FEDERAL UNIERSITY OYE-EKITI

DEPARTMENT OF ECONOMICS AND DEELOMENT STUDIES

# PROJECT ON THE IMPACT OF MACROECONOMIC FUNDAMENTALS ON STOCK PRICES IN NIGERIA (1985-2014)

BY

BOLARINWA OMOWUMI IFE

MATRIC NO: EDS/11/0168

A PROJECT SUBMITTED TO THE DEPARTMENT OF ECONOMICS IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELORS OF SCIENCE (B.SC) DEGREE IN ECONOMICS AND DEVELOPMENT STUDIES

SUPERVISOR: DR. D. AMASSOMA

AUGUST, 2015.

## CERTIFICATION

This is to certify that this research project titled the impact of macroeconomic fundamentals on stock prices in Nigeria (1985-2014) was carried out by Bolarinwa Omowumi Ifeoluwa with matriculation number EDS/11/0168 in the department of economics and development studies, faculty of social science, Federal University Oye Ekiti, Ekiti state. Under the supervision of Dr D. Amassoma, has been fully supervised and found worthy of acceptance in partial fulfillment of the award of Bachelor of Science, (B.Sc) Degree in Economics and Development Studies at federal university Oye-Ekiti, Ekiti State, Nigeria.

---------------------------------------- 28/9/15 ----------------------------------------

PROJECT SUPERVISOR                                Date

Dr. D. Amassoma

H O D
DEPT. OF ECONOMICS STUDIES
09 OCT 2015
FEDERAL UNIVERSITY, OYE-EKITI

---------------------------------------- 09/10/2015 ----------------------------------------

Head of department (H.O.D)                                Date

Economics and Devt. Studies

Dr. C. Ehinomen

# DEDICATION

I dedicate this to the Lord Almighty for the perfection of this project.

# ACKNOWLEDGEMENT

Final Year Project is not an easy task and it would not be possible to complete it without the support and help of numerous people. Hence, I would like to extend my sincere greetings to all of them. First and foremost, I give thanks to the God Almighty for the great privilege he has given to me to even keep my breath till now because, who am I to pen down this acknowledgement's forum if not that God has spared and catered for me to be alive up to this moment? I so much acknowledge the fact of being alive because I am not better off than many handy creatures that have passed away; this is never a mark of mockery, but a worthwhile appreciation to the one that is the owner of the breath I keep (God).

Moreover, I extend my uncommon gratitude to Dr D. Amassoma for being the true, epitome of supervisor to me. His sincere supervision, guidance, and pieces of advice he gave to me personally like father to daughter in the course of this research. Despite my imperfection, he still guided me, thank you so much sir. Infact, you are one in a million sir. Apart from supervision, he inculcated into me some morals which will be forever fresh in the memory of mine.

Greatly deals appreciation goes to my HOD, Dr. Chris Ehinomen and the contribution of all the lecturers in Economics And Development Studies Department, the persons of Prof Ogunleye, Prof. Adebayo, Dr Rufus Akindola, Dr Adeleke, Dr Phillips, Mrs Adegoke, Mr Ephraim, Mrs Mba, Mr Agwu, Mr Imoh, Mr Kachi, Mr Mathew and others. The teamwork and effort from every member are highly appreciated as it is the key factors to the completion of this research project.

In continuation, the acknowledgement of mine goes to those God has used to send the message to the world who are my parents because they still keep the blanket that God has given to them to cover Bolarinwa Omowumi Ifeoluwa from the time she has entered the world. To be candid, I am indebted to Chief Bolarinwa and Mrs Bolarinwa because they never gave up on me up to this level of the career of mine. Daddy and mummy, you

have made an indelible mark for me not to be forgotten in my life which I know the appreciation will never be by oral and correspondence alone but in kind as well.

Also, my sincere appreciation goes to my big aunt, the person of Mrs Adeyemo T, thanks so much mum, I really appreciate your effort over me because, if not because of you that God sent, i might still be at home seeking for admission. Tank you so much big mummy.

I am very grateful to my brothers and sisters: Adekunle Temitayo, Bolarinwa Tosin, Bolarinwa Dorcas, Bolarinwa Comfort, Bolarinwa Blessing, And Bolarinwa Gold. And my nephew and niece: Adekunle Testimony, Adekunle praise, Adekunle lovet and Bolarinwa Goodness for always exhibiting the family bond that has made me feel loved. They showed to me an agape love at all times, most especially, in the aspect of giving me motivational talks and sprit lifted message. In fact, you are wonderful to me , with heart full of praise, I wholeheartedly say an uncommon thank you to that love of mine who is the person of Adeyemi Solomon G. for being good accompaniment emotionally, financially, materially, spiritually and morally to me. My dear, we will both live long to maximize our potential to the fullest in Jesus Name. Appreciation to the family members of mine will never be complimented if I fail to mention my motivational, inspirational, and God fearing brothers from another mother who is the person of brother Babatunde Olalekan, and Brother Omotosho Temitope for their wise advice. Thank u so much dear brothers.

Also, i would like to express a very special thanks for my colleague, Olowe Ibukun, Ikeji Lizzy, Olatuyi Mercy, Owolabi Segun (pastor), Akinsanmi Ronke, Ayinla Naphy, Amidu Kurdijat, Odeniyi Debby, Francis, Gbemi, Kukoyi Tunrayo, Ayo, Opeyemi Ruka and others for their support and love.

*Abstract*

*This study empirically investigated the impact of macroeconomic fundamentals on economic growth in Nigeria with the broad objective of ascertaining the impact of macroeconomic fundamentals on stock prices in Nigeria using time series data from 1985 -2014. The macroeconomic fundamentals considered in this study include: money supply, gross domestic product, consumer price index, and exchange rate. Quarterly data was employed in this study so as to capture the volatility of stock price in Nigeria. The study adopted the Exponential Generalized Autoregressive Conditional Hetroscedasticity (EGARCH) model procedure to know how macroeconomic fundamentals have impact on stock prices in Nigeria.This result shows that as volatility increases, the all share index correspondingly increase by a factor of485.2836, 1.143345and 1.58E-05 and 1.66E-05respectively. These results are consistent with the theory of a positive risk premium on stock indices which states that the higher returns are expected for asset with higher level of risk. The study therefore recommends that the Federal Government should put in place appropriate policy measures to ensure that the exchange rate is stabilized. This is because empirical evidence from study has shown that exchange rate affects stock returns. Also,The government should seek to minimize fluctuations on some macroeconomic fundamentals such as exchange rate, and the consumer price index.*

## TABLE OF CONTENTS

Title page……i
Certification……ii
Dedication……iii
Acknowledgement……iv-v
Abstract……vi
Table of content……vii-viii

### CHAPTER ONE

1.0 Introduction……1
1.1 Background of the study……1-2
1.2 statement of problem……2-3
1.3 objectives of the study……4
1.4 Research hypothesis……4
1.5 Significance of the study……4-5
1.6 Scope of the study……5
1.7 Organization of the study……5
1.8 Definitions of important terms……5-6

### CHAPTER TWO

### LITERATURE REVIEW

2.0 Introduction……7
2.1 Conceptual issues/ Theoretical review……7-14
2.2 Theoretical framework……14
2.2.1. Capital Assets Pricing Model (CAPM) (1964)……14-15
2.2.2 Efficient Market Hypothesis (EMH)(1960)……15-16
2.2.3. Arbitrage Pricing Theory (APT) (1976)……16-17
2.2.4. Classical Theory of Money……17-18
2.3 Emperical Evidence……18-22
2.4 Summary of reviewed literature……22

## CHAPTER THREE

## RESEARCH METHODOLOGY

3.0 Introduction........................................................................................23
3.1 Model specification.............................................................................23-24
3.1.1 The Family of Autoregressive Conditional Heteroskedasticity (ARCH) Models.......................................................................................24-25
3.1.2 The Exponential GARCH (EGARCH) Model.......................................25-26
3.2 The Sign Restrictions.................................................................................26
3.3 Model Estimation Techniques.............................................................26-27
3.3.1 Unit Root Test...........................................................................................27
3.4 Empirical Result...................................................................................27-28
3.5 Sources and Method of Data Collection...................................................28

## CHAPTER FOUR

## DATA ANALYSIS AND INTERPRETATION

4.0 Introduction..............................................................................................29
4.1 Descriptive statistic.............................................................................29-30
4.1.1 Stationary Analysis.............................................................................30-31
4.1.2 Co-integration test...............................................................................31-33
4.1.3 Correlation Analysis Result........................................................................33
4.1.4 Testing for Heteroskedasticity...........................................................34-35
4.1.5 The EGARCH Model Result..............................................................36-38
4.2 Discussion of the Findings...................................................................39-40

## CHAPTER FIVE

## SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary of findings.....................................................................................41
5.2 Conclusion..............................................................................................42-43
5.3 Recommendation....................................................................................43-44
References
Appendix

# CHAPTER ONE

# 1.0 INTRODUCTION

## 1.1 Background to the study

The Nigerian economy has over the years and under various administrations been influenced with series of social, political and economic policies and reforms. In the pre-1980 era, the economy was basically agrarian and the various regional governments then largely achieved food security. The need to introduce private capital for development was realized early enough with the establishment of the Nigerian Stock Exchange (NSE) in 1961 to develop the capital market. It is an undisputable fact that the investment that will promote economic growth and development requires long term funding, far longer than the duration for which most savers are willing to commit their funds and sometimes beyond the capacity of the government.

Stock market is a part of the capital market and the capital market is the centre of any nation's economy. Capital markets generally are believed to be the determinant of the economy given their ability to respond almost instantaneously to fundamental changes in the economy. Capital markets encourage savings and real investment in any strong economic environment. Aggregate savings are directed into real investment that influences the capital stock and therefore economic growth of the country. Given this attributes, the capital market makes it possible for the discerning minds to feel the impulse of the economy. The Nigerian Stock Exchange may not be an exemption as it is expected to be influenced by macroeconomic forces, which are outside the realm of capital market. These forces are the macroeconomic factors that determine the stock prices movement in Nigeria. The changes in macroeconomic balances are often reflected by the magnitude and movement in stock prices, market index and liquidity of the market.

The stock market plays an important role as an economic institution which enhances the efficiency in capital formation and allocation. It enables both corporations and the government to raise long-term capital which enables them to finance new projects and expand other operations. In this manner, Alile (1984) observed that the performance of the economy is boosted when capital is supplied to productive economic units. Furthermore, as the economy continues to develop, additional funds are therefore needed to meet the rapid expansion; and the stock market therefore serves as an appropriate tool in the mobilization and allocation of savings among competing uses, which are critical to the growth and efficiency of the economy.

Alile (1984) further explained that the determination of the growth of an economy depends on how efficiently the stock market performs in its locative functions of capital. When the stock market mobilizes savings, it simultaneously allocates a larger portion of the same to firms with relatively high prospects as indicated by their returns and level of risk.

Economic theory and empirical studies consider stock prices and thus, market index to be one of the best indicators that fluctuate the economic activities. This intellectual curiosity gained ascendancy in the last two decades due to the increasing belief that real economic activities often have effect on stock prices. For instance, Chen et al. (1986) explained and empirically showed that movements in macroeconomic variables affect future dividends as well as discount rates, thus affecting stock prices. Smith (1990), in his study of the American stock price behaviour, observed that stock prices usually decline shortly (on average, for months), before a recession begins and rise shortly before a recession ends. Changes in consumption and investment opportunities are priced in capital markets, hence stock price changes are related to innovations in economic variables (Goswami and Jung 1997).

## 1.2 Statement of problem

The stock market plays a major role in ensuring that the funds from surplus savings units are mobilized and efficiently allocated to various sectors of the economy, which facilitate economic growth and development in both developed and developing countries.

The question of whether or not stock price can be predicted by macroeconomics fundamentals in the economy is of serious concern to the academics all over the world. Many scholars have explained the relationship between macroeconomic fundamentals and stock prices and found that changes in some macroeconomics fundamentals are associated with risk premium.

Some brilliant attempts have been made by the Nigerian researchers to investigate the impact of macroeconomic factors on stock prices in Nigeria. Although there have been substantial studies, for instance, Maysami, Lee and Hamzah (2004), Maysami and Koh (2000) and Wong, Khan and Du (2006) proved that macroeconomic factors changes, such as money supply, consumer price index, exchange rate and real gross domestic products will have impacts on the stock price movements and the stock market as a whole. There are arguments proposed on how these variables behave in influencing the stock price.

Amadasu (2011) and Osamwonyi (2003) noted that since the exchange rate is the price of a unit of domestic currency in terms of a foreign currency, a rise in it negatively affects the performance and profitability of industries relying on imports. External trade, Balance of Payments and the level of external reserves influence the exchange rate. Also, theoretically, there is a positive relationship between the exchange rate and the stock prices (Akinnfesi, 1981).

Owing to the aforementioned mixed feeling among researchers regarding the impact of macroeconomic fundamentals and stock prices and in view of the phenomena above, this study intends to investigate whether the selected macroeconomic fundamentals have impact on stock prices in Nigeria. Specifically, the study attempts to examine whether the Nigerian stock price has any significant impact on money supply, exchange rate, real gross domestic product and inflation.

## 1.3 Objectives of the Study

The broad objectives of this research are to examine the impact of macroeconomics fundamentals of stock prices in Nigeria and its specific objectives are as follows:

- To determine the impact of consumer price index on stock price.
- To pinpoint the impact of exchange rate on stock price.
- To ascertain the relationship between money supply and stock price.
- To establish the relationship between real gross domestic products (GDP) and stock price.

## 1.4 Research Hypothesis

$H_0$ = There is no significant relationship between money supply and stock price fluctuation.

$H_1$ = There is a significant relationship between money supply and stock price fluctuation.

$H_0$ = There is no significant relationship between consumer price index and stock price fluctuation.

$H_1$ = There is a significant relationship between consumer price index and stock price fluctuation.

## 1.5 Significance of the study

There have been many empirical investigations, analyses and studies on the macroeconomics fundamentals and how these factors affect the stock price in Nigeria. This study will examine the Nigerian stock price and its relationship to macroeconomic variables. This study is also an opportunity to highlight the importance of macroeconomic fundamentals and how significant they are in the marketplace and also to unprecedented, hence our compelling interest to fully investigate, document and explain the impact of macroeconomic fundamentals on stock prices in Nigeria.

## 1.6. Scope of the study.

The Stock price is affected by various macroeconomic variables present in the economy. In order to do justice to our enquiry, this study aims to investigate empirically and examine the impact of macroeconomic fundamentals on stock prices in Nigeria (i.e., several macroeconomic variables which include consumer price index, real gross domestic product, exchange rate and money supply) and this study covers the period of 1980-2014.

## 1.7. Organization of the study

The study is divided into five chapters. Chapter one covers the introduction part, which include the background to the study, objective of the study, research questions, research hypothesis, scope of the study, significance of the study and the organization of the study. Chapter two explains the literature review of the concept of the impact of macroeconomic fundamentals on stock prices in Nigeria. Chapter three focuses on the methodology utilized for the study. Chapter four is concerned with the presentation of findings, while Chapter five presents discussion of findings and the conclusion to the study.

## 1.8 Definition of important concepts

**Macroeconomics:** Macroeconomics is the study of the major economic 'totals' or aggregates-- total production (GNP), total employment and unemployment, the average price level of all goods and services, the total money supply, and others," Robert J. Gordon, Macroeconomics (1978).

**Gross Domestic Product (GDP)**: the GDP is the total value of goods and services produced in a country during a year. Economic growth is therefore, a sustainable increase in the amount of goods and services produced in an economy over time (Todaro 2005)

**Money supply:** Friedman and Schwartz (1963) explained the total stock of money in an economy as the money supply. The circulating money involves the currency, printed notes, money in the deposit account and in the form of other liquid asset.

**Consumer price index**: the consumer price index (CPI) is a measure of the average change overtime in the prices of consumer items-goods and services that people buy for day-to-day activity (www.investopedia.com).

**Exchange rate:** (Amadasu(2011) and Osamwonyi (2003) explains exchange rates as foreign currency per unit of domestic currency or domestic currency per unit of foreign currency. That is, the price of a unit of domestic currency in terms of a foreign currency.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.0 Introduction

This chapter provides a historical background of the Nigerian stock exchange market, the impact of macroeconomics fundamentals on Nigeria stock prices, an overview of the real GDP, consumer price index, money supply and aggregate demand performance as well as the Nigerian stock market. It also provides an overview of literature and past research work in related areas which provide a setting for this current research.

## 2.1 Conceptual Issues/Theoretical Review

### 2.1.1 Money Supply

Money supply plays an important role in determining stock price. Wonget al. (2005) pointed out that Singapore stock market (SGX) was co-integrated with money supply before Asian financial crisis 1997. However this equilibrium was broken and disappeared after the crisis. Brahmasrene and Jiranyakul (2007) stated that money supply has positive impact on stock price index by using unit roots test. Coinciding in time, they have found that causality between monetary variable and stock price only happen during post-financial crisis. Their findings are similar to that observed by Kumar and Puja (2012). They concluded that stock market is co-integrated and positively related to money supply and real economic activity, while there are no causality observed from stock price found in long run and short run. The positive relationship among money supply and stock price movement were seen in the research of Khan and Yousuf (2013). Injection of money supply boost corporate earning leads to increase in company's cash flows, and hence increase in company share price in the long run.

Sellin (2001) and Maskay (2007) showed that expected changes in money supply would not influence stock prices movements; only the unexpected component of a variation in money supply would influence the stock prices. Purchaser's response on money supply will affect changes on price in the short run. Peace and Roley (1983) carried out the same research by Ordinary Least Square method. They suggested that only unanticipated money supply will have impact on stock prices. The result is consistent with prediction made by efficient market hypothesis, which is unanticipated as high money supply cause a rise in interest rate and lower down the stock prices. But, Corrado and Jordan (2005) disagree by arguing that all available information is not embedded in the prices, and hence, stock price would also respond to the expected announced money supply.

Broad money supply (M2) has been used as proxy variable in explaining money supply. Ray (2012) made two conclusions in the research. First, with a rise in money supply, investor will have more money, increase liquidity on cash for buying securities, and thus market prices will rise. Thus, stock prices are directly proportional to money supply. Second, an increase in money supply tends to raise inflation, which sequentially may cause an increment in interest rate and decrease in stock prices.

Humpe and Macmillan (2007) report that Japan stock price is inversely proportional to money supply; whereas money supply did not influence the performance of stock price in US stock market. It may be because Japanese economy was facing difficulties and consequent liquidity trap since 1990.

According to Rogalski and Vinso (1977), innovation in money supply may affect real economic variables which may lead to a lagged positive impact on stock market prices. Early studies conducted in developed countries indicate that money supply is negatively related with stock market prices. Fama (1981) suggests that the negative relationship can be observed by looking at direct relationship between money supply and inflation whereby the increase in money supply increases the discount rate and in turn decreases stock prices. Many researchers believe that the negative effects of money supply on stock prices is perhaps the innovation in money supply which is not accompanied by proportionate increase in output growth.

Ajao (2010) advanced two economic reasons why money supply must be included as a relevant macroeconomic factor in the determination of stock prices. The first reasoning is that changes in money supply will alter the equilibrium position of money supply thereby altering the composition and price of asset in an investor's portfolio. The second point is that changes in money supply may impact on real economic growth, and may have a lagged influence on stocks.

Wongbangpo and Sharma (2002), Mukherjee and Naka (1995), Booth and Booth (1997), Chen, Kim, and Kim (1986, 2005), Ibrahim and Aziz (2003), report that money supply is an important significant factor in determining the stock market indices. But in the work of Buyuksalvarci (2010), as well as Gunasekarage, et al (2004), money supply was reported to be positively related to stock market prices. Abdullah and Hayworth (1993) obtained similar result on the US stock Market. Maysami and Koh (2000) found that money supply has positive relationship with stock returns in Singapore for the period 1988-1995. They suggested, however, for Indonesia and Philippine that money supply has long-run negative relation with stock prices, but with Malaysia, Singapore and Thailand, it was positive. Cheung and Ng (1998) found that money supply has long-run effect on stock market prices in developed countries such as Canada, Germany, Italy, Japan and the US. Humpe and MacMillan (2007) provide evidence that stock prices are negatively related to money supply in Japan; but in the US, they found that money supply had an insignificant influence over the stock price. Singh, et al (2011) observed that money supply is insignificant in determining stock prices on Taiwan market. Mohammad, et al (2009) found that money supply is a significant factor in explaining movement in stock prices in Pakistan. Liu, Li and Hu (2006) reported that money supply affects stock prices in China. Patra and Poshakwale (2006) found that short-run and long-run equilibrium relationship exists between money supply and the stock prices in Athens Stock Exchanges.

Maku and Atanda (2010) and Adaramola (2011) found that stock market prices and money supply are positively related in Nigeria. However, contrary to these results, Amadi, et al (2000) and Isenmila and Erah (2012) indicated that stock prices relate negatively with money supply in Nigeria. Asaolu and Ogunmuyiwa (2011) tested the Granger-causality between stock prices and money supply. The results showed that money supply does not Granger-cause stock prices.

Adam and Tweneboah (2008) indicated that money supply and stock prices are negatively related in Ghana. Adu (2012) applies co-integration tests based on arbitrage pricing theory (APT) model with results showing that money supply possesses statistically significant influence on stock market price changes in Ghana. The study also indicated that there is uni-directional causal relationship between stock price and money supply with direction running from money supply to stock price. But Osisanwo and Atanda (2012) showed that stock prices relate negatively with money supply in Nigeria. However, Nkoro and Uko (2013) found that money supply has no significant effect on stock market price changes in Nigeria.

### 2 .1.2 Gross domestic product (GDP)

Gross domestic product is a prime macroeconomic indicator used by economists and investors to predict the future performance of a country's economy (Taulbee, n.d.). In simple term, GDP measures the total domestic income and the income earned by foreign owned factors of production (Mankiw, Romer&Weil, 1992). GDP indicates the growth of domestic economy whether it is growing or not.

Peng, Cui, Groenewold and Qin (n.d.) applied tests in order to investigate for stationarity and cointegration analysis among stock prices and China economy measured by productivity level. The result pointed clearly that stock prices are directly proportional to GDP in long run. Furthermore, the research in Sudan economy states that the relationship among real GDP and prices was found to have unidirectional causality relationship from real GDP to price level without any feedback (Ahmed &Suliman, 2011).

In the study of Maysami and Koh (2000), industrial production index and domestic exports as the proxy for standard of real economic activity are likely to form a positive relationship with stock prices in Singapore. Moreover, Osamwonyi and Evbayiro-Osagie (2012) found that Gross Domestic Product and growth rate of economy have positively related that the higher the GDP, the more favours of the stock market (Chandra, 2004). According to Graham (2013), the significant change in GDP either increase or decrease will have effect on investing sentiment. When GDP increases the boost in investor confidence, investors believe the overall stock market is improving thereby investing more in the stock market causing a rise in stock price. However, if GDP reduces, investors would buy less stock, leading to a downward pressure to the stock market thereby causing a decline in stock price.

According to Shiblee (2009), one of the key factors that affect stock price movement is gross domestic product (GDP). Stock exchange price and price index positively correlate with gross domestic product. The changes in gross domestic product would expect to have positive influence on stock and real estate prices in Singapore economy (Liow, 2004). According to Sugimoto (2012), there was a positive correlation between gross domestic product and stock price in Singapore. In other words, Atje and Jovanovic (1993) pointed strong evidence to support the view that economic growth is measured by gross domestic product as a result of stock market development. That stock market performance may affect gross domestic product was proven by Modigliani (1971). Ewing and Thompson (2007) found that gross domestic product is related to stock market index. Specially, Booth and Booth (1997); Ibrahim and Aziz (2003), in Malaysia; Wongbangpo and Sharma (2002), in ASEA-5 countries; Mukherjee and Naka (1995), in Japan; Mohammad, Hussain, Jalil and Ali (2009), in Pakistan; Clare and Thomas (1994), in the UK; and Brown and Otsuki (1990), in Japan; in their separate studies show that gross domestic product is one of the most popular significant factors that explain the stock market performance. Mahmood and Dinniah (2009) reveal that gross domestic product has long-run equilibrium effect on stock prices in Japan, Korea, Hong Kong and Australia out of the 6 Asian- Pacific countries selected for a study between 1991 and 2002. However, Tan, Loh and Zainudin (2006) found that gross domestic product is negatively related to stock prices in Malaysia. Buyuksalvarci (2010) also shows negative relationship between industrial production and stock prices in Turkey. Tursoy, Gunsel and Rjoub (2008) found that GDP affects stock prices with some differences among the various industry sectors in Turkey. But Kwon and Shin (1999) show that gross domestic product relates with stock market prices in Korea. Chandra (2004) shows that gross domestic product has positive effect on stock prices in the U.S.

Singh, Mehta and Varsha (2011), using Taiwan data-sets, found that gross domestic product is a significant factor that affects stock return. Mohammad, et al (2009) observed that gross domestic product is insignificant in explaining stock prices in Pakistan. Liu, Li and Hu (2006) found that gross domestic product leads to fluctuation in stock prices in China. Mansor and Hassanuddee (2003) analyzed the dynamic linkages between stock prices and four macroeconomic variables for Malaysia. Prominent among the studies conducted in Nigeria are Maku and Atanda (2000); Amadi, Onyema and Odubo (2002); Nwokoma (2011); Asaolu and Ogunmuyiwa (2011) and Olasumbo (2012). However, Osamwuyiwa and Evbayiro-Osagie (2012) reported that stock price is affected negatively by industrial production in Nigeria. Oluwe (2007) indicated that gross domestic product has a long-run effect on stock market in Nigeria. In the study conducted in Ghana, Osei (2005), show that stock prices relate positively with gross domestic product.

### 2.1.3 Consumer price index

Inflation is a measure of the macroeconomic stability. Consumer price index is one of the most used measures to gauge the inflation of an economy (Atmadja, 2005). Inflation could be defined as the continuous and aggregate increase in the price level of commodities in an economy (Kniest et al., 1998). There is a divergent opinion on the impact of the inflation on the stock prices. Conventional school of thought following Fisherian hypothesis, argues that as the stocks provide a hedge against inflation, so the relationship between two variables should be positive (Yartey, 2008). Other schools of thought opine a negative relationship as the increased relationship induce tightening of the monitory policy that includes an increased risk free rate of interest and consequently, the discount rate in the stock valuation also rise. The effect of this increased discount rate could be neutralized by an increase in the cash flows associated with the security, which generally is not possible as cash flows do not grow at the same rate as inflation does, so the demand for the security decline and price also falls down (Maysami et al., 2004). Many studies provide evidence of the negative relationship between stock price / returns and inflation (Nelson, 1976; Jaffe and Mandelker, 1976; Fama and Schwert, 1977; Fama, 1981; Chen et al., 1986; Wongbangpo and Sharma, 2002). Some studies on the other hand provided a positive relation as well (Abdullah and Hayworth, 1993). Studies using both firm level and macro economic variables as determinants of stock prices also used the variable of inflation of consumer price index widely as determinant of the stock price (Al – Tamimi, 2007; Javaid, 2010, Supanvanij, 2010; Al-Shubiri, 2010). All these studies indicated a negative relationship between stock price and variable of inflation. Moreover, studies conducted in Pakistan also indicated a negative relationship between these two variables (Nishat and Shaheen, 2004; Sohail and Hussain, 2009). There is also an indication of the positive relationship between these variables in Pakistan (Mohammad et al., 2009). Considering the mostly found relationship, we expect a negative relationship between stock price and inflation.

Consumer price index was used as proxy of the inflation for this study as many previous studies have used this measure in their empirical investigations. Thus: Inflation = Consumer price index.

### 2.1.4 Exchange rate

Some studies found positive effects of exchange rate volatility on the activities of stock markets namely, Aggarwal (1981), Hatemi-J and Irandoust (2002), Tsoukalas (2003), Sevuktekin and Nargelecekenler (2007) etc. Others reported negative effects of exchange rate volatility on the activities of stock markets, Soenen and Hennigar (1988), Kim (2003), Ibrahim and Aziz (2003) etc. There are studies that indicated no causal relationship between stock prices and exchange rates namely, Nieh and Lee (2001), Smyth and Nandha (2003), Ozair (2006). Some studies on the other hand provided a positive relation as well (Abdullah and Hayworth, 1993). Studies using both firm level and macro economic variables as determinants of stock prices also used the variable of inflation of consumer price index widely as determinant of the stock price (Al – Tamimi, 2007; Javaid, 2010, Supanvanij, 2010; Al-Shubiri, 2010). All these studies indicated a negative relationship between stock price and variable of inflation. Also, for some of the studies, the empirical evidence on the causal relationship between exchange rates and stock prices is uni-directional namely; we have the studies by Abdalla and Murinde (1997), Yu Qiao (1997), Ajayi et al. (1998) and Granger et al. (2000).

Aggarwal (1981) argued that changes in exchange rate provoke profit or losses in the balance sheet multinational firms, which will induce their stock price to change. In this case, exchange rate cause changes in stock prices.

Dornbusch (1975) and Boyer (1977) presented models suggesting that changes in stock prices and exchange rate are related by capital movements. Decrease in stock price reduces domestic wealth, lowering the demand for money and interest rates, inducing capital outflow and currency depreciation.

Abdalla and Murinde (1997) investigated interactions between exchange rate and stock prices in India, Korea, Pakistan, and the Philippines. Using monthly observations in the period from January 1985 to July 1994 within an error correction model framework, they found evidence of unidirectional causality from exchange rate to stock prices. They found that stock prices Granger influence exchange rate.

## 2.2 Theoretical framework

### 2.2.1 Capital Assets Pricing Model (CAPM) (1964)

According to Holton, Capital Assets Pricing Model (CAPM) was first introduced by William F. Sharpein 1964. He introduced this model because in earlier decade, there was no theory to describe the relationship between stock return and risk (Sharpe, 1964). This model was further extended by John Lintner (Fama & French, 2004). Capital Assets

Pricing Model (CAPM) is to explain stock return with risks. It is used to determine the return rate that is required by investors. There are four assumptions need to be conformed before applying the Capital Assets Pricing Model (CAPM) (Perold, 2004). Firstly, the market should be efficient. This means that there is no transaction costs, taxes, and restriction in the market. The information can be transferred to all people costless so that they can borrow and lend with same risk free rate. Secondly, investors in the market are risk averse and have unanimous period of investment. Thirdly, investors enjoy same investment opportunities. Lastly, the investments' expected return, standard deviation and correlation of investors should be same.

The formula of Capital Assets Pricing Model (CAPM) is below:

$k_i = k_{rf} + \beta_i(k_m - k_{rf})$

Where:

$k_i$ =required return on security *i*

$k_{rf}$ =risk-free rate of interest

$\beta_i$ =beta of security *i*

$k_m$ =return on the market index

$(k_m - k_{rf})$ =market risk premium

$\beta_i(k_m - k_{rf})$=asset *i*'s risk premium

Womack and Zhang (2003) state that in this model, the return earn from the stock will equal to the return from market. The return an investor earn from a stock equal to the combination of risk free rate and risk premium. Normally, risks are market risk and company risk, but the model already diversified the company risk. Hence, the beta, $\beta i$ will capture the market risk, this risk will be taken into account in this model.

With this model, Friend and Blume (1970) found that when the beta is high, the cost of equity will be high. In contrast, the cost of equity is low if the beta is low.

### 2.2.2 Efficient Market Hypothesis (EMH) (1960)

Efficient Market Hypothesis (EMH) states that in an efficient market, the information can be reflected by the stock price rapidly (Fama, 1965; Fama, 1970; Maysami, Lee, &

Hamzah, 2004). This theory was established by Eugene Fama in early 1960. Investors refer to the information to make decision in the stock market (Jonathan, Tomas, &Gershon,).

According to Malik, Qureshi, and Azeem (2012); Jonathan, Tomas, and Gershon, Efficient Markets Hypothesis is divided into three forms which are: strong form, semi-strong form and weak form. Strong form efficiency is that the information entirely affects the stock price. The information includes the public information and insider information. Investors can use the costless information to predict the future stock price (Timmermann & Granger, 2004). No one can earn excessive profit in this form of efficient market. Even a manager will know the private information, that manager cannot gain excessive profits.

In semi-strong form efficient market, all investors know only the public information but not private information (Wong & Kwong, 1984). Investors know the historical stock price, the figure of company financial reports, dividend given and company expectations to several macroeconomic variables. They can earn a few profits only because all investors know the information available.

The last form of Efficient Market Hypothesis is weak form efficient market. The flow of information is not affluently like the other two forms. Investors can only know the past stock price in the market (Palan, 2004). Thus, any investor who knows the information can gain more profit than those who did not get the information. This form is the weakest form because historical stock price is unable to fully reflect the current stock price.

Some researchers argued that there is no efficient market existing in real world. Grossman and Stiglitz (1980) argue that there is no costless information in the market. Arbitragers use costly information to make gain in the market and make the market achieve equilibrium level. They suggest that investors should be interested on what the degree of efficiency is rather than whether the market is efficient or not.

### 2.2.3 Arbitrage Pricing Theory (APT) (1976)

Arbitrage Pricing Theory (APT) is an alternative model to the Capital Assets Pricing Model (CAPM) (Maysami, Lee, & Hamzah, 2004; Maysami & Koh, 2000). And it was established by Ross (1980). It is a multi-factor model, which shows linear relationship between stock price and macro-economic factors, for instance, inflations and exchange rate. It mainly measures the sensitivity of stock price to those variables and show in beta (Roll and Ross, 1980).

The Arbitrage Pricing Theory does not assume that market must be efficient. Arbitrage Pricing Theory (APT) can consider multiple variables instead of one at the same time (Franke, 1984). For Capital Assets Pricing Model (CAPM), it can only consider one variable that affect stock price. The covariance of Arbitrage Pricing Theory (APT) is the market risk measurement, which cannot be diversified by investors while covariance of Arbitrage Pricing Theory (APT) is the market return (Huberman & Wang, 2005). But the Arbitrage Pricing Theory (APT) does not limit the market risks (Sabetfar, Cheng, Mohamad, & Noordin, 2011).

The formula of Arbitrage Pricing Theory (APT) is below:

$R_j = a + b_{1j}F_1 + b_{2j}F_2 + \ldots + b_{mj}F_m + e_j$

where:

$R_j$= the stock price of security= the risk-free rate

b=the beta, the degree of sensitivity of stock price of security j to the factors

F= the factors that affect the stock price of security j

$e_j$= the error term

The Arbitrage Pricing Theory (APT) assumes that the market is in equilibrium with no riskless profit. This is due to the arbitragers will compensate all the riskless profit until zero when they realize that there is an arbitrage profits. Then, the market will turn back to equilibrium. Thus, no investors can earn extra profit in this situation.

### 2.2.4 Classical Economic Theory (1776)

Classical economy theory emerged from the foundation introduced by Adam Smith ("Classical Economics", 2013). Classical economic theory proposes intermediate variables, for instance, prosperity desired of money and interest rates act as catalyst in creating the link between exchange rate behavior and stock market performance (Md-Yusuf & Rahman, 2013).

According to Richards, Simpson and Evans (2009), classical economic theory hypothesis, there is an interaction between stock prices and exchange rates. Two approaches of economic theory can be used to show the relationship between exchange rates and stock prices. The first approach suggested by economic theory is flow-oriented model (Dornbusch & Fisher, as cited in Richards, Simpson & Evans, 2009, p.2). This model predicts exchange rate movements caused by stock price movements. Currency movements influence international competitiveness and trade position balance. When the domestic currency depreciates, leading the domestic firms to have higher volume of exports due to cheaper price of domestic goods in international trade, then, real income of country may increase as well as the domestic firms' profits. As a consequence, firms' stock prices will rise and perform well.

In contrary, the second approach is stock-oriented model or portfolio balance approach which exerts the opposite statement. Stock-oriented model (Branson, 1981) postulates stock prices Granger-cause movements in exchange rate by dealing with capital account. This model is based on the allocation of investors' wealth on the domestic and foreign assets. Stock-oriented model explains that the link between real world stock and currency market is broadly dependendent on the matters, like stock market liquidity and market segmentation (Richards, Simpson & Evans, 2009).

## 2.3 Empirical Evidence

The interaction between the stock market returns and the macroeconomic variables are mostly documented for developed countries. One seminal paper analyzing the determinants of the stock market returns is presented by Chen, Roll and Ross (1986). Their paper investigates the impact of macroeconomics fundamentals on stock prices in Nigeria with a different methodology that is based on pricing the systematic macroeconomic risks. They found a strong relationship between the market returns and the macro variables like industrial production, changes in the risk premium and the expected and unexpected inflation in the United States. There are also some papers that found no empirical evidence that the macroeconomic fundamentals affect the stock prices. Poon and Taylor (1991) in the United Kingdom and Gjerde and Saettem (1999) in Norway indicated that macroeconomic variables do not appear to affect share returns. Binswanger (2000), who used monthly data during the period 1953 to1995, also states that the price movements since early 1980's cannot be explained by fundamental factors implying that the link between stock prices and real economic activity has broken down in U.S. and G-7 countries.

Gultekin (1983) testing the generalized Fisher hypothesis for 26 countries for the period of 1947 to 1979, could not find a significant positive relationship between nominal stock returns and inflation rates.

Moreover, the findings of the study showed that regression coefficients are predominantly negative. A negative relationship between inflation and stock prices is contended in literature because an increase in the rate of inflation is accompanied by both lower expected earnings growth and higher required real returns. In the US, there is substantial empirical evidence that high inflation is associated with a high equity risk premium and declining stock prices (Hoguet, 2008). Rising inflation is apt to restrictive economic policies, which in turn increases the nominal risk-free rate and hence raises the required rate of return in valuation models.

There is no theoretical consensus either on the existence of relationship between stock prices and exchange rates or on the direction of the relationship. However, in the literature, two approaches have been asserted to establish a relationship between exchange rate and stock prices: the goods market model and the portfolio balance model. The first approach according to Flannery and Protopapadakis (2001) focused on the association between the current account and the exchange rate. They developed a model of exchange rate determination that integrates the roles of relative prices, expectations, and the assets markets, and emphasized the relationship between the behaviour of the exchange rate and the current account. They also argued that there is an association between the current account and the behaviour of the exchange rate. It is assumed that the exchange rate is determined largely by a country's current account or trade balance performance. These models posit that changes in exchange rates affect international competitiveness and trade balance, thereby influencing real economic variables such as real income and output. Thus, the goods market model suggests that changes in exchange rates affect the competitiveness of a firm, which in turn influences the firm's earnings or its cost of funds and hence its stock price. On a macro level then, the impact of exchange rate fluctuations on stock market would depend on both the degree of openness of the domestic economy and the degree of the trade imbalance. Thus, goods market models represent a positive relationship between stock prices and exchanges rates with direction of causation running from exchange rates to stock prices. The conclusion of a positive relationship stems from the assumption of using direct exchange rate quotation (Ibrahim 2013). The degree to which stock oriented models explain currency movements is a function of stock market liquidity. Accordingly, while the flow theory holds that exchange rate movement causes stock prices to oscillate, the stock theory states that exchange rates are determined by market mechanism.

In other words, stock price is expected to have impact on exchange rate with a negative correlation since a decrease in stock prices reduces domestic wealth, which leads to a decline in domestic money demand and interest rate. Besides, the decline in domestic stock prices induces foreign investors to lower demand for domestic assets and domestic currency. These shifts in demand and supply of currencies cause capital outflows and the depreciation of domestic currency. Also, when stock prices increases, foreign investors become willing to invest in a country's equity securities and so, these investors derive paybacks from international diversification thereby inducing capital inflows and an appreciation of the currency (Granger et al., 2000, Caporale et al., 2002).

By using Granger Causality test and autoregressive moving average model (ARMA), Rogalski and Vinso (1997) determined bi-directional theory of causality between stock price fluctuation and money supply. Changes of money supply will cause stock price changes while stock price changes will lead to money changes. Changes in Federal Reserve policies, (basically money supply) will have direct influence on stock return.

Highlighted from Alatiqi and Fazel (2008), there is insignificant relationship between money supply and market stock price. They employed Engle-Granger co-integration test and the Granger causality test in their research. Absolute value from test statistic is lower than critical value. They verify that money policy has no long-run explanatory power in stock price prediction. Ozbay (2009) also suggested that monetary expansion do not granger cause bank's stock return. Hence, money supply is not an indicator to increase investments in stocks for Turkish case.

Ogiji (2013) indicated that money supply has long-run significant positive relationship with stock market prices in Nigeria. The study applies co-integration and error correction model tests on time series annual data for 1980-2012.

Duca (2007) employs Granger causality test to examine direction of causality among stock prices and GDP in developed market economies. Nevertheless, result points out unidirectional relationship in the causality run from stock prices to GDP and there is no causality found in reverse direction in developed economies market. Dagadu (2010) established a long-run positive between stock price and gross domestic product in Ghana. The study used co-integration and ECM tests on monthly time series data for 1991-2008. All of the developed market economies like United States, Japan, Australia, United Kingdom and others has been determined that stock prices Granger cause GDP except Germany due to its market capitalization (Duca, 2007). Employing standard and well accepted methods of co-integration and vector auto-regression (VAR) on monthly data for the period of January 1970 to August 1998, they found a positive long-run relationship between stock prices and gross domestic product. Co-integration test analysis is a standard method usually adopted in analyzing the long-term relationship between macroeconomic variables and stock markets. Suleiman, Hussain and Ali (2009), utilizing multiple regression analysis on a sample covering the period 1986- 2006 for Kalachi Stock Exchange, found that index for industrial production does not significantly affect stock prices. Most studies in Nigeria indicate that the relationship between stock market prices and gross domestic product is positive.

**2.4 summary of reviewed literature**

The negative relationship between stock prices and inflation as evident in our result is consistent with earlier empirical findings, in various studies using different empirical methodologies (see Nelson 1976, Pearce and Rolog 1988) Defina 1991, Kaul and Seyhun 1990, Udegbunam and Eriki 2001). The positive relationship we found in our result between GDP and stock prices is consistent with the published results of several researchers including Fama and French 1989, Fama 1990, Cochrane 1994; Jensen and Johnson 1995; and Jesen et al 1996, found a positive relationship between money supply MI and stock prices as in our own findings.

From the empirical evidence, the following inferences are made: It is evident that macroeconomic fundamentals have significant impact on stock prices.

Stock prices move in the same direction with GDP, money supply, exchange rate while it moves in opposite direction with consumer price index.

The evidence from the study suggested that stock prices respond to macroeconomic variables. Therefore, it is important to monitor variables outside the market variables, in order to be able to adequately track the fluctuation in stock prices.

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.0 Introduction

This study aims to investigate the impact of macroeconomic fundamentals on stock prices in Nigeria. This chapter will therefore focus on the methodology adopted for the study; it will also describe the sources of data used for the study, model specification, and the technique of estimation to be employed for the study in a more organized and detailed manner. Necessary information has been collected to develop a valid and critical analysis as well as to address the hypothesis and research questions which were presented in previous chapters.

This quantitative research includes empirical techniques and methods to investigate the research. A total of four macroeconomics variables and stock price in Nigeria are used in this research. The macroeconomic fundamentals are money supply, consumer price index, exchange rate and gross domestic product covering the period of 1985 to 2014. The impacts of macroeconomic fundamentals on stock prices in Nigeria are estimated using the GARCH/EGARCH techniques. This method measures the conditional variation in the dependent variable based on changes in the explanatory variables. In this regard, the GARCH/EGARCH model better captures the essence of this purported relationship between stock price and macroeconomic variables.

## 3.1 Model Specification

The model estimated in this paper is GARCH/EGARCH. The usefulness of the ARCH models that was first introduced by Engle (1982) and its other form known as GARCH that was extended by Bollerslev (1986) have been proved in model building and predicting stock returns volatility. Furthermore, Poon and Granger (2005) found that the GARCH model is better than traditional predicting models for the dynamics of conditional second moments. Such a model addressing the ability of some characteristics known as a Volatility Clustering, Leptokurtosis, Mean - Reversion and Leverage Effect are common in many financial time series.

The Generalized Autoregressive Conditional Heteroskedasticity not only takes the lagged error Variances but also takes the time lagged variances while modeling volatility. GARCH model, to be used in this paper, includes mean and linear volatility equations. Mean equation is based on the assumption that logarithm of stock returns. In order to examine the effect of the stock market crash in the growth process of Nigerian economy, the model assumes an underlying relationship between some macroeconomic variables that can influence the economic growth of a nation measured as Gross Domestic Product (GDP). We therefore present a model below relating stock prices to the selected macroeconomic fundamentals.

### 3.1.1 The Family of Autoregressive Conditional Heteroskedasticity (ARCH) Models

Every ARCH or GARCH family model requires two distinct specifications: the mean and variance equations. According to Engel, conditional heteroskedasticity in a return series, $y_t$ can be modeled using ARCH model expressing the mean equation in the form:

$y_t = E_t(y_t) + \varepsilon_t$ ..........................................................................(1)

Such that : $\varepsilon_t = \varphi_t \sigma_t$

Equation 1 is the mean equation which also applies to other GARCH family model. $E_{t-1}[.]$ is expectation conditional on information available at time *t*-1, is error generated from the mean equation at time *t* and is a sequence of independent, identically distributed (IID) random variables with zero mean and unit variance. $E\{\varepsilon_t / \Omega_{t-1}\} = 0$ and $\sigma^2_t = E\{\varepsilon^2_t / \Omega_{t-1}\}$ is a nontrivial positive valued parametric function of $\Omega_{t-1}$ The variance equation for an ARCH model of order q is given as: $\sigma^2_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-1} + \mu_t$

*where*

$\alpha_0 > 0; \alpha_1 \geq 0; i = 1, \ldots\ldots q_{-1} and\ \alpha q > 0$

In practical application of ARCH (q) model, the decay rate is usually more rapid than what actually applies to financial time series data. To account for this, the order of the ARCH must be at maximum, a process that is strenuous and more cumbersome.

### 3.1.2 The Exponential GARCH (EGARCH) Model

This model captures asymmetric responses of the time-varying variance to shocks and, at the same time, ensures that the variance is always positive. It was developed by Nelson (1991) with the following specification.

The conditional variance of EGARCH (1,1) model is specified generally as

$$\log(\sigma^2_t) = \beta 0 + \sum_{1=1}^{q} \left\{ \alpha 1 \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| + \gamma_i \left( \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right) \right\} + \sum_{j=i}^{p} \beta_j \log(\sigma^2_{t-j}) \ldots\ldots(2)$$

Where $\gamma$ is the asymmetric response parameter or leverage parameter. The sign is expected to be positive in most empirical cases so that a negative shock increases future volatility or uncertainty while a positive shock eases the effect on future uncertainty (Kalu,2010). According to the author, in macroeconomic analysis, financial markets and corporate finance, a negative shock usually implies bad news, leading to a more uncertain future. Higher order EGARCH models can be specified in a similar way; EGARCH (p, q) is as follows:

$$Ln(\sigma^2_t) = \omega + \sum_{j=1}^{p} \beta_j Ln\left(\sigma^2_{t-j}\right) + \sum_{t-1}^{q} \alpha_i \left\{ \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| - \sqrt{\frac{2}{\pi}} \right\} - \gamma_i \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \ldots\ldots(3)$$

The EGARCH which captures asymmetric properties between returns and volatility was proposed to address three major deficiencies of GARCH model. They are (i) parameter restrictions that ensures conditional variance positivity; (ii) non-sensitivity to asymmetric response of volatility to shock and (iii) difficulty in measuring persistence in a strongly stationary series. The log of the conditional variance in the EGARCH model signifies that the leverage effect is exponential and not quadratic. The specification of volatility in terms of its logarithmic transformation implies the non-restrictions on the parameters to guarantee the positivity of the variance (Majose, 2010), which is a key advantage of EGARCH model over the symmetric GARCH model.

### 3.2 The Sign Restrictions

The sign restrictions we impose on impulse responses here are:

INF< 0

EXCH > 0.

GDP > 0.

M2> *0*

### 3.3. Model Estimation Techniques

This is to ascertain the impact of macroeconomic fundamentals on stock prices in Nigeria. According to the methodology, this present study adopts a model used by the previous studies; the EGARCH as developed by Nelson (1991) model is applied in empirical work in order to estimate the variance equation properly and to capture potential asymmetry in the behavior of the stock market index.

$$INDEX = f\ (CPI\ \ GDP\ \ EXCH\ \ M2) \quad \ldots\ldots(4)$$

Where

INDEX = stock market all share index,

CPI = Consumer Price Index

GDP = Gross Domestic Product,

EXCH= exchange rate,

M2= Broad money supply,

Equation (4) can be transformed into an econometric model as follows:

INDEX=β0 +β1CPI +β2*GDP*+β3*M2* + *β4EXCH*+ε..............................................(5)

Where

INDEX= All share index

RGDP= Real Gross Domestic Product

CPI = Consumer Price Index

EXCH=Exchange Rate

M2= Money Supply

ε= Error Term

β0= Intercept of the Model

Based on the results from the estimation of this GARCH/EGARCH model, the volatility of stock prices would be explained based on changes in the macroeconomic variables.

### 3.3.1 Unit root test

To test for stationarity or the absence of unit roots, this test uses the Augmented Dickey Fuller test (ADF) with the hypothesis, which states as follows: If the absolute value of the Augmented Dickey Fuller (ADF) test is greater than the critical value either at the 1%, 5%, or 10% level of significance, then the variables are stationary either at order zero, one, or two. The Augumented Dickey Fuller test equation is specified below as follows:

$$\Delta \bar{u}_t = \beta \bar{u}_{t-1} + \sum_{i=1}^{k} \Delta \bar{u}_{t-1} + \varepsilon_t$$

...........................................................................................(6)

## 3.4 Empirical Analysis

In this subsection, the various aspects of the data analysis are presented and carried out. The goal of this study is to empirically estimate a model that helps explain the behaviour of stock price volatility in the face of movements in selected macroeconomic variables in Nigeria. The nature of the research therefore requires that the time series properties of the data used in the study are to be investigated. As mentioned in the previous section, the GARCH methodology is used in the analysis.

### 3.5 Sources and method of Data Collection

Data used in this study are quarterly time series data covering the period of 1980 to 2014. All the data are sourced from the Central Bank of Nigeria Statistical Bulletin and Nigeria stock exchange publication.

# CHAPTER FOUR

# DATA ANALYSIS AND INTERPRETATION

## 4.0 Introduction

In this chapter, the impact of consumer price index, exchange rate, money supply, gross domestic product (GDP), consumer price index (CPI) and stock price are tested and presented.

## 4.1 DESCRIPTIVE STATISTICS

The Jarque-Bera (JB) test statistic was used to determine whether or not macro-economic variables and the NSE stock share index follow the normal probability distribution. The JB test of normality is a large-sample or asymptotic test that computes kurtosis and the skewness measures and uses the following test statistic:

$$JB = n\left[\frac{s}{3} + \left(\frac{k-3}{12}\right)\right]$$

Where n = sample size, S = skewness coefficient, and K = kurtosis coefficient. For a normally distributed variable, S = 0 and K = 3. Therefore, the JB test of normality is a test of the joint hypothesis that S and K are 0 and 3, respectively. Sample mean, standard deviation, skewness and kurtosis, and the Jacque-Bera statistics and the p-value have been reported. The high standard deviation of the stock index (INDEX) with respect to mean implies that there is high volatility at the stock market:

**Table 1: Descriptive Statistics for Variables**

| | INDEX | EXCH | CPI | M2 | GDP |
|---|---|---|---|---|---|
| Mean | 44610.61 | 124.1110 | 134.2758 | 15213.67 | 68948.19 |
| Median | 19275.70 | 121.4030 | 142.1733 | 16840.44 | 86059.93 |
| Maximum | 700802.5 | 158.2074 | 145.8000 | 17680.52 | 89043.62 |
| Minimum | 195.5000 | 21.88610 | 29.87000 | 413.2801 | 134.5856 |

| | | | | | |
|---|---|---|---|---|---|
| Std. Dev. | 75082.88 | 23.37886 | 24.52201 | 4456.151 | 32414.02 |
| Skewness | 5.828881 | -2.071495 | -3.083577 | -2.580931 | -1.436511 |
| Kurtosis | 49.86603 | 10.24881 | 11.22959 | 8.018602 | 3.157883 |
| Jarque-Bera | 11661.64 | 348.5478 | 528.7994 | 259.1559 | 41.39593 |
| Probability | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| Observations | 120 | 120 | 120 | 120 | 120 |

**Source: Author's computation 2015**

From the table above, the estimated result shows that all the variables have positive mean values. The result indicate that the stock market index (INDEX)'s skewness coefficient is far from zero (5.828881) and kurtosis coefficient of 49.86603 is leptokurtic. The skewness coefficient of the variables, EXCH (-2.071495), CPI (-3.083577), M2 (-2.580931) and GDP (-1.436511) are clearly far from zero while the kurtosis coefficient of the variables CPI (6.277358), EXCHR (3.423943) are all leptokurtic; and also, the kurtosis coefficients of the variables, CPI (11.22959), M2(8.018602) and GDP(3.157883) are leptokurtic. The estimation above indicates that the Jarque-Bera probability for the variables shows that the error terms are normally distributed.

### 4.1.1 STATIONARITY ANALYSIS

An important concern in data analysis is to determine whether a series is stationary (do not contain a unit root) or not stationary (contains a unit root). Time series data are often assumed to be non-stationary and thus it was necessary to perform a pretest to ensure that all the variables were stationary in order to avoid the problem of spurious regression (Granger, 2001)

**Table 2: Stationarity test**

| | **AUGMENTED DICKY FULLER TEST (ADF)** | | **PHILIP PERON UNIT ROOT (PP)** | |
|---|---|---|---|---|
| Variable | Integration of order zero I(0) | Integration of order one I(1)<br><br>**5% Critical Value -1.9428** | Integration of order zero I(0 | Integration of order one I(1)<br>**5% Critical Value -1.9427** |
| INDEX | -1.436668 | -7.247025 | -5.494992 | -25.29696 |
| CPI | -0.028636 | -3.427049 | 0.846864 | -3.605927 |
| EXCH | -0.188166 | -5.779912 | -0.177687 | -9.804821 |
| M2 | -0.177522 | -2.367993 | 0.566526 | -5.861294 |
| GDP | -0.144286 | -3.486673 | 0.498636 | -7.738785 |

**Source: Author's computation 2015**

The results showed that for stock market index (INDEX), the null hypothesis of non-stationary was rejected implying that it was stationary at level in Philip Peron unit root test. Evaluation of the results was guided by the critical values provided by Mackinnon (1996). This implied that INDEX is integrated of order zero I (0). Other macroeconomic variables; Gross Domestic Product (GDP), broad money supply (M2), and Exchange Rate were found to be non-stationary at level. However they became stationary after the first difference. This means that they are integrated of order one, I (1) both in ADF and Philip Peron unit root tests procedures.

### 4.1.2. COINTEGRATION TEST

When a linear combination of variables that are I(1) produces a stationary series, then the variables may need to be co-integrated. This means that a long-run relationship may exist among them, which connotes that they may wander from one another in the short-run but in the long-run they will move together. To establish whether long-run relationship exists among the variables or not, co-integration tests are conducted by using the multivariate procedure developed by Johansen (1988) and Johansen and Juselius (1990). The nature of the estimator means that the estimates are robust to simultaneity bias, and it is robust to departure from normality (Johansen, 1995). Johansen method detects a number of co-integrating vectors in non-stationary time series. It allows for hypothesis testing regarding the elements of co-integrating vectors and loading matrix. The result of the conducted Johansen tests for co-integration amongst the variables is specified in the table below:

**Table3: Summary of co-integration estimate**

| **TRACE TEST** | | | | **Maximum EigenValue Test** | | | |
|---|---|---|---|---|---|---|---|
| **Null Hypothesis** | **Alternative Hypothesis** | **Statistics** | **99% Critical Value** | **Null Hypothesis** | **Alternative Hypothesis** | **Statistics** | **95% Critical Value** |
| r=0 | r≥1 | 190.73 | 66.52 | r=0 | r≥1 | 0.61 | 59.46 |
| r≤1 | r≥2 | 79.92 | 45.58 | r≤1 | r≥2 | 0.39 | 39.89 |
| r≤2 | r≥3 | 22.46 | 29.75 | r≤2 | r≥3 | 0.14 | 24.31 |
| r≤3 | r≥4 | 4.32 | 16.31 | r≤3 | r≥4 | 0.03 | 12.53 |
| r≤4 | r≥5 | 0.01 | 6.51 | r≤4 | r≥5 | 0.00 | 3.84 |

**Source: Author's computation 2015**

The results indicate that there are at most two co-integrating vectors. Using the trace likelihood ratio, the results point out that the null hypothesis of no co-integration among the variables is rejected in favour of the alternative hypothesis of up to two co-integrating equations at 5% significant level because their values exceeded the critical values. This means there are at most two integrating equations, which implies that a long-run relationship exists among the variables and the coefficients of estimated regression can be taken as equilibrium values.

### 4.1.3. CORRELATION ANALYSIS RESULTS

The Logic behind the assumption of no multicollinearity is that if two or more independent variables are correlated with each other, one of them should be dropped from the list of variables. In order to check multicollinearity among independent variables, a correlation analysis was performed. A suggested rule of the thumb was that if the pair wise correlation between two regressors is very high, in excess of 0.8, multicollinearity may pose serious problem (Adam and Twenoboah, 2008). The worst consequence of multicollinearity is that it increases the variances and standard errors of the OLS estimates. High variances mean that the estimates are imprecise, and therefore not very reliable. High variances and standard errors imply low t-statistics (Granger, 2001)

**Table 4: Correlation matrix**

| | INDEX | EXCH | CPI | M2 | GDP |
|---|---|---|---|---|---|
| INDEX | 1.000000 | 0.214518 | 0.191124 | 0.216530 | 0.311194 |
| EXCH | 0.214518 | 1.000000 | -0.007360 | -0.013196 | 0.218783 |
| CPI | 0.191124 | -0.007360 | 1.000000 | 0.967146 | 0.683005 |
| M2 | 0.216530 | -0.013196 | 0.967146 | 1.000000 | 0.768342 |
| GDP | 0.311194 | 0.218783 | 0.683005 | 0.768342 | 1.000000 |

**Source: Author's computation 2015**

From the correlation matrix above, it is clear that all the correlation values are lower than 0.8. It therefore implies that there is no multicolinearity among the variables under consideration.

### 4.1.4. TESTING FOR HETEROSCEDASTICITY

One of the most important issues before applying the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) methodology is to first examine the residuals for evidence of heteroscedasticity. To test for the presence of heteroscedasticity in residuals $\mu_t$ of the Nigerian all share index, the Lagrange Multiplier (LM) test for ARCH effects proposed by Engle (1982) is applied. In summary, the test procedure is performed by first obtaining the residuals from the ordinary least squares regression of the conditional mean equation which might be an autoregressive (AR) process, moving average (MA) process or a combination of AR and MA processes; (ARMA) process. For example, in ARMA (1,1) process the conditional mean equation will be as: t e (meaning?)

$$\gamma_t = \phi_1 \gamma_{t-1} + \varepsilon_t + \theta_1 \varepsilon_{t-1}$$

After obtaining the residuals $e_t$, the next step is regressing the squared residuals on a constant and q lags as in the following equation: $e^2_t = \alpha 0 + \alpha_1 e^2_{t-1} + \alpha_2 e^2_{t-2} + ......\alpha_q e_{t-q} + v_t$

The null hypothesis that there is no ARCH effect up to order q can be formulated as:

$$Ho : \alpha_1 = \alpha_2 ... \alpha_q = 0$$

$$H_1 : \alpha_1 > 0$$

For at least one i=1,2…q

The test statistic for the joint significance of the q-lagged squared residuals is the number of observations times the R-squared from the regression. It is evaluated against $\chi^2_{(q)}$ distribution. This is asymptotically locally most powerful test. In this case, we first employ an autoregressive moving average model for the conditional mean in the return series as an initial regression, then, test the null hypothesis that there are no ARCH effects in the residual series from lag 1 up to lag 5. The results of this examination are summarized in Table below:

**Table 5: Testing for hetroscedastiicity**

| ARCH – LM Test: | Value | Probability |
|---|---|---|
| F-statistic | 0.029917 | 0.970534 |
| Obs*R-squared | 0.061363 | 0.969785 |
| 5% Critical Value | 2.73 | |

**Source: Author's computation 2015**

The ARCH-LM test results in table above provide strong evidence for accepting the null hypothesis for all lags included. Accepting is an indication of no ARCH effects in the residuals series and therefore the variance of the return series of all share index is constant for all periods specified $H_0$. From the hetroscedasticity ARCH -LM test obtained, there is evidence to conclude that there is no ARCH effect on the variables, even at 5% significant level

The probability values of the Q-statistics for all lags are less than 0.05, ARCH and GARCH coefficients are significant in all periods. The null hypothesis that there is no ARCH effect is accepted confirming that there is no serial correlation in the residuals of the estimated models at 5% significance level. Also, few points on the QQ-plots of the residuals were all within the straight line, especially at the extreme which is maintaining the consensus that the standardized residuals are normally distributed.

### 4.1.5. THE EGARCH MODEL

**Table7: The EGARCH model result**

| Mean equation | Coefficient | z-statistic | Prob. | Variance equation | Coefficient | z-statistic | Prob. |
|---|---|---|---|---|---|---|---|
| SQR(GARCH) | 0.952916 | 0.050349 | 0.9598 | | | | |
| C | -119324.1 | -0.102717 | 0.9182 | C | 22.30955 | 0.585287 | 0.5584 |
| CPI | -153.5959 | -0.044492 | 0.9645 | \|RES\|/SQR[GARCH](1) | 0.015429 | 0.029296 | 0.5584 |
| EXCH | 485.2836 | 0.333420 | 0.7388 | RES/SQR[GARCH](1) | 0.022518 | 0.041854 | 0.9666 |
| M2 | 1.143345 | 0.062222 | 0.9504 | CPI | -0.008573 | -0.127888 | 0.8982 |
| GDP | 0.584502 | 0.056845 | 0.9547 | EXCH | -0.001862 | -0.130370 | 0.8963 |
| AIC | 25.22899 | | | M2 | 1.58E-05 | 0.037686 | 0.9699 |
| SC | 25.55419 | | | GDP | 1.66E-05 | 0.360614 | 0.7184 |
| N | 120 | | | | | | |

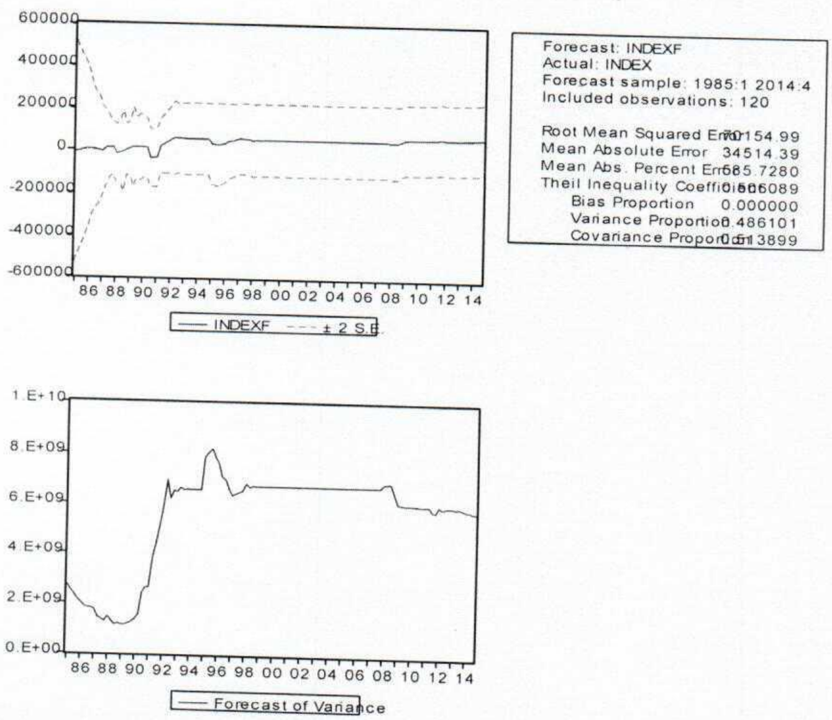
**Source: Author's computation 2015**

The mean equation of the EGARCH (1,1) model estimated for the Nigerian stock market all share index indicates that the estimated coefficients of the variables, CPI, exhibited negative sign. The asymmetric effect captured by the parameter estimates of the variables is statistically non-significant with negative sign. The result indicate that negative shocks imply a higher next period conditional variance than positive shocks of the same sign (Ahmed and Suliman, 2011), which imply that the existence of leverage effect is observed in returns of the all share index of the Nigerian stock market.

In the variance equation the first three coefficients (constant)( 22.30955), GARCH term (0.015429) and GARCH term (0.022518) for GARCH (1,1) are highly significant and with expected sign for all periods. The significance indicates that lagged conditional variance and squared disturbance has an impact on the conditional variance; in other words this means that news about volatility from the previous periods has an explanatory power on current volatility. The sum of the two estimated GARCH and GARCH coefficients (persistence coefficients) in the estimation process of the variance is less than one, which is required to have a mean reverting variance process. This implies that large changes in returns tend to be followed by large changes and small changes tend to be followed by small changes, which will therefore, confirm that volatility clustering is observed in the Nigerian stock all share index.

The estimated coefficient of the variables EXCH and (M2) in the mean equation are positive while the coefficients of the variables, M2 and GDP in the variance equation show positive signs indicating that the mean of return sequence of the variable considerably depends on past innovation and past conditional variance. This result shows that as volatility increases, the all share index correspondingly increase by a factor of485.2836, 1.143345 and 1.58E-05 and 1.66E-05, respectively. These results are consistent with the theory of a positive risk premium on stock indices which states that the higher returns are expected for asset with higher level of risk.

**Figure1: The forecast performance**




**Source: Author's computation**

On the basis of RMSE and Theil, EGARCH (1, 1) model result indicates least forecast error. This result is in consonance with Eric (2008) who noted that the covariance proportion of Theil statistics suggests that 0.03% of the remaining unsystematic forecasting error was accounted for. It is worthy to note that the closeness of the forecast evaluation statistics in terms of RMSE and Theil coefficient justifies the adequacy of the effect of the macroeconomic variables on stock market index model under consideration.

## 4.2 DISCUSSION OF THE FINDINGS

The major focus of this study is to evaluate the effect of macroeconomic fundamentals on stock markets in Nigeria. From the result table obtained, the descriptive statistics shows that all the variables have positive mean values. The estimation equally indicates that the Jarque-Bera probability for the variables shows that the error terms are normally distributed. Also the stationarity test conducted on the variables showed that for stock market index (INDEX) the null hypothesis of non-stationary was rejected which indicated that it was stationary at level in Philip Peron unit root test while other macroeconomic variables; Gross Domestic Product (GDP), broad money supply (M2), Exchange Rate were found to be non-stationary at level. But they became stationary after the first difference. This means that they are integrated of order one, I (1) both in ADF and Philip Peron unit root tests procedures. The co-integration test result obtained indicates that there are at most two co-integrating vectors. Using the trace likelihood ratio, the results point out that the null hypothesis of no co-integration among the variables is rejected in favour of the alternative hypothesis up to two co-integrating equations at 5% significant level because their values exceeded the critical values. On the correlation test conducted, the values obtained are lower than 0.8 implying that there is no multicolinearity among the variables under consideration. The ARCH-LM test conducted provided strong evidence for accepting the null hypothesis for all lags included. Accepting is an indication of no ARCH effects in the residuals series and therefore the variance of the return series of all share index is constant for all periods. This was confirmed by the correlogramme test conducted which showed that few points on the QQ-plots of the residuals were all within the straight line, especially at the extreme which is maintaining the consensus that the standardized residuals are normally distributed. Finally, the estimated EGARCH (1, 1) model result on the Nigerian stock market all share index indicates that the estimated coefficients of the variables, CPI, exhibited negative sign. The asymmetric effect captured by the parameter estimates of the variables, is statistically non-significant with negative sign. The result indicate that negative shocks imply a higher next period conditional variance than positive shocks of the same sign (Ahmed and Suliman, 2011), which imply that the existence of leverage effect is observed in returns of the all share index of the Nigerian stock market. Finally, the estimated EGARCH (1,1) model result on the Nigerian stock market all share index indicates that the estimated coefficients of the variables, CPI, exhibited negative sign. The asymmetric effect captured by the parameter estimates of the variables is statistically non-significant with negative sign. The result indicate that negative shocks imply a higher next period conditional variance than positive shocks of the same sign (Ahmed and Suliman, 2011), which imply that the existence of leverage effect is observed in returns of the all share index of the Nigerian stock market.

# CHAPTER FIVE

## 5.0. SUMMARY, CONCLUSION AND RECOMMENDATION

### 5.1 Summary of Findings

All over the world, it is known that higher stock prices heighten household wealth and this encourages consumers to spend more. Hence, a rise in stock prices makes it cheaper for firms to raise funds and thus invest more. Meanwhile, the rise in the value of collateral, such as real estate, increases banks' enthusiasm to lend. All these factors can swell domestic demand and help increase real GDP growth. Thus, if stocks prices truthfully reflect the basic fundamentals, then the stock prices should be used as principal indicators of future economic activity. Similarly, since the value of corporate equity at the aggregated level should depend on the state of the economy, it is plausible that a change in the level of uncertainty about future economic growth would produce a change in the stock market. The stock market plays a major role as an economic institution which enhances the efficiency in capital formation and allocation. It enables both corporations and the government to raise long-term capital which enables them to finance new projects and expand other operations. The need to encourage private capital for development was realized early enough with the establishment of the Nigerian Stock Exchange (NSE) in 1961 to develop the capital market. Fluctuations of macroeconomic fundamentals have been labeled as the reasons behind the daily upward and downward movement of stock prices being witnessed at the Nigeria Stock Exchange. The specific objective of this study is to examine the impact of four macroeconomic fundamentals on stock prices in Nigeria during the period of 1985 to 2014. The changes in macroeconomic balances are often reflected by the magnitude and movement in stock prices, market index and liquidity of the market.

## 5.2 Conclusion

In conclusion, the estimated result shows that all the variables have positive mean values. The result indicate that the stock market index (INDEX)'s skewness coefficient is far from zero and kurtosis coefficient is leptokurtic. The skewness coefficient of the variables, EXCH (-CPI) (-M2) and GDP are clearly far from zero while the kurtosis coefficient of the variables CPI and EXCHR are all leptokurtic. The estimation indicates that the Jarque-Bera probability for the variables shows that the error terms are normally distributed.

The stationarity test procedure conducted shows that for the stock market index (INDEX), the null hypothesis of non-stationary was rejected implying that it was stationary at level in Philip Peron unit root test. Other macroeconomic variables; Gross Domestic Product (GDP), broad money supply (M2), and Exchange Rate were found to be non-stationary at level. However they became stationary after the first difference. The co-integration test result conducted indicates at most two co-integrating equations. From the correlation matrix obtained, it shows that there is no multicolinearity among the variables under consideration. The Hetroscedasticity test result conducted indicates that the Lagrange Multiplier (LM) test for ARCH effects shows that there is evidence to conclude that there is no presence of ARCH effect on the variables under consideration even at 5% significant level. Also, serial correlation test results conducted using Q-Statistics (Correlogram of Residuals) show that the null hypothesis that there is no ARCH effect is accepted confirming that there is no serial correlation in the residuals of the estimated models at 5% significance level. Also, few points on the QQ-plots of the residuals were all within the straight line, especially at the extreme which is maintaining the consensus that the standardized residuals are normally distributed.

The EGARCH model estimation result obtained indicates that in the mean equation of the model estimated for the Nigerian stock market all share index indicates that the estimated coefficients of the variables, CPI, exhibited negative sign. The asymmetric effect captured by the parameter estimates of the variables, is statistically non-significant with negative sign. The variance equation's first three coefficients (constant) GARCH term and GARCH (1,1) are highly significant and with expected sign for all periods. The sum of the two estimated GARCH and GARCH coefficients (persistence coefficients) in the estimation process of the variance is less than one, which is required to have a mean reverting variance process. Equally, The estimated coefficient of the variables EXCH and (M2) in the mean equation are positive while the coefficients of the variables, M2 and GDP in the variance equation show positive signs indicating that the mean of return sequence of the variables considerably depends on past innovation and past conditional variance. These results are consistent with the theory of a positive risk premium on stock indices which states that the higher returns are expected for asset with higher level of risk.

### 5.3 Recommendation/ policy implication

**Based on the findings above, the following recommendations are therefore made:**

1. The government should put in place appropriate policy measures to ensure that the exchange rate is stabilized. This is because empirical evidence from study has shown that exchange rate affects stock returns.
2. The Nigerian government should put in place measures that will curtail depreciation of the currency. The results of the study findings have showed that a shock to exchange rates showed negative response to stock returns. This implies that exchange rate and stock returns are negatively related.
3. The government should seek to minimize fluctuations on the variables; exchange rate, GDP growth, and the consumer price index.
4. High frequency data such as monthly data or daily data are suggested to be used in future researches. According to Liu (2006), high frequency data are more useful in estimation time series data. Therefore, high frequency data can obtain the more reliable result of their search.

5. This research is using time series data set and this type of data set has always been used by many previous researches. However, time series data has some disadvantages that may make the result becomes bias. Other type of data such as panel data are encouraged to be employed in future researches instead of using time series data as time series data may cause inconsistent result.

## References


Adam A., Tweneboah G (2008). Do macroeconomic variables play any role in the stock market movement in Ghana? *Munich Personal RePEc Archive , MPRA Paper No. 9357,* Online at: http://mpra.ub.uni-muenchen.de/9357/.

Ahmed, A. E., &Suliman, S. Z. (2011). The Long–Run Relationship Between Money Supply, Real GDP, and Price Level: Empirical Evidence From Sudan. *Journal of Business Studies Quarterly*, 68-79.

Ajayi, R.A. and M. Mougoue,(1996). On the dynamic relation between stock prices and exchange rates. *J. Finance. Research., 19:* 193-207.

Alile, H.I., (1984). The Nigerian Stock Exchange: *Historical Perspective, Operations and Contributions to Economic Development. Central Bank of Nigeria Bullion,* Silver Jubilee Edn., 2: 65-69.

Asaolu, T. O. and Ogunmuyiwa, M.S. (2011). An Econometric Analysis of the Impact of Macroecomomic Variables on Stock Market Movement in Nigeria, *Asian Journal of Business Management, 3 (1)*: 72-78.

Booth JR and Booth L.C. (1997). *Economic Factors, Monetary Policy, and expected Returns on Stocks and Bonds.* Economic Review, Federal Reserve Bank of San Francisco, pp. 32-42.

Branson, W. H. (1981). *Macroeconomic Determinants of Real ExchangeRates(No.0801).*National Bureau of Economic Research, Inc.

Chandra, P. (2004). *Investment Analysis and Portfolio Management*. New Delhi: McGraw-Hill.

Chen, N. F., Roll, R. and Ross, S. (1986). Economic forces and the stock market. *Journal of Business 59(3)*: 83-403

Chen, N. F., Roll, R., and Ross, S. A. (1986). Economic forces and the stock market. *The Journal of Business, 59(3)*, 383-403. *Retrieved from http://www-personal.umich.edu/~jizhu/jizhu/Empirical%20Finance/Papers/Cross%20Sectional%20Predictability/ChenRollRoss86.pdf*

Chen, N. and Roll, R., Ross, A. S. (1986). "Economic Forces and the Stock Market", *Journal of Business, Vol. 59, No. 3,* pp. 383-403.

Classical Economics. (2013, August 19). AmosWEBEncyclonomicWEBpedia. *Retrieved from http://www.AmosWEB.com*

Corrado, C. J., and Jordan, B. D. (2005*). Fundamentals of Investments: Valuation and Management.* New York: McGraw-Hill Irwin.

Fama, E. F., 1981. Stock returns, real activity, inflation and money. *American Economic Review, 71(4)*, 45-565.

Fama, E.F. (1990). Stock returns, expected returns and real activity. *The Journal Finance, 45(4)*, 1089–1108.*Retrieved from http://didattica.unibocconi.it/mypage/upload/FAMA20081107164805.PDF*

Fama, E.F., and Schwert, G.W. (1977). Asset returns and inflation. *Journal of Financial Economics, 5(1977)*, 115-146. *Retrieved from http://schwert.ssb.rochester.edu/ari_jfe77.pdf*

Granger, C.W.J.,et al (2000). *Investigating causal relationships by econometric models and cross spectral methods.* Econometrica. 17(2): 424-438.

*http://ijcsms.com/journals/Paper2.pdf, Retrieved dated: 28th June 2011.*

*http://www.cmb.gov.tr/displayfile.aspx?action=displayfile&pageid=61&fn=61.pdf*

Humpe, A., and Macmillan, P. (2007).*Can macroeconomic variables explain long term stock market movements?* A comparison of the US and Japan.*School of Economics and Finance, University of St Andrews.*

Ibrahim, Mansor H. (2003). Macroeconomic Forces and Capital Market Integration: A VAR Analysis for in Case of KSE (Karachi Stock Exchange). *European Journal of Scientific Research, 38(1)*, 96-103.

Isenmila, P. A., and Erah, D. O. (2012). Share prices and macroeconomic factors: A test of the arbitrage pricing theory (APT) in the Nigerian stock market. *European Journal of Business and Management, 4(15)*, 2222-2839.

Johansen, S. (1991). *Estimation and Hypothesis testing of Co-integration Vector in Gaussian Vector Autoregressive Models, Econometrica, 59*: 1551-1581.

Kim, C.M. and S. Kon. (2003). "Alternative Model of Conditional Heteroscedasticity in Stock Returns." *Journal of Business. 67.* 563-98.

Kumar, N. P., & Puja, P. (2012).*The impact of macroeconomic fundamentals on stock prices revisited: An envidence from Indian Data. MPRA paper*, 38980(23).

Liu, L. and Hu, Z., (2006). Responses of the stock market to macroeconomic announcements across

Liew, V. T. Chong and K. Lim.,(2004), The inadequacy of linear autoregressive models for real exchange rates: empirical evidence from Asian economies, *Applied Economics 35*, 1387 – 1392

Liow, K. H. (2004). *Dynamic Relationship Between Stock And Property Markets.*

Maku, E. O. and Atanda, A. A. (2000). *Does Macroeconomic Indicators Exert Shock on the Nigerian Capital Market? Paper No. 17917*, Munish Publication, University of Demark.

Maku, O. E. and Atanda, A. A. (2010). Determinants of Stock Market Performance in Nigeria. *Journal of Management and Organisational Behaviour, 1(3):* 1-16.

Malaysia. *Journal of the Asia Pacific Economy, 8(1):* 19-40.

Maysami, R. C., and Koh, T. S. (2000). A vector error correction model of the Singapore stock market. *International Review of Economics and Finance, 9(2000)*, 79–96. *Retrieved from http://web.ebscohost.com.libezp.utar.edu.my/ehost/pdfviewer/pdfviewer?sid=dcb6871c-53f1-4a5b-8d2a-512de28b78c0%40sessionmgr111&vid=5&hid=119*

Maysami, R. C., Lee, C. H., &Hamzah, M. A. (2004).Relationship between macroeconomic variables and stock market indices: Cointegration evidence from stock exchange of Singapore's all-S sector indices. *JournalPengurusan, 24(2004)*, 47-77.*Retrieved from http://journalarticle.ukm.my/1762/1/Jp24-03.pdf*

Maysami, R.C. and T.S. Koh, (2000). A vector error correction model of the singapore stock market. Int. Rev. Econ. Finance, 9: 79-96.

Maysami, R.C., Howe, L.C. and Hamaz, M.A. (2004), Relationship between Macroeconomic Variables and Stock Market Indices: Cointegration Evidence from Stock Exchange of Singapore's All-S Sector Indices, Journal *Penguruson, 24:* 47-77.

Mohammad, S.D., Hussain, A., Jalil, M.A., and Ali, A. (2009). *Impact of Macroeconomics Variables on Stock Prices:* Empirical Evidence

Mukherjee, T.K. and A. Naka, (1995). Dynamic relations between macroeconomics and the Japanese stock market: An application of a vector error correction model. *Journal of Finance. Res., 18(2):* 223-237.

Mukherjee, T.K. and Naka, A. (1995). Dynamic relations between Macroeconomic Variables and the Japanese Stock Market: An application of a Vector Error Correction Model, *The Journal of Financial Research, 2*: 223-237.

Nelson, C. R. (1976). Inflation and rates of return on common stocks. *Journal of Finance,31(2)*, 471-483. *Retrieved from http://www.jstor.org/discover/10.2307/2326618?uid=3738672&uid=2129&uid=2&uid=70&uid=4&sid=21102528831543*

Nieh, C. and Lee, C (2001) *"Dynamic Relationship between Stock Prices and Exchange Rates for G-7 Countries,"*

Nieh, C. C., and Yau, H.-Y.(2001). *Testing for cointegration with threshold effect between stock prices and exchange rates in Japan and Taiwan.*

Nishat, D.M., and Shaheen, R. (2004).Macroeconomic Factors and Pakistan Equity Market. *The Pakistan Development Review, 43(4)*, 619-637. *Retrieved from: http://www.pide.org.pk/pdf/PDR /2004/4 /Part II /M%20Nishat.pdf, Retrieved dated: 7th September 2011.*

Ogiji, F. O. (2011). *Impact of Monetary Policy Management on Economic Growth in Nigeria:1990-2008.* A Thesis presented to the Department of Banking and Finance, Faculty of Management Sciences, Ebonyi State University, Abakaliki.

Osamwonyi, I. O., and Evbayiro-Osagie, E. I. (2012).The relationship between macroeconomic variables and stock market index in Nigeria. *Journal of Economics, 3(1),* 55-63. *Retrieved from http://www.krepublishers.com/02-Journals/JE/JE-03-0-000-12-Web/JE-03-1-000-12-Abst-PDF/JE-03-1-055-12-052-Osamwonyi-I-O/JE-03-1-055-12-052-Osamwonyi-I-O-Tt.pdf*

Osamwonyi, I. O., and Evbayiro-Osagie, E. I. (2012).The relationship between macroeconomic variables and stock market index in Nigeria. *Journal Economics, 3(1)*, 55-63.*Retrieved from http://www.krepublishers.com/02-Journals/JE/JE-03-0-000-12-Web/JE-03-1-000-12-Abst-PDF/JE-03-1-055-12-052-Osamwonyi-I-O/JE-03-1-055-12-052-Osamwonyi-I-O-Tt.pdf*

Ozbay, B. (2009). *The relationship between stock returns and macroeconomic factors: Evidence from turkey*. Financial analysis and fund management.

Pearce, D. K., and Roley, V. V. (1983). The reaction of stock prices to unanticipated changes in money: A Note. *The Journal of Finance*, *38(4),* 1323-1333.

Poon S, Taylor SJ (1991). Macroeconomic Factors and the UK Stock Market" *Journal of Business and Accounting Vol. 18.*

Poon, S. and Taylor, J. (1991) "Macroeconomic factors and U.K Stock Market*", Journal of Business and Account, 18(5)* PP 619 – 636

Richards, N. D., Simpson, J., & Evans, J. (2009). The interaction between exchange rates and stock prices: An Australian context. *International Journal of Economics and Finance*, *1*(1), P3.

Rogalski, R. J., &Vinso, J. D. (1997). Stock returns, money supply and the direction of causality. *The Journal of Finance, 32(4),* 1017-1030.

Ross, S. A. (1976). The Arbitrage Theory of Capital Asset Pricing, *Journal of Economic 3(6)* 55-63

Schwert, W. 1977. "Stock Volatility and Crash of '87," *Review of Financial Studies, 3,* 77–102.

Sellin, P. (2001). Monetary Policy and the Stock Market: Theory and Empirical Evidence. *Journal of Economic Surveys*, *15 (4),* pp. 491-541.

Shiblee, L. S. (2009). *The Impact of Inflation, GDP, Unemployment, and Money Supply On Stock Prices.* Retrieved August 7, 2013, from http://ssrn.com/abstract=1529254 or http://dx.doi.org/10.2139/ssrn.1529254

Singh, T., Mehta, S., & Varsha, M.S. (2011). Macroeconomic factor and stock returns: Evidence. from Taiwan. *Journal of Economics and International Finance, 2(4),* 217-227

Sugimoto, I. (2012). *Exploration of Economic Growth Analysis of Singapore :Construction of Historical GDP Estimates (1900-39 and 1950-60) and Empirical Investigations* . 47-67. *Theory*, 13: 341-360.

Wong, W. K., Khan, H., and Du, J. (2006). Do money and interest rates matter for stock prices? An econometric study of Singapore and USA.*The Singapore EconomicReview, 51(1)*, 31–51. Retrieved from *http://repository.hkbu.edu.hk/cgi/viewcontent.cgi?article=1043&context=econ_ja&sei-redir=1&referer=http://repository.hkbu.edu.hk/cgi/viewcontent.cgi?article=1043&context=econ_ja&sei-redir=1&referer=*

Wongbampo, P. and S.C. Sharma, (2002). Stock market and macroeconomic fundamental dynamic interactions: ASEAN-5 countries. *Journal of Asian Economics., 13*: 27-51.

Yusof, R. M., Majid, M. S. A., &Razali, A.N. (2013). *Macroeconomic variables and stock returns in the post 1997 financial crisis: An application of the ARDL model.* 6th global conference on business & economics held in USA, 15-17 October 2006(pp.1-10). Gutman Conference Center. Retrieved from http://www.gcbe.us/6th_GCBE/data/Macroeconomic%20Variables%20&%20Stock%20Returns.pdf

**Appendix**

FROM 1985 RESULTS

DATA

| YEAR | INDEX | EXCH | CPI | M2 | GDP |
|---|---|---|---|---|---|
| 1985:01:00 | 336.9 | 102.1052 | 29.87 | 413.280129 | 134.5856 |
| 1985:02:00 | 348.4 | 111.9433 | 35.51 | 488.145786 | 134.6033 |
| 1985:03:00 | 351.1 | 120.9702 | 40.08 | 628.95216 | 193.1262 |
| 1985:04:00 | 451 | 129.3565 | 45.7 | 878.457274 | 263.2945 |
| 1986:01:00 | 415.1 | 133.5004 | 52.56 | 1269.32161 | 382.2615 |
| 1986:02:00 | 437.9 | 132.147 | 61.95 | 1505.9635 | 472.6487 |
| 1986:03:00 | 456.9 | 128.6516 | 67.05 | 1952.92119 | 545.6724 |
| 1986:04:00 | 488 | 125.8331 | 70.66 | 2131.81898 | 875.3425 |
| 1987:01:00 | 494.8 | 118.5669 | 78.84 | 2637.91273 | 1089.68 |
| 1987:02:00 | 507.8 | 148.9107 | 87.94 | 3797.90898 | 1399.703 |
| 1987:03:00 | 581.3 | 148.9107 | 100 | 5127.4007 | 2907.358 |
| 1987:04:00 | 539.1 | 148.9107 | 110.84 | 8008.20395 | 4032.3 |
| 1988:01:00 | 195.5 | 92.6934 | 124.38 | 9411.11225 | 4189.25 |
| 1988:02:00 | 605.3 | 102.1052 | 134.92 | 11034.9409 | 3989.45 |
| 1988:03:00 | 653.2 | 111.9433 | 145.8 | 12172.4903 | 4679.212 |
| 1988:04:00 | 693.5 | 120.9702 | 140.36 | 13895.3891 | 6713.575 |
| 1989:01:00 | 747.6 | 129.3565 | 143.08 | 15160.2899 | 6895.198 |
| 1989:02:00 | 773.8 | 133.5004 | 141.72 | 17680.52 | 7795.758 |
| 1989:03:00 | 830.1 | 132.147 | 142.4 | 16420.4049 | 9913.518 |
| 1989:04:00 | 934.9 | 128.6516 | 142.06 | 17050.4625 | 11411.07 |
| 1990:01:00 | 1048.3 | 125.8331 | 142.23 | 16735.4337 | 14610.88 |
| 1990:02:00 | 1161.7 | 118.5669 | 142.145 | 16892.9481 | 18564.59 |
| 1990:03:00 | 1377.2 | 21.8861 | 142.1875 | 16814.1909 | 20657.32 |
| 1990:04:00 | 1496.7 | 21.8861 | 142.1663 | 16853.5695 | 24296.33 |
| 1991:01:00 | 1686.7 | 21.8861 | 142.1769 | 16833.8802 | 24794.24 |
| 1991:02:00 | 1925.8 | 92.6934 | 142.1716 | 16843.7248 | 54612.26 |
| 1991:03:00 | 2137.4 | 102.1052 | 142.1742 | 16838.8025 | 62980.4 |
| 1991:04:00 | 2309.5 | 111.9433 | 142.1729 | 16841.2637 | 71713.94 |
| 1992:01:00 | 2443.8 | 120.9702 | 142.1736 | 16840.0331 | 80092.56 |
| 1992:02:00 | 2575.3 | 129.3565 | 142.1732 | 16840.6484 | 89043.62 |
| 1992:03:00 | 2871 | 133.5004 | 142.1734 | 16840.3407 | 84568.09 |
| 1992:04:00 | 3282.1 | 132.147 | 142.1733 | 16840.4946 | 86805.85 |
| 1993:01:00 | 3363.8 | 128.6516 | 142.1733 | 16840.4176 | 85686.97 |

| | | | | | |
|---|---|---|---|---|---|
| 1993:02:00 | 3521.7 | 125.8331 | 142.1733 | 16840.4561 | 86246.41 |
| 1993:03:00 | 3593.6 | 127.2424 | 142.1733 | 16840.4369 | 85966.69 |
| 1993:04:00 | 4269.2 | 126.5377 | 142.1733 | 16840.4465 | 86106.55 |
| 1994:01:00 | 5174.4 | 126.89 | 142.1733 | 16840.4417 | 86036.62 |
| 1994:02:00 | 5640.2 | 126.7139 | 142.1733 | 16840.4441 | 86071.59 |
| 1994:03:00 | 5796.4 | 126.802 | 142.1733 | 16840.4429 | 86054.1 |
| 1994:04:00 | 6347.7 | 126.7579 | 142.1733 | 16840.4435 | 86062.85 |
| 1995:01:00 | 7216.2 | 84.575 | 142.1733 | 16840.4432 | 86058.47 |
| 1995:02:00 | 9472.8 | 79.6 | 142.1733 | 16840.4433 | 86060.66 |
| 1995:03:00 | 13837 | 74.625 | 142.1733 | 16840.4433 | 86059.57 |
| 1995:04:00 | 15255.4 | 84.3679 | 142.1733 | 16840.4433 | 86060.11 |
| 1996:01:00 | 15581.7 | 92.52838 | 142.1733 | 16840.4433 | 86059.84 |
| 1996:02:00 | 16915.2 | 109.55 | 142.1733 | 16840.4433 | 86059.98 |
| 1996:03:00 | 18562.3 | 112.4864 | 142.1733 | 16840.4433 | 86059.91 |
| 1996:04:00 | 20402.5 | 126.4 | 142.1733 | 16840.4433 | 86059.94 |
| 1997:01:00 | 23529 | 135.4067 | 142.1733 | 16840.4433 | 86059.93 |
| 1997:02:00 | 25781.4 | 132.67 | 142.1733 | 16840.4433 | 86059.93 |
| 1997:03:00 | 22961.6 | 130.4 | 142.1733 | 16840.4433 | 86059.93 |
| 1997:04:00 | 19391.1 | 128.27 | 142.1733 | 16840.4433 | 86059.93 |
| 1998:01:00 | 19160.3 | 117.968 | 142.1733 | 16840.4433 | 86059.93 |
| 1998:02:00 | 18039.9 | 123.119 | 142.1733 | 16840.4433 | 86059.93 |
| 1998:03:00 | 17310.4 | 120.5435 | 142.1733 | 16840.4433 | 86059.93 |
| 1998:04:00 | 17031.9 | 121.8313 | 142.1733 | 16840.4433 | 86059.93 |
| 1999:01:00 | 16327.5 | 121.1874 | 142.1733 | 16840.4433 | 86059.93 |
| 1999:02:00 | 16609.3 | 121.5093 | 142.1733 | 16840.4433 | 86059.93 |
| 1999:03:00 | 14801.4 | 121.3483 | 142.1733 | 16840.4433 | 86059.93 |
| 1999:04:00 | 15432.1 | 121.4288 | 142.1733 | 16840.4433 | 86059.93 |
| 2000:01:00 | 17674.8 | 121.3886 | 142.1733 | 16840.4433 | 86059.93 |
| 2000:02:00 | 18454.9 | 121.4087 | 142.1733 | 16840.4433 | 86059.93 |
| 2000:03:00 | 21593.7 | 121.3986 | 142.1733 | 16840.4433 | 86059.93 |
| 2000:04:00 | 22690.7 | 121.4037 | 142.1733 | 16840.4433 | 86059.93 |
| 2001:01:00 | 27134.5 | 121.4012 | 142.1733 | 16840.4433 | 86059.93 |
| 2001:02:00 | 30682.7 | 121.4024 | 142.1733 | 16840.4433 | 86059.93 |
| 2001:03:00 | 31179.6 | 121.4018 | 142.1733 | 16840.4433 | 86059.93 |
| 2001:04:00 | 33224.1 | 121.4021 | 142.1733 | 16840.4433 | 86059.93 |
| 2002:01:00 | 32446.3 | 121.4019 | 142.1733 | 16840.4433 | 86059.93 |
| 2002:02:00 | 35326.5 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2002:03:00 | 36597.7 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2002:04:00 | 35211.9 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2003:01:00 | 40498.7 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2003:02:00 | 42139.8 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |

| | | | | | |
|---|---|---|---|---|---|
| 2003:03:00 | 45888.5 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2003:04:00 | 58191.7 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2004:01:00 | 70403.7 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2004:02:00 | 57444.2 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2004:03:00 | 49220.1 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2004:04:00 | 47469.8 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2005:01:00 | 65714.2 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2005:02:00 | 65008.6 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2005:03:00 | 69482.3 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2005:04:00 | 74315.5 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2006:01:00 | 7088.9 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2006:02:00 | 7436.3 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2006:03:00 | 93521.5 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2006:04:00 | 98465.5 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2007:01:00 | 120971.3 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2007:02:00 | 148384.7 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2007:03:00 | 153541.8 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2007:04:00 | 162381 | 121.402 | 142.1733 | 16840.4433 | 86059.93 |
| 2008:01:00 | 182948.9 | 116.23 | 142.1733 | 16840.4433 | 86059.93 |
| 2008:02:00 | 174318.9 | 116.13 | 142.1733 | 16840.4433 | 86059.93 |
| 2008:03:00 | 147116.2 | 116.06 | 142.1733 | 16840.4433 | 86059.93 |
| 2008:04:00 | 700802.5 | 130.75 | 142.1733 | 16840.4433 | 86059.93 |
| 2009:01:00 | 65042.8 | 145.2 | 142.1733 | 16840.4433 | 86059.93 |
| 2009:02:00 | 78052.4 | 146.25 | 142.1733 | 16840.4433 | 86059.93 |
| 2009:03:00 | 45074.1 | 146.82 | 142.1733 | 16840.4433 | 86059.93 |
| 2009:04:00 | 63642.2 | 147.6 | 142.1733 | 16840.4433 | 86059.93 |
| 2010:01:00 | 71546.2 | 147.6 | 142.1733 | 16840.4433 | 86059.93 |
| 2010:02:00 | 78020.5 | 147.8 | 142.1733 | 16840.4433 | 86059.93 |
| 2010:03:00 | 73163 | 148 | 142.1733 | 16840.4433 | 86059.93 |
| 2010:04:00 | 74577.4 | 149.35 | 142.1733 | 16840.4433 | 86059.93 |
| 2011:01:00 | 77468.7 | 148.67 | 142.1733 | 16840.4433 | 86059.93 |
| 2011:02:00 | 75888.5 | 148.67 | 142.1733 | 16840.4433 | 86059.93 |
| 2011:03:00 | 65697.6 | 155.2636 | 142.1733 | 16840.4433 | 86059.93 |
| 2011:04:00 | 43669 | 158.2074 | 142.1733 | 16840.4433 | 86059.93 |
| 2012:01:00 | 61651.8 | 148.2018 | 142.1733 | 16840.4433 | 86059.93 |
| 2012:02:00 | 65711.7 | 152.3017 | 142.1733 | 16840.4433 | 86059.93 |
| 2012:03:00 | 72823..8 | 149.9513 | 142.1733 | 16840.4433 | 86059.93 |
| 2012:04:00 | 81004.1 | 149.8285 | 142.1733 | 16840.4433 | 86059.93 |
| 2013:01:00 | 9846.2 | 150.1915 | 142.1733 | 16840.4433 | 86059.93 |
| 2013:02:00 | 107399.7 | 151.0332 | 142.1733 | 16840.4433 | 86059.93 |
| 2013:03:00 | 110747.9 | 150.4799 | 142.1733 | 16840.4433 | 86059.93 |

| | | | | | |
|---|---|---|---|---|---|
| 2013:04:00 | 117872.8 | 152.5074 | 142.1733 | 16840.4433 | 86059.93 |
| 2014:01:00 | 118878.5 | 154.5029 | 142.1733 | 16840.4433 | 86059.93 |
| 2014:02:00 | 122449 | 155.2636 | 142.1733 | 16840.4433 | 86059.93 |
| 2014:03:00 | 124839.9 | 158.2074 | 142.1733 | 16840.4433 | 86059.93 |
| 2014:04:00 | 106750.5 | 158.2074 | 142.1733 | 16840.4433 | 86059.93 |

The conformity of the residuals to homoscedasticity is an evidence of good volatility models because ARCH effect has been adequately accounted for. Again, serial correlation test results, using Q-Statistics (Correlogram of Residuals) is presented in the table below:

**Table 6: Q-Statistics (Correlogram of Residuals)**

| Autocorrelation | Partial Correlation | | AC | PAC | Q-Stat | Prob |
|---|---|---|---|---|---|---|
| .\|**** \| | .\|**** \| | 1 | 0.535 | 0.535 | 35.214 | 0.000 |
| .\|*** \| | .\|** \| | 2 | 0.438 | 0.213 | 59.068 | 0.000 |
| .\|*** \| | .\|* \| | 3 | 0.405 | 0.156 | 79.599 | 0.000 |
| .\|*** \| | .\|* \| | 4 | 0.400 | 0.143 | 99.838 | 0.000 |
| .\|*** \| | .\|* \| | 5 | 0.365 | 0.072 | 116.79 | 0.000 |
| .\|*** \| | .\|* \| | 6 | 0.371 | 0.104 | 134.49 | 0.000 |
| .\|** \| | .\|. \| | 7 | 0.325 | 0.017 | 148.20 | 0.000 |
| .\|** \| | .\|. \| | 8 | 0.306 | 0.028 | 160.44 | 0.000 |
| .\|*** \| | .\|* \| | 9 | 0.387 | 0.175 | 180.15 | 0.000 |
| .\|*** \| | .\|. \| | 10 | 0.338 | 0.012 | 195.39 | 0.000 |
| .\|** \| | *\|. \| | 11 | 0.250 | -0.082 | 203.80 | 0.000 |
| .\|** \| | .\|. \| | 12 | 0.241 | -0.009 | 211.64 | 0.000 |
| .\|** \| | .\|. \| | 13 | 0.259 | 0.035 | 220.85 | 0.000 |
| .\|** \| | .\|* \| | 14 | 0.286 | 0.079 | 232.15 | 0.000 |
| .\|** \| | .\|. \| | 15 | 0.253 | -0.013 | 241.10 | 0.000 |
| .\|** \| | .\|. \| | 16 | 0.235 | 0.000 | 248.85 | 0.000 |
| .\|* \| | .\|. \| | 17 | 0.177 | -0.057 | 253.29 | 0.000 |
| .\|** \| | .\|* \| | 18 | 0.282 | 0.140 | 264.69 | 0.000 |
| .\|** \| | .\|. \| | 19 | 0.285 | 0.053 | 276.42 | 0.000 |
| .\|** \| | .\|. \| | 20 | 0.250 | 0.010 | 285.55 | 0.000 |
| .\|** \| | .\|. \| | 21 | 0.236 | 0.028 | 293.77 | 0.000 |
| .\|** \| | .\|. \| | 22 | 0.245 | 0.018 | 302.72 | 0.000 |
| .\|** \| | .\|. \| | 23 | 0.220 | -0.032 | 310.04 | 0.000 |
| .\|** \| | .\|. \| | 24 | 0.216 | -0.010 | 317.16 | 0.000 |
| .\|* \| | *\|. \| | 25 | 0.159 | -0.075 | 321.05 | 0.000 |
| .\|* \| | *\|. \| | 26 | 0.105 | -0.065 | 322.76 | 0.000 |
| .\|* \| | .\|. \| | 27 | 0.165 | 0.043 | 327.02 | 0.000 |
| .\|* \| | .\|. \| | 28 | 0.165 | -0.030 | 331.38 | 0.000 |
| .\|* \| | *\|. \| | 29 | 0.074 | -0.123 | 332.27 | 0.000 |
| .\|* \| | .\|. \| | 30 | 0.067 | -0.023 | 332.99 | 0.000 |
| .\|. \| | *\|. \| | 31 | 0.037 | -0.058 | 333.21 | 0.000 |
| .\|. \| | *\|. \| | 32 | -0.015 | -0.118 | 333.25 | 0.000 |
| .\|. \| | *\|. \| | 33 | -0.034 | -0.082 | 333.45 | 0.000 |
| .\|. \| | .\|. \| | 34 | -0.035 | -0.039 | 333.66 | 0.000 |
| *\|. \| | .\|. \| | 35 | -0.060 | 0.004 | 334.27 | 0.000 |
| *\|. \| | *\|. \| | 36 | -0.076 | -0.069 | 335.27 | 0.000 |

**Appendixi**

PHILIP PERON

| | | | |
|---|---|---|---|
| PP Test Statistic | -5.494992 | 1% Critical Value* | -2.5830 |
| | | 5% Critical Value | -1.9426 |
| | | 10% Critical Value | -1.6171 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

| | | |
|---|---|---|
| Lag truncation for Bartlett kernel: 4 | ( Newey-West suggests: 4 ) | |
| Residual variance with no correction | | 5.00E+09 |
| Residual variance with correction | | 5.14E+09 |

Phillips-Perron Test Equation
Dependent Variable: D(INDEX)
Method: Least Squares
Date: 09/10/15 Time: 20:55
Sample(adjusted): 1985:2 2014:4
Included observations: 119 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| INDEX(-1) | -0.407895 | 0.074907 | -5.445383 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.200722 | Mean dependent var | 894.2319 |
| Adjusted R-squared | 0.200722 | S.D. dependent var | 79410.01 |
| S.E. of regression | 70994.40 | Akaike info criterion | 25.18696 |
| Sum squared resid | 5.95E+11 | Schwarz criterion | 25.21031 |
| Log likelihood | -1497.624 | Durbin-Watson stat | 2.450282 |

| | | | |
|---|---|---|---|
| PP Test Statistic | -25.29696 | 1% Critical Value* | -2.5831 |
| | | 5% Critical Value | -1.9427 |
| | | 10% Critical Value | -1.6171 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

| | | |
|---|---|---|
| Lag truncation for Bartlett kernel: 4 | ( Newey-West suggests: 4 ) | |
| Residual variance with no correction | | 4.64E+09 |
| Residual variance with correction | | 1.94E+09 |

Phillips-Perron Test Equation
Dependent Variable: D(INDEX,2)
Method: Least Squares
Date: 09/10/15 Time: 20:57
Sample(adjusted): 1985:3 2014:4
Included observations: 118 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(INDEX(-1)) | -1.513455 | 0.079357 | -19.07157 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.756617 | Mean dependent var | -153.3975 |
| Adjusted R-squared | 0.756617 | S.D. dependent var | 138735.2 |
| S.E. of regression | 68443.40 | Akaike info criterion | 25.11384 |

| | | | |
|---|---|---|---|
| Sum squared resid | 5.48E+11 | Schwarz criterion | 25.13732 |
| Log likelihood | -1480.717 | Durbin-Watson stat | 2.297559 |

| | | | |
|---|---|---|---|
| PP Test Statistic | -0.177687 | 1% Critical Value* | -2.5830 |
| | | 5% Critical Value | -1.9426 |
| | | 10% Critical Value | -1.6171 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

| | | |
|---|---|---|
| Lag truncation for Bartlett kernel: 4 | ( Newey-West suggests: 4 ) | |
| Residual variance with no correction | | 192.8779 |
| Residual variance with correction | | 177.6380 |

Phillips-Perron Test Equation
Dependent Variable: D(EXCH)
Method: Least Squares
Date: 09/10/15 Time: 20:58
Sample(adjusted): 1985:2 2014:4
Included observations: 119 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| EXCH(-1) | -0.002213 | 0.010149 | -0.218035 | 0.8278 |

| | | | |
|---|---|---|---|
| R-squared | -0.000750 | Mean dependent var | 0.471447 |
| Adjusted R-squared | -0.000750 | S.D. dependent var | 13.94154 |
| S.E. of regression | 13.94677 | Akaike info criterion | 8.116741 |
| Sum squared resid | 22952.47 | Schwarz criterion | 8.140095 |
| Log likelihood | -481.9461 | Durbin-Watson stat | 1.801022 |

| | | | |
|---|---|---|---|
| PP Test Statistic | -9.804821 | 1% Critical Value* | -2.5831 |
| | | 5% Critical Value | -1.9427 |
| | | 10% Critical Value | -1.6171 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

| | | |
|---|---|---|
| Lag truncation for Bartlett kernel: 4 | ( Newey-West suggests: 4 ) | |
| Residual variance with no correction | | 191.9867 |
| Residual variance with correction | | 150.8705 |

Phillips-Perron Test Equation
Dependent Variable: D(EXCH,2)
Method: Least Squares
Date: 09/10/15 Time: 20:59
Sample(adjusted): 1985:3 2014:4
Included observations: 118 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| D(EXCH(-1)) | -0.904254 | 0.091829 | -9.847117 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.453173 | Mean dependent var | -0.083374 |
| Adjusted R-squared | 0.453173 | S.D. dependent var | 18.81735 |
| S.E. of regression | 13.91501 | Akaike info criterion | 8.112252 |
| Sum squared resid | 22654.43 | Schwarz criterion | 8.135733 |
| Log likelihood | -477.6229 | Durbin-Watson stat | 2.014207 |

| | | | |
|---|---|---|---|
| PP Test Statistic | 0.846864 | 1% Critical Value* | -2.5830 |
| | | 5% Critical Value | -1.9426 |
| | | 10% Critical Value | -1.6171 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

| | | |
|---|---|---|
| Lag truncation for Bartlett kernel: 4 | ( Newey-West suggests: 4 ) | |
| Residual variance with no correction | | 9.126917 |
| Residual variance with correction | | 35.38995 |

Phillips-Perron Test Equation
Dependent Variable: D(CPI)
Method: Least Squares
Date: 09/10/15 Time: 20:59
Sample(adjusted): 1985:2 2014:4
Included observations: 119 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| CPI(-1) | 0.004108 | 0.002039 | 2.015150 | 0.0462 |

| | | | |
|---|---|---|---|
| R-squared | -0.067427 | Mean dependent var | 0.943725 |
| Adjusted R-squared | -0.067427 | S.D. dependent var | 2.936469 |
| S.E. of regression | 3.033853 | Akaike info criterion | 5.065912 |
| Sum squared resid | 1086.103 | Schwarz criterion | 5.089266 |
| Log likelihood | -300.4217 | Durbin-Watson stat | 0.401669 |

| | | | |
|---|---|---|---|
| PP Test Statistic | -3.605927 | 1% Critical Value* | -2.5831 |
| | | 5% Critical Value | -1.9427 |
| | | 10% Critical Value | -1.6171 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

| | | |
|---|---|---|
| Lag truncation for Bartlett kernel: 4 | ( Newey-West suggests: 4 ) | |
| Residual variance with no correction | | 3.270942 |
| Residual variance with correction | | 2.709497 |

Appendix ii

Phillips-Perron Test Equation
Dependent Variable: D(CPI,2)
Method: Least Squares
Date: 09/10/15 Time: 21:00
Sample(adjusted): 1985:3 2014:4
Included observations: 118 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(CPI(-1)) | -0.207449 | 0.054188 | -3.828333 | 0.0002 |

| | | | |
|---|---|---|---|
| R-squared | 0.110769 | Mean dependent var | -0.047797 |
| Adjusted R-squared | 0.110769 | S.D. dependent var | 1.926093 |
| S.E. of regression | 1.816287 | Akaike info criterion | 4.039904 |
| Sum squared resid | 385.9711 | Schwarz criterion | 4.063384 |
| Log likelihood | -237.3543 | Durbin-Watson stat | 2.651149 |

| | | | |
|---|---|---|---|
| PP Test Statistic | 0.566526 | 1% Critical Value* | -2.5830 |
| | | 5% Critical Value | -1.9426 |
| | | 10% Critical Value | -1.6171 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

| | | |
|---|---|---|
| Lag truncation for Bartlett kernel: 4 | ( Newey-West suggests: 4 ) | |
| Residual variance with no correction | | 257139.3 |
| Residual variance with correction | | 850847.6 |

Phillips-Perron Test Equation
Dependent Variable: D(M2)
Method: Least Squares
Date: 09/10/15 Time: 21:02
Sample(adjusted): 1985:2 2014:4
Included observations: 119 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| M2(-1) | 0.004226 | 0.002947 | 1.433717 | 0.1543 |

| | | | |
|---|---|---|---|
| R-squared | -0.060094 | Mean dependent var | 138.0434 |
| Adjusted R-squared | -0.060094 | S.D. dependent var | 494.5890 |
| S.E. of regression | 509.2332 | Akaike info criterion | 15.31206 |
| Sum squared resid | 30599582 | Schwarz criterion | 15.33541 |
| Log likelihood | -910.0674 | Durbin-Watson stat | 0.879494 |

Appendix iii

| | | | |
|---|---|---|---|
| PP Test Statistic | -5.861294 | 1% Critical Value* | -2.5831 |
| | | 5% Critical Value | -1.9427 |
| | | 10% Critical Value | -1.6171 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

| | | |
|---|---|---|
| Lag truncation for Bartlett kernel: 4 | ( Newey-West suggests: 4 ) | |
| Residual variance with no correction | | 178212.3 |
| Residual variance with correction | | 199784.0 |

Phillips-Perron Test Equation
Dependent Variable: D(M2,2)
Method: Least Squares
Date: 09/10/15 Time: 21:03
Sample(adjusted): 1985:3 2014:4
Included observations: 118 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(M2(-1)) | -0.430480 | 0.075982 | -5.665573 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.215284 | Mean dependent var | -0.634455 |
| Adjusted R-squared | 0.215284 | S.D. dependent var | 478.5867 |
| S.E. of regression | 423.9523 | Akaike info criterion | 14.94556 |
| Sum squared resid | 21029056 | Schwarz criterion | 14.96904 |
| Log likelihood | -880.7879 | Durbin-Watson stat | 2.647028 |

| | | | |
|---|---|---|---|
| PP Test Statistic | 0.498636 | 1% Critical Value* | -2.5830 |
| | | 5% Critical Value | -1.9426 |
| | | 10% Critical Value | -1.6171 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

| | | |
|---|---|---|
| Lag truncation for Bartlett kernel: 4 | ( Newey-West suggests: 4 ) | |
| Residual variance with no correction | | 10576390 |
| Residual variance with correction | | 26273391 |

Phillips-Perron Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 09/10/15 Time: 21:05
Sample(adjusted): 1985:2 2014:4
Included observations: 119 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| GDP(-1) | 0.004457 | 0.003937 | 1.132123 | 0.2599 |

| | | | |
|---|---|---|---|
| R-squared | -0.039970 | Mean dependent var | 722.0617 |
| Adjusted R-squared | -0.039970 | S.D. dependent var | 3202.512 |
| S.E. of regression | 3265.887 | Akaike info criterion | 19.02882 |
| Sum squared resid | 1.26E+09 | Schwarz criterion | 19.05217 |

| | | | |
|---|---|---|---|
| Log likelihood | -1131.215 | Durbin-Watson stat | 1.269816 |

| | | | |
|---|---|---|---|
| PP Test Statistic | -7.738785 | 1% Critical Value* | -2.5831 |
| | | 5% Critical Value | -1.9427 |
| | | 10% Critical Value | -1.6171 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

| | | |
|---|---|---|
| Lag truncation for Bartlett kernel: 4 | ( Newey-West suggests: 4 ) | |
| Residual variance with no correction | | 9268005. |
| Residual variance with correction | | 12148654 |

Phillips-Perron Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 09/10/15 Time: 21:06
Sample(adjusted): 1985:3 2014:4
Included observations: 118 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(GDP(-1)) | -0.625289 | 0.085714 | -7.295035 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.312644 | Mean dependent var | -0.000150 |
| Adjusted R-squared | 0.312644 | S.D. dependent var | 3687.656 |
| S.E. of regression | 3057.322 | Akaike info criterion | 18.89690 |
| Sum squared resid | 1.09E+09 | Schwarz criterion | 18.92039 |
| Log likelihood | -1113.917 | Durbin-Watson stat | 2.254244 |

ADF TEST

| | | | |
|---|---|---|---|
| ADF Test Statistic | -0.144286 | 1% Critical Value* | -2.5836 |
| | | 5% Critical Value | -1.9428 |
| | | 10% Critical Value | -1.6172 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 09/10/15 Time: 21:07
Sample(adjusted): 1986:2 2014:4
Included observations: 115 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| GDP(-1) | -0.000522 | 0.003619 | -0.144286 | 0.8855 |
| D(GDP(-1)) | 0.187224 | 0.094585 | 1.979431 | 0.0503 |
| D(GDP(-2)) | 0.267645 | 0.095803 | 2.793696 | 0.0061 |
| D(GDP(-3)) | 0.103900 | 0.096013 | 1.082150 | 0.2816 |
| D(GDP(-4)) | 0.132562 | 0.095051 | 1.394636 | 0.1659 |

| | | | |
|---|---|---|---|
| R-squared | 0.226260 | Mean dependent var | 745.0232 |
| Adjusted R-squared | 0.198124 | S.D. dependent var | 3255.773 |
| S.E. of regression | 2915.464 | Akaike info criterion | 18.83595 |
| Sum squared resid | 9.35E+08 | Schwarz criterion | 18.95530 |
| Log likelihood | -1078.067 | Durbin-Watson stat | 1.934141 |

| | | | |
|---|---|---|---|
| ADF Test Statistic | -3.486673 | 1% Critical Value* | -2.5838 |
| | | 5% Critical Value | -1.9428 |
| | | 10% Critical Value | -1.6172 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 09/10/15 Time: 21:08
Sample(adjusted): 1986:3 2014:4
Included observations: 114 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(GDP(-1)) | -0.390616 | 0.112031 | -3.486673 | 0.0007 |
| D(GDP(-1),2) | -0.389934 | 0.125603 | -3.104503 | 0.0024 |
| D(GDP(-2),2) | -0.097336 | 0.127438 | -0.763793 | 0.4466 |
| D(GDP(-3),2) | 0.072098 | 0.118925 | 0.606246 | 0.5456 |
| D(GDP(-4),2) | 0.249853 | 0.092744 | 2.694013 | 0.0082 |

| | | | |
|---|---|---|---|
| R-squared | 0.448927 | Mean dependent var | -0.792871 |
| Adjusted R-squared | 0.428704 | S.D. dependent var | 3752.349 |
| S.E. of regression | 2836.180 | Akaike info criterion | 18.78117 |
| Sum squared resid | 8.77E+08 | Schwarz criterion | 18.90118 |
| Log likelihood | -1065.527 | Durbin-Watson stat | 1.979724 |

| | | | |
|---|---|---|---|
| ADF Test Statistic | -0.177522 | 1% Critical Value* | -2.5836 |
| | | 5% Critical Value | -1.9428 |
| | | 10% Critical Value | -1.6172 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(M2)
Method: Least Squares
Date: 09/10/15 Time: 21:08
Sample(adjusted): 1986:2 2014:4
Included observations: 115 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| M2(-1) | -0.000378 | 0.002131 | -0.177522 | 0.8594 |
| D(M2(-1)) | 0.281887 | 0.095043 | 2.965875 | 0.0037 |
| D(M2(-2)) | 0.557751 | 0.098454 | 5.665092 | 0.0000 |
| D(M2(-3)) | -0.074351 | 0.098723 | -0.753125 | 0.4530 |

| | | | | |
|---|---|---|---|---|
| D(M2(-4)) | 0.045996 | 0.095393 | 0.482168 | 0.6306 |

| | | | |
|---|---|---|---|
| R-squared | 0.511717 | Mean dependent var | 135.4011 |
| Adjusted R-squared | 0.493961 | S.D. dependent var | 502.4835 |
| S.E. of regression | 357.4488 | Akaike info criterion | 14.63837 |
| Sum squared resid | 14054663 | Schwarz criterion | 14.75771 |
| Log likelihood | -836.7061 | Durbin-Watson stat | 2.001978 |

| | | | |
|---|---|---|---|
| ADF Test Statistic | -2.367993 | 1% Critical Value* | -2.5838 |
| | | 5% Critical Value | -1.9428 |
| | | 10% Critical Value | -1.6172 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(M2,2)
Method: Least Squares
Date: 09/10/15 Time: 21:09
Sample(adjusted): 1986:3 2014:4
Included observations: 114 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(M2(-1)) | -0.187809 | 0.079311 | -2.367993 | 0.0196 |
| D(M2(-1),2) | -0.531347 | 0.109270 | -4.862686 | 0.0000 |
| D(M2(-2),2) | 0.027998 | 0.118227 | 0.236815 | 0.8132 |
| D(M2(-3),2) | -0.059704 | 0.117211 | -0.509374 | 0.6115 |
| D(M2(-4),2) | -0.021626 | 0.095429 | -0.226616 | 0.8211 |

| | | | |
|---|---|---|---|
| R-squared | 0.474453 | Mean dependent var | -2.075806 |
| Adjusted R-squared | 0.455166 | S.D. dependent var | 486.4347 |
| S.E. of regression | 359.0513 | Akaike info criterion | 14.64768 |
| Sum squared resid | 14052041 | Schwarz criterion | 14.76768 |
| Log likelihood | -829.9175 | Durbin-Watson stat | 1.999724 |

| | | | |
|---|---|---|---|
| ADF Test Statistic | -0.028636 | 1% Critical Value* | -2.5836 |
| | | 5% Critical Value | -1.9428 |
| | | 10% Critical Value | -1.6172 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CPI)
Method: Least Squares
Date: 09/10/15 Time: 21:10
Sample(adjusted): 1986:2 2014:4
Included observations: 115 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| CPI(-1) | -3.30E-05 | 0.001153 | -0.028636 | 0.9772 |
| D(CPI(-1)) | 0.545719 | 0.093791 | 5.818453 | 0.0000 |
| D(CPI(-2)) | 0.435226 | 0.104994 | 4.145250 | 0.0001 |
| D(CPI(-3)) | -0.238484 | 0.104710 | -2.277568 | 0.0247 |

| | | | | |
|---|---|---|---|---|
| D(CPI(-4)) | 0.096332 | 0.092660 | 1.039633 | 0.3008 |

| | | | |
|---|---|---|---|
| R-squared | 0.673774 | Mean dependent var | 0.779246 |
| Adjusted R-squared | 0.661912 | S.D. dependent var | 2.844371 |
| S.E. of regression | 1.653870 | Akaike info criterion | 3.886618 |
| Sum squared resid | 300.8814 | Schwarz criterion | 4.005963 |
| Log likelihood | -218.4805 | Durbin-Watson stat | 2.011192 |

| | | | |
|---|---|---|---|
| ADF Test Statistic | -3.427049 | 1% Critical Value* | -2.5838 |
| | | 5% Critical Value | -1.9428 |
| | | 10% Critical Value | -1.6172 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CPI,2)
Method: Least Squares
Date: 09/10/15 Time: 21:11
Sample(adjusted): 1986:3 2014:4
Included observations: 114 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(CPI(-1)) | -0.194067 | 0.056628 | -3.427049 | 0.0009 |
| D(CPI(-1),2) | -0.289207 | 0.095365 | -3.032628 | 0.0030 |
| D(CPI(-2),2) | 0.138068 | 0.097341 | 1.418393 | 0.1589 |
| D(CPI(-3),2) | -0.057782 | 0.098206 | -0.588375 | 0.5575 |
| D(CPI(-4),2) | 0.046133 | 0.090651 | 0.508906 | 0.6118 |

| | | | |
|---|---|---|---|
| R-squared | 0.326049 | Mean dependent var | -0.082368 |
| Adjusted R-squared | 0.301317 | S.D. dependent var | 1.935602 |
| S.E. of regression | 1.617917 | Akaike info criterion | 3.843024 |
| Sum squared resid | 285.3243 | Schwarz criterion | 3.963033 |
| Log likelihood | -214.0524 | Durbin-Watson stat | 1.936471 |

| | | | |
|---|---|---|---|
| ADF Test Statistic | -0.188166 | 1% Critical Value* | -2.5836 |
| | | 5% Critical Value | -1.9428 |
| | | 10% Critical Value | -1.6172 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXCH)
Method: Least Squares
Date: 09/10/15 Time: 21:12
Sample(adjusted): 1986:2 2014:4
Included observations: 115 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| EXCH(-1) | -0.001860 | 0.009882 | -0.188166 | 0.8511 |
| D(EXCH(-1)) | 0.112059 | 0.095608 | 1.172074 | 0.2437 |
| D(EXCH(-2)) | 0.081801 | 0.088739 | 0.921813 | 0.3586 |
| D(EXCH(-3)) | -0.381900 | 0.088709 | -4.305072 | 0.0000 |
| D(EXCH(-4)) | 0.021479 | 0.095112 | 0.225831 | 0.8218 |

| | | | |
|---|---|---|---|
| R-squared | 0.155136 | Mean dependent var | 0.214843 |
| Adjusted R-squared | 0.124413 | S.D. dependent var | 14.10818 |
| S.E. of regression | 13.20141 | Akaike info criterion | 8.041030 |
| Sum squared resid | 19170.51 | Schwarz criterion | 8.160375 |
| Log likelihood | -457.3592 | Durbin-Watson stat | 1.998540 |

| | | | |
|---|---|---|---|
| ADF Test Statistic | -5.779912 | 1% Critical Value* | -2.5838 |
| | | 5% Critical Value | -1.9428 |
| | | 10% Critical Value | -1.6172 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXCH,2)
Method: Least Squares
Date: 09/10/15 Time: 21:12
Sample(adjusted): 1986:3 2014:4
Included observations: 114 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(EXCH(-1)) | -1.229869 | 0.212783 | -5.779912 | 0.0000 |
| D(EXCH(-1),2) | 0.341029 | 0.181582 | 1.878098 | 0.0630 |
| D(EXCH(-2),2) | 0.402756 | 0.144298 | 2.791133 | 0.0062 |
| D(EXCH(-3),2) | 0.023356 | 0.127061 | 0.183816 | 0.8545 |
| D(EXCH(-4),2) | 0.048715 | 0.095168 | 0.511886 | 0.6098 |

| | | | |
|---|---|---|---|
| R-squared | 0.537701 | Mean dependent var | 0.011872 |
| Adjusted R-squared | 0.520736 | S.D. dependent var | 19.13630 |
| S.E. of regression | 13.24784 | Akaike info criterion | 8.048415 |
| Sum squared resid | 19130.08 | Schwarz criterion | 8.168424 |
| Log likelihood | -453.7597 | Durbin-Watson stat | 2.024475 |

| | | | |
|---|---|---|---|
| ADF Test Statistic | -1.436668 | 1% Critical Value* | -2.5836 |
| | | 5% Critical Value | -1.9428 |
| | | 10% Critical Value | -1.6172 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INDEX)
Method: Least Squares
Date: 09/10/15 Time: 21:14
Sample(adjusted): 1986:2 2014:4
Included observations: 115 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| INDEX(-1) | -0.123985 | 0.086300 | -1.436668 | 0.1537 |
| D(INDEX(-1)) | -0.645441 | 0.117325 | -5.501317 | 0.0000 |
| D(INDEX(-2)) | -0.400518 | 0.126533 | -3.165331 | 0.0020 |
| D(INDEX(-3)) | -0.241983 | 0.120504 | -2.008093 | 0.0471 |
| D(INDEX(-4)) | -0.115694 | 0.095907 | -1.206312 | 0.2303 |

| | | | |
|---|---|---|---|
| R-squared | 0.376548 | Mean dependent var | 924.6557 |
| Adjusted R-squared | 0.353877 | S.D. dependent var | 80790.99 |
| S.E. of regression | 64941.22 | Akaike info criterion | 25.04286 |
| Sum squared resid | 4.64E+11 | Schwarz criterion | 25.16220 |
| Log likelihood | -1434.964 | Durbin-Watson stat | 2.020404 |

| | | | |
|---|---|---|---|
| ADF Test Statistic | -7.247025 | 1% Critical Value* | -2.5838 |
| | | 5% Critical Value | -1.9428 |
| | | 10% Critical Value | -1.6172 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INDEX,2)
Method: Least Squares
Date: 09/10/15 Time: 21:14
Sample(adjusted): 1986:3 2014:4
Included observations: 114 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(INDEX(-1)) | -2.979949 | 0.411196 | -7.247025 | 0.0000 |
| D(INDEX(-1),2) | 1.215866 | 0.360174 | 3.375777 | 0.0010 |
| D(INDEX(-2),2) | 0.701208 | 0.282253 | 2.484326 | 0.0145 |
| D(INDEX(-3),2) | 0.346743 | 0.191108 | 1.814380 | 0.0724 |
| D(INDEX(-4),2) | 0.114569 | 0.095183 | 1.203666 | 0.2313 |

| | | | |
|---|---|---|---|
| R-squared | 0.792884 | Mean dependent var | -158.8789 |
| Adjusted R-squared | 0.785284 | S.D. dependent var | 141169.3 |
| S.E. of regression | 65414.35 | Akaike info criterion | 25.05774 |
| Sum squared resid | 4.66E+11 | Schwarz criterion | 25.17775 |
| Log likelihood | -1423.291 | Durbin-Watson stat | 2.011769 |

Date: 09/14/15 Time: 20:46
Sample: 1985:1 2014:4
Included observations: 115
Test
assumption: No
deterministic
trend in the data
Series: INDEX EXCH CPI M2 GDP
Lags interval: 1 to 4

| Eigenvalue | Likelihood Ratio | 5 Percent Critical Value | 1 Percent Critical Value | Hypothesized No. of CE(s) |
|---|---|---|---|---|
| 0.618479 | 190.7365 | 59.46 | 66.52 | None ** |
| 0.393241 | 79.92367 | 39.89 | 45.58 | At most 1 ** |

| | | | | |
|---|---|---|---|---|
| 0.145942 | 22.46698 | 24.31 | 29.75 | At most 2 |
| 0.036748 | 4.324980 | 12.53 | 16.31 | At most 3 |
| 0.000168 | 0.019340 | 3.84 | 6.51 | At most 4 |

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 2 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

| INDEX | EXCH | CPI | M2 | GDP |
|---|---|---|---|---|
| 3.22E-07 | -0.001042 | -0.000470 | -3.08E-05 | 8.19E-06 |
| -2.53E-07 | 0.000941 | -0.029924 | 0.000277 | -5.98E-06 |
| -1.40E-06 | 0.005527 | -0.012306 | 5.34E-05 | 2.70E-06 |
| -1.28E-06 | -0.003956 | 0.008483 | -3.73E-05 | 2.65E-07 |
| -3.57E-07 | -0.000767 | 0.002161 | -1.37E-05 | -7.35E-07 |

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

| INDEX | EXCH | CPI | M2 | GDP |
|---|---|---|---|---|
| 1.000000 | -3236.002 | -1460.674 | -95.55095 | 25.43562 |
| | (1907.62) | (7782.40) | (71.1971) | (11.6169) |

Log likelihood -3794.137

Normalized Cointegrating Coefficients: 2 Cointegrating Equation(s)

| INDEX | EXCH | CPI | M2 | GDP |
|---|---|---|---|---|
| 1.000000 | 0.000000 | -802247.0 | 6578.606 | 37.44172 |
| | | (7285473) | (60421.7) | (258.614) |
| 0.000000 | 1.000000 | -247.4617 | 2.062470 | 0.003710 |
| | | (2182.98) | (18.1044) | (0.07749) |

Log likelihood -3765.408

Normalized Cointegrating Coefficients: 3 Cointegrating Equation(s)

| INDEX | EXCH | CPI | M2 | GDP |
|---|---|---|---|---|
| 1.000000 | 0.000000 | 0.000000 | -788.0303 | 154.9255 |
| | | | (2683.69) | (529.899) |
| 0.000000 | 1.000000 | 0.000000 | -0.209847 | 0.039949 |
| | | | (0.72332) | (0.14282) |
| 0.000000 | 0.000000 | 1.000000 | -0.009183 | 0.000146 |
| | | | (0.00781) | (0.00154) |

Log likelihood -3756.337

Normalized Cointegrating Coefficients: 4 Cointegrating Equation(s)

| INDEX | EXCH | CPI | M2 | GDP |
|---|---|---|---|---|
| 1.000000 | 0.000000 | 0.000000 | 0.000000 | -0.800281 |
| | | | | (0.28294) |
| 0.000000 | 1.000000 | 0.000000 | 0.000000 | -0.001519 |
| | | | | (7.7E-05) |
| 0.000000 | 0.000000 | 1.000000 | 0.000000 | -0.001668 |
| | | | | (2.2E-05) |
| 0.000000 | 0.000000 | 0.000000 | 1.000000 | -0.197614 |
| | | | | (0.00244) |

Log likelihood -3754.184

DESCRIPTIVE STATISTICS

| | INDEX | EXCH | CPI | M2 | GDP |
|---|---|---|---|---|---|
| Mean | 44610.61 | 124.1110 | 134.2758 | 15213.67 | 68948.19 |
| Median | 19275.70 | 121.4030 | 142.1733 | 16840.44 | 86059.93 |
| Maximum | 700802.5 | 158.2074 | 145.8000 | 17680.52 | 89043.62 |
| Minimum | 195.5000 | 21.88610 | 29.87000 | 413.2801 | 134.5856 |
| Std. Dev. | 75082.88 | 23.37886 | 24.52201 | 4456.151 | 32414.02 |
| Skewness | 5.828881 | -2.071495 | -3.083577 | -2.580931 | -1.436511 |
| Kurtosis | 49.86603 | 10.24881 | 11.22959 | 8.018602 | 3.157883 |
| | | | | | |
| Jarque-Bera | 11661.64 | 348.5478 | 528.7994 | 259.1559 | 41.39593 |
| Probability | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| | | | | | |
| Observations | 120 | 120 | 120 | 120 | 120 |

CORRELATION MATRIX

| | INDEX | EXCH | CPI | M2 | GDP |
|---|---|---|---|---|---|
| INDEX | 1.000000 | 0.214518 | 0.191124 | 0.216530 | 0.311194 |
| EXCH | 0.214518 | 1.000000 | -0.007360 | -0.013196 | 0.218783 |
| CPI | 0.191124 | -0.007360 | 1.000000 | 0.967146 | 0.683005 |
| M2 | 0.216530 | -0.013196 | 0.967146 | 1.000000 | 0.768342 |
| GDP | 0.311194 | 0.218783 | 0.683005 | 0.768342 | 1.000000 |

ARCH Test:

| | | | |
|---|---|---|---|
| F-statistic | 0.029917 | Probability | 0.970534 |
| Obs*R-squared | 0.061363 | Probability | 0.969785 |

Test Equation:
Dependent Variable: STD_RESID^2
Method: Least Squares
Date: 09/10/15 Time: 21:42
Sample(adjusted): 1985:3 2014:4
Included observations: 118 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.745895 | 0.536695 | 1.389794 | 0.1673 |
| STD_RESID^2(-1) | 0.008234 | 0.093227 | 0.088322 | 0.9298 |
| STD_RESID^2(-2) | 0.021193 | 0.093221 | 0.227347 | 0.8206 |

| | | | |
|---|---|---|---|
| R-squared | 0.000520 | Mean dependent var | 0.768382 |
| Adjusted R-squared | -0.016862 | S.D. dependent var | 5.679352 |
| S.E. of regression | 5.727035 | Akaike info criterion | 6.353368 |
| Sum squared resid | 3771.877 | Schwarz criterion | 6.423809 |
| Log likelihood | -371.8487 | F-statistic | 0.029917 |
| Durbin-Watson stat | 2.001176 | Prob(F-statistic) | 0.970534 |

Date: 09/10/15 Time: 23:13
Sample: 1985:1 2014:4
Included observations: 120

| Autocorrelation | Partial Correlation | | AC | PAC | Q-Stat | Prob |
|---|---|---|---|---|---|---|
| .\|**** \| | .\|**** \| | 1 | 0.535 | 0.535 | 35.214 | 0.000 |
| .\|*** \| | .\|** \| | 2 | 0.438 | 0.213 | 59.068 | 0.000 |
| .\|*** \| | .\|* \| | 3 | 0.405 | 0.156 | 79.599 | 0.000 |
| .\|*** \| | .\|* \| | 4 | 0.400 | 0.143 | 99.838 | 0.000 |
| .\|*** \| | .\|* \| | 5 | 0.365 | 0.072 | 116.79 | 0.000 |
| .\|*** \| | .\|* \| | 6 | 0.371 | 0.104 | 134.49 | 0.000 |
| .\|** \| | .\|. \| | 7 | 0.325 | 0.017 | 148.20 | 0.000 |
| .\|** \| | .\|. \| | 8 | 0.306 | 0.028 | 160.44 | 0.000 |
| .\|*** \| | .\|* \| | 9 | 0.387 | 0.175 | 180.15 | 0.000 |
| .\|*** \| | .\|. \| | 10 | 0.338 | 0.012 | 195.39 | 0.000 |
| .\|** \| | *\|. \| | 11 | 0.250 | -0.082 | 203.80 | 0.000 |
| .\|** \| | .\|. \| | 12 | 0.241 | -0.009 | 211.64 | 0.000 |
| .\|** \| | .\|. \| | 13 | 0.259 | 0.035 | 220.85 | 0.000 |
| .\|** \| | .\|* \| | 14 | 0.286 | 0.079 | 232.15 | 0.000 |
| .\|** \| | .\|. \| | 15 | 0.253 | -0.013 | 241.10 | 0.000 |
| .\|** \| | .\|. \| | 16 | 0.235 | 0.000 | 248.85 | 0.000 |
| .\|* \| | .\|. \| | 17 | 0.177 | -0.057 | 253.29 | 0.000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| .\|** \| | .\|* \| | 18 | 0.282 | 0.140 | 264.69 | 0.000 |
| .\|** \| | .\|. \| | 19 | 0.285 | 0.053 | 276.42 | 0.000 |
| .\|** \| | .\|. \| | 20 | 0.250 | 0.010 | 285.55 | 0.000 |
| .\|** \| | .\|. \| | 21 | 0.236 | 0.028 | 293.77 | 0.000 |
| .\|** \| | .\|. \| | 22 | 0.245 | 0.018 | 302.72 | 0.000 |
| .\|** \| | .\|. \| | 23 | 0.220 | -0.032 | 310.04 | 0.000 |
| .\|* \| | *\|. \| | 24 | 0.216 | -0.010 | 317.16 | 0.000 |
| .\|* \| | *\|. \| | 25 | 0.159 | -0.075 | 321.05 | 0.000 |
| .\|* \| | .\|. \| | 26 | 0.105 | -0.065 | 322.76 | 0.000 |
| .\|* \| | .\|. \| | 27 | 0.165 | 0.043 | 327.02 | 0.000 |
| .\|* \| | *\|. \| | 28 | 0.165 | -0.030 | 331.38 | 0.000 |
| .\|* \| | .\|. \| | 29 | 0.074 | -0.123 | 332.27 | 0.000 |
| .\|. \| | *\|. \| | 30 | 0.067 | -0.023 | 332.99 | 0.000 |
| .\|. \| | *\|. \| | 31 | 0.037 | -0.058 | 333.21 | 0.000 |
| .\|. \| | *\|. \| | 32 | -0.015 | -0.118 | 333.25 | 0.000 |
| .\|. \| | .\|. \| | 33 | -0.034 | -0.082 | 333.45 | 0.000 |
| *\|. \| | .\|. \| | 34 | -0.035 | -0.039 | 333.66 | 0.000 |
| *\|. \| | *\|. \| | 35 | -0.060 | 0.004 | 334.27 | 0.000 |
| | | 36 | -0.076 | -0.069 | 335.27 | 0.000 |

ARCH Test:

| | | | |
|---|---|---|---|
| F-statistic | 0.016333 | Probability | 0.898526 |
| Obs*R-squared | 0.016610 | Probability | 0.897453 |

Test Equation:
Dependent Variable: STD_RESID^2
Method: Least Squares
Date: 09/10/15 Time: 21:49
Sample(adjusted): 1985:2 2014:4
Included observations: 119 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.772952 | 0.554257 | 1.394574 | 0.1658 |
| STD_RESID^2(-1) | 0.011814 | 0.092441 | 0.127801 | 0.8985 |

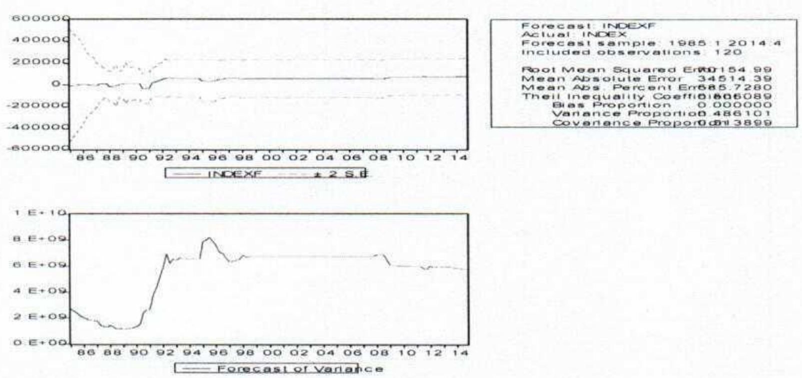
| | | | |
|---|---|---|---|
| R-squared | 0.000140 | Mean dependent var | 0.782173 |
| Adjusted R-squared | -0.008406 | S.D. dependent var | 5.969739 |
| S.E. of regression | 5.994778 | Akaike info criterion | 6.436319 |
| Sum squared resid | 4204.672 | Schwarz criterion | 6.483026 |
| Log likelihood | -380.9610 | F-statistic | 0.016333 |
| Durbin-Watson stat | 2.000663 | Prob(F-statistic) | 0.898526 |

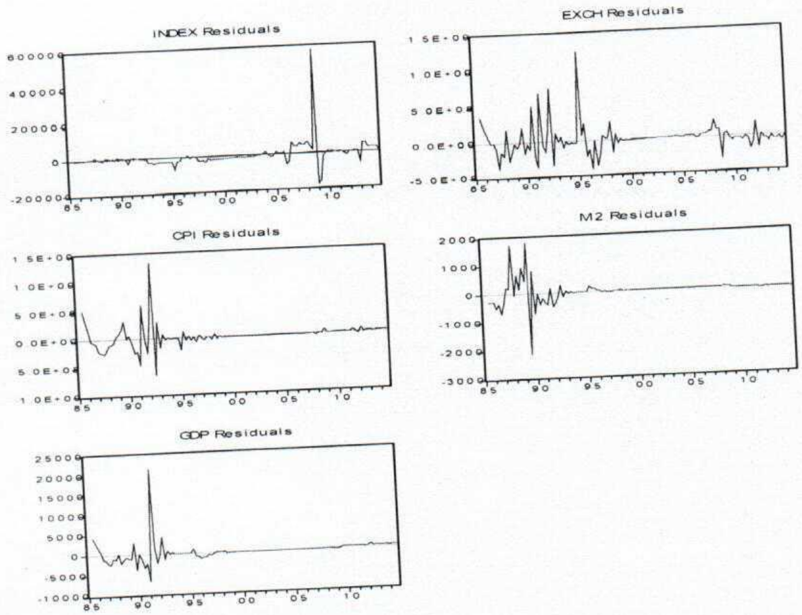
Dependent Variable: INDEX
Method: ML - ARCH
Date: 09/10/15 Time: 21:58
Sample: 1985:1 2014:4
Included observations: 120
Convergence achieved after 2 iterations

| | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| SQR(GARCH) | 0.952916 | 18.92639 | 0.050349 | 0.9598 |
| C | -119324.1 | 1161674. | -0.102717 | 0.9182 |

| | | | | |
|---|---|---|---|---|
| EXCH | 485.2836 | 1455.473 | 0.333420 | 0.7388 |
| CPI | -153.5959 | 3452.204 | -0.044492 | 0.9645 |
| M2 | 1.143345 | 18.37522 | 0.062222 | 0.9504 |
| GDP | 0.584502 | 10.28247 | 0.056845 | 0.9547 |
| | | Variance Equation | | |
| C | 22.30955 | 38.11731 | 0.585287 | 0.5584 |
| \|RES\|/SQR[GARCH](1) | 0.015429 | 0.526652 | 0.029296 | 0.9766 |
| RES/SQR[GARCH](1) | 0.022518 | 0.538020 | 0.041854 | 0.9666 |
| EGARCH(1) | 0.000890 | 1.720873 | 0.000517 | 0.9996 |
| EXCH | -0.001862 | 0.014280 | -0.130370 | 0.8963 |
| CPI | -0.008573 | 0.067038 | -0.127888 | 0.8982 |
| M2 | 1.58E-05 | 0.000418 | 0.037686 | 0.9699 |
| GDP | 1.66E-05 | 4.61E-05 | 0.360614 | 0.7184 |
| R-squared | 0.097516 | Mean dependent var | | 44610.61 |
| Adjusted R-squared | -0.013166 | S.D. dependent var | | 75082.88 |
| S.E. of regression | 75575.52 | Akaike info criterion | | 25.22899 |
| Sum squared resid | 6.05E+11 | Schwarz criterion | | 25.55419 |
| Log likelihood | -1499.739 | F-statistic | | 0.881050 |

FORECAST






Dependent Variable: INDEX
Method: ML - ARCH
Date: 09/10/15 Time: 21:41
Sample: 1985:1 2014:4
Included observations: 120
Convergence achieved after 2 iterations

| | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | -55804.98 | 368913.6 | -0.151268 | 0.8798 |
| EXCH | 510.9413 | 682.8434 | 0.748255 | 0.4543 |
| CPI | -178.2699 | 4675.381 | -0.038129 | 0.9696 |
| M2 | 1.317225 | 20.89616 | 0.063037 | 0.9497 |
| GDP | 0.593079 | 0.876005 | 0.677026 | 0.4984 |
| | Variance Equation | | | |
| C | 22.31656 | 14.61640 | 1.526816 | 0.1268 |
| \|RES\|/SQR[GARCH](1) | 0.015820 | 0.788928 | 0.020053 | 0.9840 |
| RES/SQR[GARCH](1) | 0.019613 | 0.761252 | 0.025764 | 0.9794 |
| EGARCH(1) | 0.002643 | 0.662352 | 0.003990 | 0.9968 |
| EXCH | -0.004179 | 0.014691 | -0.284430 | 0.7761 |
| CPI | -0.007924 | 0.022393 | -0.353851 | 0.7235 |
| M2 | -5.36E-07 | 0.000158 | -0.003395 | 0.9973 |
| GDP | 2.19E-05 | 2.61E-05 | 0.839275 | 0.4013 |

| | | | |
|---|---|---|---|
| R-squared | 0.119621 | Mean dependent var | 44610.61 |
| Adjusted R-squared | 0.020887 | S.D. dependent var | 75082.88 |
| S.E. of regression | 74294.61 | Akaike info criterion | 25.11307 |
| Sum squared resid | 5.91E+11 | Schwarz criterion | 25.41505 |
| Log likelihood | -1493.784 | F-statistic | 1.211550 |
| Durbin-Watson stat | 1.275674 | Prob(F-statistic) | 0.284676 |

Dependent Variable: INDEX
Method: ML - ARCH
Date: 09/10/15 Time: 21:44
Sample: 1985:1 2014:4
Included observations: 120
Convergence achieved after 8 iterations

| | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | -55804.98 | 34780.86 | -1.604474 | 0.1086 |
| EXCH | 510.9394 | 160.1644 | 3.190094 | 0.0014 |
| CPI | -178.2706 | 379.0424 | -0.470319 | 0.6381 |
| M2 | 1.234530 | 2.324224 | 0.531158 | 0.5953 |
| GDP | 0.499434 | 0.183262 | 2.725249 | 0.0064 |
| | Variance Equation | | | |
| C | 22.27488 | 6.937810 | 3.210651 | 0.0013 |
| \|RES\|/SQR[GARCH](1) | 0.352553 | 0.534902 | 0.659098 | 0.5098 |
| RES/SQR[GARCH](1) | 0.737501 | 0.475951 | 1.549532 | 0.1213 |
| EGARCH(1) | -0.103346 | 0.248759 | -0.415444 | 0.6778 |
| EGARCH(2) | -0.030605 | 0.201485 | -0.151899 | 0.8793 |
| EXCH | 0.000692 | 0.009404 | 0.073578 | 0.9413 |
| CPI | -0.025563 | 0.046440 | -0.550453 | 0.5820 |
| M2 | 0.000164 | 0.000264 | 0.620689 | 0.5348 |
| GDP | 3.60E-05 | 2.37E-05 | 1.519728 | 0.1286 |

| | | | |
|---|---|---|---|
| R-squared | 0.106985 | Mean dependent var | 44610.61 |
| Adjusted R-squared | -0.002536 | S.D. dependent var | 75082.88 |
| S.E. of regression | 75178.03 | Akaike info criterion | 24.34898 |
| Sum squared resid | 5.99E+11 | Schwarz criterion | 24.67418 |
| Log likelihood | -1446.939 | F-statistic | 0.976842 |
| Durbin-Watson stat | 1.257047 | Prob(F-statistic) | 0.478881 |

Dependent Variable: INDEX
Method: ML - ARCH
Date: 09/10/15 Time: 21:47
Sample: 1985:1 2014:4
Included observations: 120
Convergence achieved after 1 iterations

| | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| GARCH | 3.07E-06 | 9.49E-05 | 0.032347 | 0.9742 |
| C | -74248.21 | 1530320. | -0.048518 | 0.9613 |
| EXCH | 490.1075 | 1443.981 | 0.339414 | 0.7343 |
| CPI | -160.3954 | 15327.05 | -0.010465 | 0.9917 |
| M2 | 1.185296 | 71.13628 | 0.016662 | 0.9867 |
| GDP | 0.588970 | 3.111262 | 0.189303 | 0.8499 |
| | Variance Equation | | | |
| C | 22.31239 | 211.2881 | 0.105602 | 0.9159 |
| \|RES\|/SQR[GARCH](1) | 0.010000 | 0.576325 | 0.017352 | 0.9862 |
| RES/SQR[GARCH](1) | 0.010001 | 0.528112 | 0.018937 | 0.9849 |
| EGARCH(1) | 0.009999 | 9.414331 | 0.001062 | 0.9992 |
| EXCH | 5.46E-07 | 0.015188 | 3.59E-05 | 1.0000 |