DOUBLE TRILEMMA AND CENTRAL BANK BEHAVIOUR IN NIGERIA

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CERTIFICATION

We certify that this work was carried out by Taofeek Olusola AYINDE in the Department of Economics, University of Ibadan.

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DEDICATION

This doctoral thesis is dedicated to my past and present research teachers; who have been patient with my level of development and would never stop at making a better part of me. These teachers have continued to impact my world in unique ways and have made me see the world full of possibilities. To you all, this is just a lunch-pad to unleashing your bundles of ceaseless and untiring efforts on me. I will surely make you prouder, In Sha Allah.

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ABSTRACT

Free capital flows, stable foreign exchange rate and independent control of money supply by the Central Bank are necessary for a robust economy. However, a combination of any two of these policies is possible at a time and often referred to as macroeconomic trilemma. Export growth through increased credit to the private sector could counteract this trilemma. This could lead to financial trilemma which is constraint faced when combining financial stability, national financial policy and free capital flows. Both trilemmas become double trilemma. The Central Bank, therefore, behaves carefully and in a forward-looking manner to use its policy variable of exchange rate. The literature is extensive on macroeconomic trilemma but little attention is paid to financial trilemma. Hence, this study was designed to investigate double trilemma and central bank behaviour in Nigeria in the presence of political risk.

The study used an extended Mundell-Fleming Theory to examine how the Central Bank of Nigeria (CBN) stabilizes the exchange rate when faced with the double trilemma. Associated macroeconomic variables are real exchange rate policy (fixed and managed-float regimes), real gross domestic product, growth of broad money supply, net export, interest rate, consumer price index, growth of credit to the private sector and political risk variable (computed by the International Country Risk Guide). The statistical properties of the variables were examined using the Augmented Dickey Fuller, Ng-Perron, Kwiatkwoski-Phillips-Schmidt-Shin and Zivot-Andrew tests. The Markov Switching Dynamic Regression technique was employed to ascertain the number of regime switches and to further estimate the CBN behaviour when faced with the double trilemma. Also, the Structural Vector Autoregression technique was used to trace the shock transmission of the exchange rate policies of the CBN to the economy. The data were sourced from the CBN Statistical Bulletin, the International Country Risk Guide and the World Development Indicator. All estimates were validated at $\alpha \leq 0.05$.

The behaviour of the CBN was largely affected by shock from the political risk variable to the tune of 78.6%. Reduced political risk enhanced exchange rate appreciation in Nigeria; both with fixed $(z = -4.182)$ and managed-float regimes $(z = -0.159)$. Political risk increased the transition of switching between exchange rate regimes (2.2%) but reduced the degree of persistence of exchange rate regimes (9.8%). Under fixed exchange rate regime with political risk, economic growth $(z = -35.125)$, foreign interest rate $(z = -25.221)$ and credit to the private sector $(z = -12.704)$ resulted in exchange rate appreciation, while growth of money supply $(z = 20.148)$ and trade balance $(z = 0.00004)$ caused exchange rate depreciation. However, for fixed regime with no political risk, foreign interest rate insignificantly worsened exchange rate depreciation $(z = 0.635)$. For managed-float regimes with and without political risk, the variables were insignificant.

The stability of the exchange rate was found crucial for Nigeria as the Central Bank of Nigeria switches between fixed and managed-float exchange rate regimes in trying to manage the double trilemma. However, the monetary authority traded-off its independence in trying to do so. Sound macroeconomic policies, stable financial sector and low political risk are factors capable of moderating the Central Bank Behaviour in Nigeria.

Keywords: Double trilemma, Central bank behaviour, Markov switching dynamic regression, Political risk in Nigeria

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CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

The overall health of an economy is primarily determined by the extent to which it can achieve internal and external balance. The internal and external balance of an economy are usually captured by the attainment of such macroeconomic objectives as economic growth, price stability, full employment equilibrium, equitable distribution of resources and balance of payment equilibrium (Hall, 1968). It has been established in the literature that attaining these macroeconomic objectives conflicts and that achieving one objective has to do with trading off the other. As such, a unifying policy target to counteract this conflict needs to be vigorously pursued by policy makers (Blanchard and Johnson, 2013). Specifically, the interest rate affects price stability through the Fisher's effect (Fisher, 1930); economic growth through the saving-investment relation (McKinnon, 1973; Shaw, 1973); unemployment and inflation through the rational expectation hypothesis (Phelps, 1967; Muth, 1961) and equitable distribution of resources through the lending rate channel (Wicksell, 1936).

The independent determination of the domestic interest rate to realize optimum macroeconomic objectives therefore becomes a requirement of good macroeconomic management. However, the extent to which a central bank independently determines the domestic interest rate is constrained by the balance of payments position of the country. This is because the interest rate differential between the home and the referenced foreign economy is a determinant of cross-border capital flows and the exchange rate movement (Masih, 2005; Chinn, 2008). A positive interest rate differential would mean inflow of capital account transactions while a negative interest rate differential indicates outflow of capital account transactions. These affect the exchange rate movement and further lead to

balance of payment disequilibrium (Dooley, Folkert-Landau and Garber, 2013; Aizenman, Chinn and Ito, 2011). An unfavourable balance of payment would mean exchange rate depreciation while a favourable balance of payment implies exchange rate appreciation. Hence, monetary autonomy cannot be achieved without recourse to capital account transactions and exchange rate movement. As such, policy restriction becomes necessary.
One possibility is that the flow of capital account transactions is wholly or partly restricted while both monetary independence and exchange rate stability are combined (Gan, 2014; Obstfeld, Shambaugh and Taylor, 2002; Cozzi and Nissanke, 2009; An, Kim and You, 2016). Alternatively, monetary autonomy can be traded-off while both free flows of capital transactions and exchange rate stability are combined. In this case, monetary policy becomes endogenously determined (Goh and McNown, 2015; see Georgiadis and Mehl, 2015; Reade and Volz, 2011; Aizenman, Chinn and Ito, 2015). By implication, it suggests that these three policies cannot be combined together at the same time and the optimal policy is to combine any two of these two policies. It is this difficulty to simultaneously achieve these three policies of monetary autonomy, exchange rate stability and financial openness;as propounded by the duo of Mundell (1963) and Fleming (1962), that is known as the macroeconomic (or classical) trilemma.

Theoretically, however, macroeconomic trilemma can be resolved as a bargaining Nash solution under the condition that the world economies unanimously agree to consciously embark on a deliberate international policy coordination.[1]. But, the differences in the structure and policy goals of each economy coupled with the complexities of policy harmonization would not allow for the realization of this bargaining solution in practice.In effect, the extent to which the macroeconomic trilemma can be resolved is constrained by another trilemma, termed “financial policy trilemma”. Enunciated by Shoenmaker (2011), financial trilemma is the incompatibility of national responsibility for financial policy, international financial integration and financial stability. That is, it is the impossible combination of national financial policy, international financial integration and the attainment of financial stability in a domestic economy. Under a similar analogy for macroeconomic trilemma, only a binary combination of the three policies of financial

[1] See Frankel, 2016; Pikoulakis, 1995; Hallwood and MacDonald, 1996.

trilemma is possible at a time. It is the collections of these conflicting policy choices that capture the behaviour exhibited by the central bank when confronted with macroeconomic trilemma. This suggests that the concepts of macroeconomic trilemma and financial trilemma are nested together. Empirically, the macroeconomic trilemma is nested in the financial trilemma but a theoretical subset of the latter as both are anchored on the popular Mundell-Fleming framework. The latter is a limiting concept to providing a holistic policy mix by the monetary authority when confronted by the former. It is for this reason that Nakaso (2015) considered both as double trilemma confronting an economy.

1.2 Statement of Problem

The debate on the effect of financial globalization on monetary impulses and exchange rate regimes of an economy is mix in historical and empirical evidences. Historical periods are dichotomized into two. For most developing economies, the 1990s marked the period where all forms of controls were removed to pave way for capital mobility across economies owing to consensus among neoclassical economists that financial globalization is immaterial to domestic monetary policy (Yellen, 2006; Bernanke, 2007; Woodford, 2007). However, the occurrence of the global financial crisis of 2007 – 2009; with its attendant herd and contagion effects, intensified this debate and distorted the early evidence that domestic monetary policies were completely immune from the vagaries of global financial cycles (Georgiadis and Mehl, 2016; Rey, 2015; Obstfeld, 2015; Rey, 2013). The global financial cycle is the boom, bubble and bursts in the prices of global credits and financial assets; especially when transmitted through the interest rate channel. As a result, it is posited that for developing and emerging economies, there is a coincidence between the global financial cycle and global monetary policy shifts (Borio and Zhu, 2012; Bruno and Shin, 2013; Rey, 2013). Therefore, the extent to which the central bank alternates between various monetary policy regimes when confronted with macroeconomic and financial trilemma are at the centre of this debate.

In Nigeria, available data show that the Nigerian economy has been characterized by increasing interest rate regimes for the period 1970 – 2016. In 1970, the prime lending rate was 7.0 percent and this rate was consistently maintained till 1974. Up till 1981, a single

digit interest rate of 7.75 was maintained but since 1982, the economy has been on double digit interest rate hovering around 20.0 to 30.0 percent. At times where the domestic interest rate has exceeded the foreign interest rate, the outcomes have been increased net financial flows. This happened in the periods 1970 – 1974 and 2011 – 2015 with corresponding average net capital flows of ₦66.96Million and ₦11,946.175Million respectively. To complete the insights for macroeconomic trilemma, the domestic currency depreciated to ₦2.026 in 1986 and exchanged for ₦193.28 by the end of 2015. In order to draw implication(s) for financial stability[2], the growth rate of credit to the private sector will be employed as an indicator (Demirguc-Kunt and Detragiache, 1997; Kaminsky and Reinhart, 1999). For the period 1981 – 1985, growth rates of credit to the private sector was 11.4 percent; 21.2 percent between 1986 and 1990; 44.2 percent between 1991 – 1995; 24.4 percent between 1996 – 2000; 28.5 percent between 2000 – 2005; 43.3 percent between 2006 – 2010 and 13.5 percent between 2011 – 2015. Although, it is posited that, consequent upon high default rate, an excessive credit growth leads to instability in the financial sector but the threshold level remains an empirical question. It is expected that the accumulation of external reserves should afford the economy to maintain a middle-ground position of the trilemma constraint (Aizenman and Ito, 2012). A period of foreign reserve accumulation occurred in Nigeria only between 2003 and 2008. The foreign reserve increased correspondingly from US$10Million to US$50Million.

Also, it is believed that the central bank faces both ex-ante and ex-post constraints to its independence. The former, which is the ex-ante constraint, is such that the central bank board is usually appointed by the political authorities. Being appointed by the political officeholders suggests that the independence of the monetary authority can be compromised. In fact, Smaghi (2007) posited that legal provisions are only necessary but not sufficient conditions to ensuring the independence of central bank. This position is of greater concern for developing economies where it is said that poor institution still largely exists. As such, the autonomy of its monetary policy strategies would be less circumspect. It implies that the functional independence of the central bank cannot be ascertained if the

[2] See Minsky (1977); Crockett (1997) for an extensive review on the measures of financial stability

personal independence cannot be guaranteed; especially when monetary policies are used to achieve fiscal policy goals (Golomejic, 2011).

The latter; which is the ex-post constraint, is such that the central bank also plays the role of government's bank. With this, the central bank can be influenced to make some unpopular decisions to protect the interest of the government of the day, particularly to remain in office and even possibly embezzle public funds when providing interventions in certain capital projects or some special needs with the claim of fulfilling its avowed role of economic management. Also, the monetary authority can be compelled to embark on lowering the interest rate or even charge negative interest rate so as to obtain cheap or costless capital purely for political motives in the economy. In this vein, monetary policy becomes instrument of obtaining fiscal objectives either directly through imposition of inflation tax or indirectly, through a discriminate but favourable interest rate to government borrowings (Dooley and Isard, 1980; Bartolini and Drazen, 1997). It is this latter position that is known as the self-serving government view of financial repression enunciated in the writings of Alesina and Roubini (1992) and Nordhaus (1975).

Beckmann, Ademmer, Belke and Schweickert (2017)put it succinctly when they classified these ex-ante and ex-post constraints as the opportunistic business cycle and partisan business cycle theories, respectively. On the one hand, the authors defined opportunistic business cycle as the existence of a selfish government who would not hesitate to manipulate macroeconomic policies for political gains. Partisan business cycles, on the other hand, occur when the partisan preferences or the ideology of an incumbent impacts on macroeconomic policy decisions. However, the authors considered only the partisan preferences of the government as the political economy of trilemma constraint. The explanations provided was that opportunistic business cycle is not prevalent in developed economies for which the study focused on. In most developed economies, institutions have been found relatively sustainable that political forces cannot hold sway with impunity (Park, Buntaine and Buch, 2017). For a developing economy such as Nigeria, however, both the partisan preferences and the opportunistic business cycle views matter for the autonomy of the monetary authority. These two forms of political business cycles, which

are constituted into issues of institution, can delimit the potency of its monetary policy strategies.

Even though the Central Bank of Nigeria Act of 2007 seeks to set the monetary authority in Nigeria to be truly autonomous, the fact that the central bank governor and its board are being appointed by the executive indicates that it cannot be truly independent. In fact, Woo and Nasution (1989) posited that the monetary authority is usually compelled to support a non-market determined exchange rate regime in order to avoid a free fall of the domestic currency and score cheap political points.It is the collection of these issues that makes it imperative that this study investigate the role of institution in the behaviour exhibited by the central bank when confronted with the double trilemma.

1.3 Research Questions

Going by the statement of research problem, the appropriate questions that this study seeks to answer on completion are as follows:

i. Can macroeconomic trilemmabe empirically validated for the Nigerian economy?
ii. How do shocks through macroeconomic trilemma alter the conduct of the CBN in terms of financial trilemma being a limiting constraint?
iii. How has this regime-switching behaviour of the central bank in managing macroeconomic trilemma been constrained by shocks coming from financial trilemma?
iv. What role do institutions play in altering the behaviour of central bank of Nigeria in grappling with the double trilemma?

1.4 Objectives of the Study

The main objective of this study is to investigate the behaviour of the Central Bank of Nigeria in managing double trilemma. Specifically, the following sub-objectives will be pursued.

i. Test the validity ofmacroeconomic trilemma for the Nigerian economy.
ii. Estimate the shocktransmission of macroeconomic trilemma on Central Bank of Nigeriain terms of its regime-switching behaviour.

iii. Analyse how the regime-switching behaviour of the Central Bank of Nigeria in managing the macroeconomic trilemma is constrained by shocks occasioned by financial trilemma.

iv. Investigate the role of institutions in altering the behaviour of Central Bank of Nigeria to grapple with the macroeconomic and financial trilemma.

1.5 Justification for the Study

Prior investigation of the macroeconomic trilemma has been conducted with the use of the Mundell-Fleming (MF) framework as the basic theoretical anchor. This study extends the basic framework in order to investigate the double trilemma of macroeconomic and financial trilemma confronting the behaviour of the central bank. With this extension, this study seeks to investigate the role of the domestic interest rate as an endogenous variable in the classical (macroeconomic) trilemma which later turned exogenous in the transmission mechanism of the financial trilemma hypothesis. In addition, the basic MF framework does not consider the political factors as well as the institutional factors determining the exchange rate movement and cross-border capital transactions in an economy. This basic MF framework is modified to capture this institutional phenomenon as it pertains to a developing economy such as Nigeria.

Although, Beckmann et. al., (2017) appeared to have enriched the empirical literature with the political economy coverage of the impossible trinity; the study was a cross-country study where the peculiarities of the political components of each country have not been carefully addressed. Again, the study captured the political economy of the trilemma constraint as a form of partisan business cycles; distinct from opportunistic business cycle. However, this study incorporates both the opportunistic and partisan business cycles as it properly characterized institutional development in a developing economy such as Nigeria. Also, Chen et. al., (2017) analyzed the exchange rate dynamics within a Taylor's rule framework. However, the Taylor's rule is still a static framework which cannot fully explain the dynamic ex-ante and the discretional ex-post effects of the trilemma constraint on the strategy of the monetary authority. It is for this reason that this study employs, as a

robustness check, the Taylor's rule framework within the Markov Switching Dynamic Regression model.

In fact, this study contributes to the existing literature in four significant ways. Firstly, and theoretically, the study extends the basic Mundell-Fleming framework to investigate the double trilemma and also incorporate institutional factor; being an essential factor characterizing the behaviour of central bank in a developing economy such as Nigeria. This study is, thus, unique as it traces the political economy of the double trilemma facing an economy. Secondly and methodologically, the study underscores the regime switching behaviour of the central bank, and the pattern exhibited; consequent upon the impulses from the double trilemma. Thirdly, the study traces the transmission mechanism of both macroeconomic and financial trilemma; within the same framework, for empirical investigations. This sets this study apart from other existing studies which have either confused the two hypotheses together or have not being able to provide an empirical clarification. More so, this is unlike the use of indexes that has been commonly used in the empirical literature of macroeconomic (the classical) trilemma. Fourthly, the study accounts for the behaviour of central bank in the face of double trilemma confronting any type of economy; thereby accounting for the full global financial and economic dynamics in central bank strategies.

1.6 Scope of the Study

This study seeks to investigate the nexus between the trilemma hypothesis and central bank behaviour in a developing economy such as Nigeria; with a focus on the double trilemma. The double trilemma comprises both the macroeconomic trilemma and financial trilemma. The period of investigation spans 1981 – 2016. This period is found suitable because the structural adjustment programme was introduced in 1986 with many reforms, including a market determined exchange rate regime coupled with financial and interest rate liberalization policies. As such, the chosen period for empirical investigation is most appropriate to capture the various episodes of regime-switching behaviour of the central bank of Nigeria; consequent upon these policy reforms. It is important to note, however, that data availability for political risk factor is available till 2016 and extending the study

beyond this period could bias the estimated results obtained. Although, moving averages have been the common approach to obtaining few missing observations, data for political risk cannot be so obtained as power shift and significant changes in political activities occurred in Nigeria since 2016. This occurred after the political election that ushered in new government of a different political party in 2015. There was a shift to a different political ideologies and the political outlook changes significantly.

The data requirements for this study are high frequency data in quarterly form and it comprise the real exchange rate, real interest rate, real gross domestic product, credit to the private sector ratio of the gross domestic product, growth of money supply, consumer price index and the political risk variable. With these high frequency data, regime switching behaviour of the central bank, would be properly captured. The frequency of changes in the strategies of the central bank depends on its desire to achieve a set of macroeconomic objectives but the impending pressures from changes in these objectives are expected to alter the policy instrument of the monetary authority.

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

This chapter details some stylized facts, summary statistics and trends on the components of double trilemma. The essence for this is to appreciate the dynamics of various policy choices and highlights various episodes of economic and financial reforms in the country. As an important addition, the political economy of central bank behaviour was also discussed such that the degree and phases of political risk in the country were depicted. In addition, the extant literatures around the research topic were reviewed. It began with the review of conceptual literature which addresses the definitional issues. This was closely followed by the review of theoretical literature that details the theories of international financial integration and the theories of exchange rate management. Also, the theories of central bank behaviour coupled with the procedure of monetary policy were also reviewed. The review also captured the theoretical links between financial openness, exchange rate regimes and monetary policy. Going by the divergent positions around the triad policy of the trilemma index, necessitating different measures of the three components of the trilemma, various measurement issues were also examined within the context of the methodological literature.

2.1 Institutional Framework for Central Bank of Nigeria towards Double Trilemma

The Central Bank of Nigeria (CBN) is made up of twenty-eight (28) departments that are constituted into five (5) directorates in order to facilitate easy management and smooth operations of its avowed responsibilities. The directorates are the corporate services, economic policy, financial system stability, operations and the governor's directorates. With recourse to this structure, the institutional framework for managing monetary policy

in Nigeria is a committee-based and anchored primarily on the Monetary Policy Committee (MPC). The MPC is legally backed by the CBN Act of 2007. However, the MPC is expected to discharge itconstituted responsibility of formulating monetary and credit policyfor the CBN and reports directly to the President of the Federal Republic of Nigeria (FGN) (CBN, 2011). More so, the MPC is constituted into wide-ranging representation across the Bank and two-member representative from the government. This suggests that the functional independence as well as the behaviour of the monetary authority could be comprised due to possible political interference. In addition, other committees are constituted to further enhance the MPC in discharging its constituted responsibilities. These other committees are the Monetary Policy Technical Committee (MPTC), Monetary Policy Implementation Committee (MPIC), the Liquidity Assessment Group and the Fiscal Liquidity Assessment Committee (FLSC). The MPTC oversees the technical soundness of the monetary policy decisions reached by the MPC, the MPIC is to ensure appropriate policy tool and ascertains the adequate quantum of liquidity in the economy from time to time. The MPIC works in cooperation with the Liquidity Assessment Group. Finally, the FLSC is to ensure that there is policy harmonization between the monetary and fiscal policy. They are saddled with the responsibility of ensuring that there is no fiscal dominance in the system (CBN, 2011) as the monetary policy is expected to play a complementary role (and not to be subservient to one another) to the fiscal policy in achieving the desired macroeconomic objectives.

2.2 Overview of Financial Policies in Nigeria

Financial policy entails a broad spectrum of structural and financial reforms directed at the money, capital and the entire financial markets in order to achieve lower short- and medium-term interest rates. In the light of this, this sub-section provides various insights into structural and financial sector reforms in Nigeria since independence and draws the implications that these reforms have had on interest rate liberalization in the economy.

2.2.1 Stylized Facts on Financial Policies in the Money Market in Nigeria

Historically, a monetary policy framework; termed the minimum rediscount rate (MRR), was introduced in 1962 and by 2006, a new monetary policy framework, termed the

monetary policy rate (MPR) was introduced to replace the former one. The need to design a new framework became imperative due to the insensitivity of the former framework to the policy initiative of the monetary authority. With the new framework, the issue of financial instability; occasioned by excess liquidity problem, was put under control. More so, the new framework of MPR operates within upper and lower thresholds and posseses some degrees of freedom that seek to accommodate the CBN standing facility. It provides the direction for the dynamics of other interest rates in the economy (Agu, 2011). The new framework also hybridizes between the lending and deposit facilities at specified optimum rates. This stems interest rate volatility and stabilizes the market rates to an appreciable level.

It is instructive to note that the use of the MRR as a monetary policy framework in Nigeria intercepted two periods of direct and indirect monetary policies. Since independence when the MRR was effective up to 1992, the direct policies of selective credit and interest rate controls were in place (see Table 2.2). Since 1993 – 2005, however, the use of the open market operations; which ushered in the indirect policies was activated (see Table 2.1). The implication is that the old framework was operationalized alongside with the direct monetary policies for 30 years but just for 13 years with the indirect policies (see Figure 2.2). On the other hand, the new framework of MPR has been in operation since 2006 and has just been operational for 14 years. A fair stylized fact would consider these peculiarities.

Table 2.1: Nigeria's (Direct) NationalFinancial Policies in the Money market

Panel A: Direct National Financial Policies that affect the Money Market			
S/N	**Date**	**Policy**	**Details**
1.	1972 – 1982	Selective credit and interest rate controls	- Individual and aggregate ceilings - 75 – 79 percent of bank loans and advances. - Sectoral allocations to preferred sectors. - Bank deposit lending pegged at 30 percent. - Merchant banks also compelled to lend long term.
2.	August, 1987	Interest rate deregulation	- Fixed MRR to indicate the desired direction of interest rate changes. - To enhance market-based interest on loan
3.	1989	Moral Suasion and Money market liberalization	- Banks were encouraged to pay interest on current account deposits - Negotiated rates between banks and customers
4.	1990	Stabilization Control	- Use of stabilization securities to mop up banks' excess liquidity.
5.	1992	Unified and lowering of Reserve Requirements	- The essence was to increase credit to the private sector for investment opportunities.
6.	1992	Selective lifting of credit ceilings for healthy banks	- This was to reward effective banking operations.
7.	1993	Removal of credit control	- It was to improve investment in the economy.
8.	1994	Re-regulation of interest rate	- Interest rate was pegged and not allowed to move in relation to market forces.

Source: Ikhide (1996); Onoh and Eugene (2007).

Table 2.2: Nigeria's (Indirect) NationalFinancial Policies in the Money market

Panel B: Indirect National Financial Policies that affect the Money Market			
S/N	**Date**	**Policy**	**Details**
1.	1962	Minimum Rediscount Rate (MRR)	- It was the official market rate of monetary authority. - It gives direction to all other interest rate in the financial market. - It immediately affects the exchange rates and indirectly affects price level in the economy. - A rate to which the CBN rediscounted first class bill of exchange before maturity.
2	1992	Introduction of open market operations (OMO)	- Serves as open market for government securities - Replaced direct control of liquidity management
3.	2006	New monetary policy nominal anchor (MPR)	- This replaced the old framework of minimum rediscount rate which failed to give direction to other interest rates.

Source: Central Bank Annual Statement (2009)

The trend in Figure 2.1 examines the level of interest rate in Nigeria between 1970 and 2018. It is evident that MRR, as a monetary anchor, truly behaves erratic. This lends credence to the transition to a new framework, known as the MPR. However, the objective for which the MPR was established has been elusive since its establishment in 2006 until 2012 (six years after). How sustainable the interest rate would behave remains a question of time. As observed, the MPR reduced in 2015 to 11 percent from 13 percent in 2014. Since 2016, however, the rate of interest has stabilized at 14 percent.

Interestingly, there is no demarcation that can be drawn regarding the peculiarities of direct and indirect monetary policies. But noticeably, interest rate has been the lowest between two periods of 1970 – 1978 and 2008 – 2010. The period between 1981 and 1994 has recorded an increasing trend in interest rate in Nigeria. It was during this period that interest rate was highly regulated in Nigeria. According to the details in Table 2.1, stabilization control was launched in 1990. Also, unifying and lowering of reserve requirements which further resulted increase in the monetary anchor occurred in 1992. Interest rate deregulation occurred in 1987 but it was re-regulated in the year 1994. In tandem with the trend depicted in Figure 2.1, this showed that the switch to an indirect monetary policy immediately became effective as the rate of interest fell from 28 points in 1993 to 14 points in 1994. It further became stabilized at 14 points between 1994 and 1999. The effect of the new framework of MPR in lowering interest rate in Nigeria was more felt between 2002 and 2009. Interest rate sustainably reduced from 21 points in 2002 to less than 5 points in 2009. From the less than 5 points between 2009 and 2010, the interest rate increased sharply to 12 points in 2011.

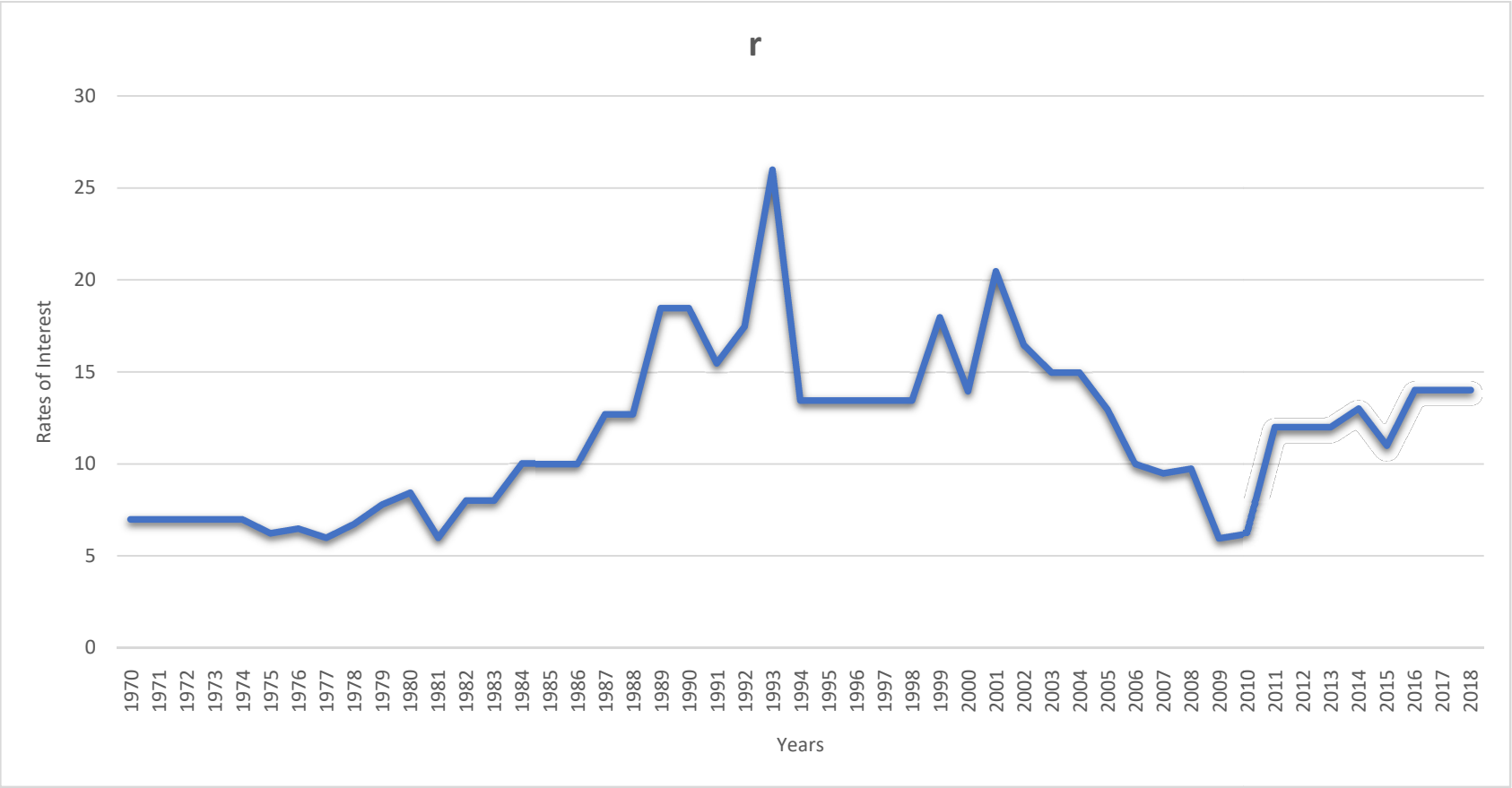

Figure 2.1: Interest Rate Movement in Nigeria: 1970 – 2018.

Source: Underlining data from CBN Statistical Bulletin (2018)

Apart from the use of monetary policy framework to alter the changes in interest rate in Nigeria, other policy strategies include the use of direct and indirect tools. The former policies include the use of selective interest rate control, interest rate deregulation cum re-regulation and money market liberalization. However, the indirect monetary policy strategies are anchored on open market operations (OMO). In Nigeria, the use of indirect monetary policy began in 1993 and consequently, the use of cash reserve ratio (CRR), liquidity ratio (LQR); among others are being employed by the central bank to control the quantity of money in the circulation through the commercial banks from time to time. As depicted in Figure 2.2, the overall implication is that these monetary policies have not being able to stabilize the interest rate in Nigeria. This suggests that the combined effects of indirect monetary policy and the new monetary policy framework of monetary policy rate (MPR) have produced a less important influence in lowering the rate of interest in Nigeria (Figure 2.2). However, the central bank of Nigeria has been strategic with its interest rate policies to forestall unfettered capital outflow consequent upon a lower interest rate (MPC Report, 2018). As such, interest rate has been stabilized at 14 percent since 2016.

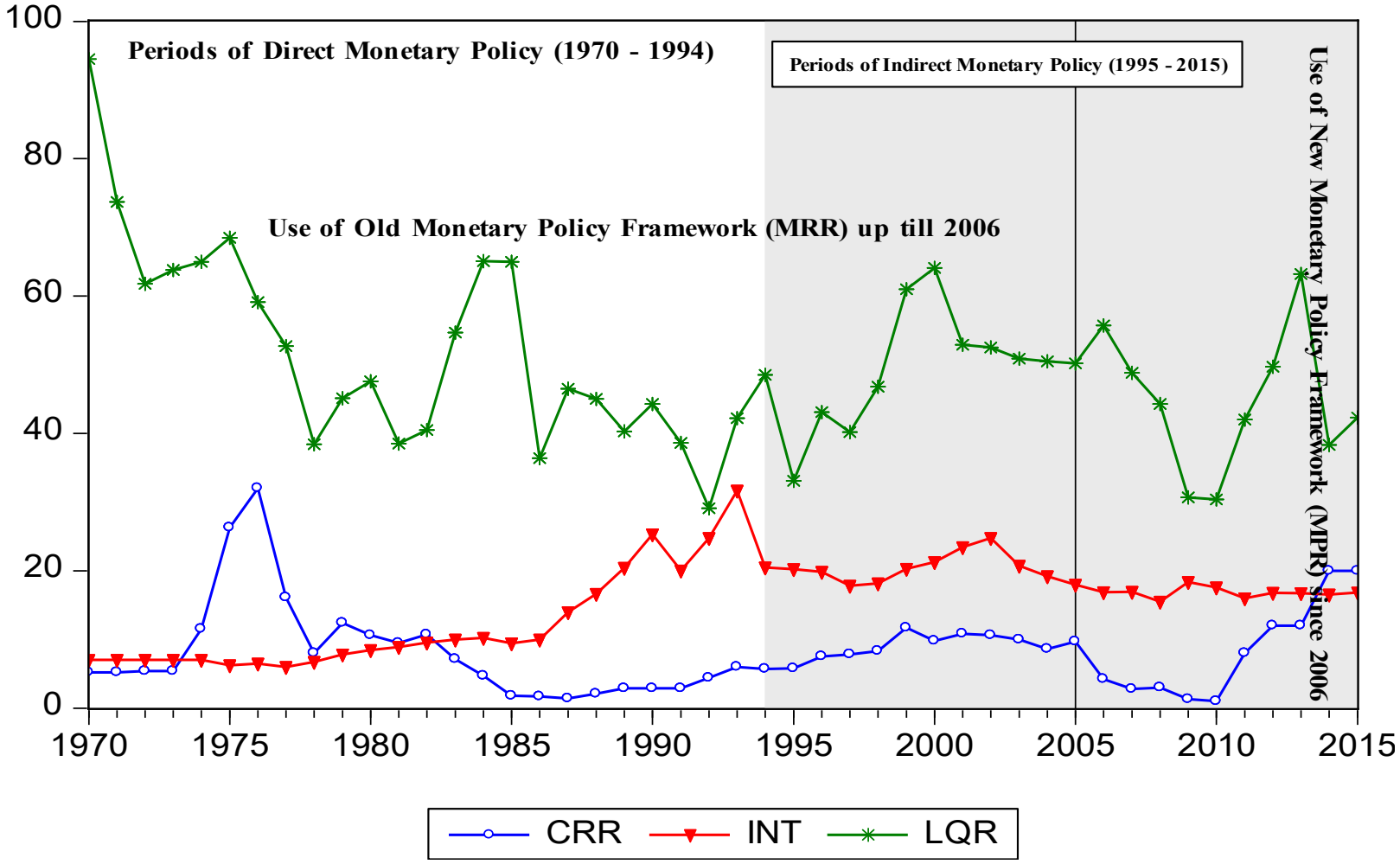

Figure 2.2: Trends on Nigeria's Financial Policies in the Money Market: 1970 – 2015.

Source: Underlining data from CBN Statistical Bulletin (2015)

As monetary anchors, the MRR and MPR are expected to provide directions for the other rate of interests in the economy. Specifically, the effects of these monetary policies on savings and loanable funds in Nigeria tend to diverge. Since 1996, the interest rate on savings has declined persistently. The interest rate on savings remained historically high for the period 1986 – 1995 (Figure 2.3). During this period, the monetary policy strategy is liberalization of the money market and it occurred at the final phase of the direct monetary policies in the country (Figure 2.2). These policies have no substantial effects on the movement of interest rate for loanable funds. More so, the maximum and prime lending rates have similar trends. It is expected that the maximum lending rates serve as the highest threshold at which loanable funds can be given to investors in the country while the prime lending rates are rates to which loanable funds are given to institutional investors who are into manufacturing and other allied products.

Expectedly, the prime lending rates are to be below the maximum lending rates since the latter is the rates to which loanable funds are offered to high-risk small investors. However, the reverse is the case in Nigeria. Specifically, since 1993, the prime lending rates has marginally toppled over the maximum lending rates and before 1993, both lending rates have not substantially diverged from each other. The implication is that there has not been serious peculiarity given to institutional investors in the country as this is capable of undermining productivity and manufacturing sector development in Nigeria. This coupled with a lowering saving rate since 1997 indicates that fund mobilization would be difficult and fund allocation by commercial banks have not be done to enhance productivity in the country. This has implications for financial openness in Nigeria as individuals would prefer to relocate their fund to high interest-yielding bonds and real investment would become difficult to achieve in the country. This would impact of triad policies of financial and macroeconomic trilemmas that would shape the behaviour of the monetary authority. In a nutshell, this has implication for the behaviour of the central bank as the monetary authority would find it difficult to mobilize funds for investment activities in the domestic economy.

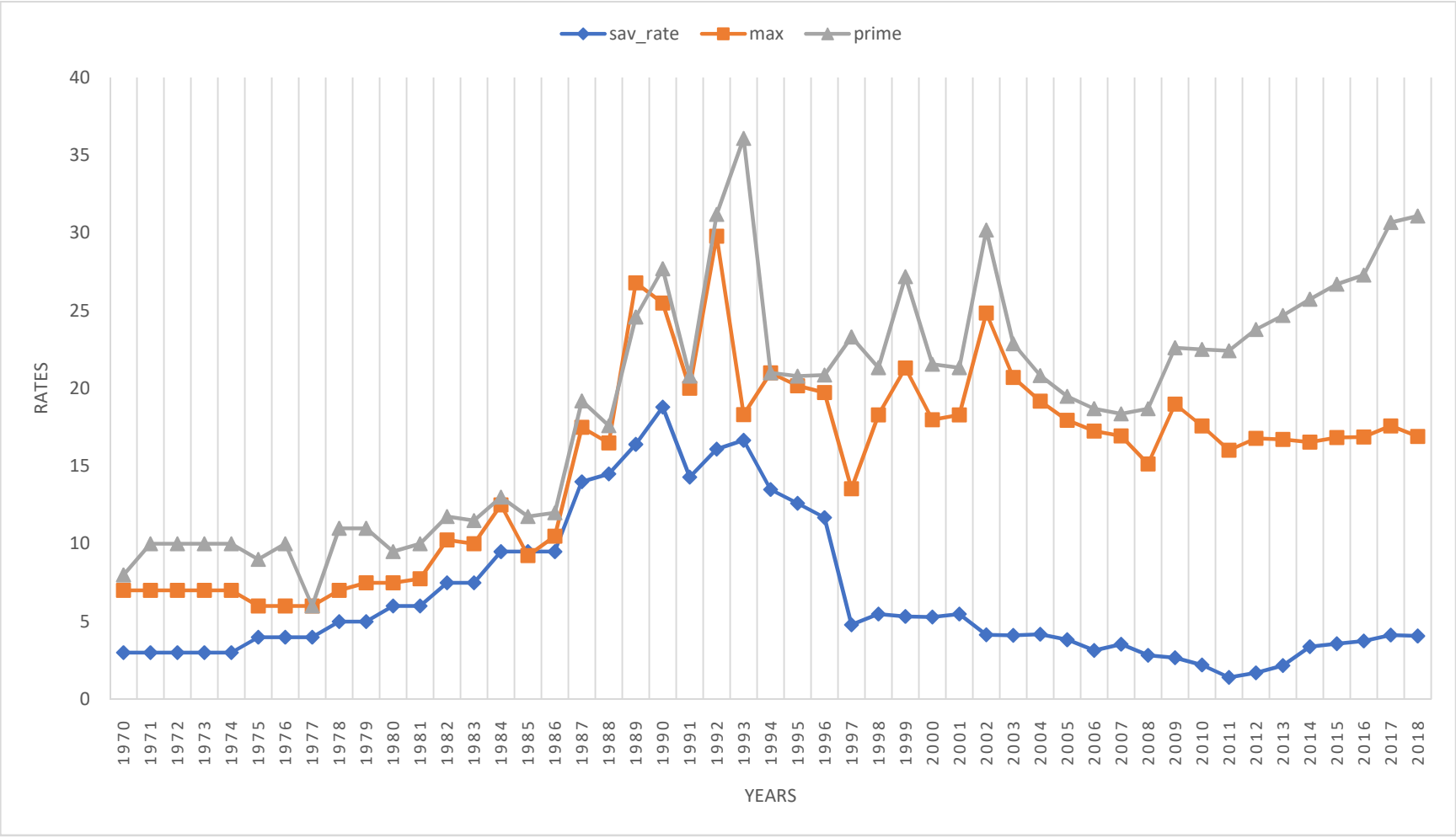

Figure 2.3: Trends on Interest Rates for Savings and Loanable Funds in Nigeria: 1970 – 2018.

Source: Underlining data from CBN Statistical Bulletin (2018)

2.2.2 Stylized facts of Financial Policies on Exchange Rate in Nigeria

The exchange rate regimes in Nigeria is characterized by three different regimes of fixed exchange rate system, market determined rates and managed-float system (Figure 2.4). The fixed exchange rate regimes comprise four different arrangements. The first was between 1960 – 1967 when there was fixed exchange rate parity between the Nigerian pound and the British pound. The Nigerian pound goes for one-to-one of the British pound during this period until the British pound was devalued in 1967. For the advent of civil war and the fear of possible damages of devaluation on the economy, the Nigerian pound was pegged to the American Dollar in 1967. This marked the beginning of the second phase of the foreign exchange rate regime in Nigeria. This regime was short-lived as the occurrence of international financial crisis in the 1970s forced the Nigeria dollar to maintain a fixed parity with the British pound; once again.

Consequent upon the effects of 'sympathy devaluation' of the Nigerian pound during this era and the need to hold a strong currency; the policy of single currency pegging was altogether abandoned in 1974. This led to the third stage of independent exchange rate policy where the authority was free to peg the domestic currency to any strong currency in the market and further pursue a policy of currency appreciation of the naira during the period 1974 - 1976. This was enhanced by the appreciable oil demands in the 1970s (see Ogiogio, 1996).

In furtherance of this, stage four of the fixed exchange rate regime, where the naira was pegged to an import-weighted basket of currencies, emanated between 1976 and 1985 (Figure 2.4). This was informed by the dwindling fortune of the economy and to further ensure the stability of the volatile Naira. The Naira was pegged to a basket of seven currencies such as the US dollar, the British pound sterling, the German mark, the French franc, the Dutch guilder, the Swiss franc and the Japanese Yen. As evident in Figure 2.4, the Naira stabilizes throughout these periods of fixed exchange rate regimes. The second regime was the era of market determined exchange rate policy which became effective in 1986 consequent upon the structural adjustment programme (SAP) of the government.

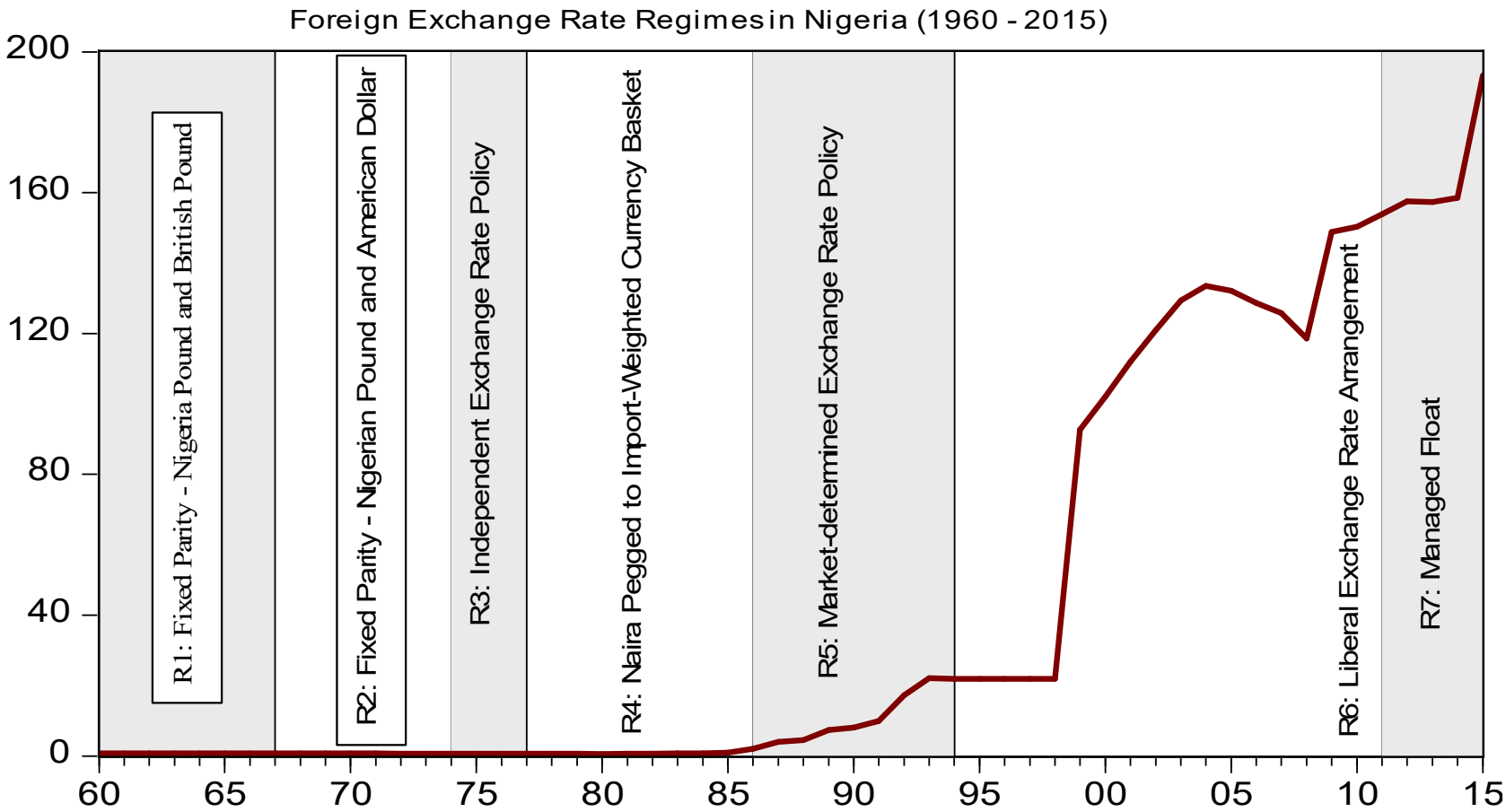

Figure 2.4: Nigeria's Financial Policies on Foreign Exchange.

Source: Underlining data from Central Bank of Nigeria Annual Statistical Bulletin (2015)

With this arrangement, the rate of domestic currency to foreign currency is purely determined by the market forces of demand for and supply of foreign currency. This era lasted till 1994 until further reforms of liberal exchange arrangement was undertaken in 1995 which led to the introduction of an autonomous foreign exchange market (AFEM) and the recognition of the Bureau De Change as an authorized buyers and sellers of foreign exchange to end-users in Nigeria. A further liberalization in October 1999 led to the introduction of the inter-bank foreign exchange market (IFEM), the Dutch Auction System (DAS) and the Wholesale Dutch Auction System (WDAS) in 2001 and 2006 respectively (Ogiogio, 1996).

The third exchange rate regime is the managed-float system effective from November 2011 where the domestic currency responds to market forces within a soft exchange rate band of ±3% in order to accommodate continued downward foreign exchange market pressure. However, Figure 2.4 shows that the domestic currency was only stable during the period of fixed exchange rate regime. Since 1986, however, the domestic currency has been unstable, and the movements brought about three episodes of shocks. In fact, the real exchange rate suggests that the purchasing power of the Naira is not competitive in reference to the US Dollar throughout the periods except for the period 2003 – 2007 (Figure 2.5). Since the exchange rate of the domestic currency in referenced to the US Dollar is not market-determined during this period, it could simply be described as an over-valuation of the domestic currency.

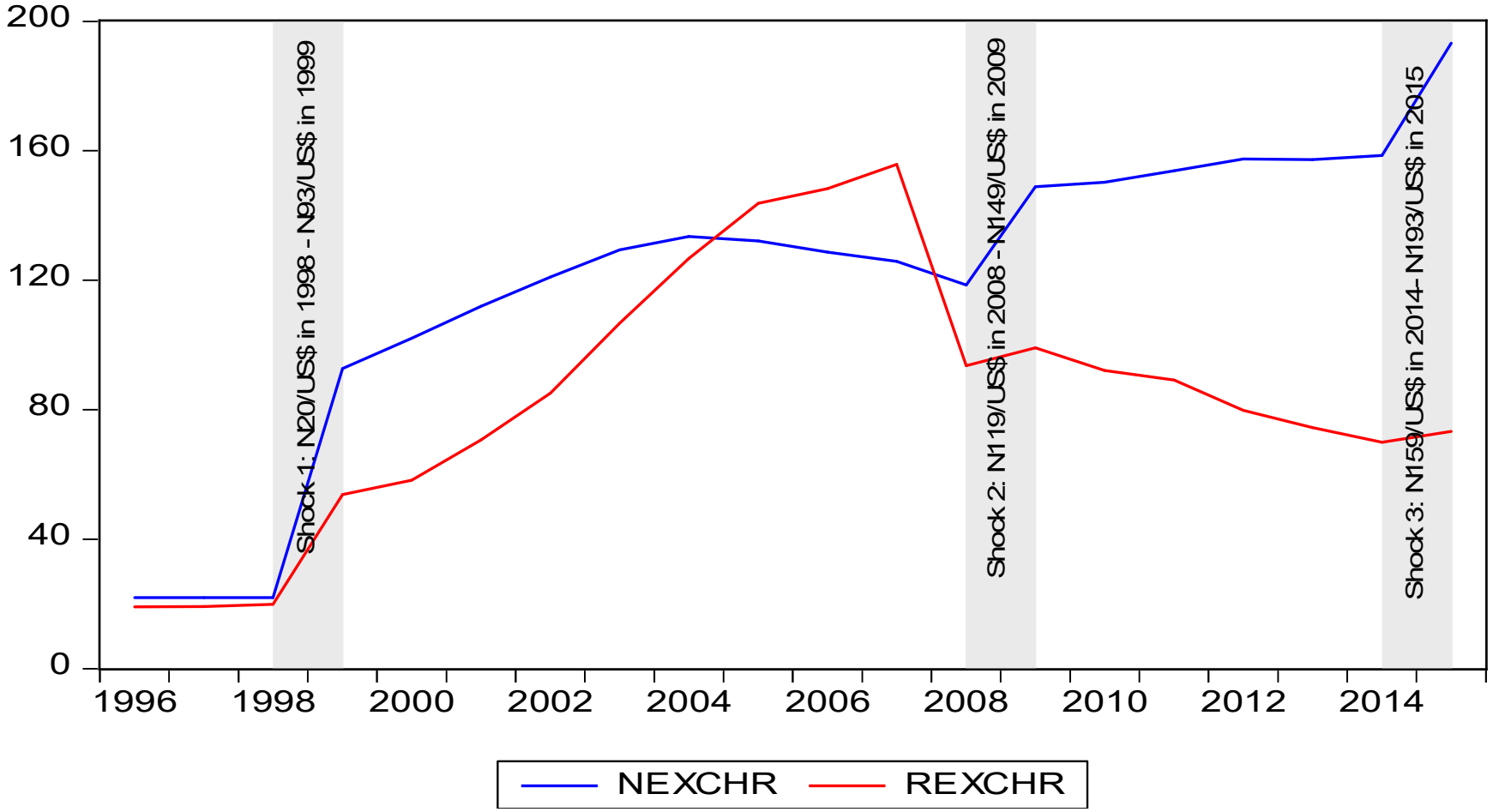

Figure 2.5: Purchasing Power Parity of Naira to US Dollar.

Source: Underlining data from Central Bank of Nigeria Annual Statistical Bulletin (2015)

2.2.3 Stylized facts of Financial Policies on Capital Market Transactions in Nigeria

The capital market is a financial market where the transactions for medium to long-term financial services are undertaken. There are generally two broad types of capital for long-term investment activities; debt capital and equity capital. Usually, firms prefer equity capital to debt capital due to its less leverage effects as firms are not obligated to pay dividend to equity holders while it is compelling for firms to pay interest on debt capital to financial service providers. In contrast, also, firms prefer debt capital to equity capital as it does not erode the ownership status of the equity holder. Therefore, it becomes imperative that a financing window, such as the capital market that serves as a conduit for demand and supply of debt and equity capital and serves as a linking pin between the surplus and the deficit units, is established. The capital market provides alternative channel in the economy to stimulate investment drives by offering investible funds from the surplus units to the deficit units. This is done through the issuance of bond, notes and shares; termed securities. It is expected that national financial policies that would make the capital market competing and substantial enough at stabilizing the domestic interest rate should be pursued.

In Nigeria, there is preponderance of national financial policies towards investment-driven capital market that has been undertaken. However, these policies are tied to the dynamics of interest rate in the money market coupled with the strategies taken to keep it low for investment activities. From the foregoing, it becomes evidently clear that national financial policies for capital market transactions are mainly those policies that directly affect the surplus units (such as the banking sector, pension administrators, etc.) coupled with those that facilitated equity financing of firms. Other policies could be termed institutional policies (such as automation, centralization of operation, electronic operations, corporate governance and financial reporting issues, etc.) that enhance the capital market as an investment window.

Figure 2.6 shows that since 1987, the volume of activities; in terms of units of capital traded, on the floor of the Nigerian stock exchange has been largely equity-based. This contrasts with the trends between the periods 1981 – 1986 where industrial loans were most prominent. The period 1999 – 2008 has been most indicative. This shows that the structural

adjustment programmes (SAP) introduced in 1986 has reformed the Nigerian capital market to become equity-capital-driven. The implication here is that most corporate entities in Nigeria would prefer equity sources of financing and would not bother about the extent at which ownership control could be eroded. More so, it indicates that there would be less cases of corporate take-over due to default in repayment of debt forms of capital and/or the interest due. However, the periods of global recession that spanned 2007 – 2010 and the stock market crash in Nigeria that began in 2015 that significantly affected the volume of transactions on the floor of the stock exchange market; including the volume of traded equity capital.

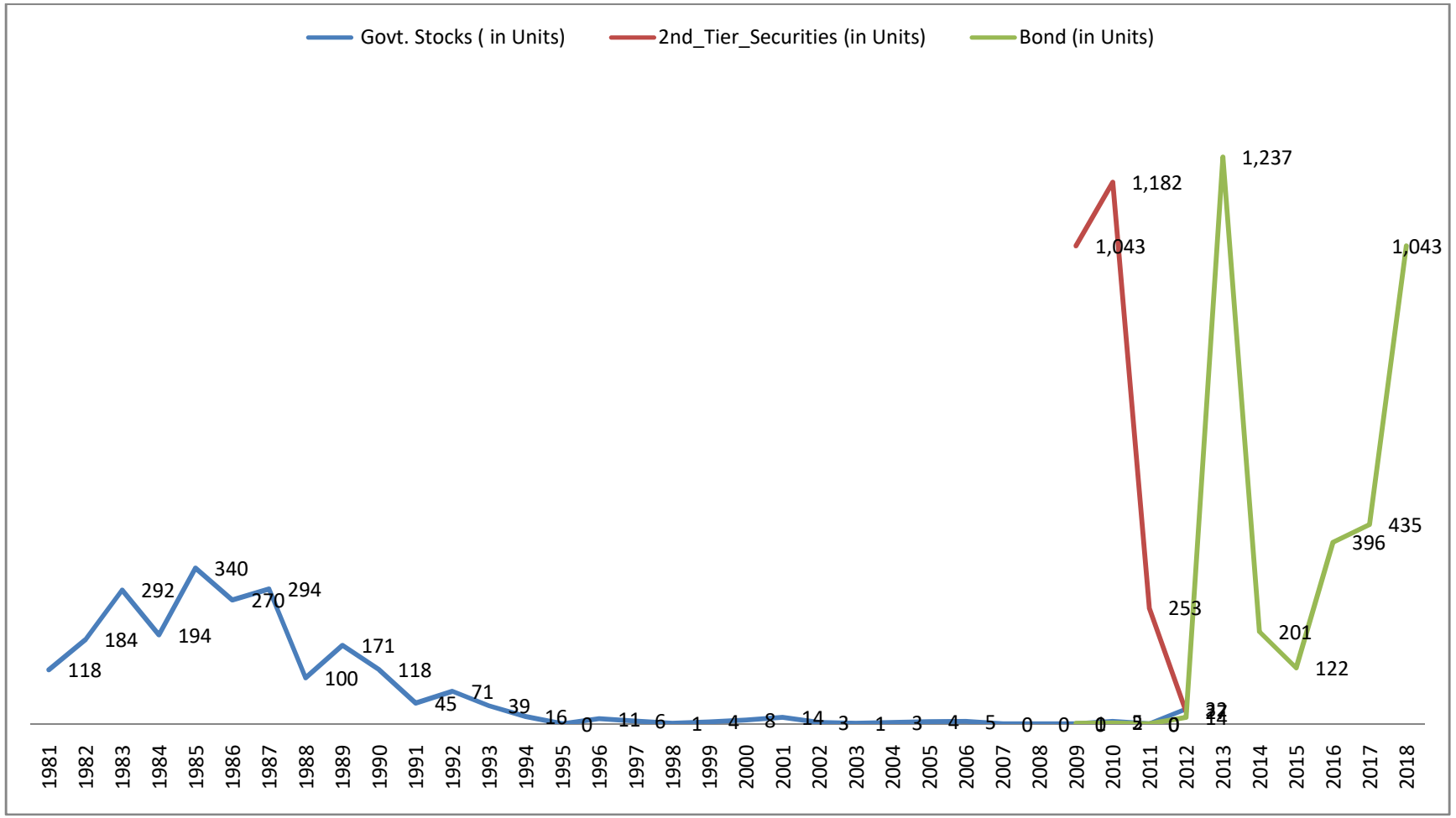

Figure 2.6a: Transactions (in Volume) at the Nigerian Stock Exchange (1981 – 2018).
Source: Underlining data from Central Bank of Nigeria Annual Statistical Bulletin (2018)

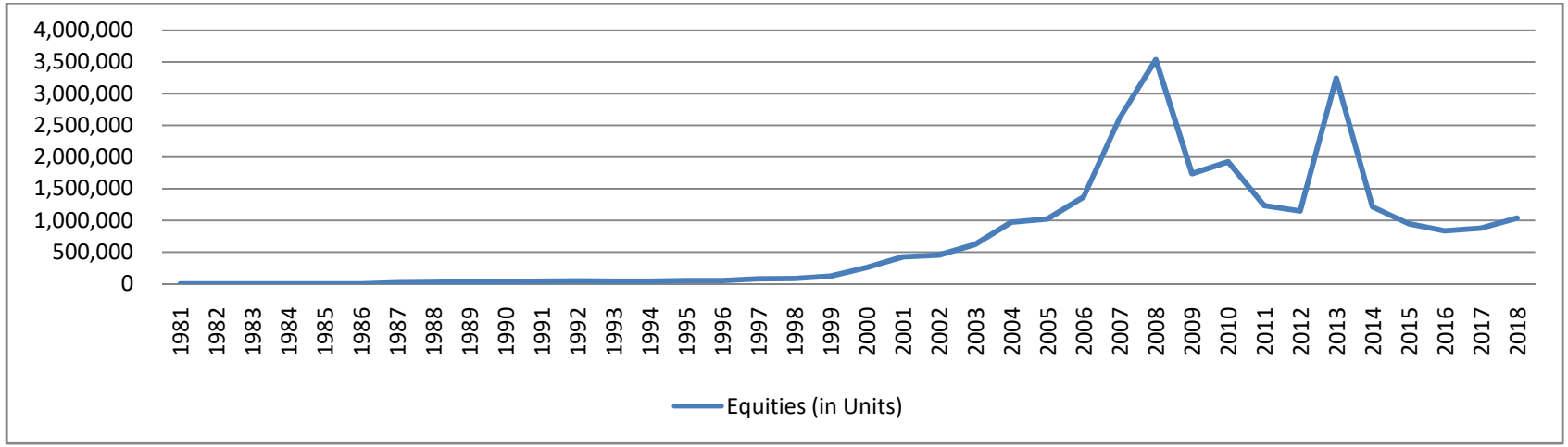

Figure 2.6b: Transactions (in Volume) at the Nigerian Stock Exchange (1981 – 2018).
Source: Underlining data from Central Bank of Nigeria Annual Statistical Bulletin (2018)

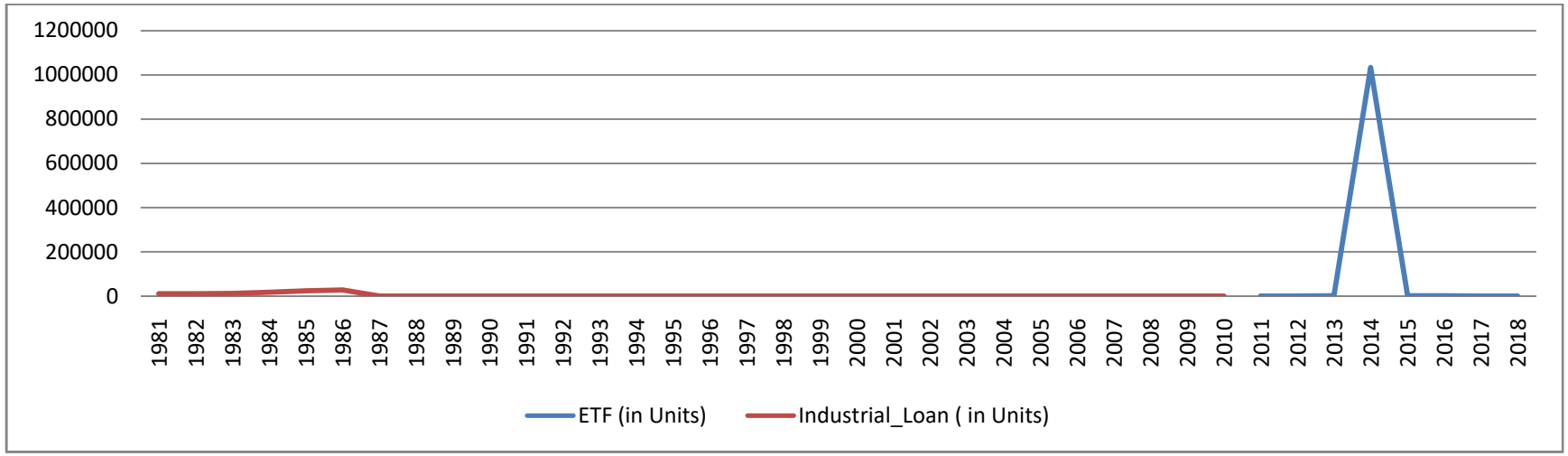

Figure 2.6c: Transactions (in Volume) at the Nigerian Stock Exchange (1981 – 2018).
Source: Underlining data from Central Bank of Nigeria Annual Statistical Bulletin (2018)

2.3 Financial Sector Development and Financial Stability Issues in Nigeria-

2.3.1 Stylized facts on Financial Sector Development in Nigeria

Generally, there are many measures of financial sector development. This is predicated on the multi-dimensional nature of financial sector and this has been widely documented in the empirical literature (Cihak, Demirguc-Kunt, Feyen and Levine; 2013). Specifically, however, the development of the financial sector can be considered under five broad headings such as the quantity measures (captured as ratio of broad money supply to the gross domestic product and the ratio of credit to the private sector to the GDP), structural measures (indicated as the ratio of broad money supply to narrow money supply and the ratio of securities market outstanding to broad money supply), measure of financial prices (denoted as interest rate levels and interest rate flexibility), measure of financial product range (captured as business financing product, investment products and foreign exchange and risk management products) and measure of transaction cost – denoted as interest rate margins – (Lynch, 1996). It is along these measures that the financial sector development in Nigeria would be discussed in this study.

Beginning with, Figure 2.7 depicts the graphical illustration of the quantity measures of financial sector development in Nigeria for the period 1981 - 2018. These measures are the ratio of broad money supply to the gross domestic product (m2_gdp) and the ratio of credit to the private sector to the gross domestic product (cps_gdp). The former is known as financial widening while the latter is referred to as financial deepening. It is evident from the trend that Nigerian financial sector from 1981 – 2009 was more of financial widening than financial deepening as the ratio of broad money supply to the gross domestic product (m2_gdp) is greater than that of the ratio of credit to the private sector to the gross domestic product (cps_gdp). The implication here is that the supply of money into the economy during these periods was not been sufficiently absorbed into productive sectors and this would have resulted into inflationary pressures in the economy. Since 2010, however, both measures tarry together and it indicates that financial resources injected into the economy have been productively utilized. More so, there has been an increase in the proportion of the two ratios. As compared to the periods 1981 – 2007, the periods 2008 – 2016 suggests a remarkable increase from around 15 percent to 20 percent; with little reduction between 2017 – 2018.

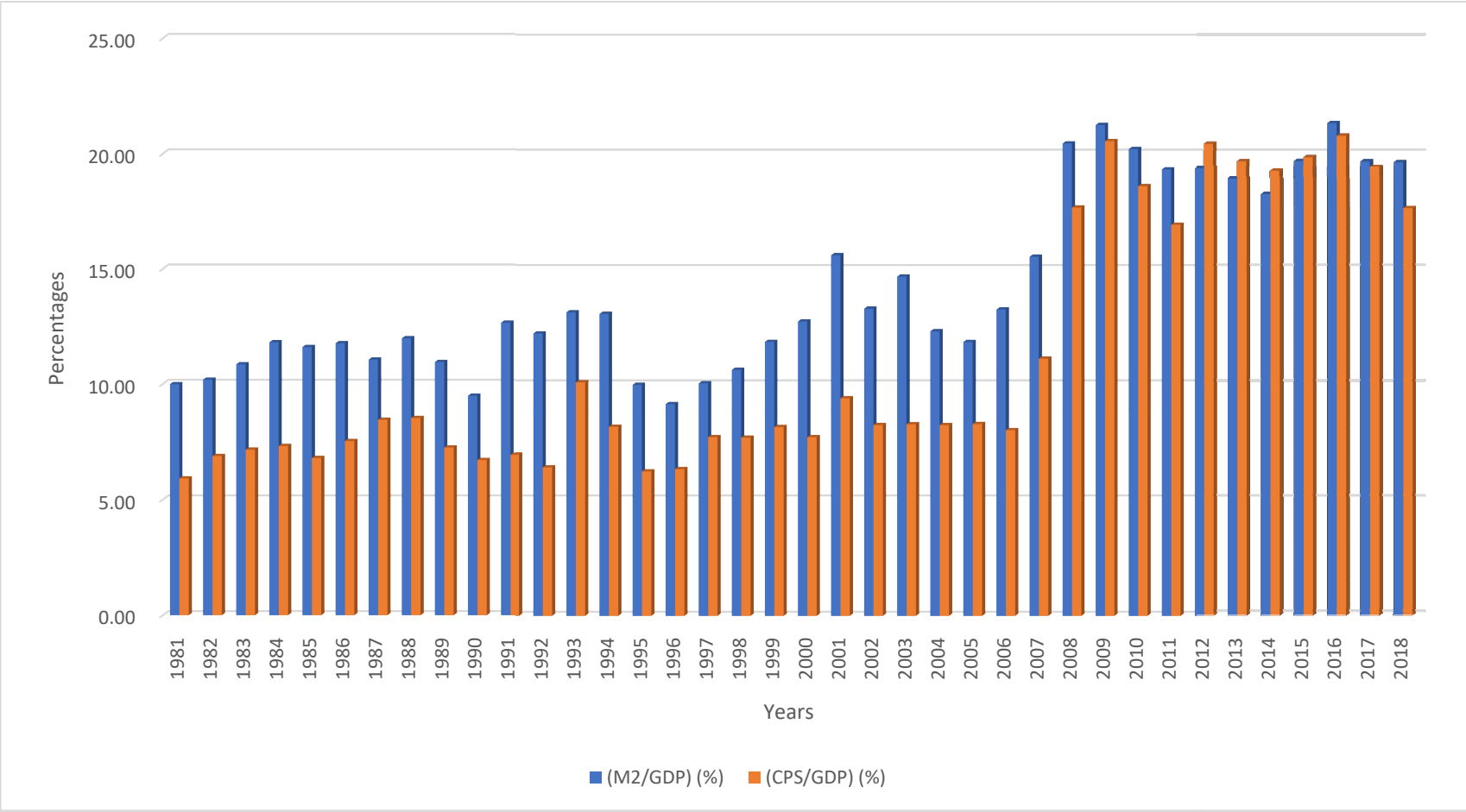

Figure 2.7: Quantity Measures of Financial Sector Development in Nigeria.

Source: Underlining data from Central Bank of Nigeria Annual Statistical Bulletin (2018).

Additionally, financial sector development can be captured in the form of structural development. This structural development can be measured by two indexes. These are the ratio of broad money supply to the narrow money supply (m2_m1) and the ratio of the securities to the broad money supply (sec_m2). It is expected that both measures are positive and increase with increasing level of financial development (Lynch, 1996). As indicated in Figure 2.8, there has not been substantial structural changes in the Nigerian financial sector since 1981. Better still, improved strutural development in the Nigerian financial sector can be considered to be a recent phenomenom; albeit unsustainably. It is noticed that there has been improved structural development since 2013; with the year 2015 having the highest level of structural development and a decline in the year 2016. The year 2016 coincides with the period of stock market crash in Nigeria and a recovery from the crash has been spontaneous that in 2017, the structural level of development in the Nigerian stock market is fast returning to its pre-crisis level. However, the second measure provides more information as it suggests that the period 1991 – 2003 are the worst of structural development in the Nigerian capital market (see Figure 2.8).

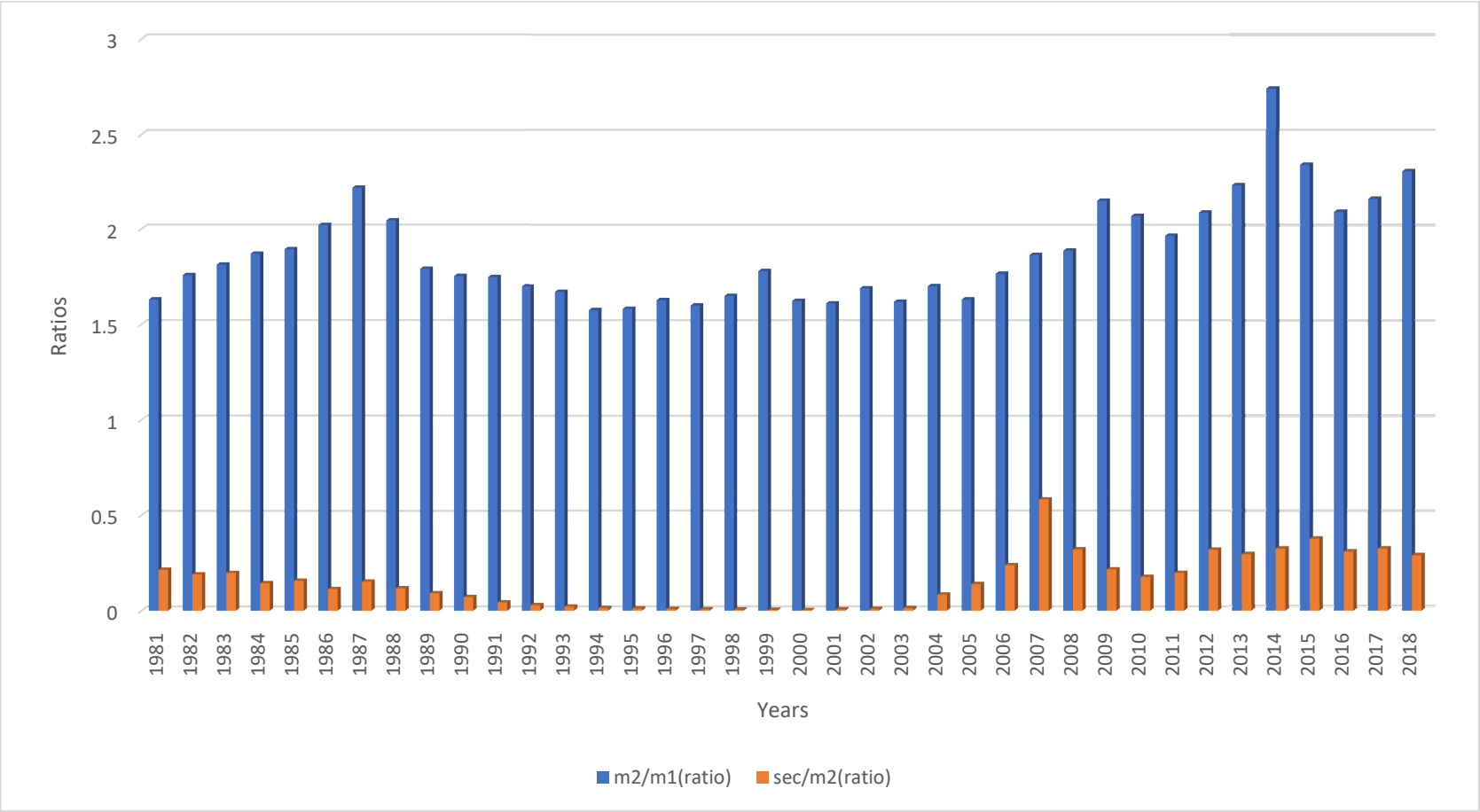

Figure 2.8: Structural Measures of Financial Sector Development in Nigeria.
Source: Underlining data from CBN Statistical Bulletin (2018)

In terms of the financial price, financial development is measured by the real interest rate. As an important precondition, the real interest rate is expected to be positive as only this would encourage resource mobilization through increased savings in the domestic economy. Expectedly, a positive real interest rate enhances resource mobilization especially when it is sufficient enough to cover for the price changes in the domestic economy (i.e. inflation) and still reward the lenders. More so, a positive real interest rate; especially in an economy with unstable prices, would create a win-win situation for all stakeholders as the lenders, borrowers and investors would be fairly rewarded. Investors would have paid a high cost on capital but with perfect competition, returns on investment would have also compensate the investors accordingly. In effect, a positive real interest rate would supports capital budgeting and facilitates investment and projects drives in the economy.

Figure 2.9 shows that financial development, measured in terms of real interest rate, has maintained all time high in the years 1991 and 1999. An all time low real interest rate occurred in the year 1995. Throughout the periods, however, the real interest rate has been largely unstable except for the period 2011 – 2015 with the real interest rate moving from zero to about 10 percent. During this period, deposits would be high and investment projects would increase appreciably. On the other hand, the periods 1970 – 1997 are the worst periods of financial sector development in Nigeria as resource mobilization would be very poor. Consequently, aggregate demand would reduce drastically. It is important that the government and policy makers should ensure a stable price level in the economy through sustainable macroeconomic policies. Since 1998, three periods were observed to a downward swing in the real interest rates. These were 2005, 2010 and 2016. The year 2005 coincided with the period of stock market crash, the year 2010 conformed to the aftermath of the global financial crisis of the 2007 – 2009 on the Nigerian financial sector and the year 2016 related to the occurrence of the national economic crisis in Nigeria.

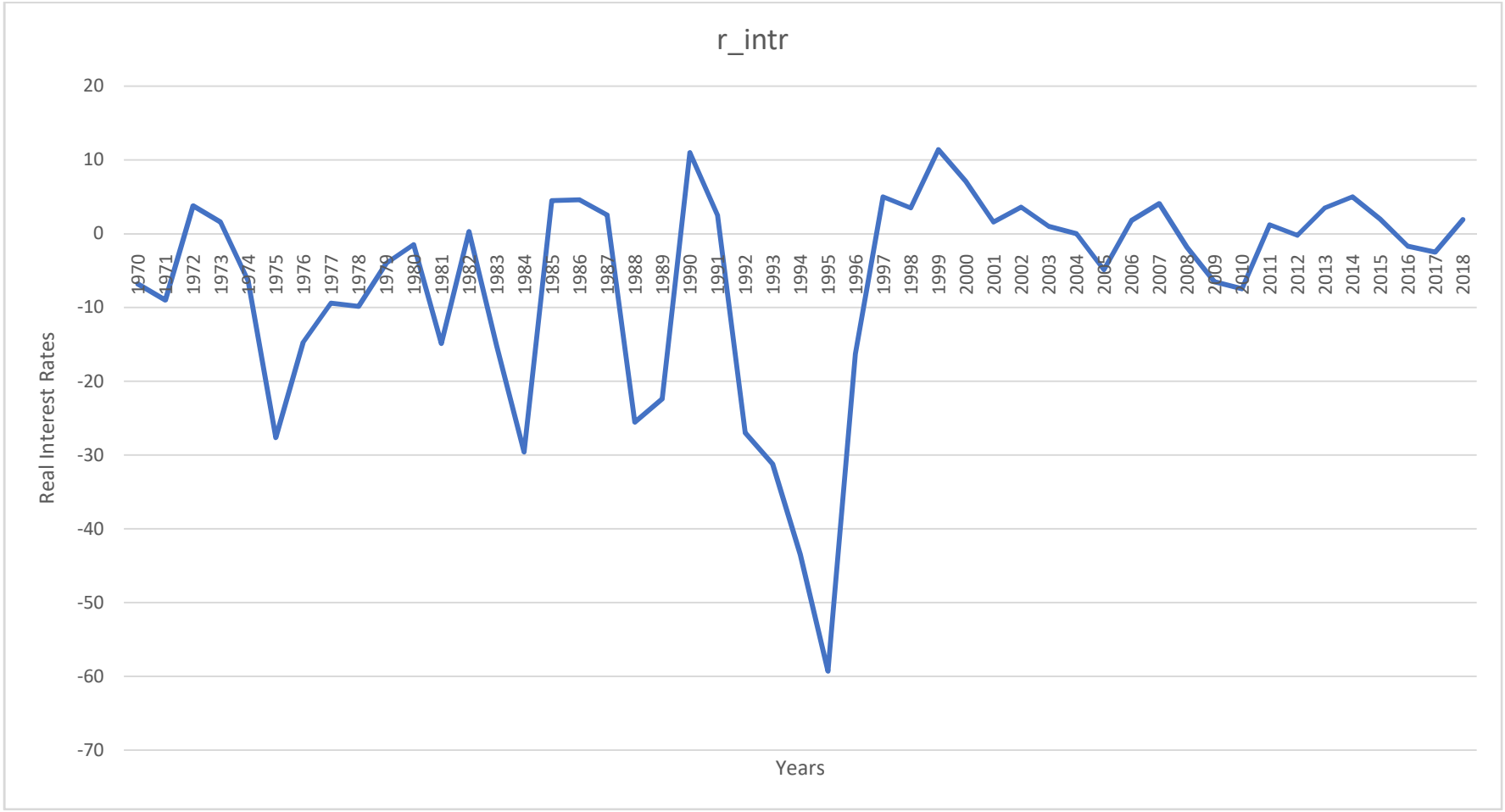

Figure 2.9: Financial Prices in Nigeria.

Source: Underlining data from CBN Statistical Bulletin (Various Issues)

Besides, there are three basic categorizations of product range to depict financial sector development in any economy. These are business-financing products, investment products and foreign exchange and risk management products. The first categorization includes bank loans, commercial papers, commercial bills, corporate bonds, listed equity and foreign capital market. The second categorization includes bank deposits, government paper and foreign markets while the third categorization includes foreign exchange, interest rate and equity (Lynch, 1996). Therefore, this study seeks to depict the trends in the product range in the Nigeria financial sector using these indicators. As indicated in Figure 2.10, it is obvious that both investment financing (as indicated by bank deposits) and foreign exchange and risk management products (as indicated by equities) dominate the financial products in the Nigerian financial sector. The business financial product is negligible as it only forms less than 10 percent of the total product value.

The implication of this is that corporate bonds is not popular as a financial products in Nigeria and it suggests that Nigerian are risk aversed and largely prefer spreading risk among investors rather than being a sole risk taker. While spreading risk, through equity shareholding, is a great idea; it erodes the ownership control of businesses in Nigeria and makes decision making for better investment opportunities to be slow and more cumbersome. Also, the trend in Figure 2.9 further lends credence to the fact that the Nigerian financial sector has not fully exploit available financial products that would facilitates resource mobilization and makes financial transactions to be less cumbersome. The use of commercial papers and bills discounting have not enjoy any strong patronage. Although, the year 2009 was exceptional but this appears short-lived (Figure 2.11). The use of commercial papers and bills discounting allows for creditors to legally transfers bills to third parties who can afford to finance the bills before the maturity date. It makes investors to take advantage of urgent investment needs.

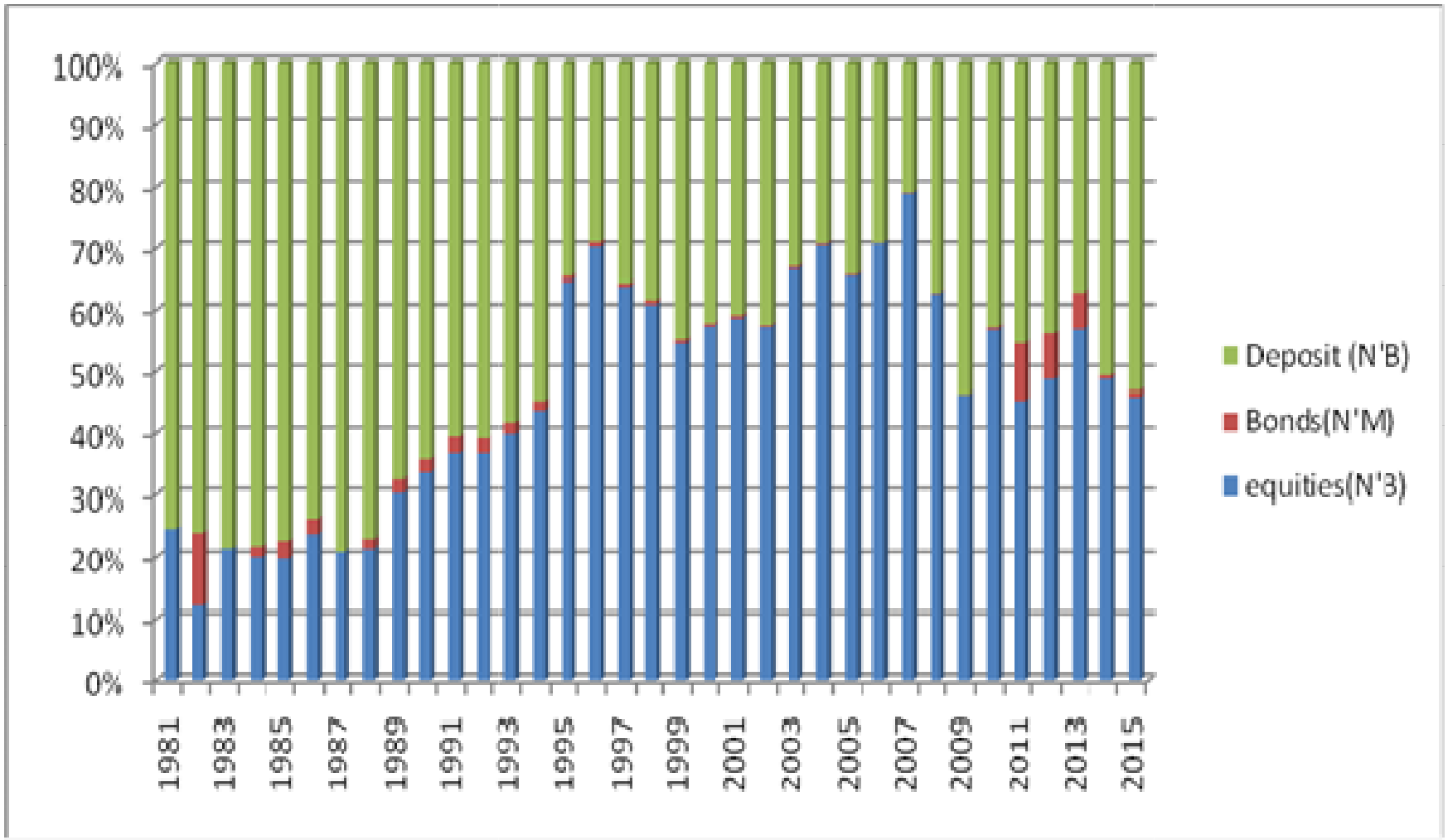

Figure 2.10: Financial Product Range in Nigeria (Proportion of Total Products Value).

Source: Underlining data from Central Bank of Nigeria Annual Statistical Bulletin (2015)

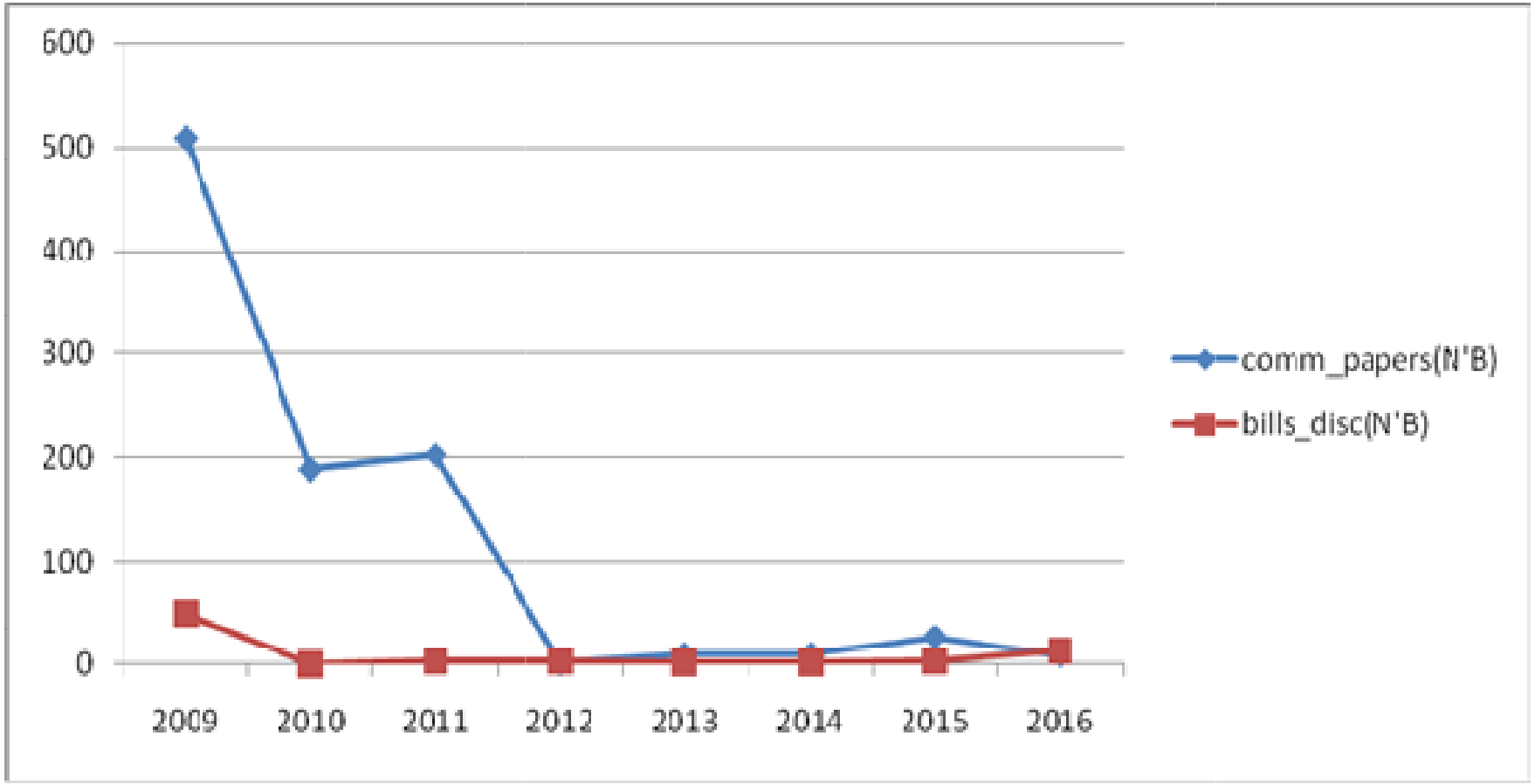

Figure 2.11: Commercial Papers and Bills Discounting (N'Billion) in Nigeria.

Source: Underlining data from Central Bank of Nigeria Annual Statistical Bulletin (2018).

Lastly, a fundamental of financial sector development is that there is low or zero transaction costs of trading and undertaking financial products. It is in this light that it is required that for a financial sector to be considered developed and efficient, the interest rate spread (measured as the difference between the lending rate and deposit rate) should be as low as possible. The trend depicted in Figure 2.12 shows that the financial sector in Nigeria might not have developed after all. This is because the period 1981 – 1985 appears to have the lowest interest rate spread; reducing from about 4 percent to about zero percent. Expectedly, the trend shows policy inconsistency in the Nigerian financial sector. This was more evident between the periods 1986 – 1998 perhaps due to series of interest rate policy reversals such as interest deregulation, re-regulation and money market liberalization and stabilization controls. Consequent upon this, efforts at ensuring continuous lower interest rate are usually truncated. This is also evident between the periods 2010 – 2014 as the years 2015 – 2016 further shows an increased interest rate spread in the financial sector. However, there was a sharp decline in the interest rate spread in the year 2017.

The decade 1988 – 1999 has the highest interest rate spread. By contrast, it is during this period that the interest rate spread is expected to be the lowest. It was the decade that immediately followed the structural adjustment programme when the entire money market was deregulated. Two periods of 1999 – 2004 and 2010 – 2014 have the lowest interest rate spread. These were the eras of financial market reforms in Nigeria. The implication is that a specific reform directed to the financial sector seemed to be more effective at achieving a lower interest rate spread than an economy-wide reforms like that of the structural adjustment programme that was implemented in 1986.

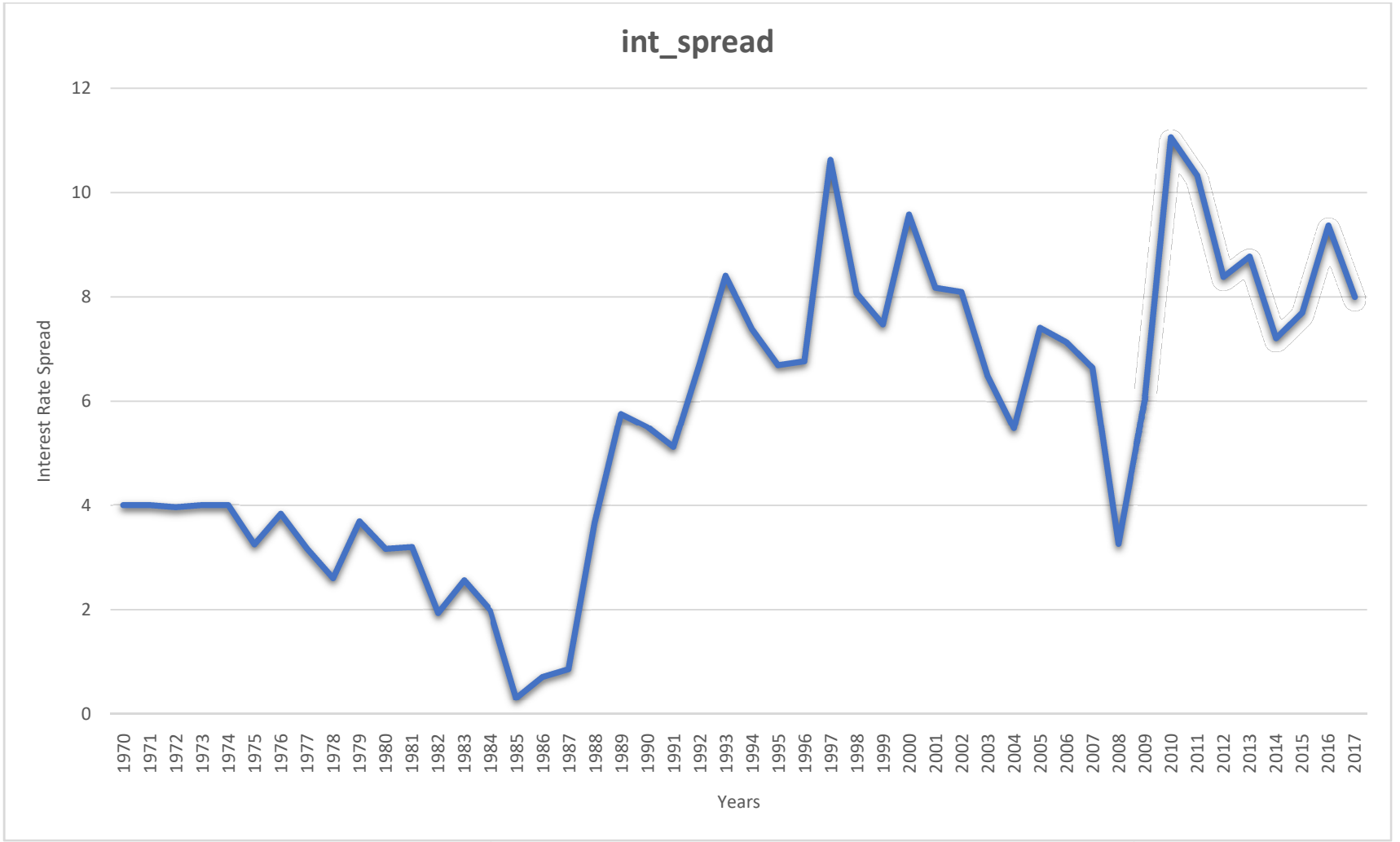

Figure 2.12: Financial Product Transaction Cost in Nigeria

Source: Underlining data from World Development Indicator (2018)

2.3.2 Stylized facts on Financial Stability Issues in Nigeria.

There are many indicators of financial stability. Generally, however, financial stability can be captured either as a form of soundness of the financial sector or with the existence of instability in the whole of the financial sector (Demirguc-Kunt and Detriagiache, 1997; Kaminsky and Reinhart, 1999). To appraise the soundness of the financial sector, there are three broad categories of indicators such as the assets-based indicators, capital-based indicators and income/expenditure-based indicators. The asset-based indicators include the ratio of non-performing loans to gross loans, the ratio of core liquid assets to short term liabilities and the non-performing loans net of provision of capital. The capital-based indicators include the ratio of regulatory capital to risk-weighted assets and the ratio of regulatory Tier 1 capital to risk-weighted assets. The income/expenditure indicator is mainly on the return on assets (ROA).

Altogether, there are five basic measures of financial soundness and these are regulatory capital to risk-weighted assets, regulatory Tier 1 capital to risk-weighted assets, non-performing loans net of provisions to capital, non-performing loans to total gross loans, return on assets and liquid assets to short-term liabilities. It should be noted that the direction of movement for these indicators to signal financial stability differ. Both the ratios of non-performing loans to total gross loans and non-performing loans net of provisions to capital are expected to decrease in trend to signal financial stability; the other indicators are expected to increase in trend to signal financial stability. For this study, however, the indicator for financial stability is to capture the threshold for the existence of financial instability; through the measure of excessive credit growth to the private sector. While there is no agreeable benchmark to determining when credit expansion is in excess due to differing institutional and structural formation required for the growth and development of every economy, the threshold level that credit to the private sector will ceased to be beneficial is given as ratio of credit-to-GDP growth rate above 20 percent. Although, credit boom is required for macroeconomic performance, an excessive expansion could also endanger the stability of the financial sector. This is occasioned by the increased moral hazard, very high default risk and the consequent irrecoverable bad debt (Dell'Arcicca, Igan, Laeven and Tong; 2012).

In Nigeria, there were five periods of negative growth rate of ratio of credit-to-GDP that marked episodes of financial instability between 1981 - 2018. These periods were 1984 – 1985, 1988 – 1990, 1994 – 1996, 2009 – 2011 and 2016 - 2018. It is instructive to note that these periods largely coincide with the era and height of military incursion in Nigeria. More so, the period 2009 – 2011 was when the spillover effects of the global economic and financial crisis became more telling on the economy while 2016 – 2018 coincides with the era of economic recession in Nigeria (Figure 2.13). Since excessive credit expansion could also be detrimental to macroeconomic performance and affect the stability of the financial sector, there are also episodes of financial instability due to excessive credit expansion in Nigeria. Specifically, the periods 1992 – 1994, 1999 - 2002 and 2007 – 2009 are also periods of financial instability in Nigeria. The period 2007 – 2009 coincide with the period of global financial crisis. This implies that the global financial crisis had immediate and later effects on financial stability in Nigeria as the period 2009 – 2011 also witnessed negative growth rate of credit-to-GDP.

The trend in Figure 2.14 suggests that the episodes of financial instability in Nigeria (as depicted in Figure 2.13) appears to be determined by the dynamics in the domestic and global economic and financial conditions. A comparison of both the targeted growth and actual growth of ratios of credit to the private sector to the gross domestic product clearly reinforces this fact (Figure 2.14). The targeted growth of the ratio of credit to the private sector to the gross domestic product (denoted as targeted_cps_gr) appears relatively stable as compared to the actual growth of the ratio of credit to the private sector to the gross domestic product (denoted as actual_cps_gr) in the economy. The latter is more volatile. More so, it is important to note that the targeted growth of the ratio credit to the private sector to the gross domestic product moves in tandem with the growth level of the Nigerian economy as it has a parallel trend to that of the real growth of the gross domestic product (denoted as rgdpgr) – see Figure 2.14. This suggests that movement in the actual growth rate of ratio of credit to the private sector to the GDP is conditioned by the dynamics in the global economy.

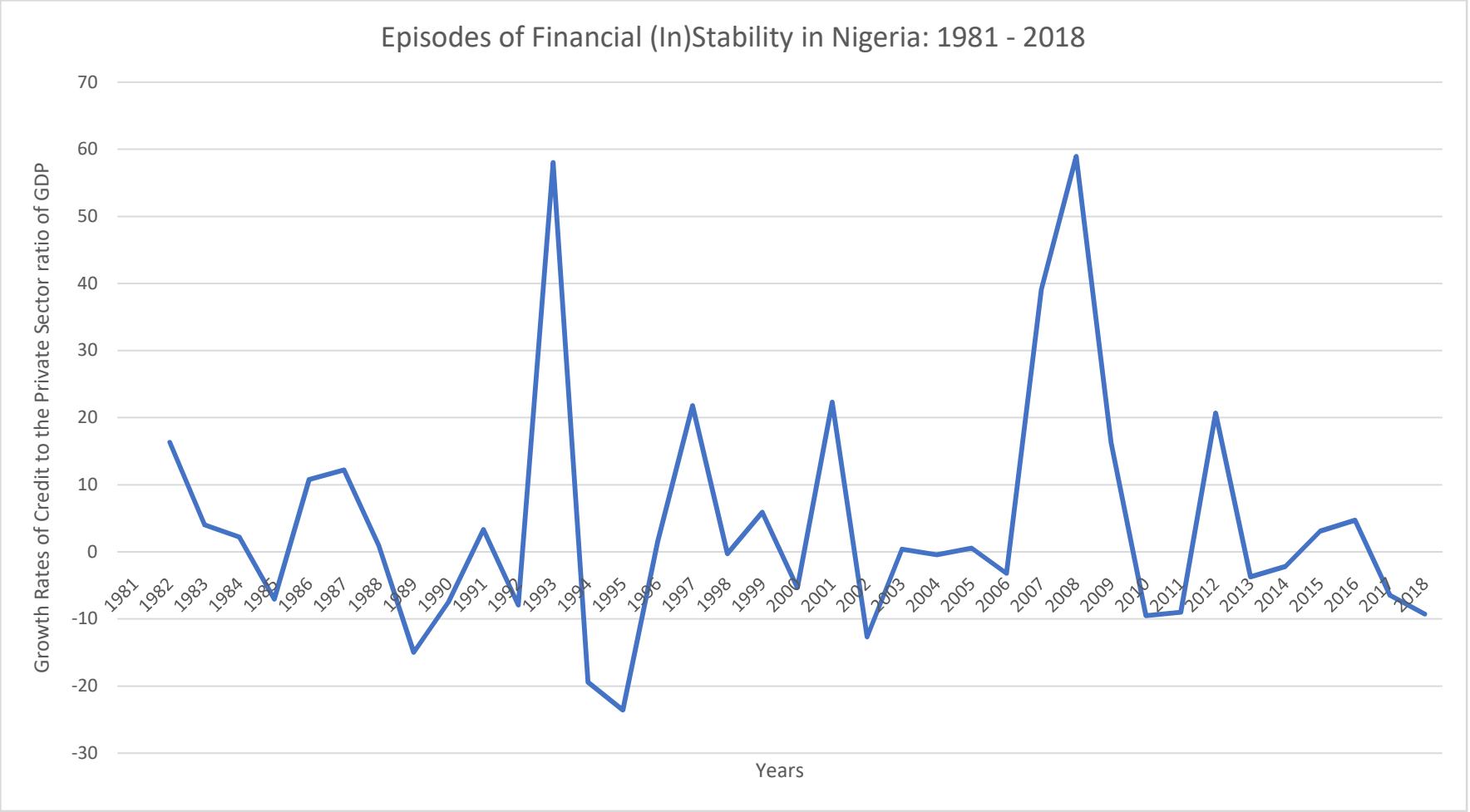

Figure 2.13: Episodes of Financial Instability in Nigeria: 1981 - 2018

Source: Underlining data from CBN Statistical Bulletin (2018)

The relation between the targeted growth rate of the ratio of credit to the private sector to the gross domestic product (denoted as targeted_cps_gr) and the real growth of the gross domestic product (denoted as rgdpgr) is further supported by parallel trend between the values of the two (Figure 2.15). The value of credit to the private sector in ₦billion and the value of real gross domestic product (in ₦billion), also, tends to support the notion that developing economies such as Nigeria are finance-led as the growth dynamics are largely determined by the available financial resources at its disposal. In level form, the value of the productive capacity exceeds the value of the credit given to the private sector (see Figure 2.5). In growth form, however, it is evident that there is bound to be financial instability. The financial instability aspect can further be explained by the fact that the growth rate of the ratio of the targeted credit to the private sector to the gross domestic product is higher than that of the real growth rate of the gross domestic product itself. What this imply is that the credit to the private sector grows more than what the economy could always absorb into productive activities (Figure 2.14).

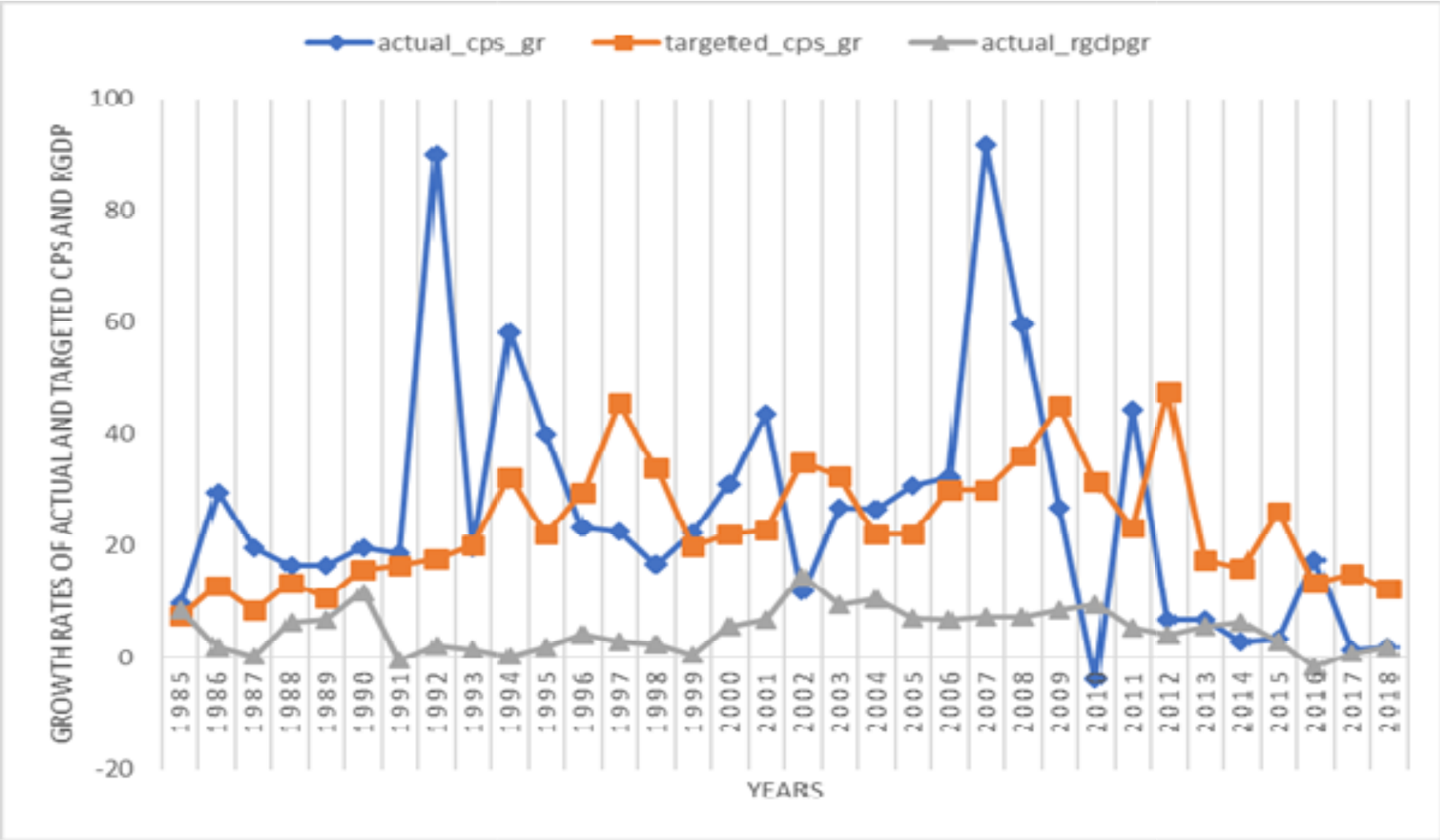

Figure 2.14: Growth Rates of Targeted and Actual Credit to the Private Sector in Nigeria.

Source: Underlining data from Central Bank of Nigeria Annual Statistical Bulletin (2018)

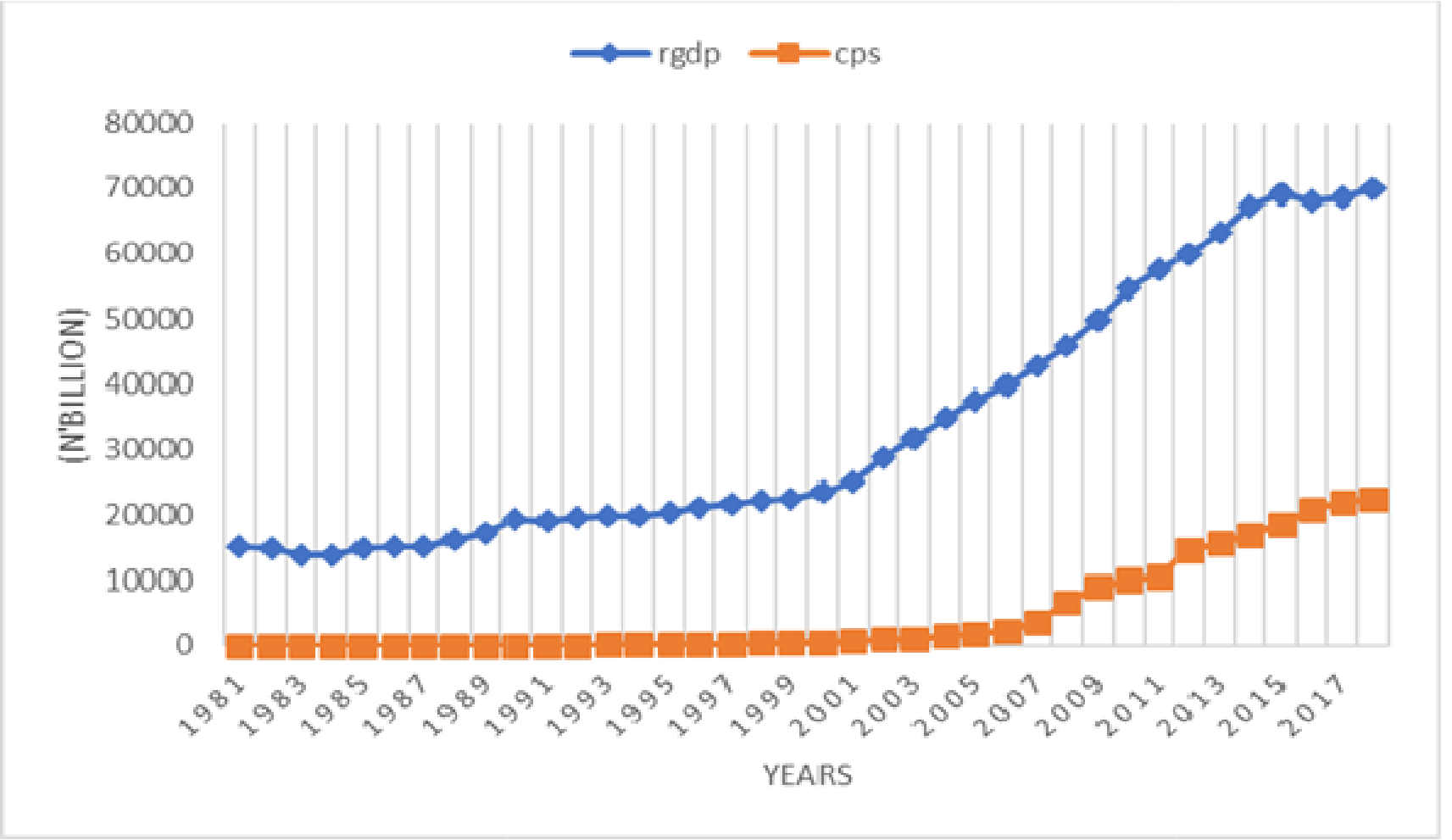

Figure 2.15: Credit to the Private Sector and Real Gross Domestic Product for Nigeria.

Source: Underlining data from Central Bank of Nigeria Annual Statistical Bulletin (2018)

2.4 Stylized Facts on Financial Openness in Nigeria

The degree of financial openness; measured as the ratio of FDI stock to the nominal gross domestic product (GDP) indicates that the economy continually opens for capital transactions throughout the period 1970 – 2015; but not without some oscillations. This oscillation in the degree of financial openness, however, does not seem to affect the continual increase in net capital flows for the economy (Table 2.3).

With 3.7 percent degree of financial openness in the 1970 – 1974 period and a consistent increase to 58.2 percent in the period 1996 – 2000, there is reduction in the level of financial openness to 41 percent in the period 2001 – 2005 and this further reduces to 25.7 percent for the period 2006 – 2010. But, an increase in the degree financial openness to 33.5 percent occurs between 2011 and 2015 (Table 2.3). However, this oscillation in the degree of financial openness does not matter for net capital inflows. The net capital inflows increase from N66.96 million in the period 1970 – 1974 to N11,946.175 million in the period 2011 – 2015 (Table 2.3).

Figure 2.16 is instructive as it shows that the trends of FDI net and FDI inflows are virtually mirror images. This suggests that FDI outflows are completely absent for Nigeria. The implication is that Nigeria does not have substantial foreign assets abroad. However, assets of foreigners in the Nigerian economy is huge. This indicates that the Nigerian economy is susceptible to the vagaries of the global dynamics. Any panicking and dynamics in the global economy would seriously affect the Nigerian economy when foreign investors must sell off or pull out of their investment. Although, since foreign direct investment are categorized as investment in brick and mortals, it is not easily withdrawn from the economies in which it is invested.

Table 2.3: Trends on Financial Openness and Net Capital Flows in Nigeria (1970 – 2015)

Year	Financial Openness (%)	Net Capital Flows (N'M)	Prime Lending Rate
1970 – 1974	3.7	66.96	7.00
1975 – 1980	3.5	220.58	6.67
1981 – 1985	4.6	289.02	9.95
1986 – 1990	19.2	531.22	19.36
1991 – 1995	41.2	2,380.8	21.86
1996 – 2000	58.2	5,817.84	18.17
2001 – 2005	41.0	9,761.88	20.20
2006 – 2010	25.7	11,550.42	17.18
2011 – 2015	33.5	11,946.175	16.59

Source: Author with Data from Central Bank of Nigeria Annual Statistical Bulletin (2015) and WDI (2016)

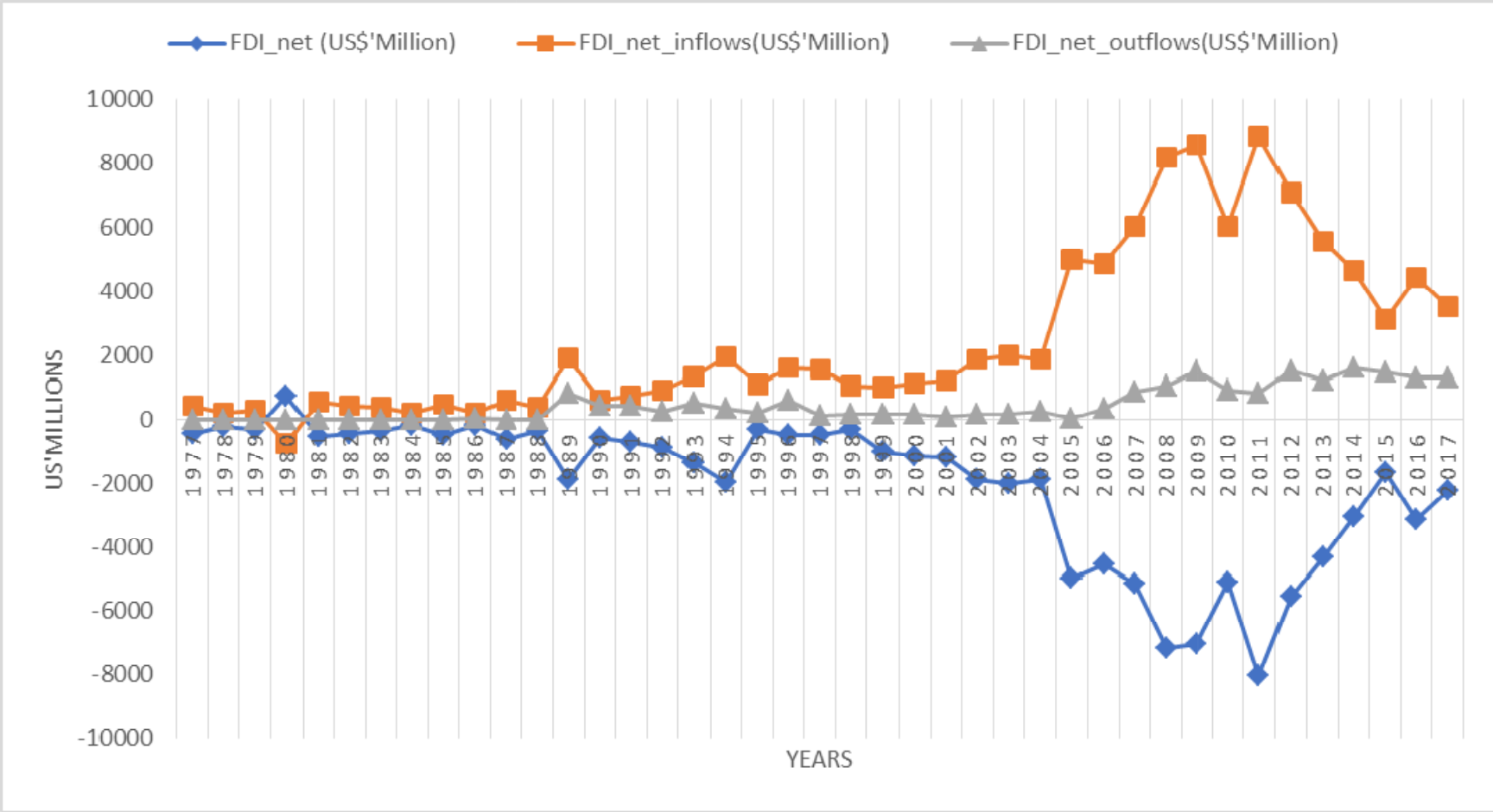

Figure 2.16: Capital Account Transactions Nigeria (1970 – 2018).

Source: Underlining data from World Development Indicator (WDI, 2018)

It should be noted that both the de-jure (KAOPEN) and de-facto (CAOPEN) measures of capital account openness in Nigeria were captured. The former is the legal/policy indicator while the latter is the market-based measures of capital openness. As indicated in Figure 2.17, there were policy regulations on cross-border capital account transactions between 1989 and 1996 but the market-based indicator suggests that there was increasing financial openness during this period. Between 2010 and 2014, both measures conformed together, and this suggests that it is only during this period that both the legal/policy framework reflects the market dimension to capital openness in Nigeria. Since 2015, however, both measures show divergence again on capital openness. This further reaffirms the submission that there are political economy issues of cross-border capital flows. The indication here is that the institutional factors as well as political risk factors that do prevent the market forces from moving in tandem with the legal/policy frameworks of capital mobility should be addressed (Figure 2.17).

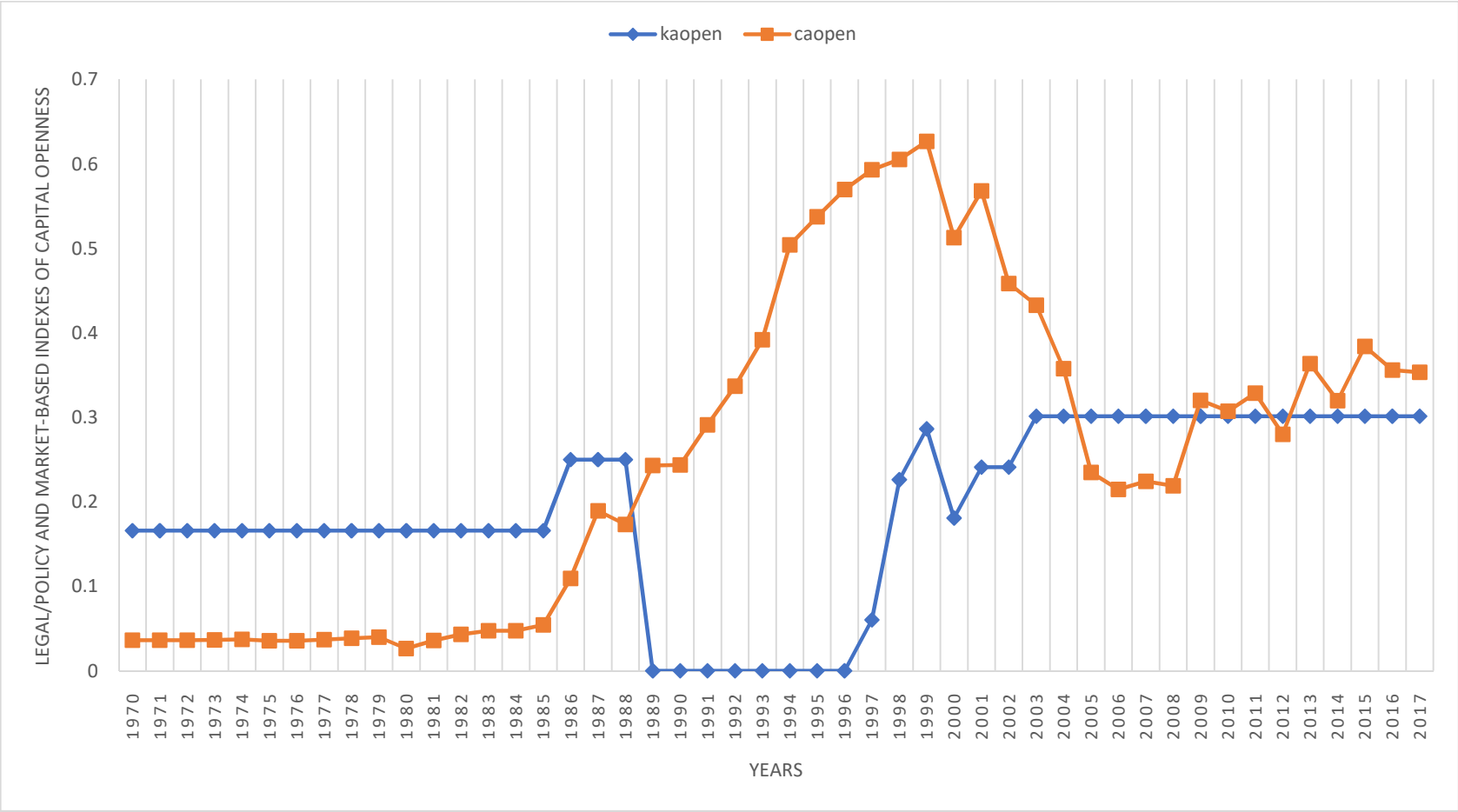

Figure 2.17: Degree of Capital Account Openness in Nigeria (1970 – 2018).

Source: Using the Chinn-Ito Trilemma Index and data obtained from the CBN Statistical Bulletin (2018)

To further highlight the degree of financial openness on capital account transactions in Nigeria, the extent of gross capital flows will also provide very useful insights. The extent of parity between the domestic interest rate (r) and the foreign rate of interest (r^*) determines the amount of short-term capital flows in the economy. It is the amount of hot money that flows in and out of the country. By observation, the domestic interest rate in Nigeria has always been non-responsive to the foreign interest rate. In fact, the former often toppled over the latter in virtually all the years since 1970; except for the periods of 1981 that both are same.

This implies that investors can exploit an incentive for arbitrage opportunities. This will possibly increase the amount of 'hot-money' or short-term capital inflows into the economy during the periods that the economy allows for unhindered flow of capital transactions. For the case of Nigeria, however, the period under study is mainly constituted of capital control, at some point, and marginal capital mobility, at some other times (Figures 2.18). This indicates that investors would be constrained to undertake meaningful arbitrage opportunities. Therefore, exchange rate would stabilize as unwarranted inflows and withdrawal of 'hot-money' would have been put under-check.

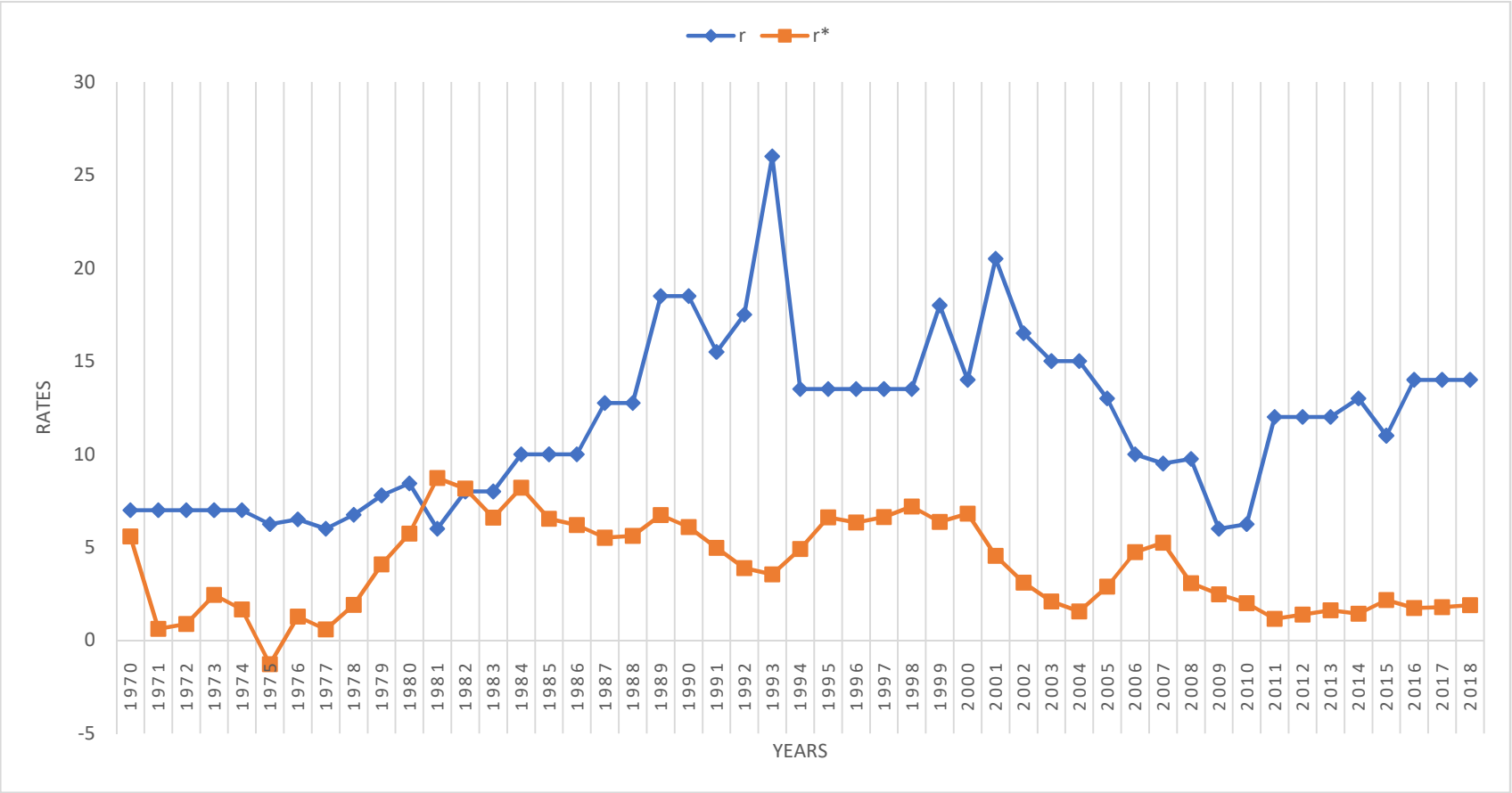

Figure 2.18: Interest Rates in Nigeria and Foreign (United States of America) Interest Rates.

Source: Underlining data from Central Bank of Nigeria Annual Statistical Bulletin (2018) and WDI (2018).

2.5 Stylized Facts on the Components of Macroeconomic Trilemma and Financial Trilemma (DoubleTrilemma) in Nigeria: 1970 – 2018

In Nigeria, the stability of the exchange rate and independence of the monetary authority to freely deploy its monetary policy strategies were evident between 1970 and 1985 and sparsely between 1994 and 1998. But this occurred at the expense of financial openness up until 1986. There appeared to be huge control on cross-border capital transactions during this period as the degree of financial openness tend towards zero; specifically, it hovered around 0.2 point. Since 1986, however, there has been increase in the degree of financial openness; even with moderate stability of the exchange rate due to interventionist policies. Expectedly, this occurs at the expense of monetary authority autonomy. Specifically, the structural adjustment programme that was launched in 1986 allowed for financial liberalization; including the use of market-determined exchange rate policy. The exchange rate could move freely as dictated by the market forces of demand and supply and this led to instability in exchange rate movement in the economy. This occurred till 1993 before the advent of military incursion in 1994; abandoning all forms of market clearing policies. More so, the democratic dispensation in 1999 favoured interventionist strategy to stabilize the exchange rate through a managed-float regime.

Between 1986 and 1993, it was evident that the economy was faced with macroeconomic trilemma. However, two factors of financial trilemma can limit this evidence of macroeconomic trilemma. These are the rate of interest and growth rate of the ratio of credit to the private sector to the gross domestic product (that is, the rate of credit to the private sector to the GDP). The former is an indicator for national financial policy while the latter is the indicator for financial instability. An expansion in credit will lead to increased capital inflows and this would translate to increased financial openness. This is limiting in that the period 1970 – 1985 was when cross-border capital transactions were controlled. The threshold is that a more than 20 percent growth rate of ratio of credit to the private sector to the GDP is excessive credit expansion and this was the case for the period 1970 – 1985. Also, the interest rate increases considerably between the periods 1986 – 2015 and this would imply that the national financial policy was not achieved. Concomitantly, it was during this period that the monetary authority, through its use of indirect monetary policies,

was considered autonomous and was able to independently determine its interest rate (Figure 2.19).

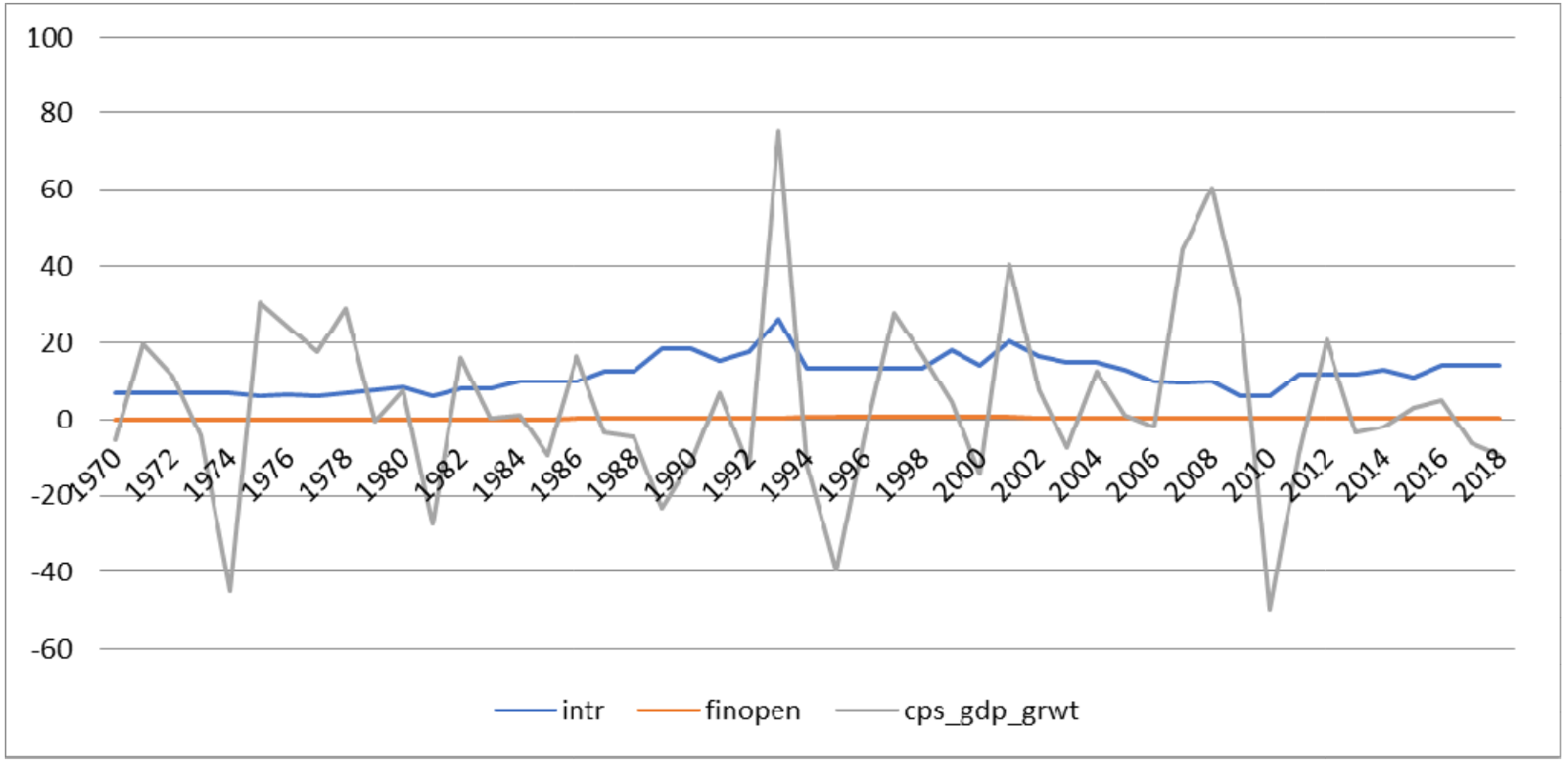

Figure 2.19a: Trends of Interest Rate, Financial Openness and Financial Stability in Nigeria: 1970 – 2018.

Source: Underlining data from Central Bank of Nigeria Annual Statistical Bulletin (2018)

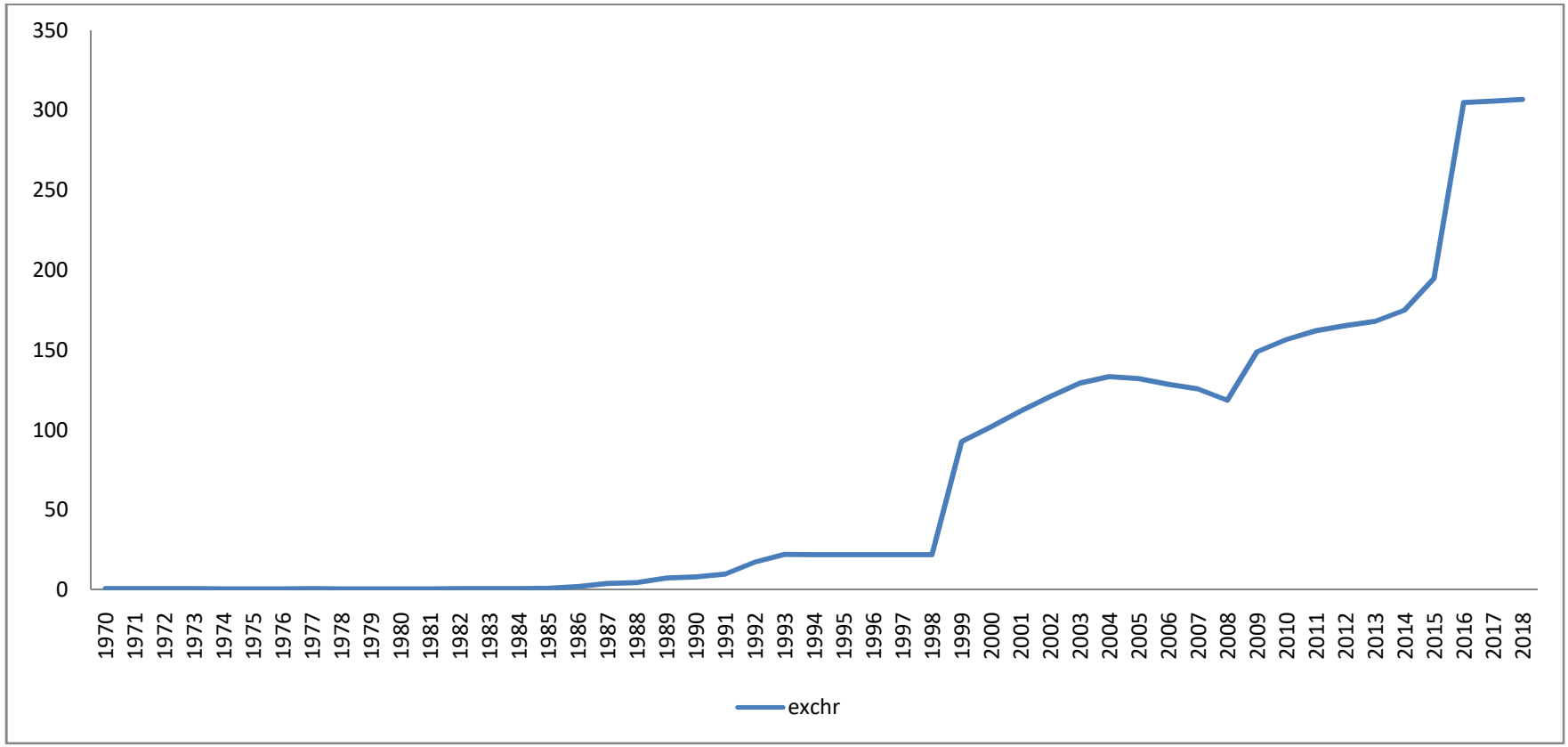

Figure 2.19b: Exchange Rate Movement in Nigeria: 1970 – 2018.

Source: Underlining data from Central Bank of Nigeria Annual Statistical Bulletin (2018)

2.6 Stylized facts on Central Bank Behaviour in Nigeria

As encapsulated in Appendices 1 and 2, the behaviour of the central bank in the face of double trilemma can be examined on the bases of how the monetary authority employs the use of monetary policy instruments to achieve an overall health of the economy with trade off of macroeconomic objectives; including economic growth (through increased investment) and balance of payment equilibrium (through interest rate differential and exchange rate stability). Also, the attainments of these macroeconomic fundamentals are to be examined in order to determine how they will alter the stability of monetary policy variables such as the interest rate and the exchange rate. The ex-ante behaviour relates to how the central bank uses the monetary policy instruments to achieve macroeconomic objectives while the ex-post behaviour indicates how the extent of attaining these macroeconomic objectives affect the stability of interest rate and exchange rate. Specifically, the ex-post behaviour is usually considered as the reaction function of the central bank (Siri, 2012). It is the combination of both the ex-ante behaviour and ex-post behaviour that summed up the behaviour of central bank in an economy.

The changes in the rate of interest in the economy, as depicted in Figure 2.18, are usually affected by the level of money supply. Basically, the level of money supply provides the direction for the rate of interest. Figure 2.21 implies that money supply has increased steadily since 1996:Q1 with negligible decline in few periods of 2009 and 2014. Expectedly, if these increases in money supply have been absorbed into the economy, the level of interest rate should decline and further stimulate investment opportunities.

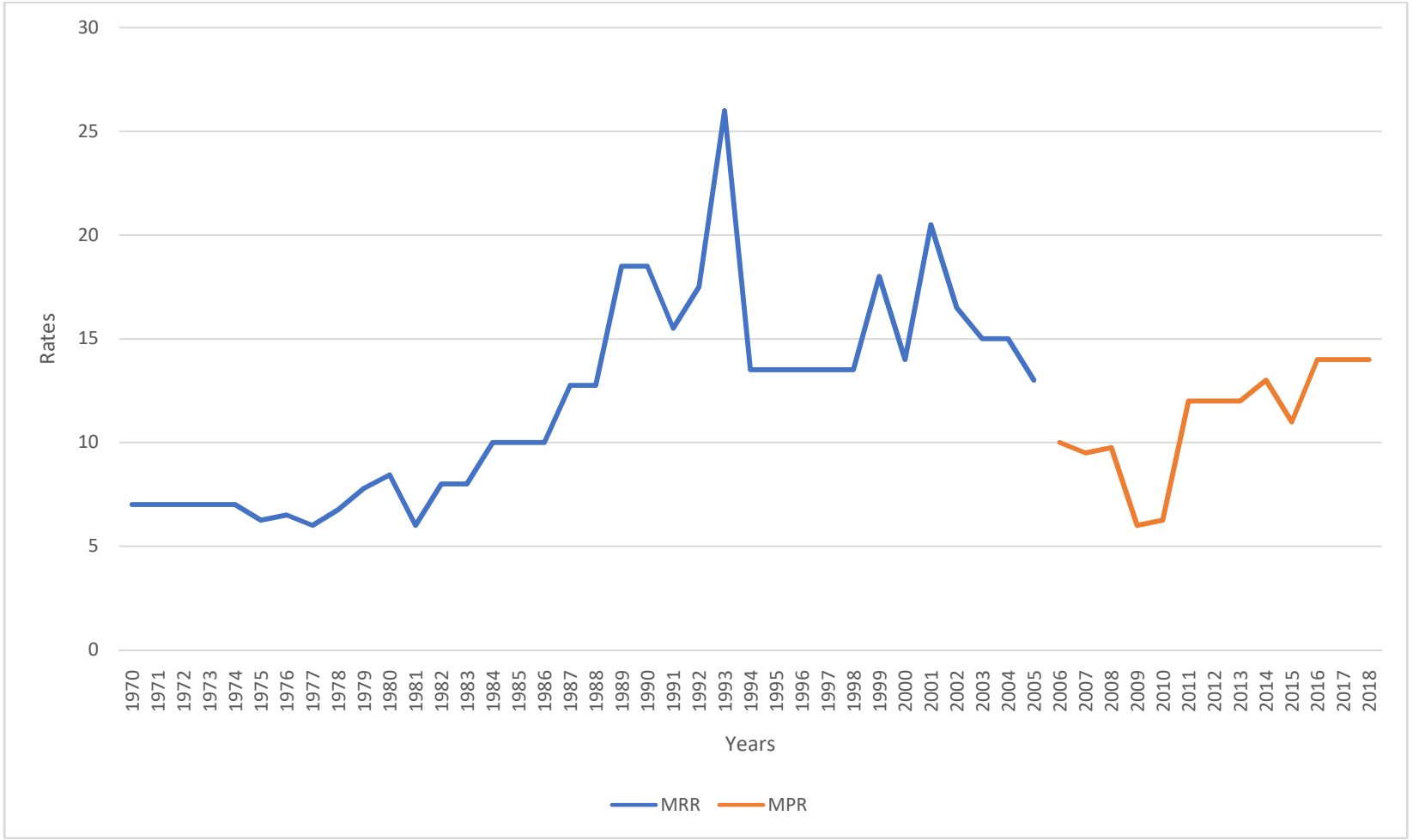

Figure 2.20: Money Market Interest Rate in Nigeria

Source: Underlining data from CBN Statistical Bulletin (2018)

However, the rate of interest appeared not particularly affected by the changes in the supply of money (Figure 2.20). During these periods, the reserve requirements of the deposit money banks in Nigeria remain stable until 2011Q1. While the increase in the reserve requirements is considered a contractionary monetary policy, the money supply still increased steadily. The implication is that other counteracting expansionary policy would have neutralized that effect (Figure 2.21).

A further implication of the foregoing is that even though the money supply is expected to be an endogenous variable in an economy such as Nigeria which operates a managed-float foreign exchange rate regime and sometimes fixed peg regime, money supply has been largely exogenously determined by the monetary authority. More so, the interest rate in Nigeria did not always moves with that of the foreign interest, indicated by the US interest rate (Figure 2.18). By the simple interest rate parity condition and given a capital mobility condition, the domestic interest rate is expected to be at par with that of a referenced foreign interest rate. For the case of Nigeria, however, it is evident that this is not always the case. This further lends credence to the independence of monetary policy in Nigeria.

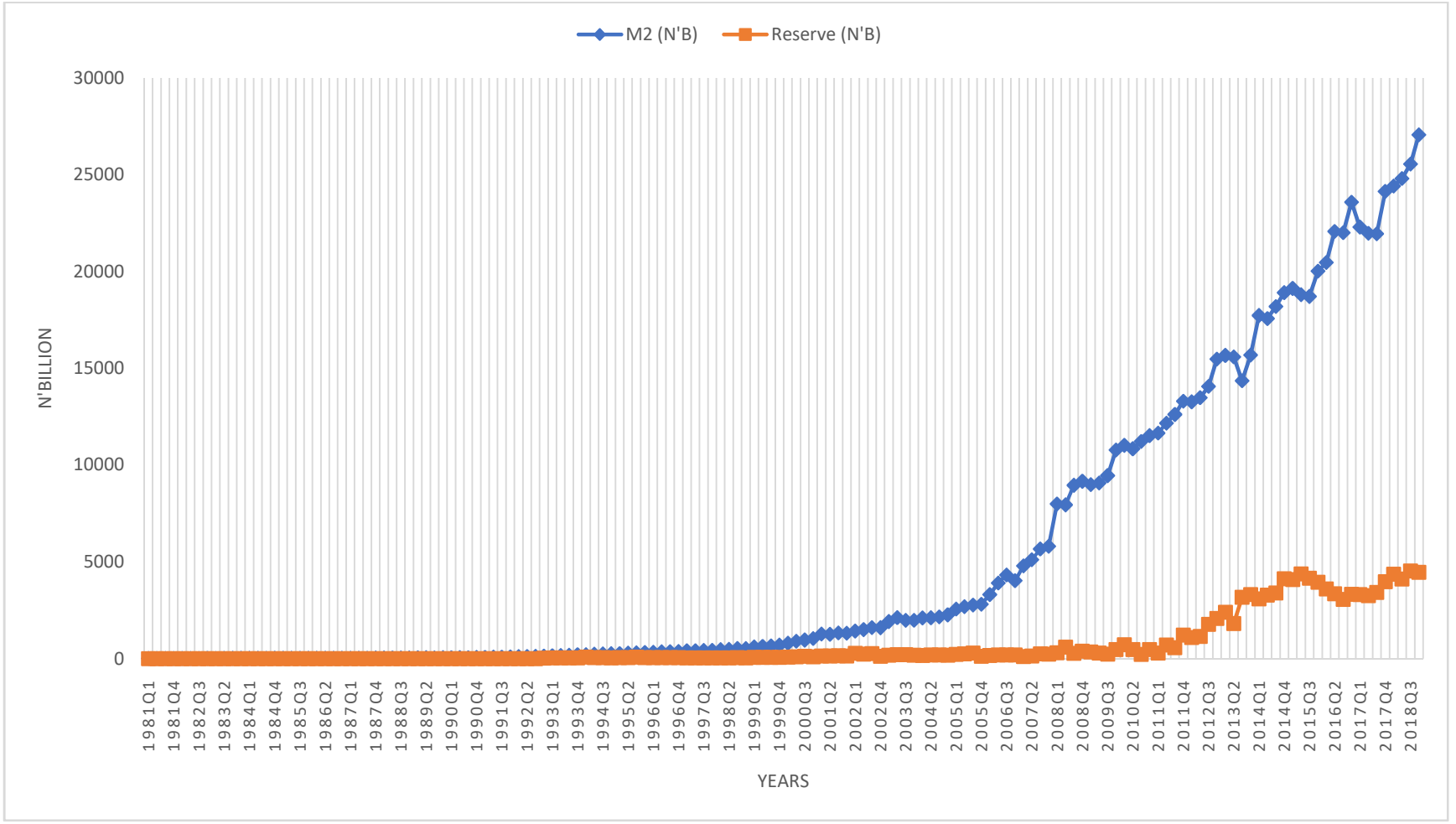

Figure 2.21: Broad Money Supply and Reserve Requirements of DMBs in Nigeria

Source: Underlining data from CBN Statistical Bulletin (2018). Note: DMBs – Deposit Money Banks.

Nonetheless, the exogenous determination of money supply by the central bank of Nigeria has been carried out at discretion rather than sticking to rules. This is obvious from the graphical trend of both the targeted and actual money supply depicted in Figure 2.22. Except for the periods 1996 – 1997, 2004, 2009 and 2011; the actual money supplied into the economy deviated from the targeted amount by the monetary authority throughout the periods 1985 – 2015. For the period 1985 – 1990, there was no target earmarked by the central bank of Nigeria for its monetary aggregates. While the targeted money supply was relatively stable between 1996 and 2005, that actual money supplied is cyclical throughout. In whole, this suggests that the behaviour of the central bank towards money supply in Nigeria is discretional rather than being at a rule.

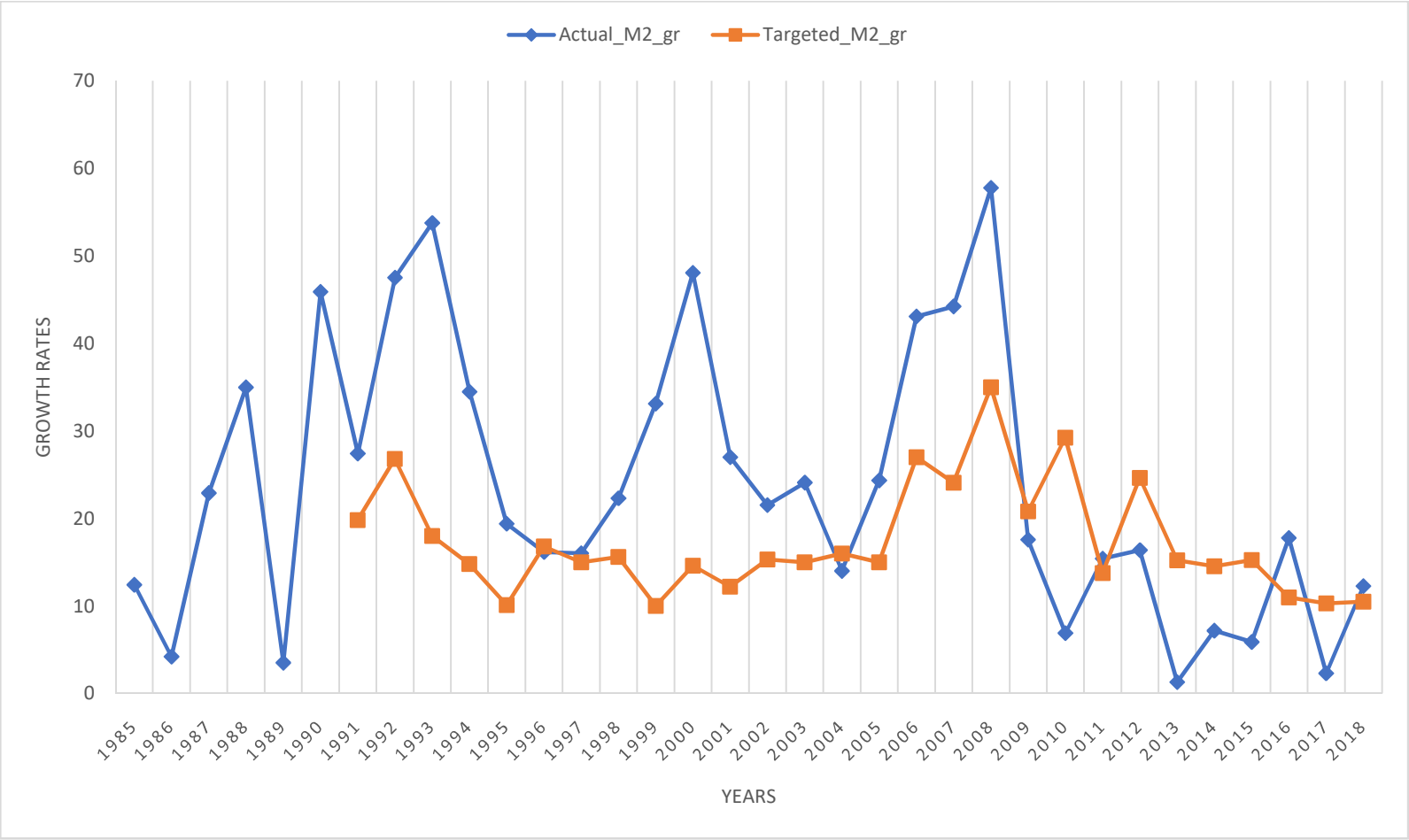

Figure 2.22: Growth Rates of Targeted and Actual Broad Money Supply (M2) in Nigeria.

Source: Underlining data from CBN Statistical Bulletin (2018).

2.7 Policy Variables of Central Bank Behaviour in Nigeria

Consequent upon the exogenous determination of interest rate in Nigeria, it becomes expedient to acknowledge that the exchange rate, therefore, becomes the policy variable of the monetary authority in Nigeria. This is because the exchange rate alters the direction of money supply in the economy and the supply of money, then, impacts on the interest rate. This underscores the reason why the interest rate cannot be the policy variable. The interest rate is endogenously determined by the exchange rate. Again, the fact that the assumption of perfect capital mobility does not hold for a developing import-dependent economy such as Nigeria suggests that interest rate would be endogenously determined rather than being the variable for strategic monetary policy in the country. This is importantly so in that the monetary policy must review its interest rate from time to time to align the economy to the dynamics in the global marketplace.

2.8 Stylized facts on Political Risks and Central Bank Behaviour in Nigeria.

In order to capture the political economy of central bank behaviour in Nigeria, this study considers the political risk factor as the most appropriate measure of institutional factor in the country. This is because it is believed that the central bank; being the government's bank, can do the biddings of public office holders and can be influenced to behave differently from what the economic situation demands; mainly for political reasons – like winning elections, perpetuating themselves in office, stepping down unpopular decisions due to ethnic, religious and cultural pressures and, even, pressures from opposition parties (Table 4.1). The exegeses of these political factors tend to alter the behaviour of the central bank in a developing economy such as Nigeria. It is from the foregoing that the behaviour of the central bank in Nigeria is likely to be affected by political risks; even in the face of the double trilemma of macroeconomic trilemma and financial trilemma.

Stemming from the foregoing, a cursory overview of political risks confronting Nigeria for the period (1981Q1 – 2015Q4) under review is highly imperative in this sub-section of the study. More so, how these political risks have influenced the direction of monetary policies in the country will be highlighted. As a decision rule, it is expected that the higher the sum total of the weight, the lower the risk and vice versa. For assessment purposes, a weighted

sum less than 50 percent is considered very high risk; between 50 – 60 percent is high risk; 60 – 70 percent is moderate risk; 70 – 80 percent is low risk while 80 – 100 percent is very low risk. The trend in Figure 23 borders on political risks for the country and the behaviour of monetary policies during this period. These monetary policies are growth of money supply (gm_2), the rate of interest ($\text{int}\, r$) and the growth ratio of credit to the private sector to the GDP (cps_gdp_grwt) – see Figures 2.19a and 2.21.

In Nigeria, there were just two episodes of political risks; an episode of very high political risk and the episode of high political risk. The former episode occurred from 1981Q1 – 1987Q2 and 2003Q3 – 2015Q4 while the latter episode occurred only between 1987Q3 – 2003Q2. For the episodes of very high political risks, the weighted sum of the political risk components were less than 50 percent benchmark while for the episode of high political risks, the weighted sum hovers between 50 – 60 percent benchmark (see Figure 2.23). This implies that there were even more periods of very high political risks in the country. Curiously, the interest rate is highest during the period 1992Q2 -1994Q4. This implies that investment will be stifled, and growth will be impeded. The implication for macroeconomic trilemma is that there would be high influx of capital transactions into the country due to portfolio adjustment of the global investors. If this influx of capital transaction exceeds the productive capacity of the economy at that point in time, there would be financial instability.

Consequently, the growth ratio of credit to the private sector to GDP is highest during this period. This suggests that credit expansion is highest during this period. It is an indication that there is high financial instability in this period in Nigeria than any other period under study. Another period of relatively high interest rate in the country is 1991Q1 – 2002Q2. It is observed that there is no financial instability during this period as the growth ratio of credit to the private sector to the GDP is almost lowest during this period. This suggests that the productive capacity of the economy has been able to absorb the influx of financial flows that was necessitated by the increase in interest rate. The growth of money supply is highest between 2007Q3 – 2008Q3. This suggests that the monetary authority embarked on

expansionary monetary policy during the period of very high political risks. This is also evident during the earlier period of very high political risk (1981Q1 – 1983Q2).

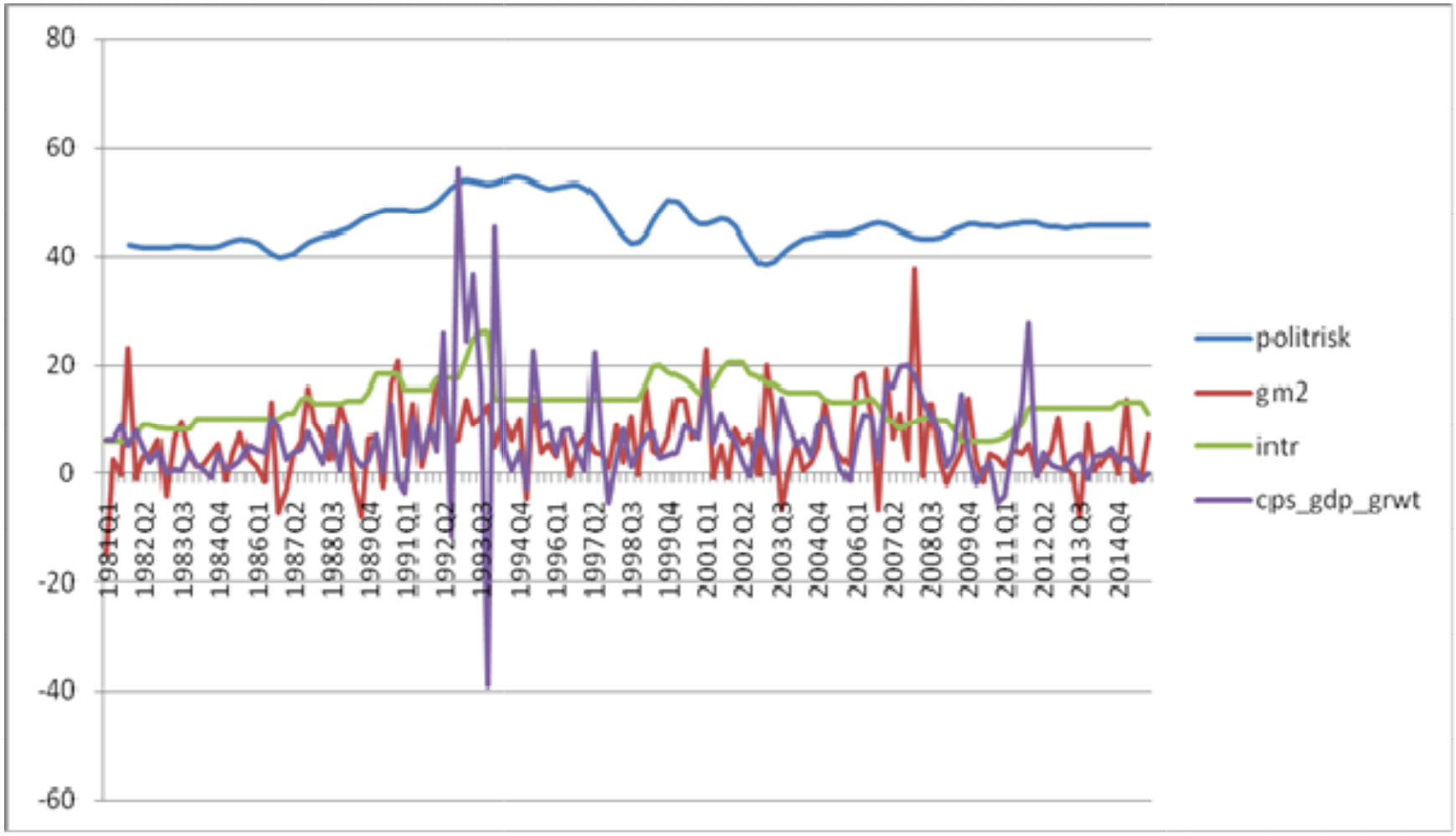

Figure 2.23: Political Risks and Monetary Policies in Nigeria (1981Q1 – 2015Q4)

Source: Underlining data from CBN Statistical Bulletin (2015) and ICGR (2016)

2.9 Conceptual Literature and Definitional Issues

This study revolves around two main concepts of double trilemma and central bank behaviour. The former comprises macroeconomic trilemma and financial trilemma while the latter entails the ex-ante and ex-post strategies of the monetary authority. Also, the procedure for the conduct of monetary policy highlights the transmission mechanism of monetary policy in an economy.

2.9.1 Conceptual Literature on Double Trilemma

The concept of trilemma has been dichotomized into macroeconomic trilemma and financial trilemma. The macroeconomic trilemma, which is otherwise known as the 'impossible trinity' was postulated by Mundell (1963) and Fleming (1962). It refers to a policy trade-off resulting in binary policy choices among exchange rate stability, financial integration and monetary independence of an economy. The hypothesis of macroeconomic trilemma suggests that countries are faced with polarized binary choices of either combining exchange rate stability with perfect capital mobility at the expense of monetary autonomy or maintaining exchange rate stability alongside monetary independence at a price of controlling for cross-border capital transactions. Lastly, a combination of monetary autonomy and financial openness is possible only with flexible exchange rate system.

By implication, all three policies of exchange rate stability, monetary independence and openness on cross-border capital transactions are not attainable simultaneously (Mundel, 1961; 1963; Aizenman, 2011). Macroeconomic trilemma is strongly rooted in historical evidence. During the gold standard era, monetary independence of economies was sacrificed for the attainment of both exchange rate stability and free capital flows. In the case of Bretton Wood System, monetary autonomy and exchange rate stability were guaranteed only at the expense of free capital mobility (Aizenman and Ito, 2011). Macroeconomic trilemma gives rise to three other concepts that require conceptual clarifications. These concepts are financial integration, exchange rate stability and monetary independence.

Financial integration is a multidimensional process through which the allocation of financial assets becomes increasingly borderless. Financial integration encompasses trade in financial services and cross-border capital flows (FINSIA, 2015). It is the degree of a country's level of financial connectedness to other countries of the world (Financial System Inquiry, 2014). According to Sy (2014), there are four major preconditions for financial integration. These are financial development, quality governance, trade openness and capital account liberalization. Financial integration could be in the form of direct or indirect channels. The direct channel deals with market-oriented incentives towards ensuring borderless and costless capital transactions across economies while the indirect channel relates to policy guidelines and legal frameworks towards unhindered mobility of capital across borders (Egbetunde and Akinlo, 2015).

In the same vein, exchange rate stability is usually likened to fixed exchange rate regime in developing economies. Although, a fixed exchange rate regime does not automatically translate to stability of exchange rate but the fact that the monetary authority is committed to ensuring, through open market operations, a stable value of its currency in relation to the referenced currency to which it is pegged, makes the definition appropriate. The market forces are not allowed to affect the value of the domestic currency in relation to its referenced currency or basket of currencies. This is because the monetary authority would sell domestic currency to buy foreign currency in the period of nominal exchange rate appreciation and buys domestic currency to sell foreign currency in the period of nominal exchange rate depreciation. The emphasis here is that in a fixed exchange rate regime, money supply becomes an endogenous policy variable that is employed to prevent the changes in the value of the domestic currency. However, the flexibility of exchange rate ensures that the supply of money maintain its exogenous status (Pikoulakis, 1995).

Lastly, monetary independence, otherwise known as monetary autonomy, is the ability of the monetary authority to freely determine its own monetary policy, as opposed to allowing the interest rate to move at par with the foreign rate of interest. More so, it indicates that the supply of money would not become an endogenous component of exchange rate intervention. This suggests that with exchange rate intervention, there is loss of monetary

independence (Suranovic, 2005). But relative monetary independence is possible with control on cross-border financial transactions in and out of the domestic economy. This is the trade-off enunciated in the macroeconomic trlemma (Aizenman and Ito, 2015).

On the other hand, financial trilemma is the impossible combination of national financial policy and financial stability when the economy is faced with openness on international financial transactions. It further implies that macro-prudential guidelines would be ineffective in the presence of financial globalization (Schoenmaker, 2013; Obstfeld, 2015). With the exception of financial integration that is already included in the concept of macroeconomic trilemma, financial trilemma has two other concepts namely national financial policy and financial stability. National financial policy is the embodiment of policy framework directed at ensuring the stability of the financial sector. It includes the use of monetary policy and a broader spectrum of structural and financial reforms of the money, capital and foreign exchange markets. Generally, the major objective of national financial policy is to obtain low and investment-driven short- and medium-term interest rates that would further facilitate credit flows for businesses and economic activities (Affab, Jebran, Ullah and Awais, 2016).

Financial stability, on the other hand, is the ability of the financial system to continue to provide core financial intermediation services, risk management and efficient payment system in the face of inevitable shocks and global economic dynamics (Tucker, 2015). The conceptual literature on financial stability indicates that it can either be direct (that is, in the form of financial soundness) or indirect (that is, as a way of financial instability). This conceptual clarification implies that financial trilemma is a particular variant of the macroeconomic trilemma. Although, it is posited that macroeconomic trilemma is empirically nested in the financial trilemma. Theoretically, however, financial trilemma is nested in macroeconomic trilemma as both have the same theoretical exposition; through the popular Mundell-Fleming framework. It is along this thread that Nakaso (2015) provided a conceptual framework between the Mundell-Flemings' (Macroeconomic Trilemma) and the Shoenmakers' (Financial Trilemma) trilemma; now termed the double trilemma.

2.9.2 Conceptual Literature on Central Bank Behaviour

The behaviour of the Central Bank is simply the strategy adopted by the Central Bank in its conduct of monetary policies to stabilize and/or stimulate the economy. The behaviour of the central bank suggests that monetary policy can either be conducted as a rule or done at discretion. A monetary policy rule specifies future monetary actions as a simple function of economic or monetary conditions and rules out the use of contingent approaches in the face of economic uncertainties (Blejer, 1998). Kydland and Prescott (1977) put it more succinctly when they posited that rules increase the ability of the central bank to remain discipline to its committed policies so as to avoid monetary surprises and, in the end, obtain a lower rate of inflation (Fischer, 1990).

On the other hand, the conduct of monetary policy as discretion is a 'zero-based' strategy that seeks to revise the current monetary policy in tandem with the prevailing economic and/or financial realities. Discretionary strategy is an accommodating method that redefines the position of the central bank in discharging its avowed goal(s) from time to time (Svensson, 1997). It further extends to discussing the goals of the central bank not only of price stability but also as exercising some level of flexibility in the accomplishment of its goals and the choice of instruments; both being the component of central bank financial and/or economic independence. Generally, monetary rules are either quantity rules or price rules (Barro, 1986). But the public prefers the movement from current to future prices as central bankers usually adopt contingent approach in the use of the many quantity measures of monetary aggregates (Hetzel, 1984). Van Lear (2000) provides a standard review of the various measurement issues around the rules-discretion strategy of monetary policy; with strong emphasis on the former.

Basically, the author emphasized five major measurements. These include the quantity theory measure, the McCallum's (1988) money growth rule, Angell's (1992) commodity price rule, the measure of the natural rate of unemployment and the Taylor's (1993) rule. The quantity theory measure is seen as a framework to explain the long-run behaviour of prices while the McCallum's (1988) rule is a price adjustment mechanism through the money growth with which the GDP growth rate is kept at a given benchmark. Angell's

(1992) rule is the adjustment in the interest rate in tandem with a commodity price index, the natural rate of unemployment is a non-inflationary unemployment rate with which price is also made stable. Finally, the Taylor's rule is a modification of the natural rate of unemployment rule where the basis of comparison is between the actual and potential growth of the economy as against actual and natural rate of unemployment in the former (Van Lear, 2000). More so, inflation targeting has been suggested as an ideal policy framework to counteract the conflict between rules and discretionary strategies. But, the potency of the inflation targeting framework has been disputed in empirical investigations (see for example, Friedman; 2004). As such, reputational forces and credibility have been suggested as rules substitute (Barro and Gordon, 1983).

The use of discretionary policy is a strong signal for the dynamically inconsistent problem of monetary policy (Cukierman, 1992; Cukierman, Webb and Neyapti, 1992; Barro and Gordon, 1983). This dynamically inconsistent problem suggests that policymakers become bias to inflationary policy with a view to stimulating aggregate demand and consequently reduce the level of unemployment in the economy. This is the popular short-run trade-off between inflation and unemployment. But, the desire for the monetary authority to always reneged on its promise of low inflation leads to output loss. The implication from this is that the society benefits more if the behaviour of the central bank follows rules rather than operates discretionarily. Discretionary monetary policy is sub-optimal in this regard as it leads to reduction in the social welfare of the public (Cukierman, 1986; Cukierman, 2006). However, central bank in a developing small economy such as Nigeria cannot afford to stick to rule because it is usually affected by various global financial and economic. This is due to her 'small country' status as the domestic economy does not have commanding influence in the determination of global monetary impulses and global capital cum financial transactions. As such, this study conceptualizes the behaviour of central bank as the use of discretion in stabilizing the economy when faced with the double trilemma of macroeconomic and financial trilemma.

2.9.3 Procedure for the Conduct of Monetary Policy

The manner in which the central bank affects the economy reflects its conduct of monetary policy. The operating procedure of the monetary authority is usually to achieve some end goals such as price stability, foreign exchange (FOREX) stability, financial market stability, interest rate stability, high employment and economic growth. However, the policy instruments of the central bank such as the open market operation (OMO), discount policy and reserve requirements, can only be employed to achieve these goals through its effects on some monetary targets (such as the operational and intermediate targets). The intermediate targets are easily more observable and are only directly affected by the operational targets. With the former, the monetary authority can evaluate the efficacy of its policy instruments. This transmission can better be illustrated with the schema in Chart 2 below:

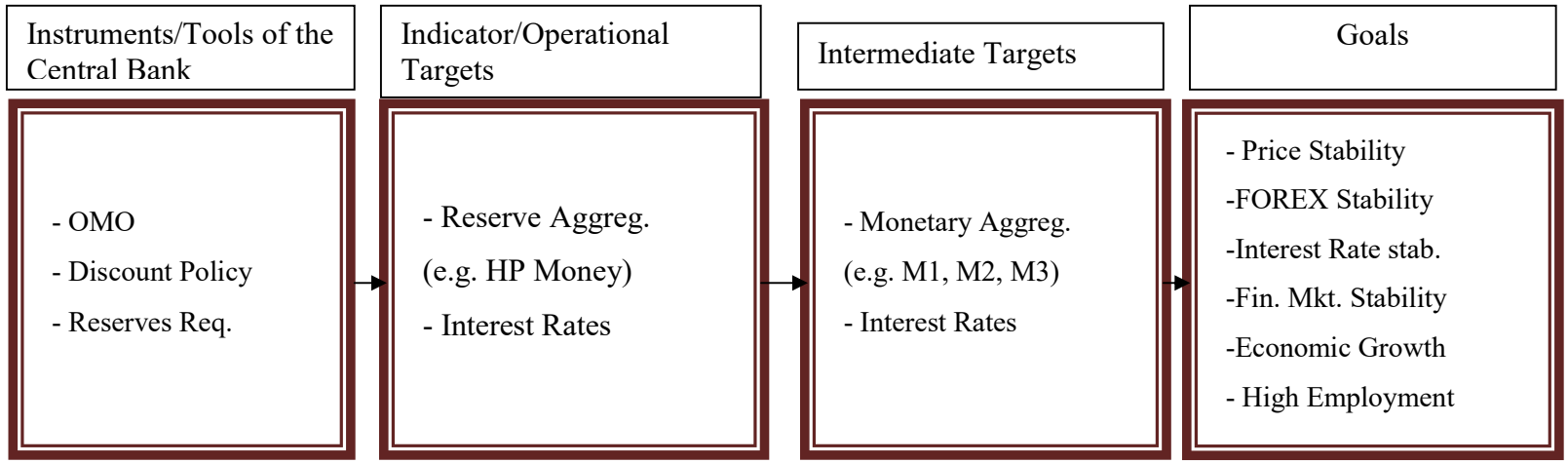

Chart 2.1: Linkages between Central Bank Tools, Policy Instruments, Intermediate Targets and Goals of Monetary Policy

Source: Mishkin and Serletis (2016)

It is instructive to note that there are set of criteria that determine the choice variables of intermediate targets employed by the central bank. These criteria are measurability, controllability and the predictable effects on goals. The extent to which the central bank is able to control the chosen monetary target(s) will determine its degree of autonomy. In Nigeria, the central bank seeks to stabilize the interest rate rather than make the money supply exogenous. Due to the type of exchange rate regime practiced over the years which has been largely a mix of both managed float and exchange rate fixity, money supply has been rather endogenous. Also, the extent to which the chosen interest rate is stabilized depends on the degree of capital mobility for the economy. It is within this context of operating procedure of the central bank that the triad policies of exchange rate stability, monetary autonomy and financial integration are to be harmonized.

2.10 Review of Theoretical Literature

2.10.1 Theories of International Capital Flows

There are three major theoretical handles to the study of international capital flows. The first is the standard static general equilibrium theory propounded by Arrow (1952), Debreu (1951), Arrow and Debreu (1954); the extended general equilibrium theory enunciated by Dixit and Stiglitz (1977) and the various extractions from the thesis of institution; under which the political economy views of capital flows are highlighted.

2.10.1.1 Arrow-Debreu Static Theory

The Arrow-Debreu static model is predicated on a one-period general equilibrium and it promotes beneficial capital account liberalization on productive and allocative efficiencies of global capital within a single global real interest rate. The basic tenet of this theory is that there is cheap cost of capital at world interest rate. It allows for global exchange of resources that yields productive efficiency and promises higher returns; consequent upon optimal investment opportunities and efficient allocation of resources. However, this theory is criticized majorly for its restrictive assumption of perfect competition. This led to the extension of the model. Basic factors such as imperfect competition, increasing returns to scale, technological and ‘network’ externalities coupled with reward for innovative

activities are considered worthy of evaluation and thus, altered the baseline static general equilibrium model of Arrow-Debreu (1954) (Milner, 2014).

2.10.1.2 Dixit-Stiglitz Dynamic Theory of Capital Flows

Under a monopolistic competition framework of Dixit and Stiglitz (1977); a form of dynamic structure that seeks to capture the extension to the Arrow-Debreu static general equilibrium model is advanced. This dynamic model supports joint interdependencies of economic agents of a 'network' good that yields network of externalities. As a result, the production cost either reduced or the consumption benefits increased. Within this framework, the externality outcomes of investment largely led to increased social returns on investment. This further stimulates the need for reducing the real interest rate, in the domestic economy, to the world level; especially due to the shortage of domestic savings. The overriding implication of this theory is that competition breeds innovation, enables technological transfer that further reduces cost of transactions and communications; altogether favour free international transactions in financial claims and consequently leads to increasing returns to scale of production (Engelen and Grote, 2009; Aghion et. al., 2005; Rochel and Tirole, 2009). Heuristically, this lends credence to the modification of the baseline 'AK' production function to capture the extended general equilibrium framework. However, this theory is criticized for being too simplistic as it discounts the importance of political factors in international flow of capital.

2.10.1.3 Political Economy Theories of Capital Flows

Another theoretical handle to international flows of capital is that which accounted for the effects of political factors in cross-border financial flows. An integration of political factors to the movement of cross-border capital is dichotomized into two major strands of purely benevolent and purely self-serving government; with the median voter's theorem of Persson and Tabellini (1992), as later extended by Edwards and Keen (1996), holding the hybrid position. As posited in the theoretical literature, a self-serving government prefers financial repression as a way to manipulate the rate of interest and then compelled the banks; in the absence of viable business opportunities, to subscribe to using unremunerated reserve for open market transactions. This made the government to obtain cheap capital,

through the sales of treasury bills and other instruments of the open market operations. This serves as means of imposing tax on the banks, for expansionary macroeconomic objectives; mainly for their political interest (Alesina and Roubini, 1992; Nordhaus, 1975). This is also similar to the manipulation of the central bank to discriminately charge low or negative interest rate on government borrowings so as to have access to cheap or costless capital for purely political motives. As such, monetary policies become the instrument of obtaining fiscal objectives; either directly through seigniorage or indirectly, through a discriminate but favourable interest rate to government borrowings (Dooley and Isard, 1980; Bartolini and Drazen, 1997).

From the standpoint of a purely benevolent government, the idea of capital account liberalization is promoted. However, this appears costly to the economy as it erodes its fiscal autonomy since the government will evidently loss huge revenue due to remover of barriers on foreign capital flows and the distributional objectives of fiscal policies would have been defeated (Obstfeld, 1998; Rasin and Sadka, 1991; Sorensen, 2004). For the hybrid position, there is no 'water-tight' position to the two extreme political economy views of self-serving and purely benevolence. This view considers cost-benefit analysis as the basis for the desirable capital flows and that financial integration policies should be in tandem with how the economy is structured. A relatively closed economy is said to give preference to monetary independence, allows for cross-border financial transactions at the expense of exchange rate stability, while the vice versa holds for a relatively open economy (Gallagher, 2012; Milne, 2014).

2.10.2 Theories of Exchange Rate Management

There are three views to the types of exchange rate arrangement adopted by an economy. The first view is the structural approach, the second view is the conventional approach while the third view is the bipolar view.

2.10.2.1 Structural Theory of Exchange Rate Management

The structural approach focuses on the structural characteristics of the economy. It weighs the country's ability to achieve internal and external balance as a major determinant of the exchange rate arrangement adopted. Also, it considers the shock effects of trade agreements

with other economies (Ouchen, 2013; Fisher, 1977). The basic conclusion of the theory is that fixed exchange rate regime is supported when the economy is affected only by nominal domestic shocks. However, a flexible exchange rate regime would be appropriate when both real and nominal foreign shocks coupled with real domestic shocks affect the economy. The structural approach to exchange rate management can also be referred to as situation theory of exchange rate management where the present economic situation determines the type of exchange rate to adopt. However, this approach would lead to serious uncertainties in the economy as there would be frequent exchange rate switches as the situation demands.

2.10.2.2 Conventional Theory of Exchange Rate Management

The conventional approach emphasizes a trade-off between credibility and flexibility of exchange rate. In line with this trade off, this approach assumes a utility loss optimization procedure of the monetary authority. The conventional approach is most appropriate when the monetary authority aims to alternate between fixed and flexible exchange rate regimes. This theory presupposes that a credible but flexible exchange rate makes monetary policies become quasi-exogenous as it is able to accommodate domestic and foreign shocks. This theory is diametrically opposed to the bi-polar view which suggests a mutual exclusivity of hard-peg and flexible exchange rate regimes. This is the practice of exchange rate management in most developing economies. Most developing economies are categorized small open economies and dynamics and shocks from larger economies largely affect the value of her domestic currency. It is instructive to note that this theory is so named conventional as exchange rate management has been a matter of great concerns that economies have to trade-off a level of credibility of hard-peg to obtain some levels of exchange rate flexibility.

2.10.2.3 Bi-Polar View of Exchange Rate Management

The bi-polar view serves as the third approach. This approach indicates that countries with intermediate exchange rate regime cannot afford open cross-border financial flows because only corner-point exchange rate positions can be maintained (Eichengreen, 1994; Obsfeld and Rogoff, 1995). This approach suggests that exchange rate management of countries can

only be categorized into purely hard-peg or purely free-float exchange rate regimes and exchange rate interventions of managed-float; with varying degrees of fixed and flexible exchange rates at a particular band level, cannot be practiced. This approach was a post-Bretton Wood practice. This view to exchange rate management creates investor's confidence and improves the credibility of the monetary authority. There would be less volatility in the economy and follows the rule-based approach where exchange rate management is not subjected to contingencies due to global financial cum economic dynamics.

2.10.3 Theories of Central Bank Behaviour

The theoretical literature on central bank behaviour can be explained either as a positive or normative hypothesis (Cukierman and Meltzer, 1986).

2.10.3.1 Positive Hypothesis of Central Bank Behaviour

The positive hypothesis is an exposition about the objectives and constraints that central bankers have to contend with. In this case, inferences are usually drawn from observable variables (such as inflation rate and rate of money growth) while intuition and heuristic implications are obtained from unobservable variables (such as policy credibility). The positive view is an inter-temporal approach to evaluating the behaviour of the central bank. It is an optimization process where the monetary authority derives utility from its mandate of price stability but constrained by many factors such as government intervention, economic structure and its intervention to exchange rate management. This theory is prevalent mostly in developing economies where there is problem of institution and the central bank has hierarchical mandate of primarily maintaining price stability in addition to other objectives towards the overall stability of the economy. The major criticism of this theory is that the monetary authority would suffer credibility problem and would also be dynamically time inconsistent. The idea of dynamic time inconsistence has to do with the situation where the monetary authority could not be consistent with future economic projections that are decided today.

2.10.3.2 Normative Hypothesis of Central Bank Behaviour

On the other hand, normative hypothesis relates to how monetary authorities would improve on the social welfare condition of all economic agents in the economy. It is along this thread that Kibmer and Wagner (1998) provided three central reasons (such as the employment motive, revenue motive and the balance of payment motive) for the time inconsistency policy; popularly referred to as the inflation biasness problem. The employment motive is a game-theoretic model which centres on the short-run Phillip curve. This motive predicts that changes in employment is mainly predicated on an unexpected inflation and that given perfect forecast as well as rational expectations of private economic agents, output would fluctuate around its natural level on the attendant of supply shock. The model presumes that the natural unemployment level can only be lower than the socially desirable output if there exist distortions in taxes or in the presence of distorting wage-setting.

The revenue motive presupposes that the government can be motivated to generate unexpected inflation; even in the presence of nominal debt without any effect on the nominal interest rate. In real terms, cost of debt would decline and the real balances for inflation tax would remain unchanged. Regarding the BOP motive, an unexpected devaluation can be undertaken by policymakers in the presence of persistent current account deficits. This is an analogy for surprised inflation but under the theory of one price. It is indicative to note that one major feature standing out of these motives is the potency of rational expectation of the private agents in shaping the opinion of the policy makers towards a desirable socially optimal welfare function (Blanchard and Fischer, 1989; Schaling, 1995; Kibmer and Wagner, 1998).

2.10.4 Theoretical Links among Financial Openness, Exchange Rate and Monetary Policy

The theoretical linkage among financial openness, monetary policy and exchange rate is anchored on the Mundell-Fleming framework and the Compensation thesis.

2.10.4.1 Mundell-Fleming Theory and Extensions

The Mundell-Fleming theory is an open economy extension of the Keynesian IS-LM framework of closed economy. The underlying assumption of the theory include static formation, perfect asset substitutability, uncovered interest rate parity condition, imperfect capital mobility and small country assumption (see Biswas, 2018). In an open economy with a fixed exchange rate regime, fiscal policy is considered to be the effective policy while monetary policy is effective for a floating exchange rate regime in a globalized world. The Mundell Fleming framework follows an adaptive (backward-looking) expectation and assets in different denominations are perfectly substitutable.This standard Keynesian view, which is enshrined in the Mundell-Fleming framework, suggests that money supply is exogenous and can be viewed as a vertical curve. Rates of interest are endogenous. In this case, there exists a natural rate of interest and causality runs from reserves or high-powered money to money and then to credit and excess money growth causes price inflation.

This theory has been criticized on many grounds. The very underlying assumptions form the grounds of criticism. First, the idea of adaptive expectation is criticized on the basis that it makes expectation formation to be old fashioned and becomes unrealistic. Also, the uncovered interest rate parity condition have been faulted on the basis that there could be need to build risk into asset values due to some reasons. This could be attributed to the sterilization intervention of the government or the emergence of non-credible government. More so, the level of financial development and the state of financial configuration of a country may make the assumption of perfect capital mobility to be unwarranted. This suggests that capital account transactions become sequenced and financial openness becomes gradual. It is these shortcomings that led to various extensions to the standard Mundell-Fleming framework. Dornbusch (1976) addressed the problem of adaptive expectations as forward-looking as well as rational expectation approach was introduced to exchange rate determination while Obstfeld and Rogoff (1995) built an inter-temporal framework to model the micro-foundation of exchange rate behaviour.

The Dornbusch (1976) theory of overshooting exchange rate integrated monetary and Mundell-Fleming models. The theory predicts that real markets adjust slowly due to price fixity in the short-run while financial market adjusts very rapidly. This made financial markets to over-adjust to compensate for the sluggish real (goods) markets. A long-run full price adjustment allows all real variables to adjust rapidly and be restored while the nominal exchange rate is left at the new equilibrium level predicted by the simple monetary model. The Obstfeld and Rogoff (1995) framework is a time-variant abstraction of the Mundell Fleming model that was built on monopolistic competition. Hence, prices and wages were still considered rigid but allow producers to earn possible mark-up. The basic contribution of the Obstfeld and Rogoff (1995) theory is that welfare maximization analysis of exchange rate management can be done while the Dornbusch (1976) extensions largely focused on the role of expectations and forward-looking behaviour of economic agents.

2.10.4.2 Compensation Thesis

The compensation thesis illustrates sterilization effects by an automatic mechanism within a stock-flow accounting analysis. The theory presupposes that fluctuations in the central bank's foreign exchange reserves will be compensated by opposite movement in the other elements of the balance sheets of the central bank. Following from this, there is a positive correlation between the domestic and international assets of the central bank. It was this positive correlation that Bloomfield (1959), following the study of Nurkse (1947), regarded to as the 'rule of the game'. As a post-keynesian theory, the compensation thesis is anchored on the assumption that the supply of money is endogenous, demand-led and has a horizontal curve. There is a possibility of multiple natural rates of interest since the short-term interest rates are exogenous and set by the monetary authority.

The compensation thesis is an extension of the reflux principle evidenced in the earlier writings of Nurkse (1947), Kaldor (1980) among others. This theory was built on the weaknesses of the Mundell-Fleming model. The compensation thesis does not assume infinite asset substitution, whereas most Keynesian authors such as Mundell (1961) predicated their theory on infinite asset substitution (Levoie and Yan, 2004). The compensation thesis is predicated on an accounting framework of double entry principle.

Within the compensation thesis, causality moves from credit to money aggregates to reserves, Inflation and output growth. The theory suggests that all sectors of the economy need buffers as adjustment factors. The major criticism of the theory is that sterilization of the central bank accounts cannot sustain into the long-run situation because of many imperfect market conditions; especially in developing economies where the assumption of automatic stabilization is not realistic.

2.11 Review of Empirical Literature

For clarity of exposition, the review of empirical literature were discussed primarily under three the sub-headings of developing economies, developed economies and emerging economies. Also, some studies which considered a mix of these economies were also reviewed. Irrespective of these classifications of review, these studies generally revolve around country-specific studies and cross-country studies. These reviews deal highlight the scope, objective of study and the main results were also highlighted in the following sub-sections.

2.11.1 Review of Empirical Studies from Developing Economies

Beginning with the first category of studies, the study of Chernshoff, Jacks and Taylor (2009) was one of the leading studies that tested for the trilemma hypothesis in developing economies. The authors enquired whether fixed regimes, like the era of the gold standard, diminished macroeconomic volatility. The study employed a panel dataset that comprised twenty-nine (29) small economies for the period 1875 – 1939 but excluded periods of World War I and German hyperinflation period of 1922/1923. The authors estimated series of regression pooling observations from 1914 (denoted as 'prewar') and from after 1918 (denoted as 'interwar') and controlled for series of diagnostics and sensitivities but still not without some caveats. The results obtained indicated that for a fully flexible economy, there would be money neutrality and that the regimes of exchange rate would be irrelevant. It was concluded that the global economy conformed greatly to a fixed exchange rate regime during the pre-war era. The same thing cannot be said of the interwar period when the gold standard was in use. The study, then, gave prominence to the flexibility of exchange rate as a panacea to resolving the trilemma constraint.

Also, the study of Glick and Hutchison (2009) examined the trilemma constraints in China. The study investigated how monetary policy faired in China when open cross-border transactions were in practice. The study found that the monetary authority in China employed the use of sterilization control to wedge against the inflationary effects of economic openness and the results showed a significant positive correlation intermediated with international foreign reserves. More so, Aizenman, Chinn and Ito (2010) investigated the effect of the trilemma constraint on macroeconomic fundamentals for a panel of developing countries. The authors found that the independence of the monetary authority served as a control measure to the volatility of output while the stability of exchange rate aggravates it but can be mitigated by foreign reserve accumulation. Openness on financial transactions also reduced output volatility. By contrast, greater monetary independence led to price instability but price stabilized with high degrees of exchange rate stability and financial openness.

In another study, Aizenman, Chinn and Ito (2011) assessed the effects of the triad policies on the economies of the Asian countries. The results obtained largely conformed to that found in earlier study of the same authors in 2010. The study also found that the Asian economies employed the use of international reserve to reduce the effects of the trilemma constraint; with greater preference for the stability of the exchange rate. Closely followed, the study of Taguchi, Nataraj and Sahoo (2011) examined the evidence for the trilemma constraints in selected Asian economies. The results were mixed as some countries that practiced flexible exchange rate have its monetary authorities enjoyed more autonomy. For other countries, independence of the monetary authorities became more guaranteed under a pegged regime; albeit with financial openness. It was found that the accumulation of international reserve played a great intermediation role in attaining the monetary autonomy for these emerging economies.

In the same vein, Tagushi (2011) and Steiner (2013), in their separate studies, argued that central bank accumulates foreign reserves as a veritable tool for capital control; especially short-term financial flows. Steiner (2013) employed an annual dataset between 1970 and

2010 with series of regression models estimated for 87 – 180 economies. The results confirmed that foreign reserve accumulation by the monetary authority checks the damaging effects of floating regimes and disregard the trilemma constraint. However, the study of Hadwibowo and Komatsu (2011) could not find any correlation among the triad policies for the Indonesian economy during and after the Asian financial crisis. This lent credence to the harmonious efficiency of monetary and fiscal policies in this economy. In line with an earlier study of Cheung and Qian (2009), however, Cheung and Sengupta (2011) could not find any justification for the accumulation of foreign reserves by the monetary authorities in Latin American economies but likened it to the bandwagon effects of keeping up with the Joneses. This result was found robust with the inclusion of regional-specific factors.

In addition, the study of Hsing (2013) found a country-specific evidence for the trilemma constraint for the Brazilian economy; which suggested that the three triad policies were binding constraint. With a further introspection, the study found mix effects of the triad policies on economic growth, inflation and output volatilities.Similarly, the studies of Oshikoya (2014) and Akinkunmi (2017) focused on investigating the trilemma hypothesis for the Nigerian economy. The study of Oshikoya (2014) employed a dataset of 1970 – 2012 and used the ordinary least square method to investigate the option for economic trilemma and exchange rate management in Nigeria. Anchored on the Mundell-Fleming framework, the study found evidence for the trilemma constraint in Nigeria for the full sample period and for the in-sample periods demarcated by the respective regimes of central bank governors in Nigeria. Also, the accumulation of foreign reserve was found to mitigate the severity of the trilemma constraint and monetary policy independence was found to largely dominate the trilemma index. Within the same context, Akinkunmi (2017) examined the effect of central banks' interventions on trilemma constraint and employed the use of panel dataset for 30 emerging market economies for the period 1980 – 2014. The study was predicated on the portfolio balance theory and the pooled regression technique was used as the method of analysis. The analytical framework was still the Aizenman, Chinn and Ito framework of regressing the trilemma index against a constant. The result showed, for the case of intervention, the weighted sum of the trilemma objective was small

compared to the absence of intervention. The implication drawn was that intervention, through the accumulation of external reserve, was considered crucial in expanding the policy space of the trilemma constraint and also to strengthen private capital flows. Also, the study found evidence for the trilemma constraint in developing African economies but invalidated for the non-Africa emerging economies.

In order to investigate ex-ante behaviour of Central Bank of Nigeria, Agu (2011) specified two sample models of monetary policy reaction function with the first being a tracking model based on the revealed preference of the Central Bank of Nigeria and the second as an alternate model which closely followed the Taylor rule. The study could not find evidence for interest rate smoothing and fiscal dominance in the reaction function. Due to the high frequency data demanded for such a study, monthly data that covered mainly the periods of current democracy in Nigeria and spanned 1999 – 2005 were used. No long-run relationship was established among monetary variables and even less so between monetary and real sector variables. The result was consistent with the pronounced policy of the Central Bank of Nigeria to tackle inflation as a priority and the primacy of credit to the private sector as the growth strategies of the monetary authority. However, these results contradicted the findings in the study of Bello and Sanusi (undated) where they found that the central bank was conscious of interest rate smoothing. The authors estimated monetary policy reaction function for the central bank of Nigeria through a Taylor-typed rule with quarterly data that spanned 2006Q4 – 2015Q2. The technique of analysis was the Generalized Method of Moment and the results obtained showed that the central bank followed a forward-looking policy rule and committed to an anti-cyclical monetary policy with a forward-looking behaviour of not more than a single quarter into the future.

In another study, Iklaga (2007) examined the effect of monetary policy on macroeconomic variables through a Taylor-type reaction function. The results showed the significance of inflationary pressures in the decision-making process of the monetary authority and that output plays the path dependence of interest rate. Also, Siri (2009) analyzed the reaction function of the central banks of Ghana, Nigeria and WAEMU and found that Ghana and Nigeria monetary policy are not consistent with the Taylor-type rule or any of its variants. Evidence obtained showed that interest rate weakly reacted to the variations of inflation and

output gap. The main observation from the result of the model was that monetary policy applied was different from those announced a'priori and that except for the inflation rate, the output appears not to have any influence on the adjustment of the interest rate of Bank of Ghana (BoG) and the Central Bank of Nigeria (CBN). In addition, the negative sign of the two bank's reaction coefficient did not adjust their interest rate in response to economic over-activity. Recently, the study of Onanuga, Oshinloye and Onanuga (2017) relied on the augmented Taylor's rule to evaluate the reaction function of the historical path of nominal monetary policy rate in Nigeria for the quarterly period that spanned 1996Q1 – 2014Q4. The main technique of analysis was the Generalized Method of Moments and the reaction function was augmented with the real exchange rate. The study found that real output and exchange rate were both significant in explaining the path of monetary policy in Nigeria.

In another cross-country study, Andrew (2014) opined that instead of undertaking a fixed exchange rate regime in order to enjoy monetary autonomy, small open economies now embarked on an inflation targeting regime. For a panel of 170 countries, the study, that spanned the period 1970 – 2012, found that the differences between the economic outcomes of fixed exchange rate and inflation targeting regimes are negligible; in terms of macroeconomic and financial consequences; notwithstanding the effect following the global financial crisis. Anchored on the portfolio balance model, Steiner (2017) showed that the exchange rate interventions may substitute for capital controls and that the former provides an effective instrument to relax the trilemma. The study lent credence to the efficacy of reserve accumulation as a panacea to remove the trilemma restrictions. Taking a panel of large countries between 1970 and 2010, the author found that foreign exchange intervention reduces the trilemma problem and that emerging countries have increasingly obtained the capacity to relax the trilemma constraint. However, the study showed the evidence for the trilemma constraint in the long-run. Given that assets are not perfectly substitutable, the use of international reserve has been suggested as a veritable neutralizing component of the trilemma constraint.

2.11.2 Review of Empirical Studies from Developed Economies

Globan (2014) tests for the trilemma constraints within the Eurozone. The study was anchored on the simple interest rate parity condition with a Marshall-Lerner orientation. The results found were consistent with the trilemma hypothesis and even robust to alternative measures.Investigating central bank behaviour, Brzozowski (2005) conducted a study to underscore the preferences of the monetary authority in Poland. The study employed a loss optimization reaction function that spanned the period 1995 – 2003. For further introspection, the study has two sub-samples for the period 1995 – 1999 and 1999 – 2003. The study found evidence for inflation bias by the Central Bank of Poland; especially since the year 2000 when the output stabilization goal was abandoned. Prior to the year 2000, the monetary authority pursued a dual mandates of price and output stabilities. However, Epstein (2009) employed a case study method to elicit vital conclusion and far-reaching policy suggestions than cross-country econometrics would do.

The study of Richardson and van Horn (2018) described how banks in the New York City reacted to herd effects of the 1931 global financial crisis that began in Austria and spread far and beyond the trans-Atlantic consequent upon the golden fetters and bank balance sheet effects. The study employed a detailed commercial bank balance sheet data to analyze the illuminating behaviour of banks in the central-money market of the United States before, during and after the financial crisis that swept through Europe and spread to America. The technique of analysis was the Randomized Controlled Trials (RCT) where the authors compared the behaviour of banks with substantial foreign exposure to European financial crisis in the Summer and Fall of 1931 to the behaviour of banks with little (or no) foreign exposure. The former is the experimental group while the latter is the controlled group. The study employed both aggregate and micro firm-level data and also preceded to a higher frequency data of weekly dimension and that has wider sample coverage of 100 other cities in the United States, aside the New York. This allowed the authors underscored the aggregate behaviour of banks in the New York and examined reactions to events as obtainable elsewhere. The authors found that European crises did little or nothing to alter the balance sheets of the American banks exposed to it against banks elsewhere in Europe that had even little exposures. However, the exposure to the financial crisis was only

occasioned by the golden fetters' effect where the United States has to protect its gold reserves by raising the discount rate.

Also, Beckmann, Ademmer, Belke and Schweickert (2017) examined a broad context restriction of how government ideology impacted on the impossible trinity of monetary independence, exchange rate stability and capital flow restrictions. The authors enquired on how partisan preferences affect the positioning of a country within the trilemma context and analyzed the impact of ideology on the degree of monetary independence and exchange rate stability as well as on capital flow restrictions. The study covered a sample of 111 countries and spanned the period 1980 – 2011 with the three-staged Least Squares being the technique of analysis. As robustness checks, various sub-samples estimations were undertaken to address outliers and region-specific peculiarities. With preference to the de-facto measures, the results validated the argument that government ideology affects a country's position within the trilemma constraint and even further proved that this effect of partisan preferences is peculiar and situational between the developed and developing countries; among the OECD versus non-OECD countries and between the financially opened and closed sub-samples. It was found that these results are not technique sensitive.

The study of Disyatat and Rungcharoenkitkul (2017) investigated whether financial globalization has compromised central banks' effectiveness in managing domestic financial conditions. The authors isolated the contagion component and focused on co-movements in measures of bond return risk premia that are unrelated to domestic economic fundamentals of 31 advanced and emerging market economies. The study employed a technique that eliminated co-movement of correlated fundamentals; as reflected in the simple correlation method. Although with the advanced economies more susceptible to global contagion; the results showed that central banks did substantially retained its influence over local financial conditions during the era of financial globalization. In the end, what was considered more relevant was how financial globalization did complicate the underlying trade-offs and the set of attainable outcomes.

Steiner (2017) investigated the macroeconomic policy choices in open economies in the presence of the quadrilemma constraint by extending the analytical framework of Aizenman et. al., (2009, 2013); the author included the measure of foreign exchange intervention. For a panel of 159 countries constituted into industrialized, emerging and developing countries with investigation period that spanned 1970 – 2010, the study confirmed that the quadrilemma hypothesis holds and further showed that the foreign exchange interventions provided an effective instrument to relax the trilemma constraint; especially effective for emerging markets. The conclusion was that the central banks were able to relax the trilemma trade-off.

Lastly, the study of Chen, Yao and Ou (2017) established a dynamic exchange rate determination model incorporating capital control and foreign exchange intervention in a Taylor's rule framework. The paper employed quarterly data that spanned 1985 – 2015 for China, Japan, the United Kingdom and the United State economies. The authors followed Weymark (1997) and Fiess and Shankar (2009) on the measures of foreign exchange intervention and used it alongside other variables such as output growth rate, interest rate, exchange rate and inflation; predicated on a loss minimization function. The technique of analysis was the Structural Vector Autoregression (SVAR) and the results obtained were mix. It was found that compared to supply shock, a demand shock appeared more important for exchange rate dynamics. It was, however, posited that reducing foreign exchange intervention by the central bank was helpful to realize the independence of monetary policy. The estimated results showed that the social welfare loss of China was the largest, and that of Japan, the smallest. As a policy suggestion, the central bank of China was advised to gradually open up its capital account and give up fixed exchange regime or embarked upon managed floating exchange rate regime, reduce central bank intervention in order to improve the effectiveness of monetary policy and social welfare.

2.11.3 Review of Empirical Studies from Emerging Economies

For a study on emerging economies, Taguchi (2011) tested for the presence of the trilemma constraint in emerging Asia and Latin American economies. The striking result obtained is that accumulation of foreign reserve is key to the independence of monetary policy and that

floating regimes enhanced monetary autonomy. The study of Ma and McCauley (2013) querried the Chinn-Ito measure of de-jure capital account openness and investigated whether the Lane-Milessi-Ferreti measure of de-facto openness ranks China and India correctly. The authors examined eight dimensions of de-facto capital account openness and they also introduced two new measures into the debate of the quantity measures such as the openness of consolidated banking system and the internationalization of currencies. The study found that the Indian economy appeared more financially opened. The study of Ihnatov and Capraru (2014) found evidence for the volatility effects of capital mobility in selected CEE countries. More so, the study of Obstfeld (2015) mainly found an evidence for the classical trilemma hypothesis in the short-run situation using short end of the interest rate term structure but a long-run evidence for the global financial cycle hypothesis where he posited that long-term interest rate was found to be highly correlated across countries irrespective of the exchange rate regimes. The paper of Shoenmaker (2013) laid the foundation for financial trilemma.

The second category of literature are those studies that provided various alternative computations for the trilemma indexes and ascertain whether it differs from the conclusion reached with the use of the seminal measures provided by Aizenman, Chinn and Ito (2008). These studies queried the very basic foundation of the trilemma hypothesis; the trilemma indexes as computed by Aizeman et. al., (2008), and presupposes that one component or the other of the triad measures is fraught in error. The main index that suffers from this criticism is the measure of financial integration or capital account liberalisation. Traditionally, there are two measures of capital account liberalisation. These are the de facto and de jure measures. The former measure is a market-based measure that includes both the price and quantity measures while the latter measure includes legal and/or political measures[3]. More so, the interest rate parity condition between countries has been employed in various studies[4]. For the extent of financial integration, the popular Feldstein and Horioka (1980) remains largely prominent while later writers have strengthened the

[3] See Rizavi, Naqvi and Rizvi (2011); Pasricha (2010); Chinn and Ito (2008); Baele et. al., (2004)
[4] See Frankel, (1991); Haque and Montiel (1991); Montiel (1994).

literature with additional measures[5]. Also, the measure of monetary independence has not been spared[6].

It is within these existing measures that Aizenman et. al., (2008) measure monetary independence as the reciprocal of the correlation between interest rates in the home country and the base country; the exchange rate stability is the standard deviations of the change in the log of domestic to foreign exchange rate while financial integration is the use of legal/political measure provided by the International Monetary Fund (IMF) through its yearly Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). It is the critique of these foundational measures that other new measures as well as gauges were suggested in the empirical literature for testing the validity or otherwise of the trilemma hypothesis. Schularik and Ward (2015) suggested a wavelet analysis where oscillations and cyclical properties of financial variables were accounted for. This result was consistent with the global cycle hypothesis of Rey (2013); lending credence to dilemma rather than trilemma problem of international financial configuration.

The paper of Shoenmaker (2013) laid the foundation for financial trilemma. The study only provided a methodological framework through the trade-off of national financial policy in the face of international financial integration and financial stability. The framework was built on the trade-off between national financial autonomy and financial integration. The two other binary policy choices were completely neglected in the study. The only empirical effort was the study of Aizenman and Sengupta (2012) which only came up with implication for financial trilemma in China and India as the study still employed the measures provided by Aizenman et. al., (2008). The India economy was found to possess a financial configuration consistent with the trilemma trade-off while the trilemma configuration could not attribute any role for financial integration in China; uncharacteristic of emerging market economies. Lastly, the study of Hutchison, Sengupta and Singh (2013) sought to ascertain whether the description of Dove or Hawk aptly characterized monetary policy regime switches in India. Using a Markov-switching model with a time-varying open economy Taylor rule, the authors found that the central bank's objective switched

[5] Vo (2005); Quinn, Schindler and Toyoda (2011); Yabara (2012)
[6] See Frankel, Schmukler and Serven (2004); Shambaugh (2004); Reade and Volz (2010).

from ensuring price stability (termed Hawk) in the first regime to output expansion (termed Dove) in the second regime. The implication was that central bank followed a discretional policy rather than sticking to some sought of rules.

Goh and McNown (2015) examined the exchange rate regime-monetary policy autonomy nexus in Malaysia. The authors employed the use of unrestricted error correction model Pesaran Bounds test to analyze the interaction between the Malaysia and US interest rates during three different sub-periods of fixed, flexible and managed-float regimes. The study was predicated on the uncovered interest parity (UIP) condition for the quarterly period that spanned 1991 – 2012. The estimated results indicated that the trinity existed in Malaysia for the period investigated; especially in the long-run situation. Sengupta (2015) did a meta-analysis of past empirical studies on the India economy. The author examined various studies with different measurement issues around the three components of the macroeconomic trilemma coupled with international reserves; being the fourth component. More so, the study of Aizenman, Chinn and Ito (2010a, 2010b and 2011); Hitchison, Sengupta and Singh (2011); Aizenman and Sengupta (2013) and Sengupta and Sengupta (2013; 2014) examined similar objectives and the unanimous conclusion was that the accumulation of international reserve has become so central to meeting the trilemma constraint; as consistently done by most emerging economies since the past three decades. In fact, monetary autonomy remains the traded-off policy should the trilemma constraint hold at all. Foreign exchange intervention and moderate as well as sequenced capital control measures have remained the potent policies in most economies. These findings were also obtained for the case of India and other emerging economies.

2.11.4 Review of Empirical Studies with Mixed Economies

The study of Obstfeld, Shambaugh and Taylor (2004) examined the coherence of international interest rates over more than 130 years. The question posed by the study is whether the exchange rate and capital control regimes influence the extent to which local interest rates diverged from the world interest rate. The study found that non-pegs, both before 1914 and in the present, have enjoyed considerably more monetary independence than pegs. Overall, the results obtained showed strong evidence in support of the trilemma

as long enduring and still very relevant constraint on the political policy equilibrium. Also, Frankel, Schmukler and Serven (2004) investigated a host of developing and industrialized economies for the period 1970 – 1999. The study found evidence for global monetary impulses; even for country with floating regime and that the small country assumption holds in the long-run. This finding was inconsistent with the global financial cycle hypothesis.

Adam (2008) provided trend analysis and reviewed the extant literature to capture important factors in modeling monetary policy regimes in the world economies. The paper underscored the choice of nominal anchor within the context of the trilemma constraint. The author posited that immediately after independent, African economies had controlled for the influx of capital flows. The author enthused that since the mid-1990s; however, liberalization of capital account together with exchange rate intervention policy has been adopted while the policy trade-off has been the nominal anchor. The trend analysis further showed that, although, some countries preferred the 'hybrid' position which could neither adopt an explicit monetary target nor an external anchor, more than half of the 190 world economies stuck to the external anchor of exchange rate stability and sacrificed their nominal anchor of interest rate.

In another sense, Aizenman and Ito (2012) investigated the trilemma hypothesis for a host of developing and industrialized economies for the period 1970 – 2009. The results showed that developing countries have reclined to a 'middle-ground' position within the trilemma constraint; taking the international reserve as a buffer. More so, the greater the accumulation of foreign reserve, the lower the volatility of output in these economies. On the other hand, the trilemma constraint hold for the industrialized economies and that monetary autonomy have been the policy trade-off; especially for those within the Eurozone. Popper, Mandilaras and Bird (2013) found evidence for the simultaneity of the triad policies and the results further showed that the sovereignty of the monetary policies has to give way for the other two triad policies in either low or high income countries. The authors employed the use of a non-linear panel stability gauge method within some Gaussian restrictions. The findings also showed that international reserves intermediated

the stability of the trilemma constraint. In another study, Mandilaras (2015) introduced new gauge of stability which was bounded and correspondingly non-Gaussian. The study found that the combination of fixed exchange rates and financial market openness is the most suitable arrangements for either low or high-income countries. This is a possibility for emerging economies, only under a regional financial arrangement as obtained by Aizenman and Ito (2012) for the case of industrialized economies under European Union.

For a cross-country study, Aizenman, Chinn and Ito (2015) investigated how the financial conditions of developing and emerging market countries can be affected by the movements in the advanced economies – the United States of America, Japan, the Eurozone and China. The authors applied a two-step approach and sensitivity analyses and found that in the last two decades, financial variable such as exchange rate stability and financial openness have been significantly dominant in the centre economies. More so, the direction of linkage from exchange rate stability to financial openness is significantly stronger; thereby, lending credence to the relevance of the trilemma hypothesis. The unanimous results of these studies are that emerging market economies are adopting policy choices that are converging to a 'middle-ground' coupled with accumulation of high international reserves since the past two decades. On the other hand, industrialized developed economies have experienced more divergence of the triad policies with a combination of high exchange rate stability and financial openness taking the centre stage at the expense of monetary independence; largely due to their regional integrations such as the European Union. The common conclusion reached is that the trilemma hypothesis is still binding. More so, the convergence of the triad policies to a 'middle-ground' position is found to be a pre-condition for financial stability in developing as well as emerging economies. A condition not required for stability in output. But generally, to stabilize the real sector, convergence policy has to be accorded with high international reserve holdings. A condition not necessary for developed industrialized economies.

2.12 Review of Measurement Issues and Methodological Literature

The indicator for measuring the behaviour of central bank has been less controversial in the literature than the measure of macroeconomic trilemma which has been plagued with

myriads of issues. The behaviour of central bank can appropriately be measured through the use of interest rate differential which captures the reaction function of the central bank to the trilemma indices. Although, there exists a preponderance of measurement issues around measuring the reaction function of the central bank. The workhorse remains the Taylor rule but issues of interest rate smoothing and accounting for several constraints remain topical in the methodological literature of central bank reaction function (Siri, 2012; Agu, 2011). The measurement issues around the trilemma index largely center on the component values of monetary independence (MI), exchange rate stability (ES) and financial integration (FI). For example, Aizenman et. al., (2008) defined and computed indexes for these components.

Of the three indexes, the measures of financial integration have received heavy research patronage. Many indicators have been suggested and many measures have been provided by financial experts and economists alike (Vo, 2005; Pasricha, 2010; Quinn, Schindler and Toyoda, 2011; Yabara, 2012). However, there are generally four broad categories under which these various measures are classified. These are the price-based measure, the quantity-based measure, the de-jure measure and the de-facto measure. The price-based measures directly estimate the speed rate of return of comparable assets convergence across borders while the quantity-based measures examine the degree of correlation between savings and investment; in tandem with the Feldstein and Horioka (1980) hypothesis. This hypothesis presupposes that no relationship should exist between domestic savings and investments since domestic investments are financed by a pool of global (or regional) savings under a unified interest rate. Yabara (2012) suggested that the price-based measures appear more reliable as it has a clear-cut interpretation, simple and relatively reliable as compared to the savings and investment data in low-income countries which have high frequency that allows assessment of progress of integration over a relatively short term.

Many measures of price-based measures have been well documented in the empirical literature and are also suggested too for empirical investigations. The average absolute deviations price convergence measure enunciated by Chin and Ito (2007), the beta-convergence measure of Baele et. al., (2004) and the beta and sigma convergence measure; among others, have been largely promoted to measure the law of one price across various

economies but not without defects (Pascricha, 2010). The de-jure measure is a legal/political indicator which seeks to capture the quantum of regulatory barriers that hinders trade and capital flows across borders while the de-facto measure is a market-based measure that determines the actual value of these barriers (Park, 2013; see Bankole and Ayinde, 2014). Interestingly too, a level of cointegration of stock market returns has also been considered as a measure of integration in stock markets. This is also the price-based measure of financial openness.

Generally, the measures of financial integration as included in the trilemma measure by Chinn and Ito (2007) and Aizenman et. al., (2008) have legal/policy orientation. This is the de-jure measure. However, this measure would not adequately capture financial openness for developing economies due to the inherent structural and institutional rigidities that have characterized these economies. A market-based measure would most appropriately capture the degree of financial openness for developing economies as they have economic set-up that is porous such that tax can easily be evaded, lacuna in laws and regulations are unduly exploited to allow investors circumvent policy guidelines and poor implementation structure exists to operationalize existing laws (Edwards, 1999). Also, the techniques employed for empirical investigation of the macroeconomic trilemma have been wide-ranging; depending on the objective of investigation. While some studies have mainly tested for the trilemma hypothesis using a simple ordinary least square method upon the framework provided by Aizenman et. al., (2008); others have proceeded to ascertain the divergence as well as convergence ratio of the triad policies using formular method.

2.13 Critiques of Theories, Summary of Literature and Lessons Learnt

This section provides the general highlights of the reviews of theoretical, empirical and methodological literature.Particularly, the critiques of the various theories were highlighted. Beginning with, the main highlight of the theoretical literature on capital flows is that economies have been assumed to operate in a globalized world and these economies have to promote cross-border capital flows; to a varying degree. The Arrow-Debreu theory predicted these flows of capital within a static world capital arrangement while the Dixit-Stiglitz theory considered it dynamic. Even though the latter is a significant development

over the former, these two theories still assumed away one important factor that is so fundamental in the movement of capital across borders. This is the direction of capital flows. In fact, the third theory, the political economy theory, could not also address this concern. While the flow of capital is important, the idea that, in practice, capital moves more in reverse; from capital-poor economies to capital-rich economies, is to fundamental to be ignored. It is this direction of capital flows that determines the static or dynamic nature, and even the political-economy atmosphere, of capital flows. Even in this age, capital flows among most capital-poor economies is still largely static as the use of technology, that is prevalent in the dynamic approach to capital flows, is still missing in capital-poor economies. More so, political economy view of capital flows is more in practice for capital flows among capital-poor developing economies.

In relation to exchange rate, the three theories on exchange rate management are the structural, conventional and the bi-polar views. The major pitfall of these theories is that countries where exchange rate has become the policy variable of the monetary authority was not considered. These theories mainly considered exchange rate management based on the domestic and foreign economic and financial dynamics. Importantly, exchange rate management has become areas of interest for political office holders in resource-rich economies. This is because improper management of the exchange rate could be the single most important factor to loose political bid or to renew terms of office. Lastly, the behaviour of the central bank has been considered under positive and normative hypotheses.The former relates to inter-temporal as well as disaggregated construct while the latter is aggregated. However, the behaviour of central bank in the modern age is better described as an integrated hypothesis where the inter-temporal choice of economic agents will be used to obtain the social welfare function for the society.

From the foregoing empirical review, it is evident that several studies have been conducted on the macroeconomic trilemma but investigation into financial trilemma is still grossly latent in the literature. In the case of financial trilemma, the studies of Shoenmaker (2011), Obstfeld (2014) and Issing and Ito (2015) remain mainly prominent. These studies only identified financial trilemma as a possible constraint for the macroeconomic trilemma. The

only empirical effort towards the investigation of financial trilemma was the study of Aizenman and Sengupta (2012). However, this study used the same classical macroeconomic trilemma indexes computed by Aizenman et. al., (2008) to capture financial trilemma by only adjusting for the capital account component to reflect price measures rather than quantity measures.

Specifically, the reviews of extant literature were discussed under three major strands. The first strand relates to those studies that tests for the trilemma hypothesis, examines its impacts on macroeconomic fundamentals and argued for the adjustment in methods and methodologies. The second strand of the literature concerns the early studies that implied central bank behaviour of the trilemma constraint through the monetary transmission mechanism. The third strand pertains to studies that underscored the ex-ante behaviour of the central bank through Taylor-typed and augmented-Taylor-typed reaction functions. As a way of general overview, the extant literature on the trilemma hypothesis is discussed under three major categories. The first and second categories relate to those studies that test for the trilemma hypothesis and further investigate for its impacts on macroeconomic fundamentals; either as country-specific studies or cross-country studies. Examples of empirical works in this strand include the studies of Cheng and Qian (2009); Sengupta and Cheung (2011); Hadiwibowo and Komatsu (2011); Aizenman and Ito (2012a, 2012b); Hsing (2013); Jamilov (2013); Ihnatov and Capraru (2014); Aizenman and Ito (2014); Georgiadis and Mehl (2015) among others.

The major results obtained by these studies are that for the past two decades, emerging market economies are obtaining a 'middle-ground' position of the trilemma constraint through the use of accumulation of international reserves. For industrialized developed economies; however, there has been more divergence of the triad policies as these countries mostly combined both high degree of exchange rate stability with the openness of financial flows. This usually occurs trading-off monetary independence; largely due to regional integrations among countries within the European Union. The common conclusion reached is that the trilemma hypothesis is still binding. More so, the convergence of the triad

policies to a 'middle-ground' position was found to be a pre-condition for financial stability, but not for output stabilization, in developing as well as emerging economies.

The third category of the trilemma hypothesis literature are those studies that provided various alternative measures for the trilemma indexes and different methods of analyses and, then, ascertain whether it differs from the conclusion reached with the use of the seminal measures provided by Aizenman, Chinn and Ito (2008). These studies queried the very basic foundation of the trilemma hypothesis through the trilemma indexes computed by Aizeman et. al., (2008) and, then, argued that either one component or the other of the triad measures is fraught in error. The index measure that is mostly criticized is the measure of financial openness. Traditionally, there are two measures of capital account liberalisation; indicators for financial openness. These are de facto and de jure measures. The de-facto measure is a market-based measure that includes both the price and quantity measures while the latter measure includes legal and/or political measures[7]. More so, the interest rate parity condition between countries has been employed in various studies[8]. For the extent of financial integration, the popular Feldstein and Horioka (1980) remains largely prominent while later writers have strengthened the literature with additional measures[9].

Also, the measure of monetary independence has not been without its criticisms[10]. It is the critique of these foundational measures that informed that other new measures as well as gauges were suggested in the empirical literature for testing the validity or otherwise of the trilemma hypothesis. Schularik and Ward (2015) suggested a wavelet analysis where oscillations and cyclical properties of financial variables were accounted for. The result obtained was found consistent with other alternative measures; including the trilemma index. Popper, Mandilaras and Bird (2013) and Mandilaras (2015) introduced new gauge of stability which was bounded and correspondingly non-Gaussian. The study found that the

[7] See Rizavi, Naqvi and Rizvi (2011); Pasricha (2010); Chinn and Ito (2008); Baele et. al., (2004)
[8] See Frankel, (1991); Haque and Montiel (1991); Montiel (1994).
[9] Vo (2005); Quinn, Schindler and Toyoda (2011); Yabara (2012)
[10] See Frankel, Schmukler and Serven (2004); Shambaugh (2004); Reade and Volz (2010).

combined effects of exchange rate fixity with open cross-border financial flows have been the most favoured arrangement by majority of countries.

The second strand of the empirical literature relates to those early studies that implied the central bank behaviour of the trilemma effect through the monetary transmission mechanism. For example, the study of Aizenman and Sengupta (2012) came up with implication for financial trilemma in China and India. The study employed the measures provided by Aizenman et. al., (2008) and found that the India economy possess a financial configuration consistent with the trilemma trade-off. However, the trilemma configuration could not attribute any role to financial integration in China; uncharacteristic of emerging market economies. Also, the study of Hutchison, Sengupta and Singh (2013) sought to ascertain whether the description of Dove or Hawk aptly characterized monetary policy regime switches in India. Anchored on Markov Switching Regression Model together with a time-compliant open economy Taylor rule, the authors found that the objectives of the central bank switched from ensuring stability of prices (termed Hawk) in the first regime to expansion of output (termed Dove) in the second regime. The implication was that central bank followed a discretional policy rather than sticking to some sought of rules.

Regarding the third strand of the empirical literature, studies on the ex-ante behaviour of the central bank through the use of the Taylor-typed and augmented Taylor-typed rules have been largely prominent. The results obtained showed that most of these studies lend credence to the relevance of the Taylor (1993) rule as a way to capturing the ex-ante behaviour (reaction function) of central bank. Review of studies in this area is largely country-specific and few studies that were able to identify the peculiarities of each country, for cross-country studies, were also reviewed.Regarding the trilemma hypothesis and the behaviour of the central bank, some collection of studies has individually explored the objectives that this study seeks to pursue in one way or the other; albeit non-exhaustively. Specifically, Richardson and van Horn (2018) conducted explorations in economic history; Beckmann, Ademmer, Belke and Schweickert (2017) investigated the political economy of the impossible trinity; Disyatat and Rungcharoenkitkul (2017) examined whether monetary policy and financial spillovers are losing traction and the study of Chen, Yao and Ou (2017)

established an exchange rate determination framework which incorporated both capital restrictions and exchange rate intervention measures together in Taylor-typed model. However, the objectives pursued by these recent studies are not only aggregated in this study, but this study still further extends the frontier of knowledge in areas not covered.

For instance, Beckmann et. al., (2017) appeared to have enriched the empirical literature with the political economy coverage of the impossible trinity; the study was a cross-country study where the peculiarities of the political components of each country have been muddled up. Again, the study captured the political economy of the trilemma constraint as a form of partisan business cycles; distinct from opportunistic business cycle. However, this study incorporates both the opportunistic and partisan business cycles as this properly characterized institutional development in a developing economy such as Nigeria. Again, this study examined the political economy of the double trilemma hypothesis; which no study has ever undertaken. Also, Chen et. al., (2017) investigated exchange rate dynamics within a Taylor's rule framework. However, the Taylor's rule is still a static framework which cannot fully explain the dynamic ex-ante and the discretional ex-post effects of the trilemma constraints. It is for this reason that this study employs the Taylor's rule framework within the Markov Switching Dynamic Regression modeling. The studies of Disyatat et. al., (2017) and Steiner (2017) were rethinking formulations of the old hypotheses. The former reconsidered the dilemma hypothesis while the latter re-examined the quadrilemma hypothesis.

The lessons learnt from the existing literature are the areas of contributions for this study. First, no study has employed the Mundell-Fleming framework to investigate the political economy of the double trilemma. Secondly, the use of regime switching technique in investigating the central bank behaviour is still grossly latent in the literature. Thirdly, the behaviour of the central bank has been investigated in the literature without accounting for the full domestic and global dynamics. Fourthly, studies on the trilemma hypothesis mostly employed the use of the trilemma indexes computed by Chinn and Ito (2008); as amended. This is less than desirable for a thorough behavioural investigation.For clarity, the various views oftheoretical literature and frontier of empirical investigationson the trilemma hypotheses and the behaviour of central bank are summarizedin the following tables;

Table 2.4: Cursory Review of Theories of International Capital Flows

	Theories	Proponents	Assumptions	Predictions	Strength and Weaknesses
(A)	**Theories of International Capital Flows**				
(i)	Standard Static General Equilibrium Model	Arrow (1952); Debreu (1951); Arrow and Debreu (1954)	- Constant returns to scale; Perfect competition; One-period general equilibrium; single global interest rate.	Beneficial capital account liberalization predicated on global capital yield efficiency under a single global interest rate	***Strength:*** There is productive and allocative efficiency of capital ***Weakness:*** Restrictive assumption of perfect competition
(ii)	Dynamic General Equilibrium Model	Dixit and Stiglitz (1977)	- Joint interdependency; imperfect competition; increasing return to scale.	Competition breeds innovations, enables technological transfer and reduce transaction and communication costs; altogether favours free flow of cross-border capital.	***Strength:*** Dynamic model as time-dimension of capital flow is considered. ***Weakness:*** Too simplistic as it discounts the effect of political factors in international capital flows.
(iii)	Political Economy Theory of financial integration	Persson and Tabellini (1992); Alesina and Roubini (1992); Nordhaus (1975); Edwards and Keen (1996)	-Political climate plays a perceptible role; - The personal attributes of the leaders (self-serving or benevolent) contributes largely to dimension of flow	A self-serving government represses financial flows for future selfish political gains while a benevolent leader allows for free flow of capital movement.	***Strength:*** Cost-benefit analysis of financial flow can be negotiated. ***Weakness:*** Fiscal autonomy can be impaired when capital flow is encouraged.

Table 2.5: Cursory Review of Theories of Exchange Rate Management

	Theories	Proponents	Assumptions	Predictions	Strength and Weaknesses
(B)	**Theories of Exchange Rate Management**				
(i)	Structural Approach	Fischer (1977); Frankel and Aizenman (1982)	- General equilibrium; structural characteristics of the economy.	The desire to achieve internal and external balance is the major determinant of exchange rate and only nominal domestic shocks could allow for exchange rate fixity.	***Weakness:*** Complexity of the general equilibrium framework. - It is not clear in its classification effects of nominal and real variables.
(ii)	Conventional Approach	Eichengreen, 1994	- Monetary authority maximizes a utility function or minimize a loss function; Credible but flexible exchange rate; quasi-exogenous monetary policy.	It emphasizes trade-off between credibility and flexibility of exchange rate.	***Weakness:*** It is most suitable for switching exchange rate regimes. - The substitutability of credibility and flexibility of exchange rate is confusing.
(iii)	Bi-polar view	Obstfeld and Rogoff, 1995.	Intermediate exchange rate practice	Corner-point exchange rate regimes are not optimal.	***Weakness:*** It discounts the credibility of corner-point exchange rate regime.

Table 2.6: Cursory Review of Theories of Central Bank Behaviour

	Theories	Proponents	Assumptions	Predictions	Strength and Weaknesses
(i)	Positive Hypothesis	Cukierman and Meltzer (1986)	- Inferences are drawn from observable variables. - Implications are drawn from unobservable variables	The hypothesis indicates the expositions about objectives and constraints that the central bank faces.	***Weakness:***It is a partial equilibrium framework. ***Strength:*** The model is parsimonious and easy to manage.
(ii)	Normative Hypothesis	Kibmer and Wagner (1988)	- It is predicated on three central motives of employment, revenue and balance of payment.	- It relates to how the central bank would, simultaneously, improve the social welfare condition of all economic agents.	***Weakness:*** The framework could be over-paramterized (complex) since it is a general equilibrium framework. ***Strength:*** The model simultaneously achieves equilibrium in all markets.

Table 2.7: Cursory Review of Theoretical Linkages among Financial Openness, Exchange Rate and Monetary Policy

	Theories	Proponents	Assumptions	Predictions	Strength and Weaknesses
(D)	**Theoretical Linkages**				
(i)	Mundell-Fleming Framework	Mundell (1963); Fleming (1962)	- Supply of money and rate of interest are exogenous; Perfect capital mobility.	Causality runs from reserves or high-powered money to money and then to credit and excess money growth	***Weakness:*** Restrictive assumption of perfect capital mobility. - The model is most suitable to developed economies.
(ii)	Compensation Thesis	Nurkse (1947); Kalder (1980) among others	- Imperfect capital mobility; infinite asset substitutability.	Causality moves from credit to money aggregates to reserve; then to inflation and output growth.	***Weakness:*** It adopts an accounting framework of double entry principle. ***Strength:*** The model addresses the peculiarities of developing economies.

Table 2.8: Summary of Empirical Literature on the Trilemma Hypothesis

	Objective	Author(s)	Measures and Technique(s)	Findings and Conclusion
(A)	Trilemma Hypothesis and Macroeconomic Fundamentals			
(i)	Test for the Trilemma Hypothesis	Adam (2008), Oshikoya (2014); Ogbuagbu and Ewubare (2015); Akinkunmi (2017)	- Panel Regression; VECM; OLS.	- The studies found that the trilemma constraint holds for Nigeria.
(ii)	Potential effects of trilemma constraints on inflation, economic growth and their volatilities.	Hsing (2013); Ihnatov and Capraru (2014)	Simple OLS technique for a country-specific study of Brazil	- Trilemma constraint holds. - More exchange rate stability and more financial integration produce positive effect. - More monetary independence yields negative effect on growth
(iii)	Tests for the effect of the Trilemma hypothesis on the activity of financial globalization.	Georgiadis and Mehl (2015); Rey (2013).	- A panel of countries.	- Evidence for the classic trilemma is mix as some opined it has tapper off. - Financial globalization further amplified monetary policy effectiveness since the 1990s.
(iv)	Test for the trilemma hypothesis under gold std.	Chernshoff, Jacks and Taylor (2009)	Pooled Regression method and sensitivity analyses.	The study suggested exchange rate should be traded off for trilemma constraint
(v)	Open macroeconomy policy choices among developing, emerging and industrialized economies. - Examined the effects of foreign reserves accumulation as indication for the 'fear of mobility'	Aizenman and Ito (2012); Aizenman, Chinn and Ito (2010, 2011); Steiner (2013); Glick and Hutchison (2009); Taguchi (2011); Cheung and Sengupta (2011); Taguchi, Nataraj and Sahoo (2011).	- Steiner (2013) employed annual data that spanned 1970 – 2010 for 87 – 180 countries with pooled regression. - Glick and Hutchison (2009) used quarterly data (1992Q1: 2007Q4) for China with VECM method	- Striking difference showed emerging markets converged to a middle ground given reasonable size of reserves. - Industrialized economies still satisfy the trilemma constraint as evident in the Euro zone. - Emeging economies with converged policy choices experience low volatility.

Table 2.9: Summary of Empirical Literature on Alternative Methods and Measures of Trilemma Indexes

	Objective	Author(s)	Measures and Methodologies	Findings and Conclusion
(B)				
(i)	Intensity reactions of capital flows to shocks in domestic and euro zone interest rate	Frankel, Schmukler and Serven (2004); Globan (2014)	The use of VAR technique predicated on the simple interest parity condition coupled with many robustness checks	- The results found was consistent with the trilemma hypothesis; at least for the long-run situation (Franket et. al., 2004).
(ii)	Trilemma Stability and International Macroeconomic Archetypes.	Popper, Mandilaras and Bird (2013)	- Non-Gaussian Stability measure of monetary sovereignty - Use Generalized Estimation Equation within balanced panel for 177 countries. - The period spanned 1970 – 2010.	- Results showed consistency with the Trilemma hypothesis - Combination of fixed exchange rates and financial market openness was the most stable arrangement.
(iii)	Examined the Lane-Milesi-Ferreti de-facto measure of openness	Ma and McCauley (2013)	Eight measures of de-facto capital openness including openness on consolidated banking system and internationalization of currencies.	The study found consistent result results of trilemma constraint as per the conventional trilemma measures.
(iv)	Provide alternative measure to the Trilemma Indexes.	Mandilaras (2015)	Employed the elements of Euclidean Geometry.	- The results obtained was consistent with the trilemma hypothesis. - There was degree of trilemma-ineffectiveness that was costly for real output growth and price inflation.

Table 2.10: Summary of Empirical Literature on Central Bank Reaction Function (Ex-ante Behaviour)

	Objective	Author(s)	Measures and Methodologies	Findings and Conclusion
(i)	Central bank preferences in Poland	Brzozowski (2005)	- Data spanned 1995 – 2003. - Adopted reaction function from optimization.	- Same weight attached to price stability and output expansion objectives.
(ii)	Econometric analysis of central banks' reaction functions in Nigeria.	Iklaga (2007); Agu (2011)	- Data spanned 1999 – 2005 - Specified two sample models of central bank revealed preferences and Taylor-typed rule.	-No interest rate smoothing and absence of fiscal dominance. - No long-run relationship among monetary variables. - Price stability and credit expansion were growth strategies.
(iii)	Voting dynamics evidence of monetary policy reaction function in Nigeria.	Bello and Sanusi (undated)	- Data spanned 2006Q4 – 2015Q2. - The method of analysis is the GMM. -Taylor-typed rule framework was adopted.	- Central bank was conscious of interest rate smoothing. - It was recommended that central bank be committed to anti-cyclical monetary and forward-looking policies
(iv)	Investigate Central Banks Reaction function.	Siri (2009); Epstein (2009)	- Siri (2009) investigated cross-country study of Nigeria, Ghana and WAEMU. - Taylor-typed rule framework was employed	- Discretional policy was dominant. -Output did not affect interest rate objective.

Table 2.11: Summary of Empirical Literature on the Trilemma Hypothesis and Monetary Policy Transmission

	Objective	Author(s)	Measures and Methodologies	Findings and Conclusion
(i)	Examined inflation-targeting as alternative to hard peg.	Andrew (2014)	- Panel of 170 countries and period spanned 2007 – 2012.	- found that inflation targeting represents a serious alternative to a hard exchange rate fix for small economies seeking monetary stability.
(ii)	Central Banks and Monetary Policy Choices within the Trilemma.	Steiner (2017)	- The period of investigation spanned 1970 – 2010. - Exchange rate interventions substituted for capital controls	- Active reserve policy allows central bank to pursue independent monetary and exchange rate policies when capital account is liberalized.
(iii)	Examined where India stood within the Trilemma constraint.	Sengupata (2015)	- Meta-analysis of past empirical works.	- Policy combination of exchange rate stability and financial openness was considered more consistent.
(iv)	Monetary Policy Spillovers and the Trilemma constraint	Aizenman, Chinn and Ito (2015)	- Employed a two-staged and sensitivity approaches.	- Found that exchange rate stability and financial openness has been more consistent in the centre economies.

Table 2.12: Summary of Empirical Literature on the Trilemma and Monetary Policy Transmission (Cont'd)

	Objective	Author(s)	Measures and Methodologies	Findings and Conclusion
(v)		Aizenman and Sengupta (2012)		
(vi)	Examined a broad restriction of how government ideology impacted on the trilemma constraint.	Beckmann et. al., (2017)	- 111 countries for period that spanned 1980 – 2011. - Three-staged Least squares techniques - Robustness checks of sub-samples	The result validated the hypothesis that partisan preferences were peculiar and situational between countries and among regions.
(vii)	Investigated whether financial globalization has compromised central banks' effectiveness in managing financial conditions.	Disyatat and Rungcharoenkitkul (2017)	- The authors isolated focused on co-movements in measures of bond return risk premia from macro-fundamentals. - 31 advanced and emerging economies. - method that eliminated co-movements of correlated fundamentals was used.	- Central banks did substantially retain its influence over local financial conditions during the era of financial globalization.
(viii)	Characterizing Monetary Policy Regime Switches in India as a Dove or Hawk	Hutchison, Sengupta and Singh (2013)	- Quarterly data that spanned 1987 – 2008; - Markov Switching model within a time-varying Taylor-type rule framework.	- The central earlier moderated inflation (inflation-targeting) in the first half of the period. A 'hawk' attitude. - The later half found that the monetary authority adopted 'dove' regime of output expansion and exchange rate targets to stimulate exports.

CHAPTER THREE
THEORETICAL FRAMEWORK AND METHODOLOGY

3.0 Introduction

This chapter relates to the methodological framework upon which empirical investigation on the research topic would be investigated. It begins with setting the theoretical framework upon which the empirical models would be specified. Sources, type, measures and frequency of data are also highlighted while the technique and test of analyses for which the estimations would be conducted are also identified. The chapter concludes with identifying the various diagnostic checks for the validity of the estimates obtained while the need for robustness tests to ascertain the reliability of the results were also considered.

3.1 Theoretical Framework

A major contribution of this study is to modify and extend the basic Mundell-Fleming framework in such a way that both macroeconomic trilemma and financial trilemma would be nested together; both being the double trilemma facing an economy, and concomitantly, trace how it alters the behaviour of the central bank. Practically, the modification is that, within the framework of the classical (macroeconomic) trilemma, the assumption of perfect asset substitutions must be relaxed. Consequently, the condition of uncovered interest parity, which presupposes risk-neutral investors, is modified to include a risk premium. These modifications become imperative since there are imperfect asset substitutions in developing economy such as Nigeria. In fact, investors are usually risk-averse in developing economies due to innumerable uncertainties (Canbaloglu and Gurgun, 2017). More so, the uncovered interest parity (UIP) condition cannot be satisfied without the inclusion of a risk premium since empirical studies have not established strong evidence for the validity of the UIP condition; even in the long-run situation (Chinn and Meredith,

2004). An extension of the Mundell-Fleming framework is to account for the political economy of central bank behaviour in a developing economy such as Nigeria where the role of institution cannot be under-estimated.

The basic Mundell-Fleming framework is anchored on five (5) major assumptions of risk-free arbitrage condition; imperfect competitive firms with constant domestic price level and elastic supply of domestic output; imperfect capital mobility; perfect asset substitutions and small country assumption that is not capable of influencing the global dynamics of prices and income. As presumed, an evaluation of these assumptions validates that there is imperfect capital mobility in Nigeria. Capital is imperfectly mobile in a developing economy such as Nigeria since cross border capital transactions are usually sequenced and movement of financial capital is often gradual (Bankole and Ayinde, 2014). Importantly, the Mundell-Fleming model contributes two main theoretical elements to the autarky framework of IS-LM. Firstly, there exists an extra output demand element to capture economic interaction with other economies of the world. This is the net export component of the real sector equilibrium. Secondly, there is uncovered interest parity (UIP) condition that is predicated on risk-neutral behaviour of investors. These two conditions are weighty.

The first contribution indicates that the balance of payment (BoP) equation would be included in obtaining the simultaneous equations that comprise set of endogenous and exogenous variables, thus, the name IS-LM-BP framework. The second condition suggests there is risk-free arbitrage where the ratio of the forward to the spot exchange rate will equate the interest rate differential between the two assets; measured in domestic currency. This is given as;

$$e_{f_{t,t+k}} - e_{s_t} = (i_{t,k} - i^*_{t,k}) \quad \text{.....(1)}$$

Where; e_{s_t} is the exchange rate of domestic currency in terms of foreign currency at time t (spot rate); $e_{f_{t,t+k}}$ is the forward value of e_{s_t} for a contract due in k periods in the future; $i_{t,k}$ is the k-period return on domestic assets while $i^*_{t,k}$ is the corresponding return on the foreign assets. Equation (1) is the risk-free arbitrage condition. To the extent in which the investors are risk-averse, the forward rate differs from the spot rate at a risk premium given as φ.

This is to compensate for the perceived riskiness of holding the domestic assets in terms of the foreign assets. The risk premium is defined as;

$$\varphi_{t,t+k} = e_{f_{t,t+k}} - e^{*}_{s_{t,t+k}} \quad \text{……(2)}$$

Substituting equation (2) into (1) gives;

$$e^{*}_{s_{t,t+k}} - e_{s_t} = (i_{t,k} - i^{*}_{t,k}) + \varphi_{t,t+k} \quad \text{……(3)}$$

$$\Delta e^{*}_{s_{t,t+k}} = (i_{t,k} - i^{*}_{t,k}) - \varphi_{t,t+k} \quad \text{……(4)}$$

From equation (4), the uncovered interest parity (UIP) condition holds when the risk premium equals zero (i.e. $\varphi_{t,t+k} = 0$) such that;

$$\Delta e^{*}_{s_{t,t+k}} = (i_{t,k} - i^{*}_{t,k}) \quad \text{……(4')}$$

This implies that the expected change in the exchange rate from period t to period t+k equals the current interest rate differential. As such, the investors become risk-neutral between holding domestic assets or foreign assets. Including a rational expectation hypothesis as the market value of expected exchange rate is not observable. Then, we have;

$$e^{r*}_{s_{t,t+k}} = -e_{s_{t+k}} + \zeta_{t,t+k} \quad \text{……(5)}$$

Therefore, substituting equation (5) into (4) gives;

$$\Delta e_{s_{t,t+k}} = (i_{t,k} - i^{*}_{t,k}) + \varphi_{t,t+k} + \zeta_{t,t+k} \quad \text{……(6)}$$

Under the risk-neutral condition of the investors, the last two terms are assumed orthogonal to the interest rate differential.

Relaxing the assumption of risk-neutral investors, however, we have an empirical model for uncovered interest parity condition with risk premium given as;

$$\Delta e_{s_{t,t+k}} = \beta_o + \beta_1 (i_{t,k} - i^{*}_{t,k}) + \zeta_{t,t+k} \quad \text{……(7)}$$

Where; a non-zero β_o captures the risk premium component of the UIP condition.

This study is, therefore, anchored on an augmented Mundell-Fleming model. This model has four building blocks that comprised the goods market, money market and balance of payment equilibriacoupled with uncovered interest parity (UIP) condition. Equation (7) is the UIP condition with risk premium component and the goods market equilibrium is made up of:

$$Y = C(Y-T) + I(i) + G + NX(Y,e) \quad \text{.....(8)}$$

Where; C is the consumption, I is the level of investment, G is the government expenditure; which is exogenously determined, NX is the net export. The Mundell-Fleming framework presupposes that consumption is determined by the disposable income $(Y-T)$, investment is determined by the interest rate (r) and the net export is a function of income (Y) and the real exchange rate (e). The (e) measures the level of competitiveness given as $E\frac{P*}{P}$. Where; E is the nominal exchange rate and $\frac{P*}{P}$ is the ratio of foreign price level to the domestic price level.

The third equilibrium is the money market equilibrium given as;

$$M^d = M^s \quad \text{.....(9)}$$

M^d is the demand for money while M^s is money supply which is exogenously determined.

$$M^d = L(\bar{r}, \overset{+}{Y}) \quad \text{.....(10)}$$

Equation (10) suggests that the demand for money is determined by both the interest rate and aggregate income in the economy.

Equating equations (9) and (10) yields;

$$\frac{M}{P} = L(\bar{i}, \overset{+}{Y}) \quad \text{.....(11)}$$

Where; $\frac{M}{P}$ is the real money balances. However, the fact that there is interest rate differential implies that equation (11) becomes;

$$\frac{M}{P} = L(\bar{i}* + \varphi, \overset{+}{Y}) \quad \text{.....(12)}$$

On the condition that capital mobility is imperfect for a developing economy such as Nigeria, the balance of payment equation is non-zero and it is given as;

$$BP = CA + KA \quad \text{.....(13)}$$

Where; CA is the current account component while KA is the capital account component. Given that the current account captures the trade balance (NX) and that the capital account being largely determined by a shift parameter (k) and the interest rate differential of the returns on domestic asset and foreign asset; equation (13) becomes;

$$BP = NX + \Upsilon(i - i^*) + k \quad \text{.....(14)}$$

3.2 Models Specifications

Equations (8), (12), (14) and (7) are four systems of equations that include the real sector (goods market) equilibrium, money market equilibrium, external sector equilibrium and the UIP condition respectively. These give a modified Mundell-Fleming model thus;

$$\begin{aligned} &Y = C(Y-T) + I(i) + G + NX(Y,e) \\ &\frac{M}{P} = L(\bar{i}, \overset{+}{Y}) \\ &BP = NX + \Upsilon(i - i^*) + k \\ &\Delta e_{s_{t,t+k}} = (i_{t,k} - i^*_{t,k}) - \varphi_{t,t+k} + \zeta_{t,t+k} \end{aligned} \quad \text{.....(15)}$$

A solution to the simultaneous equations above would partition the variables into a set of exogenous variables $(p, p^*, i^*, \Delta e_{s_{t,t+k}}, EorM_s)$ and a set of endogenous variables $(Y, i, M_s orE)$; depending on the exchange rate regime. E (nominal exchange rate) becomes the endogenous variable if the exchange rate regime is flexible. Then, M_s (money supply) becomes an exogenous variable. M_s (money supply) is the endogenous variable if it is a fixed exchange rate regime and the E (nominal exchange rate) becomes an exogenous variable.

Alternatively, equation (15) is re-arranged such that the domestic interest rate becomes the subject of the formular for a single regression equation. This yields a behavioural model for this study, given thus;

$$i = f(Y, \frac{M}{P}, NX, \pi) \text{ .....(16)}$$

Equation (16) is the economic model for this study and it suggests that the domestic interest rate is a function of income, real money balances, net export and some control factors such as level of financial development.

Recall from equation (12) that $i = i^* + \varphi$. Therefore, equation (16) becomes;

$$i^* + \varphi = f(Y, \frac{M}{P}, NX, \pi) \text{ .....(17)}$$

Invoking the uncovered interest rate parity condition that interest rate differential must equal the expected proportionate change in the spot exchange rate between the time the investment is undertaken and the time it matures (future rates).

$$\varphi = \frac{e^s - e^m}{e^s} \quad \text{.....(17a)}$$

$$i - i^* = \frac{e^s - e^m}{e^s} \quad \text{.....(17b)}$$

Where; e^s is the expected spot exchange rate while e^m is the expected exchange rate at maturity.

Since $\varphi = i - i^*$, then, substitute equation (17) into (16) to have;

$$i^* + i - i^* = f(Y, \frac{M}{P}, NX, \pi) \quad \text{.....(18)}$$

$$i^* + \frac{e^s - e^m}{e^s} = f(Y, \frac{M}{P}, NX, \pi) \quad \text{.....(19)}$$

$$\frac{e^s - e^m}{e^s} = f(Y, \frac{M}{P}, NX, \pi, i^*) \quad \text{.....(20)}$$

With perfect foresight assumed, the expected change in exchange rate is taken as the actual change. Therefore, equation (20) becomes;

$$\Delta e = f(Y, \frac{M}{P}, NX, \pi, i^*) \quad \text{.....(21)}$$

Equation (21) is the functional model that relates to how the central bank behaves in the face of macroeconomic trilemma and the behavioural variable for the monetary authority is the changes in the exchange rate. It is important to note that money supply would no longer be exogenous but rather becomes endogenous in nature; especially for a developing economy such as Nigeria where the monetary authority seek to stabilize the exchange rate. As a result, the central bank sells domestic currency to buy foreign currency in order to avoid an appreciation and buys domestic currency to sell foreign currency in order to avoid depreciation.

Given that the extent to which macroeconomic trilemma alters the behaviour of the central bank is affected by financial trilemma, equation (21) is extended by including growth of domestic credit expansion as a variable that captures the extent of financial stability or otherwise in Nigeria. It is this inclusion that nested both macroeconomic trilemma and financial trilemma. Growth of domestic credit expansion is measured as the change in the ratio of credit to the private sector to GDP. Therefore, equation (21) becomes;

$$\Delta e = f(Y, \frac{M}{P}, NX, i^*, \pi, \Delta\frac{cps}{gdp}) \ldots\ldots(22)$$

Equation (22) conforms to the harmonization of the price stability, employment generation and financial stability mandates of the monetary authority in the face of the double trilemma. Also, the behaviour of the central bank of Nigeria is not only limited to these factors alone as institutional factors (indicated as political risk factors) is a strong determinant to how central bank behaves in Nigeria. To properly characterize the type of institutional factors confronting the behaviour of central bank in a developing economy such as Nigeria, both the partisan and opportunistic business cycle of political factors are considered relevant. The International Country Risk Guide database (ICGR, 2016) provides a flexible but definite framework to capture this peculiarity. This is captured as the political risk factors.

The study of Beckmann et. al., (2017) is the first noticeable study to have enriched the empirical literature with the political economy dynamics of the trilemma hypothesis. However, the authors distinguished between partisan and opportunistic business cycles and investigated only the partisan business cycle form of political factor. Opportunistic business cycles are defined as the existence of a selfish government who would not hesitate to manipulate macroeconomic policies for political gains. Partisan business cycles, on the other hand, occur when the partisan preferences or the ideology of an incumbent impacts on macroeconomic policy decisions. This study is a significant contribution to the study of Beckmann et. al., (2017) as it does not only consider the political economy of the double trilemma but also incorporates both political factor forms (partisan and opportunistic forms) of business cycle. This properly characterizes the institutional development in a developing economy such as Nigeria. More so, the International Country Risk Guide database (ICGR, 2016) has a flexible but definite framework to capture this peculiarity. This is captured as the political risk factors.

As a result, the empirical model for this study; having considered primarily the political factors and the vector component of the triad policy coupled becomes;

$$\Delta e = \beta_0 + \beta_1 rgdp + \beta_2 gm_2 + \beta_3 nx + \beta_4 f\,\text{int}\, r + \beta_5 \Delta cps\_gdp + \beta_6 polit\_risk + \beta_7 cpi + \varepsilon$$
……..(23)

Where; $rgdp$ is the real gross domestic product, gm_2 is the growth of broad money supply, nx is the trade balance, $exchr$ is the nominal exchange rate, $polit\_risk$ is the variable for political risk factors, Δcps_gdp is the change in the ratio credit to the private sector to GDP as an indicator of financial stability, cpi is an index for price level in the economy and $inst$ is to capture the institutional factor. The inclusion of cpi is to ascertain how the price level in the domestic economy has affected the rate of exchange of domestic currency. Equations (18) and (23) are the empirical models for this study. Equation (15) will be modeled as simultaneous equation within the Structural Vector Autoregression (SVAR) framework while equation (23) will be specified along the Markov Switching Regression Framework. In relation to Hurwicz (1962) writings, a structural model such as the SVAR is to predict the effect of policy changes consequent upon the effect of interventions or shocks in the economy. To, however, address the caution about the non-linearity of monetary policy strategies raised by Lucas (1976) on the suspect nature of simultaneous equation models makes the Markov Switching Dynamic Regression model most appropriate for this study.

Stemming from this framework, this study also seeks to test for the validity of the trilemma constraint in Nigeria. The trilemma equation is usually expressed as a constant of 2 being a function of the exchange rate stability, monetary independence and financial integration (Aizenman, Chinn and Ito, 2008b; 2011a; Hsing, 2013).

$$C = f(ES_t, MI_t, FI_t) \quad \text{…….(24a)}$$

$$2 = f(ES_t, MI_t, FI_t) \quad \text{…….(24b)}$$

The three policies are considered binding and that a trade-off exist among them if the goodness of fit in the equation is relatively high. With a binding constraint, an increase in the value of one of the trilemma policies will reduce one or both of the other policies. To ascertain the binary choice priority among the three policies, it is expected that combinatorial interactions of the policies are made such that a weighted exchange rate and

monetary independence, weighted exchange rate stability and financial integration and weighted monetary independence and financial integration are made in successive order. With the interactions of these policy combinations, the optimal as well as dominant binary policy choice(s) can be identified.

3.3 Method of Data Analyses

3.3.1 Tests of Analysis

A set of tests were conducted to examine the data stability condition of the series and, concomitantly, ascertain the fitness of the data generating process (DGP) of the variables to the techniques of analysis employed. There were three major preliminary tests conducted for this study. The first are sets of unit-root as well as stationarity tests while the second test is to check for structural breaks in the data points. The third test was to examine the regime switching behaviour of the Central Bank of Nigeria's policy variable. For the unit-root tests, both the conventional and modified unit-root tests are employed while the Zivot-Andrew test was used for testing for structural breaks. Also, a fixed probability Markov Switching test was conducted to examine the fitness of the technique to the DGP of the variables and further ascertained the appropriate number of regime switches. Generally, in choosing the appropriate model, the likelihood ratio statistics and the information-based criteria have been prominently used. These are the Akaike Criterion, Schwarz Criterion and the Hannan-Quinn Criterion (see Lutkepohl, 2005; Tsay, 2014).

The likelihood ratio statistics is of the form;

$$\varpi_{LR} = 2\left[In\lambda(\hat{\theta}) - In\lambda(\hat{\theta}_r) \right] \tag{25a}$$

Where; $\lambda(\hat{\theta})$ is the likelihood ratio of maximum regimes of, for example, 4 for the unrestricted model; $\lambda(\hat{\theta}_r)$ is the likelihood ratio of restricted model. In a case where the H_0 cannot be rejected, the iteration is continued with a lesser maximum number of regime(s) and a much lesser number of regimes for the restricted model. The procedure continues iteratively until the H_0 can be rejected. It is then that the optimum number of regime(s) is attained. It is a sequential and general to specific procedure of obtaining the optimum

number of regime-switching. On the other hand, the information-based criteria are always preferred to the likelihood ratio statistics as the former balances the trade-off between penalty for over-parameterization and robustness for goodness of fit. The frameworks for the information-based criteria are given thus;

$$AIC(p) = In\sum_{\theta,p} + \frac{2}{T} pK^2 \quad (25b)$$

$$BC(p) = In\sum_{\theta,p} + \frac{In(T)}{T} pK^2 \quad (25c)$$

$$HQ(p) = In\sum_{\theta,p} + \frac{2In\left[In(T)\right]}{T} pK^2 \quad (25d)$$

Where; T is the sample size, K is the number of equation, p is the number of regimes, $\sum_{\theta}$ is the maximum likelihood estimates of the covariance matrix. AIC penalizes each parameter by a factor of 2, BC and HQ impose penalties that depend on the sample sizes. The decision rule for the optimal number of regime switch is associated with the criterion that has the smallest values of these criteria. In reality, also, common sense plays an important role in making a decision as to the appropriate number of regime switches for the central bank behaviour.

The general specification for the Augmented Dickey Fuller (ADF) test is given as;

$$\Delta y_t = \rho y_{t-1} + \sum_{i=1}^{\rho} \delta_i \Delta y_{t-i} + \varepsilon_t \quad (25e)$$

For ADF Hypothesis, we have:

$H_0 : \varphi = 1 \quad H_0 : \delta = 0$

$H_1 : |\varphi| < 1 \quad H_1 : \delta < 1$

Reject H_0 if $t_{\varphi=1} < CV$ but reject H_0 if $t_{\delta=0} < CV$.

Kwiatkowski, Phillips, Schmidt and Shin(KPSS)(1992) proposed a test for the stability of series Unlike the ADF test, the KPSS test has a null hypothesis that is stated as stationarity as againt unit-root. The series is expressed as the sum of deterministic trend, random walk, and stationary error, and the test is the LM test of the hypothesis that the random walk has zero variance.KPSS is the only popular used test in which the null of stationarity is tested against a non-stationary alternative. In particular, the KPSS test regression is given as:

$$y_t = \varphi t + \sigma_t + \varepsilon_t \tag{25f}$$

$$\sigma_t = \sigma_{t-1} + \mu_t \tag{25g}$$

And the null hypothesis is $H_0 : \delta_\mu^2 = 0$.

3.3.2 Techniques of Analyses

In order to capture the methodological model for this study, the techniques of analysis remain an important component of our model specifications. There are two basic features of our empirical models which require methodological modeling; regime-switching behaviour of the central bank and the structural behaviour of the economy. The Markov-switching models has a dynamic non-linear framework that made it amenable to time-varying parameter, high-moment structures, regime dependent asymmetric cycles, and jumps or breaks in a time-series (Fan and Yao, 2003). A typical large sample data has inherent features of very interesting episodes of policy changes, regime shifts, political cycles, economic dynamics, exogenous effects like global imbalances, global financial, economic and political misalignments and crises; including natural disasters like flood, earthquakes etc that alters the smooth pattern of time-series data.

To characterize the impact of the double trilemma on behaviour of Central Bank of Nigeria, both the fixed transition probabilities (FTP) and time-varying transition probabilities (TVTP) formulations of the Markov Switching models were employed. The latter approach is considered more robust as it is able to accommodate dynamic (as against a static form) transition probabilities primarily due to changes in some economic variables. For all, the number of periods and the probabilities of regime changes are inferred from the data. A graphical trend of the variable of interest is usually engaged to provide possible insights into the number of regimes or switching periods that the model should be evaluated. Of

importance is to note that regime switching of economic phenomena is usually predicated on the structural changes in the economy. A structural model is firstly imperative for this study because external interactions and influences from foreign economies do not directly affects the monetary policies of the central bank. These external influences would hit the economy first and then determine the monetary authority's behaviour in stabilizing the exchange rate, sequencing the degree of financial openness and also ensuring monetary autonomy. It is in the process of providing an optimal balance for this triad-policy of financial trilemma that the central bank behaves characteristically.

3.3.2.1 Framework for SVAR Model

It is important to stress that the approach to the methodological modeling began with the Structural Vector Autoregression (SVAR) and followed by the Markov Switching Dynamic Models. With the latter, structural changes of the economy can be accommodated because it is imbued with a self-correcting mechanism (Balcitar, Gupta and Miller, 2014; Andrew, 2014). In tandem with Sim's (1980) modeling philosophy, the matrix form of the double trilemma pass-throughto the exchange rate; being the indicator for central bank behaviour is represented in a non-recursive form;

$$\begin{vmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ NA & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ NA & NA & 1 & 0 & 0 & 0 & 0 & 0 \\ NA & NA & NA & 1 & 0 & 0 & 0 & 0 \\ NA & NA & NA & NA & 1 & 0 & 0 & 0 \\ NA & NA & NA & NA & NA & 1 & 0 & 0 \\ NA & NA & NA & NA & NA & NA & 1 & 0 \\ NA & NA & NA & NA & NA & NA & NA & 1 \end{vmatrix} \begin{vmatrix} \Delta e \\ gm_2 \\ \Delta cps\_gdp \\ f\,\text{int}\,r \\ nx \\ polit\_risk \\ cpi \\ rgdp \end{vmatrix} = V(L) \begin{vmatrix} \Delta e \\ gm_2 \\ \Delta cps\_gdp \\ f\,\text{int}\,r \\ nx \\ polit\_risk \\ cpi \\ rgdp \end{vmatrix} + \begin{vmatrix} \varepsilon\Delta e \\ \varepsilon gm_2 \\ \varepsilon\Delta cps\_gdp \\ \varepsilon f\,\text{int}\,r \\ \varepsilon nx \\ \varepsilon polit\_risk \\ \varepsilon cpi \\ \varepsilon rgdp \end{vmatrix}$$

……(26)

Where; εgm_2; εr; $\varepsilon\Delta e$; εnx; $\varepsilon f\,\text{int}\,r$; εcps_gdp, $\varepsilon polit\_risk$; εcpi and εr_gdp are structural disturbances for growth of broad money supply, interest rate, exchange rate, net export, foreign interest rate, ratio of credit to the private sector to the gross domestic product, institutional factors (indicated by political risk factor), consumer price index

(CPI)and the growth rate of GDP respectively. The variables were ordered with the implicit assumptions that the speed with which they respond to shocks differ. The growth rate of GDP ($rgdp$) was assumed to be the least responsive as shocks to the policy variables have no contemporaneous impact on price due to the time lag involved before external effects reflects on the price level in the domestic economy.

Equation (26) is a methodological model for the Structural Vector Autoregression (SVAR) for this study. It captures the structural behaviour of the economy in the face of double trilemma. Prior to this, equation (26) will be estimated with the exclusion financial stability indicator (Δcps_gdp). This considers the structural behaviour of the economy when faced with the constraint of classical (macroeconomic) trilemma.

3.3.2.2 Framework for Markov Switching Dynamic Models

Considering an unobserved states or regimes which is said to follow a Markov chain process (Quandt, 1972; Goldfeld and Quandt, 1973; Mills and Wang, 2006; Guidolin, 2011a; 2011b), the evolution of exchange rate can be modeled as a state-dependent intercept term for k states;

$$e_t = \psi_{s_t} + \phi e_{t-1} + \xi_s ; \quad \text{.....(27)}$$

$$e_t = \psi_{s_t} + \beta \sum_{t=1}^{3} X_t + Z_t \lambda_s + \xi_s \quad \text{.....(28)}$$

Equation (27) is a Markov Switching Autoregression Model while equation (28) is a Markov Switching Dynamic Regression Model. The former has a fixed transition probability while the latter has a time-varying transition probability that is amenable to the changing form of the transition probability from one state to another; due to the dynamics of the explanatory variables. The explanatory variables include the triad-policy of exchange rate stability, financial integration and monetary independence; this gives the summation of the financial trilemma components. It has state-invariant coefficients β whileother variables that drive exchange rate are considered as control variables in equation (25) coupled with independently identically distributed random variable ξ_s that follows a normal distribution

with zero mean and $\delta_{s_t}^2$ state-dependent variance (equations 29 and 30). λ_s is the state-dependent coefficients for the control variables.

$$\xi_t \sim N(0, \delta_{s_t}^2) \quad \text{.....(29)}$$

$$\delta_{s_t}^2 = \sum_{s=1}^{k} \delta_s^2, \sum_{s=1}^{k-1} \delta_s^2 > 0 \quad \text{.....(30)}$$

$$\psi_{s_t} = \sum_{s=1}^{k} \psi_s, \quad \text{.....(31)}$$

Where; $\psi_{s_t} = \psi_1$ when $s_t = 1$, $\psi_{s_t} = \psi_2$ when $s_t = 2, \ldots,$ and $\psi_{s_t} = \psi_k$ when $s_t = k$. The conditional density of i_t is assumed to be dependent only on the realization of the current state s_t and is given by $f(i_t | s_t = n, i_{t-1}; \vartheta)$ where ϑ is a vector of parameters. There are k conditional densities for k states, and estimation of ϑ is performed by updating the conditional likelihood using a nonlinear filter. s_t is an irreducible, aperiodic Markov chain starting from its ergodic distribution $\pi = (\pi, ..., \pi_k)$; - (Hamilton, 1989; 1990). The probability distribution of the Markov Switching model is expected to follow a logistic distribution (Appendix 1; Hamilton, 1994; Chen and Shen, 2007 for modeling frameworks)

With a reflection of the dynamic interactions among the variables, the lags of exchange rates are also introduced as explanatory variables in equation (32) such that the methodological model, based on the Markov Switching framework, becomes;

$$e_t = \psi_{s_t} + \alpha e_{t-i} + \beta \sum_{t=1}^{3} X_t + Z_t \lambda_s + \xi_s \quad \text{.....(32)}$$

It should be noted that the number of lags of dependent variable, i, introduced depends on what is considered the optimum lag length. Substituting equation (23) into (32) yields the time-varying Markov-Switching model of the form

$$e_t = \psi_{s_t} + \alpha e_{t-i} + \beta_1 rgdp + \beta_2 gm_2 + \beta_3 nx + \beta_4 f\,\text{int}\, r + \beta_5 \Delta cps\_gdp + \beta_6 inst + \beta_7 cpi + \xi_s \quad \text{.....(33)}$$

Equation (33) is the methodological model for this study. It captures the Markov-Switching behaviour of the central bank. The model is a time-varying form of the Markov-Switching model.

3.4 Robustness Test and Diagnostic Checks

3.4.1 Robustness Test

As a robustness check, further evidence on the double trilemma and the political behaviour of Central Bank of Nigeria were sought through the Taylor's (1993) rule; being the popular approach at investigating monetary policy issues. It is important to emphasize that the Taylor's (1993) rule is a closed-economy and an apolitical simple interest rate rule that the monetary authority is expected to adhere to in order to stimulate macroeconomic performance. In this study, however, we obtain an extended Taylor's rule to capture the open economy components and the political economy of interest rate rule. This extended Taylor's (1993) rule was done in two ways. The first is the inclusion of political risks factor as an integral part of central bank reaction function in a developing economy such as Nigeria. This is to address the political economy of central bank's reaction function in Nigeria. As enunciated, a purely self-centered public office holder will deliberately keep the interest rate low in order to enjoy public fund at little or no cost for political activities and perpetuate itself in office. Also, the exchange rate is introduced in order to capture the economic activities with other economies of the world.

The second aspect of the extensions is methodological. This is to model the reaction function of the central bank; not as a deterministic model but within the regime switching framework. Basically, the baseline Taylor rule is structured in such a way that the monetary authority is expected to stick to rules in its monetary policies strategy. It does not allow for discretionary policy. The policy strategy to adopt by the monetary authority would have been identified at the wake of every year and issues in global and domestic dynamics are not expected to affect it. However, the behaviour of the central bank in the face of the double trilemma cannot face a rule-based approach as the monetary authority is expected to continually review its policies and strategies in order to properly place the economy and reduce uncertainties to the barest minimum.

Specifically, the central bank of Nigeria describes its policy actions in terms of discretion owing to several factors accounted for during the monetary policy committee (MPC) meetings held at successive intervals. Using the Taylor's rule, however, the question is

whether the seeming discretional policy expected of the central bank in the face of the double trilemma can be empirically described by a systematic rule that allows for occasional regime switches. It is these inclusions that suggest a more appropriate regime switching model for the central bank reaction function of the form;

$$i_r = r^* + \pi_{t-1} + \alpha(\pi_t - \pi^*) + \beta(y_t - y_t^*) \quad \text{.....(34)}$$

Where; i is the nominal interest rate; r^* is the equilibrium real interest rate; π is the rate of inflation over the previous four quarters; π^* is the target inflation rate while $y_t - y_t^*$ is the percentage deviation of real GDP from its target level. Modifying the basic Taylor rule and incorporating financial trilemma as a defining variable, the appropriate reaction function for the central bank of Nigeria is given as;

$$i_r = \alpha(\pi - \pi^*)_t + \rho\pi_{t-1} + \beta(y_t - y_t^*) + i_{t-1} + \vartheta z_t + \mu_t \quad \text{.....(35)}$$

Where; r^* as earlier defined is the measure of interest rate smoothing[11] but would be used in this study as the lagged dependent variable, i_{t-1}. The π_{t-1} is to capture the backward-looking as well as ex-ante behaviour of the central bank as the $(\pi - \pi^*)$ addresses the ex-post central bank behaviour. z_t is to capture the political risk factors of central bank reaction function in Nigeria. The Holdrick-Prescott filter would be used to obtain the potential output as developing economies such as Nigeria does not have a forward-looking projection.

Considering the regime switching modeling of the central bank reaction function, equation (36) becomes;

$$i_t = \psi_{s_t} + \alpha(\pi - \pi^*)_t + \rho\pi_{t-1} + \beta(y_t - y_t^*) + i_{t-1} + \vartheta z_t + \xi_s \quad \text{.....(37)}$$

The regime switching parameters are as earlier defined.

3.4.2 Diagnostic Checks

In terms of diagnostics, series of specification tests for the Markov-Switching models were undertaken. These tests are all of variance-covariance distribution of the Markov specification models. In addition, diagnostics on the SVAR model such as the impulse

[11] See Agu (2011)

response functions (IRFs) and the Variance Decompositions would be undertaken. Also, Impulse response functions (IRFs) show the effects of shocks on the adjustment path of the variables in the VAR model. IRFs can also be graphically presented showing the effect of shocks on the current and future path of the variables under consideration. In essence, IRFs show how these variables react to different shocks in the model.

Recall the generalized VAR model:

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \ldots + A_p y_{t-p} + \varepsilon_t$$

This model can be written equivalently as:

$$y_t = \Omega^{-1} c + \Omega^{-1} \varepsilon_t \qquad (38)$$

where $\Omega = I - A_1 L - A_2 L^2 - \ldots - A_p L^p$. We can write equation (35) in a more compact form as:

$$y_t = \overline{y} + \sum_{i=0}^{\infty} \Psi_i \varepsilon_{t-i} = \overline{y} + \Psi_0 \varepsilon_t + \Psi_1 \varepsilon_{t-1} + \Psi_2 \varepsilon_{t-2} + \ldots \qquad (39)$$

Equation (39) which is usually used to trace the impulse responses is regarded as the Vector Moving Average (VMA) model. The impulse responses, that is, the effects of the various shocks of the explanatory variables on the dependent variables can be determined by differentiating equation (39) with respect to each of the shocks ($\varepsilon_{1t}, \ldots, \varepsilon_{nt}$).In relation to the implication of the ordering of the variables of interests, the Generalized Impulses as described by Pesaran and Shin (1998) is used to generate the impulse responses. Unlike the Cholesky factor, the Generalized Impulse approach does not depend on VAR ordering.The analysis of the impulse responses is extended to the SVAR estimations.

Nonetheless, the properties of VAR analysis are also described by forecast error variance decomposition (variance decomposition of forecast errors). Forecast error variance decompositions (FEVDs) measure the contribution of each type of shocks to the forecast error variance. FEVD tells us how much of a change in a variable is due to its own shock and how much due to shocks to other variables. Usually, for the initial period, FEV is due to own shock, however, as the lagged variables' effect starts manifesting, the percentage of the effect of other shocks increases over time.

For example, from equation (39), we can calculate the n-period forecast error of y_t :

Start from 1 period: $y_t = \overline{y} + \Psi_0 \varepsilon_{t+1} + \Psi_1 \varepsilon_t + \Psi_2 \varepsilon_{t-1} + \ldots$

$$E_t y_t = \bar{y} + \Psi_1 \varepsilon_t + \Psi_2 \varepsilon_{t-1} + \ldots$$

Therefore, 1-period forecast error: $y_{t+1} - E_t y_{t+1} = \Psi_0 \varepsilon_{t+1}$

In the same way, we can get 2-period forecast error: $y_{t+2} - E_t y_{t+2} = \Psi_0 \varepsilon_{t+2} + \Psi_1 \varepsilon_{t+1}$

3-period forecast error: $y_{t+3} - E_t y_{t+3} = \Psi_0 \varepsilon_{t+3} + \Psi_1 \varepsilon_{t+2} + \Psi_2 \varepsilon_{t+1}$

Therefore, n-period forecast error is obtained from:

$$y_{t+n} - E_t y_{t+n} = \Psi_0 \varepsilon_{t+n} + \Psi_1 \varepsilon_{t+n-1} + \Psi_2 \varepsilon_{t+n-2} + \ldots + \Psi_{n-1} \varepsilon_{t+1} = \sum_{i=0}^{n-1} \Psi_0 \varepsilon_{t+n-i}$$

Considering y_{1t} for example, the variance of its n-step-ahead forecast error can be expressed as:

Total Var (y_{1t})= Proportion of Variance Due to Y_{1t} shock

+ Proportion of Variance Due to shocks of other variables in the model

The interpretation of the FEVDs is guided thus; the proportion of Variance Due to own shock decreases over time; proportion of Variance Due to shocks of other variables in the model increases over time; if errors of other variables can explain none of the forecast error variance of the series under consideration say y_{1t}at all forecast horizons, then;y_{1t} is assumed to be exogenous.However, if errors of other variables can explain most of the forecast error variance of the series under consideration say y_{1t}at all forecast horizons, then,y_{1t} is assumed to be endogenous. Like the IRFs, the generalized impulses approach is also used in the analysis of the FEVDs for the same reason earlier adduced. Similarly, the variance decompositions are also computed for VECM and SVAR estimations.

3.5 Conceptual Framework

In tandem with theoretical literature upon which the above theoretical framework is anchored, the conceptual framework for this study is depicted in Chart 3.1 below. The other trilemma concepts that are subsumed under the concept of double trilemma are dilemma and quadrilemma. The dilemma presupposes that financial openness is considered given in a global economy. According to Rey (2013), global financial cycles made local monetary policy and the local financial conditions exhibit asymmetric behaviour. In this case, it is the control on cross-border financial flows that could guarantee monetary autonomy. This is

unlike the case of the trilemma constraint where floating exchange rate allows for the independence control of the monetary policy. Quadrilemma, on the other hand, indicates that the accumulation of foreign reserve allows economies to reduce the damaging effects of balance of payment deficit due to outflow of financial resources in the economy.

It is instructive to note in Chart 3.1 that the financial trilemma serves as a limiting constraint to macroeconomic trilemma because the use of financial policies to obtain lower interest rate translates to outflow of cross-border financial resources and, then, leads to exchange rate depreciation. This further feeds in to the plane of macroeconomic trilemma with a similar but possible counteracting effect; in terms of trade balance and exchange rate movement. With foreign reserves accumulated, the effect of financial flows on balance of payment deficit is reduced and the problem extends to quadrilemma which is the impossible combination ofexchange rate stability, financial openness, monetary independence and huge accumulation of international financial reserves (see Chart 3.1). However, quadrilemma is exogenous to double trilemma that this study centres on.

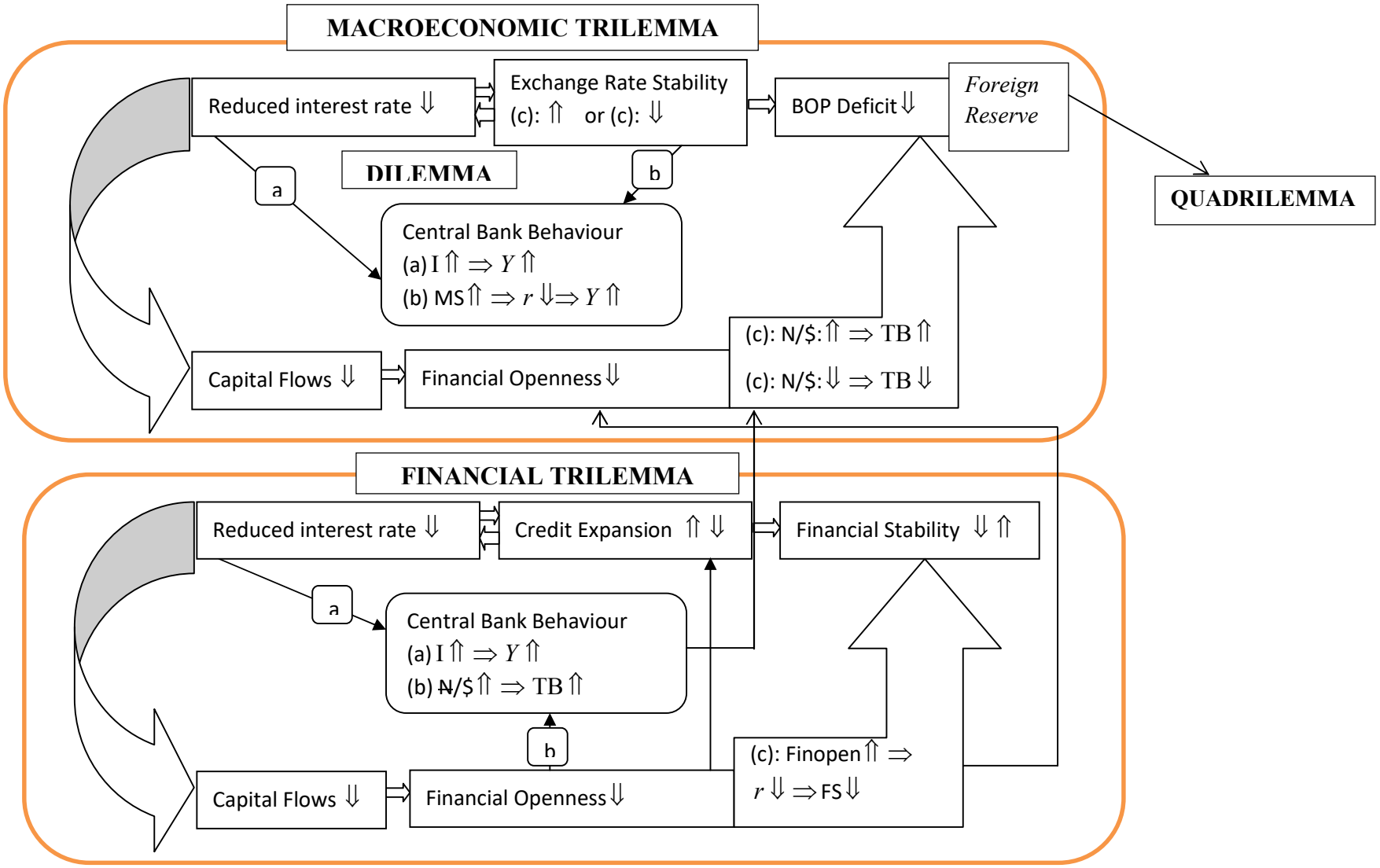

Chart 3.1: Conceptual Framework for Double Trilemma and Central Bank Behaviour

Source: Author with insights from Theoretical Literature

3.6 Measurement of Data, Sources and Apriori Expectation

In tandem with the theoretical cum conceptual frameworks and coupled with the corresponding model specifications, the following variables (exchange rate, interest rate, real gross domestic product, foreign interest rate, net export, political risk factor, broad money supply, consumer price index and the credit to the private sector ratio of gross domestic product) would be employed for empirical investigation. Beginning with, the change in exchange rate is the dependent variable while other variables serve as the explanatory variables. Theory is not explicit on whether to have exchange rate appreciation (-ve) or depreciation (+ve) when the effect of all the explanatory variables were not accounted for on the dependent variable. Either of the two is possible depending on the competitive nature of the economy in concern. That which is obtained for Nigeria remains purely an empirical question. The rate of interest has a negative effect on the exchange rate movement because an increase in the domestic interest rate would imply portfolio adjustment by portfolio investors. This translates to increased financial flows and leads to exchange rate appreciation (which is a decrease in the value of exchange rate). In a similar relation, the foreign interest rate is expected to impact positively on the changes in the exchange rate. This is because an increase in foreign interest rate increases the interest rate differential that leads to outflow of capital from the domestic economy. This would mean depreciation of the domestic currency.

The growth of broad money supply could positively or negatively impact on the movement of exchange rate depending on whether the monetary anchor serves as an exogenous or endogenous policy instrument. If there is exchange rate intervention, the supply of money becomes the adjustment variable for exchange rate in the country. As such, an increase in the broad money supply would lead to exchange rate depreciation to counteract earlier currency appreciation. Also, a decreased supply of money leads to exchange rate appreciation to counteract earlier currency depreciation. However, an increase in the economic growth enhances exchange rate appreciation (a reduction in the quantity of exchange rate). This is similar to that of the net export where trade surplus enhance exchange rate appreciation while trade deficit leads to exchange rate depreciation. Inflation rate and political risk factors are expected to have positive impact on exchange rate as

increases in both variables would also increase the rate of exchange of the domestic currency to the foreign rate. There is a threshold that growth rate of credit to the private sector to the gross domestic product enhances exchange rate appreciation. This is empirically estimated to be at the 20 percent threshold. The measurement of the variables and the corresponding theoretical expectation are summarized in Table 3.1 below. Specifically, the measurement of political risk variable was discussed under section 3.6.1 while its components were detailed in Table 3.2.

Table 3.1: Variables Measurements and Theoretical Expectations

S/N	Variables	Definition of Variables	Measurements	Unit of Measurement	Theoretical Expectations
1.	$\wedge e$	Exchange rate movement	Changes in real exchange rate	Rate	-ve/+ve
2.	$\text{int}\, r$	Domestic interest rate	Minimum Rediscount Rate (MRR) / Monetary Policy Rate (MPR)	Rate	-ve
3	$forei\_\text{int}\, r$	Foreign interest rate	Real interest rate for the United States of America	Rate	+ve
4	gm_2	Monetary growth	Growth of broad money supply	Growth rate	-ve/+ve
5	*rgdp*	Real gross domestic product	Gross Domestic Product at Constant Prices	Growth rate	-ve
6	*nx*	Trade balance	Net export	Naira value	-ve
7	$\text{inf}\, r$	Inflation rate	Change in Consumer Price Index (CPI)	Rate	+ve
8	*politrisk*	Political risk factor	Political risk computed by ICGR (2016) – see Table 3.2	Index	+ve
9	*cps _ gdp _ grwt*	Financial Instability	Growth rate of credit to the private sector ratio of GDP	Growth rate	-ve/+ve

Source: Author with insights from Theories

3.6.1 Measurement of Political Risk and Data Sources

These data for the above variables were sourced from various data banks such as the Central Bank of Nigeria (CBN) Statistical Bulletin; National Bureau of Statistics (NBS); World Development Indicators (WDI), and the International Country Risk Guide (ICGR). Institutional factors will be captured by the political risk components as detailed in the ICGR. The components are government stability, socio-economic condition, investment profile, internal conflict, external conflict, corruption, military in politics, religious tensions, law and order, ethnic tensions, democratic accountability and bureaucratic quality. It is the weighted combinations of these twelve (12) components that form the political risk and data on this has been computed as the international country political risk. Data on this is available since 1984.

The international country risk guide (ICRG) provides three major components of institutional factors facing every economy from time to time. These components are political, economic and financial in nature. These measures have twenty-two (22) sub-components; out of which twelve (12) components are for political risk, five (5) sub-components for each of economic and financial risks. In order to capture the political economy of central bank behaviour in Nigeria, this study considers the political risk factor as the most appropriate measure of institutional factor in the country. This is because it is believed that the central bank; being the government's bank, can do the biddings of public office holders and can be influenced to behave differently from what the economic situation demands; mainly for political reasons – like winning elections, perpetuating themselves in office, stepping down unpopular decisions due to ethnic, religious and cultural pressures and, even, pressures from opposition parties (Table 3.2). The exegeses of these political factors tend to alter the behaviour of the central bank in a developing economy such as Nigeria. It is from the foregoing that the behaviour of the central bank in Nigeria is likely to be affected by political risks; even in the face of double trilemma. Each of these sub-components has weight attached to them and the sum of these weights range between zero (0) and One Hundred (100). The sum of these weighted values determines how risky a country could be in terms of political, economic and financial conditions confronting it.

The higher the weight, the lower the risk and the closer the sum of the weighted value to zero, the higher the risk (Table 3.2)

The ICRG methodology for these weighted sums of the political risk components allows for possible modification of these attached weights to suit the respective country's peculiarities on the weight attached to these sub-components and then recomputed the actual political risks confronting the nation from time to time. As a decision rule, it is indicated that the higher the sum totals of the weight, the lower the risk and vice versa. For assessment purposes, a weighted sum less than 50 percent is considered very high risk; between 50 – 60 percent is high risk; 60 – 70 percent is moderate risk; 70 – 80 percent is low risk while 80 – 100 percent is very low risk.

Table 3.2: Weighted Sums of Political Risks Components

Item	Political Risk Components	Weight
A	Government Stability	12
B	Socioeconomic Conditions	12
C	Investment Profile	12
D	Internal Conflict	12
E	External Conflict	12
F	Corruption	6
G	Military in Politics	6
H	Religious Tensions	6
I	Law and Order	6
J	Ethnic Tensions	6
K	Democratic Accountability	6
L	Bureaucratic Quality	4
	TOTAL	100

Source: ICRG Methodology (2016)

CHAPTER FOUR
RESULTS AND FINDINGS

4.0 Introduction

This chapter considers the estimations of the models specified in the previous chapter. Prior to this, the trilemma hypothesis was tested for the Nigerian economy. As a further analysis, this study investigates the impact of the double trilemma on the behaviour of central bank in developing economies such as Nigeria. The focus is to estimate a Structural Vector Autoregression (SVAR) model to capture the structural behaviour of the economy and a Markov Switching model that captures the behaviour of the central bank when faced with the double trilemma.As such, various pre-estimation tests such as unit-root with structural breaks and Structural Vector Autoregression (SVAR) estimations were conducted in order to establish the preference of the Markov Switching model to any deterministic model. Markov switching model, as against the deterministic approaches, accommodates probabilistic approach to regime switching. As a robustness check, however, a modified Taylor rule was estimated.

4.1 Statistical Properties of the Variables

In order to obtain the descriptive statistics for the variables included for models specifications, both the descriptive statistics and correlation among these variables were found appropriate. As detailed in Table 4.1, the change in the exchange rate ($\wedge e$) has mean value of 5.95. This suggests that the exchange rate in Nigeria depreciated more for the period under consideration. This is an indication that there is presence of currency over-valuation with the skewness value of 8.57. The implication is that the *naira* positively deviates from the expected market value. This is supported by the standard deviation value of 28.19 that indicates that the domestic currency largely deviates from the expected value. Although, the kurtosis (being an atheoretical measure of normal distribution) value of 83.91

suggests that exchange rate movement in Nigeria is leptokurtic. That is, it is highly peaked with very thin tail.Also, the political risk variable (denoted as *politrisk*) shows that political risk in Nigeria is averagely very high as the mean value is below the 50 percent threshold. Specifically, it is 45.76. The skewness value of 0.65 is an indication that political risk in Nigeria is positively skewed; implying that it escalated a little bit from the expected value.Also, the standard deviation value of 3.90 for political risk factor in Nigeria shows that the political risk in the country does not deviate substantially from the expected value. Both the kurtosis value of 2.69 and Jarque-bera statistics of 10.21 strongly lend credence to the normal distribution of political risk in the country for the period under review.

On the other hand, the growth of real gross domestic product (denoted as *rgdp*) is averagely 1.21 but with -1.31 skewness value. This shows that economic growth in Nigeria has averagelybeen on a downswing and has skewed negatively from the expected value by 1.31. This is an indication that economic growth in Nigeria has been grossly non-performing for the period under consideration. Both the foreign interest rate ($forei\_\text{int}r$) and the domestic rate of interest ($\text{int}r$) have not been at par throughout. The average foreign interest rate is 7.41 while the average domestic rate of interest is 13.15. This implies that the simple interest rate parity condition does not hold in Nigeria. Furthermore, it illustrates that there has been increasing inflow of capital by the excess of the domestic interest rate over the foreign interest rate. Interestingly, both interest rates are normally distributed with kurtosis value of 3.73 and 4.16 respectively. This is supported by the Jarcque-bera statistics of 11.09 and 21.66 values respectively. This is considered significant; even at the 1 percent level. Both rates of interest deviate from their market determined value; as shown by the standard deviation of 4.02 and 3.24 for the domestic and foreign interest rates respectively.

In addition, growths of money supply (gm_2) and growth rate of credit to the private sector ratio of gross domestic product (cps_gdp_grwt) also have similar behaviour with 5.71 and 6.11 mean values respectively. This indicates that price and financial stabilities in Nigeria have been appreciably controlled as the average price index; caused by monetary growth, has not reached double digit while the 20 percent threshold for credit expansion is

still under control. The correlation matrix detailed in Table 4.2 supports that there is no strong correlation among the variables and it further indicate that these variables can be combined together for empirical estimations and there would not be any problem of collinearity or multicollinearity. The threshold is $r <= 0.8$ for its absence.

Table 4.1: Descriptive Statistics of the Variables

Variables	Maximum	Minimum	Mean	Std. Dev.	Skewness	Kurtosis	Jarcque-Bera Stat.
$\wedge e$	294.41	-9.22	5.95	28.19	8.57	83.91	39045*
cpi	180.15	0.48	47.84	51.95	1.00	2.83	23.08*
cps_gdp_grwt	56.10	-39.10	6.11	9.56	1.26	13.00	607.4*
$forei\_\text{int}r$	18.87	3.11	7.41	3.24	0.78	4.16	21.66*
gm_2	37.67	-8.12	5.71	6.88	1.02	5.66	64.19*
$\text{int}r$	26.00	6.00	13.15	4.02	0.59	3.73	11.09*
nx	5734530	-2086.68	625,882.8	1029110	2.55	10.20	443.56*
$politrisk$	54.33	38.46	45.76	3.90	0.65	2.69	10.21*
$rgdp$	10.46	-11.57	1.21	3.08	-1.13	9.38	261.85*

Source: E-Views Output. Note: * denotes significance at the 1 percent level

Table 4.2: Correlation Matrix

	$\wedge e$	$rgdp$	cpi	$\text{int}\, r$	cps_gdp_grwt	gm_2	nx	$politrisk$
$\wedge e$	1.00							
$rgdp$	-0.094	1.00						
cpi	-0.108	0.153	1.00					
$\text{int}\, r$	0.056	0.150	-0.224	1.00				
cps_gdp_grwt	0.042	0.024	-0.082	0.077	1.00			
gm_2	0.148	-0.012	-0.087	0.002	-0.013	1.00		
nx	-0.108	0.150	0.734	-0.181	0.020	-0.029	1.00	
$politrisk$	-0.089	-0.034	-0.103	0.434	0.205	0.124	-0.089	1.00

Source: STATA Output

4.2 Pre-Estimation Tests

4.2.1 Unit-Root and Stationarity Tests

4.2.1.1 Unit-Root Tests (Conventional Unit-Root and Stationarity Tests)

The test statistics for the unit-root and stationarity tests detailed in Table 4.3 suggests that some of the variables are unit-root as well as non-stationary at levels while some other variables are non-unit-root as well as stationary at levels. Particularly, the conditioning variable or the variable of interest – the change in the exchange rate ($\wedge e$) – is non-unit-root and stationary at levels. The use of the Augmented Dickey Fuller (ADF) and the Phillip-Perron (PP) confirm the non-unit-root of the change in the exchange rate while the Kwiatkwoski-Phillips-Schmidt-Shin (KPSS) confirm its stationarity. This is so as the variable ($\wedge e$ **)** has test statistics of -10.923 and -10.928 that are greater than their values at the critical level; given as -3.478 for both, at the 1 percent level. As such the null hypothesis of unit-root is rejected; even at the 1 percent level of significance.

Other variables that are also stationary at the 1 percent level are growth of money supply (gm_2), the rate of inflation ($\inf r$ **)** and the growth ratio of credit to the private sector to GDP (cps_gdp_grwt). The gm_2 have -12.863 and -12.781 as test statistics values for both ADF and PP; which are greater than their critical values at the 1 percent level. The $\inf r$ have -2.916 and -8.390 as test statistic values for both ADF and PP that are greater than their critical values at the 5 percent levels. Hence, the null hypothesis of unit-root is also rejected. The stationarity test for these variables reinforces the submission on non-unit-root for these variables as the test statistics values for $\wedge e$ **,** gm_2 and cps_gdp_grwt suggests that the null hypothesis of stationarity for the KPSS cannot be rejected at the 1 percent level of significance (Table 4.3)

Table 4.3: Conventional Unit Root and Stationarity Tests

	Level			First Difference		
VARIABLES	**ADF**	**PP**	**KPSS**	**ADF**	**PP**	**KPSS**
$\wedge e$	-10.932*	-10.928*	0.189*	-	-	-
int r	-3.013**	-2.415	0.256*	-	-9.494	-
forei _ int r	-2.725	-3.399**	1.187	-4.254*	-	0.190
gm_2	-12.863*	-12.781*	0.193	-	-	-
rgdp	-2.673	-21.797*	0.724	-21.583*	-	0.328*
nx	-3.573*	-3.332**	0.984	-	-	0.034*
inf r	-2.916*	-8.390*	0.403**	-	-	-
politrisk	-1.559**	-2.042	0.193*	-4.596*	-4.471*	-
cps _ gdp _ grwt	-12.215*	-12.256*	0.143	-	-	-

Note: Unit-root and Stationarity tests are with constant but without deterministic trend. Lags are included with automatic and based on Schwarz info criteria. *, **, *** imply that the series is stationary at 1%, 5% and 10% respectively. ADF, PP and KPSS represent Augmented Dickey-Fuller, Phillips-Perron and Kwiatkwoski-Phillips-Schmidt-Shin Unit Root and stationarity tests respectively. ADF: 1% = -3.478; 5% = -2.882; 10%= -2.578; PP: 1%= -3.478; 5%= -2.882; 10% = -2.578; KPSS: 1%=0.739; 5%= 0.463; 10%= 0.347.

For all other variables, such as the rate of interest ($\text{int}r$), the foreign interest rate ($forei\_\text{int}r$), the rate of real GDP ($rgdp$), the net export (nx) and the political risk ($politrisk$); there is no consensus among the tests. The summary conclusion here is that the stationarity of these variables depends on the test statistic used. Therefore, it can be inferred that these variables are stationary one way or the other; depending on the test statistic. In fact, the non-unit-root of these variables is established when the trend and intercept of these variables are included for the unit-root tests. As contained in Table 5.2, the modified unit-root tests of Dickey Fuller Generalized Least Square (DFGLS) and the Ng-Perron tests suggests that non-unit-root of the variables is not only test-statistic dependent but also has to do with the critical values found appropriate for each variable (Table 4.4).

4.2.1.2 Unit-Root Tests (With Modifications)

Table 4.4: Modified Unit Root Tests

Modified Unit Root Tests				
	Level		**First Difference**	
	DFGLS	**Ng-P**	**DFGLS**	**Ng-P**
$\wedge e$	-10.943*	-5.859[c]*	-	-
int r	-1.682	-5.717[c]*	-9.482*	-
$forei\_\text{int}\,r$	0.845	1.306[c]	-1.978**	-2.144**
gm_2	-2.798[a]***	0.562[b]*	-	-
$rgdp$	-4.276[a]*	3.625[b]*	-	-
nx	-3.244*	-3.023[c]*	-	-
inf r	-3.900*	-2.233[c]**	-	-
$politrisk$	-0.925	-11.296[c]*	-4.135*	-
cps_gdp_grwt	-12.260*	-5.880*	-	-

Note: DFGLS and Ng-p denote Dickey-Fuller_GLS and Ng-Perron for modified Unit Root tests. The null hypothesis for DFGLS and Ng-P is that an observable time series is unit-root. The critical values for DFGLS at the 1%, 5% and 10% level of significance are -2.582, -1.943 and -1.615 respectively. [a] denotes both the test and intercept are included in the test equation of the unit-root tests; [b] denotes the MSB test statistic of the Ng-Perron Test; [c] is the MZt test statistic of the Ng-Perron Test.

The implication that the non-unit-root as well as stationarity of these variables portend for the Markov Switching models is that it suggests that the long-run probability of each state actually exists. This suggests that the estimated probabilities can be used for forecasting and predictions; as diagnostic tests. More so, the stationarity of the variables fulfills the precondition to investigate the structural behaviour of the central bank in the face of the double trilemma. This is undertaken by employing the Structural Vector Autoregression (SVAR) technique to estimate the extended Mundell-Fleming (MF) model; earlier specified. In order to further explore the statistical properties of the variables included for modeling central bank behaviour in the face of the double trilemma, it becomes imperative to examine the structural break pattern of exchange rate in Nigeria.

4.2.1.3 Unit-Root Tests (With Structural Breaks)

As detailed in Table 4.5, it is evident that the variables for estimations of double trilemma and central bank behaviour in Nigeria have different break periods and the levels of stationarity also differ. Only the change in the exchange rate, growth of the economy, degree of credit expansion and output gap that are non-unit-root at levels, other variables such as the political risk, interest rate, inflation rate, net export and growth of money supply that are all unit-root at levels. This suggests that the use of deterministic models would not be appropriate for this study. This further justifies the use of the Markov Switching models which can capture different break-point period within a structural analysis in a modeling framework such as this.

Table 4.5: Zivot-Andrew Unit-Root (with Structural Breaks) Test

Variables	Break Point Period	Test Statistics Value
$\wedge e$	1999:01	-6.245*
$\text{int}\, r$	2005:01	-3.675
$forei\_\text{int}\, r$	1996:02	-4.207
gm_2	2009:01	-5.556*
$rgdp$	2000:01	-8.243*
nx	2010:02	-3.881
$\text{inf}\, r$	1995:04	-4.007
$politrisk$	2001:02	-3.166
cps_gdp_grwt	1992:02	-5.984*
$outpgap$	2001:02	-6.520*

Source: RATS Output. Note: Critical Values at the 1% = 5.34; 5% = -4.80.

4.2.1.4 Regime Switching Selection Criteria

The Markov Switching Model is preferred because it can address various significant data behaviour such as parameter shifts, structural breaks, swings and slopes. Importantly, therefore, the justification for this methodology is usually an inherent feature of the data generating process (DGP).Considering the data generating process (DGP) of a series within a Markov Switching framework, it is expedient that the optimal number of time that regime switches are determined. It is this that forms the basis of analyses for the series of interest. As detailed in Table 4.6, there are three (3) regime switches for exchange rate determination in Nigeria between the periods 1981Q1 – 2015Q4 when the economy does not have to contend with neither macroeconomic trilemma nor double trilemma.

Efforts were made to simply categorize these regimes as just market-determined policy and exchange rate intervention. However, the information criteria of Aikaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC) and Schwarz Bayesian Information Criterion (SBIC) suggest that there are three (3) switching regimes of the exchange rate in Nigeria between the periods 1981Q1 – 2015Q4. This is because the information criteria for three (3) regime switches have values that are strictly lower than those of two switching regimes. The values are 3.713, 3.816 and 3.966 for the AIC, HQIC and SBIC criteria of three regime switches as against 5.912, 5.963 and 6.038 for the respective criteria of two regime switches. Efforts were also made to obtain the information criteria for lesser than two (2) regime switches and greater than three (3) regime switches but no convergence was reached. This, therefore, lends credence to the fact that only two (2) and three (3) regime switches could be optimized within the Expectation Maximization (EM) algorithm.

Table 4.6: Regime Switching Selection Criteria (1981Q1 – 2016Q4)

Panel 1: Regime Switching Without Trilemma			
Regimes	**AIC**	**HQIC**	**SBIC**
3	3.713	3.816	3.966
2	5.912	5.963	6.038
Panel 2: Regime Switching with Macroeconomic Trilemma			
Regimes	**AIC**	**HQIC**	**SBIC**
2	6.081	6.202	6.379
Panel 3: Regime Switching with Double Trilemma			
Regimes	**AIC**	**HQIC**	**SBIC**
2	6.091	6.230	6.432

Source: STATA Output

When the economy is faced with macroeconomic trilemma and double trilemma, however, there are only two (2) regime switches. These regimes can simply be categorized as exchange rate intervention and market-determined regimes. This finding is highly intuitive as it implies that exchange rate stability remains a cardinal policy variable of the monetary authority. This conforms to the results obtained from the estimates of the trilemma constraint where it was found that exchange rate stability, together with financial openness, can be combined while the autonomy of the central bank is traded off. The fact that there is exchange rate intervention indicates that the monetary authority will always ensure that the supply of money is employed to stabilize the domestic currency from time to time.

Stemming from the foregoing, the modeling of exchange rate switching behaviour in Nigeria will most appropriately hold under the phases of two (2) and three (3) regime switches. With the effect of either macroeconomic trilemma or double trilemma, the monetary authority can only switch regime twice. Excluding the effects of these trilemma constraints, however, the central bank can afford to switch regime three different times. The fixed transition probability (FTP) form of Market Switching model is used to model no-global economy effects of central bank behaviour. On the other hand, the full fledge effects of the global dynamics through either the macroeconomic trilemma or double trilemma is modeled with the time-varying transition probability (TVTP). The constant or fixed transition probability model is generally considered too restrictive to explain the behaviour of the central bank as global dynamics are not allowed to affect the workings of the economy. As such, only the time-varying transition probability Markov Switching modeling framework would be estimated to elicit vital information that are germane to the proper understanding of central bank behaviour in the face of double trilemma.

4.3 Estimations of Empirical Models

4.3.1 The Trilemma Constraint and Policy Trade-Off in Nigeria

In validating whether the trilemma hypothesis holds, the weighted sum of the three trilemma variables are regressed against a constraint and the goodness of fit is observed as an indication of possible trade-off among these policies. The data would be consistent with the existence of the trilemma hypothesis if all the coefficients are positively related to

the constant and the goodness of fit is high. In order to determine the binary choice, also, a significantly inverse relationship is expected between any two of the three policy choices. This investigation into the existence of the trilemma hypothesis is a pre-condition for any structural analysis on this subject matter. The maintained hypothesis is usually of two policy stances, between which the policy maker chooses depending on the dynamics in both the domestic and global economic cum financial conditions (Hutchison, Sengupta and Singh; 2013). Using an uncovered interest rate parity condition with risk premium, the policy variable of the central bank is the exchange rate. Therefore, the maintained hypothesis of two policy stances is between exchange rate intervention and market-determined policy.

The starting point for a study on investigating the trilemma hypothesis is to ascertain if the trilemma constraint holds and identify the binary choice variables of the triad policy that is optimal for the economy. One decision rule to validate the existence of the trilemma hypothesis and that the trilemma constraint holds is that the estimates as well as the coefficients for these triad policies; when regressed against a constant, should all be positive and must have high goodness-of-fit. Also, the trade-off to determine the binary policy choice, when regressed against one another, must be negatively signed. As detailed in Table 4.7, it is evident that all the coefficients for the triad policies are positively related to the constant and highly statistically significant; at least, at the 5 percent level.

Table 4.7: Estimates of Trilemma Constraint and Policy Trade Offs

Panel A: Estimates of the Trilemma Constraint			
Variables	**Coefficient**	**T-statistics**	**Probability Values**
ES	0.353	2.126	0.041
FO	1.708	4.127	0.000
MI	2.532	13.818	0.000
Panel B: Policy Trade Off between Exchange Rate Stability (ES) and Financial Openness (FO)			
Variables	**Coefficient**	**T-statistics**	**Probability Values**
C	0.469	4.401	0.0001
FO	0.022	0.047	0.963
Panel C: Policy Trade Off between Exchange Rate Stability (ES) and Monetary Independence (MI)			
Variables	**Coefficient**	**T-statistics**	**Probability Values**
C	0.665	2.535	0.016
MI	-0.333	-0.750	0.459
Panel D: Policy Trade Off between Monetary Independence (MI) and Financial Openness (FO)			
Variables	**Coefficient**	**T-statistics**	**Probability Values**
C	0.656	16.999	0.000
MI	-0.418	-2.431	0.021

Source: E-Views Output

Also, the regression estimates to determine the appropriate binary combinations show that, on the one hand, trade-off significantly exists between monetary independence and financial openness (Panel D, Table 4.7). On the other hand, there is trade-off between exchange rate and monetary independence (Panel C). However, the estimates in Panel B suggests that exchange rate stability (ES) and financial openness (FO) are the binary choices of the triad policy for the Nigerian economy; albeit insignificantly. The implication is that only exchange rate stability and financial openness can be combined at a time in Nigeria while the monetary independence is the policy trade-off. This confirms that the trilemma constraint holds for Nigeria and that the trilemma hypothesis has been validated. From an empirical standpoint, this study conforms to the findings in many country specific studies on the validation of the trilemma hypothesis in most economies.

Studies that obtained these results include Hsing (2013) and Oshikoya (2014). More so, it conforms to the findings in the empirical literature that both exchange rate and financial openness have remained the optimal policy choices for developing economies for at least a decade now. Studies in this category are Sengupta and Sengupta (2013, 2014). This implies that monetary policy becomes an endogenous variable in Nigeria as the central bank has to ensure it sells domestic currency to buy foreign currency in order to avoid the pressure for currency appreciation during the period under consideration. On the other hand, the monetary authority buys domestic currency in order to sell foreign currency so as to avoid the pressure for currency depreciation. This is to ensure exchange rate stability in the country.

The statistically significant trade-off between monetary independence and financial openness in Nigeria is highly instructive. The insight from this is that for the monetary authority in Nigeria to independently determine interest rate in the economy, it must significantly control the flow of capital transactions in and out of the economy. The implication is that sudden withdrawal of short-term capital; known as hot-money, must be avoided and that surge in the quantum of long-term capital must be in tandem with the developmental pace of the economy. In fact, liberalization on capital account transactions must be gradual and sequenced. Otherwise, the injection of additional and withdrawal of

excess liquidity by the monetary authority will becomes less effective in driving the growth of the economy.

4.3.2 SVAR Model Estimates for Double Trilemma and Central Bank Behaviour inNigeria.

In this section, the structural vector autoregression (SVAR) models specified in the previous section would be estimated and discussed. There are two specified SVAR models to be estimated. The first model is to capture the shock transmission within the classical (macroeconomic) trilemma framework while the inclusion of financial instability variable is to examine if financial trilemma serves as a limiting constraint to macroeconomic trilemma in Nigeria. In another sense, the inclusion of the growth ratio of credit to the private sector to the GDP is to ascertain whether both the macroeconomic and financial trilemma are empirically nested together as double trilemma in the country. In obtaining the Structural VAR estimates, the method of scoring was employed in maximizing the log likelihood. In the optimization process, the maximum number of iterations of 500 was imposed. Before adding and eliminating unrestricted coefficients in the A matrix, the value of log likelihood and signs of impulse response functions against one standard deviation change in the exchange rate.

The first model that captures macroeconomic trilemma and central bank behaviour in Nigeria is over-identified. The value of log likelihood (LR) of the derived structural VAR estimates is -4231.2with corresponding Chi-Square statistics of 989.5 and probability value of 0.000. These suggest that null hypothesis of under-identification is rejected at the 5 percent level (Appendix). For the second model that addresses double trilemma and central bank behaviour in Nigeria, also, the null hypothesis of under-identification is rejected as the model is just identified. As these models were found either just- or over-identified, it suggests that the structural parameters were uniquely solved. In order to avoid the issue of variable ordering sensitivity of both the impulse response functions and vector decompositions of the Structural Vector Autoregression (SVAR) models, the structural decomposition (as against the cholesky decomposition) was employed to partition the shock effects of the variables. Due to the short-run orientation of exchange

rate movement leading to the use of high frequency quarterly series, a short-run restriction is imposed on the parameters.

The variance decomposition measures the contribution of each shock to the forecast error variance. It indicates how much shock of a variable is related to shock from within and which of these shocks are external. In other words, it accounts for proportion of self-reinforcing shocks and spillover shocks to other variables. In Tables 4.8 and 4.9, the estimates of the variance decomposition of each variable due to innovation (shocks) in the other variables are detailed. In Table 4.8, the shock transmissions within a classical (macroeconomic) trilemma constraint are traced out while the estimates of the shock transmission of the double trilemma are detailed in Table 4.8. Since the analyses are done on quarterly data, the shock transmissions are traced over ten quarters as this period is enough to capture the shock effects; irrespective of the phase that the economy is at that point in time. The variance decomposition estimates for Model 1 (Table 4.8) suggests that the exchange rate movement is largely affected by its own shock while shocks from other variables within the classical (macroeconomic) trilemma constraint are considered negligible. Expectedly, the self-shock is expected to die out gradually while shocks from other variables are expected to increase over time. Although, the results found evidence for this trend, but the self-shock was still substantial at about 85 percent; even after the ten quarters. Also, the self-shock of growth in broad money supply follows similar pattern, only that shock from both the exchange rate movement and foreign interest rate hover around 30 percent altogether while the self-shock remained at about 67 percent after the tenth quarter. This lends credence to the endogenous nature of money supply within the trilemma constraint when the monetary authority seeks to stabilize the exchange rate; using the money supply as policy instrument.

On the other hand, the foreign interest rate was only able to retain one-third of its shock and one-third shock each from both exchange rate movement and the growth in broad money supply impacted on it. The explanation here is that shock from a change in exchange rate and expansionary broad money supply in the domestic economy affect the returns on foreign assets. More so, self-shock from the net export dies out drastically after

the tenth quarter to 26 percent while shocks from the movement in the exchange rate, growth of broad money supply and the foreign interest rate impacted substantially on external demand (net export). This is plausible because an increase in the foreign interest rate would lead to exchange rate depreciation and net export declines; since the Marshall-Lerner condition cannot be validated for an oil producing country like Nigeria.

Instructively, the political risk facing the Nigerian economy suggests that its self-shock is immaterial but shocks from the macroeconomic fundamentals such as exchange rate management, growth of broad money supply and foreign interest rate sustainably impacted on the political environment at an average of 25 percent. However, the shock from the external sector dies out gradually and stood at 11.6 percent at the tenth quarter. Also, the price level of the economy has self-shocks that substantially dies out and stood at 32 percent after the tenth quarter. The shocks from the exchange rate and growth in broad money supply are the only major sources of shocks on inflationary pressure in the country. This implies that the exchange rate movement and expansionary money supply beyond the absorbing capacity of the economic agents were the two major causal factors for price instability in Nigeria. Regarding the growth of the economy; shocks from exchange rate movement, growth of broad money supply and that of the foreign interest rate increase over the ten quarters to an appreciable average level of 15 percent. This suggests that these are important factors that affect economic stabilization in Nigeria. Shocks from the external sector, political risk and the price level were stable throughout at negligible level of 6 percent (Appendix).

Table 4.8: Variance Decomposition of Central Bank Behaviour due to an innovation in the Classical (Macroeconomic) Trilemma and Political Risk:

Period	Δe^a	$gM_2{}^b$	$f\,\text{int}\,r^c$	nx^d	$polit\_risk^e$	$\inf r^f$	$rgdp^g$
1	100.0[a]	1.19[a]	30.90[a]	0.0[a]	21.53[a]	2.46[a]	7.20[a]
	0.00[b]	98.81[b]	30.90[b]	0.00[b]	21.53[b]	2.46[b]	7.20[b]
	0.00[c]	0.00[c]	38.20[c]	0.00[c]	21.53[c]	2.46[c]	7.20[c]
	0.00[d]	0.00[d]	0.00[d]	100.00[d]	21.53[d]	2.46[d]	7.20[d]
	0.00[e]	0.00[e]	0.00[e]	0.00[e]	13.86[e]	2.46[e]	7.20[e]
	0.00[f]	0.00[f]	0.00[f]	0.00[f]	0.00[f]	87.70[f]	7.20[f]
	0.00[g]	0.00[g]	0.00[g]	0.00[g]	0.00[g]	0.00[g]	56.82[g]
3	96.19[a]	1.87[a]	30.97[a]	1.05[a]	25.63[a]	2.98[a]	8.90[a]
	1.17[b]	91.05[b]	30.60[b]	0.90[b]	23.45[b]	20.62[b]	6.66[b]
	0.71[c]	4.80[c]	38.40[c]	0.63[c]	21.82[c]	5.27[c]	9.32[c]
	1.55[d]	0.18[d]	0.00[d]	94.77[d]	17.50[d]	4.19[d]	10.17[d]
	0.14[e]	0.19[e]	0.00[e]	0.21[e]	11.59[e]	5.50[e]	7.01[e]
	0.19[f]	1.43[f]	0.01[f]	0.88[f]	0.00[f]	60.85[f]	7.65[f]
	0.04[g]	0.43[g]	0.01[g]	1.57[g]	0.01[g]	0.59[g]	50.29[g]
5	91.82[a]	8.13[a]	31.00[a]	5.12[a]	27.24[a]	8.54[a]	8.57[a]
	2.60[b]	80.31[b]	30.58[b]	6.91[b]	24.91[b]	22.67[b]	7.93[b]
	1.89[c]	9.34[c]	38.36[c]	6.58[c]	22.35[c]	9.03[c]	10.88[c]
	2.93[d]	0.19[d]	0.01[d]	78.74[d]	15.12[d]	4.17[d]	9.10[d]
	0.43[e]	0.34[e]	0.00[e]	0.29[e]	10.35[e]	7.99[e]	6.53[e]
	0.20[f]	1.23[f]	0.04[f]	0.83[f]	0.02[f]	46.58[f]	8.13[f]
	1.31[g]	0.46[g]	0.01[g]	1.53[g]	0.01[g]	1.01[g]	48.87[g]
7	87.92[a]	11.49[a]	30.94[a]	13.31[a]	28.02[a]	12.82[a]	12.76[a]
	3.71[b]	73.32[b]	30.66[b]	15.13[b]	26.00[b]	24.17[b]	9.65[b]
	2.92[c]	12.46[c]	38.31[c]	15.76[c]	22.98[c]	11.99[c]	12.64[c]
	4.19[d]	0.46[d]	0.02[d]	53.61[d]	13.36[d]	3.85[d]	9.04[d]
	0.93[e]	0.76[e]	0.01[e]	0.39[e]	9.61[e]	8.19[e]	6.06[e]
	1.93[f]	1.10[f]	0.05[f]	0.69[f]	0.03[f]	38.06[f]	7.39[f]
	0.13[g]	0.41[g]	0.01[g]	1.12[g]	0.01[g]	0.93[g]	42.47[g]
10	85.20[a]	14.39[a]	30.84[a]	22.17[a]	28.68[a]	15.88[a]	15.91[a]
	4.53[b]	67.24[b]	30.77[b]	23.86[b]	27.00[b]	25.37[b]	14.33[b]
	3.56[c]	15.26[c]	38.24[c]	26.41[c]	23.63[c]	14.32[c]	17.63[c]
	5.02[d]	0.64[d]	0.07[d]	26.20[d]	11.64[d]	3.59[d]	7.20[d]
	1.36[e]	1.17[e]	0.01[e]	0.41[e]	9.00[e]	8.15[e]	4.87[e]
	0.19[f]	0.95[f]	0.07[f]	0.40[f]	0.04[f]	31.85[f]	5.96[f]
	0.15[g]	0.35[g]	0.01[g]	0.56[g]	0.01[g]	0.84[g]	34.09[g]

Source: Author's Extracts from the E-Views Output (Appendix)

In order to account for the shocks transmission within the constraint of double trilemma, the growth ratio of credit to the private sector to the gross domestic product (as an indicator for financial instability) was included as another variable into the systems of equations. The inclusion of the financial instability indicator is mainly to nest the financial trilemma to the macroeconomic trilemma within the same framework (a' la augmented Mundell-Fleming framework).

The estimates of the variance decomposition for the exchange rate movement quickly dies out after the second quarter while shock spillover from the political environment becomes dominant and increases to a tune of 78.6 percent by the tenth quarter (Table 4.9). Shock from the foreign interest rate oscillates from 12.4 percent in the second quarter to 47.7 percent in the third quarter. This shock dies out gradually to 13.5 percent in the tenth quarter. Shocks from other variables to the movement in the exchange rate were highly negligible. In terms of the growth of broad money supply, the variance decomposition shows that the supply of money has become endogenous in Nigeria such that both variables have half-life at quarter 1 and dies out gradually in similar proportion. However, it is shock from the foreign interest that substantially affects the growth of broad money supply. This shock increases to 65.4 percent in the tenth quarter. The impulse response functions also have similar effects where the movement in the exchange rate, growth of money supply, the rate of interest and the net export respond similarly to the shock effect of each other while the response of the price level and growth of the economy to these shocks were negligible (Appendix). This suggests the transmissions to the economic growth and general price level was sluggish without the financial trilemma component of the double trilemma.

For the case of financial instability in Nigeria, the shocks from foreign interest rate and the level of political risk confronting the country remain largely prominent; increasing gradually to 42.2 percent and about 38.0 percent shock effects respectively. The growth of broad money supply was the major shock effect in the first quarter to about 68.9 percent and dies out gradually to 12.3 percent in the tenth quarter. Evidently, the small country assumption is validated. The foreign interest rate is not affected by any shock from

macroeconomic fundamentals as well as political risk factors from Nigeria. Similar effects were also observed for the impulse response function where both the foreign interest rate and political risk factors have explosive effects on the other variables within the structural dynamics of the economy (Appendix). The implication is that the Nigerian economy is not a big player in influencing the dynamics in the global market place. The foreign interest is largely and sustainably affected by self-shock. More so, the shocks transmissions from the other variables to the political environment in Nigeria are inconsequential. This finding has to be interpreted with caution as it would not imply that macroeconomic fundamental and even global dynamics are immaterial to the way of political configuration in the country. One possible interpretation is that the political environment has not been made flexible enough to get impulses with the way the economy moves and how the global factors play out.

Table 4.9: Variance Decomposition of Central Bank Behaviour due to an innovation in the Double Trilemma and Political Risk

Period	Δe^a	$gM_2{}^b$	$cps\_gdp\_grwt^c$	$f\,\text{int}\,r^d$	nx^e	$polit\_risk^f$	$\text{inf}\,r^g$	$rgdp^h$
1	100.0[a]	58.40[a]	7.84[a]	0.00[a]	8.61[a]	1.37[a]	3.85[a]	7.66[a]
	0.00[b]	41.60[b]	68.95[b]	0.00[b]	10.74[b]	0.39[b]	15.76[b]	0.11[b]
	0.00[c]	0.00[c]	23.21[c]	0.02[c]	65.48[c]	0.00[c]	5.99[c]	1.64[c]
	0.00[d]	0.00[d]	0.00[d]	99.98[d]	15.17[d]	3.42[d]	36.60[d]	18.51[d]
	0.00[e]	0.00[e]	0.00[e]	0.00[e]	0.00[e]	0.22[e]	6.09[e]	5.64[e]
	0.00[f]	0.00[f]	0.00[f]	0.00[f]	0.00[f]	94.58[f]	15.18[f]	23.73[f]
	0.00[g]	0.00[g]	0.00[g]	0.00[g]	0.00[g]	0.00[g]	16.55[g]	0.62[g]
	0.00[h]	0.00[h]	0.00[h]	0.00[h]	0.00[h]	0.00[h]	0.00[h]	42.09[h]
3	17.29[a]	28.68[a]	4.45[a]	0.00[a]	7.14[a]	1.74[a]	5.54[a]	5.52[a]
	4.76[b]	20.31[b]	26.14[b]	0.00[b]	9.27[b]	0.48[b]	10.62[b]	0.20[b]
	4.77[c]	0.30[c]	8.99[c]	0.02[c]	57.07[c]	0.00[c]	3.42[c]	1.70[c]
	47.71[d]	47.78[d]	40.60[d]	99.95[d]	10.19[d]	1.00[d]	19.81[d]	42.34[d]
	0.46[e]	0.73[e]	0.04[e]	0.00[e]	0.63[e]	0.27[e]	3.84[e]	3.93[e]
	23.27[f]	0.06[f]	19.37[f]	0.02[f]	5.69[f]	96.49[f]	47.15[f]	15.18[f]
	0.83[g]	1.43[g]	0.37[g]	0.00[g]	0.11[g]	0.00[g]	9.21[g]	0.43[g]
	0.91[h]	0.70[h]	0.04[h]	0.00[h]	9.91[h]	0.00[h]	0.40[h]	30.69[h]
5	7.10[a]	16.82[a]	3.14[a]	0.00[a]	2.23[a]	1.97[a]	4.74[a]	4.86[a]
	2.47[b]	11.82[b]	17.57[b]	0.00[b]	2.46[b]	0.57[b]	8.50[b]	0.17[b]
	1.68[c]	0.30[c]	6.08[c]	0.02[c]	16.62[c]	0.01[c]	2.84[c]	1.54[c]
	25.78[d]	65.25[d]	48.09[d]	99.91[d]	72.82[d]	0.53[d]	18.16[d]	47.35[d]
	0.64[e]	0.47[e]	0.03[e]	0.00[e]	0.22[e]	0.30[e]	3.06[e]	3.36[e]
	60.83[f]	4.03[f]	24.56[f]	0.05[f]	2.34[f]	96.60[f]	54.61[f]	15.93[f]
	0.32[g]	0.85[g]	0.28[g]	0.01[g]	0.05[g]	0.01[g]	7.39[g]	0.37[g]
	1.19[h]	0.46[h]	0.23[h]	0.00[h]	3.26[h]	0.01[h]	0.69[h]	26.08[h]
7	5.13[a]	13.64[a]	2.95[a]	100.0[a]	0.92[a]	2.08[a]	4.55[a]	4.79[a]
	1.93[b]	9.52[b]	14.28[b]	0.00[b]	0.85[b]	0.61[b]	7.18[b]	0.19[b]
	1.17[c]	0.26[c]	4.97[c]	0.03[c]	6.19[c]	0.01[c]	2.47[c]	1.56[c]
	17.05[d]	66.63[d]	44.80[d]	99.87[d]	89.01[d]	1.21[d]	15.89[d]	47.85[d]
	0.47[e]	0.40[e]	0.05[e]	0.01[e]	0.08[e]	0.31[e]	2.65[e]	3.31[e]
	73.18[f]	8.48[f]	28.77[f]	0.08[f]	1.67[f]	95.76[f]	60.41[f]	15.52[f]
	0.21[g]	0.69[g]	0.25[g]	0.01[g]	0.03[g]	0.01[g]	6.20[g]	0.36[g]
	0.85[h]	0.38[h]	0.20[h]	0.00[h]	1.25[h]	0.01[h]	0.64[h]	26.41[h]
10	4.22[a]	11.36[a]	2.80[a]	0.01[a]	0.37[a]	2.17[a]	4.36[a]	3.52[a]
	1.56[b]	7.81[b]	12.30[b]	0.00[b]	0.25[b]	0.62[b]	6.52[b]	0.15[b]
	0.81[c]	0.26[c]	4.27[c]	0.03[c]	1.98[c]	0.02[c]	2.27[c]	1.16[c]
	13.54[d]	65.40[d]	42.17[d]	99.83[d]	94.97[d]	2.79[d]	15.53[d]	60.66[d]
	0.46[e]	0.36[e]	0.09[e]	0.01[e]	0.04[e]	0.31[e]	2.41[e]	2.40[e]
	78.60[f]	13.93[f]	37.97[f]	0.10[f]	2.00[f]	94.06[f]	62.69[f]	12.82[f]
	0.15[g]	0.57[g]	0.20[g]	0.01[g]	0.02[g]	0.02[g]	5.59[g]	0.69[g]
	0.67[h]	0.32[h]	0.21[h]	0.00[h]	0.38[h]	0.00[h]	0.63[h]	19.02[h]

Source: Author's Extracts from the E-Views Output (Appendix)

Concerning the external sector, the self-shock is totally negligible but largely affected by the increasing shock from the foreign interest rate, which stood at 94 percent in the tenth quarter. The reason why the external sector has a negligible self-shock is that the Nigerian economy is a major oil exporter and quota distribution to members of petroleum exporting countries (OPEC) has not largely weaken its exportation strength. The essence why the foreign interest rate has the major shock transmission effect is that a change in the foreign interest rate leads to portfolio adjustment of investors and then leads to exchange rate movement which then impacts on the trade balance. This is not only a theoretical plausibility but empirically validated also. However, the shocks from other variables to the price level of the Nigerian economy are irrelevant except for the shock from the political activities in the country. This shock increases sustainably to about 62.7 percent in the tenth quarter. The implication is that the political conducts and practices in the country have put an inflationary pressure on the economy. The shock through the foreign interest rate dies out gradually from about 37 percent in the first quarter to 15.5 percent in the tenth quarter. This shows a relative impact of imported inflation in the country. This is similar to the shocks from the growth of money with 15.8 percent effect in quarter one to 6.5 percent in quarter ten. The shock from the price level is not self-reinforcing as it stood at 16.5 percent in quarter one to 5.6 percent in quarter ten.

Lastly, shocks from other variables to the growth of the economy were traced mainly to foreign interest. As this is also the case for the net export, this confirms that the net export is the major source of growth in Nigeria and any shock that affects the external sector would have a consequential effect on the aggregate economy. Shock transmission from the political environment to growth, however, dies out gradually from 24 percent in the first quarter to 12.8 percent in the tenth quarter. The shock is relatively self-reinforcing but dies out gradually over time. It stood at 42 percent in quarter one to 19 percent in the tenth quarter.

4.3.3 Estimation of Regime Switching Model without Trilemma

Modeling the switching pattern of the exchange rate with fixed or constant transition probabilities is the same as examining the behaviour of the Central Bank of Nigeria

(CBN) without the effect of the trilemma. It is with this that the effects of other policy choices of the trilemma are not considered in determining the exchange rate movement. As earlier posited, the results from the fixed transition probability model are in order to adequately underscore the effects of the trilemma on the behaviour of the monetary authority in Nigeria.

The estimates detailed in Table 4.10 is highly informative on the various estimates of the parameters of the regime switching model without the effect of any form of trilemma; macroeconomic trilemma or/and financial trilemma. This is the case when the behaviour of the exchange rate is not modeled to reflect effects of the binary policy choices of the trilemma hypothesis on the behaviour of Central Bank of Nigeria. ζ_1, ζ_2 and ζ_3 denotes the average values of the exchange rate at the three (3) States respectively. δ_1^2, δ_2^2 and δ_3^2 are the standard deviations of the exchange rate at States 1, 2 and 3 respectively. P_{11}, P_{22} and P_{33} are the estimated probabilities of persistence in each State. P_{11} denotes the estimated probability of staying in State 1 in the next period given that the exchange rate is in State 1 in the current period. P_{22} indicates the estimated probability of staying in State 2 in the next period given that the exchange rate is in State 2 in the current period. P_{33} suggests the estimated probability of staying in State 3 in the next period given that the exchange rate is in State 3 in the current period.

The respective cross probabilities of persistence are P_{12}, P_{13} for State 1; P_{21}, P_{23} for State 2 and P_{31}, P_{32} for State 3. P_{12} is the probability of transitioning to State 2 in the next period given that the exchange rate is in State 1 in the current period; P_{13} is the probability of transitioning to State 3 in the next period given that the exchange rate remains in State 1 in the current period. Also, P_{21} is the probability of transitioning to State 1 given that the exchange rate is still in State 2 in the current period; P_{23} is the probability of transitioning to State 3 given that the exchange rate remains at State 2 in the current period. P_{31} implies the probability of transitioning to State 1 given that the exchange rate is still in State 1 and P_{32} indicates the probability of transitioning to State 2 given that the exchange rate

remains in State 3. The average exchange rate for State 1, State 2 and State 3 are 1.51, -0.001 and 43.895 respectively.

While there is no any direct indication from the data relating to how the respective State would be labeled in terms of regimes, information obtained from both economic and statistical theories provide helpful insights. The standard deviations for States 1, 2 and 3 are 0.235, 0.005 and 13.122 respectively. This suggests that State 3 is the most volatile, the least volatile State is State 2 while State 1 is a relatively high volatile State. With insights from economic theory, State 1 is a managed-float regime, State 2 is market-determined exchange rate regime while State 3 is a fixed exchange rate regime. This is because economic intuition has it that when exchange rate is fixed, it tends to diverge widely from its intrinsic value dictated by the market forces of demand and supply; hence, the high standard deviation of 13.122. Also, when the exchange rate is market-determined, its value reflects its real value; thus, the near negligible standard deviation of 0.005.

With a managed-float exchange rate system, the exchange rate is expected to hover around a particular band. The higher the allowable band, the higher the standard deviation and the lower the allowable band, the lower the standard deviation. The standard deviation of 0.235 suggests the managed-float exchange rate regime in Nigeria is a categorical form of the floating exchange rate regime as its standard deviation tends towards that of the market-determined standard deviation with 0.005 value as against that of the fixed exchange rate regime; with 13.122 standard deviation. In terms of the estimated probabilities of persistence and cross probabilities of transition, the managed-float regime has a persistence probability of 0.869 (i.e. $P_{11} = 0.869$); the market-determined exchange rate regime has a persistence probability of 0.83 (i.e. $P_{22} = 0.830$) while the fixed exchange rate regime has a persistent probability of 0.478 (i.e. $P_{33} = 0.478$).

Table 4.10: Maximum Likelihood Estimation of the Parameters and Asymptotic Standard Errors

Parameters	Estimation	Standard Errors
ζ_1	1.151	0.292
ζ_2	-0.001	0.001
ζ_3	43.895	18.572
δ_1^2	2.623	0.235
δ_2^2	0.004	0.005
δ_3^2	72.080	13.122
P_{11}	0.869	0.037
P_{12}	0.061	0.025
P_{13}	0.070	0.028
P_{21}	0.111	0.062
P_{22}	0.830	0.068
P_{23}	0.059	0.049
P_{31}	0.522	0.142
P_{32}	0.000	0.000
P_{33}	0.478	0.142

Source: STATA Output

Except for the fixed exchange rate regime with persistence level of 47.8 percent; which is considered moderate, both the managed-float and market-determined exchange rate regimes have high persistence level of 86.9 percent and 83.0 percent respectively (Table 4.10). This suggests that the exchange rate is more persistent at a managed-float regime in Nigeria than at a market-determined regime while the fixed exchange regime is only sustainable at a moderate level. In fact, the expected duration that the exchange rate will remain persistence at each regime are 7.67 quarters (approximately 8 quarters); 5.89 quarters (approximately 6 quarters) and 1.92 quarters (approximately 2 quarters) respectively (Table 4.11).

Table 4.11: Expected Duration of Persistence at each Regime (State)

Expected Duration	Estimates	Standard Errors
S_1	7.672	2.164
S_2	5.887	2.370
S_3	1.916	0.521

Source: STATA Output

More importantly, the cross probabilities provide more insight into exchange rate behaviour in Nigeria. The transition probability of $P_{12} = 0.061$ denotes that there is a probability of 0.061 as well as 6.1 percent of transiting to a market-determined regime in the next quarter when the exchange rate is operating a managed-float exchange rate regime in the current quarter while $P_{13} = 0.07$ indicates that there is probability of 0.07 or 7.0 percent of transiting to fixed exchange rate regime in the next quarter when the economy is operating managed-float regime in the current quarter. This implies that there is a 50 percent chance of either transiting to market-determined regime or fixed exchange rate regime when the economy is currently operating on a managed-float regime in Nigeria.

On the other hand, the cross probability of $P_{21} = 0.111$ indicates that there is a probability of 0.111 or 11.1 percent of transiting to a managed-float regime in the next quarter when the economy operates a market-determined exchange rate regime in the current quarter while $P_{23} = 0.059$ suggests that there is a probability of 0.059 or 5.9 percent of transiting to fixed exchange rate regime in the next quarter when the economy currently operates on market determined regime in the current quarter. More so, the cross probability of $P_{31} = 0.522$ indicates that there is probability of 0.522 or 52.2 percent of transiting to managed-float regime in the next quarter when the economy operates on a fixed exchange rate regime in the current quarter while $P_{32} = 0.000$ denotes that it is uncertain for the economy to transit to market-determined exchange rate regime in the next quarter when currently operating on a fixed exchange rate regime in the current quarter.

These results are heuristic in nature as it suggests that it is easier to transit from a fixed exchange rate regime to managed-float regime to the tune of 52.2 percent but not vice versa as the probability of transiting from a managed float regime to a fixed exchange rate regime is a meager chance of 7.0 percent. Interestingly, too, the result shows that it is uncertain to transit from a fixed exchange rate regime to a market-determined regime. This is true as both market-determined and fixed exchange rate regimes are the two ends of the continuum of exchange rate regimes.

4.3.4 Estimation of Regime Switching Model with Macroeconomic Trilemma

When the monetary policy is faced with the effect of macroeconomic trilemma in Nigeria, there are two possible exchange rate regimes viz; managed-float regime and fixed exchange rate regime. This information is gleaned from the fact that State 1 has average exchange rate of 1.925 with 1.160 standard errors while State 2 has average exchange rate of 82.18 with 40.15 standard errors. The implication is that the managed-float regime (State 1) has average exchange rate value that dispersed away from its intrinsic value by 1.160 while the fixed exchange rate (State 2) dispersed widely with 40.148 standard errors but with 82.181 average values. The lagged dependent variable is significant at probability values of 0.012 and 0.084 for the case of managed-float regime; with and without political risk factors respectively. This confirms that exchange rate behaviour is better modeled as a dynamic process.

For the case of fixed exchange rate regime, also, its fitness to Markov Switching dynamic regression model is confirmed. It should be noted that under each of the exchange rate regimes, there is a dichotomy to both the inclusion of political risks factor and without. It is evident that under managed-float regime, all explanatory variables for macroeconomic trilemma do not differ in terms of size and significant. The only exception is the growth process of the Nigerian economy (indicated as rgdp) which, with political risk factor, is significantly negatively related to exchange rate behaviour at the 5 percent level with -0.170 coefficient. Specifically, the political risk is inversely related to the exchange rate movement in Nigeria with -0.159 coefficients with significantly T-statistics value at the 5 percent level with 0.017 probability values. The implication is that an increase in the value of political risk (which simply denotes a reduced political risk) would results in a fall in exchange rate (that is, an appreciation). Therefore, the results show that a lower political risk will engender an exchange rate appreciation in the Nigerian economy.

Table 4.12: Maximum Likelihood Estimations for both Managed-Float and Fixed Exchange Rate Regimes with Macroeconomic Trilemma in Nigeria (With and Without Political Risks)

Panel A: Regime 1 (Managed-Float Regime)					
Without Political Risk			**With Political Risk**		
Variable	**Estimation**	$P\|z\|$	**Variable**	**Estimation**	$P\|z\|$
$\wedge e\_L_1$	0.022	0.084	$\wedge e\_L_1$	0.023	0.012
ζ_1	1.925	0.097	ζ_1	8.848	0.008
rgdp	-0.169	0.120	*rgdp*	-0.170	0.036
gm_2	0.017	0.739	gm_2	0.021	0.569
forei _ int *r*	-0.055	0.970	*forei* _ int *r*	0.0005	0.996
nx	-4.97e-07	0.202	*nx*	-4.26e-07	0.147
politrisk	-	-	*politrisk*	-0.159	0.017
Panel B: Regime 2 (Fixed Exchange Rate Regime)					
Without Political Risk			**With Political Risk**		
Variable	**Estimation**	$P\|z\|$	**Variable**	**Estimation**	$P\|z\|$
$\wedge e\_L_1$	-0.834	0.000	$\wedge e\_L_1$	0.669	0.000
ζ_2	82.181	0.041	ζ_1	25.687	0.366
rgdp	-127.964	0.000	*rgdp*	-98.075	0.000
gm_2	-0.967	0.277	gm_2	8.357	0.000
forei _ int *r*	9.875	0.003	*forei* _ int *r*	21.403	0.000
nx	0.0003	0.000	*nx*	0.0005	0.000
politrisk	-	-	*politrisk*	-4.182	0.000

Source: STATA Output

This is also the case under a fixed exchange rate regime with -4.182 coefficient and 0.000 probability value. Interestingly, though, when the economy is faced with macroeconomic trilemma and the exchange rate regime is fixed, then, the growth of the economy have significant impacts on the exchange rate movement with -127.964. This suggests that economic growth enhances exchange rate appreciation. Also, the growth of money supply has -0.967 coefficients; albeit insignificantly at the 5 percent level. A possible intuition for macroeconomic trilemma here is that with fixed exchange rate regime, increase in monetary growth could create a pressure for currency appreciation.

Both the foreign interest rate and net export are positively signed with 9.875 and 0.0003 coefficients respectively. These estimates are significant at the 5 percent level too. The implication is that an increase in the foreign interest rate, which translates to reduced financial openness; consequent upon portfolio adjustment, would lead to pressure for foreign exchange rate devaluation. The positive coefficient of 0.0003 for the net export would significantly create a pressure for exchange rate devaluation under a fixed exchange rate regime; either with or without political risks. This is unlike the case of managed-float regime where the increase in the net export and foreign rate of interest creates pressure for exchange rate appreciation; albeit insignificantly. Table 16 captures the probabilities of transition and durations of persistence of exchange rate movement in Nigeria. The exchange rate is persistent at the managed-float regime to the tune of 96.1 percent but 30.6 percent at the fixed exchange rate regime (Table 4.13, Panel A).

Table 4.13: Probabilities of Transition and Durations of Persistence for Central Bank Behaviour and Macroeconomic Trilemma (With and Without Political Risks)

Panel A: Probabilities of Transition			
Without Political Risk		**With Political Risk**	
Expected Probabilities	**Estimates**	**Expected Probabilities**	**Estimates**
P_{11}	0.961	P_{11}	0.939
P_{12}	0.039	P_{12}	0.061
P_{21}	0.694	P_{21}	0.792
P_{22}	0.306	P_{22}	0.208
Panel B: Duration of Persistence			
Without Political Risk		**With Political Risk**	
Expected Duration	**Estimates**	**Expected Duration**	**Estimates**
S_1	25.78	S_1	16.36
S_2	1.44	S_2	1.26

Source: STATA Output

This indicates that there is a 96.1 percent that the exchange rate regime will be of managed-float in the next quarter if it is currently operating at the managed-float in the current quarter. In fact, the duration of persistence is approximately 26 quarters under the managed-float regime and 1.44 quarters during the fixed exchange rate regime. This is equivalent to four and a half ($4^1/_2$) years and one (1) quarter of persistence respectively. The cross probabilities of transition suggest that it is much easier to transit from a fixed exchange rate regime to a managed-float regime by 69.4 percent while it is near impossible to transit from managed-float to fixed exchange rate regime by a paltry 3.9 percent chance (Panel B, Table 4.11). However, when political risk is considered, the probabilities of persistence dropped to 93.9 percent and 20.8 percent respectively while the cross probabilities of persistence increased to 6.1 percent from a managed-float to a fixed exchange rate regime and 79.2 percent from a fixed exchange rate regime to a managed-float regime. The conclusion here is that political risk speeds up the transition of regime switching but reduced the degree of persistence of the exchange rate regimes.

In order to model the double trilemma, the growth ratio of credit to the private sector to the real gross domestic product (cps_gdp_grwt) is included to the baseline macroeconomic trilemma; as enunciated by Mundell (1963) and Fleming (1962). The cps_gdp_grwt is to capture the financial stability component of financial trilemma while the two other components of macroeconomic trilemma such as monetary autonomy and financial openness still suffice for national financial policy and financial openness components of financial trilemma. As detailed in Table 4.8, the estimates show that financial trilemma does not limit the alternative policy choices available at the disposal of the monetary authority when faced with macroeconomic trilemma if the exchange rate regime is managed-float; either with or without political risks. This is because the inclusion of financial stability component is statistically insignificant at the 5 percent level with -0.017 and -0.013 coefficients without and with political risks respectively. The inclusion of political risk allows the growth of money supply and net export to become significant at the 10 percent level but with different impacts on the exchange rate regime of managed-float. The coefficient of 0.081 shows that increase in the growth of money supply tends to depreciates the exchange rate further while the coefficient of -6.63e-07 for

the net export indicates that increase in net export leads to exchange rate appreciation in Nigeria under a managed-float regime. This implies that even though the economy does not face any financial trilemma by adopting a managed-float exchange rate regime, political risk factor makes the monetary authority to the statistically independent at the 10 percent level.

4.3.5 Estimation of Regime Switching Model with Double Trilemma

However, when the economy is on fixed exchange rate regime – i.e. exchange rate stability, it is evident that financial trilemma constrained the policy choices of macroeconomic trilemma as the variable of financial stability (i.e. cps_gdp_grwt) with -5.407 and -12.704 coefficients are statistically significant at the 5 percent level for without and with political risk factors respectively. Importantly, too, it is evident from the estimations that the trade-off of policy choices really played out under the fixed exchange rate regime but more prominently with the inclusion of political risk factors as all the explanatory variables become significant at the 1 percent level. More so, the effect of foreign interest rate on exchange rate movement in Nigeria alternates sign. It was positively significantly when political risk was not considered but negatively significant when political risk of the country was considered. Interestingly, the negative coefficient of foreign rate of interest ($forei\_intr$) of -25.221 suggests that an increase in the foreign rate of interest leads to pressure for exchange rate appreciation under a fixed exchange rate regime. Intuitively, this distorts the expected economic signals as evident without the effect of political risks. An increase in the foreign rate of interest leads to reduction in the degree of financial openness, consequent upon portfolio adjustment of investors, then, rather than a pressure for exchange rate depreciation, there is a pressure for exchange rate appreciation in the country (Table 4.14).

Table 4.14: Maximum Likelihood Estimations for both Managed-Float and Fixed Exchange Rate Regimes Behaviour with Double Trilemma in Nigeria (With and Without Political Risks)

Panel A: Regime 1 (Managed-Float Regime)					
Without Political Risk			**With Political Risk**		
Variable	**Estimation**	$P\|z\|$	**Variable**	**Estimation**	$P\|z\|$
$\wedge e\_L_1$	0.019	0.117	$\wedge e\_L_1$	0.019	0.116
ζ_1	2.043	0.076	ζ_1	5.213	0.234
rgdp	-0.154	0.150	*rgdp*	-0.158	0.139
gm_2	0.078	0.113	gm_2	0.081	0.098
forei _ int r	-0.034	0.780	*forei _ int r*	-0.055	0.657
nx	-5.95e-07	0.118	*nx*	-6.63e-07	0.090
cps _ gdp _ grwt	-0.017	0.622	*cps _ gdp _ grwt*	-0.013	0.721
politrisk	-	-	*politrisk*	-0.066	0.457
Panel B: Regime 2 (Fixed Exchange Rate Regime)					
Without Political Risk			**With Political Risk**		
Variable	**Estimation**	$P\|z\|$	**Variable**	**Estimation**	$P\|z\|$
$\wedge e\_L_1$	1.408	0.000	$\wedge e\_L_1$	2.444	0.000
ζ_2	15.327	0.596	ζ_1	-34.762	0.585
rgdp	-71.279	0.000	*rgdp*	-35.125	0.000
gm_2	13.331	0.000	gm_2	20.148	0.000
forei _ int r	0.635	0.817	*forei _ int r*	-25.221	0.000
nx	0.0003	0.000	*nx*	0.00004	0.000
cps _ gdp _ grwt	-5.407	0.000	*cps _ gdp _ grwt*	-12.704	0.000
politrisk	-	-	*politrisk*	5.986	0.000

Source: STATA Output

The general implication drawn from these models on the dichotomy between managed-float and fixed exchange regimes; whether with macroeconomic trilemma or financial trilemma, is that once the economy does not adopt a fixed exchange rate regime, the trilemma hypothesis breaks down and the economy cannot be affected by the trilemma constraints. With the double trilemma, however, there is high persistence of the managed-float regime by 95.2 percent while the fixed exchange rate regime is negligibly persistent by 13.9 percent.

Table 4.15: Probabilities of Transition and Durations of Persistence for Central Bank Behaviour and Double Trilemma (With and Without Political Risks)

Panel A: Probabilities of Transition			
Without Political Risk		**With Political Risk**	
Expected Probabilities	**Estimates**	**Expected Probabilities**	**Estimates**
P_{11}	0.952	P_{11}	0.953
P_{12}	0.048	P_{12}	0.048
P_{21}	0.861	P_{21}	0.861
P_{22}	0.139	P_{22}	0.139
Panel B: Duration of Persistence			
Without Political Risk		**With Political Risk**	
Expected Duration	**Estimates**	**Expected Duration**	**Estimates**
S_1	20.82	S_1	21.42
S_2	1.16	S_2	1.16

Source: STATA Output

In order words, the duration of persistence under a managed-float regime is approximately 21 quarters; an equivalent of five (5) years while the fixed exchange rate regime has persistent duration of just one (1) quarter (Table 5.7). In fact, it is much easier to transit from a fixed exchange rate regime to a managed-float regime by a spate of 86.1 percent while less easy to transit from managed-float to a fixed exchange rate regime by 4.8 percent. The differences in these estimates are negligible with the inclusion of political risk factor and without (Table 4.15).

4.4 Robustness Checks

An extended Taylor rule was employed as the robustness check for this study. The standard Taylor rule assumes a stable and deterministic policy response to economic variables. However, a modified Taylor rule; which is taken here as the standard Taylor rule within a Markov Switching framework, suggests a systematic and predictable manner in switching between exchange rate regimes. This chapter concludes with the use of some diagnostic tests on the estimated models. These tests revolve around heteroscedasticity, autocorrelation and specifications fits of the estimated model.

The estimates of the extended Taylor's rule specified in equations 32 – 35 are detailed in Table 4.16 below. The estimates show that only two states can be optimized at convergence level for interest rate regime switching in Nigeria. The estimates show that there is evidence of interest rate smoothing in Nigeria, irrespective of the interest rate levels. This conforms to findings in the studies of Agu (2011) and Bello and Sanusi (undated). The average rate of interest for State 1 is 5.102 while the average rate of interest for State 2 is 2.875. The implication of these estimates is that State 1 can be categorized as the high interest rate state while State 2 can be categorized as the low interest rate state. An attempt to optimize for more than two states of interest rate regime switching could not yield convergence. Therefore, there are only two regimes of high and low interest rates dynamics in Nigeria for the periods 1981Q1 – 2016Q4 (Table 4.16).

Table 4.16: Estimates of the Standard and Extended Taylor's Rule of Nigeria

Panel A: Standard Taylor's of Nigeria (Without Political Risks of the Country)							
Regime 1 (Regime of High Interest Rate)				Regime 2 (Regime of High Low Interest Rate)			
Variable	**Estimation**	**Std. Error**	$P\|z\|$	**Variable**	**Estimation**	**Std. Error**	$P\|z\|$
$\text{int}\,r\_L_1$	-0.537	0.120	0.000	$\text{int}\,r\_L_1$	0.991	0.021	0.000
ζ_1	5.102	1.640	0.002	ζ_1	0.164	0.293	0.576
outpgap	1.077	0.183	0.000	*outpgap*	-0.072	0.029	0.011
$\wedge e$	-0.005	0.033	0.889	$\wedge e$	0.008	0.243	0.005
$\text{inf}\,r$	-0.305	0.166	0.066	$\text{inf}\,r$	0.009	0.014	0.532
Panel A: Extended Taylor's Rule of Nigeria (With Political Risks of the Country)							
Regime 1 (Regime of High Interest Rate)				**Regime 2 (Regime of High Low Interest Rate)**			
Variable	**Estimation**	**Std. Error**	$P\|z\|$	**Variable**	**Estimation**	**Std. Error**	$P\|z\|$
$\text{int}\,r\_L_1$	-0.017	0.080	0.830	$\text{int}\,r\_L_1$	0.981	0.024	0.000
ζ_2	2.857	5.596	0.610	ζ_1	-1.763	1.207	0.144
outpgap	0.678	0.094	0.000	*outpgap*	-0.048	0.033	0.142
$\wedge e$	-0.099	0.09	0.287	$\wedge e$	0.088	0.03	0.002
$\text{inf}\,r$	0.025	0.059	0.676	$\text{inf}\,r$	0.016	0.016	0.317
politrisk	0.230	0.127	0.071	*politrisk*	0.044	0.029	0.132

Source: STATA Output

It is evident in the estimates obtained that the previous level of interest rate ($\text{int}r\_L_1$) for the previous period negatively impacts on its current level; only that it becomes significant without the consideration of political risks in interest rate determination in the country. The lagged interest rate has -0.537 coefficients with highly statistically significant probability value of 0.000; if political risks are not considered. This implies that a higher interest rate in the previous period; excluding political risk, would attract a lower interest rate in the current period and vice versa. This is also the case when political risks were considered except that it is insignificantly so at the 5 percent level. Generally, political risk is positively related to both high and low regimes of interest rate but only significantly related in the former. It has a positive coefficient of 0.23 with 0.071 probability values and 0.044 coefficients with 0.132 probability values for the high and low interest rate regimes respectively. This suggests that a higher value of political risk, which translates to lower degree of political risk in the country, would engender higher level of interest rate in the country at the 10 percent level of significance. This, thereby, increases the inflow of capital transactions into the economy and leads to increased degree of financial openness. That the same lower degree of political risk would enhance lower rate of interest is not statistically significant; even at the 10 percent level of significance.

With or without political risk, output gaps for the economy is significantly positively related to the rate of interest under a high interest rate regime but significantly negative under a low rate of interest. This is intuitive in that when the actual output level exceeds its potential level for the economy, then, the interest rate increases further to control for inflationary pressure that could be occasioned by excess production in the domestic economy. By contrast, the exchange rate movement; with or without political risks factor, is negatively related to a higher interest rate regime but positively related to a lower interest rate regime. The implication is that exchange rate depreciation should provide counter-cyclical impulses on the cost of doing business in the domestic economy; given the dynamics of interest rate in the country. Except for the case of high interest rate regime without the effect of political risk in the country, the rate of inflation is generally positively related to the rate of interest. This largely confirms the popular Fisher's effect and further suggests that inflation-targeting is one of the policy strategies of the monetary

authority. Previous studies on this note include Agu (2011) but it contradicts the findings that interest rate weakly reacts to inflation and output gap as obtained in the study of Siri (2009).

The estimates on the transitional probabilities and duration of persistence of interest rate regimes provide more insightful information. The estimates 0.410 is the probability that a high interest rate regime in the current quarter will remain high in the next quarter but a 59 percent chance that it will transit to a low interest rate regime in the next quarter. On the other hand, there is a 3.2 percent chance that a low interest rate in the current quarter will transit to a high interest rate in the next quarter. However, there is a 96.8 percent chance that a low interest rate regime in the current quarter will remain low in the next quarter. The implication is that the duration of persistence for a high interest rate regime in Nigeria is approximately two (2) quarters while the duration of persistence for a low interest rate regime is approximately 31 quarters; about eight (8) years equivalently. All these transitions and persistence are without the consideration of political risk factors. With political factors considered, there is persistence of high interest rate regime to 75.8 percent chance and the transition from a high interest rate regime to a low interest rate regime diminishes to 24.2 percent chance (Table 4.17).

The implication, therefore, is that perhaps, the use of loanable funds for preparing for political activities and electioneering activities in the country has allowed financial institutions to charge higher interest rate on investible funds in the country. In fact, the duration of persistence has marginally increased for high interest rate regime by a spate of about additional two-and-half ($2^1/_2$) quarters while the duration of persistence for low interest rate regime reduces half-life; from 31.13 quarters to 29.9 quarters (Table 4.17).

Table 4.17: Probabilities of Transition and Durations of Persistence for the Taylor's Rule for Nigeria (With and Without Political Risks)

Panel A: Transitional Probabilities of Interest Rate Regime in Nigeria			
Transition Probabilities without Political Risks		**Transition Probabilities with Political Risks**	
Expected Probabilities	**Estimates**	**Expected Probabilities**	**Estimates**
P_{11}	0.410	P_{11}	0.758
P_{12}	0.590	P_{12}	0.242
P_{21}	0.032	P_{21}	0.033
P_{22}	0.968	P_{22}	0.967
Panel B: Duration of Persistence of Interest Rate Regimes in Nigeria			
Duration of Persistence without Political Risks		**Duration of Persistence with Political Risks**	
Expected Duration	**Estimates**	**Expected Duration**	**Estimates**
S_1	1.70	S_1	4.13
S_2	31.13	S_2	29.90

Source: STATA Output

4.4 Diagnostics and Post-Estimation Tests

In order to validate the estimates obtained from this study and to permits generalization of conclusion reached therefrom, it is important that some post-estimation tests are performed. This will serve as diagnostic tests for the model that will reinforce not only the fitness of the model but also ensure that the model does not suffer from various econometrics problems. As detailed in the appendix, the information criterion for this model is performed and it shows that the models are the most appropriate from the list of alternative specifications. Also, the variance-covariance estimates of the model are in order. More so, the analyses of the impulse response functions and the factor decomposition lend credence to the results obtained (Appendix).

4.5 Summary of findings

The descriptive statistics show that the domestic currency, *naira*, has positively deviated from its expected market value and that political risk in Nigeria has been largely very high. The real gross domestic product has shown that the Nigerian economy experienced downswing for the period under review. The non-parity between the domestic and foreign interest rates suggests that there would be capital inflows into the economy; due to portfolios adjustment of global investors. More so, price and financial stabilities are not course for concern as their average values fall below the threshold values. There was strong indication for the absence of (multi)collinearity problem as the correlation matrix show absence of high correlation among the variables. This indicated that the variables can be combined within the same framework for empirical investigation.

The preliminary test indicated that the variables are sensitive, at most at the first order (I(1)) while the Zivot-Andrew structural break test found different break periods. This lends credence to the use of Markov-Switching Dynamic Regression (MSDR) technique which is amenable to various data behaviour such as parameter shift, structural breaks, swings and slopes. The study found evidence for the presence of the trilemma constraint as monetary independence serves as the traded-off policy. Empirical country-specific studies that have similar results are Hsing (2013); Oshikoya (2014), Agu (2011) and Bello and Sanusi (undated). In tandem with the theoretical exposition of Nakaso (2015), the

results obtained showed that with fixed exchange rate regime, the financial trilemma serves as a limiting constraint to the (classical) macroeconomic trilemma. The same cannot be said of the case of managed-float regime. Political risk factor largely affects the behaviour of the Central Bank of Nigeria to the tune of 78.6 percent. Reduced political factor largely enhanced exchange rate regime when the CBN shifts between regimes.

These findings on the impacts of political risk conform to the study of Beckman et. al., (2017). The robustness checks found evidence for the Fisher's effect as obtained in the study of Agu (2011) but contradicted the findings that the interest rate weakly reacted to inflation and output gap as obtained in the study of Siri (2009). This is unlike the findings in the study of Hutchison, Sengupta and Singh (2013) where the authors investigated whether Hawk (price stability) or Dove (output expansion) well characterized the behaviour of monetary policy in China. On the whole, the stability of the exchange rate was found crucial for Nigeria as sound macroeconomic management, stable financial sector and low political factors are factors that are capable of moderating the behaviour of the CBN when confronted with the double trilemma.

CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary of Study

The study investigates the behaviour of central bank of Nigeria in the face of the double trilemma. The double trilemma comprises both the macroeconomic trilemma and financial trilemma (Nakaso, 2015). The former has three components of exchange rate stability, monetary independence and financial openness while the latter has national financial policy, financial stability and financial openness. Financial trilemma is a theoretical subset of the macroeconomic trilemma because both trilemma hypotheses are anchored on the Mundell-Fleming framework enunciated by Mundell (1963) and Fleming (1962). However, the empirical literature suggests that financial trilemma is an extension of the macroeconomic trilemma. This is because the monetary authority that is faced with financial trilemma will have to accommodate the mandate of financial stability alongside the dual mandate of price stability and employment generation in order to ensure overall economic stability.

In order to carry out this investigation, four (4) research sub-objectives were to be achieved. The first is to test the validity of macroeconomic trilemma for the Nigerian economy. The second is to trace the shock transmission of macroeconomic trilemma on the central bank of Nigeria; in terms of the shock effects of financial trilemma. The third is to analyse how the regime-switching behaviour of the central bank in managing the macroeconomic trilemma is constrained by shocks occasioned by financial trilemma while the fourth and last is to investigate the role of institution in altering the behaviour of central bank in the face of the double trilemma. The research design adopted is a tripartite approach. It includes pre-estimation tests, the estimations and analyses of empirical model and the post-estimation

tests – which are mainly the diagnostic tests and robustness checks. The pre-estimations tests have provided some viable information and the avenue to justify the use of the technique of analysis were created. Prior to the empirical estimations, a chapter – Chapter 2, is completely devoted to building incontrovertible premise upon which the investigations for central bank behaviour and double trilemma becomes highly justified and imperative. The stylized facts obtained from this Chapter were strongly indicative. First, it was evident that indirect monetary policies stabilized the interest rate than the direct options of selective interest rate controls, regulation, deregulation and re-regulation of interest rates. Second, the trends show that there are many episodes of exchange rate regimes which can generally be categorized into managed-float, free-float and fixed exchange rate regimes. Third, there was relative financial stability in Nigeria which was later affected; between 2009 and 2011, by the occurrence of the global financial cum economic crisis in 2007 – 2009. This could also suggest that the Nigerian financial sector was less integrated to the global financial hub prior to this time. Fourth, there was evidence for the existence of macroeconomic trilemma in Nigeria and that the financial trilemma portends a limiting case.

Fifth, the monetary authority in Nigeria has enjoyed some degree of autonomy and it has been discretional in its monetary policy strategies. This was more evident as the monetary authority conveniently allows the money supply to be endogenously determined; as the economy required. Sixth, the interest rate should serve as the main policy variable for the monetary authority if the assumption of perfect capital mobility is assumed but with the imperfect capital mobility assumption that characterized developing economies such as Nigeria, the optimization process for the Mundell-Fleming framework suggests that the exchange rate is the policy variable of the monetary authority. As a result, the measuring variable to determine the behaviour of the central bank would be the regime switching behaviour it exhibited to exchange rate. Sixth, there were two episodes of very high and high political risks in Nigeria between 1981Q1 – 2015Q2. There was evidence of high financial instability around this period; precisely between 1992Q2 – 1994Q4. Also, the growth of broad money supply was highest between 2007Q3 – 2008Q3.

In terms of modeling the central bank behavour, the basic Mundell-Fleming (M-F) model, as extended, serves as the theoretical framework for this study. This extension was simply by adjusting the perfect capital mobility assumption of the basic M-F model. When capital is considered imperfectly mobile, then, the interest rate parity proposition was relaxed, and the uncovered interest rate parity condition was assumed with risk premium. After series of substitutions, the basic M-F model was modified to suit the peculiarity of developing economies such as Nigeria. Stemming from this, the exchange rate becomes the policy variable of the central bank of Nigeria as this determines its characteristic behaviour in the face of the double trilemma. As a theoretical addition, the M-F model is further modified with the inclusion of political risk factors to capture the role of institution as an important variable determining the beahviour of central bank in a developing economy such as Nigeria.

Methodologically, too, this study employed the use of Markov Switching Dynamic Regression (MSDR) model in order to investigate the regime switching behaviour of the central bank of Nigeria; on the attendant impacts of the double trilemma. This technique, which is stochastic, is found most suitable as it differs from others which are considered deterministic in nature. More so, this technique addresses the various data generating issues related to the dynamics of the exchange rate and various monetary policy strategies. The breaks, jumps, and structural dynamics of these variables can be better captured with this model without necessarily controlling for their effects. Also, the study adopts a modified Taylor's rule to serve as robustness checks. The basic Taylor's rule considers the behaviour of the interest rate subject to the effects of output gap and inflationary pressures in the domestic economy. While the Taylor's rule is a rule-based model, it is still found suitable to examine the discretional behaviour that the central bank is expected to exhibit as it is anchored on a regime-switching technique. This regime switching technique allows for systematic rule-based approach to the central bank behaviour. For the validity of estimates obtained, a battery of diagnostic tests was also conducted. These include the heteroscedasticity, autocorrelation and specification tests.

The estimations of the specified models produce some additional facts. The study showed that exchange rate stability and financial openness can be combined as the binary policy for the triad policies of macroeconomic trilemma in Nigeria while monetary independence was traded-off. With this, it implies that money supply becomes an endogenous monetary policy in Nigeria as it would be used as the variable of adjustment to stabilize the exchange rate in the economy. The unit-root with structural breaks test confirms the presence of breaks and jumps for the data generating processes of the variables included in the model. This lends credence to the use of the Markov Switching Dynamic Regression model.

5.2 Conclusion

The study showed that the trilemma constraints hold for the Nigerian economy as the trilemma hypothesis was validated. The appropriate binary choice variables for the trilemma constraint are the combination of both exchange rate stability and financial openness. This implies that the monetary authority in Nigeria cannot crave for autonomy in the face of macroeconomic trilemma. The implication from this is that to stabilize exchange rate in Nigeria, the monetary authority has to continually intervene through the use of money supply. The estimates of the Structural Vector Autoregression (SVAR) suggest that most of these variables were largely affected by shocks from within. In terms of shock effects within the macroeconomic trilemma constraint, exchange rates movement and growth of money supply were largely affected by shocks from within. For shock effects of the double trilemma constraint, however, the political environments, the price level of the economy and the foreign interest rates mainly have self-shocks as spill-over shocks were altogether negligible. The small country assumption for the Nigerian economy was validated and the endogenous nature of the broad money supply in Nigeria was established.

The estimated Markov Switching Dynamic Regression (MSDR) showed that it was easier to transit from a fixed regime to managed-float regime but not vice versa. With macroeconomic trilemma; irrespective of whether fixed or managed-float exchange rate regime, lower political risk engenders exchange rate appreciation in Nigeria. More so, the growth of money supply and the growth of real GDP are the two significant determinants of central bank behaviour when the economy is faced with macroeconomic trilemma. The

implication is that when political risk is considered, macroeconomic trilemma is insensitive to the types of exchange rate regimes. This indicates that the political risk faced by the economy is less important in determining the behaviour of the monetary authority in the face of macroeconomic trilemma than even the binary choices of the triad policies made. However, foreign interest rate and net export were sensitive to the type of exchange rate regime. It leads to exchange rate appreciation, and significantly so, under a managed-float regime but results in exchange rate depreciation given a fixed exchange rate regime.

In tandem with the double trilemma, it was found that financial trilemma serves as the limiting constraint to macroeconomic trilemma only when exchange rate stability is one of the binary choice variables. This is the case for the Nigerian economy given the results obtained from the trilemma constraint. More so, further evidence was obtained from the robustness checks of the Taylor's rule that political risk matters for the beaviour of Central Bank of Nigeria (CBN). The result obtained showed that political risk distorts the significance in the level of interest rate and that the historical level of the interest rate does not matter. In fact, it was found that high political risk significantly triggers high interest rate in the country. This evidence supports the political economy thesis of financial liberalization enunciated by Edward (1984). In fact, the Fisher's effect was supported for the Nigerian economy only when the effects of political risks were considered.

5.3 Policy Recommendations

Consequent upon the conclusions drawn from the study on the behaviour of central bank in the face of the double trilemma, the following policy recommendations are provided;

(i) The study found that the autonomy of the Central Bank of Nigeria (CBN) was traded-off in order to stabilize exchange rate and obtain inflows of financial resources, hence, this study, therefore, recommended that the political risk confronting the CBN has to be drastically reduced or eliminated. This can be achieved with little or no interference from political officeholders as this will affordthe CBNthe opportunity to function optimally within the trilemma constraint.

(ii) The results obtained also suggested that the financial trilemma served as a limiting constraint to macroeconomic trilemma in Nigeria under a fixed exchange rate regime. As such, the monetary authority should ensure that growth of credit to the private sector should not be excessive beyond the absorptive capacity of the economy in order not to complicate the trilemma constraint to double.An alternative policy recommendation would have been that floating exchange rate should be practice in Nigeria to circumvent the constraints imposed by double trilemma. However, this would come at the expense of significant capital outflows and the ultimate goal of achieving a robust economy would become elusive for a developing oil-producing economy such as Nigeria.

(iii) The results showed that the foreign interest rate is one of the significant variables moderating the behaviour of the Central Bank of Nigeria within the double trilemma constraint. As a result, inflationary pressures in the country should be reduced significantly. It is through this that the domestic interest rate would become competitive,as compared with the foreign interest rate, for the mobilization of global financial resources.

(iv) Within the double trilemma constraint, the national output and net export were found significant to the behaviour of the Central Bank of Nigeria (CBN). Therefore, the real sectors of the Nigerian economy should be stimulated in order to achieve a robust economy. The full implementation of the ongoing financial bill will be supportive in this regard.

5.4 Limitations to the Study and Suggestions for Further Study

While much efforts have been made in this study to address the behaviour of the Central Bank of Nigeria in the face of the double trilemma and constraining political factors, this study does not claim to have addressed all aspects of central bank behaviour for the following reasons. First, cross-border capital flow is an essential integral of financial openness and financial integration. Future study should focus on the need to consider this aspect of financial openness as it tends to better capture the real cross-border transactions between a country and other countries of the world. Rather than the aggregate measure of

financial flow, cross-border banking flows will account for a disaggregated as well as firm-level measure. With this, more details will be obtained regarding the behaviour of central bank in the face of double trilemma. Secondly, while the use of Markov Switching models as employed in this study is well fitted, future study should also consider optimization and general equilibrium models in order to investigate the inter-temporal and microeconomic foundations of central bank behaviour through the optimization of various economic agents within the economy. This general equilibrium approach is fast becoming the workhorse of contemporary investigation of monetary policy studies.

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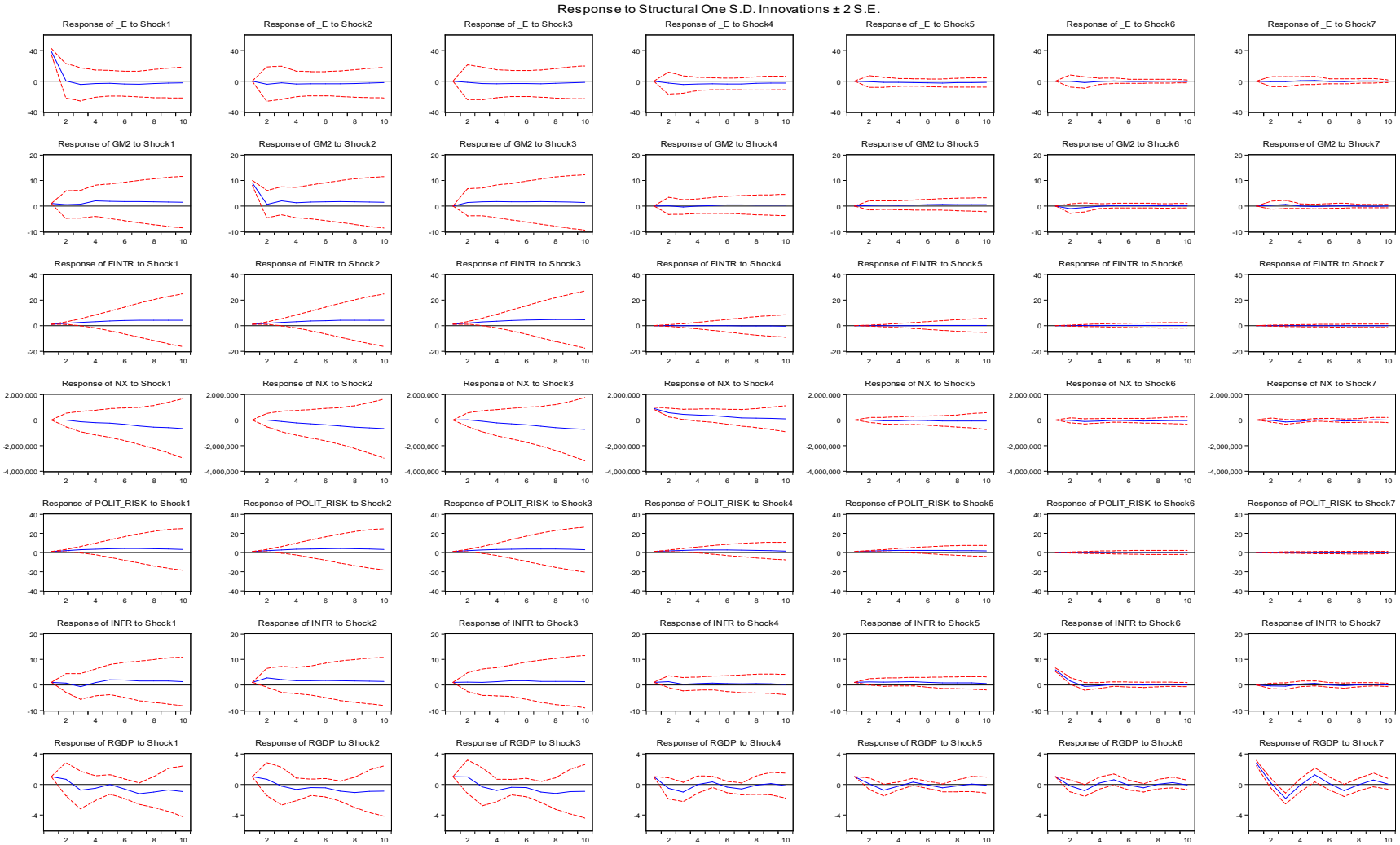
APPENDIX SECTION

Appendix 1: Macroeconomic Trilemma and Financial Trilemma with Binary Policy Choices

Panel 1a: Macroeconomic Trilemma			
Triad Policies	**Policy Choice I**	**Policy Choice II**	**Policy Choice III**
Monetary Independence	Yes	Yes	No
Financial Integration	Yes	No	Yes
Exchange Rate Stability	No	Yes	Yes
Source: Author with insights from Mundell (1963) and Fleming (1962)			
Panel 1b: Financial Trilemma			
Triad Policies	**Policy Choice I**	**Policy Choice II**	**Policy Choice III**
National Financial Policy	Yes	Yes	No
Financial Integration	Yes	No	Yes
Financial Stability	No	Yes	Yes
Source: Ito (2014)			

Appendix 2: Structural Impulse Response Functions of Macroeconomic Trilemma and Central Bank Behaviour in Nigeria (1981Q1 – 2015Q4)



Source: E-Views Output

Figure 5.4: Structural Impulse Response Functions of Double Trilemma and Central Bank Behaviour in Nigeria (1981Q1 – 2015Q4)