AN ANALYSIS OF THE DETERMINANTS OF FOREIGN EXCHANGE MARKET PRESSURE IN NIGERIA: 1995 – 2016

BY

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A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE IN ECONOMICS

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DECLARATION

Ihereby declare that this dissertation entitled, *"An Analysis of the Determinants of Foreign Exchange Market Pressure in Nigeria"* has been carried out by me in the Department of Economics under the supervision of Dr. Aliyu Rafindadi Sanusi and Dr. Lawong Damian Bernsah. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this dissertation was previously presented for another degree or diploma at this or any other institution.

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Name of Student	Signature	Date

CERTIFICATION

This dissertation entitled, "AN ANALYSIS OF THE DETERMINANTS OF FOREIGN EXCHANGE MARKET PRESSURE IN NIGERIA" by Suleiman, Onimisi MAMMAN meets the regulations governing the award of the degree of M.Sc. Economics of the Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This Dissertation is dedicated to Almighty Allah by Whose infinite and unfettered mercy I am able to complete this research work, and to my family for the unwavering support and encouragement they accorded me in the course of this programme.

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ABSTRACT

Due to the persistence of demand pressure in the foreign exchange market in Nigeria in the face of fluctuating crude oil prices, which is the major export commodity and source of foreign exchange in the economy, there has been a severe negative impact on the macroeconomic performance of the country. The study analyzes the determinants of the foreign exchange market pressure as well as the relative impact of the domestic and foreign factors play in Nigeria. To achieve this objectives, monthly time series data from 1995 – 2016 were used. First, to compute an index for the foreign exchange market pressure using alternative methods, and to study the behaviour of the foreign exchange market pressure during the period under review. Secondly, a single equation model of foreign exchange market pressure was developed for the empirical evaluation of the determinants of the foreign exchange market pressure. The Generalized Method of Moments (GMM) estimation was used (with HAC-weighting and covariance) because of endogeniety and heteroskedasticity. The result shows that in order magnitude domestic factor such as level of imports, Domestic credit to private sector and inflation rate with external factor of Global indicator for volatility were statistically significant factors responsible for depreciating market pressure as only external factor of international crude oil prices accounted for appreciating market pressure. It was found on the other hand that capital flows (in the form foreign portfolio inflows) and share returns on All-share index were not statistically significant factors. Furthermore, policy strategies such as Dutch auction systems, devaluation of the domestic currency and liberalization of the foreign exchange market were found to be effective strategies for abating foreign exchange market pressure. The study therefore recommends that government should be cautious of using monetary policy to stimulate the economy as expansionary monetary policy stance could have a negative effect on the foreign exchange market. However, the use of the identified exchange rate strategies such as Dutch auction systems, devaluation of the domestic currency and liberalization of the foreign exchange market could prove effective in mitigating the foreign exchange market pressure.

TABLE OF CONTENTS

		Page
Title page	……	i
Declaration	……	ii
Certification	……	iii
Dedication	……	iv
Acknowledgement	……	v
Abstract	……	vi
Table of Contents	……	vii
List of Figures	……	x
List of Tables	……	xi
List of Appendices	……	xii
1.0 Chapter One: Introduction		
1.1 Background to the Study	……	1
1.2 Statement of Research Problem	……	3
1.4 Objective of the Study	……	6
1.5 Justification of the Study	……	7
1.6 Scope of the Study	……	8
1.7 Organization of the Study	……	9
2.0 Chapter Two: Literature Review		
2.1 Concept of Foreign Exchange Market Pressure	……	10
2.1.1 Measurement of Exchange market pressure	……	11
2.2 Theoretical Literature	……	17
2.3 Empirical Review	……	26

2.4 An Overview of the exchange rate management in Nigeria...…….…….. 36

3.0 Chapter Three: Research Methodology

3.1 Theoretical framework……...…….....……...…… 40

3.2 Conceptual Framework…….....……..…… 42

3.3 Empirical Framework…….. 46

3.4 Choice of EstimationTechnique…….....……. 49

3.5 Data and Sources…….....…… 53

3.6 Limitation of the study……..……. 53

4.0 Chapter Four: Result Presentation, Interpretation and Discussion

4.1 Trend Analysis of Foreign Exchange Market Pressure in Nigeria….....…. 56

4.2 The Empirical Determinants of Exchange Market Pressure in Nigeria…..... 60

4.3 Model Selection……..…...…….....…… 65

4.4 Discussion of Results…….....…… 66

4.5 Summaryof Findings…….....……..…….. 70

5.0 Chapter Five: Summary, Conclusion and Recommendations

5.1 Summary…….....…… 71

5.2 Conclusion…….....…… 73

5.3 Recommendations…….....…… 75

References…….....…….....…. 76

Appendices…….....….....……81

List of Figures

Figure 3.1 Analytical Linkage of Monetary principle to Foreign Exchange Market Pressure in Nigeria

Figure 3.2 Conceptual Frameworks for Foreign Exchange Market Pressure in Nigeria

Figure 4.1 Structure of Foreign Exchange Market in Nigeria

Figure 4.2 Foreign Exchange Market Pressure for Nigeria (1995 – 2016)

List of Tables

Table 3.1 Data and Sources

Table 4.1 General Unrestricted model

Table 4.2 Parsimonious models

Table 4.3 Summary of Instrumental Variables Validity (Orthogonal) and Relevance test

Table 4.4 Summary of variable redundant restriction coefficient test

Table 4.5 Summary of endogeniety test

List of Appendices

Appendix A1: Summary of Various Measures of Exchange Market Pressure (Official Market)

Appendix A2: Summary of Various Measures of Exchange Market Pressure (BDC Market)

Appendix B1: General unrestricted Estimated model 1 (longer sample)

Appendix B2: General Unrestricted Estimated model 2 (shorter sample)

Appendix B3: Parsimonious Estimated model 1(longer sample)

Appendix B4: Parsimonious Estimated model 2 (shorter sample)

Appendix C1: Wald and Redundant variable test for model 1(longer sample)

Appendix C2: Wald and Redundant variable test for model 1(shorter sample)

Appendix D1: Structural Break estimation result

Appendix E1: Results for Instrumental variables validity (Orthogonal) test for model 1

Appendix E2: Results for Instrumental variables validity (Orthogonal) test for model 2

Appendix F1: Results for Endogeneity test for model 1.

Appendix F2: Results for Endogeniety test for model 2.

Appendix G1: Results of Weak Instrument Diagnostic for model 1

Appendix H1: Foreign Exchange from non-oil inflows

Appendix I1: Results of Heteroskedasticity test

Appendix J1: Summary of Descriptive Statistics

Chapter One

INTRODUCTION

1.1 Background to the Study

Excessive Foreign Exchange Market Pressure (FEMP) could be considered as detrimental to domestic economic performance in any developing country, including Nigeria. This is because of its consequences on the value and stability of the exchange rate as it affects every aspect of economic activities through both domestic and foreign transactions. FEMP involves the simultaneous movement in exchange rate and foreign reserves, especially in developing economies where the government has to intervene in the foreign exchange market to abate the pressure either through purchase or sales of foreign exchange reserves depending on the prevailing condition.

The maintenance of a stable exchange rate system is very important in any economy as fluctuations in the foreign exchange market could offset all other markets' performance (such as the money market and capital market) where it serves as a key determinant. Similarly, unstable exchange rate regime could have significant adverse effects on the level of foreign reserves, which is an important policy instrument, especially when operating the fixed, pegged or managed-float exchange rate regime. Thus, an inordinate foreign exchange market pressure could have inauspicious effects on foreign reserves (continuous depletion) and may finally lead to currency crises through speculative attacks, as was experienced in the chain of currency crisis of Mexico 1994, Asian 1997 and Argentina 2001 (Eichengreen, Rose, & Wyplosz, 1996).

Given that the exchange rate in Nigeria is demand driven, as argued by Garba (1997), it could be expected that the market pressure in Nigeria's foreign exchange market is of the depreciating

trait. This is evidence by the concerted depreciation of the domestic currency and fall in the foreign reserves. A number of factors have been identified as responsible for this pressure. These factors have been categorized into both domestic factors and foreign factors as noted in (Frankel & Saravelos, 2010; Aizenman & Binici, 2015).

External supply and demand shocks could be another important cause of foreign exchange market pressure. For instance, a significant fall in the price of key export commodity could significantly reduce the supply of its foreign exchange in the face of constant or rising demand for foreign exchange. It is still argued that when this occur, and concurrently happens in the cause of a prevailing foreign exchange market pressure, the response of monetary authorities plays a decisive role in determining the reaction of foreign capital. The typical reaction is to temporarily devalue the domestic currency and raise interest rate as a way to sustain market confidence. Where the devaluation fails to occur,investors may pull out leading to capital outflow and subsequently accruing more pressure to the already crisis-ridden foreign exchange market.

Other external factors such as foreign policies could also have impact on the foreign exchange market (Aizenman & Binici, 2015). Following the globalization and strong market integration between the developing, emerging and the industrial economies, shocks in the industrialized economies could spillover to the developing economies through some channels such as interest rate and exchange rate (Aizenman & Binici, 2015). This is conceived during the global financial crises where one of its major upshots was the heavy pressure on the exchange rate as well as drastic depletion foreign reserves due to capital flight.

1.2 Statement of Problem

With what is envisage as identification problem of the factors responsible for exchange market pressure in Nigeria, there has been a persistent demand pressure in the foreign exchange market through the instability in exchange rate overtime. This has also lead to difficulty in sustenance of a realistic exchange rate and effective performance of the foreign exchange market in Nigeria. Conversely, in the past decades, Nigeria has practiced various exchange rate regimes such as pegged, floating, fixed, managed float and has switched to a pseudo-flexible kind of exchange rate, but the management of exchange market pressure remains largely unsuccessful.

Changes in the demand for foreign currencies relative to autonomous supply have determined the level of foreign exchange market pressure in the official and parallel market. Rising demand relative to supply causes the foreign exchange market pressure to move towards disequilibrium of depreciating market pressure. This is often douse by Central Bank of Nigeria's timely interventions in the foreign exchange market. The CBN's willingness to intervene in the foreign exchange markets amidst mounting pressure still depends, in part, on the level of its foreign exchange reserves access, which in turn, depends on oil exports proceeds.

The crash of the international oil market has significantly reduced Nigeria's exports revenue given its high import-dependence. Thus, the rising foreign exchange market pressure has caused significant reserves depletion, complicated the macroeconomic management and threatened a major currency crisis. Nigeria's response to the mounting foreign exchange pressure appears to be as complicated as its foreign exchange arrangement.

A key manifestation of the rising market pressure is the tendency of the exchange rate to depreciate[1]. In the aftermath of the recent collapse of the international oil market, which saw Nigeria's foreign exchange earnings significantly fall relative to its imports demand, the central bank of Nigeria had difficulties responding to the shock. On the one hand, the realization that the fall in oil prices appears to be permanent suggests that there is need for adjustment. This is because the mounting foreign exchange pressure would be persistent and foreign exchange intervention at the prevailing rate would only deplete the foreign reserves. This had caused the market to expect such adjustment to come in the form of devaluation causing speculative activities.

On the other hand, the political cost of devaluation has caused the monetary authorities to explore other means of achieving the required adjustment, including trade and exchange control measures. This has caused a raging national debate amongst academics, opinion leaders, policy makers, and the public about the appropriateness of government's response as the foreign exchange market pressure continue to rise.

The debate has been whether to devalue the already depreciating domestic currency or not. Proponents[2] of devaluation in Nigeria argue that the domestic currency has to be temporarily devalued on two counts. First, that in the prevailing condition of the global oil price, the supply of foreign exchange in Nigeria had permanently dropped, and with the foreign exchange reservesfast depleting. In addition, the domestic currency is then supported at an unrealistic official rate with an already developed black market premium of over 100%. They argue that, in addition to conserving reserves, devaluation could also be use to sustain the market confidence

[1] While the parallel market rate can be left, in principle to depreciate significantly, the official rate is allowed to depreciate but closely monitored by the Central Bank. Sustained and unabated pressure will require either shifting the band's central rate (devaluation), trade and exchange control or abandoning the peg altogether.
[2]Chief amongst them is the Former CBN Governor, *SanusiLamidoSanusi*

and reduce capital outflow that adds to the pressure. Secondly, that there was wide exploitable arbitragepremium between the foreign exchange markets following the closure of the Dutch auction system windows, and that devaluation could narrow this margin. Nevertheless, the opponents of devaluation[3]based their argument on ineffectiveness of the Marshall-Lerner principle[4]because Nigeria hardly produces any commodity for export and so devaluation could prove ineffective. Secondly, they claimed that devaluation could lead to increase in inflation in the short-run. In reaction to this, the proponents further argued that although the devaluation is not an all-cure remedy to the deteriorating economic condition but rather a strategy to serve as buffer for the current situation.

Even though there have been various realignments and policy strategies put forth by the monetary authority aimed at managing this pressure, these were considered inadequate in addressing all the strong determinants of this pressure. For instance, authorities appear to have thrown greater weight on the trade sector as most of the policies appear to be moving in that direction (i.e. the restriction to access foreign exchange placed on major import commodities by CBN). Intuitively, this is just one part of the problem, as there tend to be other domestic factors even though they are inarticulate as well as outflows of capital (portfolio) due to the deteriorating economic condition.

The indicators of this pressure in Nigeria had been the movements in exchange rate and foreign reserves as prior to global financial crisis of 2007; the exchange rate was stable when it depreciated more relative to appreciation. While high in January 2004 to about ₦147/$, it appreciated for about 3 months and subsequently maintained the margin of +/-2 to +/-4

[3] chief amongst them are *President Muhammadu Buhari* and the current CBN governor, *Godwin Emefiele*
[4] A situation where a country improves its balance of payment by devaluating its domestic currency which further boosts their exports and reduces their imports

appreciation/depreciation level. On the other side, the foreign reserves moved fairly as it grew from $12.3b in September 2004 to about $23bn in November 2005. With policy allowing the BDC access to funds, the naira appreciated from ₦147.85/$ in April 2006 up Until November 2008 when it averaged to ₦119.1/$ as the foreign reserves also increased tremendously to $63.31b in 2008.

The problem as articulated above raises the following questions:

1.3 Research Questions

i. What has been the trend in Foreign Exchange Market Pressure in relation to the stability of exchange rate in Nigeria?
ii. What are the key determinants of foreign exchange market pressure in Nigeria?
iii. What is the relative role of foreign factors in foreign exchange market pressure in Nigeria?

1.4 Objectives of the Study

The broad objective of the study is to analyze the determinants of foreign exchange market pressure in Nigeria from 1995 – 2016. Nonetheless, the specific objectives are;

i. To characterize the trend and structure of Foreign Exchange Market Pressure in relation to the stability of exchange rate in Nigeria from 1995 – 2016
ii. To identify the key determinants of exchange market pressure in Nigeria
iii. To assess the relative role of foreign factors in foreign exchange market pressure in Nigeria

1.5 Justification for the Study

The management of foreign exchange market pressure is crucial as it helps in the stability of the foreign exchange market. However, several empirical works on exchange rate in Nigeria such as Garba (1997); Obadan (2006);Odusola (2006); Mordi (2006); Auwal (2006); Musa(2012); Adamu (2016) among others focused more on exchange rate volatility and management of exchange rate and in doing so used various exchange rate measures rather than an index for foreign exchange market pressure. This study however takes a different approach by first computing an index for foreign exchange market pressure; identify the various policy strategies of the government in mitigating the pressure and identifying the key determinants (both domestic and foreign factors) of the pressure in Nigeria.

The work of Jimoh, Juzhar and Mohd-Dan (2014) on Exchange Market Pressure in Nigeria focused on the applicability of the Girton and Roper (1977) of exchange market pressure. In addition, the study disaggregated the components exchange market pressure into exchange rate and foreign reserves to look at them independently rather than as a component. But this approach may not capture the trait of the foreign exchange market pressure as the concept involves simultaneous movement in the two. This study however used the aggregation approach of foreign exchange market pressure. Furthermore, the Jimoh, Juzhar and Mohd-Dan study was limited to only domestic factors which might be restrictive considering the integration and globalization of the world economy but this study extend this approach by incorporating external factors as the study assumed that domestic factors alone may not have mustered foreign exchange market pressure.

Some of the previous researches on EMP have relied on the use of structural models such as Vector Autoregression (VAR) model and Cointegration techniques for estimation rather than

direct estimation of model (Hall, Amangeldi, Swamy, & George, 2013). Studies identified with this include; Tanner (1999); Tanner (2002); Garcia & Malet (2005); Mete (2009); Panagiotis (2014) while some works which include Girton and Roper (1977); Weymark(1995); Eichengreen, Rose & Wyplosz (1996); Kumar (2007); Stavárek (2010) used direct estimation of linear and non-linear models. Nevetheless, with the assumption that some of these fundamentals are determined within a system (endogenous) there can be possibility of endogeneity which could generate bias result. Thus, the estimation techniques used by these studies could be said not to be sufficient to take care of these problems especially where the model is assumed to be recursive. Hence, this study addressed this issue by employing the Generalized Methods of Moments (GMM) estimating technique with Heteroscedastic, Autocorrelation and Consistent (HAC) weighting and covariance technique to eliminate any form of heteroskedasticity in the model and ensure both consistency and efficiency of the estimators. Lastly, this study seeks to suggest to government on the most effective policy strategies of abridging excessive foreign exchange market pressure and successful management of exchange rate based on the historical trend evaluation. This will be done through the computation of an exchange market pressure index as have not been done to the best of knowledge of this study in Nigeria.

1.6 Scope of the Study

This study covers the period from 1995 – 2016 in order to cut across many exchange rate policy reforms in Nigeria. This is because Nigeria has practiced different exchange rate regimes such as fixed, floating (flexible), managed float and most currently, flexible-like exchange rate system and so, to know the behaviour the foreign exchange market pressure in Nigeria, it becomes requisite to choose scope that cuts across these various regimes.

1.7 Organization of the Study

The study is organized into five chapters. Chapter One deals with the general introduction of the study area, which includes background of the study, problem statement, objectives of the study, justification of the study, scope and limitation of the study. Chapter Two comprises of conceptual clarification, existing theoretical literature, empirical literature and overview of the area of study. Chapter Three entails the research methodology in terms of the theoretical/empirical framework used for the study, the model specification, estimation technique, limitation of the study and source of data. Chapter Four focused on presentation of results and discussion of the findings and summary of findings. Chapter Five presents the summary of major findings, conclusion and recommendations of the study.

Chapter Two

LITERATURE REVIEW

Introduction

This Chapter reviews the related literature by starting with the conceptual clarifications before reviewing the major existing theoretical works on exchange rate determination and then review of related empirical studies and concludes the chapter with the overview of the management of exchange rate in Nigeria.

2.1 Concept of Exchange Market Pressure (EMP)

Foreign Exchange Market Pressure as a concept was first propounded by Girton and Roper (1977)in the seminal work *"Monetary Model of Exchange Market Pressure Applied to the Post-war Canadian Experience"* when there was a high degree of misalignment between the actual real exchange rate and the level of exchange rate with the absence of central bank intervention. TheGirton and Roper (1977) study defined exchange market pressure as a measure of the volume of foreign intervention necessary to achieve any desired exchange rate target. This implies the degree of money market disequilibrium that must be removed through either exchange rate or foreign reserve but not the two simultaneously. This concept was later formalised by Weymark (1995)who defined it as *"The measures the total excess demand for a currency in international markets as the exchange rate change that would have been required to remove this excess demand in the absence of exchange market intervention, given the expectations generated by the exchange rate policy actually implemented."*Eichengreen, Andrew, and Wyplosz, (1995). added

to the definitional concept, interest rate differentials[5] as a monetary policy intervention tool together with changes in exchange rate and movement in foreign reserves and in addition could be use toward off speculative attacks. Although this last component was suggested as useful by some studies[6] as some[7]argued against it that it could not be incorporated that currency speculators could actually predict the changes and adjust their balances to neutralize the effect. Kumar,(2007) also recognised the effect monetary policy when it viewed foreign exchange market pressure as excess money driven by abnormally large excess domestic currency demand or supply, which forces the monetary authorities to take measures to stem disruptive appreciation or depreciation of the currency.

Foreign exchange market pressure could be describe asthe force that causes an excess demand for a currency relative to its supply (disequilibrium), which consequently leads to depreciation in exchange rate as well as movement in international reserves (Foreign assets) while incorporating interest rate differentials and some monetary components (such as monetary base) Weymark, (1995)&Eichengreen, Rose, & Wyplosz, (1996). It could also go the other way - that is having an excess supply to its demand that could lead to currency appreciation, as well as movement (Inflow) in the foreign reserves.

2.1.1 Measurement of Exchange market pressure

The measurement of exchange market pressure is very crucial as very often, the index could reflect the reaction function of the monetary authority to particular misbalances. While Girton and Roper proposes the use of two components (Exchange rate and Reserve movement),

[5] The difference between domestic interest rate and foreign interest rate
[6] Studies like (Girton & Roper, 1977)(Weymark, 1995)(Jimoh, Juzhar, & Mohd-Dan, 2014)(Stavarek & Marek, 2009)(Aizenman & Hutchison, 2010)(Stavárek, 2010) and (Panagiotis, 2014)
[7] Studies like (Eichengreen, Rose, & Wyplosz, 1996)(Tanner, 1999)(Tanner, 2002)(Garcia & Malet, 2005)(Kumar, 2007)(Macedo, Pereira, & Reis, 2007) and (Mete, 2009)

Weymark while formalizing the Girton and Roper proposition, proposes the use of elasticity index of the two components of Girton and Roper rather than equal weights. Nevertheless, Eichengreen et al. (1996) identified the relevance of interest rate as a policy tool that could be used to wade off speculative attacks. The work of Eichengreen et al. (1996) also indicated that using equal weights could lead to bias result as the more volatile variable could dominate other variables. Hence, variables with higher variance should be given lower weights. This method is known as precision weights (Li, Ramkishen, & Willett, 2006). In addition, Li et al. modified the Weymark methods of elasticity indicating that this method should be the second best approach as sometimes the precision weight method could produce bias result because it could only capture speculative attacks that are successful but not the otherwise. There have been several modifications on works on exchange market pressure. Nevertheless, Li et al. method may have come up with some suggestions, but this method had some key algebraic assumptions[8] that need to be satisfied for its applicability. Where this condition fails, the method could be faulty and hence, it becomes preferable to use the Eichengreen et al methods with fewer assumptions as was modified by Klaassen and Jager (2008)

Based on the analysis above, it is important to breakdown the term foreign exchange market pressure further to get a clearer understanding of the composition of foreign exchange market pressure. Thus, the key related terms include; Foreign Exchange, Foreign exchange market, Foreign exchange rate, Foreign exchange reserves as well as exchange rate regimes.

Foreign Exchange as the first concept implies all foreign currencies with the exception of the domestic currency of a given country. For Nigeria, these foreign currencies include the US Dollar, British Pound Sterling, France Euro, Ghanaian Cedi, Japanese Yen, and South African

[8]See (Li, Ramkishen, & Willett, 2006) for details

Rand among other non-indigenous currency. It could also mean all tradable foreign assets available in a domestic country(Krugman & Obstfeld, 2003). The most common foreign exchange currency used in Nigeria is the US Dollar. These currencies are traded in an institution known as foreign exchange market.

The foreign exchange market could be seen as a financial medium in which foreign currencies are bought and sold with their determined conversion rate(Chand, 2015). It simply means that, the currency of one country is exchange for that of another country in this market. The agents in this market include; individuals, commercial banks, foreign exchange agents, and the central bank. Chand (2015) identified three key functions of this market. They include; Transfer, credit and hedging function.Currently in Nigeria, there are two tiers of foreign exchange market, which are the official market (interbank market) and the unofficial market (BDC/Parallel). For the purpose of this research, foreign exchange market could be seen as a medium which provides the institutional structure through which one or more currencies is exchanged at a rate, either through spot or forward transaction[9].

Foreign Exchange Rate describes the rate at which one national currency exchanges for another currency. This rate is express as the amount of one currency that is necessary to purchase one unit of another currency(Sloman, 2006). For instance, the exchange rate of Nigeria to dollar could be expressed as ₦320 = $1. This rate is usually express in different concepts in terms of their reference and measurability(David & Andrew, 2005). These concepts include bilateral exchange rate, nominal exchange rate and real exchange rate. Bilateral exchange rate means the rate at which you can swap the money of one countryfor that of another(David & Andrew, 2005). This rate seeks to measure the behaviour of one currency against another as nominal exchange

[9]Spot transaction as the name implies is a type of transaction that is done immediately. It is a day-to-day activity while the forward transaction is a type of transaction in which future contracts are traded(David & Andrew, 2005).

rate is the rate at which the currencies of two countries can be exchanged while real exchange rate is the ratio of what a specified amount of money will buy in one country compared with what it can buy in another (David & Andrew, 2005). Alternatively, the nominal exchange rate and real exchange rate could also be expressed in terms of their weights[10]. In Nigeria, the common exchange rate measure used is the nominal exchange rate as expressed in relation to the US dollars and the real exchange rate considers basket of some major currencies.

Foreign reserves also referred to as international reserves are foreign financial assets in the form of gold and currencies held and managed by the central bank of any country(Chobanov, Petrov, & Manchev, 2009). According to *IMF Balance of Payment Manual*, which refer it as those foreign financial assets available to, and controlled by the monetary authorities for financing or regulating payments imbalances or for other purposes. They consist of monetary gold, special drawing rights (SDRs), reserve position in the Fund, foreign exchange, and other claims. Furthermore, changes in the holdings of reserves may reflect payments imbalances or responses to them, official exchange market intervention to influence the exchange rate, and/or other actions or influences (IMF).

Chobanov, Petrov and Manchev (2009) identified some functions of foreign reserves among which the key ones include;

i. *To act as an exchange rate instrument helping to cut fluctuations in the exchange rates of national currency against foreign currencies or maintain a set of exchange rate*
ii. *To act as a liquidity buffer in case of an international financial market crash;*
iii. *To boost stability and confidence in financial markets since reserves are among the foremost indicators monitored by international ratings agencies*

[10]The nominal effective exchange rate is a trade-weighted average of bilateral rates while real effective exchange rate is the nominal effective rate, adjusted for inflation in the home country and abroad. It is an index of a country's price and cost competitiveness in world markets. Robert and John(2004)

Foreign exchange reserves in Nigeria play a key role in the external sector of the economy and so its functions are not limited to what was outline above but in addition, it serves as the major as the country's stock of foreign exchange for financing major imports.

Exchange Rate Regimes is a practice, in which, the government allows the exchange rate to be determined that is, the manner in which a country manages its currency with respect to other (Sloman, 2006). Prominent exchange rate regimes are Fixed, Floating and Managed float[11] exchange rate.Fixed (Rigid) Exchange Rate Regime is an exchange rate system in which the currencies of two or more countries is fix at some level and adjusted only infrequently. This rate is set by the central bank (monetary authority) and it is not allowed to vary in response to fluctuations in supply and demand(Blanchard, Alessia, & Giavazzi, 2010). Under this system, the domestic currency is peg relative to the value of one or more foreign currency. The monetary authority through either devaluation or revaluation manages fluctuations' arising from demand/supply in the foreign exchange market[12]. This system is best suitable when a country has large size of foreign exchange reserves to be able to support the domestic currency during demand shocks. This system was practiced in Nigeria before the introduction of the Second tier foreign exchange market in 1986 and re-introduced in 1993.Otherwise, the floating exchange rate would be the next ideal system.

The Floating Exchange rate regime on the other hand isa system of exchange rate in which currencies are allow to float freely allowing day-by-day movement to balance private sector flows of money across the foreign exchange market(David & Andrew, 2005). Under this system, the rates are determined by the forces of demand for and supply of foreign exchange. The

[11] The managed float is sometimes considered as a type of the flexible (free) float exchange rate system

[12]Devaluation means a situation where the government re-pegs the exchange rate at a lower level while revaluation means when the government re-pegs the exchange rate at a higher level (Sloman, 2006)

government occasionally intervenes in the foreign exchange market whenever there are extreme cases of currency appreciation/depreciation[13]. However, it is difficult to practice pure floating exchange rate system but in a situation where a country faces low reserve level simultaneously with domestic currency facing speculative attacks, the system could be a good option to manage the exchange rate fluctuations as was the situation during the currency crisis in Mexico, Asia and Argentina in the 90s and early 2000s. There are other intermediate exchange rate regimes some of these which were identified in David and Andrew (2005). They include; managed float, target zone, crawling peg, intermediate peg and adjustable peg.

The managed float is a flexible system where although the government does not target a specific exchange rate, it does intervene by buying and selling foreign exchange to try to moderate the fluctuations in the exchange rate. This system is considered as a hybrid between the fixed exchange rate and floating exchange rate system. On the other hand, the target zone is a system that allows the exchange rate to fluctuate but only within certain prescribed bands, as was the case with the European Exchange Rate Mechanism and currently with the Danish krona against the euro. This was also practice in the official market in Nigeria until it was abandon around 2014 for adjustable peg.

Under the Adjustable peg system, a country's currency conversion rate is pegged (fixed) in relation to a stronger currency specifically the U.S Dollars). The pegged rate is adjusted occasionally in an attempt to improve the country's competitive position. The degree of flexibility is usually around 2% and where the pegged rate exceeds this percentage, the government would have to intervene. This was practiced in the official market of the Nigeria foreign exchange market before flexible system in 2016.

[13]An appreciation means an increase in the price of domestic currency in terms of foreign currency. This corresponds to an increase in the exchange rate while depreciation means a decrease in the price of domestic currency in terms of a foreign currency. This corresponds to a decrease in the exchange rate.

The Intermediate peg system is a form of an adjustable peg where a fixed exchange rate is targeted but the system allows flexibility through periodic revaluations. While the Crawling pegis a system, where fixed exchange rate is announced but so too is a profile over time that allows the exchange rate to change in a managed way.

2.2 Theoretical literature

Under this section, a number of theories relating to exchange rate determination were reviewed these theories include; the purchasing power parity theory, the Asset approach to exchange rate determination which comprises of the monetary approach and the portfolio approach and lastly,the Mundell-Fleming model.

The Purchasing Power Parity (PPP) is a theory of exchange rate determination and a way to compare the average costs of goods and services between countries. It views that nominal rates should move to offset differing rates of inflation, that is, that the real exchange rate ought to be constant. The PPP theory was develop from the law of one price (LOOP) framework.

The law of one price states that in competitive markets free of transportation costs and official barriers to trade (such as tariffs), identical goods sold in different countries must sell for the same price when their prices are expressed in terms of the same currency(Krugman & Obstfeld, 2003). For instance, if the naira/dollar exchange rate is ₦100 per dollar, a phone that sells for ₦100 in Nigeria must sell for $1 in U.S. The naira price of the phone when sold in U.S is then (₦100 per dollar) X ($1 per phone) = ₦100 per phone, the same as its price in Nigeria.

The basis for LOOP is arbitrage[14] (premium) such that if phones are cheaper in the U.S, a firm can buy phones in U.S, sell them in Nigeria, and make his profit. This tends to increase the demand for phones in U.S and their supply in Nigeria. This would push up the price of mobile phones in U.S and lowers the demand for them in Nigeria, thereby reducing the price differences between the two countries. Going by the law of one price, this premium will continue until the price of the phone is the same in each country (one price emerges). The law of one price can also be express as;

$$P^i = e_{/\$} * P^i_{\$} \quad \text{.....2.1}$$

While the exchange rate equivalent could be written as;

$$e_{/\$} = {P^i}/{P^i_{\$}} \quad \text{.....2.2}$$

Where $P^i_{₦}$ = domestic price of the commodity, $e_{₦/\$}$ is the domestic exchange rate in relation to the foreign currency while $P^i_{\$}$ is the foreign price of the commodity (using the U.S as reference foreign country). The LOOP may not hold for commodities due some factors see David and Andrew (2005) they include;

i. *transportation costs*
ii. *the border effect*
iii. *pricing to market*

While the law of one price refers to the price of particular commodities, the purchasing power parity applies the law of one price to particular commodities (whether they are tradable or not)(David & Andrew, 2005). The idea of PPP was popularize in 1918 by a Swedish Economist *Gustav Cassel* who made it centrepiece of a theory of exchange rates. The equation of PPP can

[14]An investment strategy taking the form of a simultaneous purchase of an item in one market and sale of it in another with the expectation of a positive return Donald(2002)

be likened to the LOOP but the basic difference is that while the LOOP is restricted to a specific commodity, the PPP is more of a generalized version that spread to all commodities.

Hence, the equation is given as;

$$e_{/\$} = {}^{P}/_{P\$} \quad \text{.....2.3}$$

While the second equation is given as;

$$P_{₦} = e_{₦/\$} * P_{\$} \quad \text{.....2.4}$$

It could be seen that the i^{th}superscript (in equation 2.1 and 2.2) which was the LOOP equation was not in the PPP equation also, the right side of equation 2.4 measures the purchasing power of naira when exchanged for dollar and spent in U.S. The PPP therefore holds when, at going exchange rates, every currency's domestic purchasing power is always the same as its foreign purchasing power(David & Andrew, 2005).

The above analysis is considered as the Absolute Purchasing power parity and it is thus, thought to fail in determining exchange rate in reality. As it is assume that for it to hold, the law of one price must hold. In the same development, the law of one price may not hold for all commodities as the proponents of the PPP also argued that its validity (specifically as a long-run theory) does not require the law of one price to hold exactly. In addition, the law of one price fails to hold for each individual commodity, the argument still holds, prices and exchange rates should not stray too far from the relation predicted by PPP (Krugman & Obstfeld, 2003). Based on this dichotomy; the relative purchasing power parity was introduced.

The relative purchasing power parity (RPPP) states that the percentage change in the exchange rate between two currencies over any period equals the difference between the percentage

changes in national price levels. It thus translates absolute PPP from a statement about price and exchange rate levels into one price and exchange rate changes. It asserts that prices and exchange rates change in a way that preserves the ratio of each currency's domestic and foreign purchasing power(Krugman & Obstfeld, 2003).

Algebraically, the equation could be written as;

$$\frac{(e_{/\$t} - e_{/\$t-1})}{e_{/\$t-1}} = \pi_t - \pi_{\$t} \quad \text{.....2.5}$$

Where $\pi_t = {}^{P_t - P_{t-1}}/_{P_{t-1}}$ (the percentage change in a price level between periods *t* and *t-1*)

This equation could also be written as;

$$\frac{e_{/\$t} - e_{/\$t-1}}{e_{/\$t-1}} = \frac{P_t - P_{t-1}}{P_{t-1}} - \frac{P_{\$t} - P_{\$t-1}}{P_{\$t-1}} \quad \text{.....2.6}$$

In spite the adjustment brought in by the relative PPP, the PPP is still generally considered as weak in relation to monetary and portfolio approach in explaining the complete exchange rate changes especially in the short run and because of some systemic or trend deviations which were identified in Balassa and Samuelson cited inDornbusch (1976). Due to the limitations of the theory not been able to incorporate monetary and financial variable in the determination of exchange rate from the PPP, the Asset approach to exchange rate determination came in. This asset approach was divided into two approaches; the Monetary Approach and the Portfolio Approach(Krugman & Obstfeld, 2003).

The monetary model of exchange rate can be trace to a desire to improve on the ability of PPP to explain the behaviour of nominal exchange rate and an acknowledgement that asset markets as well as goods market will influence exchange rates. The monetary approaches states that exchange rate are determine by relative money demand and supply between two countries(Krugman & Obstfeld, 2003). This model assumes perfect substitutability of capital that

implies perfect capital mobility that is covered interest rate parity (CIP) which holds under the monetary approach. The CIP is a prediction that the gap between two countries spot interest rates should be the same as that between their current spot exchange rate and the current forward rate(David & Andrew, 2005). It further states that because of an arbitrage, it involves riskless transaction. This model derived its framework from purchasing power parity and the demand for money equation. Hence, the equilibrium position is given below as;

Given the PPP equation as $P_{₦} = e_{₦/\$} * P_{\$}$ which was earlier stated, and the money demand equation which is now given as;

$MS = KPY$ ……..2.7

Where MS is money supply, P is the price level; K is the proportion of aggregated national income as Y is the nominal income

$$P = \frac{Ms}{KY}$$ ……..……2.8

Substituting $P_{₦} = e_{₦/\$} * P_{\$}$ in equation 2.8 we have the derivation of the relationship between exchange rate, price level and money supply

$$e_{₦/\$} * P_{\$} = \frac{Ms}{KY}$$ ……2.9

Rearranging equation 2.9, we have the equilibrium position between exchange rate and money supply

Therefore, $e_{/\$} = \frac{Ms}{P_{\$} KY}$ …….....2.10

At this point, external equilibrium is obtained in the economy. It is clear that an increase in money supply causes the exchange rate to increase (depreciate) which causes output to increase due to increase in demand for exports. In the same vein, a decrease in foreign prices is assumed

to increase exchange rate. The monetary model though not able to incorporate all the markets, but it is able to demonstrate the role of monetary variables in determining exchange rate and how this transmits to movement in foreign reserves. Because the monetary approach was develop from PPP model, it was able to demonstrate how changes in both money and goods market account for changes in exchange rate. The monetary approach also captures the role of expectations that is the anticipation of depreciation could lead to decline in real money demand (in other words a more liquid theory of exchange rate) thus increasing price level and through PPP leads to depreciation of the exchange rate. Nevertheless, the monetary theory has limitation of not incorporating to asset and financial variables. These limitations formed the basis for the Portfolio approach(Krugman & Obstfeld, 2003).

The portfolio-balance approach on the other hand states that exchange rate is determined by the relative demand for and supply of domestic and foreign assets (money and bonds). Like the monetary approach, the portfolio balance assumes perfect capital mobility but imperfect substitutability of asset (that is, investors have preference for assets denominated in their own currency since they believed that foreign exchange risk is attached to it.)(Krugman & Obstfeld, 2003).

Under the portfolio balance approach, investors are considered to be risk-averse and hold domestic and foreign assets in order to diversify risk. Therefore, any capital movement that changes the composition of domestic and foreign asset held by private investors will be possible only if there is a change in the expected relative rate of returns of their assets that compensates for the changes in the risk they bear. In other words, foreign investors can be forced to hold a large share of their wealth in domestic bonds and hence accept riskier portfolios only if they

obtain an increase in the expected rate of return on these asset through a devaluation of the domestic currency(Krugman & Obstfeld, 2003).

A purchase (sale) of foreign currency by the central bank which reduces (augments) the ratio between domestic and foreign assets held by the private sector, induces a depreciation (appreciation) of the national currency because investors require a greater risk-premium to hold a large quantity of this currency(Krugman & Obstfeld, 2003). Thus, sterilization intervention alters currency values via portfolio balance effect nullifies the ratio between domestic and foreign assets held by the private sector(Krugman & Obstfeld, 2003). The portfolio approach explains better than monetary and PPP approach in determining exchange rate determination in terms of domestic and foreign asset prices. It shows how the behaviour of investors' could transmit to exchange rate fluctuations. Nevertheless, this approach cannot account for situation where there is capital substitutability and immobility of capital. However, both theories recognise exchange rate as an endogenous variable but not same could not be said of the Mundell-Fleming Model.

The Mundell-Fleming model is considered as an exchange rate determination enters the macroeconomic framework of interest rate and output determination because exchange rate changes affect competitiveness. The model is often consider a close relation of the IS-LM framework as it is built with interaction of money market and goods market but in addition, added the assets market. But unlike the IS-LM curve where interest rate is the key determinant of output and price level, the Mundell-Fleming model assumes a fixed price level (rigid wage level) such that exchange rate is the major determinant in the markets.

Under the Mundell-Fleming model, a monetary expansion leads the LM curve shifting to the right, as this would cause output to increase and interest rate to fall. The fall interest rate thus

leads to fall in capital inflow and an increase capital outflow that consequently leads to balance of payment deficit. This deficit further leads to an upward pressure on the domestic currency that causes it to depreciate. The currency depreciation then stimulates net export implying higher exports and lower imports and finally causing both the IS curve and BP curve to shift to the right resulting to higher output and lower interest rate.

The Mundell-Fleming model was the first to identify the impossible trinities; implying that, it is impossible to have monetary independence, fixed exchange rate and perfect capital mobility. Nevertheless, two out of the three factors can be jointly achieved. Furthermore, with perfect capital mobility a key assumption in the Mundell-Fleming model implies that there is only one rate of interest that the balance of payment can be in equilibrium. Thus, the model is assumed to ignore currency substitution[15] as this may be a big factor that influences money demand in developing countries.

All the theories reviewed at one point in time seek to determine exchange rate. But in spite of their strength, they are not devoid of weaknesses. Hence, it was identified among the theories that monetary expansion either directly or indirectly causes the exchange rate to increase (depreciate). However, there are differences in approach and the markets in their analysis. For instance, the purchasing power parity theory was able to establish a link between exchange rate and good markets between two countries. However, the model's limitations make its applicability difficult. Part of these limitations implies the model is only effective in the long run because fluctuations in price level in the short-run would cause disequilibrium. Secondly, the model only concentrated on the goods market as the model is restricted to exchange rate and

[15] a situation where domestic citizens hold foreign currency (typically U.S dollar) as well as domestic currency, and change their relative hares as circumstances change

price determination, it would be difficult in evaluating this study using the theory, as the index comprises of not only exchange rate. On the other hand, the portfolio-balance approach was able link the exchange rate to asset markets. Similarly, just like the PPP which demonstrated how changes in price level affects exchange rate, the portfolio-balance looked at how changes in demand for and supply of assets transmits to fluctuations in exchange rate. In addition, the model is restricted to capital account side of the balance of payment implying that the model does not also capture the effect of current account. In summary, the model is more of an illiquid model as it deals with assets unlike the monetary model which deals with money.

The Mundell-Fleming model is another good model as it was able to incorporate three markets in its framework (money, goods and asset markets) it was able to demonstrate how changes in exchange account for changes in this market simultaneously and most importantly it was able to identify the impossible trinity. Nevertheless, this model is assumed a static equilibrium model and hence does not capture the dynamic changes resulting from expectations. Lastly,foreign exchange market pressure is a derivation of exchange rate determination and by this; it is no longer anchored on the structural determination of exchange rate but rather a market base analysis. This is because it now a liquidity problem and therefore it becomes imperative to anchor the theoretical framework of this study on the monetary model.

2.3 Empirical Review

A number of studies on exchange market pressure have been identified and Highlighted in table 2.3.1 below. However, these studies have analyzed based on objectives, variables, weights (dependent variable) technique of estimation.

Table 2.3.1 Summary of Empirical Review

Literature on Measure of Exchange Market Pressure							
S/N	***Author/Year***	***Country***	***Objectives***	***Dependent Variables (Weights)***	***Independent variables***	***Estimation Technique***	***Summary of result***
1.	Girton & Roper 1977	Canada	To determine the currency misalignment between Canadian dollar and the U.S dollar	Exchange rate and foreign reserves	Domestic credit, money supply and price level	Ordinary Least Square	That exchange market pressure could be normalized using either the exchange rate or foreign reserves or both
2.	Diana, Weymark. 1995	Canada	To determine the most appropriate measure of Exchange Market Pressure.	Exchange rate and foreign reserves	Domestic credit, money supply, domestic price and output	Two-stage least square	That timely exchange market intervention along with movement in exchange rate helps to ease pressure
3.	Eichengreen, Andrew, & Wyplosz, 1996	20 industrial countries	To Examine the role of interest rate differentials in wading off-speculative attacks during currency crises	Exchange rate, foreign reserves and interest rate differentials	Money market rates, export & imports, current account, gov't budget, nominal gdp, bond yield, nominal stock market index, domestic credit, m2, cpi and real gdp	Probit regression	Interest rate could be used to ward off speculative attacks on currency which could lead to EMP in addition; they showed how currency crises could contagiously move from one country to another.
4.	Jimoh, Juzhar, & Mohd-Dan, 2014	Nigeria	To determine the applicability of the G-R model to the Nigerian economy	Exchange rate and foreign reserves	Domestic price level, real income, interest rate and domestic credit	Dynamic Ordinary Least Square	That among of economic fundamentals, only domestic credit showed significance in terms of determinants of EMP
Literature on relationship between exchange market pressure and some monetary indicators							

5.	Tanner, Evan 1999 & 2002	America, Asian and European economies	To evaluate the role of monetary policy in managing Exchange Market Pressure	Exchange rate, foreign reserves and interest rate differentials	Domestic credit, interest rate and EMP	Vector Autoregressive (VAR)	That contractionary monetary policy could be used to reduce pressure on exchange rate.
6.	Garcia & Malet, 2005	Argentina	To evaluate the impact of monetary policy and economic growth on Exchange Market Pressure	Exchange rate, foreign reserves and interest rate differentials	Lagged EMP, growth rate, monetary base, interest rate and domestic credit	Vector Autoregressive (VAR)	Concluded that among other variables, economic growth plays a crucial role in reduction of exchange market pressure as they have negative relationship.
7.	Francis, Kumar 2007	Kyrgyz Republic	To determine the impact of monetary policy tool on Exchange Market Pressure using a non-linear estimation technique	Exchange rate, foreign reserves and interest rate differentials	Interest rate, exchange rate and reserves	Markov-switching non-linear model	Contractionary monetary through increase in interest rate could ease pressure during depreciation but the reversal policy may not work for appreciation.
Literature on effect of financial system on exchange market pressure							
8.	Macedo, Pereira, & Reis, 2007	Cape Verde, Angola, Mozambique, São Tomé &Princípe and Guinea-Bissau	To determine the impact of financial system credibility and information on Exchange Market Pressure	Exchange rate, foreign reserves and interest rate differentials	Inflation, real exchange rate, import & export growth, M1, domestic credit, public debt, current account and fiscal balance	ARCH and GARCH	that good news lead to low volatility which eases EMP. but, bad news on the contrary, implies high volatility which causes an upward pressure in EMP in addition economic fundamentals such as Domestic credit and interest rate, all accounted for pressure on the EMP
9.	Lopes & Santos,	Mozambiqu	To determine the	Exchange rate,	CPI, domestic credit,	ARCH and	EMP in West African (Cape

	2010	e and Cape Verde	impact of financial system credibility and news information on Exchange Market Pressure	foreign reserves and interest rate differentials	real exchange rate	GARCH	Verde) is lower than EMP in South African (Mozambique) this is because financial credibility is better in the former than the latter.
Literature on Determinants of Long run relationship and some macroeconomic indicators							
10.	Stavarek & Marek, 2009	(Czech Republic, Hungary, Poland, Slovakia)	To determine whether there was a long-persisting excessive Exchange Market Pressure	Exchange rate and foreign reserves	Domestic income, foreign prices, money multiplier and domestic credit changes	Ordinary Least Square model	They found out that unlike some works where interest rate was a significant variable, theirs was that different domestic credit and money multiplier all have a negative impact on EMP as domestic income was positively related to EMP and there was fulfilment of exchange rate stability convergence criterion.
11.	Mete, Feridun 2009	Turkey	To evaluate the long-run relationship between monetary aggregates and Exchange Market Pressure	Exchange rate, foreign reserves and interest rate differentials	M2 and Domestic credit	ARDL model	That real exchange rate appreciation causes exchange market pressure and also money supply (M2) is linked to exchange market pressure such that a high ratio of M2 to international Reserves make countries more vulnerable to speculative attacks.
Literature on Determinants of Exchange Market Pressure							
12.	Aizenman	Emerging	To determine how	Exchange rate and	Trade openness,	Ordinary Least	That despite the large

	&Hutchison, 2010	markets	Exchange Market Pressure is been managed.	foreign reserves	capital account openness, net FDI, exchange rate stability index, total liability	Square model	accumulation of foreign reserves by some of these emerging economies, exchange rate depreciation is been used to manage EMP for fear of loss of reserves
13.	Stavárek, Daniel 2010	Bulgaria, Czech Republic, Estonia Hungary, Latvia, Lithuania, Poland and Slovakia	To determine the factors responsible for Exchange Market Pressure under a flexible exchange rate regime	Exchange rate and foreign reserves	Domestic income, foreign prices, money multiplier and domestic credit changes	Ordinary Least Square model	That though the zone practices flexible exchange rate regime, but EMP is not absorbed alone by changes in exchange rate movement, but also movement in foreign reserves to some extent.
14.	Panagiotis, Vlassis. 2014	Albania and Romania	To evaluate the determinants of Exchange Market Pressure and their relationship.	Exchange rate and foreign reserves	Domestic credit, budget deficit, real exchange rate, reserve adequacy ratio & current account	ARDL model	That while in one country, exchange rate and reserve adequacy ratio was the short run mechanism that drives for convergence in the long, in the other, it is budget deficit. He added that the monetary indicators used in the analysis all had a long-run relationship.
15.	Gilal & Byrne, 2015	Developed and	To determine the impact of capital	Multiple weights	Capital account openness, change in	Least Square Dummy Variable	Capital controls could be an effective tool for EMP in

		emerging economies	control on Exchange Market Pressure		money supply, remittances, growth in income, capital control and inflation	(LSDV)	developed countries more than emerging economies
16.	Aizenman & Binici, 2015	Emerging and OECD countries	To determine between domestic and external factors which account more for Exchange Market Pressure	Multiple weights	Domestic credit, inflation, credit short term external debt, stock returns, VIX, TED Spread, FDI, Portfolio, terms of trade, trade balance, real GDP	Dynamic Panel model	That external factors account for EMP pressure than domestic factors in both OECD and emerging economies.

While there have been various studies on determination of exchange market pressure, there are also issues on the approaches/methods to used in deriving the exchange market pressure index which was to be determined endogenously (as the dependent variable). However, pioneer works of Girton and Roper (1977);Weymark (1995) proposed a two-variable method (variables that include exchange rate and foreign reserves) where studies[16] adopted this method and was classified as model-dependent approach that is based on the structural form of monetary approach to balance of payment. Eichengreen et al (1996). however, proposed a model-independent approach in which a third component (interest rate differentials) was added to the weighting index of EMP. The use of interest rate differentials here was assume to capture the effect of both domestic and foreign monetary policy as studies[17] also adopted this approach. With this, it is further assumed that studies in which the two-method approach was used were restricted to a closed economy study, which ignores the effect of external policies and may not explain the true nature of the EMP.

In addition, the literatures are diverse in terms of objectives with very few looking at the determination of exchange market pressure. Studies like Girton & Roper, (1977); Eichengreen, Rose, & Wyplosz, (1996);Weymark, (1995) and Jimoh, Juzhar, & Mohd-Dan, (2014) looked at the applicability and measurability of the exchange market pressure given little attention to the determination of exchange market pressure. Studies like Tanner, (1999); Tanner, (2002) and Kumar, (2007)focused on the relationship between exchange market pressure and some monetary indicators which assuming a bi-directional relationship and impact analysis among the

[16](Girton & Roper, 1977)(Weymark, 1995)(Jimoh, Juzhar, & Mohd-Dan, 2014)(Stavarek & Marek, 2009)(Aizenman & Hutchison, 2010)(Stavárek, 2010) and (Panagiotis, 2014)

[17](Eichengreen, Rose, & Wyplosz, 1996)(Tanner, 1999)(Tanner, 2002)(Garcia & Malet, 2005)(Kumar, 2007)(Macedo, Pereira, & Reis, 2007) and (Mete, 2009)

variables.Moreover, studies like Macedo, Pereira, & Reis, (2007) and (José & Santos, 2010)looked at effect of financial system credibility on exchange market pressure that is how transparency and news affects the exchange market pressure. Works of Stavarek & Marek, (2009) andMete, (2009)evaluated the Long run relationship between exchange market pressure and some macroeconomic indicators while studies likeAizenman & Hutchison, (2010); Stavárek, (2010); Panagiotis, (2014); Gilal & Byrne, (2015); Aizenman & Binici, (2015)evaluated the determinants of Exchange Market Pressure which is the major focus of this study.

Various models in the form of systems and direct estimation models also dominated the literature with works such as Girton & Roper, (1977); Weymark, (1995); Jimoh, Juzhar, & Mohd-Dan, (2014); Stavarek & Marek, (2009); Aizenman & Hutchison, (2010) and Stavárek, (2010) relying on the use of least square techniques. On the otherhand, studies like Tanner, (1999);Tanner, (2002); Mete, (2009) and Panagiotis, (2014) relied on the use of system and structural models like the VAR and ARDL. The use of the least squares techniques by the first group may prove problematic as the estimates maybe bias due to the non-recursiveness of the variables which least squares may not be able handle. What's more, use of system model as was used by the second group may resolve the endogeniety problem but where not all the variables are endogenous and non-existence of long run relationship; the models becomes difficult in applicability especially when specifically looking at determinants of exchange market pressure. The study of Kumar, (2007) uses the non-linear model with the assumption of different regimes but situation it fails the non-linearity test, then its applicability becomes difficult. In addition, study that incorporated in a single regime may not conform tothe non-linear assumption. The study of Macedo, Pereira, and Reis, (2007);José and Santos, (2010)used the conditional heteroscedastic models (ARCH and GARCH) which is best applicable when modelling volatility as was applied in these works

and applicability may not be suitable outside this purpose. Lastly, study like Aizenman & Binici, (2015) used instrumental variable technique of panel GMM that may take care of endogeniety problem but may not be generalized to a country-specific study. Reckoning the variables used in previous studies, it is still crucial to know the Nigerian experience. For instance, where studies like Girton and Roper (1977); Stavarek and Marek (2009); Garcia and Malet (2005); Gilal and Byrne (2015); Aizenman and Binici (2015) suggested that low economic output could not account for exchange market pressure depreciation, but on the contrary an improvement could ease the depreciating foreign exchange market pressure. All the same, considering the timeline for this study,foreign exchange market pressure is expected to be computed monthly and output measure for this timeframe is not available and hence difficult to take into account the effect of output. The study then assume that output could not account for the pressure but relatively a key variable, which is international crude oil price, could serve as a key determinant.

2.3.1 Gap Analysis in the Literature

To this end, this study has identified the following gaps:

First considering the consensus among the studies reviewed that FEMP is a derivation of exchange rate determination model due to the fact that it is assumed to be a liquidity problem, the methods in terms of measurement of the EMP index as well as the outcomes in terms of direction and signs remain inconclusive. With works like Tanner (1999); Kumar (2007);Macedo, et al. (2007) advocating for monetary intervention either through hike in interest rate or shrinking of money supply also found the effect of interest rate differential to be significant componentof foreign exchange market pressure as first suggested by Eichengreen et al. (1996). Studies like Stavarek and Marek (2009); Stavárek (2010) found no significance in using interest rate differentials as components of Exchange Market Pressure. These inconclusive results, therefore,

forms part of the motivation for the Nigerian experience. Furthermore, this could provide additional evidence on either sides of the ensuing debate. In addition, the study, also seek to inquire whether the behaviour of our variables also conforms to the underlying theoretical proposition.

Secondly, studies have confined in trying to model effect of supply-side on exchange market pressure. This, the study does by incorporating the prices of major export commodities precisely the international price of crude oil. The study also seek a compromise approach from other studies by attempting to look at the both appreciating and depreciating foreign exchange market pressure concurrently rather than the unidirectional approach as adopted in previous studies.

2.4 An Overview of the exchange rate management policies in Nigeria

Prior to 1986, Nigeria was operating a fixed exchange rate regime, which saw the naira pegged rigidly to the dollar. This was possible through the movements of reserves accumulated from the oil boom from (1973 – 1977). The objectives then were to maintain low inflation and ensure price stability, which was necessary for imports of capital goods for the development of the domestic economy. Nevertheless, over the yearsthe naira became over-valued with attendant economic problems such as massive imports of consumer goods, depletion of external reserves, worsening terms of trade and competitiveness of exports, accumulation of payments arrears and debt burden(Central Bank of Nigeria [CBN], 2011).

Due to the fall in oil prices and increased demand for foreign exchange, in 1986, the foreign exchange market was deregulated. Because of its inefficiency in the mechanism used for allocating foreign exchange to ensure stability, the second tier foreign exchange market (SFEM) was introduced later that year. Here, the determinant of the domestic currency was left to the market forces. However, by 1987, there was a unified official market and the Dutch Auction Systems (DAS) was equally introduced. Nevertheless, In spite of these developments, the market was still experiencing persistent increase in demand for foreign exchange against supply. This was the driving force for the introduction of the Bureau-de-Change (BDC) in 1989 as well as the re-introduction of the Dutch auction system(Obadan, 2006).

The BDC was meant to privately source foreign exchange to meet the demand by small end users of foreign exchange and to expand the scope of access; reputable hotels were granted the status of authorized dealers. However, the BDCs were limited to dealing in private or autonomous sources of foreign exchange and from imports finance and speculative activities further increased

the demand pressures at the IFEM with widening exchange rate premium. Thus, interbank procedures were modified to allow for the re-introduction of the DAS in 1990 (CBN, 2011).

The fixed exchange rate was re-introduced again in 1993 and this time the naira was pegged to the U.S dollar. Other policies were implemented to ensure stability in the exchange rate among which include; the centralization of the foreign exchange by the Central Bank of Nigeria (CBN) and restriction of the BDC to buy foreign exchange as agent of the CBN. At the fixed exchange rate of ₦21.9960/$ in 1994, the naira depreciated further under the AFEM to N84.4 per dollar in 1998. In January 1999, the official fixed rate component was abolished leaving the AFEM as the only source of foreign exchange dealings. The foreign exchange market was again liberalised in 1995 with the introduction of the Autonomous Foreign Exchange Market (AFEM) for sales of foreign exchange in Nigeria(Obadan, 2006).

By 1998, the Inter-bank Foreign Exchange Market (IFEM) was introduced and due to the persistent increase in foreign exchange demand, the IFEM was scrapped in 2002 and replaced with the Dutch Auction System. The Retail Dutch auction system was meant to eliminate the wide premium between the official and parallel market; reduction of capital flight among others (Auwal, 2006). The RDAs was replaced with the Wholesale Dutch auction system (WDAs) in 2006 because it could not achieve its objectives of reduction of demand pressure, distortion, and speculation among others (Musa, 2012). In order to ensure the success of the WDAs, the following complementary measures were adopted which included the special intervention foreign exchange sales to DMBs, direct foreign exchange sales to licensed BDCs in April 2006 and further increase in BTA and PTA from $2,500 and $2,000 to $5,000 and $4,000 per quarter, respectively (CBN, 2011)

At the aftermath of the Global Financial Crisis in 2009, there was a sharp depreciation in naira, because of the capital outflows and declining exports of the oil witnessed by the economy. Because of the adverse effect these events had on the autonomous sources of foreign exchange, the CBN became the main source of foreign exchange, and in January 2009, as the pressure on the foreign exchange market increased, the RDAs was replaced with the WDAS. Furthermore, by July 2009, the managed float exchange rate was re-introduced, the Interbank Foreign Exchange market was liberalised while the WDAS replaced the 6 months old RDAs(Monetary Policy Committee [MPC], 2009).

Restrictions imposed on foreign exchange were removed and in addition, the net open position limit for banks was increased to 5% of banks capital base. "Class B" BDC could participate directly in the CBN window, provided they have a valid license (MPC, 2009). But under the WDAS in 2010, renewed demand pressures occasioned by the global economic crisis and abuse of official foreign exchange funds, had a destabilizing effect on the foreign exchange market, prompting the phasing out of the Class A BDCs in November 2010 (CBN, 2011)

With the Quantitative Tampering episode 3 (Q3) of 2013, there was again pressure in the foreign exchange market and there was depletion in the foreign reserves as this was one substantial way to support the naira, and it lasted up to 2014. By the last quarter of 2014, the continuous demand pressure heightened and this coincided with the falling global oil prices. This further forced the monetary authority to shift the mid-point of the official window of foreign exchange market from ₦155 to $1US to ₦168 to $1US; and widen the band around the mid-point of the exchange rate by 200 basis point for $+/-$ 3% to $+/-$ 5% (MPC, 2014).

Following the high demand for foreign exchange with widening margin between the markets, the WDAs/RDAs foreign exchange window was closed. There was a perception that the economy

was heading for a multiple exchange market and there were abnormalities going on. These include; widening premium and sharp practices round tripping, among others. Thus, all foreign exchange demand was channelled to the inter-bank foreign exchange market.

In July 2015, the Centralbank undertook another tighter measure to save the currency and ease the pressure. This, they did, by imposing restriction on 41 import items from access foreign exchange from the BDC. Nevertheless, by 11th January 2016, the Centralbank then relaxed its restriction on commercial banks from accepting foreign exchange deposit, which it did in 2015, and in addition, the Centralbank would stop the supply of foreign exchange to BDC, meaning that the BDC are to source for their fund(s) privately.

2.4.1 Ineffectiveness of Foreign Exchange Market in Nigeria

A number of militating factors has met the performance of foreign exchange market in Nigeria. These factors, which include non-harmonization of the official and parallels exchange rate in the two markets which tend to breed other problems such as; sharp practices, round tripping and wide arbitrage margin. With the existence of the parallel market, which is free floating and less regulated than the official market rate, the exchange rate movement in the parallel market is, unarguably a better reflection of the foreign exchange market pressure in the economy.

Another crucial issue is inadequacy in supply of foreign exchange and this is because the economy depends majorly on the sales of crude oil for its foreign exchange. This commodity is vulnerable to external shocks and a consequential effect of instability in the foreign exchange market. In addition, with the nature of the economy being import-dependent, it tends to demand more foreign exchange than its supply, which causes the demand pressure on the foreign exchange market.

Chapter Three
METHODOLOGY

Introduction

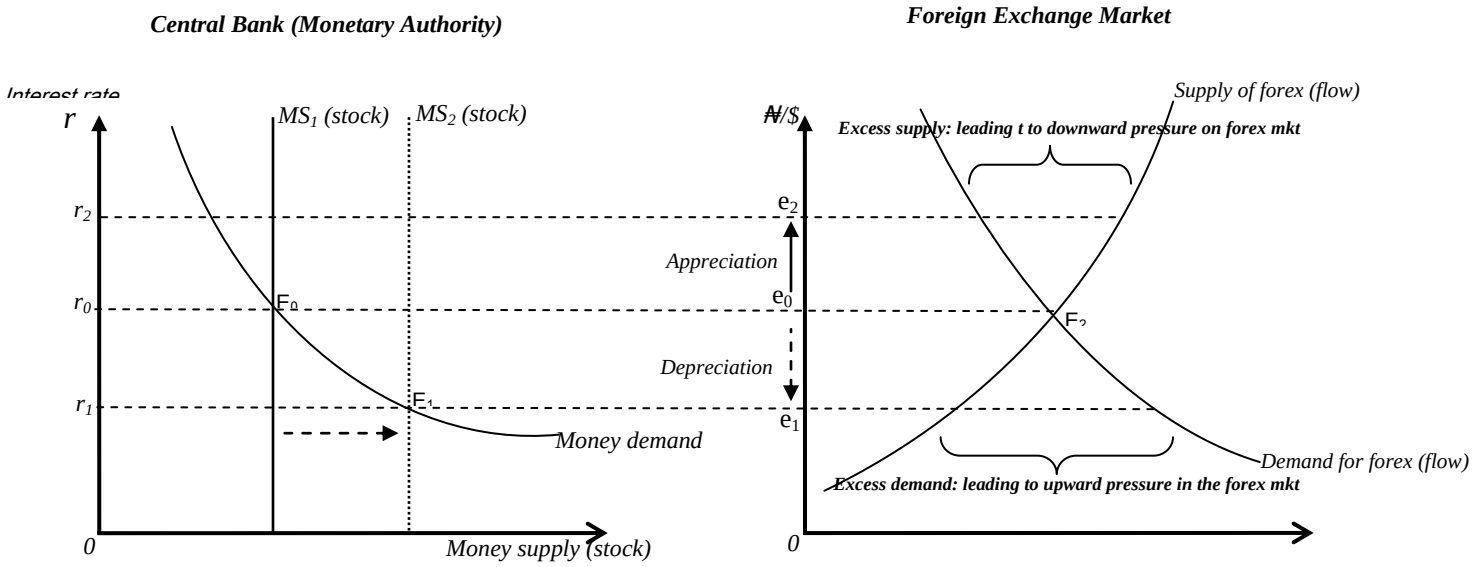
This chapter sets to explain how the main objective; *evaluation of determinants of foreign exchange market pressure in Nigeria*and other sub-objectives were achieved as it provided the conceptual framework, the empirical framework to the model of estimation as well as the data source.

3.1 Theoretical framework

The monetary approach to exchange rate and balance of payment determination provides the suitable theoretical framework for the analysis of foreign exchange market pressure. Indeed, the model of exchange market pressure was derived from this theory. It demonstrates the effect of monetary adjustments to foreign exchange market model as was used also by previous studies on exchange market pressuresee for example; (Girton & Roper, 1977;Weymark, 1995;Eichengreen, Rose, & Wyplosz, 1996). This was able to capture the simultaneous movement in both exchange rate and international reserves. The basic tenet is that exchange rate for two currencies (say naira and dollar) is determined by relative money demand and money supply (market liquidity) between these currencies resulting from changes in the balance of payment (surplus and deficits in the current and capital account)(Krugman & Obstfeld, 2003). Based on this, in line of thinking with the present external supply shock in the global market for export commodity (Oil price), this has led to current account deficit as the import outweighs the export. Due to this development, there tend to be deficit in the capital account due to the view that with capital openness, a weakening commodity export sector reduces the inflow of capital and leaves the foreign exchange market vulnerable to foreign exchange pressure(Gilal & Byrne, 2015). In addition, the monetary approach to balance of payment envisaged that deficits in the current

account should be, rectify by the surplus in the current account. Nevertheless, this may not be true considering the structure of Nigeria economy[18]. TheCentral bank tries to balance these deficits by increasing the money supply through increasing the domestic credit. Figure 3.1 below further explains this transmission. This analysis is done holding factors like price level constant and assuming changes in money supply. This is to enable the study capture the effect of monetary changes (Changes in Money supply and Interest rate) on exchange rate and foreign reserves.

Fig 3.1 Analytical Linkage of Monetary principletoForeign Exchange Market Pressure in Nigeria



Source: Adapted from monetary principle by Author

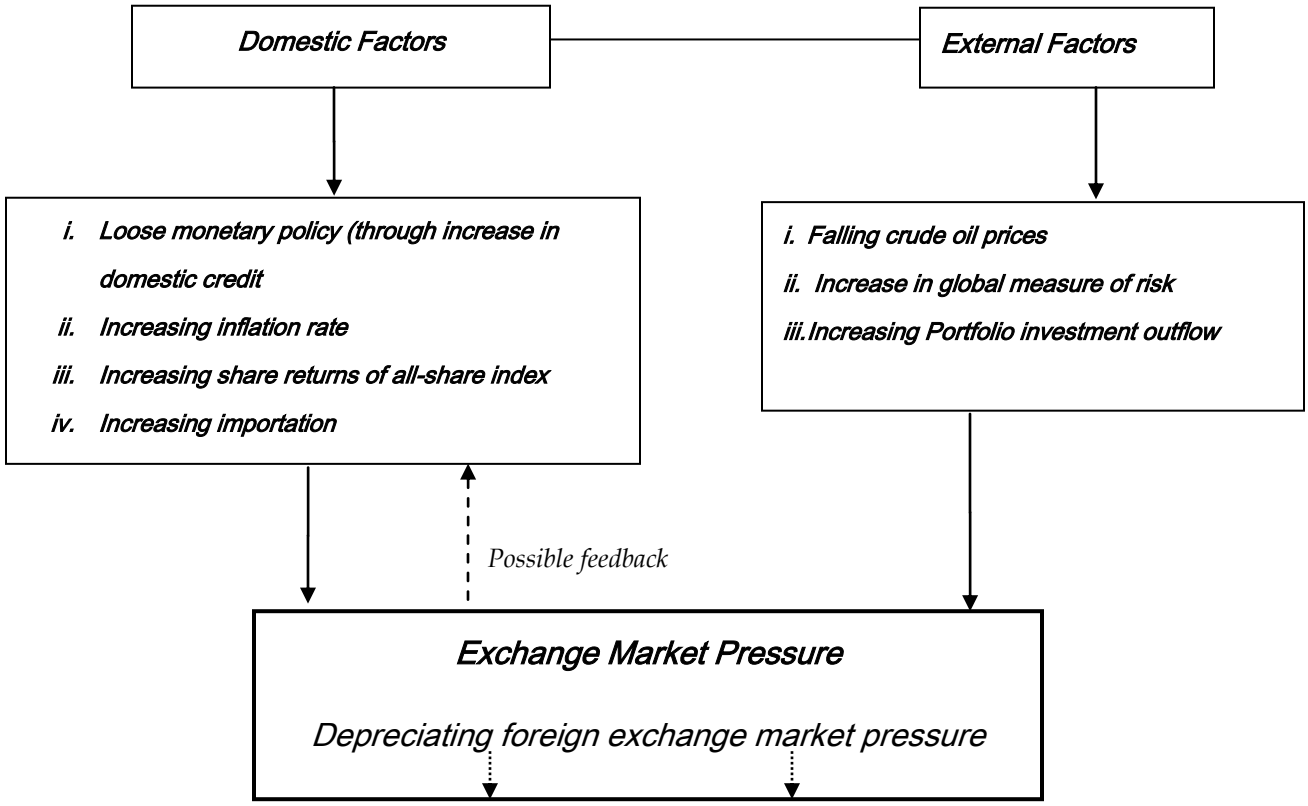
An increase in the money supply (stock) from MS_1 to MS_2 to correct the deficit in the balance of payment would result in the depreciation of the naira/dollar exchange rate from e_0 to e_1 in the foreign exchange market leading to an upward foreign exchange market pressure (as a result of excess demand).

[18]It was also based on this; the monetary approach was modified by the study by incorporating external factor such as the global oil prices. However, the new modification takes the form;
Emp_t = f(domestic factors; dc, inf, imp, asi,, external factors; crude oil, portfolio, vix)

Assuming the market is not a pure floating system and government is not ready to devalue the currency to suppress the pressure, with the government committed to maintain a particular band, it intervenes through the supply of foreign exchange from the international reserves that causes it to deplete. Furthermore, it becomes intuitive to note that decline in interest rate as a result in increase money supply causes investors (foreign) to withdraw their portfolios from Nigeria because of the decline in the rate of return on their interest bearing assets. This process could also results to pressure in the domestic currency because these investors do not leave with domestic currency (Naira).These simultaneous changes in both exchange rate and foreign reserves either upward or downward describe exchange market pressure.

3.2 Conceptual Framework

Fig 3.2Conceptual Framework for Foreign Exchange Market Pressure in Nigeria



Source: Adapted from (Aizenman & Binici, 2015) by Author

This framework is assumed to analyze how exchange market pressure evolves overtime in Nigeria. Thus, this study presumes that the pressure is caused through two channels (the domestic and foreign factors). The domestic factors can be attributed to market-based variables as well as the balance of payment. Under the market-based factors, it is assumed that an increase in domestic credit through increase in money supply could transmit to an upward or depreciating foreign exchange market pressure. Similarly, on the balance of payment, an incessant decrease in export in relation to an increasing import could mount upward demand pressure on the foreign exchange market as outflow of capital either through portfolio flows or through foreign direct investment (FDI) is assumed to have similar effect.

For the foreign factors, due to globalization and integration of world markets, there tend to be spillover effects from industrialized economies to emerging and developing economies like Nigeria. For instance, if the foreign monetary policy is geared towards stimulus, there tend to be inflow of capital (in form of portfolio or FDI) into the emerging and developing economies. Otherwise, the economies would experience outflow as was witnessed during the Quantitative tapering of 2013 (Bernanke's effect). This point forms part of the necessitation for modifying the working theory for the study to suit the condition of the economy of study.

3.2.1 Determinants of Foreign Exchange Market Pressure

There are key factors that have been identified in the literature that are responsible for the upward and downward pressure in the foreign exchange market. Some of these factors could also be linked to those responsible for currency crises see Frankel and Rose (1995);Frankel and Rose (1996);Frankel and Saravelos (2010). Among these factors include; domestic credit, money

supply, capital flow, Price level, share returns on all-share index, oil price, imports and capital controls with external factors such as volatility index (VIX), TED spread and Q.E tapering

The Domestic credit refers to lending or credit that a country or territory's central bank makes available to borrowers within the same country or territory. This may include; commercial banks and even involve the government itself. Thus, Domestic credit to the private sector means that financial resources like loans and non-equity securities are provided to the private sector by financial institutions like banks and other financial corporations, all measured as percentages with respect to GDP (or national size of economy)(Wael, 2014). Thus, the higher this measure, the higher the resources or financing is to the private sector in a country, and so the greater the opportunity and space for the private sector to develop(Wael, 2014). A higher domestic credit also implies that the monetary base would shrink through increase in money supply and thus could result to depreciation of the currency (Girton & Roper, 1977).

Aside the fact that Price level (inflation rate) serves, as a key variable used by most studies such as (Aizenman & Binici, 2015; Garcia and Malet, 2005; Panagiotis, 2014) among others, there is also a strong theoretical link between price level and exchange rate as state by PPP and later modified by the monetary model. This means that an increase in domestic price level could transmit to depreciation of domestic currency. Hence, considering its strong theoretical link, it becomes necessary to include such factor in the determination of the foreign exchange market pressure (Frankel & Rose, 1996; Aizenman & Binici, 2015).

The Share returns of All-share index refers to a series of number which shows the changing average value of the share prices of all companies on a stock exchange and is used as a measure of how well a market is performing. With the possibility of volatility spillover from the stock

market to the foreign exchange market, this can affect the stability of the market and hence could transmit to either demand/supply pressure in the foreign exchange market (Frankel & Rose, 1996; Aizenman & Binici, 2015).

Crude oil prices simply measures the spot prices of various barrel of benchmark crude of either the Brent Blend or WTI (West Texas Intermediate). Nigeria been among the major exporters of the Brent crude in Sub-Saharan Africa is affected by the recent crash in the global oil prices and hence has stiffen its source of foreign exchange. Further noted by Gilal and Byrne, (2015) that a country's weakening could have a negative effect of constricting capital inflows which could transmit into the depreciation of the domestic currency.

Capital Flow refers to the inflow and outflow of capital from one country to another. A country's capital flow is an important component for any economy, especially ones with low domestic savings as it provides additional financing and makes them liquid. Thus, the key components of capital flows relevant to this study include; Portfolio flows and Foreign direct investment (Hegerty, 2009;Aizenman & Binici, 2015). Though studies like[19] have indicated that capital flows especially portfolio flows are responsible for large movements in exchange rate although Foreign Direct Investment (FDI) account for slow movements.

Imports as a variable plays a key role on the exchange market pressure this is because Nigeria as an import-dependent country demands more foreign exchange for international transactions. Similarly, rising imports in relation to declining exports could affect the stability of exchange rate and serve as a contributory factor to the foreign exchange market pressure (Frankel & Rose, 1996; Aizenman & Binici, 2015).

[19]Jean-Louis, Tidiane, and Patrick (2011), Damyana, Sami Ben, and Bassem (2010) and Robin, Hali, Manmohan, and Torsten (2001)

Global indicator for volatility of stock market is a trademark ticker symbol for the CBOE (Chicago Board Options Exchange) volatility index is a popular measure of the implied volatility of S&P 500 index option. It is sometimes refer to as fear index or fear gauge (CBOE). Since it has served as indicator of investor sentiment and market volatility worldwide and often used as measure of risk, it could serves as external factor for the determination of the exchange market pressure (Aizenman & Binici, 2015).

3.3 Empirical Framework

In order to achieve the first objective – estimating the foreign exchange market pressure - the following methods of measuring weighted indices for exchange market pressure, as suggested by Aizenman and Binici (2015), were used. This is because they combined both the traditional and improved methods. These indices then include;

$$emp_{n,t} = \frac{e_t - e_{t-1}}{e_{t-1}} - \frac{ir_t - ir_{t-1}}{ir_{t-1}} \quad \text{3.1}$$

Where$emp_{n,t}$ is exchange market pressure; $e_t$is the exchange rate (local currency per U.S. dollar) and $ir_t$is the foreign exchange reserve (minus gold). The measure here gives a relative change in exchange rate and foreign exchange reserves. This measure was further modified by adding domestic and foreign interest-rate differentials aimed at shoring up the exchange rate pressure (Aizenman & Binici, 2015). Hence, the measure is then given as;

$$emp_{1,t} = \frac{e_t - e_{t-1}}{e_{t-1}} - (i_t - i_t^*) - \frac{ir_t - ir_{t-1}}{ir_{t-1}} \quad \text{3.2}$$

Where $i_t$and $i_t^*$are the money market rate for home and base country (the U.S.).Another measure given again is the difference between exchange rate depreciation/appreciation and foreign

exchange reserves deflated by base money and considered as the monetary model-based EMP, constructed as follows:

$$emp_{base1,t} = \frac{e_t - e_{t-1}}{e_{t-1}} - (i_t - i_t^*) - \frac{ir_t - ir_{t-1}}{mb_{t-1}} \quad \text{3.3}$$

Where $mb_{t-1}$is the monetary base expressed in U.S Dollar. The last one was constructed by taking standardized difference between the exchange rate and foreign reserve changes and shown as:

$$emp_{std,t} = \frac{\Delta e_t - \mu e}{\sigma e} - \frac{\Delta i_t - \mu i}{\sigma i} - \frac{\Delta ir_t - \mu ir}{\sigma ir} \quad \text{3.4}$$

Where $\Delta e_t$and $\Delta ir_t$are the percentage in the exchange rate and international reserves, $\Delta i_t$is interest rate differential, and μ and σ are the mean and standard deviation of respective variables. This study computes all the aforementioned alternative indices for comparative purposes and to determine the most efficient measure of exchange market pressure.

Having derived the Exchange Market Pressure index, the study further superimpose graphically the index on the end of the month actual exchange rate to see how various exchange rate policies aimed at abating the foreign exchange market pressure were successful or not which in line with the first objective. The study then proceeds to the estimation of the determinants of the EMP market pressure, for the attainment of the second objective and third objective. For the third objective, the estimated coefficients were standardized as Beta coefficients to verify the magnitude and role of each determinant.In this regards, the following the model of Aizenman and Binici (2015) for a cross-country analysis, as given below, was adapted for time series analysis;

$$emp_{it} = \beta_0 + \beta_1 emp_{t-1} + \beta_2 X_t + \beta_3 Y_t + \beta_4 Z_t + \varepsilon_{it} \quad \text{3.5}$$

emp_t = Is the exchange market pressure for at time *t*

emp_{it-1} = The lagged value of exchange market pressure

X_t = a vector of domestic factors such as change in real GDP per capita, inflation, change in domestic credit/GDP, trade balance/GDP, short-term external debt/GDP, and stock market returns

Y_t = Includes capital flows (net or gross) as share of GDP, capital controls, and commodity terms of trade

Z_t = Includes external factors such as global liquidity indicators including the TED spread, the VIX, the change in effective federal funds rate, the slope of the U.S. yield curve (the difference between 10-year long term and 3-month short-term yields)

We then sort to evaluate the determinant of exchange market pressure in Nigeria, using this methodological framework of Aizenman and Binici. The choices of these determinants were base on their performance in previous studies and their availability in Nigeria. Hence, our empirical model is then stated as;

$$emp_t = \alpha_0 + \alpha_1 emp_{t-1} + \alpha_2 DCR_t + \alpha_3 INF_t + \alpha_4 Crude_t + \alpha_5 imp_t + \alpha_6 ASI_t + \alpha_7 pfi_t + \alpha_8 vix_t \ldots\ldots\ldots\ldots\ldots\ldots 3.6$$

This equation was further disaggregated into domestic factors determinants and foreign factors determinants thus given below as;

$$emp_t = \alpha_0 + \alpha_1 emp_{t-1} + \alpha_2 DCR_t + \alpha_3 inf_t + \alpha_4 ASI_t + \alpha_5 imp_t + \varepsilon_t \ldots\ldots\ldots 3.7$$

$$emp_t = \alpha_0 + \alpha_1 emp_{t-1} + \alpha_2 pfi_t + \alpha_3 crude_t + \alpha_4 vix_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots 3.8$$

Where equation 3.7 represents domestic inclineddeterminants model, equation 3.8 represents the foreign inclined determinants model. Hence, the variables from equation 3.6 are defined as;

Where the variables are defined as;

emp_t = Exchange Market Pressure at time t

emp_{t-1} = lagged value of Exchange Market Pressure at time t

DCR_t = Domestic Credit to Private Sector to money supply

inf_t = Inflation rate

$crude_t$ = crude oil prices

ASI_t = Share returns of All-share index

pfi_t = Portfolio inflow

IMP_t = level of imports

VIX_t = Global index for volatility of stock market (It is a symbol for the Chicago board option Exchange (CBOE) for stock market returns which shows the market's expectation of 30-day volatility)

$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7, and\ \alpha_8$, Represents the parameters estimated

ε_t = Error term

3.4 Choice of Estimation Technique

Estimating a single equation model has to be done with caution so as not to have a biased result and also to ensure that the result is plausible in terms of being able to mimic reality. Nonetheless, the choice of estimation technique is crucial at this stage considering the objective we ought to achieve. The Classical ordinary least square is considered as the best estimator among other estimators provided all the assumptions (with no serial correlation and heteroskedasticity as key) as argued in(Johnston & Dinardo, 1997). Serial correlation[20] here becomes a key issue as one cannot determined the data generating process of a series in terms of been measured with error or not. Where the independent variable is simultaneously determined with the dependent variable or

[20]When one or more independent variables are correlated with the error term (which might be as result that the independent variable and dependent variable are simultaneous determined or the independent variable is measured with errors)

measured being measure with error, serial correlation becomes inevitable. Logically, it becomes inappropriate to use OLS technique, as it will produce a bias and inconsistent result due to the violation of its assumption. Alternatively, is to use an estimator that would yield consistency and efficiency in the presence of serial correlation. A basic argument is to introduce instrumental variables that are capable of eliminating the correlation between explanatory variables and error term**.** These instrumental variables must be of high correlation with the endogenous variables and not correlated (Orthogonal) with the error term. The choice of instrumental variables becomes crucial too, as weak instrumental variables (relatively low correlated with endogenous variables and partly contained in error) could give in a biased result.

The Two Stage least square (2SLS) is the leading estimator among the instrumental variable estimators as stated in (Davidson & Mackinnon, 1999)**.** The 2SLS finds the portion of endogenous and exogenous variables that can be attributed to the instruments. It involves estimating an OLS regression of each variable in the model on the set of instruments. The second stage is a regression of the original equation with all of the variables replaced by the fitted values from the first-stage regression. The Coefficients of this regression are the 2SLS estimates (Davidson & Mackinnon, 1999)**.** Even though, adding instruments should always improve estimate, this may not be practicable in small sample distributions that forms the basis of the weakness of the 2SLS. Another estimator is the Limited Information Likelihood estimator (LIML) which is similar to the 2SLS but require full information about the distribution of the disturbances. Although, this is assumed to perform better than the 2SLS where there are weak instruments. Getting full information of exact distribution of the disturbances may pose a problem as such the technique of generalized method of moments of *Hansen 1982* was introduced.

Generalized Methods of moment (GMM) is a generic estimator which belongs to a class of estimators known as M-estimators that are defined by minimizing some criteria function as implied in it follows the moment conditions which are functions of the model and variable such that their expected value is zero[21]. The GMM is considered as robust estimator in that it does not require information of exact distribution of the disturbances but has to be identified that is; there must be at least as many instrumental variables as there are parameters to estimate. This then forms the value of our optimized objective function[22]. The GMM has the advantage of being consistent irrespective of the weighting matrix used as it has three basic methods. These methods include; the Two Stage least square which is given by $W_T = (\hat{\sigma}^2 Z' Z/T)$ where $\hat{\sigma}^2$ is an estimator of the residual variance based on an initial estimate of β; the White weighting matrix which is a heteroscedasticity consistent estimator of the long-run covariance matrix of $(z_t u_t(\beta))$ based on an initial estimate of β. Lastly, *HAC-Newey-West* weighting matrix which is a heteroskedasticity and autocorrelation consistent estimator of the long-run covariance matrix of $(z_t u_t(\beta))$ based on an initial estimate of β (EviewsV.9, 2015)**.** Choosing the optimal weighting matrix helps in determining the asymptotic efficiency of the GMM[23]. As noted in(EviewsV.9, 2015) the weighting matrix is dependent on the parameter this because *HAC-NW*, White and 2SLS requires an initial consistent estimate of β even though the latter values are irrelevant since the resulting $\hat{\sigma}^2$ does not affect the resulting estimate.

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[21] $\mathrm{E}\big(m(y_t\beta)\big) = 0$ where m, is the identity function, $y_t$is the variable as β is the parameter

[22] The Objective of the GMM is now to solve $\min_{\hat{\beta}_{GMM}}\{{}^{1}/_{n}\left(Z'(y - X\hat{\beta}_{GMM})\right)'.W_n.{}^{1}/_{n}\,(Z'(y - X\hat{\beta}_{GMM}))\}$ where Z $(vectorofinstruments) = (n \times l)$, X $(vectorofexplanatoryvariables) = (n \times l) W_n(weightingmatrix) = (l \times l)$

[23]The GMM estimator is consistent and $\sqrt{T}$asymptotically normally distributed; $\sqrt{T}(\beta - \beta_0) \rightarrow n(0, v)$

Just like the other estimators, it has a weakness of been bias when there is finite or small sample size distribution as it requires large distribution for the asymptotic efficiency to be attained. The other is the over-identification restriction that is$l > K$. Albeit, considering the objective of the study looking at the determinants of the foreign exchange market pressure where some of these fundamentals'[24] generating processes are unknown that is could be measure with errors it becomes indispensable to use instrumental variable estimator. Furthermore, considering the sample size and the potential of Heteroskedasticity with autocorrelation, 2SLS may not be sufficient as LIML assumption may be difficult also fulfil. However, using GMM may not be detrimental where we could look at the moment conditions of the fundamentals. This is because knowing the effect of the variables has to be able to mimic reality.

3.4.1 Diagnostic Test

To ensure the study does not encounter the problem of misspecification in the model because of the estimating technique. The estimated models were subjected to battery of post-diagnostic tests including validity (Orthogonality) and relevance test; Du-Wu-Hausmann endogeniety tests well as weak instrument tests.

The Instrument Orthogonality test or C-test (*Eichenbaum, Hansen and Singleton (EHS) Test*) was carried to ensure the validity of the instruments. This is to ensure that each instrument selected is uncorrelated with the error term, and is relevant (highly correlated) to the explanatory variables. This was done under the null hypothesis that the instruments used were valid and relevant to the model. On the other hand, Craig Donald *F-statistics* was used to test for the joint weak instruments test, as it does not provide room for individual test. This was done using the

[24] Fundamentals such as Domestic credit, inflation, imports, portfolio flows could also be endogenous in the model

Stock-Yogo critical values at 5%, 10%, 20% and 30% critical values as provided in the software (Eviews V.9).

3.5 Data and Source

Dataset used were obtained from different source and hence summarized in table 3.1 below;

Table 3.1 Data and Sources

Variable definition	*Variables Definition*	*Data source*
$emp_{base1,t}$	Lagged value of $Emp_{base1,t}$	Computed by author
DCR_t	Domestic credit	Central bank of Nigeria statistical database
inf_t	Inflation rate	
$crude_t$	Crude oil prices	
ASI_t	All-share Index	
pfi_t	Portfolio inflows	
IMP_t	Level of Imports	
VIX_t	Volatility Index	Chicago Board Option Exchange

3.6 Limitation of the Study

The study is limited to developing economies such as Nigeria (who is a major exporter of crude oil in the Sub-Saharan Africa). In addition, knowing that econometrics is not desolate of some abstraction, the study tried to ease this by linking each finding to realism as well as carrying out a trend analysis. The stationarity of the series were not determined because the technique is to improve on the estimators rather than the variable. Changing the series property (that is differencing) could alter the performance of the result as the technique is very sensitive to variable changes.

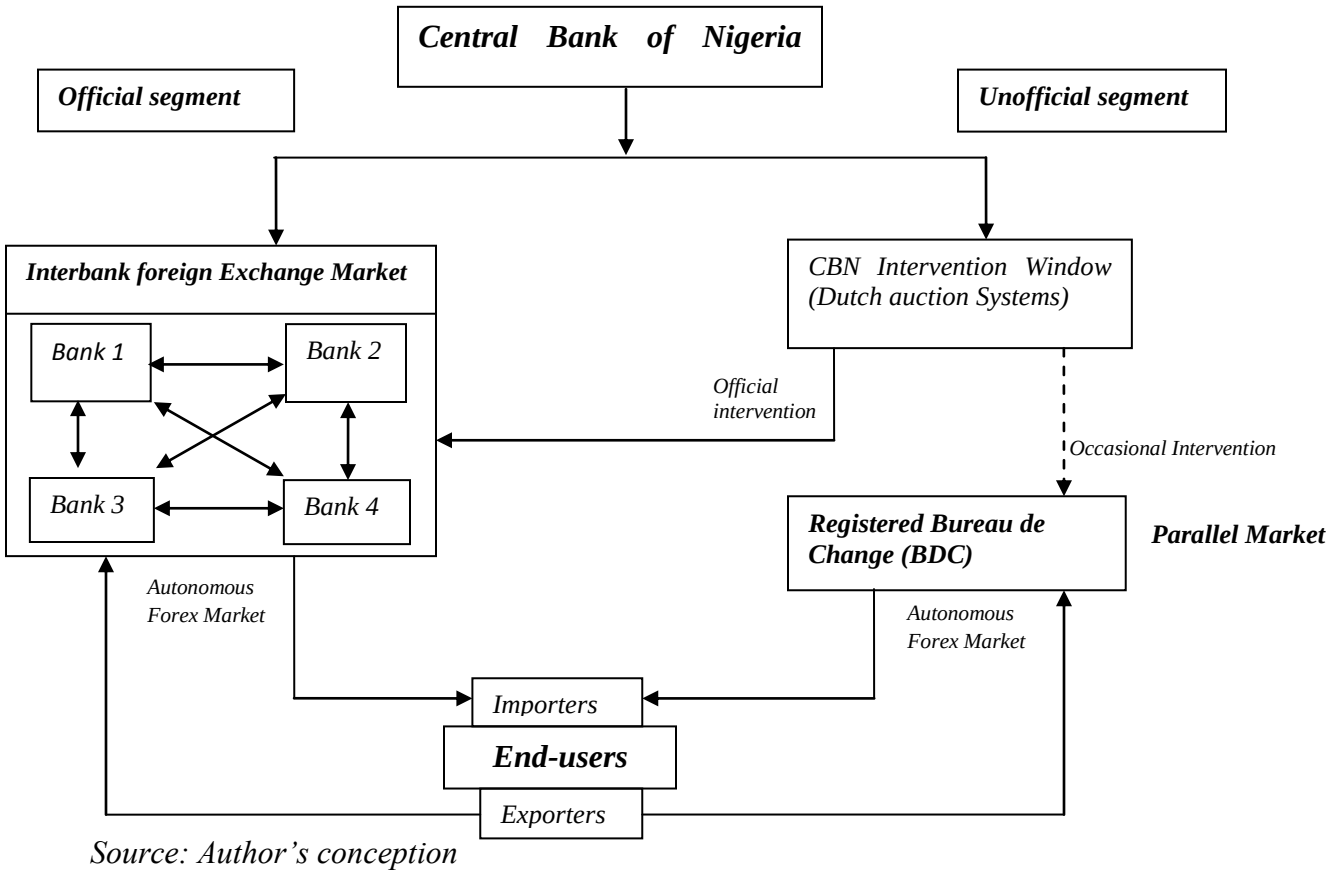
Chapter Four

RESULT PRESENTATION INTERPRETATION AND DISCUSSION

Introduction

This chapter deals with the presentation and analysis of the estimated result based on the model and objectives of the study. It begins with the presentation of the foreign exchange market characterization in Nigeria then followed by the derivation and analysis of trend of the foreign exchange market pressure in Nigeria. Then the empirical analysis based on the estimated results and the analysis of the results.

Figure 4.1 Structure of Foreign exchange market in Nigeria



Source: Author's conception

The schema above explains the institutional structure of the foreign exchange market. From the figure 4.1 above, the central bank regulates and monitors the activities in the foreign exchange market. The foreign exchange market is divided into two markets; the official market and the unofficial market. The official market consists of the interbank foreign exchange market and the intervention window of Dutch auction systems (Wholesale Dutch auction system (WDAs) and the Retail Dutch auction system (RDAs)). The interbank market consists of chains of commercial banks that trade foreign exchange among themselves at a predetermined rate. The Dutch auction system is based on a concealed bidding process where offering price is usually determined through biddings by authorized dealers in an auction organized by the central bank to find the optimal price at which to sell a currency (Ndakko, 2015). The operating of this system can be on retail or wholesale. In the WDAs the authorized dealers are allowed to bid for any amount above the customer's request at the optimal price while in the RDAs, the authorized dealers are only allowed to bid exactly the amount requested by the customers at the optimal price. The WDAs could be very effective for abating foreign exchange market pressure when there is high inflow of foreign exchange. The central bank timely intervenes in the interbank foreign exchange market when the foreign exchange market pressure is high to preserve the domestic currency and occasionally in the unofficial segment (BDC specifically).

The unofficial market consists of the Bureau de Change (BDC) and the Parallel that are less regulated by the Central bank. Nevertheless, unlike the parallel market, the bureau de change rate is determined by the central bank, which is usually ± 3 of the official rate. The BDC were initially meant to source their fund autonomously but due to the dominance of the central bank in terms of receipt of foreign exchange through export proceeds and other sources, as they

occasionally intervene by selling foreign exchange to the BDCs. Just like the official market, the BDCs have limit they can sell their foreign exchange to end-users while the other component which is the parallel market do not have limit they sell their foreign exchange but at a market determined rate. However, both the Interbank market and the BDC/Parallel market are considered to be autonomous as they are allowed to source independently for their foreign exchange and even allowed to receive proceeds from exporter but at a small quantity.

4.1 Trend Analysis of Foreign Exchange Market Pressure in Nigeria

To examine the historical trend of the market pressure, four alternative measures were estimated, as specified by equations 3.1 – 3.4. Each of these equations was estimated using two alternative measures of the exchange rate: official and parallel market rates (see Appendix A1 and A2). The estimates were then subjected to a number of selection criteria, to enable us choose the measure that is most reflective of the actual market pressure in Nigeria over the sample period with May 2008 used as the base month. First, the measures were computed based on the official market rates and were compared with those based on the parallel market rates. A cursory look reveals that the two alternatives are very similar, each having the same turning points. This suggests that, as far as the market pressure is concerned, the parallel markets contain no more information than the official does. We therefore selected the official market measures for further analysis. Of the four alternative official measures of foreign exchange market pressure, the plot shows that two of the measures (EMP_n and EMP_{base1}) are very similar in their characterization of appreciating and depreciating pressures. The other two indices (EMP_1 and EMP_{std}) appear implausible in their characterization of the market pressure because they appear persistent either above the zero line (suggesting depreciating pressure) or below the zero line (suggesting appreciating pressure). We selected the EMP_{base1} as the empirical measure of foreign exchange market pressure for the

purpose of this study because, as noted in the review, its alternative, the EMP_n, has missing component (money base and interest rate differential), and hence less likely to better reflect the role of these components in generating market pressure. The EMP_{base1} was further superimposed with the end of month actual exchange rate to access the success of the central bank intervention at abating market pressure and stability of exchange rate

A cursory look at figure 4.2 suggests that the historical trend can be divided into four distinct phases in terms of the magnitude of the pressure. From the figure, for example, the first phase (1995 – 1997) was characterized by high depreciating foreign exchange market pressure of about 51 points higher than the base index. However, the exchange rate was relatively stable as this was because there was stable inflow of in the non-oil export and significant increase in the autonomous source of foreign exchange as there was drop in the oil export. This must have informed the central bank to switch from the fixed exchange rate to floating exchange and partially liberalize the foreign exchange market with the Autonomous foreign exchange market in place. This strategy could be termed plausible as the exchange rate stable despite the surmounting depreciating foreign exchange market pressure.

The second phase (1998 – 2013) was characterized with a moderate depreciating foreign exchange market pressure (that is not as much as the first phase with 36 points higher than the base index) while the exchange rate was increasing but at a decreasing rate. During this period, the policy strategy was the replacement of the Autonomous foreign exchange market with the interbank foreign exchange market as well as scrapping the Dutch auctions system (Retail) as well. This policy was only able to manage the depreciating market pressure, which it partially achieves at the detriment of the foreign exchange. This strategy must have been informed by the

drop in the non oil export between 1998 and 2001 of about 27.2%[25] and incidentally, the oil export relatively dropped from 1996 – 1998 to about 40.8% but both rather pick-up from 2001. This policy strategy might not have been effective as despite the moderation in the foreign exchange market pressure, the exchange rate was relatively depreciated.

On the third Phase (2004 – 2008), there was a renewed increase in the foreign exchange market pressure even higher than the previous phase with high point of about 38 more than the base index. However, with the intervention of the Central bank, the exchange rate remains stable overtime and further appreciated from 2007m09 to 2008m09. The policy strategy used was the further liberalization of the foreign exchange market. Furthermore, the central bank also introduced the wholesale Dutch auction system (WDAs) in February 2006 while the foreign exchange net open position of banks was reduced from 10% - 5%. In line with policy strategy, there was devaluation of the domestic currency in the first breakpoint (2008 – 2009) in the figure 4.2 below this lead to an instantaneous appreciated pressure in the foreign exchange market. The introduction of the WDAs was made possible with by the increase in the oil export in 2006, which lasted up to 2008. However, the contrary could be said to both non-oil export and the autonomous source of foreign exchange as they significantly dropped from 2004m01 to 2007m07 but picked from 2007m08 to 2008m10.

A lot of diminution in both the foreign exchange market pressure and the foreign exchange rate characterizes fourth Phase (2009 – 2016). This must have been the resultant effect of belligerent effort of the central bank towards reducing the pressure in the foreign exchange market while being conservative with the exchange rate. Nonetheless, the large inflow from the various sources of foreign exchange, which include oil export and non-oil export from 2009 to 2013,

[25]Data from Central bank of Nigeria Database was used for the plot in the appendix H

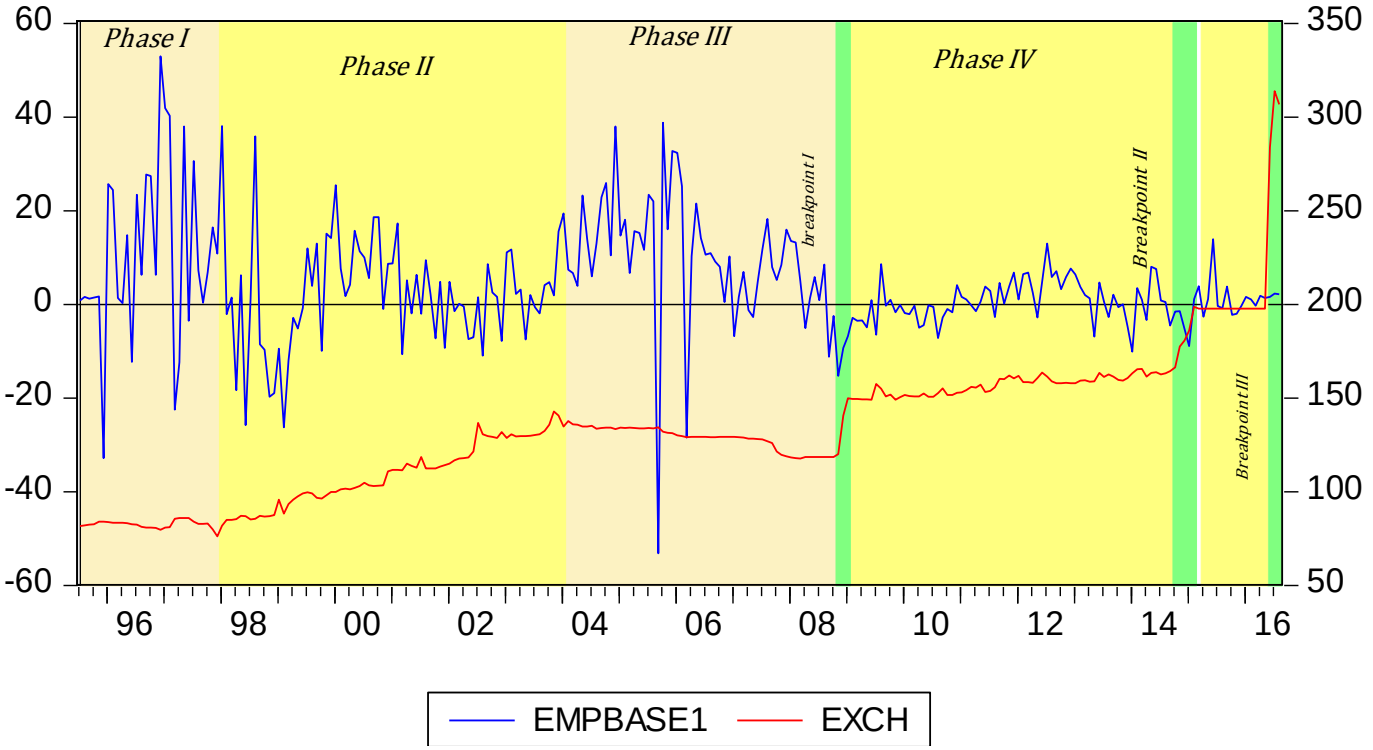
Autonomous sources in 2010 and from 2012 to 2014, aided the effectiveness of the central bank policies. Even though there was a fall in the autonomous source from 2010 to 2012, the policies were sufficient to sustain the prevailing situation of stable foreign exchange market pressure and foreign exchange rate. These policies include the suspension WDAs in January 2009 and replaced with the Retail Dutch auction system (RDAs). This must have been because of the shortfall in the sources of the foreign exchange prior to the period in relation to the high demand for foreign exchange and the high depreciating foreign exchange market pressure.

The central bank must have thought the most appropriate step was to suspend the WDAs which was later restored in July same year when there was inflow of foreign exchange from various sources. Antecedent to this, the central bank had resolved to participate in the interbank foreign exchange market to liberalize the foreign exchange market as soon as the WDAs had been successfully put in place. Furthermore, in 2011, the central bank also increased the policy rate by 275 basis points from 9.25 to 12 as this also attract inflow of capital in form of portfolio flows which boosted the supply of the foreign exchange. In order to sustain the low foreign exchange market pressure there was another devaluation of the domestic currency that resulted to the second breakpoint (2014m10 – 2015m02). In addition to the policy measures, the central bank adjusted the midpoint upwards from 155 to 168 with widening of the band around the midpoint by 200 basis point from$\pm 3\ to\ \pm 5$. This additional strategy was informed by the dwindling oil export as well as the autonomous sources of the foreign exchange.

In summary, policy strategies such as partial liberalization of the foreign exchange market, introduction of the Dutch auction systems (wholesale and retail) and devaluation of the domestic currency have been effective in management of exchange rate and abating foreign exchange market pressure. This was evident in phase one when there was high foreign exchange market

pressure but yet a stable exchange rate. In addition, the third phase was also characterized by high foreign exchange market pressure but the policy stance (Dutch auction systems and devaluation) was able to abate the pressure and effectively manage the foreign exchange rate. However, the policy stance of the second phase may not have been effective as there was persistence in the depreciation of the exchange rate in response to the depreciating foreign exchange market pressure.

Figure 4.2: Foreign exchange market pressure in Nigeria (1995 – 2016)



4.2 The Empirical Determinants of Exchange Market Pressure in Nigeria

Equation 3.6 was estimated over two sample periods: first, the longer sample (1995 – 2016), which is labelled *Model 1*, does not include the portfolio flows as an explanatory variable because the data is not available for the entire length of the sample; data on portfolio flows is

available only from 1995. It is the desire to investigate the role portfolio flows that inform the estimation of the same equation 3.6 over two subsample periods. The second sample (2007 – 2016), which is labelled Model 2, however includes all the variables. Table 4.1 and 4.2 present the general unrestricted and parsimonious estimates of model 1 and model 2. Monthly data set was used in the estimation. This was to enable the study cover as many periods of exchange rate reforms in Nigeria as possible.

Table 4.1 below shows the unrestricted GMM estimates of model for the longer sample that excludes portfolio flows (Model 1) and shorter sample that includes the portfolio flows (Model 2). These estimates appear to have a plausible magnitude with only a few variables appearing insignificant or wrongly signed[26]. Following the traditional practice in model reduction, we applied the Hendry's General-to-Specific methodology to achieve parsimony. Table 4.2 shows the parsimonious models of the determinants of foreign exchange market pressure in which the entire estimated coefficients are statistically significant, conform to the theoretically expected signs and are within plausible magnitudes. The study also conducted a battery of tests on the two alternatives (Parsimonious) models.

The J-statistics serves as an omnibus test statistics was used to test for over-identification restriction under the null hypothesis of well-specified model. The model however passed the over-identification restriction test from the p-value indicating no problem of over-identification in the model[27]. The detailed estimated output is reported in appendix B3 and B4.

[26] Due to the presence of heteroskedasticity of the residual in the estimation, the Heteroscedastic Autocorrelation Consistent (HAC) weighting and Covariance Correlation technique was used. The result of the heteroskedasticity is in Appendix I

[27]The R^2 and *the adjusted* R^2 test statistics are not reported because the GMM technique was used to remedy the presence of endogeniety in the model and further to improve the performance of the estimators as argue by Davidson and Mackinnon (1999). Hence, it was less concerned with how fit the model was. What is more, it is

Table 4.1 General Unrestricted model

Dependent Var.:*EMPbase*	***Model 1. (longer sample)***		***Model 2. (shorter sample)***	
Variables	*Value*	*P. values*	*Value*	*P. values*
C	*33.07*	*0.0001*	*5.361*	*0.816*
EMP_{base}(-1)	*0.21*	*0.0649*	*0.4185*	*0.0007*
Log(crude)	*5.138*	*0.0194*	***-4.6727****	*0.0971*
Log(Imp)	*-3.180*	*0.0027*	***-1.995***	***0.1707***
DCR	*-2.961*	*0.0258*	*-6.2072*	*0.0267*
VIX	*-0.234*	*0.0001*	*-0.166*	*0.0545*
Inf	*-0.114*	*0.0625*	***0.132***	***0.5576***
@pch(ASI)	***-1.104***	***0.7683***	***-5.5393***	***0.1612***
Log(Pf)	***Unavailable***	*-*	*2.921*	*0.0442*
J. Statistics	*12.139*	*0.145*	*14.048*	*0.081*
	Instrumental variables:*c log(imp(-1)) empbase1(-2) empbase1(-3) log(ms(-2)) log(ms(-3)) @pch(asi) @pch(asi(-3)) log(imp) inf(-1) log(crude(-1)) vixdcr(-2) @pch(asi) empbase1(+1)*		***Instrumental variables: c*** *log(imp(-1)) empbase1(-2) empbase1(-3) log(ms(-2)) log(ms(-3)) @pch(asi) @pch(asi(-3)) log(imp) inf(-1) log(crude(-1)) vixdcr(-2) @pch(asi) empbase1(+1) log(pf(-1))*	

Table 4.2 Parsimonious models

Dependent Variable: EMP_{base1}	***Model 1 (longer sample)***		***Model 2. (shorter sample)***	
Variables	*Value*	*P. values*	*Value*	*P. values*
C	*32.976*	*0.0001*	*-26.08*	*0.0932*
$EMPbase_1$(-1)	*0.2125*	*0.0481*		-
Log(crude)	*5.1269*	*0.0156*		-
Log(Imp)	*-3.1837*	*0.0017*		-
DCR	*-2.90*	*0.037*	*-6.256*	*0.0009*
VIX	*-0.2353*	*0.0003*	*-0.139*	*0.1190*
Inf	*-0.115*	*0.0589*		
@pch(ASI)				
Log(Pf)			*2.195*	*0.0045*
J. Statistics	*12.189*	*0.203*	*0.5883*	*0.745*
	Instrumental variables:*c log(imp(-1)) empbase1(-2) empbase1(-3) log(ms(-2)) log(ms(-3)) @pch(asi) @pch(asi(-3)) log(imp) inf(-1)inf(-3) log(crude(-1)) vixdcr(-2) @pch(asi) empbase1(+1)*		***Instrumental variables****: c log(ms(-2)) log(ms(-3)) DCR(-2) log(pf(-1)) vix*	

worth noting that the R^2 and the *adjusted* $R^2$are usually low and sometimes negative as we have seen in the general unrestricted model 2. This is because the Residual sum of squares (RSS) is more often bigger than the Total sum of squares (TSS) when performing an IV related estimation (Davidson & Mackinnon, 1999).

Table 4.3 Summary of Instrumental Variables Validity (Orthogonal) and Relevance test

Model 1 (longer sample model)				*Model 2 (shorter sample model)*		
Instruments	***Difference in J-stat***	***P.value***	***Remark***	***Difference in J-stat***	***P.value***	***Remark***
c	*0.433*	*0.51*	*Valid*	*0.049*	*0.825*	*Valid*
Log(imp(-1))	***3.13*****	***0.077***	*Not valid*	*Not used*	-	
Log(crude)	***4.447*****	***0.035***	*Not valid*	*Not used*	-	
Empbase1(-3)	*0.012*	*0.91*	*Valid*	*Not used*	-	
Empbase1(-2)	*2.71*	*0.10*	*Valid*	*Not used*	-	
Inf(-3)	*n.d*	-		*Not used*	-	
log(ms(-2))	*1.975*	*0.16*	*Valid*	*0.5477*	*0.459*	*Valid*
log(ms(-3))	*1.993*	*0.158*	*Valid*	*0.584*	*0.4446*	*Valid*
log(imp)	***4.74*****	***0.03***	*Not valid*	*Not used*	-	
Inf(-1)	*n.d*	-		*Not used*	-	
log(crude(-1))	***4.26*****	***0.04***	*Not valid*	*Not used*	-	
@pch(asi(-3))	*n.d*	-		*Not used*	-	
@pch(asi)	*n.d*	-		*Not used*	-	
Vix	*1.177*	*0.28*	*Valid*	*0.529*	*0.467*	*Valid*
Dcr(-2)	*2.458*	*0.12*	*Valid*	*0.104*	*0.747*	*Valid*
Empbase1(+1)	*n.d*	-		*Not used*	-	
log(pf(-1))	*Not included*	-		*n.d*	-	

*Note:**indicates that the instruments were not valid (not orthogonal) from their p.values. However, all the instruments were considered relevant to the model. This was done by comparing the J-stat of the restricted and unrestricted model. Also, the study looked at the performance of the coefficients with and without the corresponding instrument. This approach was used, as it was difficult to determine the relevance of an instrument from a test statistics.*

n.d *indicates that test could not be carried out because they have different samples due to NAs in the test series*

null hypothesis *was stated as valid instruments.*

Diagnostic tests

From Table 4.4 below, we could see that all the coefficients from the parsimonious model have passed battery of restriction tests including the Wald and Variable redundant coefficient restriction tests. The study eliminated the statistically insignificant coefficients after failing the restrictions tests and has no effect on the performance of the model. In addition, as shown in Table 4.3, all the instruments used in the parsimonious estimates were subjected to series of diagnostics test that includes Orthogonality C-test, weak instruments test and instrument

summary test, which they all passed under the null hypothesis for valid and relevant instruments. This can be seen in table 4.3 above.

Table 4.4 Summary of variable redundant restriction coefficient test

	Model 1			*Model 2*		
Variables	***Difference in J-statistics***	***P.value***	***Remarks***	***Difference in J-statistics***	***P.value***	***Remarks***
Inf	-	*0.0588*	*Not redundant*	*0.450019*	*0.5023*	*Redundant*
Log(imp)	-	*0.0018*	*Not redundant*	*0.933021*	*0.3341*	*Redundant*
Log(crude)	-	*0.0159*	*Not redundant*	*0.038191*	*0.8451*	*Redundant*
Vix	-	*0.0003*	*Not redundant*	***2.963816*****	***0.0851***	*Not redundant*
Emp_{base1}	-	*0.041*	*Not redundant*	*1.809613*	*0.1786*	*Redundant*
@pch(asi)	*0.031952*	*0.8581*	*Redundant*	*0.001693*	*0.9672*	*Redundant*

Note: *the redundancy was tested under the null hypothesis that variables are not significant. However, aside @pch(asi), all remaining variables such as inf, log(imp), log(crude), vix and Emp_{base1} were considered non redundant from their p.values and were not subjected to further redundancy test (reason for no report of difference in J-statistics) for model 1.*

******** *This variable was statistically significant at 10% but it passed the test of not being redundant*

The parsimonious models were finally subjected for endogeniety and simultaneity tests as shown in table 4.5 below. This was to indicate whether some of the explanatory variables were endogenous as well as to justify the use of the GMM technique instead of OLS. This was because OLS estimators tend to be biased in the presence of endogeniety. The results indicate that the included variables in the model are endogenous, confirming that the study has used the appropriate technique.[28]

[28]The statistics for the Over-identification test could be found in the J-statistics of the estimated model while the detailed results for other test results such as Wald, Redundant, Endogeniety test and the series of instruments tests are in the appendix C, E, and G

Table 4.5 Summary of endogeniety test

	Model 1			*Model 2*		
Endogenous variables	***Difference in J-statistics***	***p.value***	***Remarks***	***Difference in J-statistics***	***p.value***	***Remarks***
Empbase1	*14.69428*	*0.0021*	*endogenous*	*Not used*	-	-
Dcr				*3.054288*	*0.0805*	*Endogenous*
Inf				*Not used*	-	-
Log(pf)	*Not used*	-	-	*3.395120*	*0.0654*	*Endogenous*

Note:*Null hypothesis was stated as exogenous variables*

At this point, it is worth noting that the variable, crude oil prices, had a wrong sign and was statistically significant in the second model see table 4.1. This is surprising and counter-intuitive. In trying to address this issue, we took its first difference as well as its log difference after which; its instruments were changed yet the problem was not remedied. Furthermore, we checked for structural break[29] but still there was no improvement. However, it did not enter the parsimonious model after failing the relevant coefficient restriction tests in the third stage. In addition, several variables such as inflation rate, level of imports, share returns of all share index did not enter the parsimonious model 2.

4.3 Model Selection

Having estimated two alternative parsimonious models for determinants of foreign exchange market pressure (Table 4.2), in this section, we chose the best parsimonious model for the purpose of interpretation[30]. However, since the objective of the study lies on the predictive power of the estimators and being unbiased, this will serve as a good criterion for the choice of the model. Secondly, the technique was used because of the potential problem of serial correlation,

[29] The structural break test carried out to see whether the breaks must have accounted for the change in the sign of the coefficient. The result is given appendix D1 below.

[30]There are statistically criteria for Model selection criteria which include; *Akaike Information criteria (AIC),Schwarz Information criteria (SIC)* R^2, adjusted R^2, *Mallow's* $C_p$among others (Kadane & Lazar). Nonetheless, some of these statistics could not be reported from the estimated based on the estimation techniques.

the Durbin Watson statistics could serve as another good selection criteria and lastly, we look at the conformity of the two models to theory that is which best mimic the theoretical framework for the study in terms of fundamentals, their sign and magnitude.

Based on the outlined criteria above, the *J-statistics* and their respective probability levels indicates that they are both good models as their respective values are 12.19 (0.20) for model 1 and 0.59 (0.745) for model 2 with *p.values* in parenthesis. Nevertheless, base on the magnitude of their *p.values*, the second model (higher *p.value*) is better than the first model. The second criterion, which is based on the Durbin Watson (DW) statistics, showed that Model 1 with DW value of 2.35 performed better than Model2 with value 1.55. This criterion is important as the technique seeks to reduce the serial correlation to avoid obtaining a bias result.

Finally, on the theoretical ground, with the exception of share prices of all-share index, all other theoretically informed variables were statistically significant with their correct signs and plausible magnitudes. However, the second model could not meet the full theoretical expectation as only domestic credit and portfolio flows were statistically significant, thus, implying that the model has failed to explain the determinants of the foreign exchange market pressure. Based on the aforementioned evaluation, it becomes clear that model 1 is the most appropriate model for the analysis.

4.4 Discussion of Results

For convenience, estimated parsimonious Model 1, which is selected for interpretation, is re-produced below[31]:

[31] It should be noted here that the dependent variable is assumed to be an appreciating exchange market pressure. This conversion was done while standardizing the exchange market pressure index.

$$EMP_{base1,t} = 32.98 + 0.21Emp_{base1}(-1)_t + 5.13log(crude)_t - 3.18log(imp)_t - 2.90Dcr_t - 0.24log(Vix)_t - 0.12Inf_t \quad \text{.....4.1}$$

As can be seen from equation 4.1, the coefficient of the lagged value of exchange market pressure appears with the expected sign suggesting that a unit increase in the lagged value of the market pressure increases the current value by 0.21 units, indicating some significant persistence. This implies that if the previous market situation was a depreciating market pressure, there is tendency for the consistence of the pressure in Nigeria. This is in line with the findings of Aizenman & Binici (2015) for emerging economies.

The coefficient of crude oil prices, which served as supply side factor in the model, was correctly signed and is statistically significant. This suggests that an increase in crude oil price leads to an appreciating exchange market pressure (or, suppresses the depreciating exchange market pressure) by about 0.05 units[32]. This is because an increasing price of the crude oil as a major export commodity increases the foreign reserves that could then be used to subdue the prevailing depreciating market pressure through the CBN's intervention in the foreign exchange market. This is in line with study of Syed, Alfred& Perry (2015), which suggests that oil-exporting countries tend to enjoy some appreciation of their exchange rate during a demand shock in the global oil market. However, crude oil prices are not determined domestically, hence, it is considered as an external factor since Nigeria belongs to the cartel OPEC (Organization of Petroleum Exporting Countries) that can influence the prices or quantity of production.

[32]Variables such as crude oil prices, imports and portfolio flows were logged, as DCR was the ratio of domestic credit to money supply. In addition, EMP_{base1} could not be logged because it contains some negative figures. However, for interpretational convenience, we divide the coefficients of these variables by 100. Inflation rate was not logged due to some technical issues obtained encountered during estimation. However, each value in the series was divided by 100.

The level of imports also has the theoretically expected sign with plausible magnitude and statistically significant. The coefficient indicates that a unit increase in the level of import produces depreciating market pressure (alternatively reduces the appreciating market pressure) by about 0.032 units. This is plausible because an increasing level of imports leads to increase in the demand for foreign exchange in that market that further result to a depreciating market pressure. This is in line with study of Frankel & Saravelos, (2010) which suggests that the import ratio to GDP have a negative relationship with an appreciating foreign exchange market pressure. This further suggests that the rising dependence on importation across the various exchange rate regimes has not been detrimental to the foreign exchange market pressure through the rising demand for foreign exchange.

The ratio of domestic credit to money supply is statistically significant with plausible magnitude. This suggests that a unit increase in the domestic credit leads to depreciating exchange market pressure (or alternatively increases the depreciating exchange market pressure) by about 2.90. This implies that loose monetary policy could inform a prevailing depreciating exchange market pressure. This result also supports the monetary theory that monetary expansion could deplete the foreign reserves and has a chain effect on the exchange rate (depreciation). This lends support to the findings of Aizenman & Binici (2015); Stavárek (2010); Francis (2007); Macedo, Pereira, & Reis (2007) where the latter study also indicated that monetary expansion raises the volatility of the exchange market pressure. However, Stavarek & Marek (2009); Garcia & Malet (2005) found no signicant effects of monetary expansion on the market pressure.

The coefficient of inflation rate was correctly signed and significant. This implies that an increase in the level of inflation leads to a decrease in the appreciating exchange market pressure (or alternatively increases the depreciating exchange market pressure) by about 0.0012 units.

This is plausible because a rise in inflation could cause economic agents to increase foreign currency hoarding to take advantage of dynamic arbitrage or as currency substitution increases. This also lends support to the findings of Aizenman andBinici for emerging markets.

The coefficient of indicator for global stock market volatility, which was a measure of risk is also correctly signed and is statistically significant. Thus, a unit increase in the global stock volatility tends to increase the depreciating exchange market pressure by about 0.24 units. This implies that a higher expectation (risk value) in the global stock market could spillover to domestic economy thereby leading outflow capital. This variable served as an external factor in determining the market pressure.

In order to know the relative role as well as the dominating determinants of the foreign exchange market pressure, the estimated coefficients were standardized[33]. It was calculated by pre-multiplying the coefficient of each factor with their respective standard deviation and dividing it by the standard deviation of the dependent variable ($EMPbase_1$)[34]. The equation of the standardized coefficient is given below;

$$EMP_{base1,t} = 0.21Emp_{base1}(-1)_t + 0.29log(crude)_t - 0.32log(imp)_t - 0.13Dcr_t - 0.15log(Vix)_t - 0.06Inf_t \quad \text{.....4.2}$$

From equation 4.2, Considering the size and sign of the coefficients, the determinants with negative relationship on appreciating exchange market pressure are in order of strong role by imports, volatility index indicator (foreign factor), domestic credit and inflation while only crude prices which is an externalfactor accounted for positive relationship. By implication, it simply

[33]Standardized regression coefficients reflect the standard deviation change in a criterion variable associated with a standard deviation change in predictor-criterion relationships across studies in which the variables have been measured using different units of measure commonly known as beta weight (Landis, 2014).
[34]Summary of the descriptive statistics containing the standard deviations is in Appendix J1

means that domestic factors accounts for the depreciating market pressure especially the level of imports and its liquidation of the economy (domestic credit) as increase in crude oil prices tend to suppress the depreciating market pressure

4.4 Summary of Findings

From the analysis above, the findings are then summarized as follows;

i. From the trend analysis for Foreign Exchange Market pressure and the official exchange rate, the study was able to determine the effectiveness of Central bank interventions in abating the foreign exchange market pressure and management of exchange rate. However, policy strategies such as liberalization of the foreign exchange market, introduction of Dutch auction systems and devaluation of the domestic currency appears to be effective.

ii. The study was able ascertain the determining factors of foreign exchange market pressure and non-determining factors. These determinants include past value of foreign exchange market pressure; crude oil prices; level of imports; inflation and global indicator for volatility of stock market (measure of risk). However, against intuition, factors such as portfolio inflows and share returns of All-share index show were not significant in determining foreign exchange market pressure.

iii. Lastly, the study was able see the relative role of the foreign determinants of foreign exchange market pressure, which include the crude oil prices domination that accounts for appreciating market pressure although it is second to the domestic factor of level of imports and then global index for volatility of stock market (another foreign factor), domestic credit and inflation which all accounted for depreciating foreign exchange market pressure.

Chapter Five

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The study attempts to address three empirical issues relating to the determination of foreign exchange market pressure. The first relates to the best way to measure the pressure, since it is an unobservable phenomenon, and undertaking a historical review of the extent to which the various foreign exchange management strategies implemented during the period under review have succeed in insulating the Naira exchange rate from the foreign exchange market pressure. The second empirical issue relates to the identification of the empirical determinants of the foreign exchange market pressure in Nigeria during the sample periods. The final empirical issue examined in this study is examination of the relative dominance of external or internal factors in determining foreign exchange market pressure over the sample period. In Chapter One, the study provided the justification for the study while arguing that external factors such as crude oil prices and capital flow (portfolio flow) are key external fundamentals in determining foreign exchange market pressure. Chapter Two provided the overview of foreign exchange management in Nigeria and the various strategies used by the central bank to manage the foreign exchange market pressure. This chapter also provided the conceptual and definitional issues for the foreign exchange market pressure that include exchange rate, international reserves and interest rate differentials as well as the existing theories on exchange rate determination that explain the foreign exchange market pressure. It also reviewed critically the available studies on the foreign exchange market pressure and its determination. Because the issue is often viewed as a monetary phenomenon, the study argued that the monetary approach was the most suitable framework for

the study. Chapter Three presents the measurement issues regarding foreign exchange market pressure and presents a model establishing a nexus between the foreign exchange market pressure and the identified fundamentals. In order to avoid the potential issues of endogeniety, because of some of the domestic variables such as domestic credit, inflation may be endogenous; the study chooses the Generalized Method of Moments (GMM) among other instrumental variables techniques as the estimation technique. In Chapter Four, the study conducted a trend analysis of the computed exchange market pressure index. In addition, the chapter examined the trend relationship between foreign exchange market pressure and the exchange rate in order to draw less to indicate the effectiveness of the central bank intervention in managing the foreign exchange market pressure. In this chapter, the model was estimated using two alternative samples, the shorter one included portfolio flows while the longer sample did not. Using the General-to-Specific procedures, the parsimonious state of the two alternative models were estimated. Using the traditional model choice criteria, the model estimated over the longer sample, which excludes portfolio flows, is selected, thus, identifying the empirical determinants of the foreign exchange market pressure in Nigeria during the period under study. These determinants include domestic factors such as domestic credit, level of imports, inflation rate and share returns on All-share index. On the external factors, only crude oil prices were found to be associated with an appreciating foreign exchange market pressure while global indicator for volatility (which was a measure of risk) also as an external factor was negatively associated with an appreciating exchange market pressure. However, the past value of the foreign exchange market pressure tends to move in the same direction. This was expected as it signifies the role of market forces. In summary, the objectives were answered in the following ways:

i. Objective one was achieved through the first part of the chapter four where we try to compute an index and evaluate the indices to come up with an appropriate one. However, the measure with relative to monetary base was seen as more effective among others as it clearly shows the movement between positives (depreciating pressure) to negatives (appreciating pressure). The index was use afterwards to identify the causes and policy effectiveness of the central bank.

ii. Objective two was achieved by estimating models where the study was able to identify the key determinants of the foreign exchange market pressure. This included the fundamentals from the parsimonious model that are embedded in both domestic and foreign factors. This include; the previous value of exchange market pressure, crude oil prices, level of imports, domestic credit, inflation rate and global indicator for volatility (measure of risk).

iii. Objective three was achieved using the standardized coefficients from the estimated model where crude oil prices dominated the foreign factors then followed by the global indicator for volatility (measure of risk). Interestingly, only crude oil prices accounted for appreciating exchange market pressure.

5.2 Conclusion

The study was to evaluate the determinants of exchange market pressure in Nigeria having indicated the presence of pressure in the foreign exchange market. This then motivated the study to identify the key determinants and their relative roles in the market pressure. Three key conclusions arise from the study:

i. Evidently, there has been presence of foreign exchange market pressure in Nigeria over the years and this has been a menace to the stability of foreign exchange rate in Nigeria. However, the then policy strategy of the central bank such as the Dutch Action systems (wholesale and retail) has been effective in insulating the exchange rate from the vagaries of the market, especially during periods of high inflow of foreign exchange. In addition, strategy such as devaluation of the domestic currency has also proven effective as the exchange rate attain some stability afterwards especially in periods of enduring foreign exchange market pressure.

ii. Secondly, the key fundamentals responsible for foreign exchange market pressure in Nigeriainclude domestic factors such as the past value of the foreign exchange market pressure; crude oil prices; inflation rate; level of imports and foreign factors such as crude oil prices and global index for volatility of stock market prices. Nevertheless, domestic factor such as share returns of all share index and external factor such as portfolio flows were not responsible found to have significant influence on foreign exchange market pressure. In addition, it possible the portfolio inflows were held by the Central bank and not placed in the foreign exchange market. By this, the Central bank would be able avert the potential effect of portfolio outflow on the foreign exchange market pressure from the economy. Furthermore, the non-significant effect of share returns of all-share index indicates on foreign exchange market pressure non volatility spill over between the stock market and foreign exchange market that is, effect shocks in the stock market may have no consequential effect on the foreign exchange market.

iii. Lastly, the two external factors have different roles in the foreign exchange market pressure. For instance, an increases in the crude oil prices leads to reduction in the depreciating foreign exchange market pressure while increases in the global index for volatility of stock market prices lead to increase in the depreciating foreign exchange market pressure.

5.3 Recommendation

The recommendations from this study are as follows;

i. Having identified the various policy strategies deployed across various foreign exchange regimes for abating foreign exchange market pressure and stability of exchange rate with their underlying economic conditions. These conditions, which include high inflows through autonomous sources (such as remittances, non-oil exports, capital inflow), increase in oil exports among others) that made them successful; the government could follow the same to successfully management strategies for future occurrences in the foreign exchange market.

ii. The study, having identified that the dominant domestic factors are monetary fundamentals, suggests that the government should be cautious of using monetary policy to stimulate the economy. This is because easy monetary policy stance (liquidity) could have a negative effect on the foreign exchange market as some these fundamentals tends to move in an opposing direction.

iii. The study also suggests that government should look beyond the conventional factors presumed to be the sole causes of foreign exchange market pressure, which is the control importation but should consider other fundamentals identified in the study (which includes market expectation, inflation rate and its monetary instruments) when trying to mitigate an enduring in the foreign exchange market pressure. This is because it may be deceptive to assume that a pressure must have emanated from one cause even though other fundamentals may keep mum.

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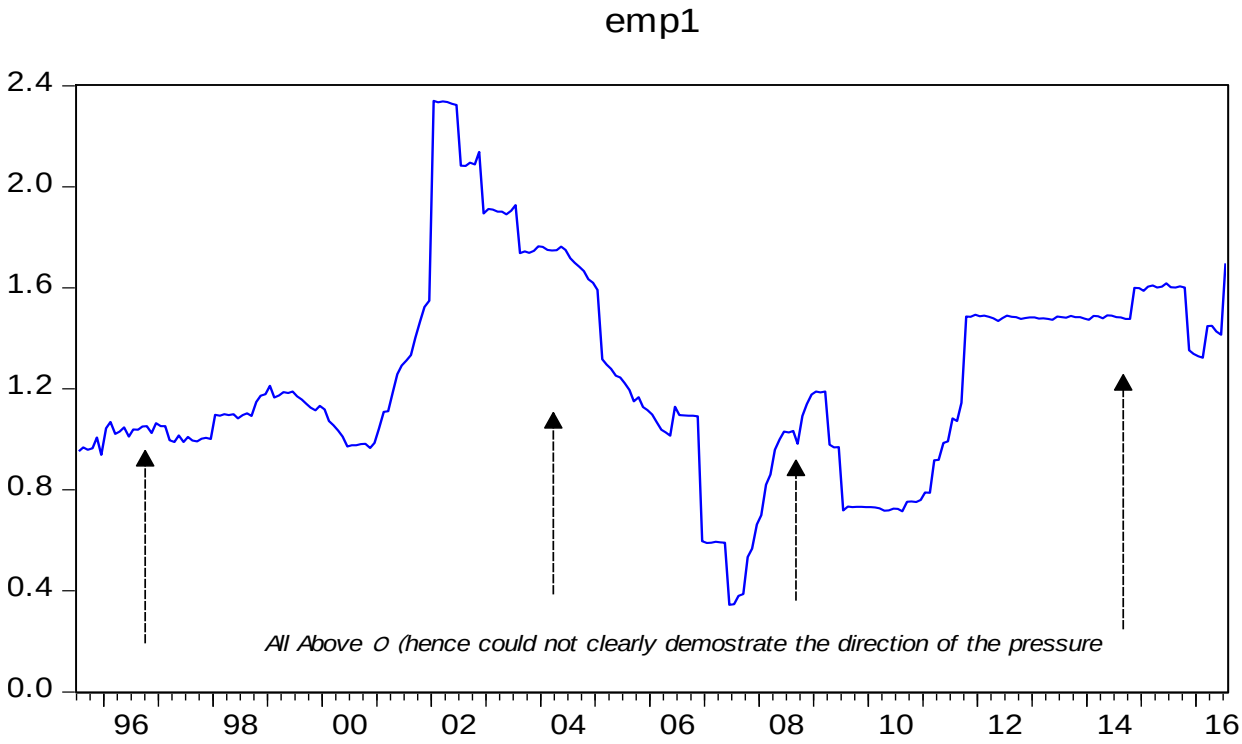
Appendices

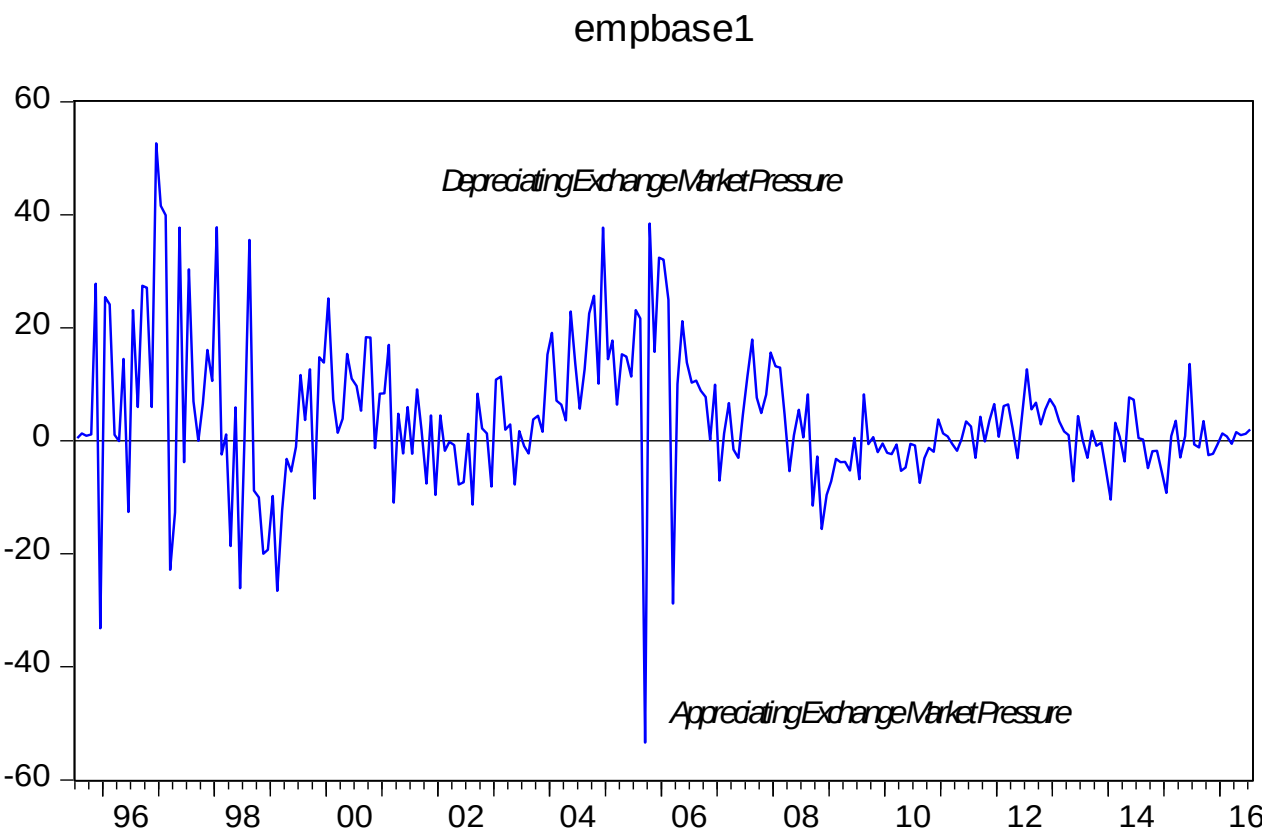
Appendix A

Appendix A1: Summary of Various Measures of Exchange Market Pressure (Official Market)



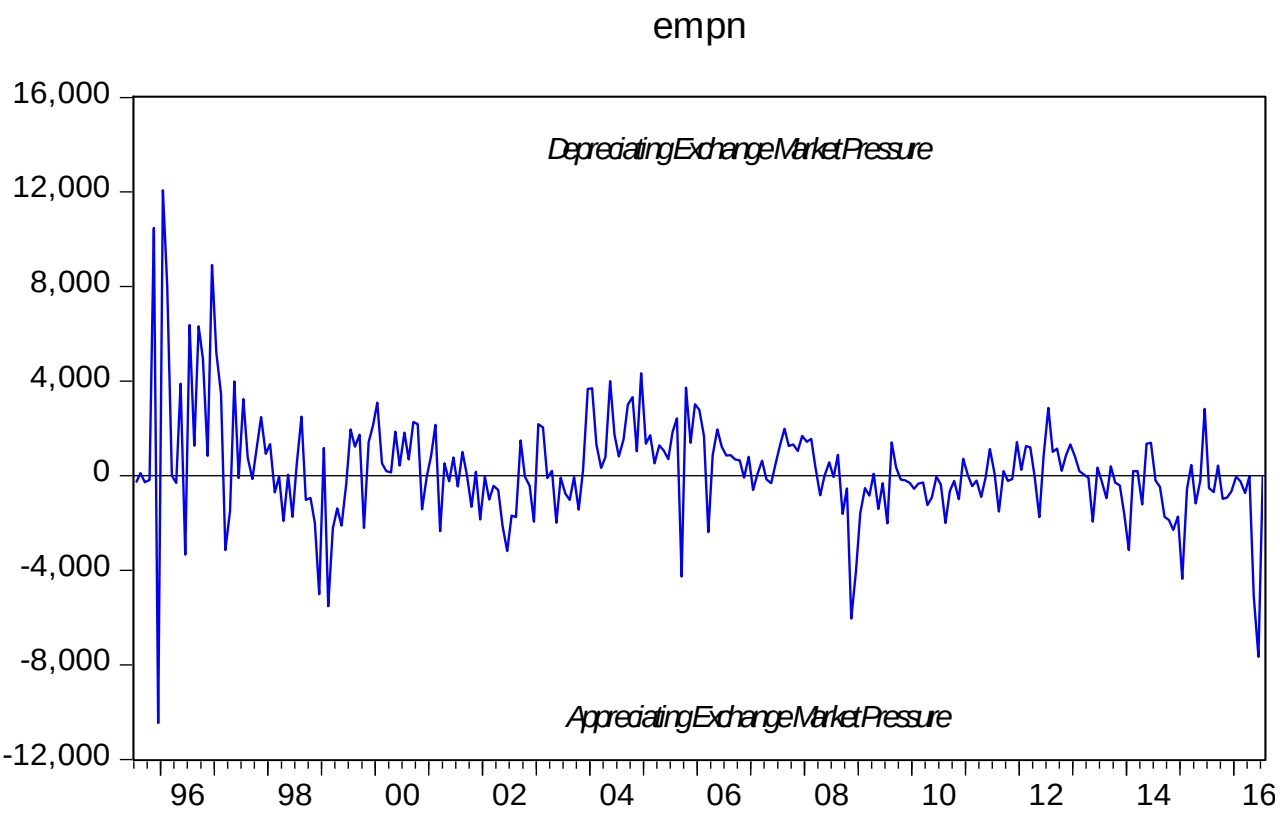
Formula: / $\boldsymbol{emp_t} = \frac{e_t - e_{t-1}}{e_{t-1}} - (i_t - i_t^*) - \frac{ir_t - ir_{t-1}}{ir_{t-1}}$ (base month = May, 2005)

Source: Author's computation using data obtained from Central bank of Nigeria and Federal Reserve Economic Data



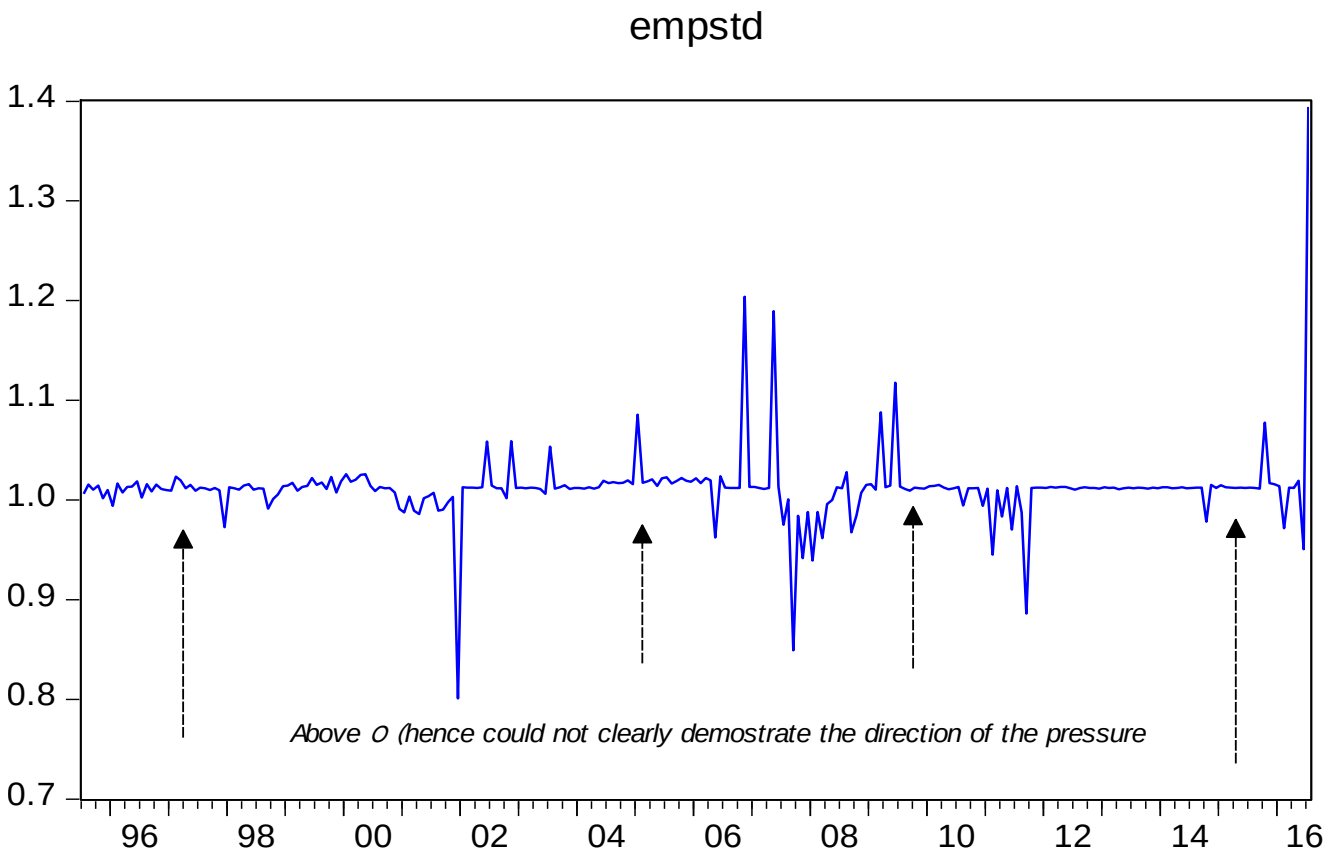
Formula: / $\boldsymbol{emp_t} = \frac{e_t - e_{t-1}}{e_{t-1}} - (i_t - i_t^*) - \frac{ir_t - ir_{t-1}}{mb_{t-1}}$ (base month = May, 2005)

Source: Author's computation using data obtained from Central bank of Nigeria and Federal Reserve Economic Data



Formula: / $\boldsymbol{emp_t} = \frac{e_t - e_{t-1}}{e_{t-1}} - \frac{ir_t - ir_{t-1}}{ir_{t-1}}$(base month = May, 2005)

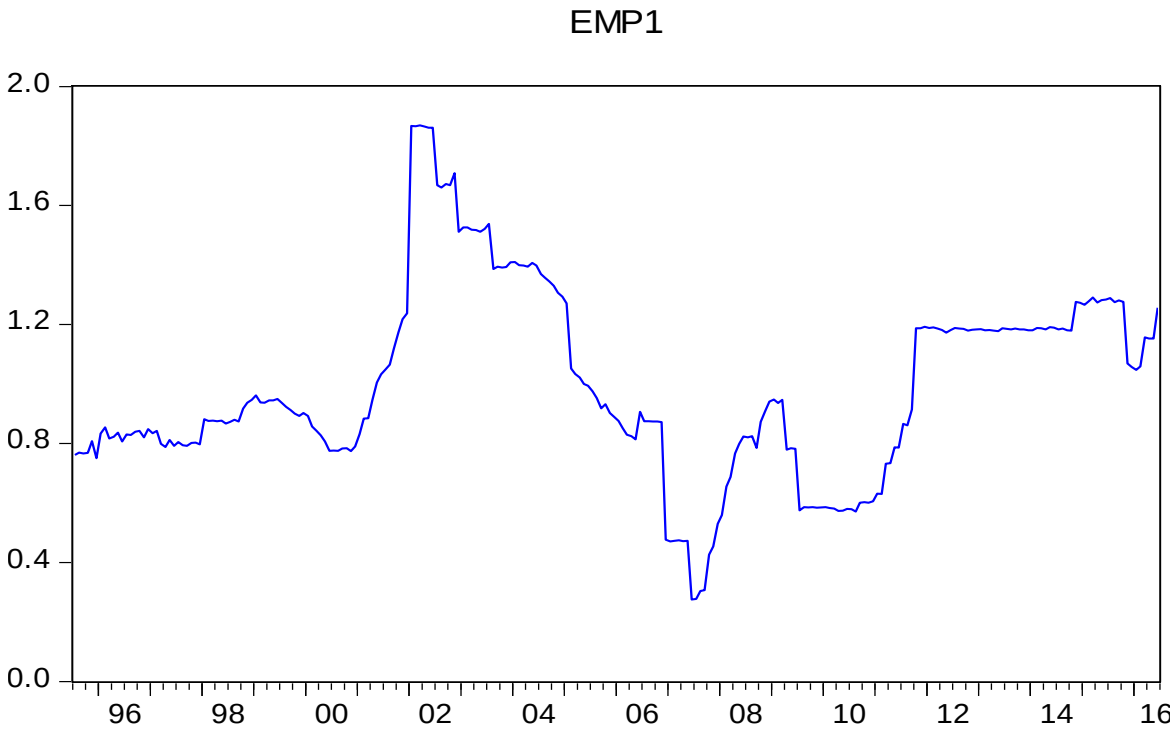
Source: Author's computation using data obtained from Central bank of Nigeria



Formula: / $\boldsymbol{emp_t} = \frac{\Delta e_t - \mu e}{\sigma e} - \frac{\Delta i_t - \mu i}{\sigma i} - \frac{\Delta ir_t - \mu ir}{\sigma ir}$(base month = May, 2005)

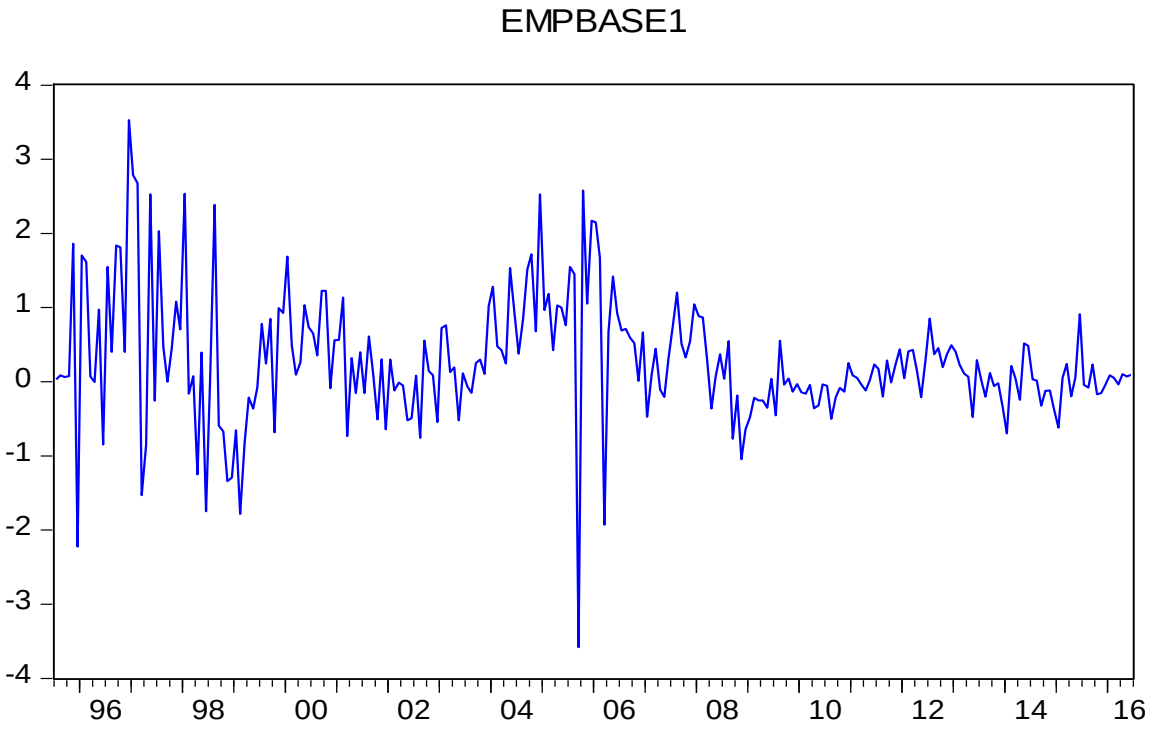
Source: Author's computation using data obtained from Central bank of Nigeria and Federal Reserve Economic Data

Appendix A2: Summary of Various Measures of Exchange Market Pressure (BDC Market)



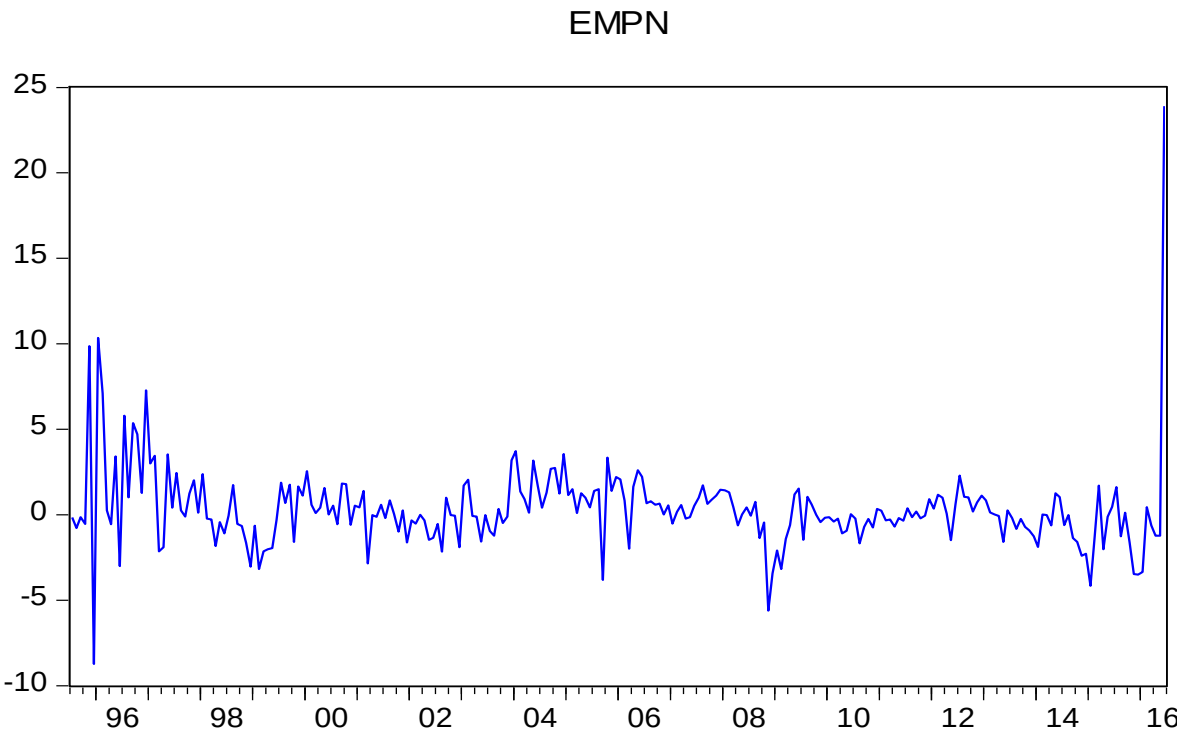
Formula: / $\boldsymbol{emp_t} = \frac{e_t - e_{t-1}}{e_{t-1}} - (i_t - i_t^*) - \frac{ir_t - ir_{t-1}}{ir_{t-1}}$ (base month = May, 2005)

Source: Author's computation using data obtained from Central bank of Nigeria and Federal Reserve Economic Data



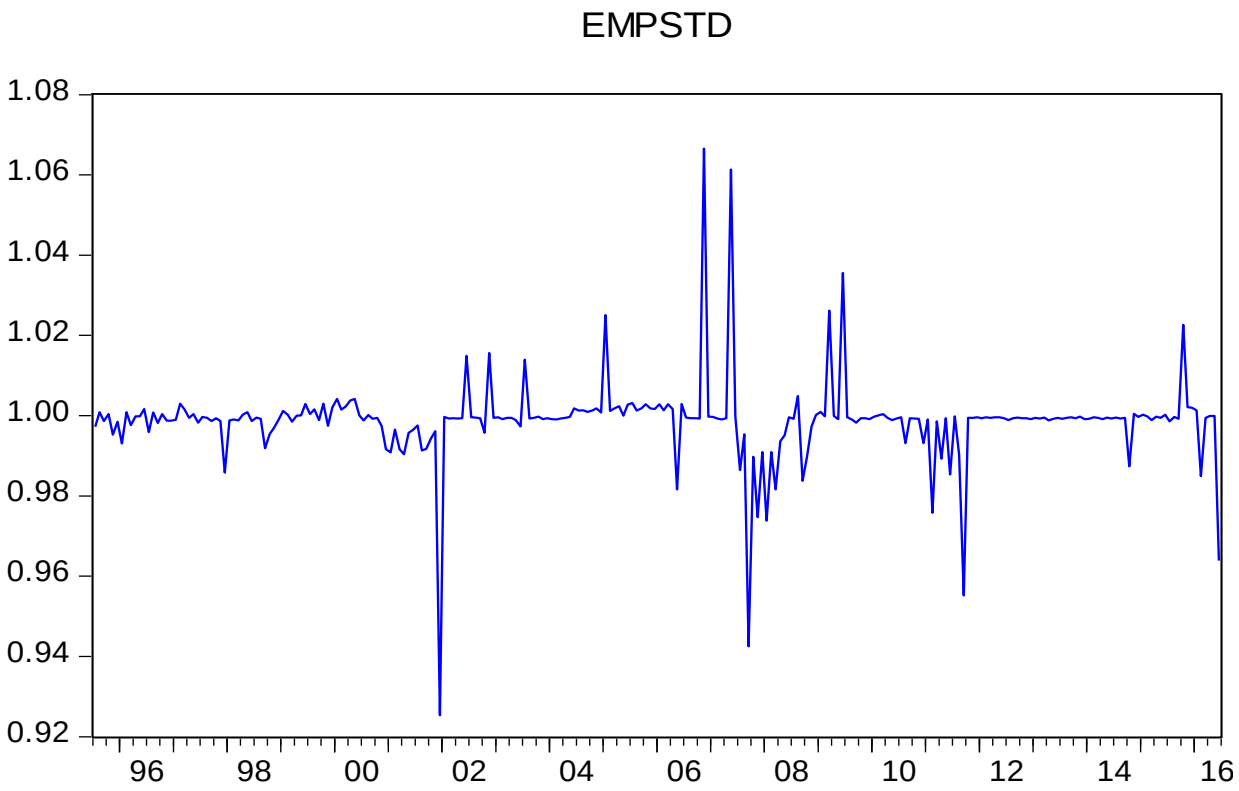
Formula: / $\boldsymbol{emp_t} = \frac{e_t - e_{t-1}}{e_{t-1}} - (i_t - i_t^*) - \frac{ir_t - ir_{t-1}}{mb_{t-1}}$ (base month = May, 2005)

Source: Author's computation using data obtained from Central bank of Nigeria and Federal Reserve Economic Data



Formula: / $\boldsymbol{emp_t} = \frac{e_t - e_{t-1}}{e_{t-1}} - \frac{ir_t - ir_{t-1}}{ir_{t-1}}$(base month = May, 2005)

Source: Author's computation using data obtained from Central bank of Nigeria



Formula: / $\boldsymbol{emp_t} = \frac{\Delta e_t - \mu e}{\sigma e} - \frac{\Delta i_t - \mu i}{\sigma i} - \frac{\Delta ir_t - \mu ir}{\sigma ir}$(base month = May, 2005)

Source: Author's computation using data obtained from Central bank of Nigeria and Federal Reserve Economic Data

Appendix B

Appendix B1: *General unrestricted Estimated model 1 (longer sample)*

Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/29/16 Time: 11:43
Sample (adjusted): 1996M04 2016M07
Included observations: 240 after adjustments
Linear estimation with 1 weight update
Estimation weighting matrix: HAC (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Daniell kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: LOG(IMP(-1)) EMPBASE1(-3) LOG(CRUDE) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) @PCH(ASI(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) @PCH(ASI) EMPBASE1(+1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	33.07354	8.376309	3.948462	0.0001
EMPBASE1(-1)	0.210209	0.113343	1.854639	0.0649
LOG(CRUDE)	5.137907	2.182832	2.353780	0.0194
VIX	-0.239471	0.058897	-4.065946	0.0001
LOG(IMP)	-3.180330	1.047210	-3.036956	0.0027
DCR	-2.960621	1.319876	-2.243105	0.0258
INF	-0.113916	0.060854	-1.871968	0.0625
@PCH(ASI)	-1.164003	3.945777	-0.295000	0.7683

R-squared	0.144041	Mean dependent var	4.111430
Adjusted R-squared	0.118214	S.D. dependent var	12.51319
S.E. of regression	11.75032	Sum squared resid	32032.25
Durbin-Watson stat	2.344725	J-statistic	12.13948
Instrument rank	16	Prob(J-statistic)	0.145088

Appendix B2: *General Unrestricted Estimated model 2 (shorter sample)*

Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/28/16 Time: 23:55
Sample (adjusted): 2007M02 2016M07
Included observations: 110 after adjustments
Linear estimation with 1 weight update
Estimation weighting matrix: HAC (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: LOG(IMP(-1)) EMPBASE1(-3) LOG(CRUDE) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) @PCH(ASI(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) @PCH(ASI) EMPBASE1(+1) LOG(PF(-1))
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.361856	23.02835	0.232837	0.8164
EMPBASE1(-1)	0.418549	0.119334	3.507383	0.0007
LOG(CRUDE)	-4.672709	2.790256	-1.674653	0.0971
DCR	-6.207211	2.760826	-2.248317	0.0267
LOG(PF)	2.920585	1.433428	2.037483	0.0442
INF	0.132479	0.225141	0.588426	0.5576
VIX	-0.165936	0.085309	-1.945130	0.0545
LOG(IMP)	-1.995309	1.445939	-1.379940	0.1707
@PCH(ASI)	-5.539347	3.925134	-1.411250	0.1612

R-squared	0.006008	Mean dependent var	0.946943
Adjusted R-squared	-0.072725	S.D. dependent var	5.668722
S.E. of regression	5.871232	Sum squared resid	3481.608
Durbin-Watson stat	2.338654	J-statistic	14.04843
Instrument rank	17	Prob(J-statistic)	0.080512

Appendix B3: *Parsimonious Estimated model 1(longer sample)*

Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/29/16 Time: 12:24
Sample (adjusted): 1996M04 2016M07
Included observations: 240 after adjustments
Linear estimation with 1 weight update
Estimation weighting matrix: HAC (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Daniell kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) @PCH(ASI(-3)) @PCH(ASI) VIX DCR(-2) EMPBASE1(+1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	32.96763	8.090181	4.075018	0.0001
EMPBASE1(-1)	0.212528	0.106985	1.986508	0.0481
LOG(CRUDE)	5.126924	2.105443	2.435081	0.0156
VIX	-0.235319	0.063986	-3.677655	0.0003
LOG(IMP)	-3.183730	1.003779	-3.171743	0.0017
DCR	-2.903894	1.385389	-2.096085	0.0372
INF	-0.115151	0.060664	-1.898157	0.0589

R-squared	0.143291	Mean dependent var	4.111430
Adjusted R-squared	0.121230	S.D. dependent var	12.51319
S.E. of regression	11.73021	Sum squared resid	32060.30
Durbin-Watson stat	2.348874	J-statistic	12.18907
Instrument rank	16	Prob(J-statistic)	0.202859

Appendix B4: *Parsimonious Estimated model 2 (shorter sample)*

Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/29/16 Time: 11:17
Sample (adjusted): 2007M02 2016M08
Included observations: 115 after adjustments
Linear estimation with 1 weight update
Estimation weighting matrix: HAC (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: LOG(MS(-2)) LOG(MS(-3)) DCR(-2) LOG(PF(-1)) VIX
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-26.08115	15.40344	-1.693203	0.0932
DCR	-6.255603	1.831420	-3.415711	0.0009
LOG(PF)	2.194838	0.757722	2.896628	0.0045
VIX	-0.138743	0.088313	-1.571033	0.1190

R-squared	0.029675	Mean dependent var	0.916294
Adjusted R-squared	0.003450	S.D. dependent var	5.562314
S.E. of regression	5.552709	Sum squared resid	3422.417
Durbin-Watson stat	1.546386	J-statistic	0.588312
Instrument rank	6	Prob(J-statistic)	0.745160

Appendix C

Appendix C1: *Wald and Redundant variable test for model 1(longer sample)*

Wald Test:
Equation: FULLFIRST

Test Statistic	Value	df	Probability
t-statistic	-0.295000	232	0.7683
F-statistic	0.087025	(1, 232)	0.7683
Chi-square	0.087025	1	0.7680

Null Hypothesis: C(8)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(8)	-1.164003	3.945777

Restrictions are linear in coefficients.

Redundant Variables Test
Null hypothesis: @PCH(ASI) are jointly insignificant
Equation: FULLFIRST
Specification: EMPBASE1 C EMPBASE1(-1) LOG(CRUDE) VIX LOG(IMP) (DCR) INF @PCH(ASI)
Instrument specification: LOG(IMP(-1)) EMPBASE1(-3) LOG(CRUDE) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) @PCH(ASI(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) @PCH(ASI) EMPBASE1(+1)
Redundant Variables: @PCH(ASI)

	Value	df	Probability
Difference in J-stats	0.031952	1	0.8581

J-statistic summary:

	Value
Restricted J-statistic	12.17143
Unrestricted J-statistic	12.13948

Restricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/29/16 Time: 11:50
Sample (adjusted): 1996M04 2016M07
Included observations: 240 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Daniell kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: LOG(IMP(-1)) EMPBASE1(-3) LOG(CRUDE) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) @PCH(ASI(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) @PCH(ASI) EMPBASE1(+1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	32.69327	8.057841	4.057324	0.0001
EMPBASE1(-1)	0.218492	0.106341	2.054642	0.0410
LOG(CRUDE)	5.058378	2.082239	2.429298	0.0159
VIX	-0.233449	0.063789	-3.659680	0.0003
LOG(IMP)	-3.149537	0.995501	-3.163772	0.0018
DCR	-2.875275	1.369202	-2.099964	0.0368
INF	-0.113887	0.059966	-1.899202	0.0588

R-squared	0.141864	Mean dependent var	4.111430
Adjusted R-squared	0.119766	S.D. dependent var	12.51319
S.E. of regression	11.73997	Sum squared resid	32113.68
Durbin-Watson stat	2.360554	J-statistic	12.17143
Instrument rank	16	Prob(J-statistic)	0.203816

Appendix C2: *Wald and Redundant variable test for model 1(shorter sample)*

Wald Test:
Equation: SECONDFULL

Test Statistic	Value	df	Probability
t-statistic	0.588426	101	0.5576
F-statistic	0.346246	(1, 101)	0.5576
Chi-square	0.346246	1	0.5562

Null Hypothesis: C(6)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(6)	0.132479	0.225141

Restrictions are linear in coefficients.

C(6) = coefficient of Inflation

Redundant Variables Test
Null hypothesis: INF are jointly insignificant
Equation: SECONDFULL
Specification: EMPBASE1 C EMPBASE1(-1) LOG(CRUDE) DCR LOG(PF) INF VIX LOG(IMP) @PCH(ASI)
Instrument specification: LOG(IMP(-1)) EMPBASE1(-3) LOG(CRUDE) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) @PCH(ASI(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) @PCH(ASI) EMPBASE1(+1) LOG(PF(-1))
Redundant Variables: INF

	Value	df	Probability
Difference in J-stats	0.450019	1	0.5023

J-statistic summary:

	Value
Restricted J-statistic	14.49845
Unrestricted J-statistic	14.04843

Restricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/28/16 Time: 23:59
Sample (adjusted): 2007M02 2016M07
Included observations: 110 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: LOG(IMP(-1)) EMPBASE1(-3) LOG(CRUDE) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) @PCH(ASI(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) @PCH(ASI) EMPBASE1(+1) LOG(PF(-1))
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.62198	18.77981	0.565606	0.5729
EMPBASE1(-1)	0.406779	0.129853	3.132602	0.0023
LOG(CRUDE)	-3.257340	2.977765	-1.093887	0.2766
DCR	-5.096974	2.990666	-1.704294	0.0914
LOG(PF)	2.064980	1.214494	1.700280	0.0921
VIX	-0.148528	0.083409	-1.780715	0.0779
LOG(IMP)	-1.694334	1.507246	-1.124126	0.2636
@PCH(ASI)	-3.045495	2.830289	-1.076037	0.2844

R-squared	0.120391	Mean dependent var	0.946943
Adjusted R-squared	0.060025	S.D. dependent var	5.668722
S.E. of regression	5.495956	Sum squared resid	3080.964
Durbin-Watson stat	2.330250	J-statistic	14.49845
Instrument rank	17	Prob(J-statistic)	0.105666

Wald Test:
Equation: SECONDFULL

Test Statistic	Value	df	Probability
t-statistic	-1.025499	102	0.3076
F-statistic	1.051647	(1, 102)	0.3076
Chi-square	1.051647	1	0.3051

Null Hypothesis: C(7)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(7)	-1.648144	1.607163

Restrictions are linear in coefficients.
C(7) = coefficient of log(imp)

Redundant Variables Test
Null hypothesis: LOG(IMP) are jointly insignificant
Equation: SECONDFULL
Specification: EMPBASE1 C EMPBASE1(-1) LOG(CRUDE) DCR LOG(PF) VIX LOG(IMP) @PCH(ASI)
Instrument specification: LOG(IMP(-1)) EMPBASE1(-3) LOG(CRUDE) EMPBASE1(-2) LOG(MS(-2)) LOG(MS(-3)) @PCH(ASI(-3)) LOG(IMP) LOG(CRUDE(-1)) VIX DCR(-2) @PCH(ASI) EMPBASE1(+1) LOG(PF(-1))
Redundant Variables: LOG(IMP)

	Value	df	Probability
Difference in J-stats	0.933021	1	0.3341

J-statistic summary:

	Value
Restricted J-statistic	11.14384
Unrestricted J-statistic	10.21082

Restricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/29/16 Time: 00:32
Sample (adjusted): 2007M02 2016M07
Included observations: 110 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: LOG(IMP(-1)) EMPBASE1(-3) LOG(CRUDE) EMPBASE1(-2) LOG(MS(-2)) LOG(MS(-3)) @PCH(ASI(-3)) LOG(IMP) LOG(CRUDE(-1)) VIX DCR(-2) @PCH(ASI) EMPBASE1(+1) LOG(PF(-1))
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-38.16024	20.13457	-1.895259	0.0609
EMPBASE1(-1)	0.176182	0.150955	1.167114	0.2459
LOG(CRUDE)	-9.041687	3.550765	-2.546405	0.0124
DCR	-11.50645	3.799987	-3.028024	0.0031
LOG(PF)	5.400133	2.071985	2.606260	0.0105
VIX	-0.154741	0.083386	-1.855724	0.0664
@PCH(ASI)	-9.301682	3.975773	-2.339591	0.0212

R-squared	-0.482803	Mean dependent var	0.946943
Adjusted R-squared	-0.569180	S.D. dependent var	5.668722
S.E. of regression	7.101033	Sum squared resid	5193.741
Durbin-Watson stat	1.985982	J-statistic	11.14384
Instrument rank	15	Prob(J-statistic)	0.193682

Wald Test:
Equation: SECONDFULL

Test Statistic	Value	df	Probability
t-statistic	1.084534	103	0.2807
F-statistic	1.176214	(1, 103)	0.2807
Chi-square	1.176214	1	0.2781

Null Hypothesis: C(2)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2)	0.208502	0.192250

Restrictions are linear in coefficients.

C(2) = coefficient of Empbase1

Redundant Variables Test
Null hypothesis: EMPBASE1(-1) are jointly insignificant
Equation: SECONDFULL
Specification: EMPBASE1 C EMPBASE1(-1) LOG(CRUDE) DCR LOG(PF) VIX @PCH(ASI)
Instrument specification: EMPBASE1(-3) LOG(CRUDE) EMPBASE1(-2) LOG(MS(-2)) LOG(MS(-3)) @PCH(ASI(-3)) LOG(CRUDE(-1)) VIX DCR(-2) @PCH(ASI) EMPBASE1(+1) LOG(PF(-1))
Redundant Variables: EMPBASE1(-1)

	Value	df	Probability
Difference in J-stats	1.809613	1	0.1786

J-statistic summary:

	Value
Restricted J-statistic	10.62801
Unrestricted J-statistic	8.818401

Restricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/29/16 Time: 00:38
Sample (adjusted): 2007M02 2016M07
Included observations: 110 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: EMPBASE1(-3) LOG(CRUDE) EMPBASE1(-2) LOG(MS(-2)) LOG(MS(-3)) @PCH(ASI(-3)) LOG(CRUDE(-1)) VIX DCR(-2) @PCH(ASI) EMPBASE1(+1) LOG(PF(-1))
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-47.63299	24.32603	-1.958108	0.0529
LOG(CRUDE)	-10.59968	5.176815	-2.047529	0.0431
DCR	-13.76838	3.961561	-3.475492	0.0007
LOG(PF)	6.514169	2.572863	2.531875	0.0128
VIX	-0.184736	0.106188	-1.739707	0.0849
@PCH(ASI)	-10.77495	4.293450	-2.509625	0.0136

R-squared	-0.828783	Mean dependent var	0.946943
Adjusted R-squared	-0.916705	S.D. dependent var	5.668722
S.E. of regression	7.848069	Sum squared resid	6405.588
Durbin-Watson stat	1.800747	J-statistic	10.62801
Instrument rank	13	Prob(J-statistic)	0.155688

Wald Test:
Equation: SECONDFULL

Test Statistic	Value	df	Probability
t-statistic	-0.163527	105	0.8704
F-statistic	0.026741	(1, 105)	0.8704
Chi-square	0.026741	1	0.8701

Null Hypothesis: C(2)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2)	-0.941129	5.755177

Restrictions are linear in coefficients.

C(2) = log(crude)

Redundant Variables Test
Null hypothesis: LOG(CRUDE) are jointly insignificant
Equation: SECONDFULL
Specification: EMPBASE1 C LOG(CRUDE) DCR LOG(PF) VIX @PCH(ASI)
Instrument specification: LOG(CRUDE) LOG(MS(-2)) LOG(MS(-3)) @PCH(ASI(-3)) LOG(CRUDE(-1)) VIX DCR(-2) @PCH(ASI) LOG(PF(-1))
Redundant Variables: LOG(CRUDE)

	Value	df	Probability
Difference in J-stats	0.038191	1	0.8451

J-statistic summary:

	Value
Restricted J-statistic	4.407268
Unrestricted J-statistic	4.369077

Restricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/29/16 Time: 00:41
Sample (adjusted): 2007M02 2016M08
Included observations: 111 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: LOG(CRUDE) LOG(MS(-2)) LOG(MS(-3)) @PCH(ASI(-3)) LOG(CRUDE(-1)) VIX DCR(-2) @PCH(ASI) LOG(PF(-1))
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6.624123	12.90259	-0.513395	0.6087
DCR	-6.219049	1.808898	-3.438032	0.0008
LOG(PF)	1.251822	0.630102	1.986698	0.0495
VIX	-0.190626	0.070738	-2.694821	0.0082
@PCH(ASI)	4.900741	6.219359	0.787982	0.4325

R-squared	0.119929	Mean dependent var	0.954994
Adjusted R-squared	0.086719	S.D. dependent var	5.643534
S.E. of regression	5.393286	Sum squared resid	3083.278
Durbin-Watson stat	1.531110	J-statistic	4.407268
Instrument rank	10	Prob(J-statistic)	0.492386

Wald Test:
Equation: SECONDFULL

Test Statistic	Value	df	Probability
t-statistic	0.039554	106	0.9685
F-statistic	0.001565	(1, 106)	0.9685
Chi-square	0.001565	1	0.9684

Null Hypothesis: C(5)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(5)	0.261880	6.620773

Restrictions are linear in coefficients.

C(5) = coefficient of @pch(ASI)

Redundant Variables Test
Null hypothesis: @PCH(ASI) are jointly insignificant
Equation: SECONDFULL
Specification: EMPBASE1 C DCR LOG(PF) VIX @PCH(ASI)
Instrument specification: LOG(MS(-2)) LOG(MS(-3)) @PCH(ASI(-3)) VIX DCR(-2) @PCH(ASI) LOG(PF(-1))
Redundant Variables: @PCH(ASI)

	Value	df	Probability
Difference in J-stats	0.001693	1	0.9672

J-statistic summary:

	Value
Restricted J-statistic	1.121130
Unrestricted J-statistic	1.119437

Restricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/29/16 Time: 10:51
Sample (adjusted): 2007M02 2016M08
Included observations: 111 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: LOG(MS(-2)) LOG(MS(-3)) @PCH(ASI(-3)) VIX DCR(-2) @PCH(ASI) LOG(PF(-1))
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-30.08082	14.96595	-2.009951	0.0470
DCR	-7.198574	1.874089	-3.841106	0.0002
LOG(PF)	2.493444	0.728201	3.424115	0.0009
VIX	-0.141700	0.085060	-1.665882	0.0987

R-squared	-0.006512	Mean dependent var	0.954994
Adjusted R-squared	-0.034732	S.D. dependent var	5.643534
S.E. of regression	5.740703	Sum squared resid	3526.257
Durbin-Watson stat	1.579790	J-statistic	1.121130
Instrument rank	8	Prob(J-statistic)	0.890905

Wald Test:
Equation: SECONDFULL

Test Statistic	Value	df	Probability
t-statistic	-1.571033	111	0.1190
F-statistic	2.468144	(1, 111)	0.1190
Chi-square	2.468144	1	0.1162

Null Hypothesis: C(4)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(4)	-0.138743	0.088313

Restrictions are linear in coefficients.

C(4) = coefficient of VIX

Redundant Variables Test
Null hypothesis: VIX are jointly insignificant
Equation: SECONDFULL
Specification: EMPBASE1 C DCR LOG(PF) VIX
Instrument specification: LOG(MS(-2)) LOG(MS(-3)) DCR(-2) LOG(PF(-1)) VIX
Redundant Variables: VIX

	Value	df	Probability
Difference in J-stats	2.963816	1	0.0851

J-statistic summary:

	Value
Restricted J-statistic	3.552128
Unrestricted J-statistic	0.588312

Restricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/29/16 Time: 11:18
Sample (adjusted): 2007M02 2016M08
Included observations: 115 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: LOG(MS(-2)) LOG(MS(-3)) DCR(-2) LOG(PF(-1)) VIX
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-46.33152	17.60466	-2.631776	0.0097
DCR	-5.846255	1.826747	-3.200364	0.0018
LOG(PF)	3.034945	0.900431	3.370546	0.0010

R-squared	-0.130149	Mean dependent var	0.916294
Adjusted R-squared	-0.150330	S.D. dependent var	5.562314
S.E. of regression	5.965772	Sum squared resid	3986.129
Durbin-Watson stat	1.498710	J-statistic	3.552128
Instrument rank	6	Prob(J-statistic)	0.314064

Appendix D

Appendix D1: *Structural Break estimation result*

Dependent Variable: EMPBASE1
Method: Least Squares with Breaks
Date: 12/22/16 Time: 13:19
Sample: 2007M01 2016M08
Included observations: 114
Break type: Bai-Perron tests of L+1 vs. L sequentially determined breaks
Break selection: Trimming 0.15, Max. breaks 5, Sig. level 0.05
Break: 2008M06

Variable	Coefficient	Std. Error	t-Statistic	Prob.
2007M01 - 2008M05 -- 17 obs				
C	60.58746	69.93501	0.866339	0.3885
EMPBASE1(-1)	-0.169639	0.243604	-0.696372	0.4879
LOG(CRUDE)	-29.95575	13.82216	-2.167226	0.0327
VIX	1.510115	0.449087	3.362634	0.0011
LOG(IMP)	4.165254	4.134341	1.007477	0.3162
DCR	23.30374	12.83971	1.814974	0.0727
@PCH(ASI)	21.10237	19.41369	1.086984	0.2798
INF	-0.613354	0.827007	-0.741655	0.4601
LOG(PF)	-1.748204	1.221198	-1.431549	0.1555
2008M06 - 2016M08 -- 97 obs				
C	-16.45752	28.61189	-0.575199	0.5665
EMPBASE1(-1)	0.100553	0.110537	0.909681	0.3653
LOG(CRUDE)	3.548676	1.887246	1.880346	0.0631
VIX	-0.178201	0.070513	-2.527215	0.0131
LOG(IMP)	0.885388	2.119520	0.417731	0.6771
DCR	0.463944	2.261190	0.205177	0.8379
@PCH(ASI)	-0.653914	6.367340	-0.102698	0.9184
INF	0.212299	0.259288	0.818778	0.4149
LOG(PF)	-0.546582	0.623484	-0.876658	0.3829

R-squared	0.450877	Mean dependent var	0.842195
Adjusted R-squared	0.353637	S.D. dependent var	5.628089
S.E. of regression	4.524800	Akaike info criterion	6.000963
Sum squared resid	1965.486	Schwarz criterion	6.432994
Log likelihood	-324.0549	Hannan-Quinn criter.	6.176300
F-statistic	4.636720	Durbin-Watson stat	2.021811
Prob(F-statistic)	0.000001		

Appendix E

Appendix E1: *Results for Instrumental variables validity (Orthogonal) test for model 1*

Instrument Orthogonality C Test
Null hypothesis: Care valid instruments
Equation: FULLFIRST
Specification: EMPBASE1 C EMPBASE1(-1) LOG(CRUDE) VIX LOG(IMP) (DCR) INF
Instrument specification: LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(+1) @PCH(ASI(-3)) @PCH(ASI)
Test instruments: C

	Value	df	Probability
Difference in J-stats	0.432916	1	0.5106

J-statistic summary:

	Value
Restricted J-statistic	12.18907
Unrestricted J-statistic	11.75616

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 02/07/17 Time: 15:50
Sample (adjusted): 1996M04 2016M07
Included observations: 240 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Daniell kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) INF(-3) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) INF(-1) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(1) @PCH(ASI(-3)) @PCH(ASI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	35.63016	7.948024	4.482895	0.0000
EMPBASE1(-1)	0.239673	0.112923	2.122446	0.0349
LOG(CRUDE)	5.747170	2.414247	2.380523	0.0181
VIX	-0.245662	0.069420	-3.538790	0.0005
LOG(IMP)	-3.634177	1.141566	-3.183501	0.0017
DCR	-2.563763	1.317225	-1.946336	0.0528
INF	-0.119047	0.051797	-2.298316	0.0224

R-squared	0.137229	Mean dependent var	4.111430
Adjusted R-squared	0.115012	S.D. dependent var	12.51319
S.E. of regression	11.77164	Sum squared resid	32287.14
Durbin-Watson stat	2.412735	J-statistic	11.75616
Instrument rank	15	Prob(J-statistic)	0.162420

Instrument Orthogonality C Test
Null hypothesis: LOG(IMP(-1))are valid instruments
Equation: FULLFIRST
Specification: EMPBASE1 C EMPBASE1(-1) LOG(CRUDE) VIX LOG(IMP) (DCR) INF
Instrument specification: LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(+1) @PCH(ASI(-3)) @PCH(ASI)
Test instruments: LOG(IMP(-1))

	Value	df	Probability
Difference in J-stats	3.130436	1	0.0768

J-statistic summary:

	Value
Restricted J-statistic	12.18907
Unrestricted J-statistic	9.058638

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 02/07/17 Time: 15:52
Sample (adjusted): 1996M04 2016M07
Included observations: 240 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Daniell kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) INF(-3) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) INF(-1) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(1) @PCH(ASI(-3)) @PCH(ASI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	30.93642	8.590929	3.601056	0.0004
EMPBASE1(-1)	0.130623	0.108480	1.204122	0.2298
LOG(CRUDE)	5.557473	2.248671	2.471448	0.0142
VIX	-0.258311	0.067403	-3.832329	0.0002
LOG(IMP)	-2.973804	1.056597	-2.814510	0.0053
DCR	-3.864760	1.686623	-2.291418	0.0228
INF	-0.108075	0.075514	-1.431203	0.1537

R-squared	0.155182	Mean dependent var	4.111430
Adjusted R-squared	0.133427	S.D. dependent var	12.51319
S.E. of regression	11.64852	Sum squared resid	31615.30
Durbin-Watson stat	2.168798	J-statistic	9.058638
Instrument rank	15	Prob(J-statistic)	0.337374

Instrument Orthogonality C Test
Null hypothesis: LOG(CRUDE)are valid instruments
Equation: FULLFIRST
Specification: EMPBASE1 C EMPBASE1(-1) LOG(CRUDE) VIX LOG(IMP) (DCR) INF
Instrument specification: LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(+1) @PCH(ASI(-3)) @PCH(ASI)
Test instruments: LOG(CRUDE)

	Value	df	Probability
Difference in J-stats	4.447113	1	0.0350

J-statistic summary:

	Value
Restricted J-statistic	12.18907
Unrestricted J-statistic	7.741962

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 02/07/17 Time: 15:53
Sample (adjusted): 1996M04 2016M07
Included observations: 240 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Daniell kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(IMP(-1)) EMPBASE1(-3) EMPBASE1(-2) INF(-3) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) INF(-1) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(1) @PCH(ASI(-3)) @PCH(ASI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.382302	13.54355	0.397407	0.6914
EMPBASE1(-1)	0.747310	0.239780	3.116646	0.0021
LOG(CRUDE)	-0.409850	2.679559	-0.152954	0.8786
VIX	-0.108567	0.068593	-1.582761	0.1148
LOG(IMP)	0.156038	1.745170	0.089412	0.9288
DCR	-1.583726	0.971554	-1.630096	0.1044
INF	-0.009700	0.058595	-0.165547	0.8687

R-squared	-0.219280	Mean dependent var	4.111430
Adjusted R-squared	-0.250677	S.D. dependent var	12.51319
S.E. of regression	13.99397	Sum squared resid	45628.64
Durbin-Watson stat	2.993016	J-statistic	7.741962
Instrument rank	15	Prob(J-statistic)	0.459073

Instrument Orthogonality C Test
Null hypothesis: EMPBASE1(-3)are valid instruments
Equation: FULLFIRST
Specification: EMPBASE1 C EMPBASE1(-1) LOG(CRUDE) VIX LOG(IMP) (DCR) INF
Instrument specification: LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(+1) @PCH(ASI(-3)) @PCH(ASI)
Test instruments: EMPBASE1(-3)

	Value	df	Probability
Difference in J-stats	0.012179	1	0.9121

J-statistic summary:

	Value
Restricted J-statistic	12.18907
Unrestricted J-statistic	12.17690

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 02/07/17 Time: 15:54
Sample (adjusted): 1996M04 2016M07
Included observations: 240 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Daniell kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-2) INF(-3) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) INF(-1) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(1) @PCH(ASI(-3)) @PCH(ASI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	33.33207	8.622814	3.865567	0.0001
EMPBASE1(-1)	0.205838	0.129839	1.585332	0.1142
LOG(CRUDE)	5.179510	2.420128	2.140181	0.0334
VIX	-0.238096	0.064039	-3.718005	0.0003
LOG(IMP)	-3.219782	1.121474	-2.871027	0.0045
DCR	-2.920970	1.475196	-1.980056	0.0489
INF	-0.116584	0.055581	-2.097553	0.0370

R-squared	0.144792	Mean dependent var	4.111430
Adjusted R-squared	0.122770	S.D. dependent var	12.51319
S.E. of regression	11.71993	Sum squared resid	32004.11
Durbin-Watson stat	2.335730	J-statistic	12.17690
Instrument rank	15	Prob(J-statistic)	0.143484

Instrument Orthogonality C Test
Null hypothesis: EMPBASE1(-2)are valid instruments
Equation: FULLFIRST
Specification: EMPBASE1 C EMPBASE1(-1) LOG(CRUDE) VIX LOG(IMP) (DCR) INF
Instrument specification: LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(+1) @PCH(ASI(-3)) @PCH(ASI)
Test instruments: EMPBASE1(-2)

	Value	df	Probability
Difference in J-stats	2.716199	1	0.0993

J-statistic summary:

	Value
Restricted J-statistic	12.18907
Unrestricted J-statistic	9.472876

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 02/07/17 Time: 15:55
Sample (adjusted): 1996M04 2016M07
Included observations: 240 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Daniell kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) INF(-3) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) INF(-1) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(1) @PCH(ASI(-3)) @PCH(ASI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	34.93778	8.204026	4.258614	0.0000
EMPBASE1(-1)	0.211199	0.108244	1.951138	0.0522
LOG(CRUDE)	6.061847	2.160757	2.805427	0.0054
VIX	-0.243252	0.064227	-3.787363	0.0002
LOG(IMP)	-3.663154	1.037100	-3.532113	0.0005
DCR	-2.775443	1.572197	-1.765327	0.0788
INF	-0.086865	0.048987	-1.773234	0.0775

R-squared	0.146711	Mean dependent var	4.111430
Adjusted R-squared	0.124738	S.D. dependent var	12.51319
S.E. of regression	11.70677	Sum squared resid	31932.31
Durbin-Watson stat	2.360849	J-statistic	9.472876
Instrument rank	15	Prob(J-statistic)	0.303987

Instrument Orthogonality C Test
Null hypothesis: LOG(MS(-2))are valid instruments
Equation: FULLFIRST
Specification: EMPBASE1 C EMPBASE1(-1) LOG(CRUDE) VIX LOG(IMP) (DCR) INF
Instrument specification: LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(+1) @PCH(ASI(-3)) @PCH(ASI)
Test instruments: LOG(MS(-2))

	Value	df	Probability
Difference in J-stats	1.975340	1	0.1599

J-statistic summary:

	Value
Restricted J-statistic	12.18907
Unrestricted J-statistic	10.21373

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 02/07/17 Time: 15:57
Sample (adjusted): 1996M04 2016M07
Included observations: 240 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Daniell kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) INF(-3) LOG(MS(-3)) LOG(IMP) INF(-1) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(1) @PCH(ASI(-3)) @PCH(ASI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	42.50197	9.316375	4.562071	0.0000
EMPBASE1(-1)	-0.005617	0.143027	-0.039272	0.9687
LOG(CRUDE)	7.217965	2.419643	2.983071	0.0032
VIX	-0.294257	0.080144	-3.671623	0.0003
LOG(IMP)	-4.456026	1.123763	-3.965273	0.0001
DCR	-3.108117	1.661747	-1.870391	0.0627
INF	-0.092865	0.070611	-1.315167	0.1897

R-squared	0.156782	Mean dependent var	4.111430
Adjusted R-squared	0.135068	S.D. dependent var	12.51319
S.E. of regression	11.63749	Sum squared resid	31555.44
Durbin-Watson stat	1.899130	J-statistic	10.21373
Instrument rank	15	Prob(J-statistic)	0.250344

Instrument Orthogonality C Test
Null hypothesis: LOG(MS(-3))are valid instruments
Equation: FULLFIRST
Specification: EMPBASE1 C EMPBASE1(-1) LOG(CRUDE) VIX LOG(IMP) (DCR) INF
Instrument specification: LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(+1) @PCH(ASI(-3)) @PCH(ASI)
Test instruments: LOG(MS(-3))

	Value	df	Probability
Difference in J-stats	1.993635	1	0.1580

J-statistic summary:

	Value
Restricted J-statistic	12.18907
Unrestricted J-statistic	10.19544

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 02/07/17 Time: 15:58
Sample (adjusted): 1996M04 2016M07
Included observations: 240 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Daniell kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) INF(-3) LOG(MS(-2)) LOG(IMP) INF(-1) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(1) @PCH(ASI(-3)) @PCH(ASI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	44.75716	10.36441	4.318351	0.0000
EMPBASE1(-1)	-0.022682	0.149771	-0.151448	0.8798
LOG(CRUDE)	7.392541	2.469817	2.993154	0.0031
VIX	-0.295850	0.080947	-3.654860	0.0003
LOG(IMP)	-4.712898	1.248219	-3.775700	0.0002
DCR	-2.913248	1.676336	-1.737866	0.0836
INF	-0.088317	0.069771	-1.265823	0.2068

R-squared	0.155115	Mean dependent var	4.111430
Adjusted R-squared	0.133358	S.D. dependent var	12.51319
S.E. of regression	11.64898	Sum squared resid	31617.82
Durbin-Watson stat	1.867023	J-statistic	10.19544
Instrument rank	15	Prob(J-statistic)	0.251576

Instrument Orthogonality C Test
Null hypothesis: LOG(IMP)are valid instruments
Equation: FULLFIRST
Specification: EMPBASE1 C EMPBASE1(-1) LOG(CRUDE) VIX LOG(IMP) (DCR) INF
Instrument specification: LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(+1) @PCH(ASI(-3)) @PCH(ASI)
Test instruments: LOG(IMP)

	Value	df	Probability
Difference in J-stats	4.747059	1	0.0293

J-statistic summary:

	Value
Restricted J-statistic	12.18907
Unrestricted J-statistic	7.442015

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 02/07/17 Time: 15:59
Sample (adjusted): 1996M04 2016M07
Included observations: 240 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Daniell kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) INF(-3) LOG(MS(-2)) LOG(MS(-3)) INF(-1) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(1) @PCH(ASI(-3)) @PCH(ASI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	59.76358	19.38560	3.082885	0.0023
EMPBASE1(-1)	0.048439	0.213010	0.227401	0.8203
LOG(CRUDE)	9.636895	3.498753	2.754380	0.0063
VIX	-0.243760	0.088830	-2.744129	0.0065
LOG(IMP)	-7.076776	2.169139	-3.262482	0.0013
DCR	-0.595122	2.006510	-0.296596	0.7670
INF	-0.029852	0.078360	-0.380962	0.7036

R-squared	0.160036	Mean dependent var	4.111430
Adjusted R-squared	0.138406	S.D. dependent var	12.51319
S.E. of regression	11.61501	Sum squared resid	31433.66
Durbin-Watson stat	2.054372	J-statistic	7.442015
Instrument rank	15	Prob(J-statistic)	0.489777

Instrument Orthogonality C Test
Null hypothesis: LOG(CRUDE(-1))are valid instruments
Equation: FULLFIRST
Specification: EMPBASE1 C EMPBASE1(-1) LOG(CRUDE) VIX LOG(IMP) (DCR) INF
Instrument specification: LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(+1) @PCH(ASI(-3)) @PCH(ASI)
Test instruments: LOG(CRUDE(-1))

	Value	df	Probability
Difference in J-stats	4.260735	1	0.0390

J-statistic summary:

	Value
Restricted J-statistic	12.18907
Unrestricted J-statistic	7.928339

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 02/07/17 Time: 16:00
Sample (adjusted): 1996M04 2016M07
Included observations: 240 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Daniell kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) INF(-3) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) INF(-1) VIX DCR(-2) EMPBASE1(1) @PCH(ASI(-3)) @PCH(ASI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.79094	10.58248	1.019699	0.3089
EMPBASE1(-1)	0.706260	0.212146	3.329122	0.0010
LOG(CRUDE)	1.845775	2.024535	0.911703	0.3629
VIX	-0.107401	0.064646	-1.661364	0.0980
LOG(IMP)	-1.007882	1.316790	-0.765408	0.4448
DCR	-1.494932	0.891582	-1.676717	0.0949
INF	-0.000653	0.058864	-0.011089	0.9912

R-squared	-0.171836	Mean dependent var	4.111430
Adjusted R-squared	-0.202012	S.D. dependent var	12.51319
S.E. of regression	13.71900	Sum squared resid	43853.16
Durbin-Watson stat	2.985090	J-statistic	7.928339
Instrument rank	15	Prob(J-statistic)	0.440501

Instrument Orthogonality C Test
Null hypothesis: VIXare valid instruments
Equation: FULLFIRST
Specification: EMPBASE1 C EMPBASE1(-1) LOG(CRUDE) VIX LOG(IMP) (DCR) INF
Instrument specification: LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(+1) @PCH(ASI(-3)) @PCH(ASI)
Test instruments: VIX

	Value	df	Probability
Difference in J-stats	1.176956	1	0.2780

J-statistic summary:

	Value
Restricted J-statistic	12.18907
Unrestricted J-statistic	11.01212

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 02/07/17 Time: 16:01
Sample (adjusted): 1996M04 2016M07
Included observations: 240 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Daniell kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) INF(-3) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) INF(-1) LOG(CRUDE(-1)) DCR(-2) EMPBASE1(1) @PCH(ASI(-3)) @PCH(ASI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	33.91924	9.837959	3.447793	0.0007
EMPBASE1(-1)	0.282850	0.099934	2.830378	0.0051
LOG(CRUDE)	4.182519	1.704206	2.454234	0.0149
VIX	-0.363484	0.159952	-2.272452	0.0240
LOG(IMP)	-2.829014	1.066307	-2.653094	0.0085
DCR	-2.637598	1.526887	-1.727435	0.0854
INF	-0.086326	0.054502	-1.583900	0.1146

R-squared	0.117902	Mean dependent var	4.111430
Adjusted R-squared	0.095187	S.D. dependent var	12.51319
S.E. of regression	11.90275	Sum squared resid	33010.41
Durbin-Watson stat	2.485951	J-statistic	11.01212
Instrument rank	15	Prob(J-statistic)	0.201013

Instrument Orthogonality C Test
Null hypothesis: DCR(-2)are valid instruments
Equation: FULLFIRST
Specification: EMPBASE1 C EMPBASE1(-1) LOG(CRUDE) VIX LOG(IMP) (DCR) INF
Instrument specification: LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) (INF(-3)) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) (INF(-1)) LOG(CRUDE(-1)) VIX DCR(-2) EMPBASE1(+1) @PCH(ASI(-3)) @PCH(ASI)
Test instruments: DCR(-2)

	Value	df	Probability
Difference in J-stats	2.457972	1	0.1169

J-statistic summary:

	Value
Restricted J-statistic	12.18907
Unrestricted J-statistic	9.731102

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 02/07/17 Time: 16:02
Sample (adjusted): 1996M04 2016M07
Included observations: 240 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Daniell kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(IMP(-1)) LOG(CRUDE) EMPBASE1(-3) EMPBASE1(-2) INF(-3) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) INF(-1) LOG(CRUDE(-1)) VIX EMPBASE1(1) @PCH(ASI(-3)) @PCH(ASI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	17.61417	13.30133	1.324242	0.1867
EMPBASE1(-1)	0.159187	0.110812	1.436548	0.1522
LOG(CRUDE)	4.479487	4.421596	1.013093	0.3121
VIX	-0.260266	0.145388	-1.790145	0.0747
LOG(IMP)	-0.795198	2.891175	-0.275043	0.7835
DCR	-9.534765	4.281369	-2.227036	0.0269
INF	-0.127890	0.142524	-0.897324	0.3705

R-squared	0.117092	Mean dependent var	4.111430
Adjusted R-squared	0.094356	S.D. dependent var	12.51319
S.E. of regression	11.90822	Sum squared resid	33040.74
Durbin-Watson stat	2.116860	J-statistic	9.731102
Instrument rank	15	Prob(J-statistic)	0.284409

Appendix E2: *Results for Instrumental variables validity (Orthogonal) test for model 2*

Instrument Orthogonality C Test
Null hypothesis: Care valid instruments
Equation: SECONDFULL
Specification: EMPBASE1 C DCR LOG(PF) VIX
Instrument specification: LOG(MS(-2)) LOG(MS(-3)) DCR(-2) LOG(PF(-1)) VIX
Test instruments: C

	Value	df	Probability
Difference in J-stats	0.048945	1	0.8249

J-statistic summary:

	Value
Restricted J-statistic	0.588312
Unrestricted J-statistic	0.539367

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/29/16 Time: 11:33
Sample (adjusted): 2007M02 2016M08
Included observations: 115 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: LOG(MS(-2)) LOG(MS(-3)) DCR(-2) LOG(PF(-1)) VIX

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-29.25455	24.56016	-1.191138	0.2361
DCR	-6.490070	2.111498	-3.073680	0.0027
LOG(PF)	2.377128	1.280981	1.855709	0.0661
VIX	-0.132220	0.101495	-1.302720	0.1954

R-squared	0.003911	Mean dependent var	0.916294
Adjusted R-squared	-0.023010	S.D. dependent var	5.562314
S.E. of regression	5.625945	Sum squared resid	3513.290
Durbin-Watson stat	1.552235	J-statistic	0.539367
Instrument rank	5	Prob(J-statistic)	0.462695

Instrument Orthogonality C Test
Null hypothesis: LOG(MS(-2))are valid instruments
Equation: SECONDFULL
Specification: EMPBASE1 C DCR LOG(PF) VIX
Instrument specification: LOG(MS(-2)) LOG(MS(-3)) DCR(-2) LOG(PF(-1)) VIX
Test instruments: LOG(MS(-2))

	Value	df	Probability
Difference in J-stats	0.547754	1	0.4592

J-statistic summary:

	Value
Restricted J-statistic	0.588312
Unrestricted J-statistic	0.040558

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/29/16 Time: 11:35
Sample (adjusted): 2007M02 2016M08
Included observations: 115 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(MS(-3)) DCR(-2) LOG(PF(-1)) VIX

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-19.28984	19.25574	-1.001771	0.3186
DCR	-6.018643	1.853813	-3.246628	0.0015
LOG(PF)	1.856445	0.947553	1.959199	0.0526
VIX	-0.172383	0.092805	-1.857472	0.0659

R-squared	0.070602	Mean dependent var	0.916294
Adjusted R-squared	0.045483	S.D. dependent var	5.562314
S.E. of regression	5.434346	Sum squared resid	3278.065
Durbin-Watson stat	1.539699	J-statistic	0.040558
Instrument rank	5	Prob(J-statistic)	0.840393

Instrument Orthogonality C Test
Null hypothesis: LOG(MS(-3))are valid instruments
Equation: SECONDFULL
Specification: EMPBASE1 C DCR LOG(PF) VIX
Instrument specification: LOG(MS(-2)) LOG(MS(-3)) DCR(-2) LOG(PF(-1)) VIX
Test instruments: LOG(MS(-3))

	Value	df	Probability
Difference in J-stats	0.584288	1	0.4446

J-statistic summary:

	Value
Restricted J-statistic	0.588312
Unrestricted J-statistic	0.004024

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/29/16 Time: 11:36
Sample (adjusted): 2007M02 2016M08
Included observations: 115 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(MS(-2)) DCR(-2) LOG(PF(-1)) VIX

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-20.13167	18.79104	-1.071344	0.2863
DCR	-6.142496	1.840769	-3.336918	0.0012
LOG(PF)	1.912929	0.913845	2.093276	0.0386
VIX	-0.171276	0.092527	-1.851092	0.0668

R-squared	0.063658	Mean dependent var	0.916294
Adjusted R-squared	0.038351	S.D. dependent var	5.562314
S.E. of regression	5.454611	Sum squared resid	3302.558
Durbin-Watson stat	1.542430	J-statistic	0.004024
Instrument rank	5	Prob(J-statistic)	0.949420

Instrument Orthogonality C Test
Null hypothesis: VIXare valid instruments
Equation: SECONDFULL
Specification: EMPBASE1 C DCR LOG(PF) VIX
Instrument specification: LOG(MS(-2)) LOG(MS(-3)) DCR(-2) LOG(PF(-1)) VIX
Test instruments: VIX

	Value	df	Probability
Difference in J-stats	0.529148	1	0.4670

J-statistic summary:

	Value
Restricted J-statistic	0.588312
Unrestricted J-statistic	0.059165

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/29/16 Time: 11:39
Sample (adjusted): 2007M02 2016M08
Included observations: 115 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(MS(-2)) LOG(MS(-3)) DCR(-2) LOG(PF(-1))

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1206.730	13592.31	-0.088780	0.9294
DCR	18.62894	287.3043	0.064840	0.9484
LOG(PF)	49.60830	545.2956	0.090975	0.9277
VIX	9.347928	110.2394	0.084797	0.9326

R-squared	-226.715042	Mean dependent var	0.916294
Adjusted R-squared	-232.869503	S.D. dependent var	5.562314
S.E. of regression	85.06331	Sum squared resid	803170.1
Durbin-Watson stat	0.623916	J-statistic	0.059165
Instrument rank	5	Prob(J-statistic)	0.807821

Instrument Orthogonality C Test
Null hypothesis: DCR(-2)are valid instruments
Equation: SECONDFULL
Specification: EMPBASE1 C DCR LOG(PF) VIX
Instrument specification: LOG(MS(-2)) LOG(MS(-3)) DCR(-2) LOG(PF(-1)) VIX
Test instruments: DCR(-2)

	Value	df	Probability
Difference in J-stats	0.104201	1	0.7468

J-statistic summary:

	Value
Restricted J-statistic	0.588312
Unrestricted J-statistic	0.484112

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/29/16 Time: 11:30
Sample (adjusted): 2007M02 2016M08
Included observations: 115 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(MS(-2)) LOG(MS(-3)) LOG(PF(-1)) VIX

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-28.73322	19.69481	-1.458923	0.1474
DCR	-7.030163	3.011320	-2.334578	0.0214
LOG(PF)	2.417164	1.153078	2.096270	0.0383
VIX	-0.139667	0.090386	-1.545223	0.1251

R-squared	-0.008636	Mean dependent var	0.916294
Adjusted R-squared	-0.035896	S.D. dependent var	5.562314
S.E. of regression	5.661266	Sum squared resid	3557.543
Durbin-Watson stat	1.550263	J-statistic	0.484112
Instrument rank	5	Prob(J-statistic)	0.486566

Appendix F

Appendix F1: *Results for Endogeneity test for model 1.*

Endogeneity Test
Null hypothesis: EMPBASE1(-1) DCR INF are exogenous
Equation: FULLFIRST
Specification: EMPBASE1 C EMPBASE1(-1) LOG(CRUDE) VIX LOG(IMP) (DCR) INF @PCH(ASI)
Instrument specification: C LOG(IMP(-1)) EMPBASE1(-3) LOG(CRUDE) EMPBASE1(-2) INF(-3) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) INF(-1) LOG(CRUDE(-1)) @PCH(ASI(-3)) @PCH(ASI) VIX DCR(-2) EMPBASE1(1)
Endogenous variables to treat as exogenous: EMPBASE1(-1) DCR INF

	Value	df	Probability
Difference in J-stats	14.69428	3	0.0021

J-statistic summary:

	Value
Restricted J-statistic	19.67579
Unrestricted J-statistic	4.981518

Restricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/29/16 Time: 12:10
Sample (adjusted): 1996M04 2016M07
Included observations: 240 after adjustments
Continuously updating weights & coefficients
Estimation weighting matrix: HAC (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Daniell kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(IMP(-1)) EMPBASE1(-3) LOG(CRUDE) EMPBASE1(-2) INF(-3) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) INF(-1) LOG(CRUDE(-1)) @PCH(ASI(-3)) @PCH(ASI) VIX DCR(-2) EMPBASE1(1) EMPBASE1(-1) DCR INF

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.079532	15.15765	-0.071220	0.9433
EMPBASE1(-1)	1.713541	0.397065	4.315522	0.0000
LOG(CRUDE)	-0.955342	3.006428	-0.317766	0.7509
VIX	0.080400	0.148961	0.539741	0.5899
LOG(IMP)	-0.476549	1.749261	-0.272429	0.7855
DCR	2.738119	1.520393	1.800929	0.0730
INF	0.334566	0.122292	2.735804	0.0067
@PCH(ASI)	0.680246	5.637821	0.120658	0.9041

R-squared	-2.192987	Mean dependent var	4.111430
Adjusted R-squared	-2.289327	S.D. dependent var	12.51319

S.E. of regression	22.69455	Sum squared resid	119489.9
Durbin-Watson stat	2.796840	J-statistic	19.67579
Instrument rank	19	Prob(J-statistic)	0.049990

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 12/29/16 Time: 12:10
Sample (adjusted): 1996M04 2016M07
Included observations: 240 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix
(Prewhitening with lags from AIC maxlags, Daniell kernel, Newey
-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(IMP(-1)) EMPBASE1(-3) LOG(CRUDE)
EMPBASE1(-2) INF(-3) LOG(MS(-2)) LOG(MS(-3)) LOG(IMP) INF(-1)
LOG(CRUDE(-1)) @PCH(ASI(-3)) @PCH(ASI) VIX DCR(-2)
EMPBASE1(1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	32.39291	14.83952	2.182881	0.0300
EMPBASE1(-1)	0.496792	0.243420	2.040880	0.0424
LOG(CRUDE)	7.246219	3.552275	2.039881	0.0425
VIX	-0.209719	0.107468	-1.951454	0.0522
LOG(IMP)	-4.326846	1.960955	-2.206499	0.0283
DCR	-1.398119	1.463454	-0.955355	0.3404
INF	0.128852	0.086210	1.494635	0.1364
@PCH(ASI)	-1.478437	7.809211	-0.189320	0.8500

R-squared	0.003843	Mean dependent var	4.111430
Adjusted R-squared	-0.026214	S.D. dependent var	12.51319
S.E. of regression	12.67614	Sum squared resid	37278.81
Durbin-Watson stat	2.816954	J-statistic	4.981518
Instrument rank	16	Prob(J-statistic)	0.759550

Appendix F2: *Results for Endogeniety test for model 2.*

Endogeneity Test
Null hypothesis: DCR are exogenous
Equation: SECONDFULL
Specification: EMPBASE1 C DCR LOG(PF) VIX
Instrument specification: C LOG(MS(-2)) LOG(MS(-3)) DCR(-2) LOG(PF(-1)) VIX
Endogenous variables to treat as exogenous: DCR

	Value	df	Probability
Difference in J-stats	3.054288	1	0.0805

J-statistic summary:

	Value
Restricted J-statistic	3.736581
Unrestricted J-statistic	0.682294

Restricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 02/07/17 Time: 16:12
Sample (adjusted): 2007M02 2016M08
Included observations: 115 after adjustments
Linear estimation with 1 weight update
Estimation weighting matrix: HAC (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(MS(-2)) LOG(MS(-3)) DCR(-2) LOG(PF(-1)) VIX DCR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-23.50613	14.83493	-1.584512	0.1159
DCR	-4.817043	1.528615	-3.151248	0.0021
LOG(PF)	1.902721	0.725736	2.621780	0.0100
VIX	-0.143182	0.079276	-1.806121	0.0736

R-squared	0.067703	Mean dependent var	0.916294
Adjusted R-squared	0.042505	S.D. dependent var	5.562314
S.E. of regression	5.442816	Sum squared resid	3288.291
Durbin-Watson stat	1.526389	J-statistic	3.736581
Instrument rank	7	Prob(J-statistic)	0.291349

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 02/07/17 Time: 16:12
Sample (adjusted): 2007M02 2016M08
Included observations: 115 after adjustments
Fixed weighting matrix for test evaluation

Standard errors & covariance computed using HAC weighting matrix
(Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey
-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(MS(-2)) LOG(MS(-3)) DCR(-2) LOG(PF(
-1)) VIX

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-24.98409	15.85961	-1.575329	0.1180
DCR	-6.145356	1.857252	-3.308844	0.0013
LOG(PF)	2.128762	0.770387	2.763238	0.0067
VIX	-0.139693	0.089381	-1.562893	0.1209

R-squared	0.038532	Mean dependent var	0.916294
Adjusted R-squared	0.012547	S.D. dependent var	5.562314
S.E. of regression	5.527309	Sum squared resid	3391.178
Durbin-Watson stat	1.543338	J-statistic	0.682294
Instrument rank	6	Prob(J-statistic)	0.710955

Endogeneity Test
Null hypothesis: LOG(PF) are exogenous
Equation: SECONDFULL
Specification: EMPBASE1 C DCR LOG(PF) VIX
Instrument specification: C LOG(MS(-2)) LOG(MS(-3)) DCR(-2) LOG(PF(-1)) VIX
Endogenous variables to treat as exogenous: LOG(PF)

	Value	df	Probability
Difference in J-stats	3.395120	1	0.0654

J-statistic summary:

	Value
Restricted J-statistic	4.043824
Unrestricted J-statistic	0.648704

Restricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 02/07/17 Time: 16:13
Sample (adjusted): 2007M02 2016M08
Included observations: 115 after adjustments
Linear estimation with 1 weight update
Estimation weighting matrix: HAC (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
Instrument specification: C LOG(MS(-2)) LOG(MS(-3)) DCR(-2) LOG(PF(-1)) VIX LOG(PF)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.753333	9.115599	0.631152	0.5292
DCR	-5.098974	1.646465	-3.096922	0.0025
LOG(PF)	0.546460	0.432855	1.262453	0.2094
VIX	-0.234754	0.047647	-4.926984	0.0000

R-squared	0.156780	Mean dependent var	0.916294
Adjusted R-squared	0.133990	S.D. dependent var	5.562314
S.E. of regression	5.176269	Sum squared resid	2974.107
Durbin-Watson stat	1.440431	J-statistic	4.043824
Instrument rank	7	Prob(J-statistic)	0.256771

Unrestricted Test Equation:
Dependent Variable: EMPBASE1
Method: Generalized Method of Moments
Date: 02/07/17 Time: 16:13
Sample (adjusted): 2007M02 2016M08
Included observations: 115 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using HAC weighting matrix (Prewhitening with lags from AIC maxlags, Bartlett kernel, Newey-West fixed bandwidth = 5.0000)

Instrument specification: C LOG(MS(-2)) LOG(MS(-3)) DCR(-2) LOG(PF(
-1)) VIX

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-23.86924	18.32652	-1.302443	0.1955
DCR	-5.999012	1.869567	-3.208771	0.0017
LOG(PF)	2.058157	0.881639	2.334467	0.0214
VIX	-0.142373	0.092580	-1.537838	0.1269

R-squared	0.048142	Mean dependent var	0.916294
Adjusted R-squared	0.022416	S.D. dependent var	5.562314
S.E. of regression	5.499617	Sum squared resid	3357.282
Durbin-Watson stat	1.540960	J-statistic	0.648704
Instrument rank	6	Prob(J-statistic)	0.722996

Appendix G

Appendix G1: *Results of Weak Instrument Diagnostic for model 1*

Weak Instrument Diagnostics
Equation: FULLFIRST

Cragg-Donald F-stat:	1.164098

Stock-Yogo TSLS critical values (relative bias):

5%	17.80
10%	10.01
20%	5.90
30%	4.42

Stock-Yogo size critical values not available for models with more than 2 endogenous variables.

Moment selection criteria:

SIC-based:	-37.13668
HQIC-based:	-18.58603
Relevant MSC:	22.54212

Appendix G2: *Results of Weak Instrument Diagnostic for model 2*

Weak Instrument Diagnostics
Equation: SECONDFULL

Cragg-Donald F-stat:	7.146545

Stock-Yogo TSLS critical values (relative bias):

5%	11.04
10%	7.56
20%	5.57
30%	4.73

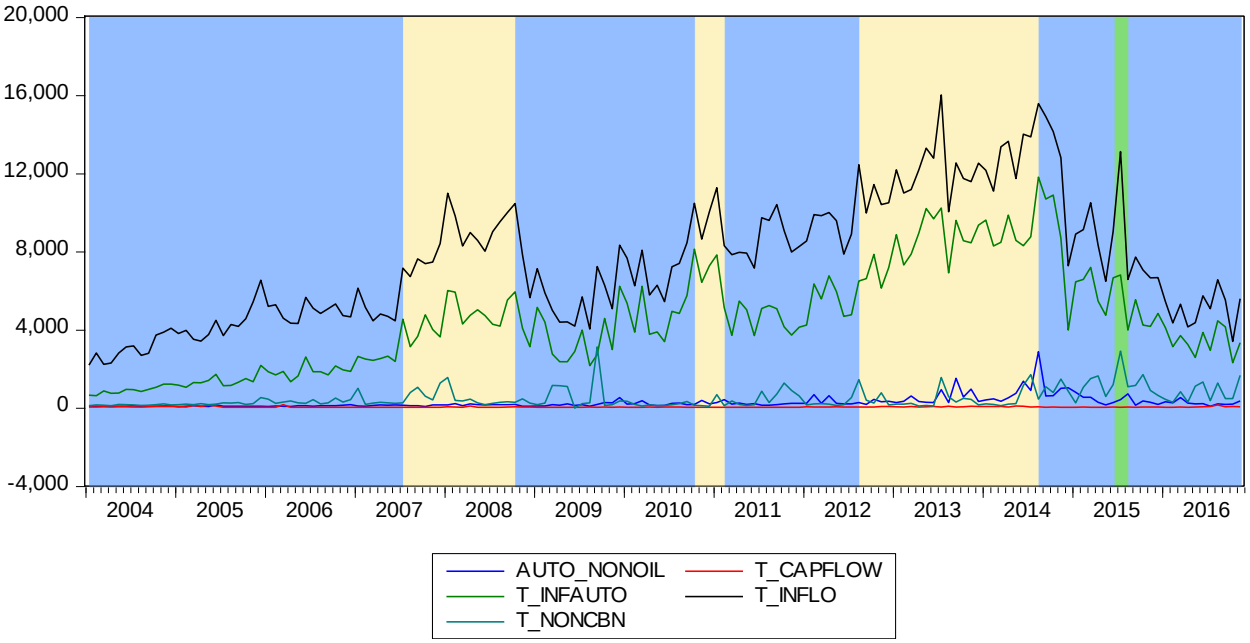
Stock-Yogo critical values (size):

10%	16.87
15%	9.93
20%	7.54
25%	6.28

Moment selection criteria:

SIC-based:	-8.901552
HQIC-based:	-5.671138
Relevant MSC:	14.13308

Appendix H1: ***Foreign Exchange from non-oil inflows (2004 – 2016)***



Appendix I1: *Result of Heteroskedasticity test*

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	3.708781	Prob. F(6,241)	0.0015
Obs*R-squared	20.96338	Prob. Chi-Square(6)	0.0019
Scaled explained SS	86.72213	Prob. Chi-Square(6)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 03/14/17 Time: 14:37
Sample: 1996M01 2016M08
Included observations: 248
HAC standard errors & covariance (Prewhitening with lags = 6 from AIC maxlags = 6, Daniell kernel, Newey-West fixed bandwidth = 5.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1211.251	476.9461	2.539596	0.0117
EMPBASE1(-1)	2.051980	0.776746	2.641766	0.0088
LOG(CRUDE)	61.40511	121.4635	0.505544	0.6136
VIX	-3.455244	2.383494	-1.449655	0.1485
LOG(IMP)	-113.9774	69.28746	-1.644993	0.1013
DCR	51.71654	41.71678	1.239706	0.2163
INF	4.573152	4.796662	0.953403	0.3413

R-squared	0.084530	Mean dependent var	128.6679
Adjusted R-squared	0.061738	S.D. dependent var	381.6205
S.E. of regression	369.6526	Akaike info criterion	14.69082
Sum squared resid	32930971	Schwarz criterion	14.78999
Log likelihood	-1814.662	Hannan-Quinn criter.	14.73075
F-statistic	3.708781	Durbin-Watson stat	1.766179
Prob(F-statistic)	0.001517		

Appendix J1: *Summary of Descriptive Statistics*

Date: 07/16/17 Time: 23:04
Sample: 1995M07 2016M08

	EMPBASE1	C	EMPBASE1(-...	LOG(CRUDE...	VIX	LOG(IMP)	DCR	INF
Mean	4.187550	1.000000	4.046468	3.822701	20.85500	12.20083	1.572114	12.19157
Median	1.904720	1.000000	1.904720	3.884337	19.50000	12.32016	1.270729	11.32500
Maximum	52.63211	1.000000	52.63211	4.932602	62.64000	14.09297	3.091683	47.56000
Minimum	-53.41525	1.000000	-53.41525	2.324347	10.82000	9.640135	0.798729	-2.490000
Std. Dev.	12.46538	0.000000	12.68806	0.696115	7.953038	1.270915	0.570439	6.760825
Skewness	0.363934	NA	0.275199	-0.180867	1.900500	-0.261166	0.708423	1.661186
Kurtosis	6.084933	NA	5.985152	1.833738	8.870922	1.656469	2.204154	8.649803
Jarque-Bera	103.8149	NA	95.21204	15.40720	505.4584	21.47169	27.28849	443.9037
Probability	0.000000	NA	0.000000	0.000451	0.000000	0.000022	0.000001	0.000000
Sum	1038.512	248.0000	1003.524	948.0298	5172.040	3025.805	389.8843	3023.510
Sum Sq. Dev.	38380.29	0.000000	39763.77	119.6902	15622.95	398.9603	80.37394	11290.06
Observations	248	248	248	248	248	248	248	248