Fig. 1, when the budget deficit was lowest (−0.41% of GDP in 2008), the current account surplus increased to 9.23% of the GDP. The negative shock to the budget deficit reduces current account surplus and positive shock to the budget deficit increases current account surplus.

The deprecation of the exchange rate is directly related to the elasticity of demand which improves the exports of the country and finally enhances current account surplus. However, the negative shift in the current account is due to structural and cyclical forces. The cyclic forces can be seen from the trade prospective: the increasing prices of Chinese imports like oil and semiconductors, pulls the current account balance downwards. However, the structural shift can be seen from the financial side, which affects Chinese saving and investments. The investments got reduced to 40% and household savings has reduced from 50% to 40% of GDP.

Data and empirical results

For undertaking the empirical analysis, we use the World Bank data for the following variables. The study covers the period from 1985–2016 and is based secondary data.

a. Current account deficit (CAD) indicates the value of goods, services and investments imported in comparison with exports on the basis of percentage of the GDP
b. Budget deficit (BD) indicates the financial health in which expenditure exceeds revenue as a percentage of the GDP

c. Deposit interest rate (DIR) as a proxy of interest rate (INT) the amount charged by lender to a borrower on the basis of percentage of principals
d. Inflation (INF) is measured on the basis of consumer price index which reflects annual percentage change in the cost of goods and services
e. Broad money (MS) a measure of the money supply that indicates the amount of liquidity in the economy. It includes currency, coins, institutional money market funds and other liquid assets based on annual growth rate and real effective exchange rate (REER)

Model. The basic model to find out the relationship among BD, CAD, INF, INT, REER, and MS is as follows:

$$\mathrm{CAD} = \mathrm{f}\,(\mathrm{BD},\ \mathrm{REER},\ \mathrm{INF},\ \mathrm{INT},\ \mathrm{MS}) \tag{3}$$

where INF is inflation and DIR is direct interest rate.

Based on Fig. 2 we will estimate the two models in which CAD and BD is dependent variables and others are independent variables which is as below:

To estimate the above models we have employed various econometric techniques to achieve the objective of the study are as below:

- Unit root test to check stationarity of the variables.
- ARDL bound testing for long-run and short-run relationship among the variables.
- Granger causality to check the causal relationship among the variables.

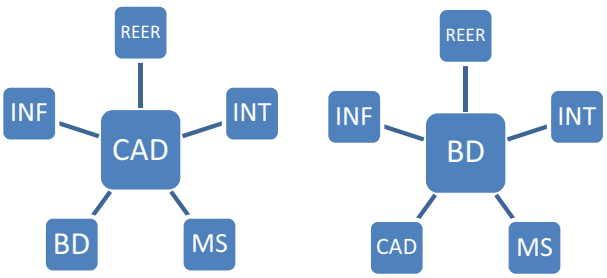

Fig. 2 Relationship of the dependent variables (CAD and BD) with other macroeconomic variables

Empirical results

Unit root test. As we are using time series data, it is important to check the properties of the data; otherwise, the results of non-stationary variables may be spurious (Granger and Newbold, 1974). To assess the integration and unit root among the variables, numerous unit root tests were performed. Apart from applying the unit root test with one structural break (Zivot and Andrews, 1992), we also employed a traditional Augmented Dickey-Fuller (ADF) unit root test (1981) and Phillips-Perron test (PP 1988).

To ascertain the order of integration, we first applied the ADF and PP unit root tests. The results of the unit root test suggest that the RER and INF series is integrated of order zero I(0), and other variables are integrated of order I(1). The Zivot and Andrews (ZA) unit root test begins with three models based on Perron (1989). The ZA model is as follows:

$$Y_t = \mu^{\mathrm{A}} + \theta^{\mathrm{A}}\mathrm{DU}_t(\lambda) + \beta_t^A + a^A Y_{t-1} + \sum\nolimits_{j=1}^{k} c_j^A \Delta Y_{t-j} + \varepsilon_t \tag{4}$$

$$Y_t = \mu^B + \beta_t^B + \gamma^B \mathrm{DT}_t(\lambda) + a^A Y_{t-1} + \sum\nolimits_{j=1}^{k} c_j^B \Delta Y_{t-j} + \varepsilon_t \tag{5}$$

$$Y_t = \mu^{\mathrm{C}} + \theta_t^{\mathrm{CDU}}(\lambda) + \beta_t^C + \gamma_t^{\mathrm{CDT}}(\lambda) + a^C Y_{t-1} + \sum\nolimits_{j=1}^{k} c_j^C \Delta Y_{t-j} + \varepsilon_t \tag{6}$$

From the above equations, $\mathrm{DU}_t(\lambda) = 1$, if $t > T\lambda$, 0 otherwise: $\mathrm{DT}_t(\lambda) = t - \mathrm{T}\lambda$ if $t > \mathrm{T}\lambda$, 0 otherwise. The null hypothesis for Eqs. 4–6 is $\alpha = 0$, which implies that (Yt) contains a unit root with drift and excludes any structural breakpoints. When $\alpha < 0$ it simply means that the series having trend-stationary process with a structural break that happens at an unknown point of time. DT_t is a dummy variable which implies that shift appears at time TB, where $\mathrm{DT}_t = 1$ and $\mathrm{DT}_t = t - \mathrm{TB}$ if $t > \mathrm{TB}$; 0 otherwise. The ZA test (1992) suggests that small sample size distribution can deviate, eventually forming asymptotic distribution. The results of the unit root tests are given below.

The first step in ascertaining the order of integration is to perform ADF and PP unit root tests. Table 1, above, provides the results of the ADF and PP tests, which suggest that four out of six variables are non-stationary at level and two variable is stationary at level. However, it is important to check the structural breaks and their implications, and the ADF and PP tests are unable to find the structural break in the data series. To avoid this obstacle, we applied a ZA (1992) test with one break, the results of which are given in Table 2. The structural break test reveals four breaks

Table 1 Augmented dickey fuller test (ADF) and Phillips-Perron (PP) test for unit

	ADF		PP	
	Intercept	**Intercept-trend**	**Intercept**	**Intercept-trend**
CAD(I_0)	−2.48615 (0.1214)	−2.45463 (0.3466)	−2.52978 (0.1184)	−2.5654 (0.2973)
CAD(I_1)	−5.1057 (0.0003)[a]	−5.07512 (0.0015)[a]	−5.165446 (0.0002)[a]	−5.3379 (0.0008)[a]
BD(I_0)	−1.98887 (0.2895)	−2.0139 (0.5669)	−2.51257 (0.1223)	−2.56240 (0.2986)
BD(I_1)	−3.70742 ((0.0098)[a]	−3.61588 (0.0472)	−7.02441 (0.0000)[a]	−7.6921 (0.0000)[a]
REER(I_0)	−4.06142 (0.0037)[a]	−4.07804 (0.0162)	−3.95265 (0.0049)[a]	−4.38008 (0.0080)[a]
REER(I_1)	−6.09864 (0.0000)[a]	−6.142736 (0.0001)[a]	−6.54687 (0.0000)[a]	−14.7227 (0.0000)[a]
MS(I_0)	−2.400962 (0.1497)	−2.963096 (0.1581)	−2.491013 (0.127)	−3.12720 (0.1179)
MS(I_1)	−6.748769 (0.000)[a]	−6.621696 (0.000)[a]	−6.826333 (0.000)[a]	−6.690086 (0.000)[a]
INF(I_0)	−3.039361 (0.0426)[a]	−4.143720 (0.0142)[a]	−2.25412 (0.1925)	−2.37494 (0.3845)
INF(I_1)	−4.936068 (0.0005)[a]	−4.92759 (0.0026)[a]	−7.70762 (0.000)[a]	−7.358584 (0.000)[a]
INT(I^0)	−0.96954 (0.751)	−1.99693 (0.580)	−1.03964 (0.726)	−2.16663 (0.4905)
INT(I^1)	−4.43685 (0.001)[a]	−4.36859 (0.008)[a]	−4.54219 (0.001)[a]	−4.31192 (0.009)[a]

Source: Computed by authors
Note: Critical value at the 1% significance level denoted by superscript 'a', with intercept and intercept-trend

Table 2 Zivot and Andrews (ZA) test for unit roots with one structural break

Variable	CAD	BD	REER	MS	INT	INF
Test-statistic (α)	−3.178	−2.548	−3.159	−3.076	−3.221	−4.923
Time of Breakdown	2008	2008	1992	1994	2003	2003
Lags (k)	0	2	2	0	0	0

Note: Structural breaks are based on breaks in trend; critical values are obtained from ZA (1992) with one structural break and an optimal lag structure by AIC

Table 3 ARDL model (2,0,2,3,0,1) dependent variable (BD)

Variables	Coefficient	*t*-value	Prob
BD(−1)	.52504	4.3020	.001
BD(−2)	−.47852	4.4321	.000
CAD	.13298	4.6230	.000
DIR	.22922	3.0986	.007
INT(−1)	−.14730	1.5119	.150
INT(`2)	−.38099	4.6848	.000
INF	.009286	.4124	.685
INF(−1)	.041560	1.6862	.111
INF(−2)	.057117	2.5665	.021
INF(−3)	.084059	3.5271	.003
MS	−.010333	.78506	.444
REER	.0013332	.18609	.855
REER(−1)	−.017791	2.1974	.043

Note: Lag selection is based on Schwarz Bayesian Criteria (SBC)

in Model A. The first, in 1992, may be due to inflation caused by privatization; the second, in 1994 may be due to higher inflation which caused the consumer price index to shot up by 27.5% and imposition of a 17% value-added tax on goods; the third, in 2003, may be due to a 48% decline in state owned enterprises at the same time as a reduction on trade barriers, tariffs and regulations was put in place and the banking system was reformed; the fourth, in 2008, is probably due to the global financial crisis

The ZA test with one structural break gives different results, as all six variables are non-stationary at a 1% level.

ARDL bounds testing approach. We applied the ARDL bounds testing approach to check the cointegration long-run relationship by comparing *F*-statistics against the critical values for the sample size from 1985 to 2016. The bounds testing framework has an advantage over the cointegration test developed by Pesaran et al. (2001), in that the bounds testing approach can be applied to variables when that have different orders of integration. Thus, it is inappropriate to apply a Johansen test of cointegration, and we applied ARDL bounds testing to determine the long-run and short-run relationships. The *F*-statistics are compared with the top and bottom critical values, and if the *F*-statistics are greater than the top critical values, it means there is a cointegrating relationship among the variables Table 3.

All values are calculated by using Microfit which defines bounds test critical values as "*k*" which denotes the number of non-deterministic regressors in the long-run relationship, while critical values are taken from Pesaran et al. (2001). The critical value changes as '*k*' changes. The null hypothesis of the ARDL bound test is Ho: no relationship. We accept the null hypothesis when *F* is less than the critical value for I(0) regressors and we reject null hypothesis when *F* is greater than critical value for I(1) regressors. For t-statistics we accept the null hypothesis when t is

Table 4 Cointegration test results

Calculated F-statistic	90% LB	90% UB	95% LB	95% UB
***F* = 9.439**	2.05	3.33	2.51	3.99

Note: When the *F*-value is greater than the lower and upper bounds value, we can say the variables are co-integrated

greater than the critical value and reject the null hypothesis when t is less than the critical value.

As seen in Table 4, the calculated *F*-statistic $F = 9.439$ is higher than the upper bound critical value 3.99 at the 5% level. The results over the period of 1985 to 2016 suggest that there is a long run relationship among the variables and the null-hypothesis of no cointegration is rejected meaning acceptance of traditional Keynesian approach for China. The bounds test results conclude that there is strong cointegration relationship among budget deficit, current account deficit, interest rate, exchange rate, inflation and money supply. Since the F-statistic was greater than the upper bound critical value, we performed a diagnostic testing based on auto-correlation, normality and heteroskedasticity, the results of which were insignificant based on the respective *P*-values. The Fig. 3 gives the results of CUSUM and CUSUMSQ tests which check the stability of the coefficient of the regression model. The CUSUM test is based on the sum of recursive residuals, and the CUSUMSQ test is based on the sum of the squared recursive residual. Both the graphs are stable, and the sum does not touch the red lines. Hence there were no issue of serial corelation, Heteroscedasticity and normaility in this model see Table 5.

Long-run and short-run relationship. After discovering the cointegrating relationship among the variables, it is important to determine the long-run and short-run relationships using the ARDL model.

$$\mathrm{BD}_i = \theta_0 + \sum_{i=1}^{q} \theta_{1i}\mathrm{CAD}_{t-i} + \sum_{i=1}^{q} \theta_{2i}\mathrm{BD}_{t-i} + \sum_{i=1}^{q} \theta_{3i}\mathrm{INF}_{t-i} + \sum_{i=1}^{q} \theta_{4i}\mathrm{REER}_{t-i} + \sum_{i=1}^{q} \theta_{5i}\mathrm{MS}_{t-i} + \sum_{i=1}^{q} \theta_{6i}\mathrm{INT}_{t-i} + u_t \quad (7)$$

$$\Delta\mathrm{BD}_i = \theta_0 + \theta_1\Delta\mathrm{ECM}_{t-1} + \sum_{i=1}^{q} \theta_{2i}\Delta\mathrm{CAD}_{t-i} + \sum_{i=1}^{q} \theta_{3i}\Delta\mathrm{BD}_{t-i} + \sum_{i=1}^{q} \theta_{4i}\Delta\mathrm{INF}_{t-i} + \sum_{i=1}^{q} \theta_{5i}\Delta\mathrm{REER}_{t-i} + \sum_{i=1}^{q} \theta_{6i}\Delta\mathrm{MS}_{t-i} + \sum_{i=1}^{q} \theta_{7i}\Delta\mathrm{INT}_{t-i} + u_{\mathrm{st}} \quad (8)$$

The above Eqs. 7, 8 of the ARDL model capture the short and long-run relationship among the variables. The model is based on Schwarz Bayesian Criteria (SBC) optimized over 20,000 replications. The lagged error correction term (ECM) is estimated from the ARDL model. The coefficient ECM_{t-1} should be negative and significant to yield the evidence of a long run relationship and speed of equilibrium (Banerjee et al. 1993). The results of Eqs. 7, 8 are provided in Table 6. The results find a strong long-run relationship among the variables for the period from 1985 to 2016.

At 5% level of significance the long-term estimates of the ARDL model find evidence of the twin deficits hypothesis for China, as all the variables are found to be significant at this level. Thus, our study upholds the empirical validity of the Keynesian proposition for China, while rejecting the Ricardian equivalence hypothesis.

The short-run results are significant; the coefficients of BD, CAD, INF, and INT are significant at a 5% level. This shows that a small change in the budget deficit has a significant impact on

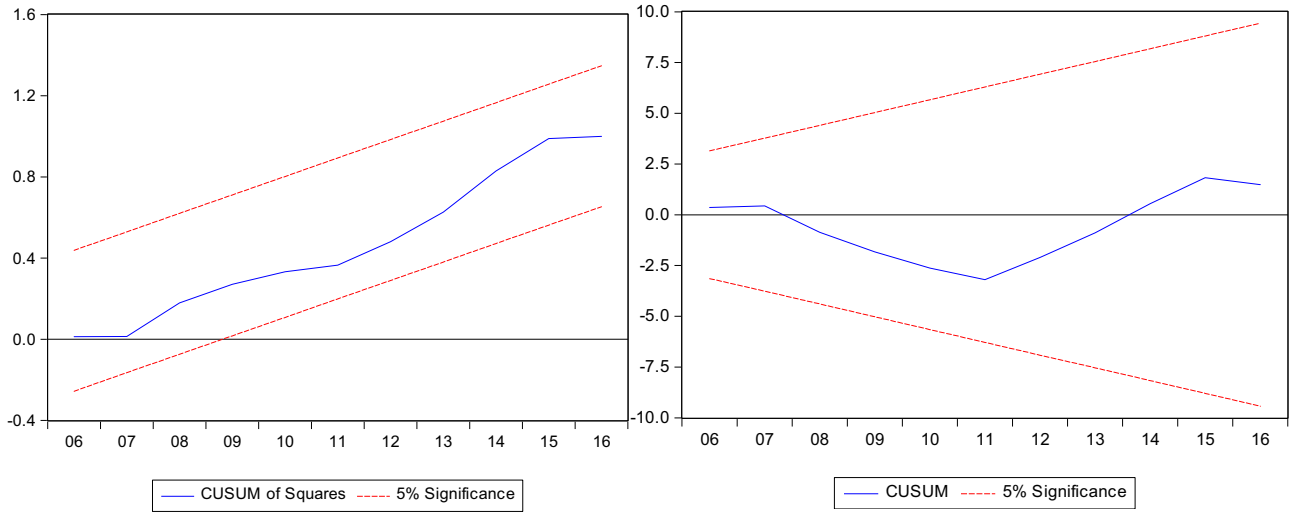

Fig. 3 CUSUM and CUSUMSQ stability tests. Plot of cumulative sum of recursive residuals and plot of cumulative sum of squares of recursive residuals

Table 5 Diagnostic testing

Test statistic	LM version	F version
(A) Serial correlation	.01999 (.964)	0.1034 (.975)
(B) Normality	.94082 (.625)	
(C) Heteroscedasticity	.58695 (.444)	.55776 (.462)

A: Based on Lagrange multiplier test of residual serial correlation
B: Based on a test of skewness and kurtosis of residual
C: Based on the regression of squared residuals on squared fitted values

Table 6 Long-run coefficient using ARDL model based on (2,0,2,3,0,1) dependent variable (ΔBD)

		Coefficient	*t*-statistic	Prob
ADJ(ECM)	BD(−1)	−0.95348	9.4018	0.000
Long Run	CAD	0.13946	4.905	0.000
	INT	−0.31366	2.924	0.010
	INF	0.20139	3.6196	0.002
	MS	−0.010837	.77795	0.448
	REER	−0.017262	9.9136	0.000
Short Run	ΔBD (−1)	0.47852	4.432	0.000
Short Run	ΔCAD	0.13298	4.6230	0.000
Short Run	ΔINT	0.22922	3.0986	0.006
	ΔINT(−1)	0.38099	4.6848	0.000
Short Run	ΔINF	0.00928	−0.4125	0.685
	ΔINF(−1)	−0.14118	4.2123	0.000
	ΔINF(−2)	−0.084059	3.5271	0.002
Short Run	ΔMS	−0.010333	0.7850	0.442
Short Run	ΔREER	0.001332	0.1860	0.854

R-squared = 0 .8326 *F*-Stat = 16.815 (.000) DW Stat = 1.9049
Note: The table reports the ECM value to be −0.95348 negative and statistically significant. The results ensure there is convergence among the BD, CAD, INT, INF, MS, and REER, meaningthere is significant long-run relationship

the current account deficit; similarly most of the macroeconomic variableshave a significant impact on the current account deficit. As we found evidence of a long-run relationship, we calculated the lagged ECM from the long-run equations. The negative (−0.95348) ECM coefficient and the high speed of adjustment brought equilibrium to the economy, with the exogenous shocks and endogenous shocks restoring it after a long period.

The Chinese economy is one of the most integrated economies in the world and has emerged as a powerful actor in the global economy. The pace of growth in china's economy has accelerated since the decades in which there was a higher export promotion due to market liquidity and flexible governmental policies. In the early 1990s, it was reported in the Chinese print media that although the Chinese economy was expanding rapidly, the deficits still existed. These were called 'hard deficits' primarily because they were financed by expanding money supply and hence exerted inflationary pressure on the economy (People's Daily, March 28, 1993). Deficit financing may also increase interest rates because once the monetary accommodation of the deficit is ruled out, the government has to incentivize consumers and firms to buy more government bonds. If the purchase of government bonds does not increase in direct proportion to the rise in deficit, government must borrow more money. This, in turn, crowds out private investment. Such a reduction in the private sector's demand for capital has been summarized by Douglas Holtz–Eakin, the director of the U.S Congressional Budget Office, as a "modestly negative" effect of the tax cut or budget deficits on long-term economic growth.

This study finds that a higher interest rate significantly affects the budget deficit and current account deficit in both the short-run and long-run. Chinese banks are increasing interest rates on home loans that had previously been very low; however, because of its economic bubble, especially in the real estate market, this is creating serious trouble in the economy. This is similar to the American bubble, in which most people were unable to repay loans, creating a financial crisis. Still, China must work within the existing bubble, even though it creates a lack of investments and can cause trouble for economies worldwide. The debt bubble is due to the elimination of loan quotas for banks in an attempt to increase small business. These companies are still struggling to repay that debt, which is almost half the amount of GDP of both private and public debt (The Economist, 2015).

While empirical research shows a statistically significant relationship between higher budget deficits and long-term interest rates, there are differences on the magnitude of the impact. Chinese needs to take care of lower interest rate rather than higher interest rate especially on home loans which was very low; in real estate market which has created a serious trouble in the economy.

It is also important to note that the concept of the deficit includes both hard and soft deficits. The "hard" part of the deficit, being financed by printing money, is inflationary. The "soft" part, being financed by the government's domestic and foreign debts, is

non-inflationary. However, they are not reported by the Chinese government.

Moreover, hard deficits and consequent inflation increases capital inflows (to prevent interest rates from rising) and causes current account deficit. In China, deficits occurred as a result of overestimating revenues or underestimating expenditures (Shen and Chen, 1981) and contributed to the development of bottlenecks in sectors such as energy, transportation, and communications sectors that are of vital importance for the long-term growth of China. However, given the reluctance of the non-government investors to venture into such low pay-back sectors, the Chinese government's policy to balance budgets by cutting its capital expenditure can severely restrict the development of these sectors (Luo, 1990, and Colm and Young, 1968).

However, the natural explanation for the external surplus is that the economy follows an export-driven growth model by increasing FDI inflows. In the rising tide of economies, China's demographic boom has created an economic miracle, allowing them to invest in education and skilled workers that will accordingly benefit the economy.

During the global financial crisis of 2008, the Chinese government combined active fiscal policy and loose monetary policy and introduced a stimulus package of $580 billion (around 20% of China's GDP) for 2009 and 2010. The package partially offset the drop-in exports and its effect on the economy, so that the economic growth of China remained well above international averages. During this period (2008–2009) the current account surplus, as a percentage of GDP was at its highest and the budget deficit was at its lowest point of the entire decade. Our findings suggest that a strong long-run and short-run relationship exists among the variables. The empirical findings support the Keynesian proposition for Chinese economy.

Granger causality

In this section we attempt to estimate the causality from X_t to Y_t and vice versa. We apply Granger causality to check the robustness of our results and to detect the nature of the causal relationship among the variables based on Eqs. 9, 10.

$$\Delta BD_t = \alpha_1 + \sum \beta_1 \Delta CAD_{t-i} + \sum \theta_1 \Delta INF_{t-i} + \sum \gamma_1 \Delta REER_{t-i} + \sum \delta_1 \Delta INT_{t-i} + \sum \lambda_1 \Delta MS_{t-i} + \varepsilon_t \quad (9)$$

$$\Delta CAD_t = \alpha_2 + \sum \beta_2 \Delta BD_{t-i} + \sum \theta_2 \Delta INF_{t-i} + \sum \gamma_2 \Delta REER_{t-i} + \sum \delta_2 \Delta INT_{t-i} + \sum \lambda_2 \Delta MS_{t-i} + \varepsilon_t \quad (10)$$

Table 7 describes the results of Granger causality test. The reverse causality holds in light of the fact that budget deficit cause Granger to the current account deficit. For all the variables, the reverse causality from budget deficit to macro variables and current account deficit to macro variables holds at 5% level of significance. Thus, the results of Granger causality gives us more evidences in support of the Keynesian proposition for China in the light of above data. The reverse causality was not apparent because Chinese economy is one of the most integrated economies with higher capital outflows, export-led growth and export promotion due to market liquidity and flexible governmental policies. While the capital inflow determines a tight fiscal policy to avoid overheating of economy (see author Castillo and Barco (2008) and Rossini et al. (2008).

Table 7 Granger causality

Equation	Chi2	Prob
BD to CAD	16.742	0.001
BD to RER	10.949	0.012
BD to INF	15.648	0.001
BD to INT	35.239	0.000
BD to MS	12.199	0.007
CAD to BD	13.795	0.003
CAD to RER	6.08	0.108
CAD to INF	15.636	0.001
CAD to INT	9.4748	0.024
CAD to MS	26.102	0.000

Note: Computed by authors

Results and discussion

The ambiguous verdict on the twin deficits hypothesis based on two competing theories: the Keynesian preposition and the Ricardian Equivalence theorem. In this paper we investigated the link between budget deficit and current account deficit with an emphasis on the impact of macro-variables shock on current account balance and budget deficit in the Chinese economy over the period 1985–2016.

The conclusion of this study is based on ARDL bound testing approach. The model is based on Schwarz Bayesian Criteria (SBC) optimized over 20,000 replications. With this data and analysis, we conclude that there is a long-run and short-run relationship among the variables. We accept the Keynesian hypothesis, which means we did not find evidence in support of the Ricardian Equivalence theorem in the Chinese economy. This was surprising because higher governmental expenditure and flexible governmental policies could have pushed up the current account deficit. We further applied Granger causality test the results concluded that there is a strong inverse causal relationship between budget deficit and current account deficit meaning that Keynesian preposition is more plausible than Ricardian Equivalence theorem in the light of above data. Our results are consistent with Banday and Aneja, (2019); Banday and Aneja, (2016); Ganchev, 2010; Bhat and Sharma (2018); Badinger et al. (2017), and Afonso et al. (2018).

The findings of the Granger causality test revealed that there exists bidirectional causality running from budget deficit to current account balance and vice versa in China. A similar movement of the budget deficit and the current account balance is the thing that one would expect when there are cyclic shocks to output. Detailed empirical findings highlight that the interest rate bubble and higher inflated housing prices are becoming a challenge for the Chinese economy, as they are now nearing the prices of the US bubble before the financial crisis popped it. If the US increases interest rates, the money will flow out of the Chinese market, which could cause a similar crisis in China. It will be a challenge for the monetary authority to bring stability in China where inflation, interest rate bubble and exchange rate volatility are of primary concern. Expenditure reduction for low payback sectors, such as energy and communication, could also be a worry in the future. Rising inflation can significantly increase the inflow of capital due to an increase in domestic demand; this can lead to a current account deficit, as it is now more than half of the GDP. The indebtedness in the economy is at its peak, and this can crush the financial cycle and cause financial crisis.

Conclusions

The cointegration investigation confirms the presence of a long-run relationship between the variables. The results propose that there is a positive connection between the current account deficit and fiscal deficit. Our outcomes show that increase in money supply and the devaluation of the exchange rate increases current account balance. The effects of the current account deficit and the

exchange rate have been taken as exogenous. A long-run stationary association between the fiscal deficit, current account deficit, interest rate, inflation, money supply, and the exchange rate has been found for China. Granger causality tests reveal bidirectional causality running from budget deficit to current account balance and macroeconomic variables to budget deficit and current account balance.

A genuine answer for the issue of budget deficit and current account deficit lies with a coherent package comprising of both fiscal and monetary approaches. It must concentrate on stable interest rate, inflation target and monetary position will supplement the budget-cut policies. The findings of the paper will be helpful for future empirical models, which attempt to further highlight the transmission mechanism.

Data availability

For undertaking the empirical analysis, we use the World Bank data for the following variables. The study covers the period from 1985 to 2016 and is based on secondary data which are available at: https://data.worldbank.org/country/china.

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Author contributions

UJB did the write-up and then analyzed the results. RA read the paper and made necessary corrections prior to submission. Both authors read and approved the final paper.

Additional information

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