CURRENCY SUBSTITUTION AND THE DEMAND FOR MONEY IN NIGERIA: 1980 - 2014

BY

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DECLARATION

I hereby declare that the work in this thesis entitled, *"Currency Substitution and the Demand for Money in Nigeria; 1980-2014"* has been carried out by me in the Department of Economics under the supervision of Dr. Aliyu Rafindadi Sanusi and Dr. Mohammed Isa Shuaibu. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at this or any other institution.

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CERTIFICATION

This thesis entitled "CURRENCY SUBSTITUTION AND THE DEMAND FOR MONEY IN NIGERIA:1980-2014" by Maryam Bala ADAMU meets the regulations governing the award of the degree of MSc Economics of the Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

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ABSTRACT

The persistent increase in demand for foreign currency, especially in recent years, exerts pressure on Nigeria's foreign exchange market. This trend is often accentuated by economic agents' perceived loss of purchasing power and confidence in the domestic currency. Therefore, resort to holding currencies that have a relatively stable value such as the United States dollar (USD) which in turn increases the extent of currency substitution in the economy. This study investigates the existence and extent of currency substitution and how it invariably affects the demand for money in Nigeria using time series data for the 1980-2014 period. A significant contribution of this study is the consideration of the impact of crude oil price as well as the extent to which election periods contribute to currency substitution phenomenon in Nigeria. The study estimated six models that were predicated on Cuddington's currency substitution framework. The Johansen cointegration test was employed in order to ascertain the existence of a long run relationship among the variables, and an error correction model was used to ascertain the short run adjustment dynamics. In addition to the finding that currency substitution had increased over time, albeit slowly; empirical results reveal that the expected rate of depreciation, inflation rate, election period, and crude oil price as well as foreign rate of interest determine the extent of currency substitution in Nigeria. Therefore, this study recommends that measures should be taken that will encourage and to bring back the confidence of economic agents in the domestic currency by the monetary authorities. Also, the financial system should be further deepened with liquidity to minimize vulnerability and exposure to sudden disturbances that could affect the financial system especially during election period and oil shocks.

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ABBREVIATIONS

ADF: Augmented Dickey Fuller

AFEM: Autonomous Foreign Exchange Market

ARDL: Autoregressive Distributed Lag Model

BDC: Bureau De Change

CBN: Central Bank of Nigeria

CIC: Currency in Circulation

CSI: Currency Substitution Index

CUSUM: Cumulative sum of recursive residuals

CUSUMSQ: Cumulative Sum of Squares of recursive residuals

CV: Cointegrating Vectors

DAS: DutchAuction System

DCC: Decimal Currency Committee

DD: Demand Deposits

DR: Dollarization Ratio

EAC: East Africa Community

ECM: Error Correction Mechanism

ECT: Error Correction Term

E-GARCH: Exponential Generalized Autoregressive Conditional Heteroscedasticity

FCC: Foreign Currency in Circulation

FCD: Foreign Currency Deposits

FGLS: Feasible Generalized Least Squares

FOREX: Foreign Exchange

GLS: Generalized Least Squares

GMM: Generalized Method of Moments

IFEM: Inter-bank Foreign Exchange Market

M1: Narrow Money Supply

M2: Broad Money Supply

M3: Quasi Money

MPT: Modern Portfolio Theory

OPEC: Organization of Petroleum Exporting Countries

OSD: Off Shore Deposits

POLS: Pool Ordinary Least Squares

PP: Phillips Perron

RDAS: Retail Dutch Auction System

SAP: Structural Adjustment Programme

TSD: Time and Savings Deposits

UAE: United Arab Emirates

USD: United States Dollar

VECM: VectorError Correction Model

WACB: West African Currency Board

CHAPTER ONE

INTRODUCTION

1.1 Overview

Currency substitution is often used interchangeably with dollarization. An economy is said to be dollarized when a foreign currency or foreign currencies serve as the local currency unit in all three functions of money (medium of exchange, store of value and unit of account) in an economy. Dollarization refers to the use of foreign currency as a store of value and unit of account. It refers more to the store of value role of money while currency substitution more narrowly relates to substitution between currencies as means of payment (Heimonen, 2008). Calvo and Vegh (1992) defined currency substitution as a shift away from domestic to foreign currencies and is often viewed as a safety precaution during periods of high and volatile inflation, while dollarization is viewed as one form of currency substitution where the store of value, medium of exchange and unit of account properties of the domestic money are transferred to foreign currencies.

The collapse of the Bretton Woods fixed exchange system and advent of generalized floating of currencies in the early 1970s gave rise to currency substitution. After the Second World War, the Bretton Woods system (also known as the gold exchange standard) was set up. Under this system, member countries defined their currencies relative to gold. Nevertheless, only the US dollar was relied upon for conversion to gold because of its dominant role as the international medium of exchange and store of value at the time. The collapse of the system in the early 1970s was followed by the adoption of floating exchange rate regime. Since then, the international monetary system has been based on fiat money rather than commodity standard. At the same time, international trade was increasing in the global economy and many changes in the financial world were occurring. For example, financial deregulations and new financial instruments which together with the floating system allowed for a reduction in portfolio risk and encouraged diversification (Arce-Catacora, 1997). This phenomenon also included location diversification, because capital movements from one country to another were observed and economic agents started to rely on

different currencies to settle business transactions. Therefore, one may conclude that financial globalization may have contributed to the portfolio diversification and currency substitution phenomena.

Currency substitution is a prevalent phenomenon and a major feature of some developing countries, especially the emerging market economies in Latin America, Asia and African countries. Some of these countries are, in fact, fully dollarized while many others are partially dollarized. Some of the fully dollarized countries in Latin America include Ecuador, El Salvador, Panama and the Marshall Islands in which the United States (US) dollar is officially used as legal tender. Partially dollarized economies include Angola, Malawi, Nigeria, Bolivia, Uruguay, Peru, Cambodia and Turkey among others. The pattern of currency substitution in Latin American countries is related to their macroeconomic policies and institutional framework. Furthermore, they are characterized by the absence of restrictions on maintaining foreign currency deposits in their domestic financial system. Notably, weak financial markets and unstable macroeconomic environment in these countries (especially their previous inflationary history) can be attributed to the factors determining the presence of currency substitution (Selcuk, 2003; Calvo and Vegh, 1992).

In Asian countries for example, currency substitution and high dollarization accelerated due to exchange rate fluctuations. The experience of the Asian crisis led to the shift from pegged to floating exchange rate system. Loss of confidence in the domestic currency led to an unstable exchange rate and consequently, agents substitute dollars for domestic currency, thereby depleting foreign reserves and increasing devaluation pressure (Sharma, Kandil and Chiasrisawatsuk, 2005). The implementation of Structural Adjustment Programmes (SAPs) and subsequent liberalization of foreign exchange markets, led to the removal of many foreign exchange restrictions. This has resulted in a number of emerging market economies to move from fixed to flexible exchange rates. In most African countries, the late 1980s and the early 1990s were characterized by massive

depreciation of their currencies as they sought to reduce and /or eliminate the influence of parallel market for foreign exchange that had existed in these countries over the years (Agenor, 2004).

In Nigeria, exchange rate arrangements have transited from a fixed regime in the 1960s to a pegged regime between the 1970s and the mid-1980s and to the floating regime from 1986 with the deregulation and adoption of SAP. This was the period when there was no restriction on holding of foreign currency by residents or non-residents in the country. Foreign currency (especially the US dollar) was used as medium of exchange, store of value as well as for unit of account in the economy (Gabriel 2012; Falana 2015). Foreign currency deposits in the Nigerian banking system as at 1986 was ₦0.6 billion, ₦2.3 billion in 1990 and was ₦9.04 billion in 1994. It fell to ₦6.1 billion in 1995 and rose to ₦7.7 billion in 1999. It maintained its upward trend as at 2003 with ₦122.6 billion, and more than quadrupled to ₦1, 444.3 billion, ₦3, 402.2 billion, ₦3961.8 billion in 2009, 2013 and 2014, respectively (Central Bank of Nigeria Statistical Bulletin). Thus, currency substitution generally takes place in the context of worsening economic and financial conditions that unfavorably affect the return on holding of local currency as compared to foreign currency. As such, individuals attempt to protect the value of their income and wealth from being eroded by inflation and/or exchange rate volatility (Meyer, 2000).

Although, some studies have shown that dollarization in Latin America have helped some countries reduce their hitherto out-of-control inflation and increased output growth, currency substitution can have several adverse spillover effects. These spillover effects include weakening the autonomy of monetary policy, increasing vulnerability to economic shocks arising from the host country, the potential for significant deterioration of the balance of payment account and/or exchange rate volatility (Boamah, Guy, Grosvenor and Lescott, 2012).

1.2 Statement of the Problem

The demand for money is one of the critical variables that affect the level of aggregate economic activity in the economy. With the persistent inflation and depreciation of the naira occasioned by exchange rate instability and monetary policy inconsistency, currency substitution has been a dominant, yet silent, feature of the Nigerian economy with far reaching macroeconomic implications (Effiom and Samuel, 2010). The fundamental problem is that domestic agents perceive loss of purchasing power from holding the home currency as a result of inflation risk, exchange rate risk or political instability. The use of foreign currency has become so prevalent that a large proportion of domestic trade and contracts are transacted in foreign currencies. People move freely around with dollars, rents are fixed and paid in dollars in the high-brow areas of Lagos, Abuja, Port Harcourt and other cities. While some educational institutions charge tuition fees in dollars just as contracts are also being awarded to foreign contractors and companies in dollars (Chidiebere, 2013).

The Central Bank of Nigeria (CBN) notes that the use of the US dollar as means of payment or legal tender in the local market is seriously affecting the value of naira as most Nigerians are fast losing confidence in the local currency as a store of value. Sanusi (2013), noted that the dollarization of the Nigerian economy was of serious concern to the CBN, the Economic Management Team, the President and the policy makers and that the CBN would come up with a policy to stop the practice.. For instance, in a bid to tackle the issue of dollarization in the country, the House of Representatives in 2013 passed a resolution urging the CBN to put an end to the dollarization of the economy.

Nigeria is a monocultural economy. The country depends heavily on crude oil of which the transactions are carried out in foreign currency, mainly in US dollars. Nigeria is a member of Organization of Petroleum Exporting Countries (OPEC), as such any decision taken on the international arena concerning crude oil prices could affect the country and potentially its

monetary stability. The relevance of the currency substitution problem in Nigeria does not appear to be related to the choice of fixed versus floating exchange rate regime, but more to the potential problems of short-run monetary instability that currency substitution can create (Doguwa, 2014). If the demand for domestic currency is strongly influenced by foreign factors (for instance, foreign interest rate, crude oil pricesetc.), a substantial degree of instability may be imported from abroad, even if the monetary authorities follow consistent monetary and exchange rate policies. In November 2014, for instance, the CBN devalued the national currency (naira) by fixing the exchange rate at ₦168 to a dollar due to the falling price of crude oil in the international market. Falana (2015) noted that the CBN governor, Mr. Godwin Emefiele explained the basis of the devaluation, stating that "falling oil prices have consistently reduced the accretion to external reserves, thus constraining the ability of the bank to continually defend the naira and sustain the stability of the naira exchange rate".

Furthermore, the unrestricted and over-bearing demand of the dollar by Nigerian politicians and business class is exerting a lot of pressure on the naira which is having an adverse effect on the strength of the naira and its purchasing power (Falana, 2015). The pressure on the dollar has been increasing especially due to unprecedented demand from politicians during election periods in the country, particularly the March and April, 2015 Presidential and gubernatorial elections. The demand for dollars had significantly increased in the periods running up to party congresses and primaries, reportedly because of the convenience it offers for moving large sums of money to facilitate transactions during the electioneering campaigns.

One implication of these events is the potential increase in the currency substitution index (CSI) or the dollarization ratio (DR) in Nigeria. Based on the data obtained from CBN Statistical Bulletin, the trend of currency substitution in Nigeria started at a slower pace and is moving gradually at an increasing rate. In 1986, for instance, CSI was 2.85%, but increased to 4.5% and 5.29% in 1990 and 1994, respectively. It fell to 2.98% in 1995 and peaked up in 1996 to 3.3% and has continued

to fall to 1.57 in 1999. The low dollarization experienced in 1999 can be attributed to the period of general election which brought about the transition of military rule to democratic rule in the country. In 2002, it rose to 9.6% and this may be explained by the reintroduction of the Dutch Auction System (DAS). The ratio continued to increase as follows: 10.04% in 2004, 19.69% in 2013 and 24.49% in 2014.

Therefore, this study sets out to examine the existence, determinants and extent of currency substitution and the demand for money in Nigeria, and how it invariably affects the demand for domestic currency.

1.3 Research Questions

The foregoing discussion has prompted the following questions that this study seeks to answer:

i) What is the trend and extent of currency substitution and the demand formoney in Nigeria?

ii) What is the impact of crude oil price on currency substitution and the demand for money in Nigeria?

iii) To what extent do political cycles (election period) contribute to currency substitution and the demand for money in Nigeria?

1.4 Objectives of the Study

The broad objective of the study is to ascertain the existence and determinants of currency substitution within the context of money demand in Nigeria. Specifically, the study seeks to;

i) examine the trend and extent of currency substitution and the demand for money;

ii) analyze the impact of crude oil price on currency substitution and the demand for money; and

iii) assess the extent to which political cycles contribute to currency substitution and the demand for money in Nigeria.

1.5 Justification for the Study

A primary objective of central banks is the attainment of exchange rate stability. Over the years, efforts have been made to achieve this objective through the use of various policy prescriptions in country. The Nigerian economy is not immune to currency substitution, as it is a prevalent phenomenon in the country. The Nigerian economy has witnessed tremendous changes, especially since the return of the country to democratic rule. Some of the changes relates to policies put in place in order to put an end to the growing dollarization in the country which affect the monetary stability of the economy. Policies have been made in several ways to address the issue of which it was not successful. Thus, there is need to reevaluate the currency substitution phenomenon in the light of current economic realities. The growing rate of currency substitution in Nigeria with its significant effect on domestic money demand motivated this research.

Studies carried out in Nigeria on currency substitution include those of (Yinusa and Akinlo 2008; Effiom and Samuel 2010; Doguwa 2014; Aigheyisi 2015). The first two studies relied on Cuddington's Portfolio balance model while the other study used variants of the money demand function. However, none of the studies accounted for oil price in their models which is an important factor in influencing and enhancing dollarization of the economy. This study will not only account for oil price but election periods in its model by using the Cuddington's portfolio balance model.

Furthermore, contribution of the present study comes from the use of co-integration approach as it helps in determining the presence of co-integration among the variables while accounting for possible exogenous structural breaks which previous studies have ignored. Notably, other researches have relied on co-integration tests, Error Correction Model (ECM), Autoregressive Distributive Lag (ARDL) models or combination of these to estimate currency substitution models. Based on the modifications to the theoretical and methodological issues, it is expected that this study has provided new empirical evidence on the dynamics of currency substitution in Nigeria.

In addition, it is expected that this research has provided requisite inputs for the formulation and implementation of policies. Reliable estimates of a currency substitution model in Nigeria are important to the monetary authorities in formulating appropriate and well-coordinated monetary policies via the monetary transmission mechanism.

1.6 Scope/Limitation of the Study

The study focused on currency substitution and the demand for money in Nigeria using two samples of annual data for the period between 1980 to 2014 and 1986 to 2014. The choice of this period coincides with the adoption of flexible exchange rate system and also captures the major crude oil price shocks as well as election years. The limitation of this study comes from the results obtained from the currency substitution index, which must be taken with caution because the index represents the lower bound of currency substitution in Nigeria. As sizable amounts of foreign currency are held in form of cash and cross border deposits, which cannot be captured in this study for lack of data.

1.7 Organization of the Study

The study has been organized in five chapters. Chapter one is the introduction, problem statement, and the study objectives. While the second Chapter contains review of related literature based on the concept, theories and empirical results. Chapter three presents the methodology and theoretical framework on which the model is specified. Chapter four consists of trend analysis and the presentation and discussion of results. While Chapter five comprises the summary, conclusion and recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Several studies have been carried out with a view to ascertaining the determinants of currency substitution in both developed and developing countries. Currency substitution is a prevalent phenomenon especially in Latin American countries that are well known for their dollarized economies. The phenomenon is equally common in several emerging market economies, transition economies, Asian countries and African countries (including Nigeria) due to experience with the increasing use of foreign currencies along with national currencies. This chapterexplores conceptual issues, theoretical issues,research methodologies used and review of empirical studies/literature.

2.2 Conceptual issues

There is no consensus in economic literature on the definitions of currency substitution. The term dollarization is often used interchangeably with currency substitution. Even though widely used as synonyms, different authors use the terms in different ways. Dollarization is not a mere reference to the United States Dollar (USD), but rather, it is a generic term used to characterize the use of any foreign currency that effectively serves as replacement for a national currency (Kessy, 2011). Calvo and Vegh (1992) defined dollarization as the use of foreign currency to fulfill the store of value and unit of account functions of money in an economy.

Currency substitution may be viewed as the substitution between currencies as a medium of exchange and means of payment. The substitute currency is typically the currency of a major trading partner or an important industrial power with a reputation of sound monetary policy. The foreign currency may serve as a means of transaction, unit of account and store of value to the domestic economy. Adam (2013) defines dollarization as the extensive use of foreign currency in a country, either in place of the local currency or alongside it.

Therefore, the concept of dollarization/currency substitution used in this study refers to the use of foreign currency either in place of the domestic currency or simultaneously to fulfill the three functions of money: as a medium of exchange, unit of account and store of value in an economy. Although, the concept of dollarization was coined with reference to the USD, the conversion to any stable foreign currency such as the European euro, Japanese yen, German Deutch mark, may be referred to as dollarization.[1]

Meyer (2000) distinguishes three types of dollarization/currency substitution and they are:

Official dollarization or full currency substitution

This is a situation whereby a country adopts a foreign currency as its sole legal tender, and negates to issue the domestic currency or it abandons its domestic currency for a foreign currency. Official dollarization is also referred to as *de jure* (by law) currency substitution. It implies a complete replacement of the domestic currency by a foreign currency. Whereby, the chosen foreign currency becomes a legal tender. The dollarized country adopts the central bank's monetary policy of the dollarizing country.[2]

Semi-official or officially bi-monetary systems

This is a scenario where both domestic and foreign currencies are freely used in the domestic economy. Both the foreign currency and domestic currency are legal tender and therefore used simultaneously. The country retains a domestic central bank or other monetary authority and has the right to conduct their own monetary policy. Semi officially dollarized countries are those that are identified as having foreign currency as additional legal tender. This means that foreign currency circulates widely but plays a secondary role relative to the domestic currency (Balino, Bennett and Borensztein 1999 pg. 2-3). Countries that opt for semi-official dollarization are either

[1]For example, the European Union adopted the euro as a legal tender while San Marino and Vatican City adopted the Italian lira, etc.

[2]This type of dollarization is prevalent in small open economies like in Latin America, the Caribbean and the pacific that are heavily dependent on the United States. Examples of officially dollarized countries are East Timor, Panama, Ecuador, El Salvador, etc.

small countries that rely on large neighboring economies for a significant share of their income and trade.[3]

Unofficial dollarization or partial currency substitution

This is the most popular type of dollarization. It is a scenario in which residents of a country choose to hold a significant share of their financial assets denominated in foreign currency, but the foreign currency is not a legal tender. Foreign currency is widely used in private transactions, but the local currency remains the only legal tender. Foreign currencies are held perhaps due to the relative weakness of the local currency. The practice might be widely accepted in that country, but is not classified as legal tender by the country's government.

Unofficial dollarization is also referred to as *de facto* currency substitution (which means in practice but not necessarily ordained by law). The country retains a domestic central bank or other monetary authority and has the right to conduct its own monetary policy. Unofficial dollarization can include holding any of the following; foreign bonds and other non-monetary assets generally held abroad, foreign currency deposits abroad, foreign currency deposits in the domestic banking system or foreign notes (paper money) in wallets and mattresses, which is foreign currency in the hands of public.[4]

De Nicolo, Honohan and Ize (2005) identified three types of unofficial dollarization within the context of the functions of money and they are; (i) transaction dollarization (also known as currency substitution) which is the use of foreign currency for transaction purposes or as a means of payment,(ii) Financial dollarization (also referred to as asset substitution) which consist of residents holdings of financial assets or liabilities in foreign currency; and (iii) real dollarization; which is the setting of local or domestic prices and /or wages in foreign currency.

[3]For example, Swaziland and Lesotho where South African rand is officially accepted as legal tender or countries that suffer from macroeconomic mismanagement leading to hyperinflation rate such as Zimbabwe. Other examples include Bahamas, Cambodia, Haiti and Liberia.

[4]Examples of unofficially dollarized countries are; Argentina, Bolivia, Mexico, Peru, central America, Maldives, United Arab Emirates (UAE), Saudi Arabia, South Africa, Tanzania, Russia, Hong Kong, Turkey, etc.

Dollarization often reflects a history of macroeconomic instability. The decision to dollarize is made, in part, because a country is undergoing macroeconomic turbulence such as high inflation and devaluation of its currency. Economic agents tend to lose confidence in the domestic currency and would prefer their money holdings to be denominated in foreign currency whose value is relatively more stable. By deciding to use foreign tender, they are protecting against possible devaluation of the local exchange rate (domestic currency). The literature suggest that the main driver of currency substitution in many countries is the attempt by residents to protect the value of their wealth and income from been eroded by inflation and exchange rate depreciation (Levy-Yeyati 2006 and Yinusa 2008). Macroeconomic instability especially high episodes of inflation have left some countries with no option but to dollarize their economy. Examples are Ecuador, Panama and Zimbabwe which due to the hyperinflation experienced in the country made them to embrace full dollarization.

Meyer (2000) identified some reasons of currency substitution as; i) after repeated episodes of high inflation and currency devaluation/depreciation, residents of a country no longer view local currency as a reliable store of value. They want to hold dollars and dollar denominated assets instead. ii) Similarly, people become unwilling to denominate medium or long term loans in local currency because they have no confidence that they can estimate its future purchasing power, so financial transactions are denominated in dollars (and long-term lending often disappears in any case). iii) When inflation is high and volatile and reliable measures of inflation are not available promptly, it is easier to write contracts of all kinds in dollars than it is to write inflation indexed contracts in local currency. iv) When inflation is high, it is easier to quote prices in dollars than to quote prices in local currency and change them frequently.

The benefits of dollarization flow from using a currency that is presumably better than a domestic central bank could provide. Some of the benefits associated with dollarization as stated by Schuler (2000), are as follows:

First, dollarized countries benefit from lower transaction costs. This is the least cost of exchanging one currency for another. These costs take the form of a difference between the buying and selling rates for converting domestic currency into foreign currency. Dollarization reduces this transaction cost with other currencies. Second, lower inflation now and lower risk of future inflation. By using a foreign currency, an officially dollarized country assures itself of a rate of inflation close to that of the issuing country. Using the foreign currency would reduce inflation to single digits from the double digits levels in the country. Third, with dollarization there could be a substantial reduction of interest rates for local borrowers at a relatively stable rate. The reduction of interest rates will result in substantially higher levels of domestic investment and future economic growth.

Fourth, dollarization can also establish a basis for a sound financial sector. Instead of investing heavily in efforts to build confidence in its own monetary policy, a government can achieve credibility by adopting the issuing country's policy. Dollarization means more than merely the adoption of a foreign currency. It also means financial integration with the issuing country, which will assist domestic financial institutions to improve their efficiency and the quality of their services. Another benefit comes from greater economic openness and transparency, especially on the part of the government. Dollarization eliminates balance of payments crises and the rationale for exchange controls (restrictions on buying foreign currency) like in many developing countries. By eliminating the government's power to create inflation, dollarization fosters budgetary discipline. This implies that the government budget must not be balanced every year, but it means that deficits are financed through the fairly transparent methods of higher taxes or more debt rather than through printing more money.

Some of the potential costs associated with dollarization include; Currency mismatch- and this can be defined as the sensitivity of net worth of or the present value of net income to changes in the exchange rate (Goldstein and Turner, 2004). Financial systems of highly dollarized economies are prone to exchange rate fluctuation risks. The extent to which commercial banks are exposed to

exchange rate risks is limited by the restrictions on the net open position for foreign currency assets and liabilities. However, the indirect effects of portfolio deterioration may arise through unhedged bank borrowers. Large depreciation of local currency will have a negative effect on the financial position of firms producing for the local market with loans in foreign currency. Foreign currency debtors whose receipts are in local currency may fail service their loans, increasing the possibility of default and potentially weaken the financial position of banks. In the absence of hedging instruments, the currency mismatch problems could potentially be eliminated by encouraging banks to extend foreign loans to firms whose stream of income is denominated in foreign currency.

Loss of seigniorage:[5] The dollarized country loses the ability to print money, which is a huge fiscal disadvantage. Since the country abandons its currency and adopt foreign currency as legal tender, the country can no longer print units of domestic currency at a minimum cost and use it to finance public spending. The substitution of domestic currency in transaction limits the revenue that the government receives from printing domestic currency. In officially dollarized countries, all seigniorage revenue accrues to the issuer of the currency. Under unofficial dollarized countries, all seigniorage accrue to the domestic authority. In semiofficial dollarized countries, arrangements allow monetary authorities to earn seigniorage.

Loss of lender of last resort facility of the central bank: Another cost associated with dollarization is the restriction it imposes on central bank as a lender of last resort to the domestic banking system. Domestic banks may be exposed to potential liquidity risks, and as a lender of last resort, central banks provide emergency funds from reserves to banks in distress. In a financial system where large amounts of foreign currency are held, central banks may not be able to accommodate bailout request by the domestic banking sector where deposits are in foreign currency, because official foreign exchange may serve as the buffer tomitigatesuchscenarios.

[5]Seigniorage is the revenue earned from issuing currency.

Dampens the effectiveness of monetary policy: Dollarization tends to make monetary policy more complicated and less effective. Policy makers have to resolve issues relating to the choice of intermediate targets of monetary policy, particularly in the case of reserve money targeting framework. The key issue is whether central banks should choose monetary aggregates that include or exclude foreign currency components. The dollarizing country also forfeits its monetary autonomy since it can no longer exercise unilateral control over its own money supply or exchange rate.[6]

Furthermore, currency substitution has the potential to negatively affect overall economic growth, especially for small open economies (Bahmani-Oskooee and Techaratanachai, 2001). They argued that depreciation of the domestic currency raises the domestic currency value of foreign assets. Therefore, those expecting further depreciation substitute more foreign currency for domestic currency, thereby reducing their domestic money holdings. If these effects are strong, the decline in domestic currency holdings could cause economic slowdown.

Conceptually, the degree of dollarization is measured by the stock of foreign currency held by domestic residents which include foreign currency deposits (FCD) in the domestic banking system, foreign currency in circulation (FCC) within the domestic economy and the offshore deposits (OSD) held by the domestic residents at foreign banks (Kessy, 2011).

However, there are shortcomings associated with measuring currency substitution/dollarization. Firstly, it is difficult to estimate the foreign cash held by domestic residents. This is because no domestic institution is responsible for its issue, at best; foreign currency in circulation can only be estimated. However, there are problems associated with generating reliable estimates of the stock of FCC because there is a substantial unrecorded foreign currency inflows and outflows from a

[6]Ortiz (1983) argued the autonomy of monetary policy is severely weakened in the presence of currency substitution. He noted that a considerable amount of instability may be imported from foreign territories as the demand for domestic currency is significantly influenced by foreign factors.

country as a bulk of foreign currency is used by traders engaged in imports and exports. Secondly, it is not easy and possible to track all deposits held abroad by domestic residents. The quantitative importance of the above shortcomings is not easy to estimate. Therefore, one has to keep in mind that misspecification is possible and it is more likely that the measured currency substitution underestimates the actual magnitudes. The only source of measurable data is the foreign currency deposits in domestic financial institutions, which are held mostly by domestic residents.

Therefore, the most common measure of currency substitution/dollarization is the ratio of foreign currency deposits to total deposits (FCD/LCD). Other measures include; i) foreign currency deposits as a ratio of local currency deposits (FCD/LCD), ii) the ratio of foreign currency deposits to broad money supply (FCD/M2), iii) the ratio of foreign currency deposits to broad money supply after deducting for currency in circulation in the country (FCD/M2-CIC), iv) the ratio of foreign currency deposits to extended broad money (FCD/M3), v) the ratio of loans denominated in foreign currency to total loans (known as loan dollarization), vi) the ratio of foreign currency denominated public debt to the total public debt of the country (public debt dollarization).

2.3 Theoretical issues

Most of the empirical models used to determine the dollarization process are based on money demand models and portfolio balance models. The main theoretical underpinning of these models is that the demand for foreign currency depends largely on the interest rate differentials and the exchange rate risk. However, given the fact that the dollarization process in most countries cannot be completely explained by the money demand and portfolio balance models, these models have been extended to include other macroeconomic and institutional variables (Adam, 2013).

2.3.1 Money demand approach

The macroeconomic foundation for the money demand function stems from two important functions of money, namely, medium of exchange and store of value. The implication of this is that economic agents are faced with the options of holding money partly cash and/or in form of

assets. In this regard, changes in money demand are commonly explained in terms of the scale variable and the opportunity cost of holding it. Whereas the scale variable captures the impact of income or wealth on money demand, the opportunity cost variable refers to the substitution effect arising from the relative attractiveness of economic agents to investments assets (this impact is usually captured by the interest rate on assets which are close substitutes to money). From the foregoing argument, real money balances are usually expressed as a function of income and interest rate as follows

$$m/p = f(y, r)$$

Where m, p, y and r denotes money demand, price level, income and real interest rate respectively. In addition to the above money demand function, other variables are added relevant to a peculiar research. The currency substitution hypothesis states that the domestic demand for domestic money depends on the expected rate of depreciation, as well as the domestic rate of interest and level of income (Poloz, 1984). This is evident from the dollarization literature that, when the exchange rate is expected to depreciate, the expected return from holding foreign money increases, and the demand for domestic currency falls as individuals substitute foreign money for domestic currency (Yinusa and Akinlo, 2008, Bahmani-Oskooee and Techaratanachai, 2001, Doguwa, 2014). On the other hand, dollarization is also attributed to high inflation, which implies that countries where hyperinflation is prevalent tend to hold more of foreign currency which has a relatively stable value (Quispe-Agnoli and Whisler, 2006, Bailey, 2005).

The classical economists approach to the demand for money is inherent in the quantity of money. They emphasized the transactions demand for money in terms of the velocity of circulation of money. This is because money acts as a medium of exchange and facilitates the exchange of goods and services. They view the demand for money as a constant proportion of the level of transactions, which in turn, bears a constant relationship to the level of national income. Further, the demand for money is linked to the volume of trade going on in an economy at any time. Thus,

its underlying assumption is that people hold money to buy goods, there is full employment level of income, and it also assumed that money is transferable.

The Keynesian argued that money is not held for transaction purposes only but rather they formulated three motives for holding money (transactions, precautionary and speculative motive). The transaction motive for holding cash balances arises from the medium of exchange function of money in making payment for goods and services. Keynes relates the need of cash for current transactions of personal and business exchange. He postulated that the transactions demand for money is a direct proportional and positive function of the level of income. The precautionary motive relates to the desire to provide for contingencies requiring sudden expenditures and for unforeseen opportunities of advantageous purchases. Individuals, firms and government keep cash in reserve to meet unexpected needs. Individuals hold some cash to provide for illness, accidents, unemployment and other unforeseen contingencies. Similarly, firms keep cash in reserve to tide over unfavorable conditions or to gain from unexpected deals.

The precautionary demand for money depends upon the level of income and business activity, opportunities for unexpected profitable deals, availability of cash, the cost of holding liquid assets in banks reserve, etc. Poloz (1986) modeled the currency substitution hypothesis by extending the theory of the precautionary demand for cash balances to a two-currency economy. A three-asset model was presented in which transaction costs are explicit and an agent is faced with uncertain cash requirements in two different currencies. The agent chooses to hold a quantity of both types of cash, the relative quantities being influenced at the margin by movements in the rate of return on bonds and the expected rate of depreciation of the domestic currency.

The speculative motive implies that economic agents hold money in order to secure profit. They tend to hold money for speculative purposes and as a liquid store of value that can be invested at an appropriate time in interest bearing bonds or securities. Bond prices are inversely related to the

rate of interest. Keynes argued that, it is expectations about changes in bond prices or in the current market rate of interest that determine the speculative demand for money. Thus, the speculative demand for money is a decreasing function of the rate of interest. The higher the rate of interest, the lower the speculative demand for money and the lower the rate of interest the higher the speculative demand for money. The speculative demand for money is a function of income and interest rate.

However, modern Keynesians (primarily attributed to the works of W. Baumol and J. Tobin) concluded that interest rate is not only a function of the speculative motive, but the transaction and precautionary motive as well. Baumol concentrated on transaction aspect of holding cash balances and explains the transaction demand for money from the perspective of inventory control or management. As firms keep inventory of goods and materials to facilitate transactions or exchange in the context of changes in demand for them, Baumol assert that individuals also hold inventory of money because it facilitates transactions of goods and services. Moreover, by holding money with them implies they have forgone interest which they could have earned if they had kept their wealth in savings or fixed deposits or invested in bonds.

This interest income forgone is the cost of holding money for transactions purposes. Poloz (1984) extended the model of Baumol transactions demand for money to an economy where transactions are conducted in two currencies. He included a third asset (foreign money) which is treated as a medium of exchange, a quantity of which is essential if the agent is to carry out planned expenditure. Poloz noted that the degree of currency substitution might depend on several factors which could vary overtime, namely the sign and size of the expected rate of depreciation, the proportion of agents who adopt corner as opposed to interior solutions and the fraction of domestic economic activity which is carried out using foreign currency. Tobin opined that rational behavior on the part of the problem of what proportion of his portfolio of financial assets should be kept in form of money and interest bearing bonds. He asserts that individual behavior shows risk aversion.

Thus, individuals tend to diversify their portfolio by holding a balanced combination of safe and risky assets. Individuals tend to prefer less risk to more risk at a given rate of return. As such, they tend to invest more on less risky assets.

The monetarist approach to the demand for money proposed by Milton Friedman in his reformulation of the quantity theory of money assert that, the quantity theory is in the first instance a theory of the demand for money. It is not a theory of output or of money income, or of the price level. The demand for money on the part of ultimate wealth holders is formally identical with that of the demand for a consumption service. He regards the amount of real cash balances (m/p) as a commodity which is demanded because it yields services to the person who holds it. Thus money is an asset or capital good. He argued that the demand for money depend on asset prices or relative returns and wealth or income. The demand for money function is symbolically stated as:

$$m/p = f\ (y, w, Rm, Rb, Re, gp, u)$$

where m is the total stock of money demanded, p is the price level, y is the real income, w is the fraction of wealth in non-human form, Rm is the expected nominal rate of return on money, Rb is the expected rate of return on bonds, including expected changes in their prices, Re is the expected nominal rate of return on equities, including expected changes in their prices, gp=(1/p)(dp/dt) is the expected rate of change of prices of goods and hence the expected nominal rate of return on physical assets, and u stands for variables other than income that may affect the utility attached to the services of money. The demand function for money leads to the conclusion that a rise in expected yields on different assets (Rb, Re and gp) reduces the amount of money demanded by a wealth holder, and that an increase in wealth raises the demand for money.

2.3.2 Portfolio balance theory

The portfolio theory or the Modern Portfolio Theory (MPT) was founded by the classical economist, Harry Markowitz in his article “portfolio selection” which appeared in the 1952 Journal of Finance. MPT was developed in the 1950’s through the early 1970’s and was considered an

important advance in mathematical modeling of finance. Portfolio balance theory is a theory that attempts to maximize portfolio expected return for a given amount of portfolio risk, or equivalently maximize risk for a given level of expected return, by carefully choosing the proportions of various assets.

Portfolio balance theory is a mathematical formulation of the concept of diversification in investing with the aim of selecting a collection of investment assets that has collectively lower risk than any individual asset. Intuitively, this holds because different types of assets often change in value in opposite ways. For example, to the extend prices in the stock market move differently from prices in the bond markets, a collection of both types of assets can in theory face lower overall risk than either individually. But diversification lowers risk even if they are positively correlated. More technically, portfolio balance theory models an assets return as a normally distributed function, defines risk as the standard deviation of return, and models a portfolio as a weighted combination of asset return. By combining different assets whose returns are not perfectly positively correlated, portfolio theory seeks to reduce the total variance of the portfolio return.

Some of the assumptions of portfolio balance theory are: investors are rational and risk averse, markets are efficient, assets return are (jointly) normally distributed random variable, correlations between assets are fixed and constant forever, all investors aim to maximize economic utility (in other words, to make as much money as possible, regardless of any other considerations),investors have an accurate conception of possible returns, that is, the probability beliefs of investors match the true distribution of returns, there are no taxes or transaction costs, all investors are price takers, that is, their action do not influence price, risk/volatility of an asset is known in advance/is constant.

The portfolio balance approach proposed by Cuddington (1983) emphasizes the allocation of wealth between different types of money and other assets simultaneously. In accordance with financial equilibrium in the presence of currency substitution, holdings of both domestic and foreign money are allowed. Individuals may also hold domestic and foreign bonds under the assumption of perfect capital mobility. The portfolio share of each asset is determined by the expected return on all assets and real income. As a result, Cuddington's model facilitated the empirical estimation of domestic money demand with the inclusion of both currency and asset substitution.

Thomas (1985) developed a liquidity services model where economic agents determine currency substitution based on transaction costs and nominal interest rates, while unofficial dollarization was influenced by real return differentials, assets risk characteristics and economic agent's attitude to risks. The model assumes perfect financial markets, where economic agents can borrow and lend on both the domestic and international markets without constraints. The model allows for the possibility of portfolio balance motives for currency substitutability. Thomas (1985) argued that expected utility maximizing agents respond to changes in inflation or exchange rate expectations by adjusting non-monetary assets or liabilities to mitigate the risks associated with money holdings.

2.4 Empirical literature

There are several studies carried out on currency substitution either as single country specific or cross country studies. The literature has attempted to examine the factors that may contribute to the emergence of currency substitution/dollarization in a country. These factors are economic and institutional factors. Economic factors such as interest rates on local and foreign currency deposits and bonds, expected devaluation, real exchange rates, domestic inflation rates, current account deficits and foreign reserves of central banks are often used in econometric studies (See Table 1.1 in appendix). Some of the key institutional factors used in the literature are the openness of the

economy, institutional constraints or regulations on holding foreign currency and capital controls, the depth of the financial market, the exchange rate regime and degree of policy credibility (Adam 2013, Ghalayini, 2011).

Selcuk (2003) used Generalized Method of Moments(GMM) to provide empirical evidence for currency substitution in emerging market economies using data for Czech Republic & Isreal:1993:01-2000:12, hungary:1991:01-2000:10,Jordan 1994:1-2000:1,Poland 1997:01-2001:03, the Slovak Republic 1993:01-2001:01 & Turkey 1987:01-1999:12. He indicates that foreign currencies are strong substitutes for domestic currency in producing liquidity services in emerging economies. Prock, Soydemir and Abugri (2003) relied on cointegration and Vector Error correction (VEC) model to investigate the extent of currency substitution in Argentina, Brazil and Mexico from October 1986 to June 2001. They found significant presence of currency substitution in Argentina and Brazil. However, they attributed the lack of significant result for currency substitution in Mexico to its credible exchange rate and monetary policy as well as its relative financial stability. Similarly, Sharma, Kandil and Chaisrisawatsuk (2005) relied on the Morishima elasticity of substitution to investigate the importance of the US dollar to six Asian economies as a substitute or complement to domestic monetary assets using quarterly data from 1977 to 1996. They argued that currency substitution is more affected by fluctuations in the exchange rate compared to interest rate fluctuations. Findings reveal that there is an increasing degree of currency substitution over time in every country except for Malaysia, where capital account controls are enforced. Furthermore, there was a higher degree of currency substitution in Japan, Korea and Singapore than in Indonesia, Malaysia and Thailand.

Bacha, Holland and Goncalves (2008) employed instrumental variable and panel data (random effect) to investigate the impact of systemic risks and financial dollarization on real interest rates in emerging economies. The data set spans 1996-2004 for 66 emerging and high income market

economies and 33 dollarized emerging market economies. Bacha, Holland and Goncalves (2008) found that higher systemic risks induce both higher real interest rates and increase dollarization. Findings revealed that financial dollarization has a significant negative impact on real interest rate, but the economic magnitude of the impact is small for all sampled countries. Heimonen (2008) relied on error correction model (ECM) and cointegration in order to evaluate the substitution of a substitute currency that is euros for dollars in the Estonian economy for the period April 1997 to November 2000. Findings revealed evidence of substitution between the dollar and euro related balances. The substitution between the dollar and euro is asymmetric in the short run while it was symmetric in the long run. Thus, it was also found that the elasticity of substitution rose whenever there was an increase in the relative interest rate of the dollar.

Kessy (2011) applies cointegration and ECM to analyze dollarization in Tanzania and the EAC region using descriptive statistics. The study used monthly series from 2001 to 2009. A survey was also conducted on some firms in order to investigate the extent to which the US dollar is used as a unit of account for pricing purposes. It was evident that financial dollarization in Tanzania is high, but steadily declining compared to other East Africa Community (EAC) countries (Burundi, Rwanda and Kenya). Evidence from the study reveals that the significance of the US dollar as a store of value is greater in Tanzania. Findings also reveal that inflation rate is negatively related to dollarization as the level of foreign currency holding was constantly rising even as inflation rate declined. Survey results suggest that US dollar is gradually displacing the Tanzanian currency as preferred unit of account most notably in real estate and education sectors largely due to its reputation as a stable currency. There was also evidence of transaction dollarization in the retail sector mainly associated with selling of high value imported products such as computers, automobile and pay TV services.

Adam (2013) relied on cointegration and ECM to analyze dollarization in Maldives using monthly data from January 1991 to December 2010. He found that unofficial dollarization remained high in

the Maldives. Findings showed that tourism inflows, macroeconomic stability and the conditions of the foreign exchange market are the main factors influencing the dollarization process in the long run. In addition to these factors, openness of the economy also influences dollarization in the short run. The results revealed that unlike other highly dollarized economies, where dollarization increased following severe macroeconomic imbalances, high and persistent inflation rates, this was not the case in Maldives. This was evident from the results which showed that increased inflation volatility had a negative impact on dollarization.

Using the qualitative approach, Kabote, Vengesayi, Mamimine and Matarusu (2014) analyse the effects of dollarization on human resources in the hospitality industry in Zimbabwe for the period September 2012. Found that dollarization had positive impact on the performance of the hospitality industry in Zimbabwe. Findings showed that dollarization has brought happiness among hospitality employees, has brought about positive social change among hospitality staff and organizations and has caused great economic positive change which has led to improved performance of the hospitality industry.

Exchange rate, which is an indication of the strength or value of currency, also determines the rate of currency substitution in an economy. Increase in exchange rate of the domestic currency (i.e. depreciation) reduces the attractiveness of the local currency vis-à-vis a foreign currency (of higher value). While currency appreciation reduces the attractiveness of the foreign currency if the appreciation is expected to be sustained. High rate of currency substitution in an economy is much likely to further depreciate the local currency. However, some studies found exchange rate volatility as a factor driving dollarization. Akcay, Alper and Karasulu (1997) relied on Exponential Generalized Autoregressive Conditional Heteroscedasticity (E-GARCH) model to assess the extent of currency substitution and its effects on exchange rate instability in Turkey using monthly data for the period January 1987 to march 1996. They found evidence in conformity with the assertion that the higher the level of dollarization, the higher is the volatility of the exchange rate. Bahmani-

Oskooee and Techaratanachai (2001) relied on cointegration on a 10 lag VAR model to investigate whether currency depreciation in Thailand resulted in currency substitution using quarterly data over the period 1977-1990. Found that currency depreciation in Thailand has indeed resulted in currency substitution away from the Thailand baht. Elkhafif (2002) used error correction model and Granger causality test to examine the dynamics of the currency substitution phenomenon in two Africa's emerging economies (Egypt and South Africa) using monthly data from 1991 to 2001. Found that currency substitution does exist, but its elasticity with respect to the exchange rate variable is larger in South Africa than in Egypt. The study finds a high degree of currency substitution for the Egyptian economy (51%) while the phenomenon was found to be insignificant in South Africa (less than 1% in 1991 and about 6% as at 2001).

Yinusa and Akinlo (2008) used cointegration and ECM on the study exchange rate volatility and currency substitution in Nigeria for the period spanning the first quarter of 1986 to the second quarter of 2005. They indicated the presence of currency substitution in the domestic banking system. A major factor that led to this was exchange rate volatility especially real parallel market exchange rate volatility. Findings showed that currency substitution was low during the period and as such classified Nigeria as a moderately dollarized economy. Effiom and Samuel (2010) relied on cointegration and Vector Error Correction Mechanism (VECM) to examine the vulnerability or immunity of the Nigerian economy to currency substitution using annual time series data from 1970-2008. Findings revealed persistent inflation and depreciation of the naira occasioned by exchange rate instability and monetary policy inconsistency, currency substitution has been a dominant feature of the Nigerian economy. The Johansen cointegration test was employed by Kalyoncu, Isik and Jelilov (2015) to investigate whether currency depreciation in Nigeria has resulted in currency substitution away from the Nigerian Naira using annual time series data from 1980-2013. They found depreciation of the naira has resulted in a decline in holding of domestic currency, indicating the presence of currency substitution in Nigeria.Boamah et al (2012) relied on

autoregressive distributed lag (ARDL) bound test to examine the degree of currency substitution within four Caribbean countries (Guyana, Jamaica and Trinidad and Tobago and Barbados) and assess the possible effects of foreign currency demand in the countries using quarterly data from 1996 to 2009. Found evidence of currency substitution due to exchange rate shocks in three of the four countries. Long-run impacts are present for Guyana, Trinidad and Tobago, with short run effects for Jamaica.

Doguwa (2014) usesAutoregressive Distributed Lag (ARDL) bound test approach to examine the presence and existence of currency substitution in Nigeria using quarterly data from December 1994 to June 2014. Findings revealed that the behavior of the foreign currency/naira demand deposit ratio in Nigeria has been influenced by devaluation expectations and exchange rate risk as well as some of the policies been pursued since the advent of the democratic governance notably some of the political uncertainties during the Obasanjo and Yar'adua-Jonathan presidency. Another study by Bawa, Omotosho and Doguwa (2015) applied the bounds testing approach to cointegration and included a ratchet variable in the estimated ARDL to examine the persistence of currency substitution in Nigeria using monthly time series data from 1990-2013. Findings revealed both the long run and short run models ofcurrency substitution indicated that a ratchet effect has been detected in Nigeria, indicating that currency substitution in the country is quite persistent. Aigheyisi (2015) relied on two stage least squares simultaneous equation technique to investigate the interrelationships among currency substitution, inflation and economic growth in Nigeria using annual data from 1994 to 2013. Findings revealed inflation and the growth of real Gross Domestic Product have no significant effects on currency substitution. But exchange rate and investment significantly affect currency substitution. Furthermore, some literature found inflation as a driving factor of dollarization. Piontkovsky (2003) relied on panel data (fixed effect) and Generalized Least Squares (GLS) to analyse dollarization, inflation volatility and underdeveloped financial markets in a sample of 9 transition economies. Quarterly data was used for the period 1992-2000.

He found relative returns on assets and inflation volatility as factors of dollarization in transition economies. Economic agents choice of assets depends on their attractiveness (their return and risk characteristics).

In order to investigate the link between financial dollarization and inflation in Jamaica, Bailey (2005) used generalized impulse response analysis and variance decomposition for the period march 1996 to December 2004. He found positive relationship between inflation and financial dollarization in Jamaica. Findings also showed that exchange rate depreciation pressures arising from increased foreign currency holdings contributes to additional inflationary impulses, associated with the relatively high exchange rate pass-through to inflation. Yinusa (2009) adopted the Pool Ordinary Least Squares (POLS) using the fixed effect and panel least squares techniques to study the effects of macroeconomic fluctuations and deposit dollarization for a group of 18 Sub-Saharan Africa for the period 1980-2004. It was found that dollarization in Sub-Sahara Africa is as a result of inflation interacting with capital accounts restrictions, political risk factor, changes in US monetary policy, domestic rate of interest, exchange rate volatility and expected exchange rate.

Ghalayini (2011) used Granger causality test to investigate the impact of dollarization on the efficiency of monetary policy in Lebanon using monthly data from 2008 to 2010. Findings revealed that inflation is explained by dollarization in Lebanon. It was evident from the results that relation between inflation and dollarization is a unidirectional relation running from dollarization to inflation. Findings also reveal that dollarization have a negative impact on monetary policy efficiency. Milenkovic and Davidovic (2013) used descriptive statistics to assess the determinants of dollarization in the Republic of Serbia for the period 2005 to 2011. They attributed presence of currency substitution to lack of confidence in the monetary authorities and the domestic currency with periods of financial instability, high inflation and the depreciation of the domestic currency. This has led to the use of foreign currency instead of domestic currency in the banking system especially for long term lending.

It is worth noting that those who favour dollarization emphasize that most dollarized countries exhibit low inflation, macroeconomic stability and fiscal discipline. Edwards (2001) relied on Kruskal-Wallis test to examine dollarization and economic performance for the period 1970-1998. The study used two groups of countries to provide a comparative perspective which are all emerging and advanced countries and also all emerging countries. The study used Panama as a case study to investigate whether terms of trade shocks and current account reversals have been more costly in Panama than in other non-dollarized countries. The Feasible Generalized Least Squares (FGLS) procedure was used for the period 1970-1998. Found evidence that some dollarized countries (Liberia and Panama) have i) grown at a significantly lower rate, ii) have had a similar fiscal record iii) have not been spared from major current account reversals iv) have had significantly lower inflation than non-dollarized economies (emerging and developed countries). Findings reveal that Panama did not perform better compared with non-dollarized economies and external shocks generated higher costs in Panama in terms of lower investment and growth.

Honohan and Shi (2001) relied on panel data (fixed effect) to assess the effects of deposit dollarization and the financial sector in emerging economies. Findings showed an increased trend towards the use of foreign currency denominated bank deposits in emerging markets. They found that dollarization tend to rise interest rates systematically through a peso premium as well as greater dollarization is associated with a higher pass-through coefficient from exchange rate change to consumer prices, potentially increasing nominal risk in the economy. Quispe-Agnoli and Whisler (2006) used panel data to examine how full dollarization and other macroeconomic institutional factors affected bank performance in Ecuador and El Salvador from 1995 to 2004. Findings indicated that the banking system in Ecuador and El Salvador has virtually benefitted from the implementation of full dollarization. The study identified factors that affect bank performance such as profitability, liquidity and asset quality in order to analyse how the banking system have actually benefitted from dollarization. The results showed that official dollarization

has played a significant role in improving bank liquidity and asset quality. Macroeconomic variables and financial structure indicators were also relevant in explaining bank liquidity and loan quality. Bank profitability responded to variables that are bank specific which are, ratio of equity to assets and to loans as well as bank solvency.

Honig (2007) relied on pooled OLS, random effect and fixed effect to examine dollarization, exchange rate regime and government quality from 1988 to 2000. He argued that the exchange rate regime does not significantly affect domestic dollarization. Instead, unofficial dollarization results from lack of confidence in the currency which ultimately stems from the belief that the government will not follow policies that promote long run currency stability. The study also indicated that improved government quality reduces unofficial dollarization, while the exchange rate regime plays no direct role in promoting dollarization. Sikwila (2013) used analytical qualitative approach to analyse the impact of dollarization on the Zimbabwean economy using annual data for the period 2008 to 2012. Findings showed dollarization positively impact on the country's economy. There was stability in price level as inflation dropped to single digits as well as all sectors in the economy experienced an improvement with real gross domestic product increasing from a negative to positive value.

From the foregoing, it is evident that there are very few studies carried out on currency substitution in Nigeria. Some of the few studies include those of Yinusa and Akinlo (2008), Effiom and Samuel (2010) and more recently Doguwa (2014) and Aigheyis (2015). These studies indicate the existence of currency substitution in Nigeria. while Yinusa and Akinlo (2008), Effiom and Samuel (2010), Kalyoncu, Isik and Jelilov (2015) as well as Aigheyisi (2015) found exchange rate volatility to be the main determinant of currency substitution in Nigeria, Doguwa (2014) found government regime quality in addition to exchange rate volatility as drivers of currency substitution in Nigeria. However, these studies did not account for crude oil price in their model of

which Nigeria heavily depend on. Nigeria is a monoculture economy, of which it depends on crude oil for over 95% of its foreign earnings and 85% of government revenue, which is transacted in foreign currency (dollar). Structural changes tend to increase foreign demand for domestic currency, appreciation of its value and raise in exchange rate. Nigeria imports more than it exports in which the transaction are carried out mainly in foreign currency, thereby increases the demand for foreign currency. Capital flight encourages increasing demand for foreign currency, which tends to exert pressure on exchange rate, thereby increasing the rate and is reflected in the appreciation or depreciation of the local currency (Uguru,Ozor and Nkwagu 2014). Therefore, this study deemed it fit to include the crude oil price variable as well as periods of elections in its model.

2.5 Institutional and policy developments on currency substitution in Nigeria

The Naira is the legal tender in Nigeria and use of any foreign currency instead of or along the naira is termed currency substitution or dollarization. Dollarization is a monetary policy that replaces the domestic currency in circulation with a foreign currency (especially US dollars). The institution responsible for issues regarding currency substitution is the Central Bank of Nigeria (CBN). The central Bank of Nigeria (CBN) is the apex regulatory authority of the financial system in the country. The Central Bank of Nigeria was established by the CBN Act of 1958 and commenced operations on July 1st, 1959. The core mandate of the Central Bank of Nigeria is to ensure monetary and price stability, issue legal tender currency in Nigeria, maintain external reserves to safeguard the international value of the legal tender currency, promote a sound financial system and act as a banker of last resort as well as provide economic and financial advice to the federal government (CBN, 2011).

Prior to the establishment of CBN, there existed a body known as the West African Currency Board (WACB). This board was established by the then British colonial government and was intended to serve as a central bank for the Anglophone West African countries. Thus, the board was charged with the primary responsibility of issuing the West African pound, which served as the legal tender currency in Ghana, Sierra-Leone, Gambia and Nigeria. On 1st July 1959, the CBN issued the Nigerian currency notes and coins and the West African Currency board notes and coins were withdrawn. The report submitted by the Decimal Currency Committee (DCC) in 1964 brought about the decimal currency, of which the major currency unit was called the naira which was equivalent to ten shillings, while the minor unit called kobo in 1973. As a result of the growth of incomes in the country and also the preference for cash transactions and the need for convenience, the N20 banknote was issued in 1977. From 1979 to 2014, new currency notes and coins were issued and there have been several transformations with regards to issuing of local

currency in Nigeria. The present paper banknotes in Nigeria are N100, N200, N500 and N1000 while the lower denomination notes (N5, N10, N20 and N50) are in polymer form.

The incidence of the use of dollar in Nigeria may be traced to the adoption of the Structural Adjustment Programme (SAP) when the CBN official encouraged the opening of domiciliary account, allowing hotels to charge and accept dollars from foreigners. That was when Nigeria was in dire need of foreign exchange to meet accumulated foreign trade bills. This was followed by the high inflation rates which decreased the demand for naira and raised the demand for alternative assets, including foreign currency and assets. There are no restrictions on holding of foreign currency by residents or non-residents in Nigeria at the time. There are also no capital controls and Nigerians were free to maintain foreign currency accounts both at home and abroad, and businesses and individuals often hold naira and US dollar accounts in domestic banks.

In recent times the CBN had raised alarm over the use of dollar as a means of payment or legal tender in the local market in Nigeria as seriously affecting the value of naira as most Nigerians are fast losing confidence in the local currency as a store of value. Dollarization of the Nigerian economy was of serious concern to the CBN, the president and the Economic Management Team (Gabriel, 2012). Some of the proposed policies to help curb dollarization include; the Currency Restructuring Exercise tagged "PROJECT CURE". The project cure was designed to reduce cost of printing small currency notes and also to minimize dollarization of the Nigerian economy. The currency restructuring exercise ushered in the idea of introducing the N5000 note in order to check mate the practice of the movement of huge funds around the country in dollars and also to provide Nigerians with heavy cash transactions with higher denominations. However, this exercise did not survive following heavy criticisms it suffered. Some of the criticisms was that; i) it will promote expected inflation within the economy on one hand and positioning the Nigerian currency as worthless and without real economic value, thus promoting movement in the supply and demand for dollars by making economic agents believe that the dollar is stronger, ii) it was also viewed as a

medium of promoting corruption and money laundering within and among the political class/political elite.

There was the issue of observed deficiencies in the operation of Bureau De Change (BDCs) in Nigeria which had led to gross inefficiencies and sharp practices in the foreign exchange market. The CBN thought of considering stopping the cash sales of dollars to Bureau De Change, where members of the Nigerian public usually make their purchases of dollars in cash to make transactions within the country. The CBN proposed transactions between the apex bank and BDCs on the one hand and between BDCs and their customers on the other through an online platform. Furthermore, those who need to make payments outside the country would have the recipients paid directly from the bank accounts of the BDCs or take the option of buying travellers' cheques.

In order to check and reduce the growing incidence of dollarization, rent-seeking, depletion of external reserves and financing of unauthorized transactions, the CBN provided a new set of modified guidelines for the BDC operators. They are (i)increase in the capital base of BDC operators from ₦10million to ₦35million in a bid to maintain exchange rate stability and preserve the value of the domestic currency, (ii) mandatory cautionary deposit for BDC to ₦35million which shall be put in a non-interest yielding account in the CBN upon the grant of approval-in-principle, (iii) the application fees remain ₦100,000 while the issuing fees which was ₦500,000 was increased to ₦1million, (iv) the annual renewal fee for the foreign exchange dealers have been increased to ₦250,000 from ₦10,000 and; (v) the weekly allocation of foreign exchange to BDCs was reduced from $50,000 to $15,000.These new regulations have been criticized of being capable of sending many operators out of business as it had provided some Nigerians with job opportunities. After the expiration of the deadline, some of the operators will not be able to do business. This will be as a result of not able to meet up with the capital requirement. The Association of Bureau De Change operators of Nigeria said the new capital requirement was too high and the deadline too short.

However, these proposed policies/measures taken by the CBN to reduce or stop dollarization has not been effectively achieved. Most of the goods in the country are imported due to weak domestic productive capacity and these transactions are carried out in foreign currencies. Therefore, if the country's economic performance is driven by a strong industrial base, the naira will be strong compared to the dollar or other foreign currencies and economic agents will prefer to hold the domestic currency. However, anecdotal evidence suggests that economic agents feel safer to hold the US dollar as a store of value than the naira.

Another policy aimed at stabilizing the foreign exchange market and stimulating local production of goods and services, is that in May 2015 the CBN has barred importers of certain goods and services from accessing foreign exchange in the Nigerian market. The CBN directed all authorized FOREX dealers, BDCs and the general public against funding the importation of the classified items at the interbank market from the proceeds of exports and BDC sources. It went further to direct the BDCs not to fund import transactions in any form whatsoever, either by cash or wire transfer. However, the BDCs are only authorized to deal in foreign currency cash, and to sell not more than $5,000 to an individual customer, and strictly for business travel/personal travel allowance, monthly mortgage payment, school fees abroad, credit card payment, utility bills and life insurance premium payments.

Furthermore, another policy was the directive from the CBN urging banks to stop receiving foreign currency deposits. The CBN issued a circular to all deposit money banks warning them to desist from the collection of foreign currencies for payment of domestic transactions on behalf of their customers and the use of their customers domiciliary accounts for making payments for visible and invisible transactions (fees, charges, licences, etc) originating and consummated in Nigeria. Nonetheless, the CBN explained that foreigners, visitors and tourists are encouraged to use their cards for payments or exchange their foreign currency for local currency at any of the authorized dealers' outpost including hotels. The banks have complied with the directives- and have stopped

receiving foreign cash deposits but have stressed that customers can access their domiciliary accounts to withdraw but not to deposit. However, this practice may have implication to the economy as it may warrant transferring such funds to overseas banks which is a huge disadvantage to the economic activities of the country.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter contains the theoretical framework on which the model specification is based. Following the model specification, the estimation techniques, are presented while the last subsection dwells on data issues.

3.2 Theoretical Framework

The Cuddington's Portfolio balance model was adopted and adapted for this study. Therefore, this study focused on the estimation of the demand for domestic money in line with the portfolio balance model of Cuddington (1983). The use of this framework is based on the fact that, the Cuddington's portfolio balance approach is unrestricted in the sense that agents can hold four different assets and switch among them simultaneously. In addition, the model also permits for the inclusion of structural breaks to ascertain how agents respond to changes in different stimuli. The portfolio approach proposed by Cuddington (1983) emphasizes the allocation of wealth between different types of currency and other assets simultaneously. In line with financial equilibrium in the presence of currency substitution, holdings of both domestic and foreign currency are taken into account. Domestic investors are allowed to hold their wealth in the form of four different assets: domestic money, domestic currency denominated non-monetary assets (which are referred to, for convenience, as domestic bonds), foreign bonds and foreign money. The portfolio share of each asset is determined by the expected return on all assets and real income. Thus, domestic residents' assetsdemands are:

$$M^d = M(i, i* + x, x, Y), \qquad M_1 < 0, M_2 < 0, M_3 < 0, M_4 > 0 \ldots\ldots\ldots\ldots\ldots 3.2.1$$

$$B^d = B(i, i* + x, x, Y), \qquad B_1 > 0, B_2 < 0, B_3 < 0, B_4 < 0 \ldots\ldots\ldots\ldots\ldots 3.2.2$$

$$F^d = F(i, i* + x, x, Y), \qquad F_1 < 0, F_2 > 0, F_3 < 0, F_4 < 0 \ldots\ldots\ldots\ldots\ldots 3.2.3$$

$$N^d = N(i, i* + x, x, Y), \qquad N_1 < 0, N_2 < 0, N_3 > 0, N_4 > 0 \ldots\ldots\ldots\ldots\ldots 3.2.4$$

Where M^d is the demand for domestic money, B^d is the demand for domestic bonds, F^d is the demand for foreign bonds, N^d is the demand for foreign money, i is the domestic interest rate on

bonds, i* is the interest rate on foreign bonds, x is the expected rate of depreciation of domestic currency, and Y is real income.

Hence, i*+ x is the expected return, including expected exchange rate changes, on foreign bonds held by domestic investors. The terms i, i*+ x, and x, therefore represent the expected nominal returns on domestic bonds, foreign bonds and foreign money, respectively from the domestic investors' point of view. The nominal return on domestic (and foreign) currency is exogenously set at zero, as is conventional in such models. All asset demand functions depend on domestic income (Y). The domestic demand for both domestic and foreign currencies rise with an increase in domestic income.According to the portfolio balance framework where domestic agents allocate their wealth among domestic money, domestic bonds and foreign bonds, the domestic money demand function should depend on the net return on foreign assets, i*+x in addition to the usual domestic interest rate and income variables. The level of total (domestic plus foreign) money balances is chosen based on the return(s) on nonmonetary assets (i, i*+ x or both) and domestic income or some other scale variable. Also, the optimum currency composition is chosen solely on the basis of the expected rate of depreciation x. Thus, the net effect of an increase in the expected rate of depreciation is to increase the demand for both foreign money and foreign bonds. In the presence of currency substitution we expect to find a significantly negative coefficient. In the Cuddington's model, in order to distinguish the effect of the changes in the net return on foreign bonds from changes in the return on foreign money, i* + x and x are entered separately into the money demand regression equation. Consequently, it becomes possible to test whether expected depreciation affects money demand indirectly through i* + x (capital mobility or directly through x (dollarization) or both.Some studies that rely on Cuddington's portfolio balance theory are (Akcay et al, 1997, Effiom and Samuel, 2010) of which other variables peculiar to the studies were included.

3.3 Model Specification

This study relies on a specification of Cuddington's (1983)portfolio balance model drawn from the money demand specification. In the spirit of this model, this study estimates money demand and Currency Substitution Index (CSI) models. The money demand model tries to uncover the existence of currency substitution, while the CSI model examines the determinants of currency substitution in Nigeria. For the money demand model, we estimate four alternative specifications. For the CSI distribution, two alternative specifications are also estimated.

The basic specification of the money demand model is viewed as a function of domestic interest rate, income and exchange rate (eq. 3.3.1). The study also estimated two additional specifications which alternates the inclusion of such variables as foreign interest rate, expected exchange rate depreciation, andcrude oil price in the second model while dummy variables to capture election years was included in the third model. A fourth specification simultaneously includesboth oil price and the dummy variable. Thus, the models are specified as:

Model 1: basic money demand model including exchange rate

$$Md/_{P} = f\ (i, y, e) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.3.1$$

Model 2: set out to achieve the second objective which includes foreign variables in addition to the basic model

$$Md/_{p} = f\ (i, i^{*}, x, y, op) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.3.2$$

Model 3: is to achieve the third objective

$$Md/_{p} = f\ (i, i^{*}, x, y, \boldsymbol{D}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.3.3$$

Model 4: the general model which incorporates all the variables in the models as above

$$Md/_{p} = f\ (i, i^{*}, x, y, op, \boldsymbol{D}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.3.4$$

Where Md is desired stock of nominal cash balance, p is general price level ($Md/_{p}$) is also written as RM2 which is referred to as real broad money demand, e is the average official exchange rate of

the naira with US dollar. i is the domestic policy interest rate, i* denotes foreign rate of interest plus expected exchange rate depreciation, x is the expected rate of depreciation of domestic currency,y is real income, op is oil price and **D** is a vector of dummy variables used to capture election period. These dummies include 1983, 1993, 1999, 2003, 2007 and 2011.

The stochastic form is:

Model 1

$$Md/_p = \alpha_0 + \alpha_1 i_t + \alpha_2 y_t + \alpha_3 e_t + u_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.3.5$$

Model 2

$$Md/_p = \alpha_0 + \alpha_1 i_t + \alpha_2 i_t^* + \alpha_3 x_t + \alpha_4 y_t + \alpha_5 op_t + u_t \ldots\ldots\ldots\ldots\ldots 3.3.6$$

Model 3

$$Md/_p = \alpha_0 + \alpha_1 i_t + \alpha_2 i_t^* + \alpha_3 x_t + \alpha_4 y_t + \alpha_5 D_t + u_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.3.7$$

Model 4

$$Md/_p = \alpha_0 + \alpha_1 i_t + \alpha_2 i_t^* + \alpha_3 x_t + \alpha_4 y_t + \alpha_5 op_t + \alpha_6 D_t + u_t \ldots 3.3.8$$

Where real money balances, real income and crude oil prices are expressed in logarithm,$u_t$is the error term and the αs are the estimate parameters. All other variables are as earlier defined.

In order to ascertain the determinants of currency substitution and how it invariably affects the demand for domestic currency, data for the period 1986 to 2014 were used. The currency substitution index equation is specified as:

Model 5

$$\frac{FCD}{M2 - CC} = f(i, i^*, x, y, op, inf, \boldsymbol{D}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.3.9$$

Model 6

$$\frac{FCD}{DD+TSD} = f(i, i^*, x, y, op, inf, \boldsymbol{D}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.3.10$$

The stochastic form is:

$$\frac{FCD}{M2-CC} = \beta_0 + \beta_1 i_t + \beta_2 i_t^* + \beta_3 x_t + \beta_4 y_t + \beta_5 op_t + \beta_6 inf_t + \beta_7 D_t + u_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.3.11$$

$$\frac{FCD}{DD+TSD} = \beta_0 + \beta_1 i_t + \beta_2 i_t^* + \beta_3 x_t + \beta_4 y_t + \beta_5 op_t + \beta_6 inf_t + \beta_7 D_t + u_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.3.12$$

Where all variables except interest rate and inflation rate are expressed in logarithm.Inf is inflation rate, FCD is foreign currency deposits in the domestic banking system, M2 is broad money supply, CC is currency in circulation, DD is demand deposits, TSD is time and savings deposits, all other variables are as earlier defined.$\frac{FCD}{M2-CC}$is also written as CSI1 and $\frac{FCD}{DD+TSD}$ is also written as CSI2.

3.4 Estimation Technique

The empirical analyses are presented in three stages; unit root test, co-integration test, and Error Correction Model (ECM). Central to the framework of analysis is the examination of the unit root characteristic of the variables in order to ascertain the stationarity of the variable. The co-integration test entails examining the long run relationship between the variables while the error correction is expected to present the parsimonious model. These issues are discussed in the subsequent sub-sections.

3.4.1 Unit Root Test

The time series data used in this study was examined for unit root in each variable. The unit root test is important in order to avoid spurious results which are possible with the use of non-stationary data. Several procedures for the test of order of integration for stationarity have been developed.And they include amongst others- the Augmented Dickey-Fuller (ADF) test (1979) and

the Phillips-Perron (PP) test (1988). Augmented Dickey-Fuller test relies on rejecting a null hypothesis of unit root (the series are non-stationary) in favour of the alternative hypothesis of stationarity. The tests are conducted with and without a deterministic trend for each of the series. The use of line graph would suggest whether the series have intercept, trend and intercept or none in order to specify the ADF unit root test. The general form of ADF test is estimated by the following regression:

$$\Delta Y_t = \alpha + \beta T + \delta y_{t-1} + \gamma_i \sum \Delta y_{t-i} + e_t \quad \text{....4.4.1}$$

Where Y is a time series, T is a linear time trend, Δ is the first difference operator, α is a constant, β is the coefficient on a time trend, ɣ = ρ-1, where ρ is the lag order of the autoregressive process and e is the random error term.

Phillips and Perron (PP) developed a generalization of the ADF test procedure that allows for assumptions concerning the distribution of errors. The PP statistics are modifications of the ADF t statistics that take into account the less restrictive nature of the error process. The PP equation is thus:

$$\Delta Y_t = \alpha_0 + \beta y_{t-1} + e_t \quad \text{.....4.4.2}$$

Where Δ is the first difference operator, α_0 is constant and e_t is random error term.

3.4.2 Co-integration Test

This involves testing for the presence of co-integration between the series. The basic idea behind co-integration is pointed out by Engle and Granger (1987), that a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be co-integrated. The stationary linear combination is called the co-integrating equation and may be interpreted as a long-run equilibrium relationship among the variables.

The co-integration approach of Johansen (1995) was adopted for this study. This procedure has some advantages over the Engle-Granger two-step single equation procedure. The test explores the possibility of more than onecointegrating vector among all endogenousvariables. The test also employs maximum likelihood method that estimatesall possible cointegrating vectors and provides two likelihood ratio tests for the number of cointegrating vectors. The starting point of Johansen approach is a Vector Autoregressive (VAR) model.

Consider a VAR of order p:

$$\boldsymbol{y_t} = A_1\boldsymbol{y_{t-1}} + \cdots\cdots\cdots + A_p\boldsymbol{y_{t-p}} + B\boldsymbol{x}_t + \epsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.4.4$$

Where $\boldsymbol{y_t}$ is a K-vectorof non-stationary I(1) variables, $\boldsymbol{x_t}$ is a d-vector of deterministic variables, and ϵ_t is a vector of innovation. We may rewrite this VAR as,

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + Bx_t + \epsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.4.5$$

where

$$\Pi = \sum_{i=1}^{p} A_i - I, \;\; \Gamma_i = -\sum_{j=i+1}^{p} A_j \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.4.6$$

If the coefficient matrixΠ hasreduced rank r < k, then there exist k x r matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is I(0). r is the number of co-integrating relations (the co-integrating rank) and each column of β is the co-integrating vector (Hjalmarsson and Osterholm, 2007).

To determine the number of co-integration vectors, two statistic test are used. The first test is the trace test (λ trace). It test the null hypothesis that there are at most 'r' co-integrating vectors against the alternative hypothesis that there are more than 'r' co-integrating vectors.

The test is calculated as:

$$\lambda\, trace\ (r) = -T \sum_{i=r+1} in\left(1 - \widehat{\lambda_t}\right) \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots ..3.4.7$$

T is the number of usable observations and λ are the estimate Eigen value from the matrix. The second statistical test is the maximum Eigen value test (λ max) that is calculated as:

$$\lambda \max(r, r+1) = -Tin\ (1 - \lambda r + 1) \dots \dots \dots \dots \dots \dots \dots \dots \dots .. \dots \dots \dots \dots \dots \dots \dots \dots \dots .3.4.8$$

It test the null hypothesis that there are at most 'r' cointegrating vectors against the alternative of (r+1)co-integrating vectors. If co-integration is proven to exist, the next step is to estimate the error correction mechanism (ECM) to model dynamic relationship from the short run to long run equilibrium. The ECM incorporates the short run dynamic of the model:

$$\Delta Y_t = \alpha_0 + \beta \Delta X_t - \Pi U_{t-1} + \varepsilon_t \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots . \dots \dots .3.4.9$$

Where, β is the impact multiplier (the short run effect) that measures the immediate impact that a change in X_t will have on a change in Y_t, Π is the feedback effect, or the adjustment effect and shows how much of the disequilibrium is being corrected (Asteriou and Hall, 2007).

3.5 Diagnostic Tests

It may be possible for the dynamic model we estimated usingtime series data to exhibit residuals that may be serially correlated whether or not the regressors include lagged values. The Breusch-Godfrey serial correlation (Lagrangian Multiplier) test is employed to test for the presence of serial correlation. The Jarque-Bera test is used to test for non-normality of the residuals while the Breusch-Pagan-Godfrey procedure is employed to test for heteroscedasticity. The multicollinearity test was also carried out on the independent variables to check whether they are correlated to each other. Furthermore, stability test of the short run coefficient was conducted. The cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) was employed to test for the stability of the coefficients.

3.6 Data Sources, Definitions and Measurement of Variables

Broad Money Supply (**M2**) is used to measure the dependent variable,**P** is general price level proxy by the consumer price index,**i**is the domestic Treasury bill rate, used as a measure of opportunity cost of holding money and an alternative wealth allocation to money holdings. **e** is average official exchange rate of the naira with US dollar**. i*** is a measure of return on foreign money (US treasury bill rate). **x** is expected exchange rate depreciation and is measured as the spread between the official and parallel market exchange rate.**Y** is a measure of transactions in the economy and accumulation of wealth. To measure this variable, we usedReal Gross Domestic Product (RGDP). **Inf** is inflation rate. **op** is crude oil price which is used as a measure of crude oil price. **D** is used as a proxy for election periods (see Table 2 in appendix). All data, except US treasury bills rate and crude oil prices are sourced from Statistical Bulletin, published by Central Bank of Nigeria (CBN) - various years. Treasury bills rate was sourced from the Board of Governors publication of the US Federal Reserve while crude oil prices was obtained from US Energy Information Administration.

CHAPTER FOUR

RESULTS/DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter presents the empirical results based on the methodology developed for the study. Thechapter consists of the trend and extent of currency substitution in Nigeria during the period 1994-2014, the cointegration results obtained from the six models specified in the methodology, the error correction model for the cointegrated models, as well as the diagnostic test results.

4.2Magnitude and Trend of Currency Substitution in Nigeria

To analyse the magnitude of the currency substitution in Nigeria, we constructed the currency substitution index (CSI). We used two definitions to measure the degree of currency substitution in the Nigerian economy, hence we have two CSIs. The first measure of the Currency Substitution Index (CSI1) is computed by taking the ratio of foreign currency deposit to monetary aggregates adjusted for local currency in circulation in Nigeria. That is;

$$CSI1 = FCD/M2 - CC$$

The second measure (CSI2) incorporates all deposits and is defined as the ratio of foreign currency deposit to naira Demand Deposit (DD), as well as Time and Savings Deposits (TSD) in the banking system. Thus CSI2 is expressed as;

$$CSI2 = FCD/DD + TSD$$

These ratios are derived from the monetary survey of the Central Bank of Nigeria (CBN). Figure 4.2 presents the ratio of foreign currency deposits to broad money adjusted for local currency in circulation in Nigeria, alongside with the ratio of foreign currency deposits to total deposits held in Nigeria's banking system from 1994 to 2014. From a close inspection of figure 4.2, it is discernible that the level of currency substitution in Nigeria is increasing but at a gradually low pace especially during the period of 1994 to the first quarter of 1999. This coincided with the

period government operated a dual exchange rate system (the fixed and autonomous foreign exchange market as part of its guided deregulation). This policy of guided deregulation and dual exchange rate continued with a merger achieved in 1999. With respect to the pursuance of the financial sector liberalization policy, the Inter-bank Foreign Exchange Market (IFEM) was re-introduced in October 1999, to replace the Autonomous Foreign Exchange Market (AFEM).

The period 2002 to 2004 witnessed further increase in the CSI. These was the period when the Dutch Auction System (DAS) was introduced, of which the Retail DAS(RDAS) was implemented at first instance with CBN selling to end users through the authorized users (banks). However, the currency substitution index has been steadily increasing until in 2011when it rose to 17.81% for CSI2 and 18.36% for CSI1. This coincided with the period general elections were held. It can be deduced that close to the period scheduled for the general elections, agents demand for foreign currency increased. This may be probably due to the fear that a new government may come into power with new policies they think may not favour them. Afterwards, it can be viewedthat the CSI trend has continued to rise. In addition, visual inspection of the figure shows the CSIs was low at the beginning of the period under review, that is from 1994Q4-1997Q4while it was a little bit stable during the period 2003Q4-2008Q1 which coincided with periods elections has already been held in the country and also crude oil price has also appreciated.It is also evident that there are two pronounced periods of rising CSI from 1998Q1-2003Q1 and 2008Q2-2014Q4.

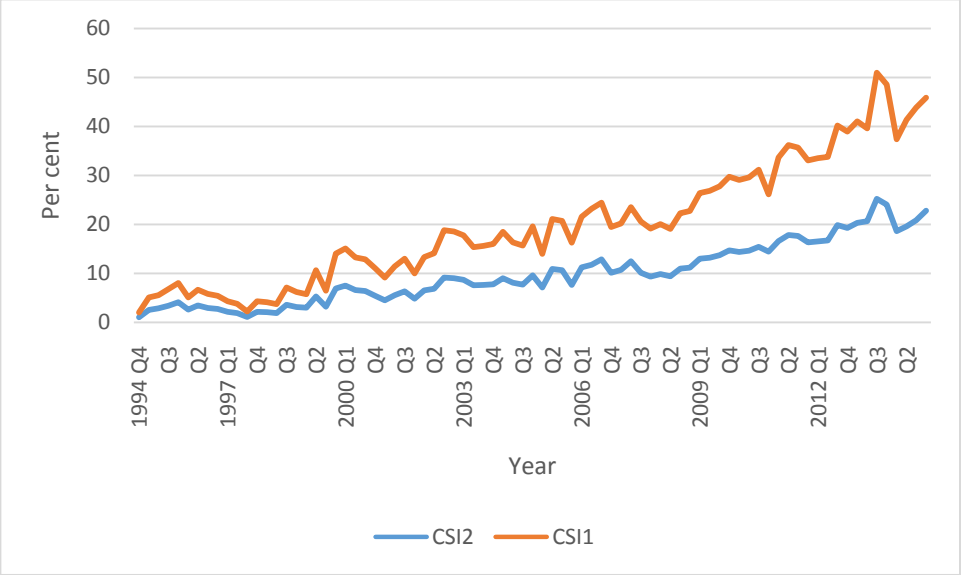


Figure 4.2: Currency Substitution Ratio in Nigeria

Source: Author's calculation based on CBN quarterly data on Nigeria

Figure 4.2.1 depicts the trend of CSI and broad money supply (M2). The CSI has been on the increase, but as at 2008 money supply had risen above it and fell in 2013 and continue to increase further. This may be attributed to the global financial crisis of 2008-2009 or to the tight monetary policy been pursued by the monetary authority. However, it can be deduced that faster growth of money supply tends to be associated with rising currency substitution especially when defined in terms of CSI1.

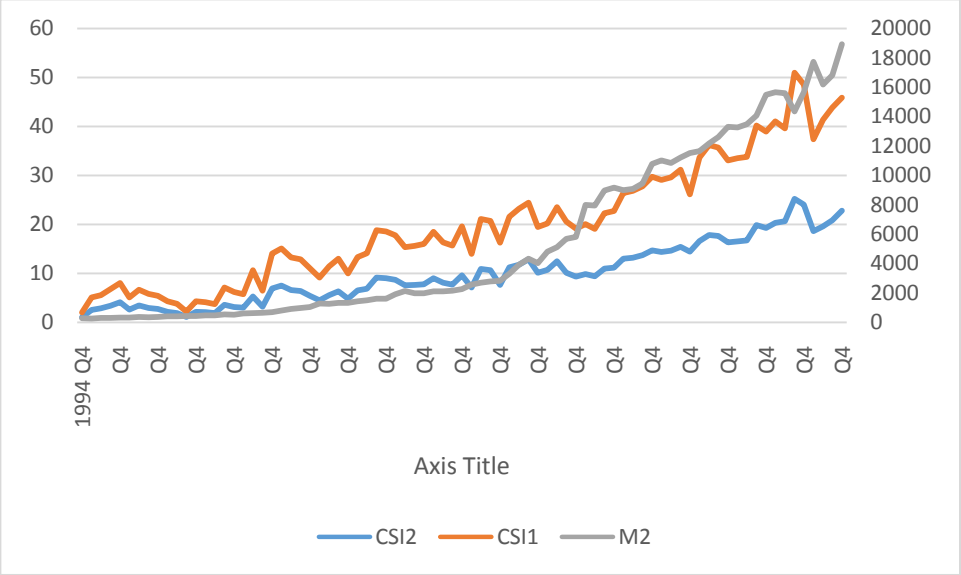


Figure 4.2.1: Currency Substitution ratio and M2 in Nigeria 1994-2014

Source: Author's calculation based on CBN quarterly data on Nigeria

The foreign exchange and exchange rate arrangements in Nigeria have transited from a fixed regime in the 1960s to a pegged regime between the 1970s and the mid-1980s and finally, to variants of the floating regime from 1986 following the adoption of Structural Adjustment Programme (SAP). The exchange rate is one of the intermediate policy variables through which monetary policy is transmitted to the larger economy through its impact on the value of the domestic currency, domestic inflation (the pass through effect), the external sector, macroeconomic credibility, capital flows and monetary and financial stability. Figure 4.2.2 shows CSI alongside the official exchange rate of the naira with the dollar (USD).

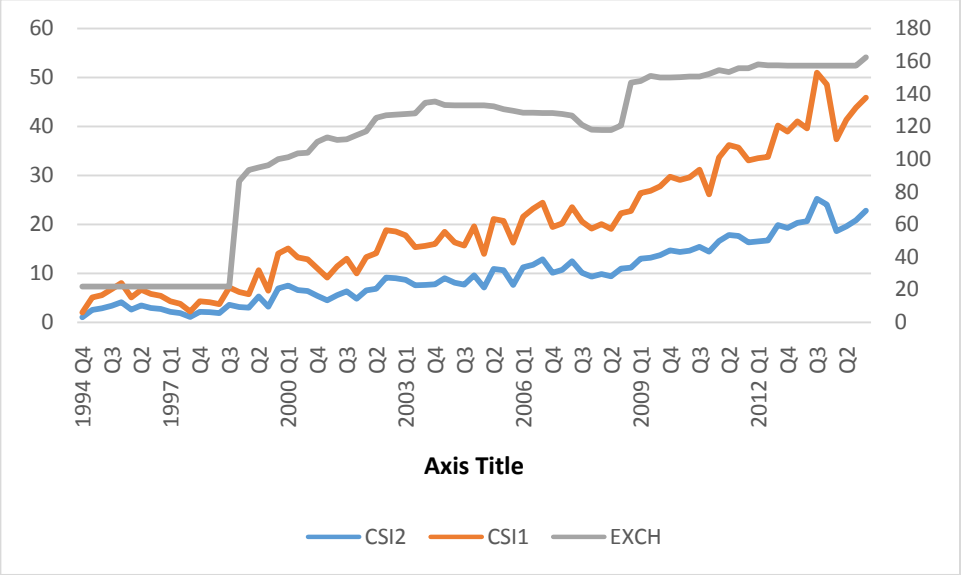


Figure 4.2.2: Currency Substitution ratio and Exchange Rate in Nigeria1994-2014

Source: Author's calculation based on CBN quarterly data on Nigeria

The figure appears to portray positive relationship between exchange rate depreciation and CSI. This implies that as the exchange rate depreciates, some economic agents would prefer to hold their monetary and non-monetary holdings in foreign currency, hence there would be increase in CSI. In other words, stability appears to be associated with appreciating exchange rate which tends to reduce currency substitution. While depreciation of the domestic currency tends to be associated with rising currency substitution.

In order to curb inflation, monetary policy has focused on an objective of single digit inflationwith monetary tightening since 2011.In the currency substitution literature, some studies are of the view that a fall in the CSI is taken as an indication of macroeconomic stability and low inflation. But this is not always the case, while other studies are of the view that arise in the CSI is an indication of macroeconomic instability and high inflation. Figure 4.2.3 describes the CSIs alongside the inflation rate. It is evident that inflation has been on the increase until 2006 when it began to fall. The fall in inflation rate did not show any fall in the CSI, but rather the CSI continued to rise. However, as shown in figure 4.2.3 starting from the left, it can be deduced that declining inflation is associated with sluggish increase in currency substitution. The second period somewhat portrays

a stable movement, which may imply stable inflation (stable domestic value of naira) tends to be attributed to stable currency substitution (2000Q1-2006Q1). But in the last period (from 2006Q2), it can be deduced that declining inflation appears to be associated with rising currency substitution. Comparing figure 4.2.2 and 4.2.3, it can be argued that the recent rise in currency substitution is due to declining external rather than internal value of the currency.

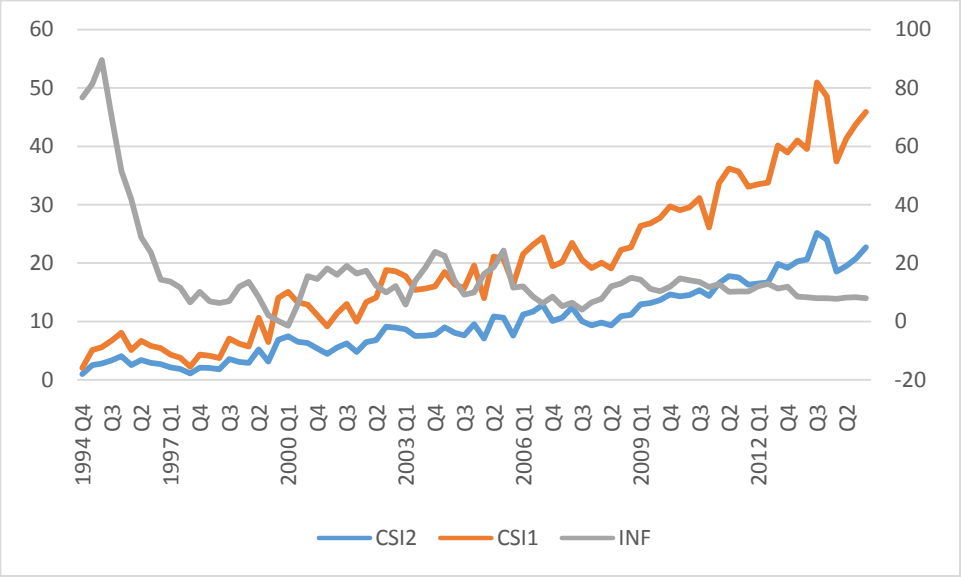


Figure 4.2.3: Currency Substitution ratio and inflation rate in Nigeria 1994-2014

Source: Author's calculation based on CBN quarterly data on Nigeria

In all, judging by the trend of figures presented above, it could be observed that currency substitution index has been on the increase in Nigeria notably from the period 2006 despite all macroeconomic reforms implemented in the country. Also, the period leading to general elections has contributed to the increase in the useofforeign currency as shown infigure 4.2 especially in 2011. This may imply that economic agents tend to prefer holding foreign currency as against the domestic currency due to its relative stability and also to hedge against domestic inflation during such period. In addition, as the exchange rate depreciates, agents may prefer their monetary and non-monetary assets to be in foreign currency as they have more confidence in it than the domestic currency due to fear of devaluation, hence increase in currency substitution. But an appreciation of

the exchange rate tends to decrease currency substitution. In sum, it can be argued that the recent rise in currency substitution is due to declining external rather than internal value of the currency.

4.3Descriptive Statistics

In order to analyse the distributional properties of the variables used in estimations, descriptivestatistics are reported in Table 4.3.1 and Table 4.3.2. Table 4.3.1, presents the mean of crude oil price, average official exchange rate, domestic interest rate, foreign interest rate, real money demand, real gross domestic product and expected rate of depreciation variables are 42.4, 0.2, 66.0, 11.7, -7.2, 39.6, 8954.4 and -13.6 respectively. This indicates that the variables exhibit significant variation in terms of magnitude. This may suggests that estimation in levels may introduce some bias in the results. In addition, the mean value of crude oil price is 42.4 dollar per barrel and the median valueis 28.6. The series ranges from a minimum value of13.3 to a maximum value of 115.4. The asymmetry of the distribution of the series around its mean (skewness) displays a positive skewness which means that the distribution has a long right tail. The value of the kurtosis is2.9 which is less than 3. This indicates that the distribution of the series is flat (platykurtic) relative to the normal.Themean value of i* is -7.2 and a median of -0.8 is recorded. The series ranges from a minimum value of -61.2 to a maximum value of 13.5. The series portrays negative skewness, which means the distribution has a long left tail. The value of the kurtosis is more than 3, implying the distribution of the series is peaked (leptokurtic) relative to the normal.

Table 4.3.1: Model 1-4 (sample period: 1980-2014)

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
OP	42.425	28.6	115.35	13.3	32.469	1.194	2.991
E	66.031	21.886	158.55	0.546	63.848	0.267	1.264
I	11.735	11.77	26.9	4	4.964	0.815	3.889
I*	-7.214	-0.773	13.52	-61.234	19.313	-1.686	4.969
RM2	39.603	17.76	115.108	8.89	36.352	1.125	2.592
RGDP	8954.42	377.830	67152.79	31.5	21380.31	2.069	5.333
X	-13.597	-3.360	0.833	-66.014	20.106	-1.757	4.642

Table 4.3.2 shows that the mean of currency substitution index 1 (CSI1), currency substitution index 2 (CSI2), domestic interest rate, inflation rate, foreign interest rate, crude oil price, real gross domestic product and expected rate of depreciation variables is 0.08, 0.07, 12.7, 20.2, -10.5, 44.3, 10764.3 and -16.1 respectively. Thismay partly explain the relatively high standard deviation of some of the variables. Therefore, this makes a case for taking the natural logarithm of the variables. Also, the mean value of RGDP is ₦10764.3billion and the median is 412.3. The series ranges from a minimum value of 255.9 to a maximum value of 67152.8. The series reveal positive skewness, indicating the distribution has a long right tail. The value of the kurtosisis more than 3 and this implies that the distribution of the series ispeaked (leptokurtic) relative to normal distribution.

Table 4.3.2: Model 5 and 6 (sample period: 1986-2014)

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
CSI1	0.080	0.051	0.245	0.016	0.066	1.111	3.218
CSI2	0.077	0.049	0.2401	0.007	0.065	1.114	3.256
I	12.750	12.25	26.9	4	4.824	0.719	4.074
INF	20.224	12	72.8	5.4	18.007	1.561	4.318
I*	-10.532	-3.280	9.098	-61.234	19.608	-1.573	4.332
OP	44.392	24.85	115.35	13.3	35.389	0.960	2.350
RGDP	10764.3	412.332	67152.79	255.997	23136.11	1.761	4.149
X	-16.111	-5.448	0.833	-66.014	21.271	-1.487	3.700

4.4 Correlation Matrix

Correlation analysis was also conducted on the variables. It was found that there exist positive as well as inverse relationships among the variables(see Table 4.4.1and Table 4.4.2).The result in the Tables consider two sub-samples (1980-2014 and1986-2014) used in the analysis. Table 4.4.1 shows that there is an inverse relationship between domestic interest rate and foreign rate of interest, expected rate of depreciation, real income and crude oil price respectively.

Table 4.4.1: Correlation Test for models 1-4 (sample period: 1980-2014)

	OP	E	I	I*	RM2	RGDP	X
OP	1.000	0.755	-0.347	0.095	0.944	0.793	0.249
E	0.755	1.000	-0.099	-0.099	0.852	0.585	0.111
I	-0.347	-0.099	1.000	-0.193	-0.298	-0.054	-0.153
I*	0.095	-0.099	-0.193	1.000	-0.042	-0.084	0.866
RM2	0.944	0.852	-0.298	-0.042	1.000	0.770	0.146
RGDP	0.793	0.585	-0.054	-0.084	0.770	1.000	0.049
X	0.249	0.111	-0.153	0.866	0.146	0.049	1.000

Also, the result in Table 4.4.2 indicate a negative relationship between expected rate of depreciation with domestic interest rate and a positive relationship between expected rate of depreciation with foreign rate of interest, real income, and crude oil price respectively.

Table 4.4.2: Correlation Test for models 5 and 6 (sample period: 1986-2014)

	CSI1	CSI2	I	INF	OP	RGDP	I*	X
CSI1	1.000	0.994	-0.343	-0.346	0.909	0.844	0.044	0.212
CSI2	0.994	1.000	-0.343	-0.309	0.904	0.844	0.023	0.192
I	-0.343	-0.343	1.000	0.422	-0.460	-0.162	-0.014	-0.028
INF	-0.346	-0.309	0.422	1.000	-0.404	-0.267	-0.240	-0.296
OP	0.909	0.904	-0.460	-0.404	1.000	0.789	0.157	0.300
RGDP	0.844	0.844	-0.162	-0.267	0.789	1.000	-0.013	0.109
I*	0.044	0.023	-0.014	-0.240	0.157	-0.013	1.000	0.857
X	0.212	0.192	-0.028	-0.296	0.300	0.109	0.857	1.000

4.5 Unit Root Test Result

The stationarity properties of the variables used in the model are analysed. All the variables were tested for unit root using the Augmented Dickey Fuller (ADF) andPhillips Perron (PP) test. The

analysis of the time series properties of the variables showed that all the variables arenon-stationary at level for the ADF and the PP test. As the results of the unit root test shows that the null hypothesis of a unit root cannot be rejected at 1 per cent, 5 per cent and 10 per cent significance level for the variables in level. Therefore unit root test was conducted on the first difference of the variables, which indicated that all the variables are stationary. This suggest that all the series considered are integrated of order one. That is I (1). These results are shown in Table 4.5.1 and 4.5.2.

Table 4.5.1: Unit Root Test for Variables in models 1-4 (sample period: 1980-2014)

Variables	ADF			PP		
	Level	First difference	Remark	Level	First difference	Remark
RM2	2.550	-4.981*	I(1)	-1.267	-3.628**	I(1)
I	-2.752	-6.710*	I(1)	-2.697	-7.066*	I(1)
I*	-3.447	-7.239*	I(1)	-3.574	-7.441*	I(1)
X	-1.950	-4.711*	I(1)	-2.101	-4.711*	I(1)
RGDP	-0.761	-5.814*	I(1)	-0.761	-5.868*	I(1)
OP	-1.916	-6.049*	I(1)	-1.761	-9.668*	I(1)
E	-2.136	-5.402*	I(1)	-2.176	-5.402*	I(1)

Note: Trend and intercept was included., **, *** denotes rejection of the null hypothesis at 1%, 5% and 10% respectively. The ADF and PP critical values are Mackinnon (1996) one-sided p-values.*

Table 4.5.2: Unit Root Test for Variables in models 5 and 6 (sample period: 1986-2014)

Variables	ADF			PP		
	Level	First difference	Remark	Level	First difference	Remark
CSI1	-1.064	-5.270*	I(1)	-0.855	-5.263*	I(1)
CSI2	-1.197	-5.767*	I(1)	-1.054	-5.784*	I(1)
I	-3.477	-5.996*	I(1)	-3.428	-7.815*	I(1)
I*	-3.247	-6.422*	I(1)	-3.247	-12.223*	I(1)
X	-1.849	-4.206*	I(1)	-1.960	-4.210*	I(1)
RGDP	-0.970	-5.295*	I(1)	-0.969	-5.308*	I(1)
OP	-2.072	-5.398*	I(1)	-2.072	-9.947*	I(1)
INF	-3.780	-4.658*	I(1)	-2.917	-4.999*	I(1)

*Note:Trend and intercept was included. *, **, *** denotes rejection of the null hypothesis at 1%, 5% and 10% respectively. The ADF and PP critical values are Mackinnon (1996) one-sided p-values.*

4.6Long run Analysis- Cointegration Test Results

Given the unit root properties of the variables, we proceeded to establish whether or not there is a long run cointegrating relationship among the variables by using the Johansen (1995) co-integration technique. The Johansen cointegration test is useful if we have non-stationarity time series. The essence is to determine whether non-stationary time series are cointegrated or to

establish whether long run relationship exist among the variables. The lag length selection was based on Schwarz Information Criterion (SIC). The co-integration test results follow.The discussion of the results is carried out based on the models specified.

Result of Model 1 ($Md/P = f(i, y, e)$)

The result of our estimation of this model is shown in Table 4.6.1 below. Both the trace statistics and maximum Eigen statistics do not reject the null hypothesis of no co-integration. This implies that there is no long run equilibrium linkage amongst the variables.

Table 4.6.1: Cointegration Test Result of model 1(1980-2014)

Hypothesized No. of CE(s)	Trace Statistic	5% Critical Value	Max-Eigen Statistic	5% Critical Value
None	39.320	47.856	23.688	27.584
r ≤ 1	15.633	29.797	9.243	21.132
r ≤ 2	6.389	15.495	6.335	14.265
r ≤ 3	0.055	3.842	0.055	3.842

*Note: r represents number of cointegrating vectors. Trace test and Max-eigen value test indicates no cointegration at the 5% significance level. *denotes rejection of the hypothesis at the 5%significance level.*

Result of model 2 ($Md/p = f(i, i^*, x, y, op)$)

On the contrary, an augmented version of model 1 that takes into consideration crude oil price reveals the existence of at least one cointegrating relationship amongst the variables. This is based on the trace and max-eigen value statistics which rejects the null hypothesis of no cointegration as shown in Table 4.6.2.

Table 4.6.2: Cointegration Test Result of model 2(1980-2014)

Hypothesized No. of CE(s)	Trace Statistic	5% Critical Value	Max-Eigen Statistic	5% Critical Value
None*	124.309	95.754	67.699	40.078
r ≤ 1	56.609	69.819	22.816	33.877
r ≤ 2	33.794	47.856	16.569	27.584
r ≤3	17.225	29.797	11.404	21.132
r ≤4	5.821	15.495	5.479	14.265
r ≤ 5	0.343	3.842	0.343	3.842

*Note: r represents number of cointegrating vectors. Trace test and Max-eigen value test both indicates 1 cointegrating equation at the 5% significance level. *denotes rejection of the hypothesis at the 5%significance level.*

Theco-integration test provided the coefficients for the long run relationship of the model as specified in equation 4.6.1 with their respective t-values in parenthesis.

$$InRM2 = 1.9949 - 0.0682i - 0.0904i^{*} + 0.0630x + 0.0072Iny + 0.6566Inop \ldots\ldots\ldots 4.6.1$$
(5.7071) (14.5806)(-12.1153) (-0.1639) (-4.8386)

All the variables except real gross domestic product (RGDP) are statistically significant.Foreign rate of interest and domestic policy rate of interest are negatively related to real money demand. The variable x does not have the expected negative sign. This suggests that there is no evidence of currency substitution in Nigeria under the review period. This may be partly explained by a scenario in which agents do not anticipate depreciation of the domestic currency, and in this case they would keep their money and non-money denominatedassets in naira. In other words, as economic agents' confidence in the naira increase, their demand for the currency increases as well for transaction and accumulation of wealth. This is contrary to the long run estimates found in (Doguwa, 2014) which has a negative sign as expected. The differences in the sign of the coefficient of expected rate of depreciation could be probably due to different samples used in the studies. Thecoefficient of crude oil price is positively related to domestic money demand. Therefore, a unit increase in crude oil price would on average increase real money demand by0.65%.

Results of model 3 ($\boldsymbol{Md/p = f(i, i^{*}, x, y, D)}$)

An augmented version of model 2 that accounts for election periods reveals the existence of at least one cointegrating relationship. This is based on the trace and max-eigen value statistic which rejects the null hypothesis of no cointegration as presented in Table 4.6.3 below.

Table 4.6.3: Cointegration Test Result of model 3 (1980-2014)

Hypothesized No. of CE(s)	Trace Statistic	5% Critical Value	Max-Eigen Statistic	5% Critical Value
None*	124.851	95.754	65.160	40.078
r ≤ 1	59.690	69.819	29.565	33.877
r ≤ 2	30.125	47.856	15.749	27.584
r ≤ 3	14.375	29.797	7.682	21.132
r ≤4	6.693	15.495	5.956	14.265
r ≤5	0.737	3.842	0.737	3.842

*Note: r represents number of cointegrating vectors. Trace test and Max-eigen value test both indicates 1 cointegrating equation at the 5% significance level. *denotes rejection of the hypothesis at the 5%significance level.*

The co-integration test provided the coefficients for the long run relationship of the model as specified in equation 4.6.2 with their respective t-values in parenthesis.

$$InRM2 = 5.6211 - 0.2093i - 0.2626i^{*} + 0.1960x - 0.0593Iny - 2.7088D \ldots\ldots\ldots\ldots\ldots 4.6.2$$
(6.7516) (11.8823) (-10.5376) (0.6895) (4.6583)

All the variables except real income (RGDP) are statistically significant. The existence of currency substitution was examined through the coefficient on expected rate of depreciation. It could be observed that this variable does not have the expected negative sign but is statistically significant. Therefore, this suggests the absence of currency substitution in the long run. Another important variable to note is the coefficient on the dummy variable used to capture election period in Nigeria. The variable has a negative sign. This suggests that during periods of general election, economic agents would demand less for domestic currency. The foreign rate of interest and the domestic policy interest rate are with the expected signs, which is in line with our apriori expectation similar to the second model.RGDP had a negative sign against the positive sign postulated by theoretical underpinning. However, having determined the number of cointegration vectors (CV), the adjustment coefficients of the normalized cointegrating coefficients indicated that the dependent variable (RM2) is negative (-0.023) but not statistically significant. This suggest that the long run relationship established may be probably between the explanatory variables alone. Therefore, it can be concluded that there is no long run relationship amongstthe dependent variable with the explanatory variables included in the model.

Result of model 4 ($\boldsymbol{Md/p = f(i, i^{*}, x, y, op, D)}$)

This model takes into account crude oil price as well as election periods. The cointegration test result reveals the existence of at least one cointegrating relationship. This is based on the trace and max-eigen value statistic which reject the null hypothesis of no cointegration as shown in Table 4.6.4 below.

Table 4.6.4: Cointegration Test Result of model 4

Hypothesized No. of CE(s)	Trace Statistic	5% Critical Value	Max-Eigen Statistic	5% Critical Value
None*	171.482	125.615	84.905	46.231
r $\leq$ 1	86.577	95.754	28.807	40.078
r $\leq$ 2	57.770	69.819	23.270	33.877
r $\leq$ 3	34.500	47.856	18.379	27.584
r $\leq$ 4	16.121	29.797	9.827	21.132
r $\leq$ 5	6.294	15.495	5.629	14.265
r $\leq$ 6	0.665	3.841	0.665	3.842

*Note: r represents number of cointegrating vectors. Trace test and Max-eigen value test both indicates 1 cointegrating equation at the 5% significance level. *denotes rejection of the hypothesis at the 5%significance level.*

The coefficients for the long run relationship of the model arespecified in equation 4.6.3 with their individual t-values in brackets.

$$InRM2 = 1.7483 - 0.0548i - 0.0960i^{*} + 0.0663x - 0.0537Iny + 0.9049Inop - 0.8713D \quad \ldots 4.6.3$$

(5.4257) (18.4615) (-15.0455) (1.4958) (-7.8755)
(6.1402)

The coefficients of foreign rate of interest and domestic policy interest rate have negative signs and have significant impact on real money demand as expected. RGDP has a negative sign and is not significant as this is not in linewitha prior expectation. The coefficient of expected rate of depreciation indicates no evidence of currency substitution in the long run. This is evident from the positive sign of the variable, though it is significant. When economic agents do not expect depreciation of the domestic currency, they tend to demand for the domesticcurrency for transaction as well as for store of value purposes. The coefficient of crude oil price has a positive sign and significantly impact on real money demand. A one per cent increase in crude oil would on average lead to an increase in real money demand by about 0.90%. The coefficient of the election variable (D) has a negative sign, though it is significant. Based on the number of cointegration vectors (CV) established, the adjustment coefficients of the normalized cointegrating coefficients indicated that the dependent variable (RM2) is negative (-0.124) and statistically significant. This suggest there is indeed long run relationship between RM2 and the other independent variables in the model.

Result of model 5 ($\frac{FCD}{M2-CC} = f(i, i^{*}, x, y, op, inf, D)$)

In addition to models 1-4, model 5 and 6 take into consideration foreign currency deposits in the banking system (a measure of currency substitution) as its dependent variable. Crude oil price, election periods as well as inflation rate were included in the model. Based on the Trace and Maximum Eigen value statistics, the cointegration test results reveals the existence of at least 3 cointegrating relationships as shown in Table 4.6.5.[7]

Table 4.6.5: Cointegration Test Result of model 5

Hypothesized No. of CE(s)	Trace Statistic	5% Critical Value	Max-Eigen Statistic	5% Critical Value
None*	266.109	159.529	98.277	52.363
$r \leq 1$*	167.833	125.615	54.841	46.231
$r \leq 2$*	112.992	95.754	52.671	40.078
$r \leq 3$	60.321	69.819	19.857	33.877
$r \leq 4$	40.465	47.856	15.644	27.584
$r \leq 5$	24.821	29.797	12.653	21.132
$r \leq 6$	12.167	15.495	10.727	14.265
$r \leq 7$	1.441	3.842	1.441	3.842

*Note: r represents number of cointegrating vectors. Trace test and Max-eigen value test both indicates 3 cointegrating equation at the 5% significance level. *denotes rejection of the hypothesis at the 5%significance level.*

The cointegration test provided the coefficient for the long run relationship withtheir respective t-values in equation 4.6.4 as below;

$$InCSI1 = -7.8631 + 0.1225i + 0.1397i^{*} - 0.1300x - 0.0088Iny + 0.9145Inop$$
(-6.1558) (-16.2442) (14.9425) (0.1722) (-4.8773)

$$-0.0743inf + 0.4941D \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots .4.6.4$$
(15.8085) (-1.9607)

From the above equation, foreign rate of interest and domestic policy interest rate are positively related and have significant impact to CSI1. The coefficient of expected rate of depreciation has the correct sign (negative) which conformtoouraprioriexpectation and is statistically significant. The positive sign of the foreign rate of interest serve to motivate economic agents to store their wealth in foreign currency in order to take advantage of higher rates and also to hedge against depreciation of the domestic currency. This is consistent with the expectedbehavior of economic

[7] Because there is more than one cointegrating vector, identification was needed for the CSI model. Having examined the adjustment coefficients for all the variables, the three cointegrating relationships are identifiable as models of the CSI1, I and Infbecause only their adjustment coefficients are both negative and statistically significant.

agents in Nigeria. Since they prefer to keep their assets in foreign currency simply because of its relatively stable value. Real income (RGDP) has a negative sign and it is statistically insignificant.

Crude oil price has a positive and significant impact oncurrency substitution. The fact that Nigeria largely depends on crude oil, means that as the price goes up, foreign exchange earnings in the country also increase and vice versa. As such, a 1% increase in crude oil price would on average increase foreign exchange earnings which consequently increase currency substitution by about 0.91%.The coefficient on inflation is negative though highly significant. This is an evidence of expected behavior of economic agents in Nigeria, in the sense that even when inflation falls they would continue to demand for foreign currency. Thus, this may be taken asan indication of ratchet effect. This finding confirms that of (Aigheyisi, 2015). The coefficient on dummy has a positive sign, thus it has significant impact on currency substitution in Nigeria. It implies that during election periods, economic agents demand for foreign currency increases.

Results of model 6 ($\frac{FCD}{DD+TSD} = f(i, i^*, x, y, op, inf, D)$)

On the contrary, an augmented version of model 5 reveals the existence of at least four cointegrating relationship based on the trace statistic and at least two cointegrating relationship based on the max-eigen statistic, which both rejects the null hypothesis of no cointegration as shown in Table 4.6.6.

Table 4.6.6: Cointegration Test Result of model 6

Hypothesized No. of CE(s)	Trace Statistic	5% Critical Value	Max-Eigen Statistic	5% Critical Value
None*	239.501	159.529	68.908	52.363
r ≤ 1*	170.593	125.615	60.698	46.231
r ≤ 2*	109.895	95.754	37.064	40.078
r ≤ 3*	72.831	69.819	27.562	33.877
r ≤4	45.269	47.856	17.909	27.584
r ≤5	27.360	29.797	15.034	21.132
r ≤ 6	12.326	15.495	12.107	14.265
r ≤ 7	0.219	3.842	0.219	3.842

*Note: r represents number of cointegrating vectors. Trace test indicates 4 cointegrating equation while Max-eigen value test indicates 2 cointegrating equation at the 5% significance level. *denotes rejection of the hypothesis at the 5%significance level.*

The cointegration test provided the coefficients for the long run relationship of the model as specified inequation 4.6.5with their respective t-values in parenthesis.

$$InCSI2 = -9.0641 + 0.1176i - 0.2130i^{*} + 0.0992x - 0.6099InY + 4.2014Inop$$

(-1.7043) (7.0905) (-3.3367) (3.5234) (-6.5595)

$$+0.0506inf - 9.6275D \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots .4.6.5$$

(-2.9532) (11.2208)

Foreign rate of interest has negative sign and is statistically significant while domestic interest rate is positive but insignificant. The coefficient on expected rate of depreciation has a positive sign (not as expected) though it statistically significant. This suggests no evidence of currency substitution in Nigeria. RGDP is wrongly signed (negative) and does not conform with theoretical expectation even though it is significant. Crude oil price is positively related with currency substitution and the coefficient is statistically significant. Domestic inflation is positively related with currency substitution and the coefficient is statistically significant. These suggest that the higher the domestic inflation, the more residents in Nigeria tend to substitute the domestic currency with a relatively more stable currency. This finding is in line with that of (Yinusa and Akinlo, 2008).The dummy variable is negatively related with currency substitution andthecoefficient is statistically significant. However, having determined the number of cointegration vectors (CV), the adjustment coefficients of the normalized cointegrating coefficients for the dependent variable (CSI2) is positive (0.035) and not statistically significant. This means that none of the four cointegrating vectors found by the test above can be identified as the model of CSI2. Therefore, it can be concluded that there is no long run relationship between the CSI2 and any of the variables included in the model.

Overall, based on the findings above, the study has found long run equilibrium relationship between the variables included in models 2 and 4based on the money demand specification. There was however no evidence of currency substitution. This is attributed to the wrong sign (positive) of the expected rate of depreciation variable which is expected to be negative under the study period.

The expected rate of depreciation variable is positive but statistically significant. Crude oil price is positive and statistically significant as expected. This means there is a positive relationship between crude oil price and money demand in the long run. The dummy variable used to capture election periods has a negative sign but is statistically significant. This implies a negative relationship between money demand and election dummy. Hence, it can be deduced that domestic agents may demand less of the local currency and more of the foreign currency which they have confidence. We can, therefore, infer that election period has also led to increased currency substitution. The two currency substitution index specification used to ascertain the determinants of currency substitution found the existence of cointegration in model 5. There was evidence of currency substitution in Nigeria in this model as the expected rate of depreciation variable is negative and statistically significant. It is revealing to note that persistent rise in exchange rate would raise economic agents suspicion for possible devaluation of the domestic currency and therefore, may increase their desire for currency substitution. The implication of this is that the monetary authority should ensure that the difference between the official exchange rate and the parallel market rate is contained at any point in time. The sign of crude oil price and dummy variable are positive and statistically significant in contributing to the currency substitution phenomenon in the long run. The coefficient of foreign rate of interest is positively signed and significant. This suggests that domestic economic agents would prefer their monetary assets to be in foreign currency than the domestic currency so as to take advantage of higher rate. In sum, it can be concluded that expected rate of depreciation, inflation rate (domestic value of naira), election dummy, and crude oil price as well as foreign rate of interest determines the extent of currency substitution in Nigeria in the long run.

4.7Short run Analysis- Error Correction Model (ECM) Result

Having established a long run relationship, we consider the error correction model that takes into account the short run dynamics of the model. This is with a view to ascertaining the extent to which a deviation from long run equilibrium is corrected through a series of partial short run adjustments.According toEngle and Granger (1987), if cointegration exists between non-stationary variables, then there exists an error correction representation of the variables. This result is presented in Table 4.7.1.

Discussion of finding from model 2 estimation

The results of the short run dynamics for model 2 show that the error correction term ect (-1) has the right sign (negative) and statistically significant (significant at 10%). This meansthat about 10.9% disequilibrium errors which occurred the previous year are corrected in the current year. The error correction term whichis also known as the speed of adjustment from the short run to the long run implies here that the low value of the error correction term (ect) is anindication that the errors in the model would take longer time than expected before they are finally corrected (Yinusa and Akinlo, 2008).Foreign rate of interest and domestic interest rate variables are significant. However, some variables that appeared insignificant were dropped in order to have a parsimonious model which is data admissible, theory consistent and interpretable (see appendix 2). Parsimony maximizes the goodness of fit of the model with a minimum number of explanatory variables. Thus, our parsimonious reduction process made use of a stepwise regression procedure (see Adenuga, 2010) through the elimination of those variables and their lags that are highly insignificant before finally arriving at a parsimonious model. This is presented in Table 4.7.1.

Table 4.7.1: Vector Error Correction Model (VECM) Results

Variables	Model 2	Model 4	Model 5
C	0.048 (0.060)	0.048 (0.058)	0.080 (0.0485)
DLOG(RM2(-1))			
D(I(-1))	-0.011* (0.006)	-0.013* (0.007)	0.002 (0.0102)
D(I*(-1))	0.005** (0.002)	0.005** (0.002)	-0.009*** (0.0029)
D(X(-1))			0.003 (0.0041)
DLOG(RGDP(-1))		0.004 (0.035)	0.146** (0.0585)
D(OP(-1))		0.033 (0.128)	0.417** (0.2020)
DLOG(CSI1(-1)			0.334*** (0.1275)
DLOG(CSI2(-1)			
D(INF(-1))			0.023*** (0.0038)
D(election dummy)		0.069 (0.077)	-0.427*** (0.1244)
ect(-1)	-0.109* (0.058)	-0.156** (0.069)	-0.170*** (0.0440)
R-squared	0.359	0.396	0.761
D-W Statistics	2.154	2.189	1.974
Breusch-Godfrey Serial Correlation LM Test (Obs R^2)	3.203 [0.20]	3.229 [0.19]	0.000297 [0.9999]
Breusch-Pagan-Godfrey Heteroscedasticity Test (Obs R^2)	9.899 [0.63]	11.334 [0.73]	13.678 [0.5501]
Jarque-Bera Normality Test	1.138 [0.56]	1.258 [0.53	6.027 [0.0491]

*Note: ***, **, * represents 1%, 5% and 10% level of significance, figures in parenthesis ( ) are the standard errors. While figures in parenthesis [ ] are the probability values. Dependent variable for models 2 and 4 is RM2 for sample period 1980-2014, for model 5 is CSI1 for sample 1986-2014.*

Foreign rate of interest do not conform to aprioriexpectation. This is however expected as the long runbehaviour of economic agents may differconsiderablyfromtheir short run behavior and thus may influence theirdecisions (see Adam, 2013). Foreign rate of interest is positively related to real money demand. The positive sign of foreign rate of interest suggest that economic agents tend to demand for domestic currency in order to increase their foreign currency assets denomination, since asset holders are optimistic on takingadvantage of higher rates. This is particularly true in the case of Nigeria, where asset holders prefer to hold or store their assets in currency that hasa relatively stable value (like the dollar). Domestic interest rate has anegative sign as expected and is statistically significant.

The coefficient ofdetermination (R^2) provides the proportion of variation in the dependent variable explained by the explanatory variables. It measures the goodness of fit of the estimated model. The R^2 from our table is35.9%. This implies that the explanatory variables explained about 35.9% of the total variation in the dependent variable. The model passes the diagnostic test against multicollinearity, serial correlation, normality and heteroscedasticity as revealed in Table 4.7.1 respectively. The null hypothesis of Breusch-Godfreyserial correlation LM test was accepted signifying the absence of serial correlation in the residuals. The null hypothesis of no heteroscedasticity was also accepted which implies evidence of homoscedasticity among the residuals. The normality test using Jarque-Bera (J-B) statistics confirms that the null hypothesis of normality was accepted. Insummary, it means that the series are normally distributed.

The stability of the long run coefficient was tested by the short run dynamics of the model. The Cumulative Sum of recursive residuals (CUSUM) and the Cumulative Sum of Squares of recursive residuals (CUSUMSQ) tests are applied to assess the stability of the parameters. Figure 1 in appendix plots the results of CUSUM and CUSUMSQtests. The results indicate the absence of anyinstability of the coefficients because the plot of CUSUM fall inside the critical bound of the 5% confidence interval of parameter stability while the CUSUMSQ test indicate parameter instability during 1991, 1993, 1998 and 2000. However, the parameters were stable before and after these periods. Furthermore, these break dates were taken into consideration and the new stability test result is shown in Figure 4.7.1 below.

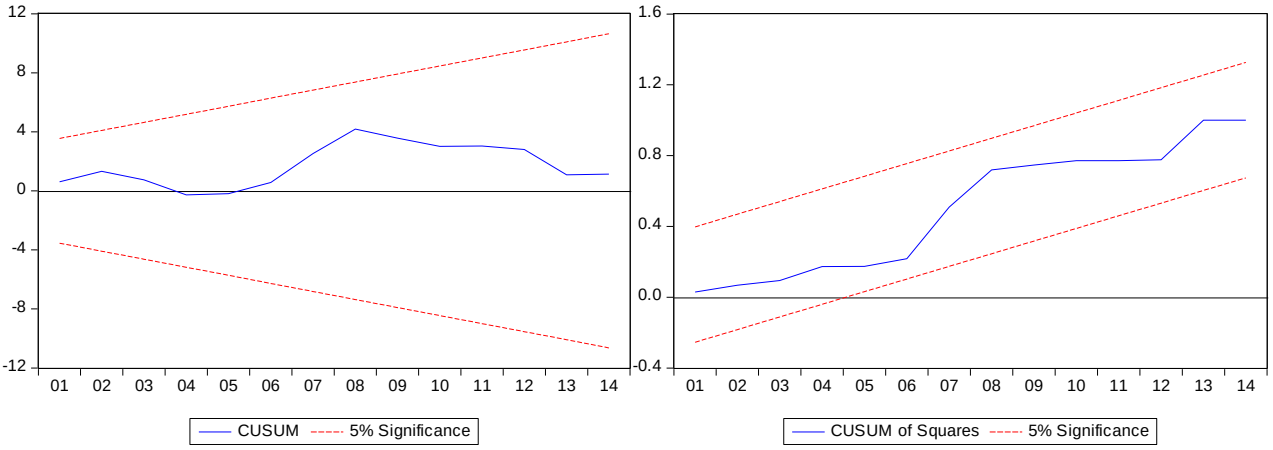


Figure 4.7.1: Parameter Stability Test for Model 2.

Results from estimations of model 4

The result of the short run (model 4) showed the error correction term ect(-1) has the correct sign (negative)and it is statisticallysignificant.Domestic interest rate has a negative sign which is in line with theory and also significant. The coefficient of foreign rate of interest (i*) has a positive sign and statistically significant. The positive value of foreign rate of interestwould stimulate domestic agents to demand for domestic currency in order to take advantage of higher foreign interest rates. This is particularly true, where asset holders prefer to hold or store their assets in currency that has a relatively stable value (like the dollar). The coefficient of op and D has positive signs, thus they impact positively to real money demand though not significant. The coefficient of determination (R^2) is 39.6%, revealing39.6%of variation in the dependentvariable is been explainedby theexplanatory variables.

The Durbin Watson statistics is satisfactory indicating non-existence of autocorrelation problem in the model. The model passes the test against multicollinearity, normality, serial correlation and heteroscedasticityasshown in Table 4.7.1 above. The seriesare normally distributed; there is absence of serial correlation and heteroscedasticityin the model. The plot of CUSUM and CUSUMSQ test for parameter stability are presented in Figure 2 in appendix. The CUSUM test revealed the parameters were stable in the period under review. The CUSUMSQ test exceeds the

upper 5 per cent critical bound for the periods 1991, 1993, 1997 and 2000 which suggest parameter instability. Haven taken into consideration of these periods, the parameter stability test is presented in Figure 4.7.2 below.

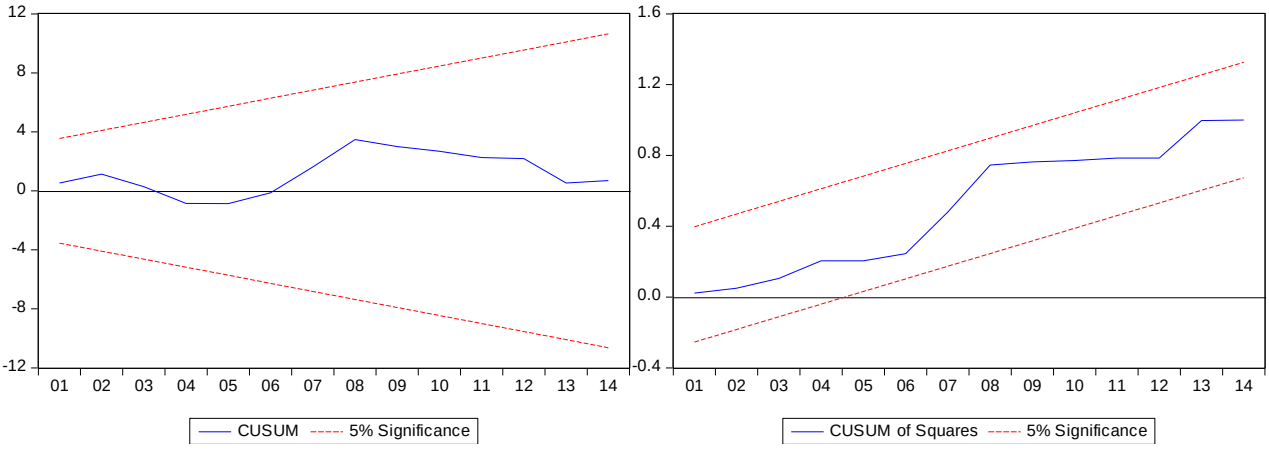


Figure 4.7.2: Parameter Stability Test for Model 4.

Discussion of short run estimates of model 5

The vector error correction form of model 5 is also presented in Table 4.7.1 as shown above. Finding reveal that the error correction term ect(-1) is (negative) and statistically significant. The domestic interest rate variable has a positive sign though not significant while foreign rate of interest is negative and significant as expected in the short run. This finding lead us to the conclusion that substitution of currency within the banking system is an important pattern of residents' behavior in Nigeria as domestic currency holdings are sometimes substituted by holding deposits denominated in foreign currency usually the US dollars. The expected rate of depreciation coefficient is positive and not significant and this is contrary to the long run negative sign. The coefficient of RGDP is positive and significant as expected. In other words, as economic agents' income increases, they may decide to seek other alternative form of holding their assets other than in domestic currency. Hence, they tend todemandforforeign currency to serveasastore of value purposes. Crude oil price variable is positive and significant.

Domestic inflation exerts a positive and significant impact on currency substitution in the short run. Thus, it follows that the positive sign of inflation is a strong determinant of currency substitution in the short run. This is because high inflation contributes to currency substitution as economic agents tend to maintain value for their assets. The impact of election variable is negative but significant. The coefficient of determination(R^2) is 76% which implies that the explanatoryvariables explained about 76% of variation in the dependent variable. The Durbin Watson statistics is satisfactory indicating non- existence of autocorrelation in the model. The model passesthe test against multicollinearity, normality, serial correlation and heteroscedasticity as shown in Table 4.7.1.The test results revealed the series are not normally distributed as the null hypothesis of normality was rejected at the 5 per cent significance level, there is no serial correlation and heteroscedasticity among the residuals in the model. The CUSUM and CUSUMSQ parameter stability test was conducted and results shown in Figure 4.7.3. The results reveal the absence of any instability in parameters because the plot of CUSUM and CUSUMSQ falls inside the critical bound of the 5 per cent confidence interval of parameter stability.

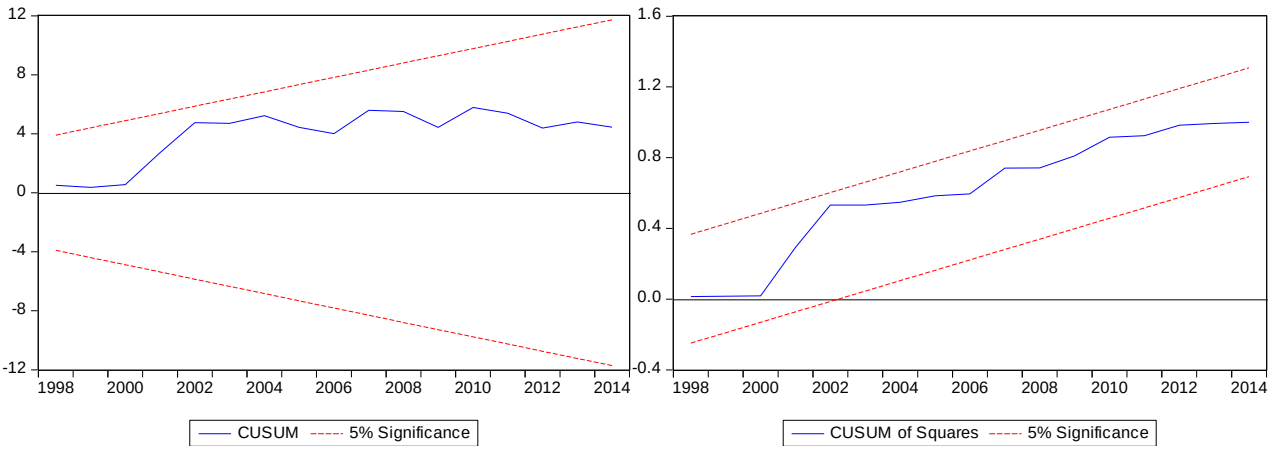


Figure 4.7.3: Parameter Stability Test for Model 5.

In all, the parsimonious short run dynamics of the cointegrated models revealed that the error correction term (ect) value are low. The low value of the error correction term suggests that errors in the model take longer time than expected before they are finally corrected. It may also mean

thatdistortions in macroeconomic variablestake longer time than necessary before they return to the steady state. Yinusa and Akinlo argued that given our experiences in the past years especially since the commencement of SAP, when most prices (for example, commodity prices, and exchange rates) in Nigeria go up, they hardly come back to the steady state. This empirical evidence therefore, supports the structure of Nigerian economy. It can be concludedthat, in the short run, foreign rate of interest, crude oil price, inflation rate and period of election also play a significant role in determining the extent of currency substitution in Nigeria.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

This study was conducted to ascertain the existence and determinants of currency substitution and its impact on money demand in Nigeria from 1980-2014. To this end, the study began by identifying the phenomenon of currency substitution especially in developing and emerging economies (including Nigeria) and how it has impacted on the economies. The studywent further to define the concepts used, reviewed related theories and literatures related to the study. The Cuddington's portfolio balance model was adopted and adapted for the study. However, the study relied on cointegration technique and error correction model to achieve its objectives. The specific objectives are; (i) to examine the trend and extent of currency substitution in Nigeria, (ii) to analyse the impact of crude oil price on currency substitution and money demand and (iii) to assess the extent to which election period contribute to currency substitution and the demand for money in Nigeria. In order to examine the trend and extent of currency substitution, two measures of currency substitution index was used (CSI1 and CSI2). To achieve the second and third objectives, six models were estimated (the first four models relied on the money demand specification and the last two models relied on currency substitution index specification) using the Johansen cointegration test procedure to establish long run equilibrium relationship and Error Correction Model (ECM) to determine short run dynamics of the model.

The study found that there was no long run equilibrium relationship among the variables in the first money demand model. Contrariwise, a long run equilibrium relationship amongst variables in the second model that takes into account crude oil price was observed. The expected rate of depreciation variable, which is a proxy used to determine the existence of currency substitution is wrongly signed (positive) which suggests no evidence of currency substitution in Nigeria for 1980-2014 sample. Crude oil price is positively related to real money demand and significant. The third

model that takes into consideration of election period found a negative relationship between election dummy and real money demand. Although, the variable contribute significantly to real money demand.Cointegration exists among variables in the fourth model. Expected rate of depreciation has a positive sign contrary to the expected negative sign, but it is statistically significant. The coefficient on crude oil price is positive as expected and also significant. Election dummy has a negative relationship but contributes significantly to real money demand (RM2).

Consequently, there was evidence of currency substitution in Nigeria as shown in the fifth model. Foreign rate of interest, crude oil price and election period dummy all exert a positive and significant influence in determining currency substitution in the long run. The positive sign of foreign rate of interest serves as a motivation for domestic agents to increase their demand for foreign currency. Findingsfrom the sixth model revealed domestic interest rate variable is positively related to currency substitution though insignificant. This implies that currency substitution is minimized with an increase in domestic rate of interest. As economic agents tend to be encouraged with the increased interest rate. The inflation rate coefficient and crude oil price are positively related to currency substitution and statistically significant in determining currency substitution. The error correction model result presentsthe error correction term (ect) of models 2, 4, and 5 as 10.9%, 15.6%, and 17.04%. The low value of (ect) is an indication that the speed of adjustment to equilibrium takes longer time to finally correct. The estimated models are satisfactory as revealed by the diagnostic tests while the CUSUM and CUSUMSQ test shows the parameters of the models are stable.

5.2 Conclusion

This study focused on currency substitution and the demand for money in Nigeria. A significant contribution of the study is the inclusion of economic and non-economic factors that may contribute to the prevalence of currency substitution in Nigeria. Findings reveal evidence of currency substitution in Nigeria. This is explained by the negative sign of the expected rate of

depreciation. However, other major factors that contributed to currency substitution was the influence of foreign rate of interest, crude oil priceaswell as election periods. In addition, inflation rate was also a contributing determinant of currency substitution in Nigeria within the sample period. Measures of currency substitution considered revealed the magnitude of currency substitution index was on the increase over the study period. The increase in the currency substitution index was primarily due to external factors rather than internal factors in the country.

5.3 Recommendations

The findings of this study prompted the following policy recommendations that may be considered given the current level of currency substitution and how it invariably affects the demand for domestic currency. Specifically, the finding provides important implications for monetary policy formulation and implementation. The monetary authorities in collaboration with the government should formulate policiesthat would promote the development of the domestic financial system, so also should measures be taken that will bring back the confidenceof economic agentsin the domestic currency by monetary authorities. If this is achieved, it will serve as an incentive to encouragedomestic agents to storetheir assets and also find alternativesto holding money in the domestic economy. To this end, thesemeasures may even bring back their confidencein the domestic currency.

There should be diversification of the economy in terms of natural resources tapped. The concentration on crude oil as a major export commodity and source of foreign earnings should be minimized and other non-oil sector should be developed to also serve as export commodities. If this is considered, it may reduce the possibility of depreciation of the domestic currency which leads to and encourage currency substitution. In essence, there should be export diversification.

The monetary authorities should take into considerationthe influence of foreign monetary developments on the domestic environment as they design/formulate their monetaryand exchange rate policies. This is in fact important as foreign factors (such as foreign interest rate) may

influence the portfolio decisions of domestic economic agents especially if it is of utmost advantage. This is because economic agents would prefer to store their assets in currencies they have confidence and are relatively stable in value.

In addition, the monetary authorities (CBN) should with the support of the government adopt tight monetary policies especially during periods leading to general election. This way the pressure on the foreignexchange market will be minimized. This implies that aseconomic agents lose confidence in the local currency or they anticipate depreciation in the currency, they prefer their holdings to be in foreign currency in other to preserve their value.Also, thefinancial system should be deepened with better liquidity in order to enhance its ability to withstand any sudden disturbances that may affect the financial system especially periods of oil shocks and elections.

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Appendix 1

Table 1.1: Summary of Empirical Findings

S/NO	AUTHOR	STUDY SCOPE	OBJECTIVE	THEORY	VARIABLES	ESTIMATION PROCEDURE	EMPIRICAL RESULT
1	Adam A. (2013)	Dollarization in a small open economy. The case of Maldives	January 1991 to December 2010	To examine the dollarization process in the Maldives	Money demand model	Dependent variable (dollarization ratio), Independent variables(inflation, international reserves, tourist bednights, openness)	Cointegration and ECM	Dollarization has remained high in Maldives as a result of imports and tourist activities
2	Yinusa D.O. and Akinlo A.E (2008)	Exchange rate volatility and the extent of currency substitution in Nigeria	First quarter of 1986 to second quarter of 2005	To examine the existence of currency substitution and attempt to gauge its magnitude in Nigeria	Portfolio balance model	Dependent variable(dollarization ratio), Independent variables(exchange rate expectation, domestic policy interest rate, GDP, consumer price index, federal funds rate, exchange rate volatility)	Cointegration and ECM	Currency substitution was present in the domestic banking system as a result of exchange rate volatility
3	Edwards S. (2001)	Dollarization and economic performance: an empirical investigation	1970-1998	To investigate the historical record of countries that have lived under a		GDP per capita growth, inflation, fiscal deficit, current account deficit	Kruskal-Wallis test	Dollarized countries have significantly lower inflation, grown at a

				dollarized monetary system.				significantly lower rate, have similar fiscal record and have not been spared from major current account reversals than non-dollarized nations
4	Yinusa D.O. (2009)	Macroeconomic fluctuations and deposit dollarization in Sub-Saharan Africa: evidence from panel data	1980-2004	To examine the key determinant of deposit dollarization in 18 Sub-Saharan African countries	Money demand model	Dependent variable(dollarization index), Independent variables(domestic interest rate, exchange rate expectation, domestic consumers consumption bundle, capital account restrictions, PPP value at domestic output, exchange rate volatility, political risk factor)	Pool Ordinary Least Squares (POLS) and panel least squares	Inflation expectation about exchange rate changes coupled with interaction between capital account restrictions and domestic inflation plays dominant roles in explaining deposit dollarization in Sub-Saharan Africa

5	Honig A. (2007)	Dollarization, exchange rate regime and government quality	1988-2000	To examine the effect of exchange rate regime on a country's exposure to foreign exchange risk.	Money demand model	Dependent variable(dollarization ratio), Independent variables (managed floating, floating government quality, regulatory controls, macro controls)	OLS, random effect and fixed effect	Improved government quality reduces unofficial dollarization, while the exchange rate regime plays no direct role in promoting dollarization
6	Bacha, E.L., Holland M.O., and Goncalves, F.M. (2008)	Systemic risk, dollarization and interest rates in emerging markets: a panel based approach	1996-2004	To investigate the impact of systemic risks and financial dollarization on real interest rates in emerging economies	Portfolio model	Dependent variable(dollarization index) Independent variables(restrictions om holdings of foreign currency deposits, jurisdictional uncertainty, capital account liberalization)	Instrumental variable and panel data (random effect)	Higher systemic risk induce both higher real interest rates and increased dollarization
7	Kessy, P. (2011)	Dollarization in Tanzania and the EAC region	2001-2009	To investigate dollarization in Tanzania and the EAC region	Money demand model	Dependent variable (asset substitution index), Independent variables (expected return on deposit, inflation, foreign currency inflows to GDP, exchange rate volatility)	Cointegration and ECM	Financial dollarization was high in Tanzania but steadily declining compared to other EAC countries
8	Akcay, O.C., Alper, C.E. and	Currency substitution and	January1987 to	To investigate the extent of	Portfolio balance	Dependent variable(domestic	Exponential Generalized	Currency substitution

	Karasulu M. (1997)	exchange rate instability: the Turkish case	March 1996	currency substitution and its effect on exchange rate instability in Turkey	model	money demand), independent variables(domestic interest rate on bonds, interest rate on foreign bonds, expected rate of depreciation of domestic currency and real income)	Autoregressive Conditional Heteroscedasticity (E-GARCH)	was attributed to volatility of exchange rate.
9	Bahmani-Oskooee,M. and Techaratanachai A. (2001)	Currency substitution in Thailand	Quarterly data from 1977-1990	To determine the relationship between currency depreciation and domestic money holding in Thailand	Money demand model	Dependent variable (real money stock), independent variable(real income, interest rate, nominal effective exchange rate)	Johansen and Juselius cointegration	Currency depreciation in Thailand has resulted in currency substitution away from the Thailand Baht
10	Heimonen, K. (2008)	Substituting a substitute currency	April 1997 to November 2000	To evaluate the dynamics between the dollar and euro balances in the Estonian economy	Money services function	Dependent variable (money services), Independent variables (euro and dollar price indices)	ECM and cointegration	There was substitution between the dollar and euro-related balances
11	Doguwa,S.I. (2014)	Currency substitution: Evidence from Nigeria	Quarterly data from December 1994 to June 2014	To examine the existence and presence of currency substitution in Nigeria	Money demand model	Dependent variable (real money balances), Independent variables (spread, real returns on domestic currency, foreign currency and an alternative asset,	Auto-Regressive Distributed Lag (ARDL) bound test	Domestic currency deposits has been influenced by devaluation expectation and exchange rate risk as

						exchange rate risk, political risk factor, expected inflation)		well as government regime policy
12	Ghalayini, L. (2011)	The impact of dollarization on the efficiency of monetary in Lebanon: Interaction between dollarization and inflation	2008 to 2010	To investigate the influence of consumer price index on dollarization		Dollarization index and consumer price index	Granger causality test	Relation between inflation and dollarization is unidirectional, running from dollarization to inflation
13	Piontkovsky, R. (2003)	Dollarization, inflation volatility and underdeveloped financial markets in Transition economies	Quarterly data from 1992-2000	To investigate the influence of relative returns on assets, inflation volatility and financial market development on dollarization in transition economies	Portfolio balance model	Dependent variable(dollarization ratio), Independent variables (inflation volatility, real relative return, expected rate of devaluation)	Panel data (fixed effect) and Generalized Least Squares(GLS)	Relative returns on assets and inflation volatility influence dollarization in transition economies.
14	Prock,J., Soydemir G.A. and Abugri, B.A. (2003)	Currency substitution: Evidence from Latin America	October 1986-june 2001	To investigate the extent of currency substitution in Argentina, Brazil and Mexico	Money demand model	Dependent variable(real money stock), Independent variables(real income, interest rate, nominal effective exchange rate)	Cointegration and Vector Error Correction (VEC)	There was significant presence of currency substitution in Argentina and Brazil unlike in Mexico
15	Sharma, S.C., Kandil M. and	Currency substitution in	Quarterly data from 1977 to	To investigate the importance	Production	Dependent variable(money	Morishima elasticity	Higher degree of currency

	Chaisrisawatsuk, S. (2005)	Asian countries	1996	of US dollar to six Asian economies as a substitute or complement to domestic monetary assets	function	services), Independent variables(CPI, wealth, institutional framework)	of substitution	substitution in Japan, Korea and Singapore than in Indonesia, Malaysia and Thailand
16	Bailey, S.A. (2005)	Investigating the ;link between financial dollarization and inflation: Evidence from Jamaica	March 1996 to December 2004	To investigate the role of financial dollarization in the dynamics of inflation in Jamaica	VAR model	Base money, exchange rate, public sector prices and dollarization ratio	Generalized impulse response analysis and variance decomposition	Positive relationship between inflation and financial dollarization
17	El-khafif, M.A.T. (2002)	Exchange rate policy and currency substitution: The case of Africa's emerging economies	1991-2001	To examine the dynamics of currency substitution phenomenon in Egypt and South Africa	Money demand model	Dependent variable(currency substation index), independent variables(nominal exchange rate, interest rate differential)	ECM and Granger causality test	The elasticity of currency substitution with respect to exchange rate is larger in South Africa than in Egypt
18	Boamah,D.,GuyK.,Grosvenor T. and Lescott A. (2012)	Currency substitution: Evidence from the Caribbean	Quarterly data from 1996 to 2009	To examine the degree of currency substitution within four Caribbean countries	Money demand model	Dependent variable(real money balances), independent variables(real income, nominal domestic interest rate, interest rate on foreign currency deposits, price level,	ARDL	Currency substitution was high in Guyana, Trinidad and Tobago due to exchange rate shocks

						nominal effective exchange rate)		
19	Kabote, F., Vengesayi, S., Mamimine P.W, Mataruse R. (2014)	The effects of dollarization on human resources in the hospitality industry in Zimbabwe	September 2012	To investigate the effects of dollarization on Zimbabwe's human resource base in the hospitality industry	Qualitative study	Improved employee performance, decreased staff turnover, high moral among staff members and improved employee benefits at work	Thematic data analysis	Dollarization has positive impact on the performance of hospitality industry in Zimbabwe.
20	Effiom,L and Samuel, U.P. (2010)	The currency substitution phenomenon: is the Nigerian economy immune?	Annual data from 1970-2010	To examine the vulnerability or immunity of the Nigerian economy to currency substitution	Money demand model	Dependent variable(real money demand), independent variables(GDP, nominal exchange rate, inflation rate, US treasury bills rate)	Cointegration and Vector Error Correction Mechanism (VECM)	Currency substitution has been a dominant feature of the Nigerian economy.
21	SelcuK, F (2003)	Currency substitution: new evidence from emerging economies	Czech Republic & Isreal:1993:01-2000:12, hungary:1991:01-2000:10,Jordan 1994:1-2000:1,Poland 1997:01-2001:03, the Slovak Republic 1993:01-2001:01 & Turkey 1987:01	To provide new empirical evidence for currency substitution in emerging market economies	Money in the utility function	Optimization	Generalized Method of Moments (GMM)	Foreign currencies are strong substitutes for domestic currency in producing liquidity services.

			1999:12					
22	Aigheyisi, O.S (2015)	Currency substitution, inflation and economic growth in Nigeria: a simultaneous equation analysis.	Annual data 1994 to 2013	To investigate the interrelationship among currency substitution, inflation and economic growth in Nigeria.	A system of simultaneous equation	Dependent variable(currency substitution, inflation, real gross domestic product growth rate), independent variables(exchange rate, federal government total expendiyure, trade openness, one year lagged value of inflation, investment, CS and exchange rate)	Two-stage least squares simultaneous estimation technique	Found inflation and real GDP have no significant effects on currency substitution, but exchange rate and investment significantly affect currency substitution.

23	Kalyoncu, H, Isik A and Jelilov G (2015)	Currency Substitution: evidence from Nigeria.	Annual data 1980 to 2013	To investigate whether currency depreciation in Nigeria has resulted in currency substitution away from the Nigerian naira.	Money demand model	Dependent variable (real narrow money demand), independent variables (real income, interest rate, nominal effective exchange rate)	Cointegration test	Depreciation of the naira has resulted in a decline in holding of M1 signifying the existence of currency substitution in Nigeria.
24	Bawa, S, Omotosho, B.S and Doguwa, S.I (2015)	Ratchet Effects in Currency Substitution: an application to Nigeria	Monthly data 1990-2013	To examine the persistence of currency substitution in Nigeria	Money demand model	Dependent variables (currency substitution index 1 and 2), independent variables (expected depreciation, exchange rate risk, spread, expected inflation, ratchet variables)	Auto-Regressive Distributed Lag (ARDL) bound test	Ratchet variables were significant, indicating the presence of ratchet effects in currency substitution in Nigeria.

Source: Authors Compilation

Table 1.2: Definition of Variables, Notations and Sources of Data

S/NO	Variable definition/measurement	Notations	Data sources
1.	Demand for domestic money proxy by broad money supply.	md	Statistical Bulletin published by Central Bank of Nigeria.
2.	Domestic policy rate of interest, proxy by Treasury bill rate	i	Statistical Bulletin published by Central Bank of Nigeria.
3.	Foreign rate of interest proxy by US treasury bill rate plus expected exchange rate depreciation.	i*	Board of Governors publication of the US Federal Reserve.
4.	Expected exchange rate depreciation. Measured as the difference between the official and real exchange rate.	x	Authors calculations based on the data obtained from Statistical Bulletin by Central Bank of Nigeria.
5.	Domestic currency value of domestic output measured by Gross Domestic Product (GDP).	y	Statistical Bulletin published by Central Bank of Nigeria.
6.	Domestic inflation rate	inf	Statistical Bulletin published by Central Bank of Nigeria.
7.	Crude oil prices	op	US Energy Information Administration.
8.	Dummy variables used as a proxy for election periods.	D	Authors compilation.
9.	General price level captured by the consumer price index	P	Statistical Bulletin published by Central Bank of Nigeria.
10.	Average official exchange rate of the naira with US dollar	e	Statistical Bulletin published by Central Bank of Nigeria.

Source: Authors Compilation

Appendix 2 (Eviews File)

Cointegration Test Result

Model 1

VAR Lag Order Selection Criteria
Endogenous variables: LOG(RM2) I LOG(RGDP) E
Exogenous variables: C
Date: 10/03/15 Time: 15:11
Sample: 1980 2014
Included observations: 31

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-309.7859	NA	7279.630	20.24425	20.42928	20.30457
1	-215.4303	158.2740*	46.94177*	15.18905*	16.11420*	15.49063*
2	-205.1537	14.58613	71.92042	15.55830	17.22358	16.10114
3	-193.5136	13.51755	110.8867	15.83958	18.24498	16.62368
4	-179.3199	12.82010	171.7586	15.95612	19.10164	16.98148

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Dependent Variable: LOG(RM2)
Method: Least Squares
Date: 10/03/15 Time: 15:12
Sample (adjusted): 1981 2014
Included observations: 34 after adjustments
LOG(RM2) = C(1)*LOG(RM2(-1)) + C(2)*I(-1) + C(3)*LOG(RGDP(-1)) + C(4)
*E(-1) + C(5)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.721425	0.127609	5.653415	0.0000
C(2)	-0.008672	0.007078	-1.225187	0.2304
C(3)	0.008281	0.023550	0.351658	0.7276
C(4)	0.003787	0.001356	2.793912	0.0091
C(5)	0.774838	0.338934	2.286103	0.0297

R-squared	0.973141	Mean dependent var	3.329626
Adjusted R-squared	0.969437	S.D. dependent var	0.837728
S.E. of regression	0.146455	Akaike info criterion	-0.869146
Sum squared resid	0.622022	Schwarz criterion	-0.644681
Log likelihood	19.77548	Hannan-Quinn criter.	-0.792597
F-statistic	262.6808	Durbin-Watson stat	1.587985
Prob(F-statistic)	0.000000		

Date: 10/03/15 Time: 15:13
Sample (adjusted): 1982 2014
Included observations: 33 after adjustments
Trend assumption: Linear deterministic trend
Series: LOG(RM2) I LOG(RGDP) E

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.512181	39.32090	47.85613	0.2477
At most 1	0.244294	15.63314	29.79707	0.7378
At most 2	0.174662	6.389735	15.49471	0.6495
At most 3	0.001665	0.054997	3.841466	0.8146

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.512181	23.68775	27.58434	0.1460
At most 1	0.244294	9.243410	21.13162	0.8123
At most 2	0.174662	6.334738	14.26460	0.5706
At most 3	0.001665	0.054997	3.841466	0.8146

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Model 2

VAR Lag Order Selection Criteria
Endogenous variables: LOG(RM2) I I* X LOG(RGDP) LOG(OP)
Exogenous variables: C
Date: 11/10/15 Time: 10:11
Sample: 1980 2014
Included observations: 33

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-445.6293	NA	31080.15	27.37148	27.64357	27.46303
1	-327.4437	186.2320	221.9619	22.39053	24.29517*	23.03138*
2	-284.9802	51.47086*	188.9949*	21.99880*	25.53600	23.18896

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Dependent Variable: LOG(RM2)
Method: Least Squares
Date: 10/03/15 Time: 20:38
Sample (adjusted): 1981 2014
Included observations: 34 after adjustments
LOG(RM2) = C(1)*LOG(RM2(-1)) + C(2)*I(-1) + C(3)*I*(-1) + C(4)*X(-1) +

C(5)*LOG(RGDP(-1)) + C(6)*LOG(OP(-1)) + C(7)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	1.007502	0.096146	10.47888	0.0000
C(2)	0.003452	0.007403	0.466324	0.6447
C(3)	-0.002104	0.003373	-0.623762	0.5380
C(4)	-0.000547	0.003096	-0.176574	0.8612
C(5)	-0.014368	0.027497	-0.522533	0.6056
C(6)	0.073562	0.131616	0.558915	0.5808
C(7)	-0.195565	0.274984	-0.711189	0.4831

R-squared	0.968300	Mean dependent var	3.329626
Adjusted R-squared	0.961255	S.D. dependent var	0.837728
S.E. of regression	0.164896	Akaike info criterion	-0.585765
Sum squared resid	0.734146	Schwarz criterion	-0.271515
Log likelihood	16.95801	Hannan-Quinn criter.	-0.478597
F-statistic	137.4548	Durbin-Watson stat	1.837010
Prob(F-statistic)	0.000000		

Date: 10/03/15 Time: 20:40
Sample (adjusted): 1982 2014
Included observations: 33 after adjustments
Trend assumption: Linear deterministic trend
Series: LOG(RM2) I I* X LOG(RGDP) LOG(OP)
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.871458	124.3091	95.75366	0.0001
At most 1	0.499120	56.60957	69.81889	0.3539
At most 2	0.394734	33.79373	47.85613	0.5131
At most 3	0.292181	17.22486	29.79707	0.6234
At most 4	0.152972	5.821162	15.49471	0.7165
At most 5	0.010324	0.342455	3.841466	0.5584

Trace test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.871458	67.69949	40.07757	0.0000
At most 1	0.499120	22.81585	33.87687	0.5446
At most 2	0.394734	16.56886	27.58434	0.6171
At most 3	0.292181	11.40370	21.13162	0.6070
At most 4	0.152972	5.478707	14.26460	0.6806
At most 5	0.010324	0.342455	3.841466	0.5584

Max-eigenvalue test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LOG(RM2)	I	I*	X	LOG(RGDP)	LOG(OP)
-2.307115	-0.157370	-0.208627	0.145434	0.016569	1.514997
2.718761	0.055577	-0.031831	0.013525	-0.665038	-0.986967
-2.347710	0.235638	-0.029110	-0.031711	-0.787273	5.799416
-0.392702	0.207746	-0.037799	0.053822	0.140793	0.219608
-0.722911	-0.026118	-0.040912	0.060265	-0.127528	1.769112
-0.441187	-0.043883	0.000751	-0.019349	0.775355	0.005275

Unrestricted Adjustment Coefficients (alpha):

D(LOG(RM2))	0.046583	0.021433	0.046669	-0.004268	-0.010345	0.010169
D(I)	0.099082	-0.516719	-1.500616	-1.057860	-0.055722	0.153842
D(I*)	14.31752	3.207904	-2.359441	-1.362162	-1.456812	-0.212428
D(X)	5.862618	2.762086	-0.118134	-4.100624	-2.703000	-0.137700
D(LOG(RGDP))	-0.076263	0.341626	-0.016066	-0.133995	0.158797	-0.005134
D(LOG(OP))	0.076946	0.115973	-0.033703	0.044016	-0.024647	0.005254

1 Cointegrating Equation(s): Log likelihood -313.2850

Normalized cointegrating coefficients (standard error in parentheses)

LOG(RM2)	I	I*	X	LOG(RGDP)	LOG(OP)
1.000000	0.068211	0.090428	-0.063037	-0.007182	-0.656663
	(0.01195)	(0.00623)	(0.00528)	(0.04334)	(0.13578)

Adjustment coefficients (standard error in parentheses)

D(LOG(RM2))	-0.107472
	(0.06111)
D(I)	-0.228593
	(1.62379)
D(I*)	-33.03217
	(4.36655)
D(X)	-13.52573
	(5.21099)
D(LOG(RGDP))	0.175948
	(0.31437)
D(LOG(OP))	-0.177524
	(0.09676)

Dependent Variable: D(LOG(RM2))
Method: Least Squares
Date: 10/03/15 Time: 20:42
Sample (adjusted): 1982 2014
Included observations: 33 after adjustments
D(LOG(RM2)) = C(1)*(LOG(RM2(-1)) + 0.0682106635265*I(-1) + 0.0904275769695*I*(-1) - 0.063037012494*X(-1) - 0.0071818108263*LOG(RGDP(-1)) - 0.656662987473*LOG(OP(-1)) - 1.99495458874)
+ C(2)*D(LOG(RM2(-1))) + C(3)*D(I(-1)) + C(4)*D(I*(-1)) + C(5)*D(X(-1)) + C(6)*D(LOG(RGDP(-1))) + C(7)*D(LOG(OP(-1))) + C(8)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.107472	0.061106	-1.758790	0.0908
C(2)	0.079642	0.191161	0.416625	0.6805
C(3)	-0.004934	0.007195	-0.685839	0.4991
C(4)	0.004290	0.003256	1.317451	0.1996

C(5)	-0.000309	0.003431	-0.090178	0.9289
C(6)	-0.011090	0.034866	-0.318079	0.7531
C(7)	0.145386	0.126178	1.152231	0.2601
C(8)	0.056374	0.029820	1.890469	0.0703

R-squared	0.246197	Mean dependent var	0.059420
Adjusted R-squared	0.035132	S.D. dependent var	0.154894
S.E. of regression	0.152149	Akaike info criterion	-0.720699
Sum squared resid	0.578731	Schwarz criterion	-0.357909
Log likelihood	19.89154	Hannan-Quinn criter.	-0.598631
F-statistic	1.166450	Durbin-Watson stat	2.062320
Prob(F-statistic)	0.356428		

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.667811	Prob. F(2,23)	0.5225
Obs*R-squared	1.811152	Prob. Chi-Square(2)	0.4043

Test Equation:

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.361397	Prob. F(12,20)	0.9630
Obs*R-squared	5.880539	Prob. Chi-Square(12)	0.9220
Scaled explained SS	4.584670	Prob. Chi-Square(12)	0.9704

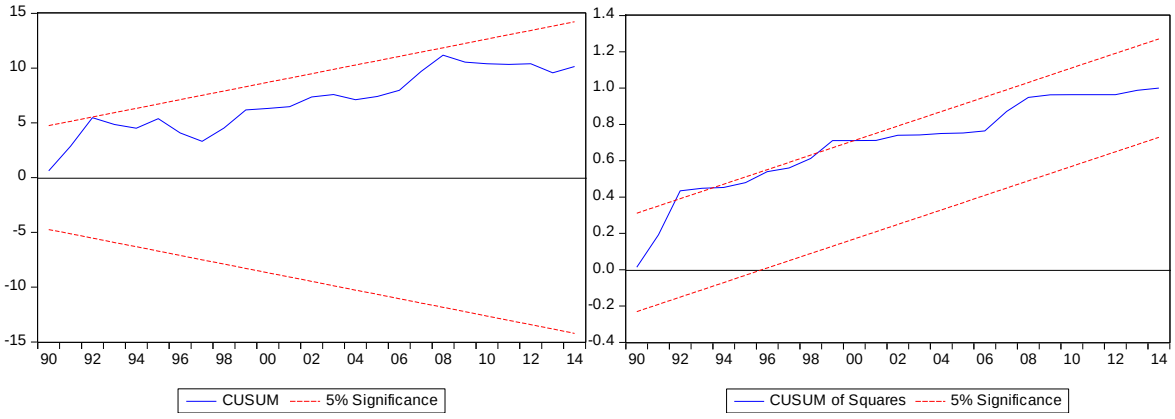


Figure 1: parameter stability test of model 2

Model 3

VAR Lag Order Selection Criteria
Endogenous variables: LOG(RM2) I I* X LOG(RGDP)
Exogenous variables: D
Date: 10/03/15 Time: 20:57
Sample: 1980 2014
Included observations: 33

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-508.6615	NA	22787205	31.13100	31.35775	31.20729
1	-349.5072	260.4344*	6846.489*	23.00043*	24.36090*	23.45819*

2	-336.0018	18.00711	15368.85	23.69708	26.19126	24.53630

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Dependent Variable: LOG(RM2)
Method: Least Squares
Date: 10/03/15 Time: 20:58
Sample (adjusted): 1981 2014
Included observations: 34 after adjustments
LOG(RM2) = C(1)*LOG(RM2(-1)) + C(2)*I(-1) + C(3)*I*(-1) + C(4)*X(-1) + C(5)*LOG(RGDP(-1)) + C(6)*D

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	1.028502	0.045987	22.36501	0.0000
C(2)	-0.000489	0.005013	-0.097469	0.9230
C(3)	-0.002063	0.002877	-0.717060	0.4793
C(4)	0.000105	0.002674	0.039260	0.9690
C(5)	-0.007953	0.025271	-0.314732	0.7553
C(6)	0.038305	0.074454	0.514480	0.6110

R-squared	0.968005	Mean dependent var	3.329626
Adjusted R-squared	0.962291	S.D. dependent var	0.837728
S.E. of regression	0.162676	Akaike info criterion	-0.635329
Sum squared resid	0.740976	Schwarz criterion	-0.365971
Log likelihood	16.80059	Hannan-Quinn criter.	-0.543470
Durbin-Watson stat	1.767764		

Date: 10/03/15 Time: 21:00
Sample (adjusted): 1982 2014
Included observations: 33 after adjustments
Trend assumption: Linear deterministic trend
Series: LOG(RM2) I I* X LOG(RGDP) D
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.861176	124.8509	95.75366	0.0001
At most 1	0.591768	59.69077	69.81889	0.2450
At most 2	0.379526	30.12540	47.85613	0.7126
At most 3	0.207687	14.37544	29.79707	0.8189
At most 4	0.165143	6.693089	15.49471	0.6136
At most 5	0.022078	0.736746	3.841466	0.3907

Trace test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.861176	65.16008	40.07757	0.0000
At most 1	0.591768	29.56537	33.87687	0.1502
At most 2	0.379526	15.74996	27.58434	0.6869
At most 3	0.207687	7.682348	21.13162	0.9221
At most 4	0.165143	5.956343	14.26460	0.6188
At most 5	0.022078	0.736746	3.841466	0.3907

Max-eigenvalue test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LOG(RM2)	I	I*	X	LOG(RGDP)	D
0.665760	0.139367	0.174841	-0.130527	0.039504	1.803421
1.562422	0.080353	0.078871	-0.062745	-0.352174	-4.032534
2.037303	0.007598	-0.003860	-0.023588	-0.729215	1.618882
0.811858	0.137767	-0.043023	0.074361	-0.134573	-1.222102
0.654531	0.226665	0.002708	-0.022827	-0.328824	-0.795943
0.277128	0.013521	0.003205	0.018859	-0.712123	0.474359

Unrestricted Adjustment Coefficients (alpha):

D(LOG(RM2))	-0.034841	0.005196	0.016951	-0.003460	0.025280	-0.017583
D(I)	-1.330266	1.494517	-0.871040	-0.542840	-0.881547	-0.054599
D(I*)	-14.87711	-4.087301	1.496543	-2.043121	-0.280466	0.235429
D(X)	-7.811277	0.981376	2.685048	-4.246213	0.278026	0.168701
D(LOG(RGDP))	-0.148282	0.249274	0.310015	0.111892	-0.106918	0.017579
D(D)	-0.207790	0.234366	-0.088229	-0.024262	0.075555	0.006522

1 Cointegrating Equation(s): Log likelihood -346.0982

Normalized cointegrating coefficients (standard error in parentheses)

LOG(RM2)	I	I*	X	LOG(RGDP)	D
1.000000	0.209336	0.262619	-0.196058	0.059336	2.708814
	(0.03105)	(0.02218)	(0.01864)	(0.08607)	(0.58159)

Adjustment coefficients (standard error in parentheses)

D(LOG(RM2))	-0.023196
	(0.01832)
D(I)	-0.885639
	(0.46733)
D(I*)	-9.904591
	(1.28336)
D(X)	-5.200440
	(1.45271)
D(LOG(RGDP))	-0.098720
	(0.09465)
D(D)	-0.138338
	(0.05320)

Model 4

VAR Lag Order Selection Criteria
Endogenous variables: LOG(RM2) I I* X LOG(RGDP) LOG(OP)
Exogenous variables: D
Date: 10/03/15 Time: 21:21
Sample: 1980 2014
Included observations: 33

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-513.7671	NA	1931648.	31.50104	31.77313	31.59259
1	-332.9130	284.9822*	309.1973	22.72200	24.62665*	23.36285*
2	-292.3499	49.16743	295.4103*	22.44545*	25.98265	23.63561

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Dependent Variable: LOG(RM2)
Method: Least Squares
Date: 10/03/15 Time: 21:25
Sample (adjusted): 1981 2014
Included observations: 34 after adjustments
LOG(RM2) = C(1)*LOG(RM2(-1)) + C(2)*I(-1) + C(3)*I*(-1) + C(4)*X(-1) + C(5)*LOG(RGDP(-1)) + C(6)*LOG(OP(-1)) + C(7)*D

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	1.021211	0.093590	10.91149	0.0000
C(2)	-0.000576	0.005196	-0.110921	0.9125
C(3)	-0.002215	0.003381	-0.655051	0.5180
C(4)	0.000195	0.002901	0.067244	0.9469
C(5)	-0.008394	0.026192	-0.320479	0.7511
C(6)	0.008105	0.090087	0.089971	0.9290
C(7)	0.038780	0.075992	0.510317	0.6140

R-squared	0.968014	Mean dependent var	3.329626
Adjusted R-squared	0.960907	S.D. dependent var	0.837728
S.E. of regression	0.165636	Akaike info criterion	-0.576805
Sum squared resid	0.740754	Schwarz criterion	-0.262554
Log likelihood	16.80568	Hannan-Quinn criter.	-0.469636
Durbin-Watson stat	1.765742		

Date: 10/03/15 Time: 21:30
Sample (adjusted): 1982 2014
Included observations: 33 after adjustments
Trend assumption: Linear deterministic trend
Series: LOG(RM2) I I* X LOG(RGDP) LOG(OP) D
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**

None *	0.923684	171.4822	125.6154	0.0000
At most 1	0.582272	86.57727	95.75366	0.1809
At most 2	0.505971	57.77077	69.81889	0.3102
At most 3	0.427045	34.50047	47.85613	0.4747
At most 4	0.257538	16.12116	29.79707	0.7037
At most 5	0.156828	6.294314	15.49471	0.6608
At most 6	0.019951	0.665044	3.841466	0.4148

Trace test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.923684	84.90491	46.23142	0.0000
At most 1	0.582272	28.80651	40.07757	0.5049
At most 2	0.505971	23.27029	33.87687	0.5099
At most 3	0.427045	18.37931	27.58434	0.4639
At most 4	0.257538	9.826850	21.13162	0.7607
At most 5	0.156828	5.629270	14.26460	0.6611
At most 6	0.019951	0.665044	3.841466	0.4148

Max-eigenvalue test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LOG(RM2)	I	I*	X	LOG(RGDP)	LOG(OP)	D
2.153411	0.118126	0.206925	-0.142697	0.115608	-1.948769	1.876157
1.309341	0.086942	0.045684	-0.040694	-0.428382	0.501430	-4.459111
2.904930	0.006243	-0.034804	0.027556	-0.446374	-2.073851	0.688319
1.808051	-0.253698	0.030490	0.030414	0.881332	-5.359356	-0.534528
0.185780	-0.227432	0.030581	-0.052237	-0.061583	-0.287147	1.698712
0.884237	0.021899	0.043392	-0.058645	0.114237	-2.021069	-0.076538
0.503701	0.018317	0.002060	0.019120	-0.746185	-0.188378	0.296736

Unrestricted Adjustment Coefficients (alpha):

D(LOG(RM2))	-0.057536	0.020528	0.009455	-0.046091	-0.000855	0.008044	-0.013999
D(I)	-0.551450	1.233716	-0.470773	1.731575	0.471957	0.142430	-0.124008
D(I*)	-13.83985	-3.076801	3.990955	1.932072	1.887823	1.476565	0.225102
D(X)	-6.206344	0.938050	2.437058	-0.186259	3.784758	2.736388	0.132974
D(LOG(RGDP))	0.023503	0.221773	0.306376	-0.015748	0.097013	-0.153685	0.015270
D(LOG(OP))	-0.072938	-0.017567	0.125197	0.014848	-0.030287	0.024294	-0.007749
D(D)	-0.160036	0.233734	-0.045473	-0.000443	-0.064310	0.072334	0.006634

1 Cointegrating Equation(s): Log likelihood -316.3070

Normalized cointegrating coefficients (standard error in parentheses)

LOG(RM2)	I	I*	X	LOG(RGDP)	LOG(OP)	D
1.000000	0.054855	0.096092	-0.066265	0.053686	-0.904968	0.871249
	(0.01012)	(0.00521)	(0.00441)	(0.03596)	(0.11496)	(0.14193)

Adjustment coefficients (standard error in parentheses)
D(LOG(RM2)) -0.123899

	(0.05627)
D(I)	-1.187499
	(1.51400)
D(I*)	-29.80287
	(4.45207)
D(X)	-13.36481
	(4.83051)
D(LOG(RGDP))	0.050612
	(0.30117)
D(LOG(OP))	-0.157066
	(0.09094)
D(D)	-0.344623
	(0.17118)

Dependent Variable: D(LOG(RM2))
Method: Least Squares
Date: 10/03/15 Time: 21:34
Sample (adjusted): 1982 2014
Included observations: 33 after adjustments
D(LOG(RM2)) = C(1)*(LOG(RM2(-1)) + 0.0606882975778*I(-1) + 0.0919567912026*I*(-1) - 0.0638243405514*X(-1) + 0.0186666461015*LOG(RGDP(-1)) - 0.750483543841*LOG(OP(-1)) - 1.74830349261) + C(2)*D(LOG(RM2(-1))) + C(3)*D(I(-1)) + C(4)*D(I*(-1)) + C(5)*D(X(-1)) + C(6)*D(LOG(RGDP(-1))) + C(7)*D(LOG(OP(-1))) + C(8) + C(9)*D

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.098631	0.062093	-1.588446	0.1253
C(2)	0.022661	0.195630	0.115835	0.9087
C(3)	-0.008472	0.007824	-1.082920	0.2896
C(4)	0.003927	0.003335	1.177714	0.2505
C(5)	0.000178	0.003458	0.051433	0.9594
C(6)	-0.022901	0.036655	-0.624788	0.5380
C(7)	0.164284	0.126631	1.297345	0.2068
C(8)	0.046409	0.031213	1.486873	0.1501
C(9)	0.085620	0.081423	1.051548	0.3035

R-squared	0.287314	Mean dependent var	0.059420
Adjusted R-squared	0.049751	S.D. dependent var	0.154894
S.E. of regression	0.150992	Akaike info criterion	-0.716183
Sum squared resid	0.547164	Schwarz criterion	-0.308045
Log likelihood	20.81702	Hannan-Quinn criter.	-0.578857
F-statistic	1.209425	Durbin-Watson stat	2.098461
Prob(F-statistic)	0.335163		

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.260484	Prob. F(2,22)	0.3032
Obs*R-squared	3.392686	Prob. Chi-Square(2)	0.1834

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.423001	Prob. F(13,19)	0.9415
Obs*R-squared	7.407137	Prob. Chi-Square(13)	0.8800

Scaled explained SS	5.318719	Prob. Chi-Square(13)	0.9675

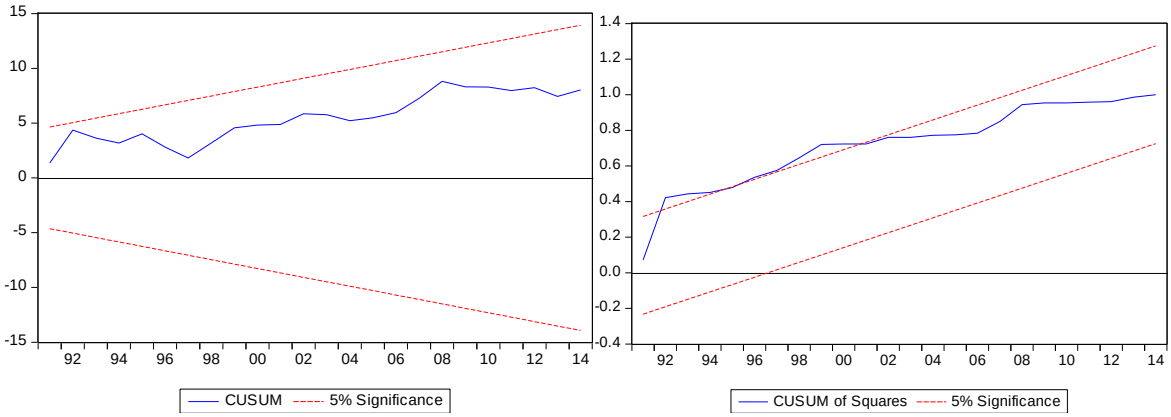


Figure 2: parameter stability test of model 4

Model 5

VAR Lag Order Selection Criteria
Endogenous variables: LOG(CSI1) I I* X LOG(RGDP) LOG(OP) INF
Exogenous variables: D
Date: 10/06/15 Time: 16:55
Sample: 1986 2014
Included observations: 27

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-563.9815	NA	5.51e+09	42.29493	42.63088	42.39482
1	-381.3983	256.9689*	315827.6	32.39988	35.08754*	33.19906
2	-310.1748	63.30978	144367.0*	30.75369*	35.79306	32.25216*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Dependent Variable: LOG(CSI1)
Method: Least Squares
Date: 10/06/15 Time: 16:59
Sample (adjusted): 1988 2014
Included observations: 27 after adjustments
LOG(CSI1) = C(1)*LOG(CSI1(-1)) + C(2)*LOG(CSI1(-2)) + C(3)*I(-1) + C(4)
*I(-2) + C(5)*I*(-1) + C(6)*I*+X(-2) + C(7)*X(-1) + C(8)*X(-2) + C(9)
*LOG(RGDP(-1)) + C(10)*LOG(RGDP(-2)) + C(11)*LOG(OP(-1)) +
C(12)*LOG(OP(-2)) + C(13)*INF(-1) + C(14)*INF(-2) + C(15)*D

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	1.284774	0.195043	6.587133	0.0000
C(2)	-0.351938	0.178800	-1.968329	0.0726

C(3)	0.016409	0.018666	0.879067	0.3966
C(4)	-0.014034	0.013952	-1.005921	0.3343
C(5)	0.006766	0.007150	0.946248	0.3627
C(6)	0.006161	0.005886	1.046797	0.3158
C(7)	-0.013998	0.010284	-1.361075	0.1985
C(8)	-0.001301	0.008321	-0.156385	0.8783
C(9)	0.116218	0.076896	1.511372	0.1566
C(10)	-0.142647	0.098733	-1.444771	0.1741
C(11)	0.624835	0.275974	2.264110	0.0429
C(12)	-0.575302	0.271147	-2.121736	0.0554
C(13)	0.012684	0.005206	2.436496	0.0314
C(14)	-0.024242	0.007217	-3.358903	0.0057
C(15)	-0.517198	0.191226	-2.704646	0.0191

R-squared	0.959247	Mean dependent var	-2.785079
Adjusted R-squared	0.911702	S.D. dependent var	0.821783
S.E. of regression	0.244192	Akaike info criterion	0.318457
Sum squared resid	0.715557	Schwarz criterion	1.038366
Log likelihood	10.70083	Hannan-Quinn criter.	0.532524
Durbin-Watson stat	2.066515		

Date: 10/06/15 Time: 17:02
Sample (adjusted): 1988 2014
Included observations: 27 after adjustments
Trend assumption: Linear deterministic trend
Series: LOG(CSI1) I I* X LOG(RGDP) LOG(OP) INF D
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.973745	266.1098	159.5297	0.0000
At most 1 *	0.868816	167.8331	125.6154	0.0000
At most 2 *	0.857834	112.9919	95.75366	0.0019
At most 3	0.520701	60.32130	69.81889	0.2256
At most 4	0.439772	40.46467	47.85613	0.2063
At most 5	0.374149	24.82056	29.79707	0.1679
At most 6	0.327852	12.16719	15.49471	0.1491
At most 7	0.051961	1.440703	3.841466	0.2300

Trace test indicates 3 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.973745	98.27676	52.36261	0.0000
At most 1 *	0.868816	54.84122	46.23142	0.0048
At most 2 *	0.857834	52.67057	40.07757	0.0012
At most 3	0.520701	19.85663	33.87687	0.7665
At most 4	0.439772	15.64411	27.58434	0.6958
At most 5	0.374149	12.65337	21.13162	0.4846
At most 6	0.327852	10.72649	14.26460	0.1685
At most 7	0.051961	1.440703	3.841466	0.2300

Max-eigenvalue test indicates 3 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LOG(CSI1)	I	INF	LOG(OP)	LOG(RGDP)	I*	X	D
0.965642	-0.118334	0.071797	-0.883112	0.008539	-0.134986	0.125555	-0.477201
-0.791848	0.072083	-0.035425	1.469885	-0.358437	-0.116835	0.069670	-3.740336
0.274079	-0.106644	-0.050551	-1.952351	0.011035	-0.076905	0.089564	4.296240
0.852938	0.326474	-0.044475	1.299634	-0.548074	0.040403	-0.099317	0.100157
2.600617	-0.339218	-0.026493	-6.268048	0.859540	0.058918	-0.056004	1.995030
2.982248	-0.007063	-0.035072	-3.193069	-0.129860	0.076375	-0.034953	-0.650989
1.678257	-0.185010	-0.003778	-0.535197	-0.460377	0.084776	-0.099073	2.177777
0.668377	0.066199	-0.036558	-0.163437	0.455366	0.019454	-0.035782	-0.738438

Unrestricted Adjustment Coefficients (alpha):

D(LOG(CSI1))	-0.140486	-0.010100	-0.003015	-0.067914	-0.043972	-0.087159	-0.000578
D(I)	-1.604356	1.563640	-1.335579	-1.357591	0.974221	0.047744	0.075670
D(INF)	-5.701031	-0.519704	5.516947	-0.679077	-1.933067	5.132435	-3.164980
D(LOG(OP))	0.099278	0.041422	0.046405	-0.004414	0.055302	0.008725	0.012641
D(LOG(RGDP))	0.133394	0.043946	0.107621	-0.294149	-0.201941	0.042732	0.258401
D(I*)	7.778492	12.15047	6.059434	0.094836	4.644985	-3.058220	0.958009
D(X)	-0.512474	8.673862	5.006940	1.509574	4.378578	-1.117965	2.694409
D(D)	-0.032312	0.283966	-0.142471	0.088031	0.018894	0.109318	0.001925

1 Cointegrating Equation(s): Log likelihood -354.3831

Normalized cointegrating coefficients (standard error in parentheses)

LOG(CSI1)	I	INF	LOG(OP)	LOG(RGDP)	I*	X	D
1.000000	-0.122545	0.074352	-0.914533	0.008843	-0.139789	0.130022	-0.494180
	(0.01999)	(0.00471)	(0.18753)	(0.05111)	(0.00865)	(0.00876)	(0.25261)

Adjustment coefficients (standard error in parentheses)

D(LOG(CSI1))	-0.135659
	(0.04829)
D(I)	-1.549234
	(0.78576)
D(INF)	-5.505157
	(2.98602)
D(LOG(OP))	0.095867
	(0.03598)
D(LOG(RGDP))	0.128811
	(0.16366)
D(I*)	7.511242
	(4.00494)
D(X)	-0.494867
	(3.22226)
D(D)	-0.031202
	(0.09490)

Dependent Variable: D(LOG(CSI1))
Method: Least Squares
Date: 10/06/15 Time: 17:08
Sample (adjusted): 1988 2014

Included observations: 27 after adjustments

D(LOG(CSI1)) = C(1)*(LOG(CSI1(-1)) - 0.130980484531*I(-1) - 0.112591220171*I*(-1) + 0.110410752425*X(-1) + 0.0568597743721 *LOG(RGDP(-1)) - 1.24148318856*LOG(OP(-1)) + 0.0608814504288 *INF(-1) + 7.86311717172) + C(2)*D(LOG(CSI1(-1))) + C(3)*D(I(-1)) + C(4)*D(I*(-1)) + C(5)*D(X(-1)) + C(6)*D(LOG(RGDP(-1))) + C(7) *D(LOG(OP(-1))) + C(8)*D(INF(-1)) + C(9) + C(10)*D

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.170441	0.044083	-3.866346	0.0012
C(2)	0.333529	0.127500	2.615925	0.0181
C(3)	0.000293	0.010278	0.028533	0.9776
C(4)	-0.009060	0.002988	-3.032336	0.0075
C(5)	0.003462	0.004146	0.835104	0.4152
C(6)	0.145529	0.058539	2.486000	0.0236
C(7)	0.416519	0.202093	2.061022	0.0549
C(8)	0.023086	0.003830	6.027735	0.0000
C(9)	0.080016	0.048576	1.647228	0.1179
C(10)	-0.426673	0.124459	-3.428223	0.0032

R-squared	0.760703	Mean dependent var	0.093354
Adjusted R-squared	0.634016	S.D. dependent var	0.333857
S.E. of regression	0.201972	Akaike info criterion	-0.083257
Sum squared resid	0.693476	Schwarz criterion	0.396682
Log likelihood	11.12397	Hannan-Quinn criter.	0.059454
Durbin-Watson stat	1.973888		

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	8.26E-05	Prob. F(2,15)	0.9999
Obs*R-squared	0.000297	Prob. Chi-Square(2)	0.9999

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.752904	Prob. F(15,11)	0.7012
Obs*R-squared	13.67777	Prob. Chi-Square(15)	0.5501
Scaled explained SS	4.786076	Prob. Chi-Square(15)	0.9938

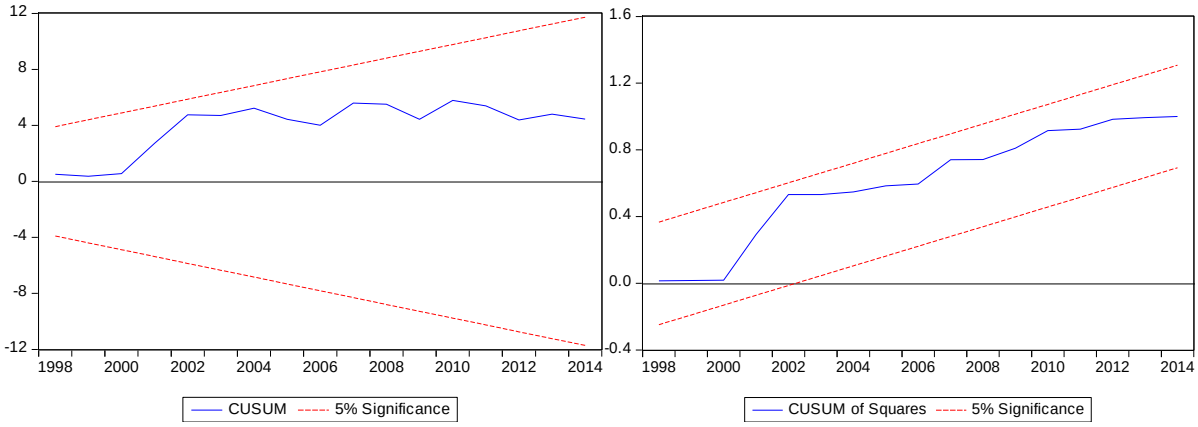


Figure 4: parameter stability test of model 5

Model 6

VAR Lag Order Selection Criteria
Endogenous variables: LOG(CSI2) I I* X LOG(RGDP) LOG(OP) INF
Exogenous variables: D
Date: 10/06/15 Time: 17:57
Sample: 1986 2014
Included observations: 27

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-566.8044	NA	6.79e+09	42.50403	42.83999	42.60393
1	-398.0376	237.5237*	1083262.*	33.63241	36.32007*	34.43159*
2	-340.0153	51.57537	1316539.	32.96409*	38.00346	34.46256

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Dependent Variable: LOG(CSI2)
Method: Least Squares
Date: 10/06/15 Time: 18:17
Sample (adjusted): 1987 2014
Included observations: 28 after adjustments
LOG(CSI2) = C(1)*LOG(CSI2(-1)) + C(2)*I(-1) + C(3)*I*(-1) + C(4)*X(-1) + C(5)*LOG(RGDP(-1)) + C(6)*LOG(OP(-1)) + C(7)*INF(-1) + C(8)*D

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.836074	0.122580	6.820665	0.0000
C(2)	-0.007531	0.028040	-0.268589	0.7910
C(3)	-0.008278	0.011185	-0.740059	0.4679
C(4)	0.012751	0.010598	1.203101	0.2430
C(5)	-0.015504	0.103001	-0.150521	0.8819
C(6)	0.019986	0.208099	0.096040	0.9244
C(7)	-0.006263	0.007211	-0.868487	0.3954
C(8)	-0.118857	0.293322	-0.405209	0.6896

R-squared	0.718195	Mean dependent var	-2.910670
Adjusted R-squared	0.619563	S.D. dependent var	0.919469
S.E. of regression	0.567125	Akaike info criterion	1.938481
Sum squared resid	6.432606	Schwarz criterion	2.319111
Log likelihood	-19.13873	Hannan-Quinn criter.	2.054843
Durbin-Watson stat	2.543139		

Date: 10/06/15 Time: 18:23
Sample (adjusted): 1988 2014
Included observations: 27 after adjustments
Trend assumption: Linear deterministic trend
Series: LOG(CSI2) I I* X LOG(RGDP) LOG(OP) INF D
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.922087	239.5011	159.5297	0.0000
At most 1 *	0.894396	170.5927	125.6154	0.0000
At most 2 *	0.746592	109.8952	95.75366	0.0037
At most 3 *	0.639695	72.83089	69.81889	0.0282
At most 4	0.484850	45.26919	47.85613	0.0858
At most 5	0.426970	27.36016	29.79707	0.0931
At most 6	0.361356	12.32610	15.49471	0.1420
At most 7	0.008081	0.219076	3.841466	0.6397

Trace test indicates 4 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.922087	68.90837	52.36261	0.0005
At most 1 *	0.894396	60.69748	46.23142	0.0008
At most 2	0.746592	37.06433	40.07757	0.1051
At most 3	0.639695	27.56170	33.87687	0.2345
At most 4	0.484850	17.90903	27.58434	0.5027
At most 5	0.426970	15.03406	21.13162	0.2865
At most 6	0.361356	12.10702	14.26460	0.1067
At most 7	0.008081	0.219076	3.841466	0.6397

Max-eigenvalue test indicates 2 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LOG(CSI2)	I	INF	LOG(OP)	LOG(RGDP)	I*	X	D
-0.504910	0.059420	0.025527	2.121345	-0.307993	-0.107566	0.050086	-4.861049
-0.692787	0.234870	-0.103513	1.983404	-0.450250	0.069029	-0.098247	-0.125634
0.394724	-0.143905	-0.023689	-1.843766	-0.062572	-0.153425	0.139140	2.411787
1.184671	0.341505	-0.017919	1.993113	-0.815365	0.035260	-0.064277	-0.540244
-1.994274	0.081190	0.027258	2.882296	0.098140	-0.028411	-0.028864	1.650022
1.518861	-0.014831	-0.048744	-3.770768	0.453765	0.039886	-0.046035	0.004727
1.199450	-0.213851	-0.010503	-1.134203	-0.165689	0.083263	-0.087571	2.251120
-1.028739	-0.035022	0.042377	1.248779	-0.583661	-0.017565	0.019230	0.703518

Unrestricted Adjustment Coefficients (alpha):

D(LOG(CSI2))	-0.069359	0.282176	-0.027894	-0.070165	0.055696	-0.162728	-0.153186
D(I)	1.346186	1.075969	-1.171959	-2.178009	-0.529771	0.285332	0.221396
D(INF)	-5.085595	5.404856	1.062905	-0.984457	-3.759805	-0.198134	-3.713504
D(LOG(OP))	0.041117	-0.070056	0.107182	0.001980	-0.032404	0.026108	0.005059
D(LOG(RGDP))	0.012062	-0.056409	0.121575	-0.059803	-0.183832	-0.348467	0.204544
D(I*)	10.05171	1.111014	11.70317	-3.433998	2.256197	2.190556	1.111398
D(X)	4.788599	5.603828	7.153916	-2.293020	0.310400	3.194992	2.926120
D(D)	0.260241	0.158223	-0.043780	0.057835	-0.127768	0.088545	-0.023546

1 Cointegrating Equation(s): Log likelihood -387.0664

Normalized cointegrating coefficients (standard error in parentheses)

LOG(CSI2)	I	INF	LOG(OP)	LOG(RGDP)	I*	X	D
1.000000	-0.117684	-0.050557	-4.201437	0.609997	0.213039	-0.099198	9.627564
	(0.06900)	(0.01714)	(0.64056)	(0.17314)	(0.03004)	(0.02976)	(0.85874)

Adjustment coefficients (standard error in parentheses)

D(LOG(CSI2))	0.035020
	(0.05993)
D(I)	-0.679702
	(0.42141)
D(INF)	2.567765
	(1.54373)
D(LOG(OP))	-0.020761
	(0.02207)
D(LOG(RGDP))	-0.006090
	(0.08650)
D(I*)	-5.075203
	(1.91408)
D(X)	-2.417809
	(1.58539)
D(D)	-0.131398
	(0.03777)

Modified Parameter Stability Test

Model 2

Dependent Variable: D(LOG(RM2))
Method: Least Squares
Date: 12/03/15 Time: 06:52
Sample (adjusted): 1982 2014
Included observations: 33 after adjustments
D(LOG(RM2)) = C(1)*(LOG(RM2(-1)) - 0.0732527135265*I(-1) + 0.0709547895027*I*(-1) - 0.0275038893806*X(-1) + 0.108905302527*LOG(RGDP(-1)) - 1.56584447304*LOG(OP(-1)) + 2.43179273248) + C(3)*D(I(-1)) + C(4)*D(I*(-1)) + C(8) + C(9) *D1991 + C(10)*D1993 + C(11)*D1998 + C(12)*D2000

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.108622	0.058373	-1.860835	0.0746
C(3)	-0.010644	0.006421	-1.657733	0.1099
C(4)	0.004847	0.002026	2.391722	0.0246
C(8)	0.048243	0.060381	0.798979	0.4318
C(9)	0.012020	0.118584	0.101362	0.9201
C(10)	-0.093079	0.120381	-0.773205	0.4467
C(11)	0.175722	0.128970	1.362500	0.1852
C(12)	-0.047819	0.131524	-0.363578	0.7192

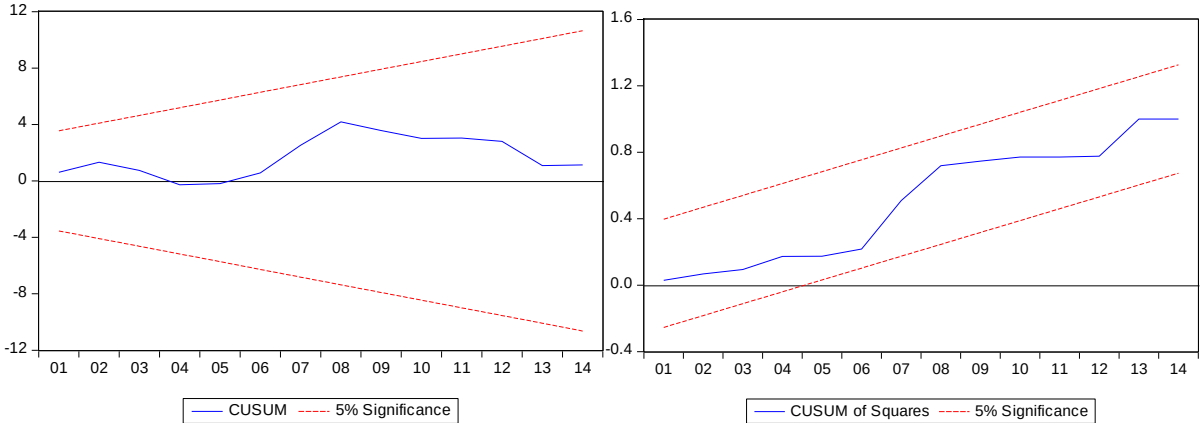
R-squared	0.359944	Mean dependent var	0.059420
Adjusted R-squared	0.180729	S.D. dependent var	0.154894
S.E. of regression	0.140200	Akaike info criterion	-0.884275
Sum squared resid	0.491402	Schwarz criterion	-0.521486
Log likelihood	22.59054	Hannan-Quinn criter.	-0.762208
F-statistic	2.008442	Durbin-Watson stat	2.154197
Prob(F-statistic)	0.094213		

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.236199	Prob. F(2,23)	0.3091
Obs*R-squared	3.203042	Prob. Chi-Square(2)	0.2016

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.714270	Prob. F(12,20)	0.7216
Obs*R-squared	9.899850	Prob. Chi-Square(12)	0.6247
Scaled explained SS	8.104989	Prob. Chi-Square(12)	0.7769



Model 4

Dependent Variable: D(LOG(RM2))
Method: Least Squares
Date: 12/03/15 Time: 07:16
Sample (adjusted): 1982 2014
Included observations: 33 after adjustments
D(LOG(RM2)) = C(1)*(LOG(RM2(-1)) - 0.066085611564*I(-1) +
0.0653190673505*I*(-1) - 0.0306989533548*X(-1) +
0.101992696004*LOG(RGDP(-1)) - 1.44763995871*LOG(OP(-1)) +
1.89973840452) + C(3)*D(I(-1)) + C(4)*D(I*(-1)) + C(6)
*D(LOG(RGDP(-1))) + C(7)*D(LOG(OP(-1))) + C(8) + C(9)*D + C(10)
*D1991 + C(11)*D1993 + C(12)*D1997 + C(13)*D2000

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.155918	0.069670	-2.237959	0.0357
C(3)	-0.013741	0.007235	-1.899350	0.0707
C(4)	0.004546	0.002264	2.007715	0.0571
C(6)	0.004161	0.035195	0.118238	0.9070
C(7)	0.032478	0.128216	0.253309	0.8024
C(8)	0.048439	0.058295	0.830928	0.4149
C(9)	0.068652	0.077956	0.880659	0.3880
C(10)	-0.014623	0.123064	-0.118825	0.9065
C(11)	-0.123409	0.132713	-0.929891	0.3625
C(12)	0.171913	0.115863	1.483768	0.1521
C(13)	0.000864	0.099027	0.008728	0.9931

R-squared	0.396220	Mean dependent var	0.059420
Adjusted R-squared	0.121775	S.D. dependent var	0.154894
S.E. of regression	0.145157	Akaike info criterion	-0.760803
Sum squared resid	0.463551	Schwarz criterion	-0.261967
Log likelihood	23.55324	Hannan-Quinn criter.	-0.592959
F-statistic	1.443711	Durbin-Watson stat	2.189409
Prob(F-statistic)	0.226174		

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.084752	Prob. F(2,20)	0.3571
Obs*R-squared	3.229374	Prob. Chi-Square(2)	0.1990

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.592832	Prob. F(15,17)	0.8428
Obs*R-squared	11.33348	Prob. Chi-Square(15)	0.7286
Scaled explained SS	7.139785	Prob. Chi-Square(15)	0.9537

