

Master's Thesis

나이지리아의 금융 위기, 통화 정책, 그리고  
주식시장에 대한 연구: ARDL 접근법

Financial Crisis, Monetary Policy and Stock Market  
Performance in Nigeria: An ARDL Approach

2017

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# Financial Crisis, Monetary Policy and Stock Market Performance in Nigeria: An ARDL Approach

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partial fulfillment of the requirements for the degree of  
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Daejeon, Korea  
February 6, 2017

Approved by

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Jangkoo Kang  
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The study was conducted in accordance with Code of Research Ethics<sup>1)</sup>.

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1) Declaration of Ethical Conduct in Research: I, as a graduate student of Korea Advanced Institute of Science and Technology, hereby declare that I have not committed any act that may damage the credibility of my research. This includes, but is not limited to, falsification, thesis written by someone else, distortion of research findings, and plagiarism. I confirm that my thesis/dissertation contains honest conclusions based on my own careful research under the guidance of my advisor.

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### 초 록

본 연구는 ARDL 접근법을 이용하여 나이지리아의 통화 정책이 주식 시장에 미치는 영향을 세계 금융 위기 전후에 대하여 분석한다. 2000년 1월부터 2016년 6월까지의 기간에 대해 나이지리아 주식 시장을 실증 분석한 결과, 통화 정책에 대한 지표는 주식 시장 수익률과 유의한 관계가 있으며 특히 금융 위기 동안과 금융 위기 이후에 더 유의한 것으로 나타났다. 또한, 나이지리아 주식 시장은 미국의 통화 정책 지표에 더 크고 유의한 영향을 받는 것으로 나타났다.

핵심 낱말 금융 위기, 통화 정책, 주식 시장, 나이지리아, ARDL

### Abstract

This thesis examines the response of the Nigerian equity market to monetary policy adjustments (measured by Treasury bill rate and broad money supply) before and after the global financial crisis using the autoregressive distributed lag (ARDL) approach to cointegration. The analysis is conducted on an initial monthly sample period from January 2000-June 2016 incorporating structural breaks captured by a crisis dummy which assumes the value of 1 from September 2008 to June 2010. Two sub-sample analysis are further conducted for January 2000-August 2008 and September 2008 -June 2016 based on an endogenously determined break date using the breakpoint test. Results indicate the presence of cointegration among stock price, domestic treasury bills rate, broad money supply, exchange rate and the US federal funds rate. Whereas short-term policy rate measured by treasury bills rate is weak with low impact on the stock market across all samples, broad money supply is consistent in providing evidence as a potent monetary policy in all sample periods. Its positive impact is much stronger during the crisis/post crisis period reinforcing the strength of the credit and liquidity channel during crisis and provides support for the lender of last resort function of the central bank. Nevertheless, evidence points to a prolonged recovery for the equity market which could be further impeded in the presence of negative shocks. I find that the Nigerian equity market is more sensitive to adjustments in the US monetary policy measured by the US federal funds rate as well as exchange rate further indicating a high reliance on external financing. Hence, the drive for increased domestic portfolio participation in the equity market should be continuously enhanced to limit the potential risks of outbound flows of foreign portfolio capital. These findings have implication for monetary policy implementation as well as stock market development initiatives.

Keywords Financial Crisis, Monetary Policy, Equity Market, Nigeria, Autoregressive Distributed Lag

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# Chapter 1. Introduction

## 1.1 Background of the Study

The role of monetary policy in financial market outcomes is well documented. In a speech to the Federal Reserve Board in 1996, Alan Greenspan – The former Federal Reserve chairman emphasized the need “...not {to} underestimate or become complacent about the complexity of the interactions of asset markets and the economy. Thus, evaluating shifts in balance sheets generally, and in asset prices particularly, must be an integral part of the development of monetary policy”. In just over a decade, the discourse on the interaction between stock markets and monetary policy has been renewed following the 2007-8 global financial crisis with debates centered on the role of monetary policy prior to and after the crisis. In developed economies, monetary policy makers grappled with the potential problem of a liquidity trap - a situation in which short term interest rates at zero or near zero levels become incapable of stimulating the markets which led to a widespread adoption of unconventional monetary policy. Prior to the crisis, the consensus view had been that monetary policy had no role in stock markets. The post-crisis views have however become more diverse. Yellen (2014) noted the limitation of monetary policy stating that interest rate adjustments could fuel inflation and argued for a balance between monetary policy adjustments and a prudential based approach to managing risks. In a somewhat counterview, May (2016) noted, though with a caveat, that the “super-low interest rates and quantitative easing {in the UK}... provided the necessary emergency medicine after the financial crash ....”. Mishkin (2009) has argued for the higher potency of monetary policy during financial crisis.

Nigeria, located in the western part of Africa was affected by the global financial crisis in what has been largely referred as the second round effect of the crisis. By 2009, the domestic stock market index declined from 57,990 in 2007 to 20,827- a decline of 64 per cent in barely two years. Stock market capitalization-- a measure of stock market size, declined from 30 per cent of GDP in 2008 to 12 per cent of GDP at end September 2012. The stock market index remained at 28,642 at end-2015, (International Monetary Fund 2013; Central Bank of Nigeria 2015). The Central Bank of Nigeria, statutorily responsible for promoting stability and soundness of the financial system, cut its policy rate from 10.25 per cent to 6.25 per cent; its cash reserve ratio and liquidity ratio were reduced from 4 per cent to 1 per cent and 40 per cent to 25 per cent. Some non-conventional monetary policy measures included the central bank’s inter-bank market guarantee, quantitative easing and injection of tier II

capital into banks, (Central Bank of Nigeria, 2010).

## **1.2 Motivation of Research**

Many studies examining the impact of monetary policy on financial markets during the financial crisis has focused largely on developed economies. In Nigeria, a repertoire of studies such as Osisanwo and Atanda (2012) and Arodoye (2012) have investigated the relationship between monetary policy and stock market in Nigeria. However, only the available studies by Aliyu (2011) and Ikoku and Okany (2014) have investigated the association between monetary policy and the stock market within the context of the global financial crisis. Aliyu (2011) employed a suite of autoregressive conditional heteroscedasticity methodologies and reached the conclusion that the anticipated component of broad money and monetary policy rate have a stabilizing impact on the equity index, while Ikoku and Okany (2014) applied an autoregressive moving average technique to investigate the sensitivities of the Nigerian and South African stock market during the global financial crisis and found that equity prices were insensitive to adjustments in the inter-bank rate. The analysis by Aliyu (2011) is, however, limited to the post-financial crisis period and narrows any possible comparisons of any differences in the response of the equity market before and after the crisis, while Ikoku and Okany (2014) do not properly account for the liquidity component of monetary policy implementation which characterized the crisis period.

This thesis contributes to the existing literature for Nigeria in several ways. To the best of my knowledge, it is the first attempt which controls for global monetary policy using the US federal funds rate in studying the sensitivity of the domestic stock market around the global financial crisis period- a period characterized by sensitivity to developments in the US economy. Second, it re-examines the impact of monetary policy during financial crisis compared with its pre-crisis period, using an alternate methodology- the autoregressive distributed lag (bounds testing) estimation method. Third, it accounts for the liquidity channel of monetary policy which had been a key feature of monetary policy implementation especially during the financial crisis. The research outcome provides an understanding of the long-run and short run dynamics of the Nigerian stock market as well as how financial crisis reinforces the transmission of monetary policy to the stock market. Fourth, it contributes to the debate on the potency of monetary policy during the crisis using country data (see Mishkin 2009), but also of importance is the global paradigm shift towards the financial stability focus of central banks which suggests the need for further empirical literature on the subject matter.

### 1.3 Research Objectives, Hypothesis, Data and Methodology

The major objective of this thesis is to examine the impact of monetary policy in Nigeria on the equity index prior and after the global financial crisis. What were the monetary policy instruments in response to the crisis? Is there an increased role for monetary policy in a crisis period? How sensitive were equity market returns to changes in monetary policy before and after the crisis? Is the interaction, if any, between monetary policy instruments and stock market static or dynamic? Has the dynamics of the Nigerian equity market been altered with the crisis? Is monetary policy more potent during the crisis period?

These research questions are addressed using a monthly time series covering an initial sample period of 2000 to 2016. A crisis dummy variable following Pennings et al (2011) is incorporated and is assigned a value of 1 from September 2008 to June 2010 and 0 otherwise. Sub-sample analysis with endogenously determined breakpoint for the period 2000:1-2008:8 and 2008:9-2016:6 are further conducted to assess monetary policy impact on the equity market prior and after the crisis. As stated by Central Bank of Nigeria, (2015), 'monetary [policy] management [in Nigeria is an] hybrid approach, comprising a combination of interest rate corridor and monetary targeting with the monetary policy rate {as} an anchor for short-term interest rates' (p.1). Hence, I proxy monetary policy intervention by short-term interest rate and broad monetary aggregate. Though, these do not solely represent the totality of the monetary policy toolkit of the central bank of Nigeria, it can however be considered as a fair representation. Since Nigeria is relatively a small open economy, the exchange rate is introduced as a control variable. Furthermore, the United States (US) monetary policy measured by the US federal funds rate captures the response of Nigerian equity market to the US monetary policy. Given the foregoing, the main hypothesis tested is. *Ho: Monetary policy is not potent at affecting the equity market during financial crisis.* *Ha: Monetary policy is potent at affecting the equity market during financial crisis.* The research hypothesis is tested using the Autoregressive Distributed Lag (ARDL) Bounds testing approach due to its appeal as an econometric technique when the variables show a mixed order of integration. In other words, when they are either integrated of order 0, I (0) or order 1, I (1) or fractionally integrated. This technique also takes sufficient number of lags to capture the data generating process of the underlying series (Pesaran et al 2001; Laurenceson and Chai 2003).

## **1.4 Thesis Structure**

This thesis is organized into six chapters. Chapter 1 sets out the direction of the study, outlines the research objectives and scope of study. Chapter 2 focuses on the conceptual, theoretical and empirical literature of the subject matter. Chapter 3 provides some stylized facts of monetary policy in Nigeria and the stock market using descriptive statistics. Chapter 4 discusses the data and research methodology. Chapter 5 presents the empirical results, while Chapter 6 concludes.

## **Chapter 2. Review of Literature**

### **2.1 Some Basic Concepts**

The significance of a stock market in an economy is evident from three broad perspectives: First, it provides an alternate source of stable long-term capital for the corporate finance needs of firms. Second, it promotes long-term investments by providing a channel for the investing public (domestic and foreign) to invest their financial assets. Third, it contributes to the functioning of the economy through efficient asset allocation in its role as a non-bank financial intermediary between economic agents, contributing to domestic savings, investments and mobilizing resources for long-term industrial needs of an economy. Other roles include risk diversification, price discovery function and acting as an external mechanism for the promotion of corporate governance (Yartey, 2008; Bala, 2013). Notwithstanding the notable importance of the stock market, some critics see the stock market as a “gambling market”, Boca (2011). The performance of the stock market from a macro-perspective can be broadly measured by indicators of size, efficiency, returns, or liquidity. These indicators include the ratio of stock market capitalization to Gross Domestic Product (GDP) – a measure of size, the value of traded stock relative to GDP and stock turnover ratios which are measures of stock market liquidity and efficiency, as well as stock market concentration (Beck et al. 1999; El-Wassal, 2013). Equity market returns are often measured using the growth in market index or sub-sector indices categorized based on homogeneity of listed firm’s activity. The direction of the index, when weighted by the market capitalization of each stock constituent, is influenced by firm size as larger firms have a higher weight in the index. An example of a market-capitalization index is the S & P 500 and the Nigerian All Share Index. Price weighted index are typically weighted based on the price of each stock in the index relative to the universe of stocks in the market and are rebalanced as prices and company fundamentals change. An example of a price weighed index is the Dow Jones Industrial Index. Other weighted index are the equally weighted and fundamentally weighted indices (Swenlin, 2015).

### **2.2 Theoretical Nexus**

There is an extensive yet divergent theoretical literature on the nexus between stock market and monetary policy. The classical economic theory propagated by the works of Tobin 1969 recognizes the need to finance the

savings-investment gap in an economy from domestic or external sources through the adjustments of interest rates. In order to restore the balance between the supply and demand of loanable funds, interest rates are adjusted higher (lower) to attract (discourage) more savings to the pool of existing funds, while reducing (raising) the demand for funds. These adjustments in rates continue till the demand and supply of loanable funds are in a steady state equilibrium. According to Ajuzie et al. 2008, the quantity theory of money (QTM) traced to Jean Bodin explained movements in prices based on the Irvin Fisher equation of exchange  $MV=PQ$ , where M is the quantity of money, V represents money velocity, P is the price level, while Q captures the volume of output in real terms. By this equation and the underlying assumptions, increases in money stock have a direct and proportional relationship with the price level, without any short or long-run effects on output. The contrasting argument considers the role of money only from its long-run impact on prices. Another strand of theoretical literature is the asset price channel anchored on the discounted cash flow and rational expectations model which hold that monetary policy affect future earnings expectations through interest rates adjustments. Theoretical expectations indicate an inverse relationship between interest rate shocks and asset price fluctuations. When the rationality assumption is implied, interventions anticipated by the market could result in immediate and unintended outcomes which are strongly correlated, in part, to markets' past and current expectations of happenings in the economy. The other strand of the expectation hypothesis is the adaptive expectations theory which explains the lag effect of monetary policy and suggests that shifts in monetary policy measures have no immediate impact on prices until such a time when inflation expectations are high. The arguments against the asset price channel include the assumption of a constant discount rate over the life of the earnings. Secondly, if the borrowing rate of firms differ from the short-term nominal interest rate, then monetary policy may be ineffective at inducing future expectations. Thirdly, it is difficult to detect causality between long term changes in stock prices and monetary policy shocks since asset prices constantly evolve as new information is obtained (Ubl, 2014). Also counteracting the view of a perfect inverse association between interest rate and stock price is the theory of stock market bubbles propagated by Gali (2014) which contends that the relationship between interest rate policy and assets prices can be ambiguous due to the inability to distinguish between the fundamental and bubble movements in stock prices. One striking feature of this theory is that asset prices respond inversely to interest rates adjustments when asset price movements are dominated by its fundamental components. In abnormal times, bubble movements dominate and therefore interest rate adjustments would only exacerbate asset price increases. Anchored on the arbitrage pricing theory associated

with Chen, Roll and Ross (1986) is the macroeconomic approach which attributes asset price sensitivities to changes in macroeconomic variables such as consumer prices, exchange rate, capital flows, and economic activity. An extension of this approach highlights the importance of institutional factors of market infrastructure, transparency, surveillance, fiscal, structural policies, and legal frameworks as tools for stimulating stock market activities, (El-Wassal 2013). Fama (1970) is at the forefront of the neo-classical approach which founded the efficient market hypothesis (EMH) as one of the cornerstones of modern financial economics. The fulcrum of the EMH is that stock price movements follow a random walk and the market responds in a fair, complete and unbiased manner thereby supporting the idea of a minimization or complete extinction of arbitrage opportunities. Supporters of the EMH distinguishes among three forms of market efficiency – the strong efficiency which describes that the price of financial assets “fully” and “quickly” reflects all available (private and public) information in the market; the semi-strong efficiency holds when all publicly available information (e.g. past prices, economic and financial reports) is instantaneously reflected by asset prices; and the weak form of efficiency which emphasizes that the stock market reflects all information that are observable from market data such as volume of trade and historical price series (Bodie and Kane, 2014). However, the EMH has been challenged by the existence of asymmetric information and irrational exuberance which impede the capital allocation process further intensifying the quest for a somewhat interventionist approach in the financial markets. This quest for an interventionist approach is a view strongly canvassed by behavioural finance theorists. In their book, “Animal Spirits”, Akerlof and Shiller (2009) alluded that asset price movements are influenced by the irrational exuberances of investors and thus occasional “nudging” through government intervention, such as actions by a central bank are required. Whether central bank policy can or should affect the equity market is subject to debate. While Illing (2001) asserts that the monetary policy transmission to asset prices would be minimal in a predominantly bank-based financial system, Cecchetti et al (2006) observed the susceptibility of market-based systems to asset price fluctuations. Embedded within the discussion on the potency of monetary policy is the choice of an appropriate monetary instrument. For instance, Hayford and Malliaris (2004) assign a higher weight to interest rates, Wong et al (2006) considers money supply as more appropriate from the policy tool kit, Akerlof and Shiller (2009) state that rediscount rates are only more effective during normal times, while others such as Yellen (2014) stress the significance of complementary macroprudential instruments. The timing of when monetary policy should be triggered has also been questioned. (Mishkin 2001; Bordo and Jeanne 2002), though



not strong supporters of traditional monetary policy, stressed the importance of timing monetary policy intervention. They support the notion of an ex-ante approach due to the negative economy-wide effects of asset price reversal arising from late interventions. Therefore, central banks should strive to intervene in the periods leading to and during observed periods of bubble growth, rather than adopt a reactionary policy stance. Certainly, the ability of central banks to discern if stock price movements are as a result of bubbles or driven by fundamentals play a key role in any decision to intervene. Notwithstanding the likely difficulties in discerning these movements, policy makers can no longer afford to fall into the trap of benign neglect. The divergent perspectives on the theoretical nexus between monetary policy and the stock market reflect the underlying choices between intervening or not to intervene, as well as the timing and tools of intervention, while questioning the potency of any approach.

## **2.3 Empirical Literature**

Earlier studies by Park and Ratti (2000) reported rolling vector autoregressive results using monthly data for the US which showed that monetary policy effect on stock returns was time sensitive. Ibrahim and Aziz (2003) studied the interactions among stock index, money supply, inflation, exchange rate to the US dollar and real industrial production for Malaysia employing both the vector error correction and vector auto-regressive models on monthly series from 1977 to 1998. Their findings indicated a negative long-run effect of money expansion and exchange rate to stock price, but a positive effect of inflation and industrial output on stock price index. Bernanke and Kuttner (2004) adopted an event study analysis to examine the effects of unanticipated changes in the federal funds rate on the aggregated and industry- based US stock indices. Using a measure of monetary policy based on federal funds rate futures data, they found a negative effect of interest rate on stock prices which was attributed to declines in equity premiums.

More recent studies such as Gali and Gambetti (2015) specified a structural time-varying vector autoregressive model to investigate the response of the S&P 500 Index to monetary policy shocks in the US using quarterly time series from 1960-2007 as a sub-sample and 1960-2011 as its full sample. Their study which distinguished between the fundamental and non-fundamental movements in stock price index yielded estimates consistent with the theoretical view that the stock index declined with hikes in interest rate for their initial sample

period, while their baseline model indicated a persistent increase in stock prices to interest rate adjustments. Employing the GARCH methodology, Zhang et al (2011) in the case of China showed a positive relationship between china's accommodative monetary policy at the onset of the global financial crisis and stock market volatility. Their study asserted that 2008 marked a turning point in China's stock market history moving from a low-volatility regime to a high volatility regime as the central bank of China took accommodative measures to mitigate the impact of the global financial crisis. Through an in-depth study which applied the granger causality and co-integration techniques to examine the relationship between monetary policy and equity index for the 27 countries of the European Union during the financial crisis, empirical evidences from Stoica and Diaconasu (2012) for a monthly sample period from 2000-2012 and a post-crisis sub-sample from 2007-2012 showed that monetary policy changes- measured by interest rate has a short-run and long-run relationship with asset prices, with a stronger long-run relationship observed during the crisis. Their results, however, indicated a weak co-movement between equity index and interest rate during the crisis. Yusof and Majid (2007) employed the autoregressive distributed lag approach to cointegration in examining the long and short run relationship between exchange rate, treasury bills rate, US federal funds rate, index of industrial production and the Malaysia stock market in the post 1997 Asian financial crisis using monthly data from May 1999 - February 2006. Their study found that the US federal funds rate impacted significantly on the Malaysia stock market with increased role for money supply, treasury bills and exchange rate in the equity market. In a similar study, Bellalah et al (2012) examined the dynamics between China's Shanghai composite index and macroeconomic variables before and after the global financial crisis using monthly data from 2001-2010. Their study which adopted the autoregressive distributed lag approach showed that equity prices are influenced by its past prices, interest rates, lagged inflation rate and index of industrial production in the short-run. Ikoku and Okany (2014) examined the sensitivities of stock market returns in Nigeria and South Africa to inflation, exchange rate, crude oil and gold prices as well as inter-bank lending rates before and during the global financial crisis using monthly data. The first sub-sample from 2003 to 2007 captured the pre-economic and financial crisis period, while the period from 2008 to 2012 depicted the global financial crisis period. Applying an autoregressive moving average (ARMA) methodology, their findings indicated that the Nigerian and South African stock indices were insensitive to the movements in short-term interest rates both prior and during the crisis. The literature is quite divergent about the appropriate role of monetary policy in the stock market, but what appears certain is that the collapse in global equity markets during

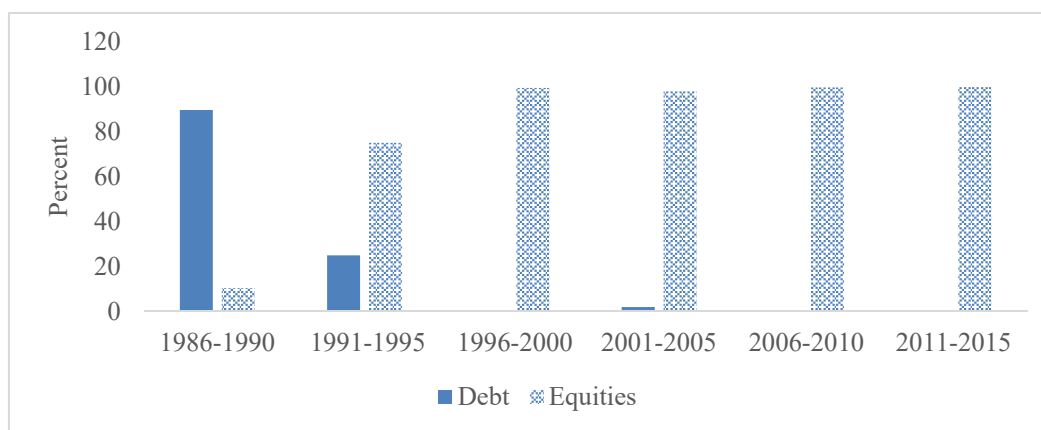
the global financial crisis has led to an increasing attention to these linkages in the financial research literature. Whether monetary policy affects the stock market is thus really a question of empirical analysis.

## Chapter 3. Monetary Policy and the Nigerian Stock Exchange

### 3.1 The Nigerian Stock Exchange

The Nigerian Stock Exchange (NSE) has evolved in terms of listed securities, size, market institutions and trading platforms. The Exchange was established on September 15, 1960 and commenced trading with 3 listed equities and 5 debt instruments in 1961. Trade in equities picked up in late 90s and has continued to dominate market activities. Figure 1 indicates the trend in value of equity and debt transactions in the stock exchange.

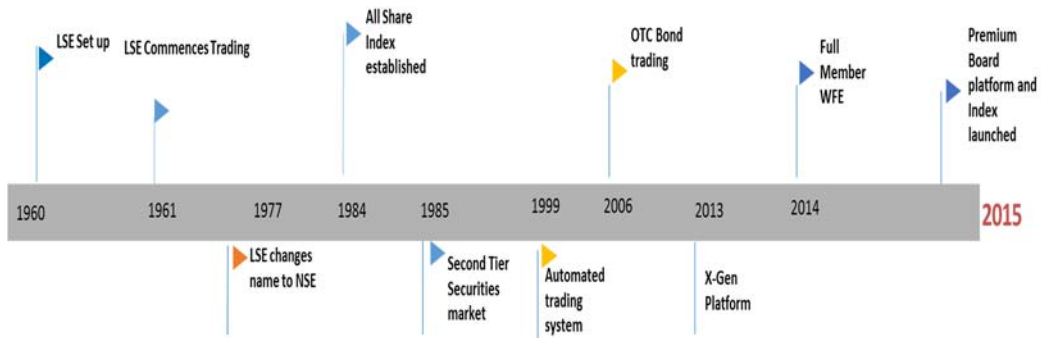
**Figure 1 Average Value of Stock Market Transactions, (%)**



*Source: Computed from CBN Statistical Bulletin (2015), The Nigerian Stock Exchange Annual Reports and Accounts*

As at June 2016, equities dominated exchange activities accounting for 72 per cent of 251 listed securities and 59 per cent of total market capitalization of ₦17.3 trillion (US\$61.1 billion at end-June spot \$1=₦230), exchange traded funds (2.79 per cent of listed securities and 0.03 per cent of total market capitalization) and the bond segment comprising government, corporate and supranational bonds (25.5 per cent of listed securities and 41.1 per cent of total market capitalization), (Nigerian Stock Exchange, 2016).

**Figure 2 Notable Events in the Nigerian Stock Exchange**



Source: Compiled from The Report of the SEC Committee on the Nigerian Capital Market - February 2009; website of the Nigerian Stock Exchange website. Note: The Nigerian Stock Exchange was previously called the Lagos Stock Exchange (LSE)

The Exchange publishes 12 indices including “NSE All Share Index (ASI), the NSE 30 Index, the NSE Pension Index, the NSE Banking Index, the NSE Consumer Goods Index, the NSE Industrial Index, the NSE Insurance Index, the NSE Oil and Gas Index, the NSE Lotus Islamic Index, the NSE Premium Board Index, the NSE Main Board Index and the NSE ASeM Index” (Nigerian Stock Exchange, 2016). The NSE all share index is value weighted and comprises only of ordinary shares.

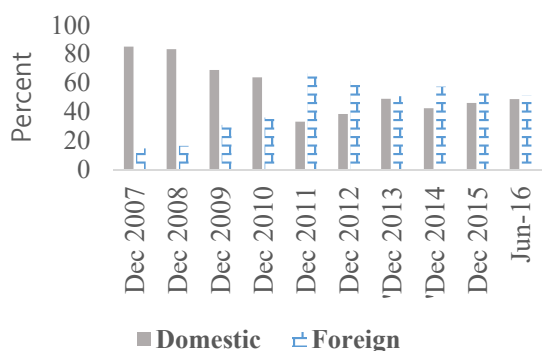
**Table 1 The Nigerian Stock Market-Functionalities**

Instruments	Stocks	Ordinary (common), preference, Real Estate Investment Trusts (REITS)- Mortgage REITS, Equity REITS, Hybrid REITS
	Bonds	Federal Govt. Bonds, State Bonds, Supranational Bonds, Corporate Bonds
	ETPs	ETFs
Market Structure	Hybrid	
	Multi-Board	Main Board, Premium board, AseM
Trading mechanism		Pre-Open, Main (continuous trade), pre-Close, Close
		Hierarchical basis of price, cross and time priority
Order method		Central order
		Limit order/Market order
		Good till Month/Day/FOK
		Two- side quotes

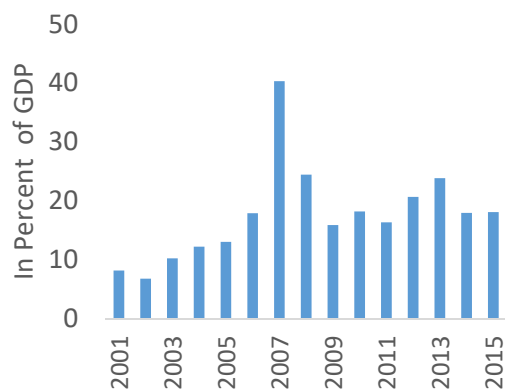
Source: Compiled from the Nigerian Stock Exchange website, Korean Exchange (2014)

Foreign portfolio investment in the stock exchange which peaked at about 60 percent of market transactions in 2012 declined to 52 per cent in June 2016. Conversely, domestic transactions has declined from a peak of about 90 per cent to about 48 per cent in June 2016.

**Figure 3 Domestic and Foreign Transactions in the NSE**



**Figure 4 Market Capitalization (In per cent of GDP)**

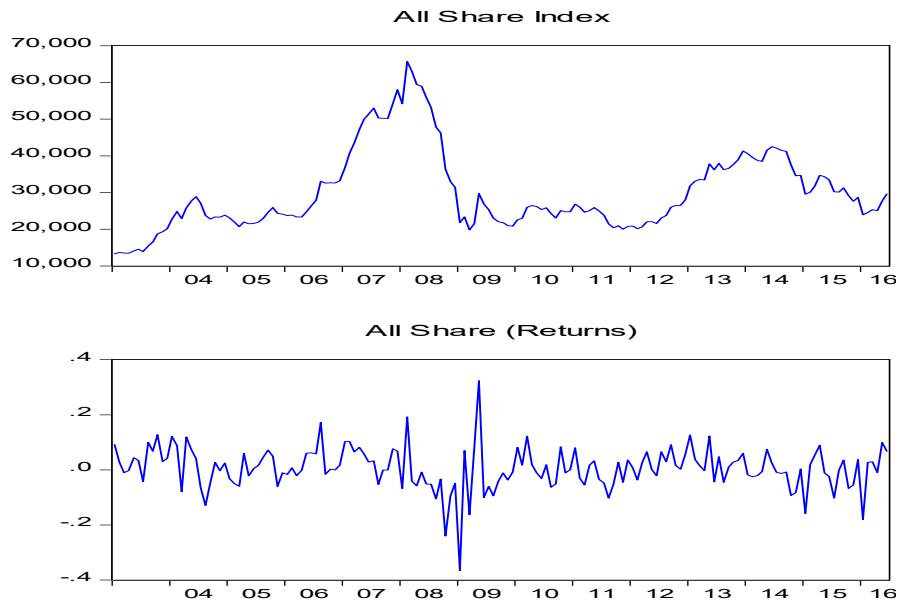


Source: Foreign Portfolio Investment Reports of the Nigerian Stock Exchange

Source: CBN Statistical Bulletin (2015)

Total market capitalization normalized by the Gross Domestic Product, (GDP) increased steadily from 2000 through 2005 - a period characterized by the financial sector reforms such as banking sector consolidation which also led to an upsurge in capital raising activities. Market capitalization peaked to an average of 22.5 per cent of GDP during 2006-2010 but thereafter declined to 19 percent. The all share index exhibited similar patterns. An examination of the time path of the equity index during the sample period show a bullish stock market prior to the global financial crisis. The plot of monthly returns show higher volatility (measured by standard deviation) and more episodes of negative equity returns in the post-crisis period (Figure 5 and Table 2).

**Figure 5 Stock Index and Corresponding Returns**



**Table 2 Average Absolute Monthly Percentage Returns (In %)**

All Share Index	Full Sample	Pre-crisis	Crisis/Post-crisis
Mean	0.6	2.7	-0.5
Median	0.3	2.7	-0.4
Standard Deviation	7.6	5.9	8.2

### 3.2 The Conduct of Monetary Policy in Nigeria

Monetary policy has been broadly implemented under an exchange rate and a monetary targeting framework towards achieving the objectives of monetary and price stability, the maintenance of a sound financial system, the maintenance of external reserves to safeguard the international value of the legal currency, and acting as a banker and provide economic and financial advice to the government (CBN Act, 2007). Within these two broad frameworks, it has evolved from a direct control process (pre-1986) to an indirect approach (post-1986) and subsequently a full adoption of market based tools in 1993. Some major changes in the monetary policy landscape since the indirect control period include: - the establishment of the monetary policy committee in 1999, and the introduction of the monetary policy rate (and an interest rate corridor) in 2006 which replaced the minimum rediscount rate. Since 2002, the Central Bank of Nigeria outlines money and credit policy measures in a two-year medium term framework.

**Table 3 Monetary Policy Framework**

Period	Framework	Horizon	Instruments/Features
1959-1973	Exchange Rate Targeting (Direct Control)	Short term (1 year)	Credit ceilings, sectoral credit allocation. Interest controls. Imposition of special deposits, mandatory sales of special Treasury bills to banks with a 200% requirement for FX cover.
1974-1985	Monetary Targeting (Direct control)	Short term (1 year)	Open Market Operations, Discount Window, Reserve requirements, Standing facilities, Autonomous Foreign exchange FX transactions, Unified exchange rate regime, Minimum Rediscount rate (MRR), Monetary Policy Committee
1986-2001	Monetary Targeting (Indirect Control)	Short term (1 year)	
2002-	Monetary Targeting (Indirect Control)	Medium-Term (2 years)	Monetary Policy rate as a new anchor in 2006, Open Market Operations, Reserve requirements, standing facilities, interest rate corridor. Net Foreign currency trading position limit

*Source: Compiled from CBN Monetary Policy Review,*

The tools for the conduct of monetary policy include:

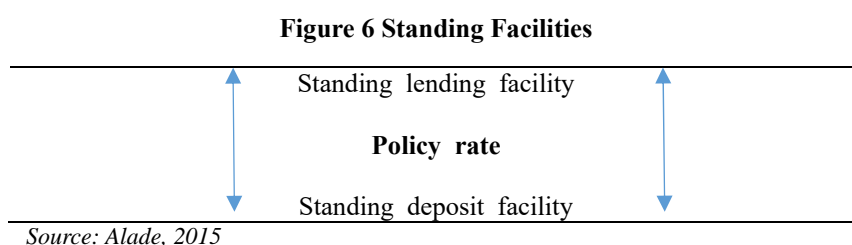
**Open Market Operations:** - It is the primary instrument of monetary management in Nigeria implemented through the issuance and auction of eligible securities such as treasury bills, central bank and open market operation bills to adjust the systemic liquidity through its impact on the reserve (base) money. Primary auctions are largely conducted with the treasury bills and transactions in this market can be broadly categorized into the outright transaction or repurchase transactions.

**Reserve Requirements:** - The cash reserve requirement (CRR) stipulates the percentage of eligible deposit liabilities of banks required to be held as reserves with the central bank, while the liquidity ratio requires banks to maintain a stipulated ratio of eligible liquid assets to time and demand deposit liabilities with the central bank. A higher cash reserve ratio and liquidity ratio indicates a restrictive policy stance which should result in lowering the system liquidity and vice versa. There is no legally prescribed bound for the reserve requirements. The bank has implemented both a dual CRR and a harmonized regime. As at December 2014, the cash reserve requirement for private sector deposits was increased from 12 per cent to 20 per cent, and from 50 per cent to 75 per cent for public sector deposits. In May 2015, the dual regime was harmonized at 31 per cent for public and private sector deposits. Liquidity ratio was kept at 30 per cent during this period.



**Monetary Policy Rate:** - This is an indicative benchmark or a signaling instrument to the short-end of the financial market. An increase (decrease) in the policy rate signals a contractionary (expansionary) monetary policy.

**Standing Facilities/Interest rate Corridor:** - The introduction of the new monetary policy framework in 2006 also marked the creation of an interest rate corridor for the conduct of monetary policy. This corridor can be symmetric or asymmetric depending on economic conditions. Adjustments are done on the policy rate, narrowing or widening of the rate corridor or both to achieve predetermined objectives. At inception, the corridor was +/-300 basis points around the policy rate. At July 2016, the corridor was symmetric at +/-500basis points around the policy rate with the deposit facilities as the floor on the corridor.



**Net Foreign Currency Trading position limit:** With adjustments in this limit, the central bank seeks to manage the foreign exchange risk exposure of banking institutions in the foreign exchange market. As at December 2014, the net foreign currency trading position limit was reduced from 1 per cent to 0 per cent. This was raised to 0.05 per cent in 2015. A lower limit indicates a contractionary policy, while an increase in the limit signals an expansionary policy stance.

### 3.3 Monetary Policy during the Financial Crisis

The central bank beginning from September 2008 adopted an expansionary policy stance; reducing policy rate to 8 per cent; reduction in cash reserve ratio from 4 per cent to 2 per cent, and reduction in the liquidity ratio from 40 per cent to 30 per cent. A series of other accommodating measures included the introduction and subsequent extension of central bank guarantee of inter-bank market transactions, setting up of the asset management corporation of Nigeria, injection of tier 2 capital to the banking system, and expansion of the definition of eligible securities for discount window operations. The market recovered somewhat in absolute terms following these accommodative policy stance which saw the stock market rebounded almost mimicking the 2006

build-up but peaked in mid-2014 thereafter which it declined. (see figure 5)

**Table 4 Synopsis of Monetary Policy Measures in Response to the Crisis**

<b>Monetary Policy Tool/Measure</b>	<b>Action</b>
Cash Reserve Requirement	Reduction from 4% to 2%
Liquidity Ratio	Reduced from 40% to 30%
Monetary policy rate	Stepwise reduction from 10.25% to 9.75% to 8%
Foreign Currency Trade position	Reduced from 20% to 10% to 1% of shareholders' funds
Expansion of Discount window facility from overnight to 360 days with interest rates not higher than 500 basis point above the policy rate	
Aggressive liquidity mop up suspended for relaxed monetary policy	
Commenced Two-way quote in the security trading	
Adoption of + 3% band of exchange rate movement	
Reintroduction of the Retail Dutch Auction system	
Suspension of daily interbank FX market to minimize speculative attacks	
Guarantee of inter-bank market transactions	
Set up of the Asset Management Corporation	
Injection of tier 2 capital to the banking system and expansion of the definition of eligible securities for discount window operations	

*Source: Author's compilation from Central Bank of Nigeria Monetary Policy Communiques, Oduh (2013)*

### **3.4 Trend Analysis**

The time plot in Figure 7 show the monthly growth of equity prices and monetary aggregates. There is a general positive trend with observable time lags, though this association appeared to be weaker prior to 2010. The mid-section of the plot reveal the growth in equity prices appeared not to be significantly driven by movements in money balances.

**Figure 7 Equity Index and Monetary aggregates**

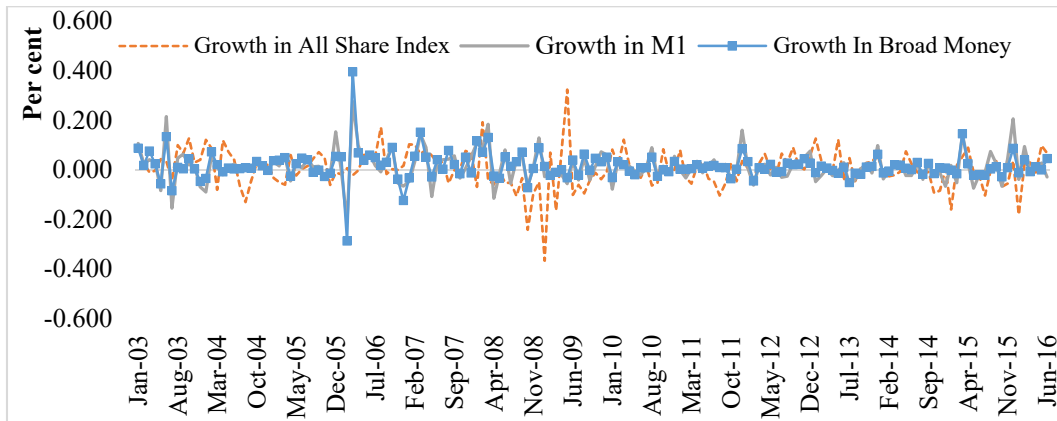
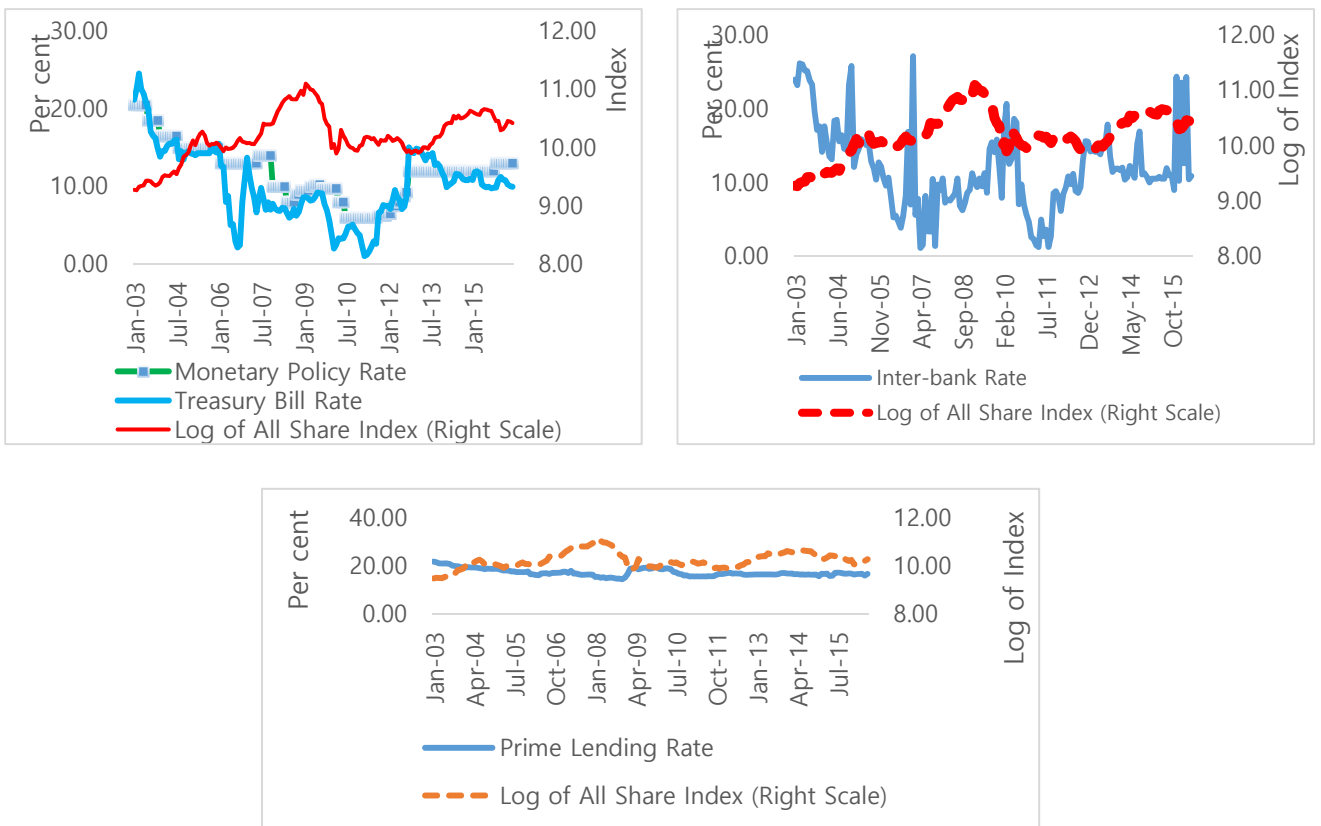


Figure 8 generally show an inverse relationship between interest rates and equity prices.

**Figure 8 Equity Index and Short-Term Interest Rates**



## Chapter 4 Data and Research Methodology

### 4.1 Data and its Properties

The dataset consists of monthly time series from January 2000 to June 2016 representing 198 observations. The full sample is further split into a pre-crisis period from January 2000 to August 2008 (104 observations), while September 2008 to June 2016 (94 observations) represents the crisis/post-crisis period. The choice of this split date is based on two factors. First, it was endogenously determined by the breakpoint test. Second, it corresponds with the standard crisis period in the literature (See Pennings et al 2011). This sub-sample analysis would provide an indication of the time-sensitivities of the equity prices to monetary policy adjustments in different time periods. The all share index of the Nigerian stock exchange is used as the representative index. Monthly index returns are calculated as the natural log difference between index at time (t) and (t-1). That is;  $r_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$ . Monetary policy intervention is captured by both short-term interest rates and broad money supply. The following short-term rates are considered; the monetary policy rate (MPR), the inter-bank call rate (IBR) prime lending rate (PLR) and the 91-day treasury bills rate (TBR). However, due to the possibility of multicollinearity, a simplistic method of examining the correlation among these interest rates is adopted to make guided inferences on whether an interest rate indicator should be dropped ex-ante. The interest rate with a strong correlation with the monetary policy rate is selected as a proxy for monetary policy adjustments. (See Pennings et al 2011). Apriori expectations are that increases (decreases) in short-term interest rates:-a signal of restrictive (expansionary) policy stance will dampen (increase) stock index if stock price movements are driven by fundamentals (bubble component). Broad money supply is expected to have a positive relationship with the equity index. However, the results could be ambiguous as excessive money growth can worsen inflationary outcomes with less than desired effect on the stock market. Two control variables namely; nominal inter-bank exchange rate and US federal funds rate are introduced. The nominal exchange rate of the Naira to the US dollar is introduced for a small open economy and also captures a transaction price of foreign portfolio investment in the equity market. The apriori expectations for exchange rate and stock prices is based on the international trade and portfolio balance theories.

**Table 5 Variables and Data Sources**

Variable	Symbol	Explanation/measurement	Source
All Share Index	LASI	Value weighted index in natural log	Thomson Reuters
Treasury Bills Rate	TBR	Rates on government securities	Central bank
Nominal exchange rate of the Naira/USD	LIBER	Inter-bank exchange rate/Represents the transaction rate for foreign flows in financial markets	Central bank
Money supply	LMS	Broad money supply	Central bank
US Federal Fund Rate	USR	Policy Rate of US	Thomson Reuters

According to the international trade theory, an exchange rate depreciation should, *ceteris paribus*, increase stock prices for export-oriented firms. For import oriented firms, exchange rate depreciation is expected to decrease stock prices (Tsai, 2012). The portfolio balance approach theorizes that exchange rate depreciation should result in decline in stock prices as foreign investors become less enthusiastic about investment prospects in a country's stock market. The flow theory suggests that a positive relation holds between exchange rate and equity price. Hence, there is no theoretical consensus on the stock price-exchange rate relation. However, in the case of Nigeria, a negative relationship is anticipated at least in the long-run between rises in exchange rate and stock prices since it is largely an import-oriented economy. The US federal funds rate is introduced as a global monetary policy factor and its significance to frontier markets. *A priori* expectation is an inverse relationship with the domestic equity market index. Data is sourced from the database of the central bank of Nigeria, with the exception of the equity market index and US federal funds rate obtained from Thomson Reuters. The choice of variables have been largely motivated by theoretical and empirical literature, (Bonfim 2003; Tsai, 2012; Saidjada et al 2013; Ruiz, 2015). All variables are expressed in their natural logarithm with the exception of domestic Treasury bill rate and the US Federal funds rate.

## 4.2 Research Methodology

The autoregressive distributed lag (ARDL) technique of Pesaran et al 2001 is adopted for three reasons. First, unlike the traditional vector error correction method which has a strict condition on the integration order of the variable, the ARDL has a non-restrictive assumption on the order of integration and inferences are valid as long as the order of integration, ( $d$ ) falls between 0 and 1  $\{0 \leq d \leq 1\}$ , (Ouattara 2004). In other words, it is a technique suitable for strictly I (1) or I (0) or mixed order of integrated series. Secondly, it is a dynamic model as

it allows for flexibility in the lag structure of variables in the model. Third, the ARDL is known to yield robust and consistent results for the long-run and short-run relationships. One disadvantage of the ARDL however is the potential difficulty in providing theoretical interpretation when there are many lagged or differenced terms. The generalized estimated ARDL model is of the following form

$$\Delta lasi_t = \mu_0 + \sum_{i=1}^n \mu_1 \Delta lasi_{t-i} + \sum_{i=0}^n \mu_2 \Delta lms_{t-i} + \sum_{i=0}^n \mu_3 \Delta tbr_{t-i} + \sum_{i=0}^n \mu_4 \Delta liber_{t-i} + \sum_{i=0}^n \mu_5 \Delta usr_{t-i} + \mu_6 lasi_{t-1} + \mu_7 lms_{t-1} + \mu_8 tbr_{t-1} + \mu_9 liber_{t-1} + \mu_{10} usr_{t-1} + \varepsilon_t \dots \dots \dots (1)$$

Where lasi is log of equity index, lms- log of broad money supply, tbr-treasury bills rate, liber- log of inter-bank exchange rate, usr is the US federal funds rate.  $\Delta$  is the difference operator and  $\varepsilon_t$  is a white noise process. Though it is not a pre-condition to test for unit root properties of a series before applying the ARDL technique, empirical literature generally concur that the use of non-stationary data could lead to spurious regression (Brooks, 2014). Moreover, conducting the unit root test is useful in determining the non-existence of I(2) variables which if present renders the use of the ARDL void. The time series are tested for the presence of unit roots using the standardized Augmented Dicker Fuller test (ADF) test equation:

$$\Delta y_t = \lambda y_{t-1} + \sum_{i=1}^n \alpha_i \Delta y_{t-i} + \varepsilon_t, \lambda = 1, |\lambda| < 1 \dots \dots \dots (2)$$

Where the errors  $\varepsilon_t$  are independent and normally distributed, with zero mean and constant variance  $\sigma^2$ . Hence, the generalised null hypothesis for unit root test is

$$H_0: y_t \sim I(1); H_1: y_t \sim I(0) \dots \dots \dots (3)$$

where  $y_t$  is a vector of all variables. Accordingly, when  $\lambda$  is significantly different from zero, the null hypothesis of unit root is rejected and the series is stationary (Hill, Griffiths and Lim 2008). To provide for robustness in the presence of structural breaks, a modified ADF unit root test with structural break is conducted. Though the onset of the crisis can be inferred, the breakpoint for the equity index is endogenously determined using the breakpoint tests, (Perron 1997). Where a breakpoint is observed, a crisis dummy variable is introduced to account for this shock in the full sample. Following Pennings et al (2011), the dummy variable is assigned the

value of 1 for the standard crisis period of September 2008-March 2009 and 0, otherwise. The value of 1 is extended to end at June 2010 to coincide with the end of broad crisis period as indicated in Pennings et al. The optimal lag length selection are guided by two rules of thumbs suggested by Brooks, 2014. First, an initial lag length of 12 is applied based on the frequency of time series. Second, the lag length which minimizes the value of the Akaike information criterion is selected as the optimal lag length. After examination of the initial conditions on the integration order of the series, the ARDL approach begins by conducting a joint significance test for the existence of long-run relationship among the coefficients of the lagged level variables with the aid of the F-test statistics. Pesaran et al (2001) developed critical values for the upper and lower bound based on the number of predictor variables and the structure of the test equation. E-views tabulates these critical values which provide a basis for deciding whether the null hypothesis of the absence of a long-run relationship is rejected or not. If the F-statistics is higher (lower) than the upper (lower) bound values, the null hypothesis is rejected (not rejected). When the F-statistics falls between the two bounds, the result is inconclusive. The existence of a co-integrating relationship permits the estimation of the error-correction model and the derivation of short-run coefficients using ordinary least square. Robustness tests are conducted on the estimated model. The parameter stability tests are performed on the residuals of the estimated error correction models using the cumulative sum (CUSUM) of recursive residuals and the CUSUM of square of recursive residuals (CUSUMSQ) tests. When the plots of the CUSUM and CUSUMSQ fall within the 5 percent bound, the null hypothesis of the long-run stability of estimated coefficients is not rejected and provide evidence that the model is correctly specified. The error correction term which represents the adjustment speed of the system when there is a shock is expected to be significant and negative. As an added robustness check, impulse response functions from a vector framework is simulated to examine the dynamic interactions of the equity index to one standard deviation shocks to money supply, treasury bills rate, exchange rate and the US federal funds rate.

## Chapter 5 Discussion of Empirical Results

### 5.1 Descriptive Analysis

The descriptive statistics in Table 6 indicate that all series are positively skewed except for all share index and broad money supply. In other words, the median values of Treasury bills rate, US federal funds rate and exchange rate show a tendency to decline relative to their mean values. The probability (p-value) of the Jarque-Bera (JB) test statistics which is commonly applied as a test for normality using the joint coefficients of skewness and kurtosis indicate that the null hypothesis of residual normality is rejected at 1 and 5 per cent level of significance for all series except inter-bank exchange rate and treasury bills. However, as noted by Brooks 2014 ‘for sample sizes that are sufficiently large, violation of the normality assumption is virtually inconsequential’.

**Table 6 Descriptive statistics**

	LASI	LIBER	TBR	LMS	USR
Mean	10.05	4.94	10.70	15.49	1.79
Median	10.11	4.90	10.30	15.85	0.94
Maximum	11.09	5.45	24.50	16.89	7.13
Minimum	8.66	4.59	1.04	13.38	0.01
Std. Dev.	0.54	0.17	4.77	1.02	2.10
Skewness	-0.64	0.26	0.19	-0.32	0.98
Kurtosis	3.05	2.72	2.67	1.65	2.56
Jarque-Bera	13.39	2.87	2.02	18.43	33.41
Probability	0.00	0.24	0.37	0.00	0.00
Observations	198	198	196	198	198

*LASI, LIBER and LMS denotes log values of all share index, inter-bank exchange rate and broad money supply. TBR, USR represents domestic treasury bills rate and the US federal funds rate, respectively.*

Table 7 present the correlation coefficients of the short-term interest rates indicating a stronger positive relationship between policy rate, treasury bills rate and inter-bank rates. Treasury bills rate is selected as the main interest rate indicator as it appears more connected to the policy rate during the sample period. In table 8, a positive correlation of 0.71 is observed between money supply and equity index; domestic interest rate and equity index (-0.58); US federal funds rate and equity index (-0.37); inter-bank exchange rate and equity index (0.47).



**Table 7 Correlation Matrix of Short-Term Interest Rates**

	TBR	PLR	MPR	IBR
TBR	1.00	0.21	0.73	0.51
PLR		1.00	0.35	0.16
MPR			1.00	0.37
IBR				1.00

**Table 8 Correlation of Equity Index and Independent variables**

	LASI	LMS	TBR	USR	LIBER
LASI	1.00	0.71	-0.58	-0.37	0.47

## 5.2 Testing for Unit Root

In table 9, the results of the Augmented Dickey Fuller (ADF) test statistics at the log-levels and first difference is presented. All variables, with the exception of the US federal funds rate, is I (1).

**Table 9 Augmented Dickey Fuller (ADF) Unit Root Test (Intercept, Trend)**

Null Hypothesis: Variables have a Unit Root

Variable	Levels	First Difference
	LASI	-3.65
TBR	-2.74	-7.79***
LIBER	-1.35	-8.27***
LMS	-1.598	-16.96***
USR	-3.93**	-3.24*

Notes: Reported values are the ADF test statistics. The ADF test equation include the trend and intercept term. The prefix "l" represents natural logarithm. All variables, with the exception of treasury bills and US federal funds rate are in their natural log form. "\*\*\*\*", "\*\*\*", "\*\*"denotes 1%, 5% and 10% significance level. The break point unit root test is conducted on the equity index. The US federal funds rate (USR) is integrated of order 0; I(0), while log of all share index(LASI), log of money supply (LMS), treasury bills rate(TBR), log of nominal exchange rate(LIBER) are integrated of order 1, I(1).

### 5.3 ARDL Bounds Test for Cointegration

The ARDL bounds cointegration results are shown in table 10 for the full sample, pre-crisis and post-crisis samples. The F-statistics for the full and pre-crisis samples are greater than the upper level I (1) bounds indicating evidence of a long-run relationship at both 5% and 10% level of significance respectively. Results from the post-crisis sample show that the null hypothesis of no cointegration is rejected at the 10% significance level but inconclusive at the 5% level. Thus, it can be inferred that a long run cointegrating relationship exists among the equity index, money supply, treasury bills rate, exchange rate and the US federal funds rate at 5% and 10% across the samples.

**Table 10 ARDL Bounds Cointegration Results**

K=4	F-Stat	90%		95%	
		I(0)	I(1)	I(0)	I(1)
Full Sample 2000:1-2016:6	4.91**	2.2	3.09	2.56	3.49
Sub-sample 2000:1-2008:8	5.16**	1.9	3.01	2.26	3.48
Sub-sample 2008:9-2016:6	3.16*	2.2	3.09	2.56	3.49

Notes: I (0) and I(1) represents the lower and upper bounds. \*\* signifies the rejection null hypothesis of no cointegration at 5% level of significance. \* rejects null hypothesis of no cointegration at 10 % significance level. Results are based on the Akaike Information criterion.

### 5.4 Estimation Results

The long run estimates shown in Table 11 indicate that domestic treasury bills rate has a negative, dampening but insignificant effect on equity prices in the pre-crisis sample. In the post-crisis sample, a 1-unit change in treasury bills rate will lead to a change in equity prices of -0.3 per cent. Though statistically significant, the magnitude of impact as indicated by its coefficient did not differ between its pre and post crisis level suggesting that equity prices were not sensitive to domestic treasury bills rate. This result is similar to findings by Ikoku and Okany (2014) of a weak sensitivity of equity index to inter-bank rate. In line with theoretical postulations, a significant and positive relationship between money supply and the equity market is observed. The findings are consistent with Yusof and Majid (2007), Osisanwo and Atanda (2012), Jannsen et al (2016) who find a dominant role for money supply in the equity market. The coefficients indicate that a percentage rise in broad money supply increases equity prices by 0.416 per cent across the full sample. The broad money supply has a greater long-run impact on equity prices in the post crisis period indicated by its coefficient of 2.24 in the post-crisis sample

compared to 0.603 in the pre-crisis. Hence, money supply could be more potent as a policy instrument to affect the equity market outcomes. In the long-run, the pre-crisis model indicate a positive coefficient for the exchange rate, suggesting the presence of a flow relationship perhaps due to the gradual build up in foreign portfolio investment. Inter-bank exchange rate has a stronger and negative impact on the equity market in the full sample and post-crisis period; a one percent change in exchange rate is expected to dampen the equity market by -0.76 per cent and -4.06 per cent, respectively. This is largely consistent with theoretical expectations for an import-oriented economy and perhaps the cautious approach to investment prospects following the crisis. The coefficient of the crisis dummy, using the Taylor's series expansion, show that the financial crisis exert a negative long-run effect in Nigeria's equity market depressing the equity market by 0.59.

**Table 11 Results for ARDL Long-Run Estimates**

Dependent Variable: LASI	Full Sample	Pre-Crisis Sample	Post-Crisis sample
LMS	0.416***	0.603***	2.243***
USR	0.167***	-0.074**	-0.863*
TBR	0.002	-0.033	-0.028*
LIBER	-0.757	0.327	-4.059***
SDUMMY	-0.882***		

Coefficient values are reported. \*\*\*, \*\*, \* significant at 1%, 5% and 10% respectively. LASI: Log of all share index, LMS: Log of Broad money supply, USR: US Federal Funds Rate, TBR: Domestic Treasury bills rate, LIBER: Log of nominal inter-bank exchange rate.

The short-run error correction model reported in table 12 show that the equity index follows an autoregressive process which is largely positive and more pronounced in the pre-crisis period. In the short run, there is no significant evidence of money supply impacting on equity market in the full sample. In the pre-crisis and post-crisis short run model, there is evidence of a general positive effect of money supply on the equity market, with the effects more pronounced in the post-crisis period judging by the size of the coefficients. Consistent with the estimates in the long-run ARDL model, the larger coefficients of broad money supply in the short-run suggest that money balances sways the equity market more than the changes in the treasury bills rate.

**Table 12 Results for Short-Run Error Correction Models**

Dependent Variable: LASI	Full Sample	Pre-Crisis Sample	Post-Crisis sample
$\Delta$ LASI (-2)		0.444***	0.229***
$\Delta$ LASI(-3)	0.153**	0.353	
$\Delta$ LASI(-4)		0.353**	-0.157*
$\Delta$ LASI(-5)		0.409***	
$\Delta$ LASI (-6)		0.278**	
$\Delta$ LASI (-8)		0.352***	
$\Delta$ LASI (-9)	0.227***	0.307**	
$\Delta$ LASI (-10)	0.165**		
$\Delta$ LASI (-11)		0.266**	
$\Delta$ LMS		0.165**	0.589***
$\Delta$ LMS (-1)		0.139*	
$\Delta$ LMS (-5)			0.641***
$\Delta$ LMS (-6)		-0.201***	
$\Delta$ LMS (-8)		0.252**	
$\Delta$ LMS (-10)		0.224**	
$\Delta$ USR		-0.034**	-0.218***
$\Delta$ USR(-7)	-0.063***		-0.150***
$\Delta$ USR(-8)			-0.092*
$\Delta$ USR(-9)	-0.063***		
$\Delta$ TBR	-0.011**	-0.014***	-0.012*
$\Delta$ TBR(-4)	-0.012		-0.010*
$\Delta$ TBR(-5)		-0.015***	
$\Delta$ TBR(-8)			-0.018***
$\Delta$ LIBER(-2)	0.693**		1.028**
$\Delta$ LIBER(-4)	1.065***	-1.113**	
$\Delta$ LIBER(-5)	0.935**		0.776*
$\Delta$ LIBER(-6)		0.973**	
$\Delta$ LIBER(-8)		-0.904**	
$\Delta$ LIBER(-9)		-1.069**	
$\Delta$ LIBER(-10)		-0.874*	
$\Delta$ LIBER(-11)		-1.477***	
SDUMMY	-0.153***		
ECT(-1)	-0.137***	-0.287***	-0.211***

\*\*\*, \*\*, \* significant at 1%, 5% and 10%. Values are coefficient estimates.  $\Delta$ : change operator. All variables remain as earlier defined. Full sample- ARDL (11, 0, 10, 6, 6). Pre-crisis- ARDL (12, 11, 12, 9, 12); Crisis/Post Crisis period- ARDL (5, 8, 9, 9, 6). See Figure 13 for model selection criteria graphs based on the Akaike Information Criteria.

The coefficients of treasury bills and the US federal funds rate are consistent across the sample periods with negative impacts on the Nigerian equity market. This implies that as interest rate increases, the equity market declines. However, the results indicate that the equity market show more sensitivity to the US federal funds rate than domestic interest rates, with the US federal funds rates exerting a higher impact in the crisis/post-crisis sample. This may not be unconnected with the increased share of foreign investment in the stock exchange over the years. Results indicate that the contemporaneous effect of US federal funds rate is larger than the effect of its lag in the

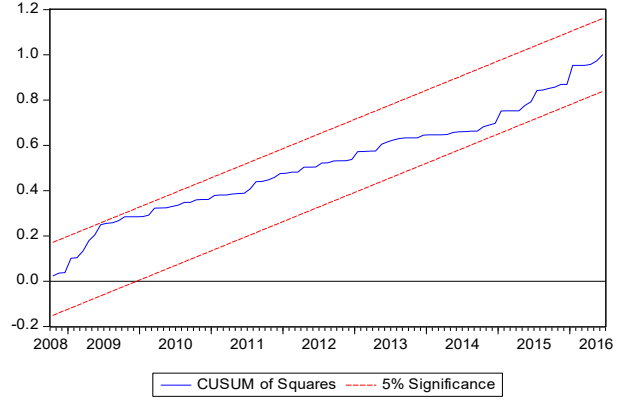
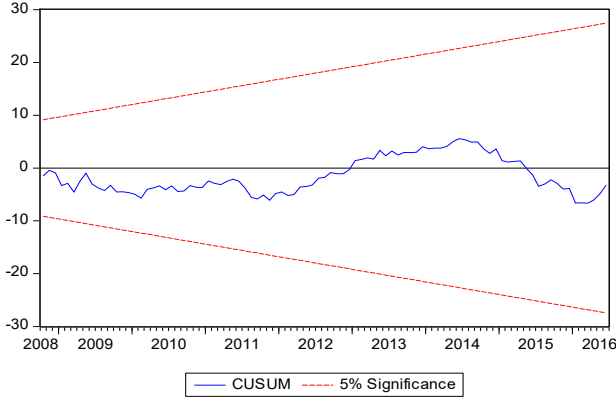
market. In the pre-crisis period, short run estimates show negative and similar response of the equity market to adjustments to both domestic and foreign interest rates. At almost all lags, nominal exchange rate was inversely related to the equity market during the pre-crisis period and consistent with the portfolio balance theory. I find short-run evidence of a positive relationship in the full sample and post sample period consistent with the flow-oriented theory suggesting that exchange rate development leads stock prices which are consistent with findings from Adaramola (2012). The coefficient of the crisis dummy significant at 1 per cent indicate the negative effect of the global financial crisis at -0.14 in the short-run. The impact of the crisis is much larger in the long-run than in the short-run. The short-run error correction term (ECT-1) is significant and negative at 1 per cent across the three sample period. In the full sample, short-run shocks are corrected at a slow rate of 13.7 per cent. Post-crisis model indicate a slower convergence at a rate of 21.1 per cent compared to the pre- crisis convergence rate of 28.7 per cent.

## **5.6 Post-Estimation Diagnostics**

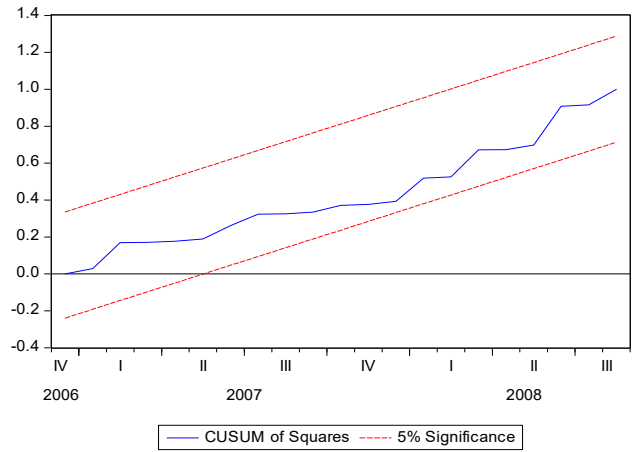
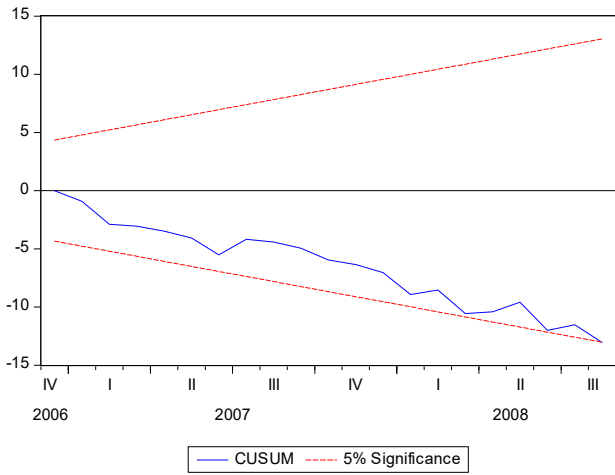
Diagnostics testing on serial correlation and stability of estimated coefficients are examined. The correlogram Q-statistics and Breusch-Godfrey Serial correlation LM test indicate the absence of serial correlation in the sample. The stability of parameter coefficients are examined through the CUSUM and CUSUMSQ. The null hypothesis of parameter stability is not rejected as the CUSUM and CUSUMSQ sum of squares plots fall within the critical bounds at 5 per cent level of significance (Figure 9). This indicates that the estimated parameters in tables 10 and 11 are stable.

**Figure 9 Plots of Cumulative Sum Recursive Residuals**

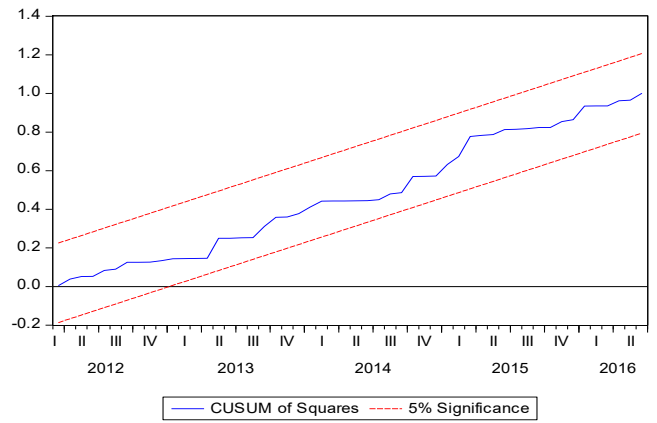
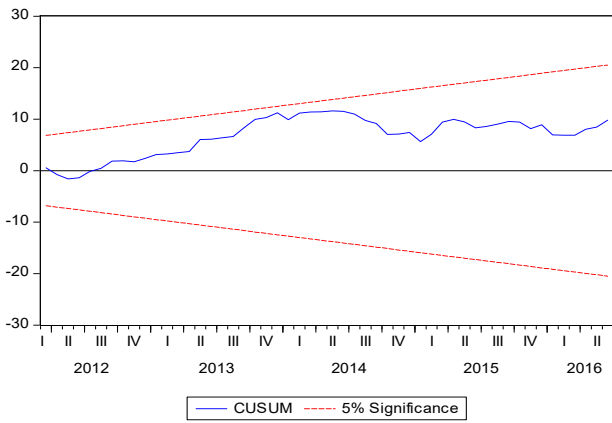
**Full Sample: 2000:1- 2016:6**



**Pre- crisis: 2000:1- 2008:8**



**Post Crisis: 2008:9-2016:6**

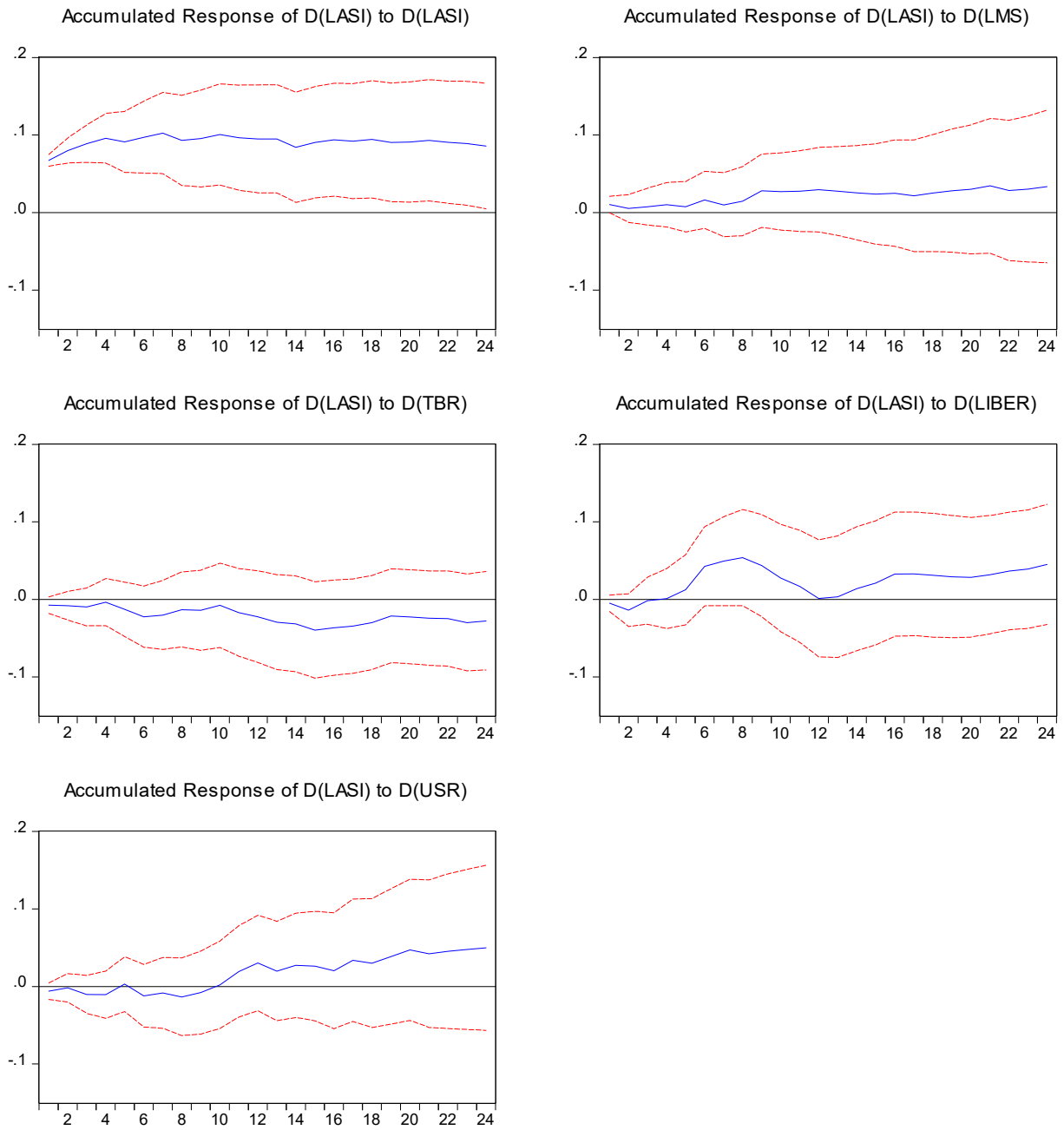


## 5.7 Other Robustness Checks

As part of additional robustness checks, the Johansen cointegration test is applied where only I (1) variables are considered and the US federal funds rate and crisis dummy treated as exogenous. Results from the Johansen cointegration test (not reported here) for the full sample indicate one cointegrating relationship in the full sample at 5% significance level, while the pre-crisis and post crisis sample both indicate the presence of two cointegrating relationship respectively at 5 percent level. Figures 10, 11 and 12 presents the shocks from the vector framework which are analyzed using the generalized impulse response function since it is not sensitive to the ordering of the variables. The accumulated responses to a one standard deviation shock to money supply is positive but minimal and almost nil during the pre-crisis period. Shocks to domestic short term interest rate indicate a negative and permanent effect on the equity market, while shocks to exchange rate have a positive impact on the equity market during the pre-crisis period. This corroborates the finding in the full sample short-run model and pre-crisis ARDL long run model. Stock market response to one standard deviation shocks to US federal funds rate is much larger in the post-crisis and it appeared that the equity market reacted to shocks in federal funds rate much faster than before the crisis which showed a negative and rather flat pattern in the first 5 periods. The post-crisis response of the equity market to shocks in US policy rate may not be unconnected with the inflow of foreign flows to the equity market in the wake of the crisis suggesting that investors 'concerns about the crisis outweighed attempts to reflate the US economy. In the post-crisis period, the stock market showed an initial negative response to shocks to exchange rate which thereafter turned positive. Responses to shocks in domestic treasury bills rate remained largely negative. The equity market shows a larger, positive and permanent effect to shocks to money supply indicating that liquidity injections was more effective during the crisis/post crisis period than the pre-crisis period, also confirming the results obtained in the post-crisis ARDL model. This result is consistent with Mishkin (2009), and Jannsen et al (2016) who argued that aggressive monetary policy and in particular the credit channel is more effective during the financial crisis than in normal times. It however contrasts with the studies by Valencia (2014) which hold the view that monetary policy is ineffective during crisis due to the impairment of the traditional credit and interest rate channel. However, in line with (Valencia 2014; Ikoku and Okany 2014), I find that the interest rate channel is weak both prior and after the crisis.

**Figure 10 Generalized Impulse Response Full Sample**

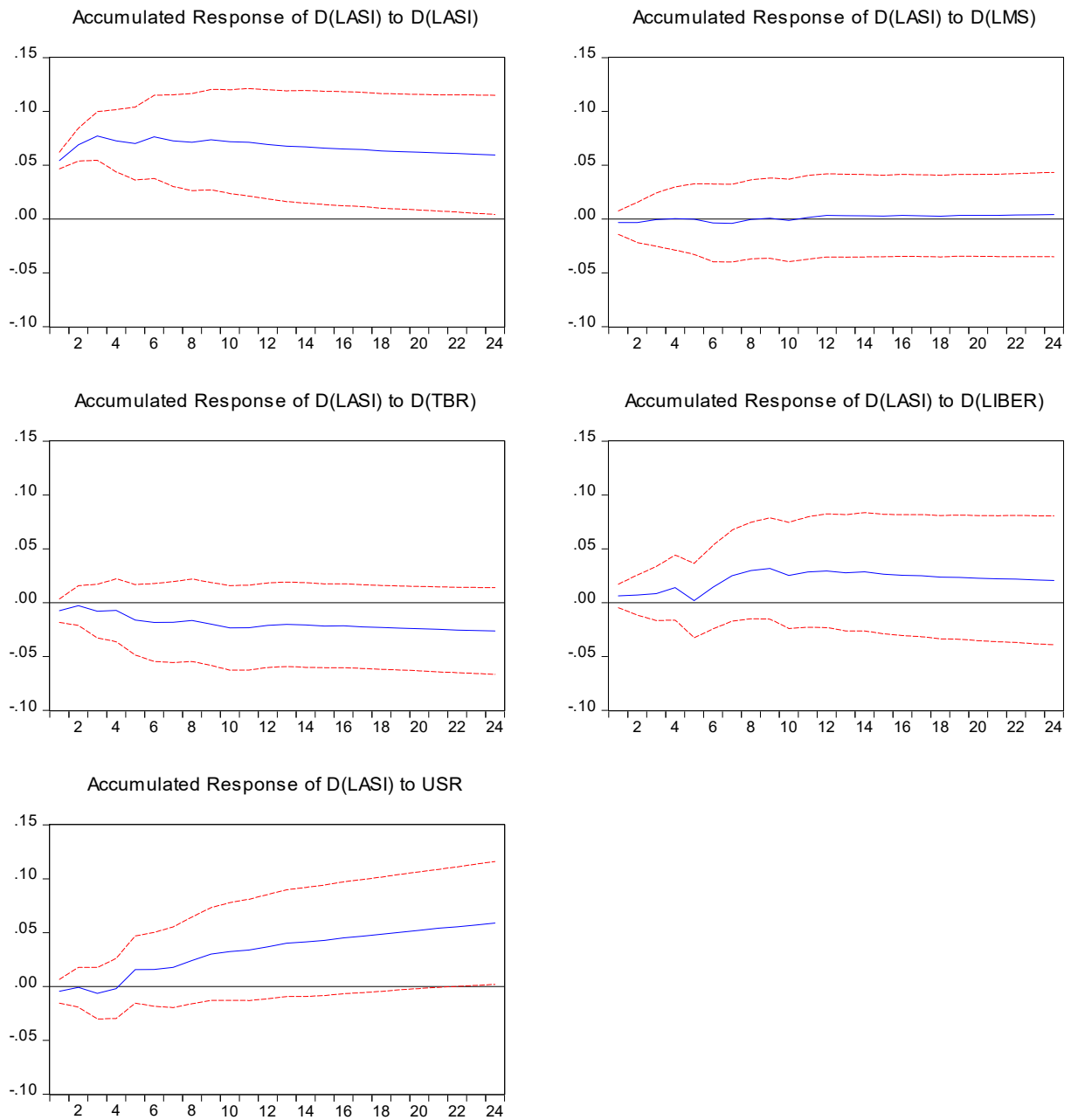
Accumulated Response to Generalized One S.D. Innovations  $\pm 2$  S.E.





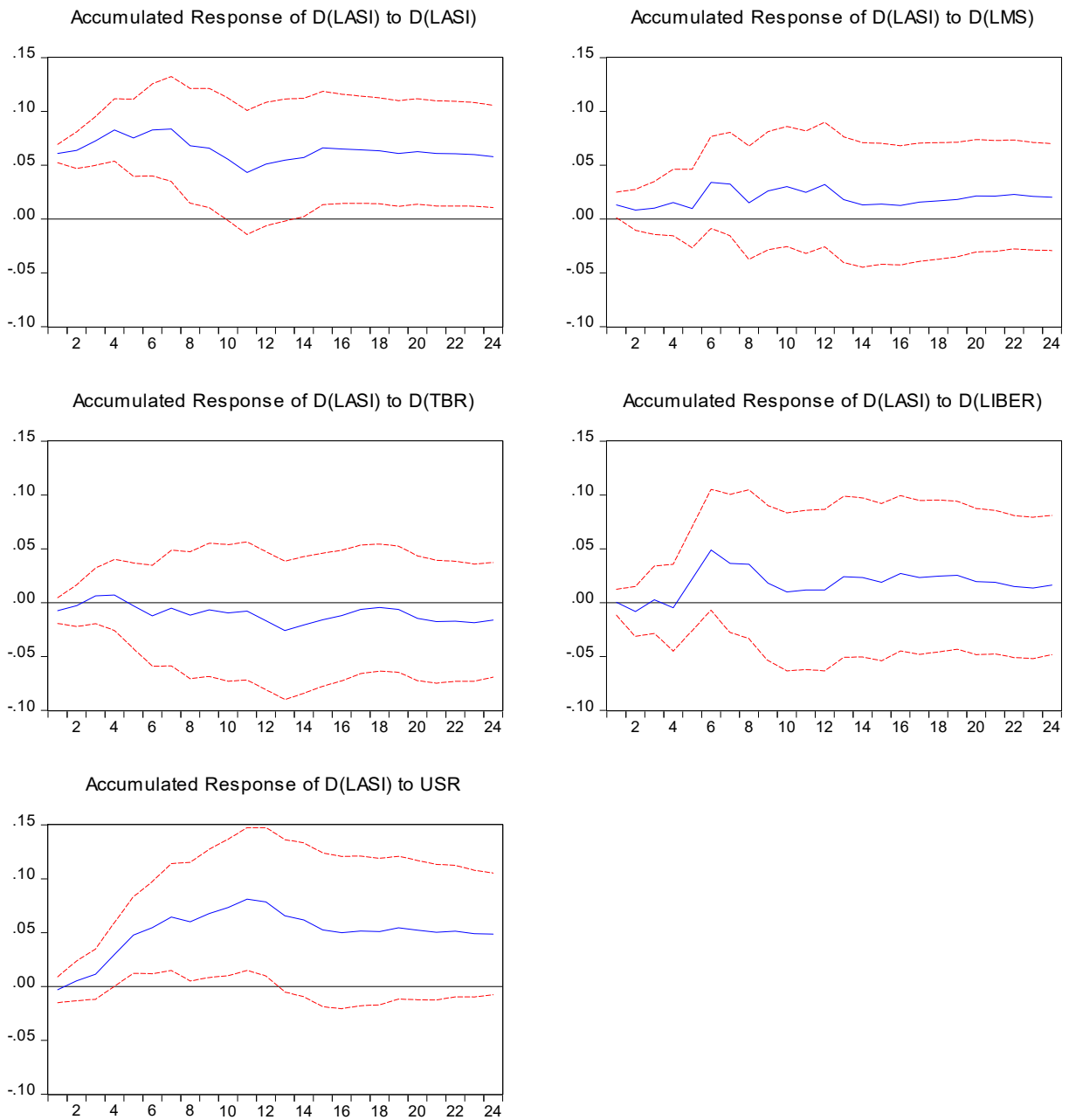
**Figure 11 Generalized Impulse Response: Pre-Crisis**

Accumulated Response to Generalized One S.D. Innovations  $\pm 2$  S.E.

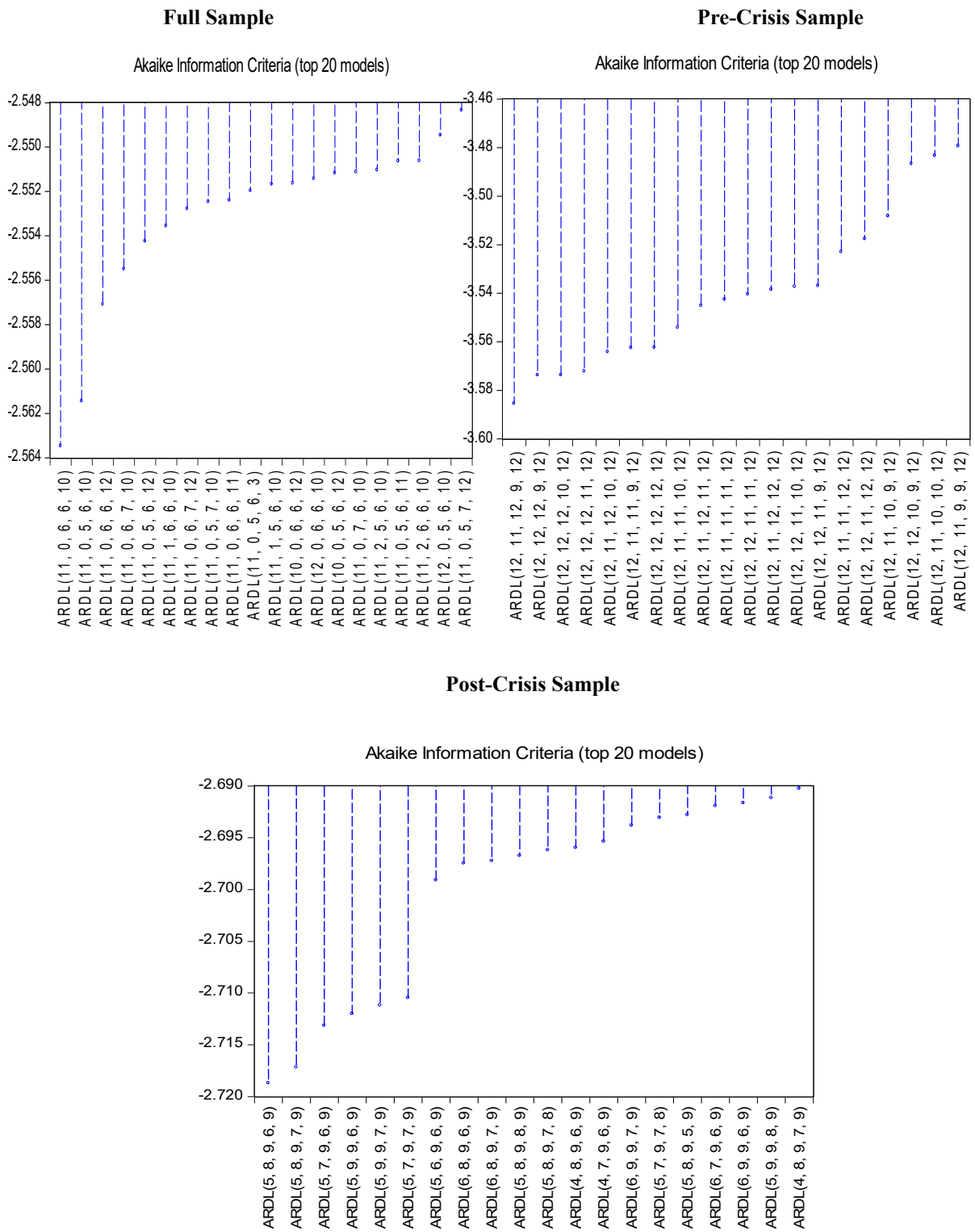


**Figure 12 Generalized Impulse Response- Post-Crisis**

Accumulated Response to Generalized One S.D. Innovations  $\pm 2$  S.E.



**Figure 13 Model Selection Criteria Graph**



## **Chapter 6. Policy Implications, Recommendation and Conclusion**

This thesis examines the impact of monetary policy on Nigeria's equity market for the pre and post global financial crisis period. Monetary policy was measured by treasury bills rate and money supply. The estimated models were broadened to include the nominal exchange rate and the US federal funds rate for an initial sample period of January 2000-June 2016. Subsequently, the pre-crisis sample of January 2000 to June 2008 and the post crisis-sample of July 2008-June 2016 were endogenously determined with the breakpoint test. Applying the autoregressive distributed lag (ARDL) approach to cointegration, there is evidence of a long-run cointegrating relationship among the variables in the full sample and pre-crisis sample at 5 per cent, and at a reduced level of significance of 10 per cent in the post-crisis period. Preliminary descriptive results also reveal that the dynamics of the equity market has been altered as evidenced by its transition from a less volatile market in the pre-crisis period to a more volatile market in the post-crisis period. Empirical results from the ARDL long run and short-run error correction model which were largely consistent with the results from impulse response function indicate that the response of the equity market though negative in line with conventional theory was weak to adjustments in treasury bills rate in the pre-crisis and post-crisis period. This implies that depending on adjustments of short term rates alone would be an incomplete approach to impact on the market. However, while the choice of treasury bills rate as a policy tool was based on its strong positive correlation with the monetary policy rate, it is very likely that equity market may show higher sensitivity to other short-term rates. Also, in line with Ikoku and Okany (2014), there is the possibility that different equity segments respond differently to interest rate adjustments. The equity market showed a higher sensitivity to the shock in money supply before and after the crisis, indicating that the liquidity channel is a very potent instrument. The impact of this channel which is much stronger during the crisis/post crisis period- suggests that the central bank's role as a promoter of financial systemic stability is better addressed through the liquidity channel and its lender of last resort function albeit with a proper anchor on inflation. The stock market exhibited a higher response to the global monetary policy factor measured by the US federal funds rate than domestic short-term rate indicative of high reliance on external financing and the transmission of external monetary policy shocks to the domestic equity market. Hence, it is recommended that while attracting and reaping the benefits from foreign investments in the Nigerian equity market, domestic portfolio participation in the equity market should be continuously enhanced to limit the potential risks of outbound flows from the

domestic equity market due to adjustments in the US monetary policy. The domestic equity market can also be insulated from risks arising from monetary policy shifts in the US through adjustments in exchange rate. The significant and strong impact of domestic money supply and US federal funds rate lend evidence to a strong credit channel and further reinforces the strength of this channel during a crisis. The introduction of the exchange rate as a control variable show mixed evidences in support of the stock and flow oriented theories simultaneously suggesting that exchange rate appreciation reduces the export competitiveness of Nigeria in the international market resulting to a fall in export revenues which depresses stock prices, while a depreciation for export-oriented companies leads to a rise in equity prices. The impact of exchange rate on the equity market further provides evidence of increased external financing and supports the sensitivity of equity market to exchange rate movements. Results also provide evidence of the significant impact of the crisis in the long-run and short run, with crisis effects much larger in the long run, than in the short-run, indicating a prolonged recovery process for the domestic equity market. This recovery could be further impeded as negative shocks occur or in the absence of mitigation measures either in the form of policy or stock market development initiatives such as enhancing domestic participation in the equity market, re-building confidence in the equity market, and improving transparency in the market. Against the aforementioned, this thesis highlights policy implication for monetary policy implementation during a crisis and for promoting stock market development initiatives.

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The views expressed in this thesis are those of the author and should not be construed to reflect the views of the Central Bank of Nigeria, the Nigerian Stock Exchange, their policies or views of any of their staff members.

