EFFECT OF MACROECONOMIC VARIABLES ON THE NET ASSET VALUES OF EQUITY: EMPIRICAL EVIDENCE FROM PENSION FUNDS IN KENYA

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DECLARATION

I declare that this dissertation is my original work and has not been previously published or submitted for the award of degree in any other institution. I also declare that this paper contains no material written by other people except where due reference is made and author duly acknowledged.

Student Name: ______________________________ Reg. No.: _____________________

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I do hereby confirm that I have examined the master's dissertation of

Leah Kemboi

And have certified that all the revisions that the dissertation panel and examiners recommended have been adequately addressed.

Sign: _____________________________________ Date: _________________________

Dr. Julius Korir

Dissertation Supervisor

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ABSTRACT

Investors of pension funds just like any other investor seek to achieve high returns on investment while at the same time minimizing risks. For this reason, fund managers choose to invest pension in quoted equity with the sole objective of growing the fund by making capital gains through appreciation of stock prices and generating revenue in the form of dividends. The relationship between macroeconomic variables and the stock market index is a well documented subject in many literatures but the effect of the stock market index and macroeconomic variables on the net asset values of equity pension funds remains an uncharted course. Whereas it is acknowledged that macroeconomic variables influences the level of investments and returns - and by extension the net asset values of equity pension funds, the magnitude and the direction of the effects is an empirical issue. The purpose of this paper therefore was to investigate the effect of the Nairobi stock exchange index (NSEI) and selected macroeconomic variables – inflation (INFL), interest rate (WIR), and Money supply (M_2) on the net assets of equity pension funds (EPF). To this end, published quarterly time series data from December 2001 up to and including December 2012 were obtained from the Central Bank, Kenya National Bureau Statistics, Pine Bridge and the Retirement Benefits Authority. Explanatory research was used to establish the relationship between the variables and as a preliminary, data was tested for stationarity using the ADF and KPSS test and the data was found to be I(1)- a necessity for cointegration. Johansen cointegration test was done, a multivariate vector error correction (VEC) model and the estimates obtained. Empirical results showed that the net asset values of equity pension funds formed a significant positive relationship with inflation, weighted interest rate and the Nairobi Stock exchange index and a negative significant relationship with money supply. The error correction model also indicated that the net asset value of equity pension funds adjusted by 44.3 % in one quarter and takes six months to eliminate the disequilibrium. Variance decomposition tests and impulse response functions indicate that approximately 81% of changes or variance in the net asset value of equity pension fund was explained by its own shocks and innovations. The implication of this study is that fund managers and scheme participants should know that the macroeconomic variables under consideration in this study and the stock exchange index indeed forms a long-term equilibrium relationship with the net asset value of equity pension funds and be concerned especially with changes in money supply.

Keywords: Net asset values, equity pension funds, macroeconomic variables, Nairobi Stock Exchange Index, cointegration, VECM, Kenya.

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DEDICATION

To my husband and friend Cosmas, for support and inspiration

&

To my sons, Ryan and Justin, for your unmatched sacrifice

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LIST OF ABBREVIATIONS

ACF	-	Auto Correlation Function
ADF	-	Augmented Dickey Fuller
AIC	-	Akaike Information Criteria
APT	-	Arbitrage Pricing Theory
ARDL	-	Autoregressive Distributed Lag
BIC	-	Bayesian Information Criteria
CAPM	-	Capital Asset Pricing Model
CBK	-	Central Bank of Kenya
CMA	-	Capital Markets Authority
CPI	-	Consumer Price Index
CSPS	-	Civil Servants Pension Scheme
DB	-	Defined Benefit
DC	-	Defined Contribution
ECM	-	Error Correction Model
EMH	-	Efficient Market Hypothesis
FDI	-	Foreign Direct Investment
FPE	-	Final Prediction Error

GARCH	-	Generalized Autoregressive Conditional Heteroscedastic
GDP	-	Gross Domestic Product
H_0	-	Null Hypothesis
H_A	-	Alternative Hypothesis
HQIC	-	Hannan Quinn Information Criteria
HSI	-	Hong Kong' Stock Index
I(0)	-	Integrated of order zero
I(1)	-	Integrated of order one
IC	-	Information Criteria
INFL	-	Inflation Rate
IRS	-	Individual Retirement Scheme
KLCI	-	Kuala Lumpur Composite Index
KNBS	-	Kenya National Bureau of Statistics
KPSS	-	Kwiatkowski, Philips, Schmidt Test
LDC	-	Least Developed Countries
LR	-	Likelihood Ration
M_2	-	Money Supply, the broad money
MPF	-	Mandatory Pension Funds

NASI	-	Nairobi All Sector Index
NAV	-	Net Asset Value
NSE	-	Nairobi Stock Exchange
NSEI	-	Nairobi Stock Exchange Index
NSSF	-	National Social Security Fund
NYSE	-	New York Stock Exchange
OLS	-	Ordinary Least Squares
ORS	-	Occupational Retirement Schemes
PACF	-	Partial Auto Correlation Function
PP	-	Philips Perron Test
RBA	-	Retirement Benefits Authority
SMI	-	Stock Market Index
TSE	-	Tokyo Stock Exchange
UK	-	United Kingdom
US	-	United States
USD	-	United States Dollar
VEC (M)	-	Vector Error Correction (Model)
WIR	-	Weighted Interest Rate

DEFINITION OF TERMS

Pension Funds	This is a pool of savings made by many scheme participants during their working lives to take care of their consumption needs upon retirement.
Equity pension funds	It is the amount of pension that is specifically invested in equity i.e. shares of quoted companies
Net Asset Values	This is the value of assets or funds invested based on the currently prevailing rates (prices of individual shares)
Stock Market	This is a public institution that deals with the trading of shares and other financial instruments e.g. derivatives
Interest rate	Refers to the commercial banks weighted average lending rate. This is the average rate at which commercial banks charge on new loans to customers denominated in local currency.
Inflation Rate	It is the weighted aggregate change in retail prices paid by customers for a given basket of goods and services for a specified period
Money Supply (M_2)	This is defined as the total sum of currency (coins and notes) in circulation, current account deposits, fixed account deposits and money market funds

Stock Market Index	This index is price weighted and based on the geometric mean of average of the constituent companies which are equally weighted.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

A properly organized and functional stock market plays a critical role in any economy specifically in mobilizing savings from excess units (idle resources) and distributing them to deficit (productive sectors) units within the economy (Muhammad, Hussain, Anwar & Ali, 2009). The stock market therefore acts as an agent between savers and borrowers of capital by pooling savings from both large and small savers and directing these funds to viable investments (Sohail & Hussain, 2009). Among these savers are the pension funds whose growth and dominance in the stock market can no longer be ignored. Because of this great importance and critical role in the economy, much attention has been drawn on the relationship between macroeconomic variables and the stock market albeit with little attention to pooled investments such as pension funds.

The global pensions industry has in the last two decades experienced enormous and significant changes in terms of structure and governance. Faced with aging populations and the fiscal implication thereof, governments the world over have gradually moved away from defined benefit (DB) to defined contribution (DC) in a bid to ease the fiscal burden. Regulations to guide on the management and investment of these contributions have also been introduced and as a result of this shift, majority of pension fund systems are asset backed thus increasing the link of retirement incomes to the performance of pension assets (Hinz, Rudolph, Antolin & Yermo, 2010). One of the highly favoured investment vehicles of these funds is through the purchase of equity shares in the stock market which is not only characterized by high return but also high volatility. It is this volatility of the stock market that indeed has the potential of wiping away all these savings in a twinkling of an eye thus jeopardizing the livelihoods of millions. Fund managers must therefore be vigilant to detect changes in market dynamics that may cause such volatility and adversely affect their equity funds. It is therefore of much essence that they must know how different trends and market forces will impact or affect the equity fund for them to make appropriate and timely decision to buy, sell or switch and thus achieve good investment performance.

Globally, the study of the relationship between macroeconomic variables and the stock market has been extensive though majority of them have concentrated on developed and emerging markets and few on the less developed countries (LDC's). Chen, Roll and Ross (1989) sought to find the effect of a set of selected macroeconomic variables on the New York Stock Exchange (NYSE) established that the stock prices were indeed affected by systematic economic news. Their finding formed the basis of what is today a widely established and accepted theory that macroeconomic variables influence the movement and changes in prices of securities (Maysami & Koh, 2000). Other studies in developing and emerging economies includes: (Najand & Rahman, 1991; Kwon & Shin, 1998; Muradoglu, Taksin & Bigan, 2000; Sohail & Hussain, 2009; Hosseini, Ahmad & Lai, 2011; Singh, Mehta & Varsha, 2011) among others. Though these studies recorded different findings in terms of magnitude and direction of specific variables and the stock market index, they are all however in agreement that there is a relationship between some macroeconomic variables and stock market returns. Chu (2010) in his paper examined the price linkages between equity fund price levels and the stock markets. Using data from Hong Kong MPF, the study established that 56.43% of the equity funds were cointegrated with the stock market index. Using the same data, Chu (2011) examined cointegration between the net asset values, stock market index and selected macroeconomic variables and added further evidence that the fund net asset values were indeed cointegrated with selected Hong Kong macroeconomic variables. It therefore suggests that fund managers, trustees and scheme participants should have a strong desire to know how each macroeconomic factor affect their funds in order to make optimal investment and asset allocation decisions at all times.

Stewart and Yermo (2009) observes that many African countries do not have proper functioning public pension systems with very little coverage though that scenario was quickly changing. In the last decade or so, the reality on the fiscal burden of old age burden became so apparent thus pushing many African countries to initiate reforms in the retirement sector. These reforms included structural changes to pension systems which included changing from DB to DC and introduction of a new regulatory framework to manage the sector. Though significant gains have been made, more is yet to be done in terms of increasing coverage and encouraging populations to embrace the culture of saving to cater for their retirement. Another key setback is the low level of contributions which is not sufficient to cater for retirement. Studies in the LDC's on the relationship between the macroeconomic variables and the stock market are scarce and limited to a few countries. Hsing (2011) applying the GARCH model examined the effects of selected macroeconomic variables on the South African stock index found that the variables indeed affected the stock market index. Using the VECM, Osamwonyi and Evbayiro-Osagie (2012) established that the selected macroeconomic variables influence the stock market index in Nigeria.

1.1.2 Pension fund systems in Kenya

Pension funds in Kenya just like many others in the continent were set up after the attainment of independence. Kenya established its first fund – the National Social Security Fund (NSSF) in 1965 through an Act of Parliament (Cap 189) (RBA, 2000). Since 1965 to date, the pensions' landscape has greatly changed and such major change being the establishment of the Retirements Benefits Authority (RBA) through the RBA

Act with the main role of regulating the industry. Coming from decades of mismanagement, the RBA has been able to initiate various reforms which have since seen the sector transform and grow to become a leading institutional investor in the country today. Despite the steps made, the main components of the pension system in Kenya that is the NSSF, Civil Servants Pension Scheme (CSPS), Occupational Retirement Schemes (ORS) and Individual Retirement Schemes (IRS), only covers about 15% of the workforce and this remains a key challenge.

The NSSF is a public provident fund covers employed persons, traders, self – employed and some informal sector workers. It is mandatory for employers to enroll their employees, who are required to contribute 5% of their basic pay but has an upper cap of Kshs. 200. Employers also pay at the same rate and employees (from 2007) are allowed to top up their contributions (Stewart & Yermo, 2008). This level of contribution is very low and has often been cited as a major hindrance to old age independence but this set back has now been addressed by the NSSF Act of 2013.The total workforce has about 7 million workers. Currently NSSF has about 1 million active members, with the various public pension schemes having about 600,000 and private occupational schemes operate 250,000 member accounts. This leaves about 5 million workers without any form of coverage, of which at least half a million are at or near retirement age (Kakwani, Son & Hinz, 2006). The CSPS takes care of all pension needs for all the civil servants excluding those employed by state agencies or Parastatals (Kakwani *et al*, 2006). The cover usually provides a range of benefits from injury, disability pension and gratuities among others. The ORS's are schemes are purely set up by employers to save and provide a means to invest and accumulate savings to take care of old age or retirement needs of its employees. Majority if not all are set up by individual employer who operate them as either defined benefit or defined contribution but majority are DC whereby both the employee and the employer jointly contribute to the scheme. The rate of contribution vary from one organization to another but employees are usually encouraged to make voluntary contributions in addition to the statutory contributions as such voluntary contributions are allowable deductions thus reducing tax liability of the employee (Stewart and Yermo, 2008). Individual retirement schemes on the other hand are set up to accommodate those who are not in formal employment thus giving them a means to save and secure their old age. Majority if not all of these monies are invested and managed by pension companies that are registered by the RBA (RBA, 2009).

The structural changes that were introduced in the industry, the RBA Act and the regulations sought among others to bring sanity to the management of the pension industry and to this end a lot has been achieved as attested by the growing amount of assets held by pension funds today. One of the greatest success brought about by reforms is in terms of increased voluntary employer sponsored occupational schemes which today control over 88% of the total pension assets (RBA, 2008).Given the increase in the number of these schemes, pension assets have grown tremendously to reach the current level of Kshs. 548.8 Billion as at 31st December 2012. Of these funds, 24% were invested in Quoted Equities i.e. Kshs. 130.4 Billion (RBA, 2013) and this is where our interest and concern lies. This further provides evidence on how pension funds have grown to become one of the greatest and influential institutional investor is in our stock market today. The passage of the NSSF Bill 2013 yet again heralds a new era in the pension industry and is expected to further accelerate the growth. For a very long time, the problem that Kenya has faced in terms of social security is low coverage and inadequate contributions but this is set to change once the NSSF Bill 2013 is operationalized. Among other objectives, the bill seeks to transform the NSSF which is a pension fund into a social security fund in line with the provisions of Article which clearly outlines social security as a constitutional right for all Kenyans. Whereas various stakeholders have to be ironed out, the Bill has largely gained support and is touted as the means out of old age poverty. The main objectives of the Bill is first to provide basic social security for its members and their dependants for various contingencies as provided in the Act, secondly to increase membership coverage of social security scheme, thirdly to improve adequacy of benefits paid out of the scheme by the fund and finally to bring the self-employed persons within the ambit of the Act to enable them access social security for themselves and their dependants.

The new Act proposes employee deductions to increase from Kshs. 200 to 6% of earnings subject to a maximum of the National Average Minimum wage. With the current minimum wage standing at Kshs. 8,600.00, it means that employees will contribute Kshs.516.00 and the employer contributing double the amount that is Kshs. 1,032.00. On the other hand, the contribution will be graduated yearly within five years with the first year being put at 1.2%, 2.4% in the second year, 3.6% in the 3rd year, 4.8% in the fourth year, and eventually 6% in the fifth year. The commencement date for the Bill was to be 10th January 2014 but by invoking the powers given by section 68(2) (a) & (d) of the Act, the government suspended the commencement date to 31st May 2014 citing the main reason for deferment as the need to educate stakeholders on the implementation of the Act and also to allow substantive implementation of the provisions of sections 18, 19& 20. The Bill has received its fair share of criticism from various stakeholders and it is hoped that the government will be address such issues in good time so that the Act can be implemented without further delay. Table 1 and 2 below presents the schedule of contributions if the new Act is implemented.

TABLE 1

Tier I Contributions

Year	Lower Earnings Limit (LEL)	Protected Rights – Contributions to NSSF	
		Employee – 6% of LEL	Employer – 6% of LEL
1	Kshs. 6,000.00	Kshs. 360.00	Kshs. 360.00
2	Kshs. 7,000.00	Kshs. 420.00	Kshs. 420.00
3	Kshs. 8,000.00	Kshs. 480.00	Kshs. 480.00
4	Kshs. 9,000.00	Kshs. 540.00	Kshs. 540.00
5 Onwards	Minimum Statutory Monthly Basic Wage ~ Kshs. 12,000.00 - Current	Kshs. 720.00	Kshs. 720.00

Source: Octagon Pensions, 2014

TABLE 2

Tier II Contributions

Year	Upper Earnings Limit (UEL)	Protected Rights – Contributions to Scheme	
		Employee less 6% of Salary or UEL less Tier I	Employer less 6% of Salary or UEL less Tier I
1	50% of National Average Earnings - Kshs. 36,000.00	Kshs. 720.00	Kshs. 720.00
2	1 Times National Average Earnings - Kshs. 36,000.00	Kshs. 1,740.00	Kshs. 1,740.00
3	2 Times National Average Earnings - Kshs. 36,000.00	Kshs. 3,840.00	Kshs. 3,840.00
4	3 Times National Average Earnings - Kshs. 36,000.00	Kshs. 5,940.00	Kshs. 5,940.00
5 Onwards	4 Times National Average Earnings - Kshs. 36,000.00	Kshs. 7,920.00	Kshs. 7,920.00

Source: Octagon Pensions, 2014

Note: Any employee earning less than Kshs. 6,000.00 p.m is not affected by Tier II

Kenya as country has witnessed many historical moments since the ushering in of new political era in the year 2003. At this very moment, Kenyans were voted as the most optimistic people on the planet though much of their anticipations have remained elusive to date. President Kibakis' administration set the country on the path of economic growth but the painful events of 2007/2008 post election violence which sadly forms part of this journey saw Kenya's economy sink to its lowest levels. Away from this, the country welcomed the new constitution in 2010 which heralded new governance structures in the country. The country also had successful elections and peaceful transfer of power to the new government under new political leadership which is expected to now implement the devolved units of government.

The macroeconomic environment in Kenya can be said to be largely stable and is expected to expand (KNBS, 2014). This is clearly indicated by high credit uptake, stronger currency and low lending rates, expanding export market and increased foreign direct investment (FDI) in infrastructure, mining and energy sectors. Statistics by the national bureau also show that inflation declined from 8.29% in Sept to 7.76% in October 2013 while the World Bank forecasts growth of upto 6% in the year 2014 (KNBS, 2014). Although inflation rate has been an issue for some time, the CBK tightened its monetary policy and has been largely successful in bringing down the inflation rate and stabilized the exchange rate.

These monetary measures saw the Kenyan Shilling exchange at a record high of Kshs. 107.00 for one USD in late 2011 but this has also been tamed. The action to bring inflation rate down also triggered a climb in interest rates thus discouraging borrowing and this slowed the economy a bit. Because of this the Central Bank of Kenya reduced its Commercial Bank Rate thus signaling the market to lower its lending rates. Currently the inflation rate and lending rates have significantly come down and stabilized. Most significantly the weighted lending rate declined from a high of 20.3% in June 2012 to 17.9 in April 2013. With this positive outlook, the main challenge in strengthening social security is the poor saving culture of Kenyans which is known to lag behind its East African counterparts.

The right to social protection is now enshrined in the new constitution and in the National Social Protection Policy (NSPP, 2012) and is expected to be achieved through three pillars namely, Social Security, Social Health Insurance and Social Assistance (World Bank, 2013). Since the majority of those who benefit from the first pillar are in formal employment, the Social Assistance is the most relevant for those already in old age and are poor but mechanics should be put in place to ensure that the assistance reaches the target group and also a deliberate move should be done to bring on board those in the informal sector to save for their old age.

However influential, pension funds still face the threat brought about by the ever changing and the unpredictable nature of the stock market which exposes retirees to market risk and uncertainties that may jeopardize their retirement by reduced benefits and income. The recent global melt-down and locally the post-election violence was a clear indication of this concern as we witnessed the plummeting of pension assets. This therefore goes to show how important the macroeconomic environment to social security of any nation that is, political, and economic stability is paramount therefore highlighting the need for research in area. The study on the stock market has attracted several scholars keen to examine the relationship between macroeconomic variables and the stock market index. Elly and Oriwo (2012) studied the possible existence of association among various macroeconomic factors with the securities exchange index and indeed found that a relationship did exist between the selected macroeconomic variables and Nairobi All Share Index (NASI). Muthike and Sakwa (2012) in their study sought too to answer the question whether macroeconomic variables could be used to predict stock market trends and found that the Kenyan securities market formed a significant relationship with the selected macroeconomic variables. Research findings are all in agreement that there's a cointegrating relationship between stock returns and macroeconomic variables.

The implication of such findings and those Chu (2010, 2011) means that pension fund managers who have the basic responsibility to invest and grow the fund must use optimal investment strategies and on a continuous basis monitor the macroeconomic environment in order to detect economic changes that might negatively impact the net asset values of equity pension funds. For them to achieve this goal, they must specifically know the magnitude and the direction of the relationship between net asset values, the securities market index and the selected Kenyan macroeconomic variables. The purpose of this study therefore, is to specifically investigate the effect of Inflation rate, Interest rates, Money Supply, and Stock Market Index on the net asset values of equity pension funds.

1.2 Statement of the Problem

Pension funds the world over just like any other investor, seeks to achieve high returns on investment. Different pension schemes have different characteristics which among others defines the risk-return levels the fund is able to assume. In addition to their concerns of risk and return, fund managers are also constrained by availability of resources, investment horizon and liquidity of the scheme. In the light of these constraints, it becomes imperative that to achieve the set objectives, fund managers adopt appropriate strategies which must address issues of investment management, market timing, asset allocation and selection of securities. Of great importance however, is asset allocation which involves deciding how much is invested in each of the classes available (Bodie, Kane & Marcus, 2008). Fund managers choose to invest pension funds in equity with the main objective of growing the fund by making capital gains through the appreciation of stock prices of shares held and also generating revenue income from dividends. At macro level, macroeconomic (systemic) variables not only influence the amount invested in the different classes of assets but also the return on these investments.

Chu (2011) examined the relationship between macro-economic variables and net asset values of funds invested in equity in Hong Kong and established that the fund net asset values were cointegrated with local stock market index and two selected macro-economic variables. Fadhil, Azizan and Shaharudin (2007) investigated the relationship between the selected Malaysian macro-economic variables and unit trust performance using data from 2002 to 2005 and established a possible long term relationship between the net asset values of unit trusts in Malaysia and selected macro-economic variables, interbank rate and the Kuala Lumpur Composite Index by fitting an error correction model (VECM). A similar result was obtained in Matallin and Nieto (2002) in their study of the stock market indicator (Ibex 35) in Spain containing information of 35 listed constituent companies.

From the foregoing literature such as Chu (2011), Fadhil, Azizan and Shaharudin (2007) and Matallin and Nieto (2002), it is widely acknowledged that macroeconomic variables influences the level of investment in equity and also returns on such investment. However, the magnitude and direction of the relationship is an empirical issue. The question is what is the relative effect of macroeconomic variables on the return and therefore net asset values of equity pension funds in Kenya? The purpose of this paper therefore is to examine the effect of the stock market index and selected Kenyan macro-economic variables on the net asset values of equity pension funds in Kenya.

1.3 Objective of the Study

The overriding objective of the study is to investigate the effect of selected Kenyan macro-economic variables and the Securities market index on the net asset values of equity pension funds in Kenya.

1.3.1 Specific objectives

The specific objectives of the study were to:-

1 Determine the effect of inflation rate on the net asset values of equity pension funds.

2 Determine the effect of weighted interest rate on the net asset values of equity pension funds.

3 Determine the effect Money Supply on the net asset values of equity pension funds.

4 Determine the effect of the Nairobi Stock Exchange Index on the net asset of equity pension funds.

1.3.2 Research questions

In view of the above stated objectives, this study seeks seek to answer the following questions:-

1. What is the effect of inflation rate on the net asset values of equity pension funds?
2. What is the effect of weighted interest rates on the net asset values of equity pension funds?
3. What is the effect of Money Supply on the net asset values of equity pension funds?
4. What is the effect of Nairobi Stock Exchange Index on the net asset of equity pension funds?

1.4 Scope and Limitations of the Study

This study analyzed the relationship between the selected macro-economic variables and the net asset values of equity pension funds for the period Dec 2001 to Dec 2012. Whereas the intention was to use monthly data because of its closeness to normal distribution Chu (2011), this was not possible since fund managers do not file monthly returns with RBA but have been filling them on quarterly basis. The monthly data for all the other variables were available save for that of the dependent variable and therefore the use of quarterly data.

1.5 Significance of the Study

The study seeks to examine whether the stock market index and selected macroeconomic variables have an effect on the net asset values of equity pension funds. Findings from this research therefore will be significant in the following ways:

1.5.1 Policy makers

Policy makers in this case include the Government, the regulator, RBA and the custodian of monetary policy, CBK. This study may find a relationship between the dependent and independent variables. This will mean that the policy makers take more precaution when manipulation of macroeconomic variables in pursuit of certain economic goals.

1.5.2 Fund managers, trustees and scheme participants

Having knowledge on the effect of the independent variables on the dependent variables will enable this group to discern the direction of the net asset values of the funds by not only observing the behavior of the stock market but also changes in the macroeconomic variables.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section reviewed both theoretical and empirical literature of this study. The conceptual framework and the research gap will also be presented.

2.2 Theoretical Literature

Following the problems of Capital Asset Pricing Model (CAPM), the Arbitrage Pricing Model (APT) (Ross, 1976) has been widely used until two decades ago when there emerged a belief that real economic activities often impact stock prices. This new perspective takes head on the propositions of the efficient market hypothesis (EMH). An efficient market is one in which security prices adjust rapidly to any new information that becomes available to the market participants. Effectively, this means that stock prices at any time reflect all the news available about such stocks. This all important theory as championed by Fama (1970) has a lot of implications on policy makers especially those that are charged with the responsibility of maintaining macroeconomic stability. This means that such policy makers should formulate their policies without fear that such decisions would not affect the formation of capital and trading in stocks. Through the EMH, Fama (1970) posits that macroeconomic activity does not influence stock returns but other studies such as that of Fama and Schwert (1977) have proven that this theory may not hold after all.

Economic theory suggests that stock prices should reflect the level of expectations about business performance and business income usually mirror the level of economic movements. In this case therefore, stock prices can be used to predict future direction of the economy. Kasa (1992) further developed this theory and suggested that low theory implied overestimation of returns especially when equity markets share a long run relationship with a trend. Today the claim that macroeconomic variables indeed drive the movement of stock prices is an established and a widely accepted theory (Maysami & Koh, 2000) and research has clearly moved from correlation analysis to cointegration to investigate long run relationships between macroeconomic variables and stock returns.

Many early studies have majorly concentrated on developed markets in particular the United States and many have tried to use the APT framework to capture the effects of the economic forces (Ross, 1976). Chen, Roll and Ross (1986) in their study concluded that stock prices were influenced by economic changes and that such stock price reflected the perceived measure of these economic changes. They further showed that economic forces have an impact on discounting rates, the ability to generate cash inflows and the amounts available for distribution to equity holders. This finding is what provided the basis to believe that stock prices and macroeconomic variables shared a long term equilibrium relationship. Some popular factors used in these models are; inflation, industrial production, interest rates, oil prices etc. The logic and methodologies used are based on the understanding that expected returns are dependent upon these risks factors. However, the direction of the relationship in this case is assumed to be unidirectional (Muradoglu, Taskin & Bigan, 2000).

Recently, a growing literature has proposed the determination of the existence of long-term relationships among the selected macroeconomic variables and stock market using the cointegration approach (Granger, 1986; Johansen & Juselius, 1990). The advantage of employing cointegration analysis is that it enables the researcher to employ and fit an error correction model which provides the basis through which short term dynamic relationships among variables are examined and at the same time providing their long run association (Muradoglu, Taskin & Bigan, 2000). Many researchers have employed this methodology in examining the impact of these macroeconomic variables on the stock markets (Maysami & Koh, 2000; Singh, Mehta & Varsha, 2010; Kwon & Shin, 1998). Employing this methodology, majority of literature reviewed have revealed that many of these studies have concentrated in the developed and emerging markets but a void in literature relates to examining cointegration between macroeconomic variables and stock markets in developing countries including Kenya.

The study of macroeconomic variables and pension funds is also scarce not only in the world but also here at home. Whereas the pension fund industry is currently a major player in the stock market today, very few researchers have paid attention to this sector. This paper therefore seeks to fill the void and compliment the literature in this area. Owing to this popularity and the ease with which to perform and interpret results of the cointegration approach, this study will apply the Johansens' (1990) VECM to examine the effect of selected macroeconomic variables (Inflation rate, Money Supply, weighted interest rate) and the stock exchange index on the net asset values of equity pension funds in Kenya and finally have Vector Error Correction Model fitted to find the estimates.

2.3 Empirical Literature

Several researchers have examined the relationship between inflation rate and stock returns. Using US monthly data for inflation rate and returns to assets for the period 1953 to 1971, Fama and Schwert (1977) employed Regression analysis and found that common stock returns were negatively related to the expected and unexpected inflation rate during the period under the study. Chen, Roll and Ross (1986) also using US monthly data for period January 1953 to November 1983 examined the relationship between economic forces and the stock market. Variables under study included Industrial production, inflation, term structure, market indices, consumption, oil prices and asset pricing. Using regression analysis, they concluded that "stock returns were exposed to economic news and were priced according to their exposures and that the news can be measured as innovations in state variables" (p.402). Singh, Mehta and Varsha (2010) extensively studied the causal relationship between Taiwan index returns and a number of macroeconomic factors which included; employment rate, exchange rate, GDP, inflation and money supply. They sampled data for companies listed in their stock exchange and the stock index data from the period 2003 to 2008. Their finding was that Inflation rate had a negative relationship with returns for portfolios of big and medium companies.

Hosseini, Ahmad and Lai (2011) investigated the relationships between stock market indices and four macroeconomic variables namely; crude oil, money supply, industrial production and inflation rate. Using monthly data for China and India for the period of ten years starting from January 1999, ADF unit root test and VECM technique, they found that there were both short term and long term linkages between the selected macroeconomic variables and the stock market index. Specifically, inflation was found to be positive and significant for Chinese stock index but negative and insignificant for the Indian stock index. However, when time series is lagged for one month, inflation is found to be positive but insignificant for the Chinese stock market but negative and significant for the Indian stock index. Maysami and Koh (2000) examined the long-term relationship between the Singapore Stock Market Index and selected macroeconomic variables as well as stock indices of Singapore, Japan and United states. Using month-end data from January 1998 to January 1995, concluded that Singapore's stock market levels formed a cointegrating relationship with the various macroeconomic variables and also the US and Japan stock markets. Using Johansen's VECM, they document based on linear restriction tests, inflation rate was not significant in forming the cointegrating relationship.

However, Maysami, Howe and Hamzah (2004) using Singapore's all sector indices documented a positive cointegrating relationship between inflation and Singapore stock returns. Ibrahim and Musah (2014) also document a positive relationship between selected Ghanaian variables and its stock returns and alludes that increase in inflation rate leads to increased stock returns in the long run. This finding is also consistent with those of Chu (2011) who found the fund net asset values to be positively related to inflation.

Hasan and Nasir (2008) studied the possible presence of a long run cointegrating link between macroeconomic factors and stock market prices using data for industrial production index, inflation rate, money supply, exchange rate, foreign portfolio investment, Treasury bill rates and oil prices and stock market index for the period June 1998 to June 2008 were used. Employing ARDL approach, they established that the inflation rate formed cointegrating relationship both in the short run and in the long run. Hsing (2011) also found that the South African stock market to be negatively associated with inflation rate. Contrary to these findings, the rate of inflation was found to have a positive association with the securities exchange index both in the long and short run in Nigeria (Osamwonyi & Evbayiro-Osagie, 2012). Their explanation for the result is that as the inflation rate rises, stock prices also go up thus pushing the SMI upwards. Elly and Oriwo (2012) examined the relationship between macroeconomic variables that is the average lending rate, the Treasury Bill Rate, inflation rate and the Nairobi Securities market index in Kenya. Correlation analysis was done using monthly data for four years that is from March 2008 and March 2012 and their findings indicated that the Nairobi All Share Index (NASI) was weakly but positively affected by inflation. It is observed that all these studies record different findings in different jurisdictions on the relationship between inflation and stock return but we highly suspect that the net asset values of equity funds may have a negative relationship. Money supply is also another important macroeconomic variable that may explain the stock market return and net asset values.

Maysami, Howe and Hamzah (2004) using the data and methodology stated above, found that Singapore's all-sector index was positively correlated to money supply. It is however interesting to note that this finding contradicts that of Maysami and Koh (2000) using the single composite index of Singapore's stock market. Hosseini, Ahmad and Lai (2011) while examining the role of macroeconomic variables in Indian and Chinese stock market found that there was positive long term relationship between Money Supply and the stock market in China and a long term negative relationship with the stock market in India. Yusof, Majid and Razali (2006) examined the relationship between macroeconomic variables and stock returns in Malaysia after the 1997 financial crisis. Using monthly data for the period between May 1999 and February 2006 and employing the ARDL methodology, the find that money supply is positively related to changes in stock prices. Employing cointegration approach, Sohail and Hussain (2009) studied the long term relationship between Pakistani stock exchange prices and the local macroeconomic variables and established that money supply was positively related to stock returns. Hasan and Nasir (2008) in their study also in Pakistan but using the ARDL methodology found that money supply is positively related with equity prices. These two studies in Pakistan are consistent irrespective of the different methodologies used.

Hsing (2011) in examining the South African stock market and selected macroeconomic variables established that the stock market was positively influenced by money supply. Osamwonyi and Evbayiro-Osagie (2012) on the other hand in examining the Nigerian stock market and macroeconomic variables using data and methodology elaborated above, found that money supply has a negative effect on the Nigerian stock market index. They further indicated that a 1% increase in money supply leads to 73.9 %

decrease in the stock market index. Muthike and Sakwa (2010) using monthly data from December 1976 to December 2008 and employing correlations test, established that there was a positive relationship between the NSE 20-Share Index and money supply. This finding is consistent with that of Chu (2011) and the conclusion reached by Ibrahim and Musah (2014) that money supply shared a long run equilibrium relationship with stock returns in Ghana. Similar results were also reported by Adam and Tweneboah (2008).

We note that all the literature reviewed above have all consistently indicated the existence of positive association between money supply and the securities market return. The only divergent finding is that of Osamwonyi and Evbayiro-Osagie (2012) which showed a negative relationship. Interesting results were also observed and reported by Kirui, Wawire and Onono (2014) who by applying regression and cointegration analysis between stock market returns in Kenya and Exchange rate, Gross Domestic Product and Treasury bill rate report that inflation rate had no significant effect on stock returns.

Interest rate is found in many studies to be a one very important factor that influences stock prices or simply put market returns. Maysami, Howe and Hamzah (2004) in their study found out that short-run interest rates has significant positive relationship with Singapore's all sector indices and significantly negative for the long-run interest rates. This finding was in agreement with that of Maysami & Koh (2000) in their study of stock returns in Singaporean securities market. Hasan and Nasir (2009) while examining the Pakistan market found that a statistically negative relationship existed between interest rates and equity returns.

The findings of the study by Hsing (2011) indicated that the South African stock market index is negatively associated with domestic real interest rate. The recent study in Nigeria by Osamwonyi and Evbayiro-Osagie (2012) showed that interest rates negatively affect the Nigerian stock market. Specifically, the study showed that a 1% increase in interest rates would lead to 34.5% decrease in the stock market index. Muthike and Sakwa (2010) find the relationship between interest rates and the stock market in Kenya to be insignificant. Elly and Oriwo (2012) however find a negative relationship between the TB rate and the stock market index in Kenya.

The study by Chu (2011) found that the interest rates were insignificant and negatively related to the short-run interest rates. All the studies above point to a possible existence of a negative correlation between rate of interest and stock market indices of the respective countries apart from those of Singapore (Maysami, Howe & Hamzah, 2004; Maysami & Koh, 2000) using the all sector index. The findings of Ibrahim and Musah (2014) show that although it is expected that higher interest rates would have a negative effect on stock returns, returns indeed indicated that had no significant impact on stock returns in Kenya.

2.3.1 Pooled funds

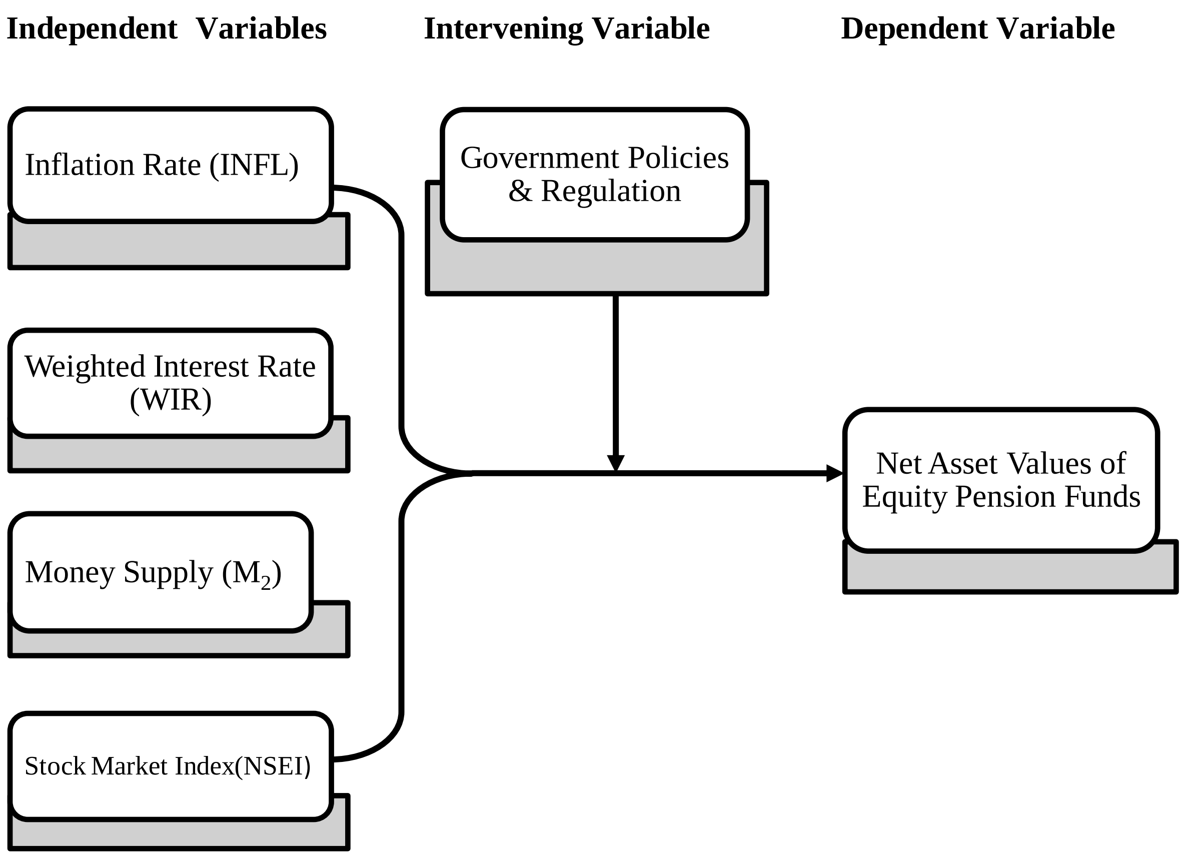
Chang, *et.al* (1995) in their study established the existence of a long run equilibrium association between the United States stock exchange index and the price levels of most of North American and European closed ended investments. On the contrary, there was no proof that such a relationship existed between the market indicators and the net asset values of closed ended investments for the Asian tigers which include Thailand, Korea, India, Taiwan, and Malaysia. On the other hand, Low and Ghazali (2007) reported a significant positive long run relationship between the stock market index returns and the price of unit trust funds and concluded that the Kuala Lumpur Composite Index (KLCI) does not affect the movement of unit trust prices in the short run and do not form a long term equilibrium relationship. Their possible explanation was that fund managers are usually obliged to stick to their investment policies usually based on a long term strategy. Another significant finding in this area is found in the work of Fadhil, Azizan and Shaharudin (2007) whose study investigated the association of selected Malaysian macroeconomic variables with unit trust performance. Using data from 2002 to 2005 and established a possible long run relationship between unit trusts' net asset values and the macroeconomic variables (Consumer Price Index, Money Supply), interbank rate, and Kuala Lumpur Composite Index by using the vector error correction model (VECM). Similarly, Matallir and Nieto (2002) obtained no proof of existence of long run equilibrium association between mutual funds and the stock exchange index in Spain. It is further established that approximately 56% of the net asset values of equity were cointegrated with selected Hong Kong macro economic variables Chu (2011).

2.4 Conceptual Framework

This study conceptualizes that the market indicator that is the NSEI and the selected macro economic variables – Inflation rate, money supply (broad money) M_2 and weighted interest rates WIR have an effect on the net asset values of equity pension funds a possible long run equilibrium relationship between the independent and dependent variables.

FIGURE 1

Conceptual framework



Source: Author, 2014

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The main purpose of this research was to explain the effect of various selected macroeconomic variables and the stock exchange index on the net asset values of equity pension funds in Kenya. To achieve this objective, 45 quarterly time series secondary data from December 2001 to December 2012 were considered. Data for pension assets invested in quoted equity by different fund managers were obtained from RBA while data for Inflation, interest rates, and money supply were obtained from CBK and KNBS websites. The NSEI 20 Share index data was obtained from monthly statistical updates by Pine Bridge investments which is also the leading pension management company.

3.2 Research Design

Cooper and Schindler (2008) outline the importance and usefulness of explanatory research explaining what is observed by descriptive studies. In order to achieve the desired objectives, this study used the explanatory research to analyze the relationship that exists between the dependent and independent variables under consideration.

3.3 Target Population

The unit of analysis in this research is the fund managers. RBA website shows that currently there are 16 registered fund managers who together control over 80% of the total pension assets in Kenya.

3.4 Sample and Sampling Technique

Saunders, Lewis and Thornhill (2009) posit that purposive sampling enables a researcher to make their own judgment in the choice of the sample. This technique was therefore adopted since the sample is not very large and will also enable the researcher to specifically answer the research questions and achieve objectives of the study. Using this technique, seven (7) fund managers were selected for this research. This sample represents 43.75% of the total population and they together control over 90% of the total assets in the pensions industry. These fund managers also required to operate under the regulations as provided in the RBA Act (2007). A full list of the sixteen fund managers and also those in the sample is provided in Table 13 Appendix 1. The choice of the seven fund managers was based on the question whether the firm existed in the year 2001. Those that came into being later such as Zimele were not included in the sample.

3.5 Model Specification

To analyze the short and the long- run relationships between the macroeconomic variables, the stock return and net asset values of equity pension funds, the following model was adopted;

$$\mathbf{EPF_t = \mathit{f}\,(INFL_t, WIR_t, M_{2t}, NSEI_t) + \varepsilon_t} \qquad \textbf{(3.1)}$$

Where:

EPF_t	:	The net asset values of equity pension funds at time t
$INFL_t$	:	Prevailing Inflation rate at time t
WIR_t	:	The Weighted interest rate at time t
M_{2t}	:	Money supply levels at time t
$NSEI_t$	:	Nairobi Securities Exchange 20 Share Index at time t
ε_t	:	Represents variables outside the model

More specifically, the following vector error correction model will be fitted:

$$\mathbf{\Delta EPF_t = \beta_0 + \beta_1\Delta INFL_t + \beta_2\Delta WIR_t + \beta_3\Delta M2_t + \beta_4\Delta NSEI_t + \beta_5(\beta_0 - \beta_1\Delta INFL_{t-1} - \beta_2\Delta WIR_{t-1} - \beta_3\Delta M2_{t-1} - \beta_4\Delta NSEI_{t-1}) + \varepsilon_t} \qquad \textbf{(3.2)}$$

Where: β_0 is the constant, β_1, β_2, β_3 and β_4 are the coefficients for the independent variables while β_5 is the coefficient for the error correction term.

3.6 Definition and Measurement of Variables

This study explores the effect of macroeconomic variables and the Nairobi Stock Market 20 Share Index on the net asset values of equity funds held by pension using quarterly data for the period, 12/2001 to 12/2012. A similar study albeit with a different set of variables and in a different country was done by Chu (2011). The selected macroeconomic variables in this study were: Inflation Rate, Money Supply and Interest Rate. A complete description of the variables under consideration in this study is provided below.

TABLE 3

Definition and Measurement of Variables

Variable	Definition	Measurement
EPF	Net Asset Value of Equity Pension Assets held by Pension fund managers	This is the value of investments in quoted equities based on current share prices. It is therefore the market value of these assets as declared to RBA by each fund manager in the quarterly returns.
INFL	Inflation Rate	The rate at which the general level of prices for goods and services is rising, and, subsequently, purchasing power is falling.
M_2	Money Supply	M_2 is measured as the total sum of currency (coins and notes) in circulation, current account deposits, fixed account deposits and money market funds.
WIR	Weighted Interest Rate	Refers to the commercial banks weighted average lending rate. It is the average rate at which commercial banks charge on new loans to customers.
NSEI	Nairobi Stock Exchange Index	This index is price weighted and based on the geometric mean of average of the constituent companies which are equally weighted.

Source: Author, 2014

3.7 Data Analysis Procedure

This study used econometric models to examine the effect of selected independent variables on the dependent variable. There are many techniques available for testing the existence of dynamic relationships in time series variables. The most commonly used techniques in the literature reviewed include Engle and Granger (1987) test and Johansen-Juselius (1990) tests. For the purpose of this study, Johansens' (1988) test for cointegration was used to establish if there is any long term equilibrium relationship among variables. A vector error correction model was also fitted to examine short run and long run relationships. This technique is also appropriate for data that are integrated of the same order specifically I (1). The model was then tested for serial autocorrelation and impulse response functions were also obtained to examine the stability of the model and its reliability in forecasting. This paper used E-Views 7.0 to analyze the data and model estimation.

3.7.1 Preliminary test

Granger and Newbold (1974) in their study showed that the use of Ordinary Least Squares (OLS) on non-stationary data would actually yield results with very high R squared and statistically significant '*t*' ratio even where there is no relationship whatsoever between the data series used in the regression. It is further argued that the regressions estimated would be 'spurious regression' because they had no meaning or foundation (Cameron, 2005). Time series data is usually deemed to be non stationary and therefore to avoid spurious regression, it is important to test for stationarity of variables under consideration. This can be achieved by carrying out unit root test. The early pioneering work on testing for unit root in time series was done by Dickey and Fuller (Dickey and Fuller, 1979, Fuller 1976). The test statistic under the ADF does not follow the usual *"t"*-distribution under the null since the null is one of non-stationarity but rather follows a non-standard distribution. Critical values are derived from Monte-Carlo experiments in for example, Fuller (1976). It should however be noted that such critical values have been incorporated in EViews 7.0 as used in this research. Philips and Perron (P-P) test on the other hand have developed a more comprehensive theory of unit root non-stationarity. The tests are similar to ADF tests but they incorporate an automatic correction to the DF procedure to allow for auto-correlated residuals. For the purpose of this research, Augmented Dickey Fuller (Dickey and Fuller, 1981) and Kwiatkowski, Philips, Schmidt (KPSS) unit root tests were applied to test for the stationarity of the above mentioned series. Using the augmented Dickey Fuller (ADF) test, the problem of non-stationarity is examined and solved as below. To perform the ADF and KPSS tests, the following regression is first estimated but for the purpose of this research, results for the regression will not be discussed.

$$\Delta y_t = \beta_0 + \beta_1 y_{t-1} + \sum_{j=1}^{k} \lambda_j \Delta y_{t-j} + \varepsilon_t \qquad \textbf{(3.3)}$$

Where: **Δ** is the difference operator, ***yt*** is the series under the test ***k*** is the number of lag differences, ε_t is the error term or white noise, β_0 is the constant term, β_1 is the vector coefficient on y_{t-1}, λ_j is the lag and Δy_{t-1} represents the lagged changes

The following hypothesis is tested in the stationarity tests.

H1 : $\beta_1 = 1$ (that is, the series are non- stationarity)

H2a : $\beta_1 < 1$ (that is, the series are stationary)

It should further be noted that both the ADF and Kwiatkowski, Philips, Schmidt (KPSS) tests usually yield the same conclusions. The joint use of stationarity and unit root tests is referred to as confirmatory data analysis and the tests are only used as a compliment for the other (Brooks, 2008).The lag length which is necessary in cointegration was selected using the AIC, SBIC and Hannan-Quinn information criteria (HQIC) which are available in EViews 7.0.

3.8 Cointegration Test

The pioneering works of Hendry and Juselius (2000) on the properties of economic series have been extended to what is known today as cointegration. Time series are said to be cointegrated if they move in the same direction in the long run. Cointegration requires the time series to be non stationary and combining such series helps to remove such non stationarity in multivariate time series without differencing (Nielson, 2005). The determination of stationarity of the series is there the first step before cointegration.

Having ascertained that the series under consideration are not stationary in 3.5 above, Johansens' methodology is then adopted to carry out cointegration tests and fit the appropriate model which in this case should be vector autoregressive (VAR) model if no cointegration is found and a vector error correction model (VECM). This method is a VAR based approach and it allows testing for a system of equations. The main advantage is that it gives more efficient estimators of cointegrating vectors and do not require variables to be normalized.

The two statistics developed in Johansens' approach to determine the number of cointegrating vectors, are the ***trace statistic*** and ***maximum eigenvalue*** (Johansen and Juselius, 1990). Johansens' approach is further elaborated below;

$$\mathbf{y_t} = \mathbf{A_o} + \sum_{j=1}^{k} \boldsymbol{A_j}\, \boldsymbol{y_t} + \boldsymbol{\varepsilon_t} \qquad \textbf{(3.4)}$$

Where $\mathbf{A_0}$ is an (n x 1) vector of constants, $\mathbf{y_t}$ is an (nx1) vector of non stationary I(1) variables, **k** is the number of lags, $\mathbf{A_j}$ is an (n x n) matrix of coefficients and $\boldsymbol{\varepsilon_t}$ is assumed to be a (nx1) vector of Gaussian error terms. Since the above is based on VAR, the equation is further transformed to a VEC model which allows the use of Johansen and Juselius test below;

$$\mathbf{\Delta y_t = A_0 + \sum_{j=1}^{k-1} \Gamma_j \Delta y_{t-j} + \Pi y_{t-k}} + \boldsymbol{\varepsilon_t} \qquad \textbf{(3.5)}$$

Where

$$\Gamma_j = -\sum_{I=J+1}^{k-1} A_j \Delta y_{t-j} \text{ and } \Pi = -I + \sum_{I=J+1}^{k} A_j$$

In this case I, is an (n x n) identity matrix, and Δ is the difference operator.

The critical values which are given by Johansen and Juselius (1990), and Osterwald-Lenum (1992) are reported by most econometric software packages such as EViews which is used throughout this study.

3.8.1 Fitting the vector error correction model

When two time series are cointegrated, it means that they have a long term equilibrium relationship but in the short run they may exhibit some level of deviation from such equilibrium. To correct such deviation, a VEC Model is fitted and such models take the general form;

$$\mathbf{\Delta y_t = \alpha\, \beta' \, y_{t-1}} + \boldsymbol{\varepsilon_t} \qquad \textbf{(3.6)}$$

Where

$\mathbf{y_t} = \begin{pmatrix} y_{1t} \\ y_{2t} \end{pmatrix}$, α is the adjustment coefficient, β= the cointegrating vector and

$\boldsymbol{\varepsilon} = \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{pmatrix}$ determines the shocks or deviations from long run equilibrium.

In this case therefore, α determines the speed of adjustment back to equilibrium while β specifies the integrating equations.

3.9 Variance Decomposition and Serial Autocorrelation

Once the cointegration test has been done and the error correction model fitted, the model is sufficient and its forecasting ability. To this end test for serial autocorrelation and variance decomposition was done and results.

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS

4.1 Introduction

This chapter presents the results of comprehensive data analysis but as a preliminary, the characteristics of data under consideration were first checked. The results were presented using visual aids which include graphs and also using descriptive statistics. Finally the data set was tested for stationarity and cointegration.

4.2 Descriptive Statistics

Table 4 below presents results of descriptive statistics of the data under consideration in this research.

TABLE 4

Descriptive Statistics

	EPF	INFL	M2	NSEI	WIR
Mean	45.70556	86.79178	713.9531	3.551778	15.07822
Median	46.53000	78.90000	605.5500	3.830000	14.06000
Maximum	112.5000	133.6300	1469.040	5.650000	20.34000
Minimum	1.570000	52.29000	320.9500	1.040000	12.17000
Std. Dev.	28.51808	25.04578	349.1840	1.235049	2.476668
Observations	**45**	**45**	**45**	**45**	**45**

As a preliminary, it is important that even before the model is estimated, there is need to examine the characteristics of the data under consideration. This study considered 45 time series observations for all the variables that is, 45 quarters from December 2001 up to and including December 2012. The summary of their basic characteristics are as presented in Table 4 above .To check for normality, histograms were used to establish the distribution of the data. It is always desired that data should be normally distributed. The histograms for the variables under this study are presented in Figure 1 in Appendix II and it is observed that data for Equity Pension Assets and that of NSEI are approximately normally distributed albeit with little deviation. On the other hand, data for INFL, WIR, and M_2 are not normally distributed.

4.3 Time Series Analysis

This is a very important part of this research and in this section preliminary analysis of the data is done by first examining its stationarity. It is compulsory to test for stationarity (Sohail & Hussain (2009) before proceeding to test for cointegration and determining the existence of long-term relationships. This study used two different tests to test stationarity that is the Augmented Dickey Fuller (ADF) test and Kwiatkowski, Philips, Schmidt (KPSS) tests. Whereas majority of economic and financial data is assumed to be integrated of order one I (1), there is need to confirm this before proceeding to fit the appropriate multivariate model. The joint use of stationarity and unit root tests is referred to as confirmatory data analysis (Brooks, 2008).

4.3.1 Testing for stationarity

For the purpose of this analysis, stationary series (weak) is defined as one with a constant mean, constant variance and constant auto covariance for each given lag. Brooks (2008) posits that the use of non stationary data can lead to spurious (nonsense) regression. If the variables in the regression model are not stationary, then it can be proved that the standard assumptions for asymptotic analysis will not be valid. In other words, the usual "*t*-ratios" will not follow a *t*-distribution, and therefore a valid hypothesis about the regression parameters cannot be undertaken. Further it will have persistent shocks which do not die or decay with time (Brooks, 2008).

4.3.2 Unit root test and stationarity test

Table 5 below presents the results of the Augmented Dickey Fuller (ADF) and Kwiatkowski-Philips-Schmidt-Shin (KPSS) Tests. The critical values at the different levels of significance (1%, 5% & 10%) are also displayed at the bottom of this table.

TABLE 5

Unit Root Test and Stationarity Test

Variables	**Augmented Dickey-Fuller Test Statistic**						**Kwiatkowski-Philips-Schmidt-Shin Test Statistic**			
	Null Hypothesis: Variable is Non Stationary						Null Hypothesis: Variable is Stationary			
	Level			**First Difference**			**Level**		**First Difference**	
	Pure Random Walk	Random With Intercept	Random Walk with Intercept & Trend	Pure Random Walk	Random Walk with Intercept & Trend	Random With a Drift	Random Walk with Intercept	RW with Intercept &Trend	Pure Random Walk	RW With Intercept & Trend
EPF	2.409	0.367	-5.709	-3.77	-4.296	-4.314	0.865	0.088	0.127	0.075
INF	3.344	0.576	-1.876	-2.73	-4.55	-4.608	0.841	0.189	0.26	0.040
WIR	-0.463	-1.740	-2.259	-4.875	-4.817	-5.012	0.192	0.181	0.317	0.050
M2	-1.303	-2.957	-4.675	-8.626	-8.583	-8.496	0.856	0.0726	0.249	-
NSEI	0.397	-1.799	-1.410	-5.840	-5.926	-6.069	0.447	0.194	0.183	0.068
Test Critical Values (MacKinnon, 1996)										
1%	**-2.631**	**-3.610**	**-4.212**	**-2.631**	**-3.606**	**-4.212**	**0.739**	**0.216**	**0.739**	**0.216**
5 %	**-1.950**	**-2.939**	**-3.530**	**-1.950**	**-2.937**	**-3.530**	**0.463**	**0.146**	**0.463**	**0.146**
10%	**-1.607**	**-2.608**	**-3.196**	**-1.607**	**-2.607**	**-3.196**	**0.347**	**0.119**	**0.347**	**0.119**

Table 5 above clearly indicates that the series under investigation are not stationary at level but they indeed become stationary after differencing once. This therefore means that the series are integrated of order one or *I*(1). Generally, the ADF test tests the null hypothesis (H_0) of data having a unit root (non stationarity) against an alternative hypothesis (H_A) of no unit root (stationarity). In this case, the null is rejected if the test statistic is less than the critical values at the different levels of significance. Rejecting the null means that the conclusion of stationarity is made. On the other hand if the null is not rejected then it is concluded that the series are not stationary. On the other hand the KPSS test tests the null hypothesis (H_0) of stationarity against the alternative hypothesis (H_A) of non stationarity. In this case, rejecting the null leads to the conclusion that the data or the series are not stationary. Similarly, if the null hypothesis is not rejected then it is concluded that the series are stationary.

This finding is consistent with the earlier statement that most economic and financial data are usually expected to be integrated of order one I (1). It should be noted however that the KPSS first difference test for money supply has no value since the test indicates that the data is stationary at level. The use of correlograms is one other simple and popular way of testing stationarity of data but this study does not consider this method due to the subjectivity that is involved in making decision.

4.4 Testing for Cointegration and Modeling Cointegrated Systems

From the test for stationarity, it is confirmed that the data is not stationary but indeed become stationary after differencing once which means that the series are integrated of order one I(1). In this case the OLS model is not adequate and cointegration analysis will be used to provide a framework for estimation, inference and interpretation (Brooks, 2008). Cointegration is therefore used to investigate and determine the existence of long-term relationship between Equity pension funds and the selected macroeconomic variables. Since it has earlier been determined that the data is integrated of order one that is $I(1)$, Johansen's (1988) approach was used to establish the existence of any cointegrating relationships. This is an important procedure since it determines the model to be fitted. If the series are cointegrated, we use the vector error correction model to investigate the short run equilibrium. If the variables are not cointegrated, then the best model to fit is the VEC model.

4.4.1 Lag selection

The first step in the analysis is to select an appropriate or optimal lag length to be included in the model. This in itself ensures that the error term in the model estimated is not mis-specified (Enders, 1995). To do this, the number of lags to be included in the cointegrating equation must be determined. The decision criteria for choosing the appropriate lag, is to choose the lag with the lowest Information Criteria (IC). This technique was developed to deal with the shortcomings of using the graphical method to identify the model examining the ACF and PCF patterns since the procedure was found to be very subjective and therefore the justification for the use of IC which eliminates the subjectivity involved. The IC embodies two factors that is a term which is a function of the residual sum of squares (RSS), and a penalty for loss of degrees of freedom from adding extra parameters (Brooks, 2008). The three well known and used IC's procedures are the (LR), Likelihood Ratio, (FPE), Final Prediction criteria, Akaike's (1974) information criterion (AIC), Schwartz's (1978) Bayesian information criterion (SBIC) and Hannan- Quinn Criterion (HQIC) and in all the three cases, the lower the value the better. The choice of lags to be included in the model is of critical essence given the effect this has on the outcome. The use of too many lags means that many degrees of freedom will also be lost while the use of too few lags will cause the model so specified to be less precise. The lag selection criterion is therefore obtained by running the test in EViews and results there from are discussed below.

4.4.1.1 Lag selection criteria

Table 6 below presents results of the choice of the number of lags to be included in the model as presented by the various IC techniques available.

TABLE 6

Lag Selection Criteria

VAR Lag Order Selection Criteria

Endogenous variables: EPF INFL WIR M2 NSEI
Exogenous variables: C
Date: 09/19/14 Time: 19:47
Sample: 2001Q4 2012Q4
Included observations: 42

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-692.6333	NA	1.84e+08	33.22063	33.42750	33.29646
1	-428.6717	452.5056	2125.925	21.84151	**23.08270***	**22.29645***
2	-399.5906	**42.92915***	**1845.055***	**21.64717***	23.92269	22.48124
3	-383.0133	20.52431	3168.700	22.04825	25.35810	23.26144

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Author 2014

The results in Table 6 above clearly indicates that the SC and the HQ Information Criterion suggest or prefer one lag to be included in the mode while the LR, FPE and AIC information criterion suggest that three lags should be included in the model. The decision criterion usually is to choose and use the number of lags preferred by most criteria. In this case, most criteria that is LR, FPE and AIC chooses two lags and we conclude that two lags will be used in the model.

4.4.2 Cointegration test

Having determined the appropriate number of lags to be included in the model, the next step is to test for cointegration implemented based on Johansen's method. Johansens' approach (1990) has two tests for cointegration that is the trace and the maximum tests. The trace statistic (λ_{trace}) is a joint test where the null is the number of cointegrating vectors is less than zero or equal to *r* against an unspecified or general alternative that there is more than *r*. The max (λ_{max}) conducts separate tests on each eigenvalue and has the null hypothesis that the number of cointegrating vectors is *r* against the alternative of ($r+1$). The trace (λ_{trace}) and the maximum eigenvalue (λ_{max}) statistics are then computed. If the null is not rejected, it is concluded that there are no cointegrating vectors and the testing would be completed. On the other hand if the null is not rejected, then it would be concluded that there is one cointegrating vector. The process would therefore continue until the null is not rejected.

Johansen cointegrating rank

In order to investigate and determine the existence of long run equilibrium relationships among the variables under consideration, cointegration test was done and Tables 7 & 8 below presents the results of the test following the Johansen procedure as provided in EViews 7.0 and using two lags as determined in 4.4.1 above.

The first panels of tables 7 & 8 below shows results for the λ_{trace} and λ_{max} statistics respectively. The second column in each in each case presents the ordered eigenvalues with the third column presenting the test statistic, the fourth presents the critical values at 95% level of confidence value. Finally the fifth column presents the *p*-value. Looking at the first row after the heading row, we observe that the trace statistic of 81.57750 significantly exceeds the critical value (at 95% level) and therefore the null hypothesis of no cointegrating equation(s) is rejected and this is also confirmed by the *p*-value of 0.0004. Moving to the next row we observe that the trace statistic of 43.39280 is less than the critical value of 47.85613 and therefore the null hypothesis of at most one cointegrating equation is not rejected at the level of % level of significance. The result of the λ_{max} test in the second panel of the table confirms the result. It is therefore concluded that there is only one cointegrating equation and this study used one cointegrating vector in order to establish the long run relationships among the variables.

TABLE 7

Unrestricted Cointegration Rank Test – Trace

Date: 09/21/14 Time: 11:53
Sample (adjusted): 2002Q2 2012Q4
Included observations: 43 after adjustments
Trend assumption: Linear deterministic trend
Series: EPF INFL WIR M2 NSEI
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *****	0.588529	81.57750	69.81889	0.0043
At most 1	0.373657	43.39280	47.85613	0.1233
At most 2	0.222469	23.27491	29.79707	0.2328
At most 3	0.218408	12.45472	15.49471	0.1364
At most 4	0.042302	1.858566	3.841466	0.1728

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

Source: Author, 2014 ,**Note:* The table is truncated.

TABLE 8

Unrestricted Cointegration Rank Test - Maximum Eigen Value

Date: 09/21/14 Time: 11:53
Sample (adjusted): 2002Q2 2012Q4
Included observations: 43 after adjustments
Trend assumption: Linear deterministic trend
Series: EPF INFL WIR M2 NSEI
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *****	0.588529	38.18470	33.87687	0.0144
At most 1	0.373657	20.11789	27.58434	0.3331
At most 2	0.222469	10.82019	21.13162	0.6652
At most 3	0.218408	10.59616	14.26460	0.1756
At most 4	0.042302	1.858566	3.841466	0.1728

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Author, 2014 ,**Note:* The table is truncated.

4.4.3. Long-run relationship

Applying Johansens (1990), vector error correction test is carried using EViews 7.0 and the results are presented below. The full table of Johansen's Cointegration test result is presented in Table 14 in Appendix II. Table 9 below presents results from fitting the Vector Error Correction Model.

TABLE 9

Normalized Cointegrating Equations

EPF(-1)	INF(-1)	WIR(-1)	M2(-1)	NSEI(-1)	C
1	-1.748*	-1.699*	0.046*	-7.125*	124.282
S.E	0.317	0.697	0.021	1.436	
t-value	-5.514	-2.439	2.23	-4.96	

Source: ***Author, 2013***

* indicates the coefficient is significantly different from zero at 0.05 % level

Table 9 above presents the long-term cointegrating relationship and the first equation was as estimated as below:

$$\mathbf{EPF_{t-1}+124.282 - 1.748INFL_{t-1} - 1.699WIR_{t-1}+0.0465M_{2\,t-1} - 7.125NSEI_{t-1} = 0} \qquad \mathbf{(4.1)}$$

Equation **(4.1)** above can also be re-written as follows:

$$\mathbf{EPF_{t-1} = -124.282 + 1.748INFL_{t-1} + 1.699WIR_{t-1} - 0.0465M_{2\,t-1} +7.125NSEI_{t-1}} \qquad \mathbf{(4.2)}$$

The two equations **(4.1)** and **(4.2)** above provides the coefficients of the long run relationships clearly indicating the magnitude and the direction of the effect that the independent variables that the selected macroeconomic variables and the stock exchange index have on the dependent variable which in this case is the net asset values of equity pension funds.

The first objective of the study was to determine the effect of inflation rate on the net asset values of equity pension funds. The first part of table 9 above contains the estimates of the long-run parameters for the model under estimation. Equation 4.2 above indicates that there is a positive long-run association between the net asset values of equity pension funds and inflation. The coefficient of +ve1.748 means that when inflation rate (INFL) increases by one unit (1%) then the net asset values of equity pension funds (EPF) increases by 1,748. The test statistic of -5.51 further indicates that the relationship is significant at 95% level of significance. This finding is in line with those of Chu (2011) who established that inflation and the net asset values of Hong Kong mandatory provident fund formed a positive long term cointegrating relationship.

Maysami, Howe and Hamzah (2004) suggested that indeed a positive long run relationship existed between inflation and Singaporean stock returns. Most studies on the relationship between stock prices and inflation specifically in the Asian markets have found many to exhibit positive relationship. A similar stance is also taken by Abdullah and Hayworth (1993) whose finding stated that a positive long run relationship existed between the rate of inflation and S&P’s 500 stock index. The findings in this study are also consistent with those of Nasseh and Strauss (2000) who in their study concluded that a long run cointegrating relationship existed between the rate of inflation and the stock market index in six European countries. Similarly, Ibrahim and Aziz (2003) and Ibrahim (2003) further postulate the existence of a positive long- run association between the inflation rate and the Kuala Lumpur Composite Index (KLCI) in Malaysia.

However, this finding (of significant positive cointegration) between inflation and the net asset values of equity pension funds contradicts those of Fama and Schwert (1977), Chen, Roll and Ross (1986) and Mukherjee and Naka (1995) who have all suggested a negative relationship between inflation and stock returns. A more recent cointegration approach as applied by various authors has also documented negative relationship between inflation and stock returns. One such study with an alternative view is that of Mukherjee and Naka (1995) which employed Johansens’ (1991) procedure and established that the Tokyo Stock Exchange (TSE) Index had a negative long term relationship with the changes in the rate of inflation in Japan. Maysami and Koh (2000) in their study also provided a conflicting view when their study established the existence of a long term relationship between the stock return index of Singapore and the rate of inflation. The positive relationship may therefore be attributed to fact that people (in this case pension funds) hold stocks and various assets to hedge against inflation (Maysami and Koh, 2000) and the fact that the stock returns have been observed to out-perform inflation in the long run.

The second objective of this study was to investigate the effect of interest rate on the net asset values of equity pension funds and results from equation 4.2 shows that the weighted interest rate has a positive long run relationship with the net asset values of equity pension funds. The coefficient of +ve1.699 means that when the weighted interest rate (WIR) increases by one unit (1%) then the net asset values of equity pension funds (EPF) increases by 1,699.The test statistic of -2.4389 does imply that the variable is significant at 95% level of significance. The finding is counterintuitive and is at variance with many studies as well as theory of finance (Abdullah and Hayworth, 1993). In theory its is usually understood that an increase in interest rates increases the overall interest expense of a leveraged firms therefore reducing the cashflows available for future dividends with the consequence being a negative impact on the share prices of the firm. Though the findings are at contrast with theory as explained above, Mukherjee and Naka (1995) supports this view since their study established the existence of a long run cointegrating relationship between short-term interest rates and stock returns in the Tokyo Stock exchange. In addition, Maysami and Koh (2000) reported the existence of a positive cointegrating relationship between the Singaporean stock market and short term interest rates. This idea was further developed and extended by Bulmash and Trivoli (1991) whose study supported the finding of a positive relationship in the case of United States.

The third specific objective of the study was to investigate the effect of Money supply (M_2) which was considered as an important variable and results as indicated in equation **4.2** shows that the net asset values of equity pension funds have a negative long run equilibrium relationship with money supply. The coefficient of –ve0.0465 means that when the money supply (M2) increases by one unit then the net asset values of equity pension funds (EPF) decreases by 0.0465 with the test statistic being 2.235 clearly showing that the variable is significant at 95% level of significance. The effect of stock prices and by extension the net asset values is an empirical question (Maysami, Howe and Koh, 2004) and also somewhat controversial in different markets (Chu, 2011).

The negative significant relationship so established above is in agreement with findings from other studies. Findings in Ibrahim and Aziz (2003), reflects the view that a negative cointegrating relationship exists between price levels of stocks in the Malaysian securities exchange and the country's' money supply (M_2). The view taken above was further extended by Kwon and Shin (1999) who observed a negative cointegrating relationship between the Korean stock market and money supply. These findings are however at variance with those of Mukherjee and Naka (1995) who document a positive long run equilibrium relationship between the changes in money supply and stock prices in Japan. A similar finding was also observed by Habidullah, (1998) whose work revealed a positive cointegrating relationship between money supply and price levels of stocks in the Malaysian stock market. A similar conclusion is reached by Bulmash and Trivoli (1991) who concluded that a positive cointegrating relationship existed in United States stock market. Ratanapakorn and Sharma (2007) build on this theory too with a finding of a positive relationship between stock prices and money supply in the case of Japan.

Finally, this study sought to find out the effect of the local Nairobi stock exchange index on the net assets of equity and results in equation **4.2** above indicate that the net assets of equity pension funds have a significant positive cointegrating relationship with the Nairobi Stock Exchange Index. The coefficient of +ve7.125 means that when the Nairobi Securities exchange Index (NSEI) increases by one unit, then the net asset values of equity pension funds (EPF) increases by 7.125.The *t*-value of 1.436 indicates the significance of the variable. This finding is consistent with those of Chu (2010) who documents the presence of cointegration between price levels of equity funds authorized and included in the Hong Kong MPF schemes and the stock market index. Similarly, Chang, Eun and Kolodney (1995) observes a positive and significant long run relationship between the US market index and the net asset values of the most of the closed- ended country funds from Europe and North America. The finding is indeed at variance with the observation and conclusion that foreign country funds including Germany, UK and Japan listed in the US stock market were not cointegrated with the national stock exchange (Ben-Zion, Choi & Hauser, 1996). The study therefore concludes that the net asset values of equity pension funds form a significant cointegrating relationship with all the four independent variables under consideration that is inflation rate, weighted interest rate, money supply and the Nairobi stock exchange index.

4.4.4 Vector error correction model

In order to capture the short- run dynamic relationships, the error correction mechanism was applied and the results are presented in Table 10 below.

TABLE 10

Vector Error Correction Estimates

Error Correction:	**D(EPF)**	**D(INFL)**	**D(WIR)**	**D(M2)**	**D(NSEI)**
CointEq1	-0.443316 (0.13881) [-3.19379]	0.142163 (0.03553) [4.00087]	0.029884 (0.02455) [1.21714]	-1.133576 (0.39501) [-2.86972]	-0.008263 (0.01026) [-0.80555]
D(EPF(-1))	0.218871 (0.22315) [0.98082]	-0.079778 (0.05712) [-1.39656]	-0.070549 (0.03947) [-1.78728]	0.902310 (0.63504) [1.42086]	-0.014393 (0.01649) [-0.87282]
D(EPF(-2))	-0.061331 (0.22384) [-0.27399]	-0.009466 (0.05730) [-0.16520]	-0.014642 (0.03959) [-0.36979]	-0.233257 (0.63701) [-0.36618]	-0.028308 (0.01654) [-1.71137]
D(INFL(-1))	-0.784532 (0.60456) [-1.29768]	0.141060 (0.15476) [0.91146]	0.040748 (0.10694) [0.38104]	0.610289 (1.72047) [0.35472]	-0.101489 (0.04467) [-2.27172]
D(INFL(-2))	-1.340649 (0.61810) [-2.16898]	0.121602 (0.15823) [0.76852]	0.251113 (0.10933) [2.29675]	-1.076387 (1.75899) [-0.61194]	-0.046978 (0.04568) [-1.02853]
D(WIR(-1))	-1.35757 (1.25981) [-1.07760]	0.776459 (0.32250) [2.40763]	0.124510 (0.22284) [0.55873]	-6.674652 (3.58515) [-1.86175]	-0.026802 (0.09309) [-0.28790]
D(WIR(-2))	-1.505751 (1.20631) [-1.24823]	0.788982 (0.30880) [2.55496]	0.143878 (0.21338) [0.67428]	-2.765445 (3.43291) [-0.80557]	-0.031479 (0.08914) [-0.35314]
D(M2(-1))	0.019923 (0.06525) [0.30532]	0.025288 (0.01670) [1.51382]	0.013596 (0.01154) [1.17792]	0.254334 (0.18570) [1.36959]	0.003289 (0.00482) [0.68199]
D(M2(-2))	0.035052 (0.06317) [0.55491]	0.001129 (0.01617) [0.06984]	-0.000464 (0.01117) [-0.04153]	0.256571 (0.17976) [1.42728]	-0.000216 (0.00467) [-0.04624]
D(NSEI(-1))	-1.517027 (3.03199) [-0.50034]	-0.402857 (0.77616) [-0.51904]	0.011375 (0.53632) [0.02121]	-15.85961 (8.62843) [-1.83806]	-0.002833 (0.22405) [-0.01265]
D(NSEI(-2))	-0.086205 (2.89644) [-0.02976]	-0.410488 (0.74146) [-0.55362]	0.309592 (0.51234) [0.60427]	-1.521153 (8.24269) [-0.18455]	0.188242 (0.21404) [0.87949]
C	5.110320 (2.15836) [2.36768]	0.935186 (0.55252) [1.69258]	-0.745029 (0.38179) [-1.95143]	14.93340 (6.14226) [2.43125]	0.347043 (0.15949) [2.17589]

Table 10 above indicates that CointEq1 relates EPF to INFL, WIR, M_2 and NSEI as envisaged. We observe that when EPF rises above its equilibrium, inflation and weighted interest rate will rise in the next period. Similarly, Money supply and the Nairobi Stock Exchange Index will fall in the next period (quarter). The coefficients of the variables are significant based on the *t*-values provided in parentheses save for weighted average interest rate. Further, we observe that the coefficient of cointegration equation (CointeEq1) showed a speedy adjustment of disequilibrium in the period of study. This is so because the error correction term -0.44 showed significance in terms of *t*-value of -3.31939 and the negative sign. The implication of this result means that the vector error correction model (VECM) depicted that the adjustments in the EPF were attributed to the error correction term (CointEq1). Equation **4.3** below shows that the coefficient of CointeEq1 was significant which means that the net asset values of equity pension funds adjusted back to its long term equilibrium by 44.3% in one quarter. The result further showed that it took approximately two quarters or six months (1/0.443) to eliminate the disequilibrium. The vector error correction model is as shown below.

$$\begin{aligned} \textbf{D (EPF)} = {} & \textbf{5.11} - \textbf{0.44(CointEq1)} + \textbf{0.22(DEPF (-1))} - \textbf{0.06(DEPF (-2))} \\ & - \textbf{0.78(DINFL (-1))} - \textbf{1.34(DINFL (-2))} - \textbf{1.37DWIR (-1))} \\ & - \textbf{1.51(DWIR (-2))} + \textbf{0.02(DM}_2\textbf{ (-1))} + \textbf{0.04(DM}_2\textbf{ (-2))} \\ & - \textbf{1.52(DNSEI (-1))} - \textbf{0.09(DNSEI (-2))} \qquad \textbf{(4.3)} \end{aligned}$$

4.5 Variance Decomposition and Serial Autocorrelation

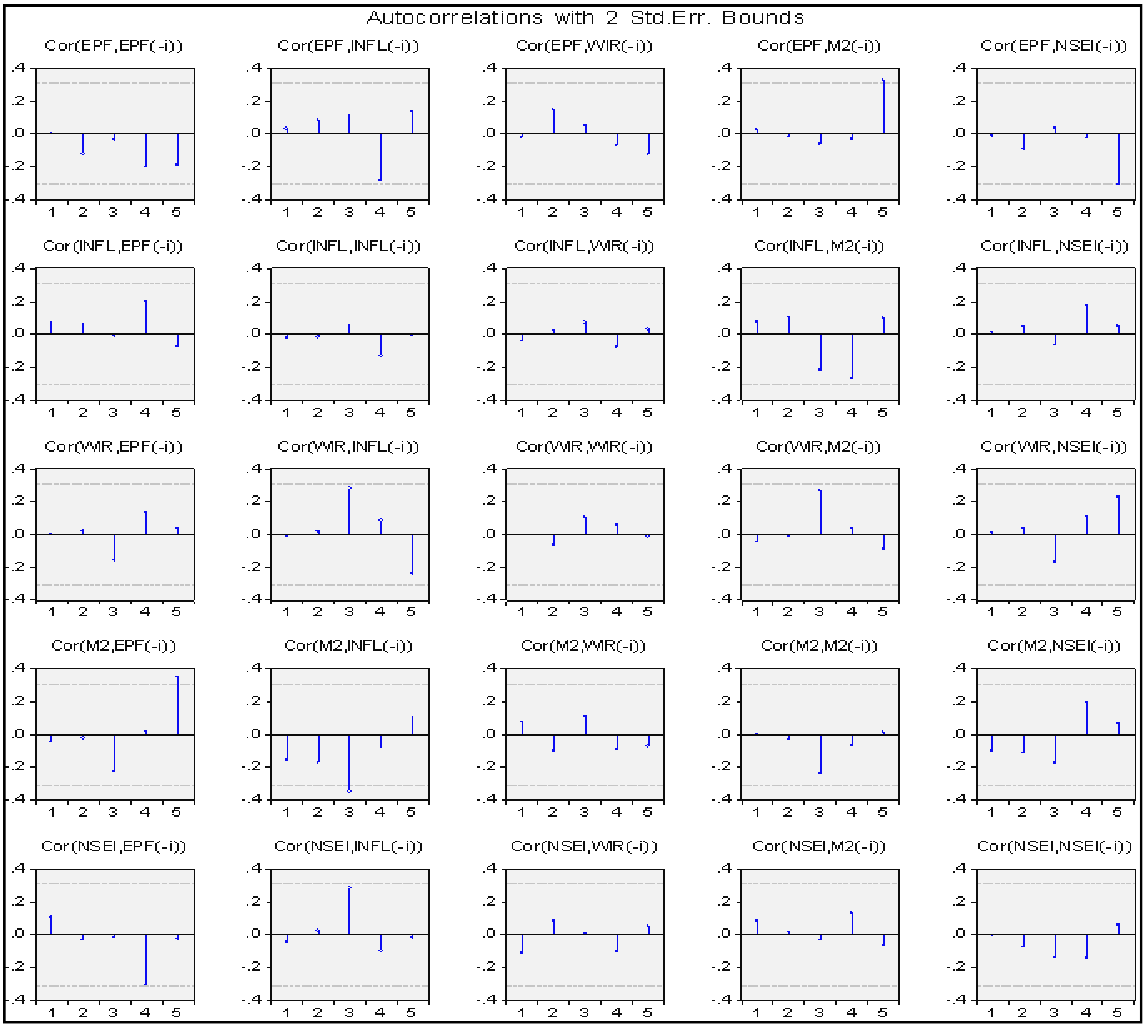
Having successfully carried out the cointegration test and determined that a long term relationship existed and finally the estimation of the vector error correction model, the next step was to test whether the model is sufficient and its forecasting ability. To this end test for serial autocorrelation and variance decomposition was done and results are discussed below.

4.5.1 Testing Serial Autocorrelation

Figure 2 below present results of serial autocorrelation test. This test is available in EViews 7.0 and correlograms of residuals are obtained to determine whether the model included the correct number of lags.

FIGURE 2

Serial Autocorrelation Test



Source: Author, 2014

From Figure 2 above it is observe that there is no serious problem of autocorrelation. In other words, the residuals of the cointegrating VAR model have no or weak serial correlations. Within two standard error bounds, only three correlation relationships {(Cor EPF, M_2 (-1))}, {(CorM_2, EPF (-1))}, and {(Cor M_2, INFL (-1))} are observed to lie outside the bounds of two. This study therefore concludes that there is no problem of serial autocorrelations.

4.5.2 Variance decompositions

Variance decomposition breaks down and shows the extent to which each variable in the model indicates the amount of information each variable contributes to the other variables in the auto regression. It determines how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables.

Table 11 below presents summarized results of the variance decomposition test. Full results as obtained from EViews 7.0 are presented in Table 18 Appendix II.

TABLE 11

Variance Decomposition

Variance Decomposition							
VDC of	**Quarters**	**S.E.**	**EPF**	**INFL**	**WIR**	**M2**	**NSEI**
EPF	1	5.402377	100.0000	0.000000	0.000000	0.000000	0.000000
	2	7.205824	98.92584	0.000953	0.407322	0.039064	0.626824
	3	8.067283	92.14238	1.503519	1.840294	0.123613	4.390191
	4	**8.714723**	**81.40387**	**1.558486**	**1.588796**	**1.876679**	**13.57217**
INFL	1	1.382960	0.004925	99.99507	0.000000	0.000000	0.000000
	2	2.096537	1.157100	85.00765	1.403095	6.925037	5.507119
	3	2.969569	0.629179	69.12997	2.735534	12.26923	15.23608
	4	3.942100	1.542490	58.99749	1.555586	16.92825	20.97619
WIR	1	0.955609	16.30721	0.311490	83.38130	0.000000	0.000000
	2	1.485878	30.01632	0.140532	67.39579	2.225144	0.222207
	3	1.898357	30.12655	3.526884	62.27890	3.633568	0.434090
	4	2.280281	27.34429	5.625320	56.94042	7.744625	2.345344
M2	1	15.37406	4.335977	5.160221	11.08384	79.41997	0.000000
	2	27.15131	4.306095	10.81255	18.78799	65.10117	0.992197
	3	39.01284	7.934354	14.12422	18.86564	58.27792	0.797863
	4	50.14678	12.96408	16.41805	15.32845	54.38518	0.904238
NSEI	1	0.399214	18.81021	0.346869	0.952918	4.116958	75.77304
	2	0.563622	10.45695	5.859123	0.550327	2.724255	80.40934
	3	0.769462	6.236649	8.375780	0.336146	3.497305	81.55412
	4	0.969157	4.686445	8.725200	0.212462	4.651735	81.72416
	Cholesky Ordering: EPF INFL WIR M2 NSEI						

Source: **Author, 2014**

The variance decomposition procedure breaks down the variance of the forecast error for each variable into components. This means that each variable is explained as linear combination of its own current innovation and lagged innovation of all the variables in the system (Hossain, 2008). The results displayed in Table 11 above provided further evidence of relationships among the variables under investigation and the proportion of the forecast error of one variable due to another. Results showed that the net asset values of equity pension funds (EPF) were less exogenous in relation to other variables that is, inflation rate, weighted interest rate, money supply and the Nairobi stock exchange index because 81% of its variance was explained by its own shocks or innovations after four quarters or one year. Inflation (INFL) explained 1.55% impact on the net asset values of equity pension funds while the Weighted Interest Rate (WIR) explained 1.59%. Similarly, money supply (M_2) and the Nairobi Stock Exchange Index (NSEI) explained the forecast variance by 1.88% and 13.57% respectively.

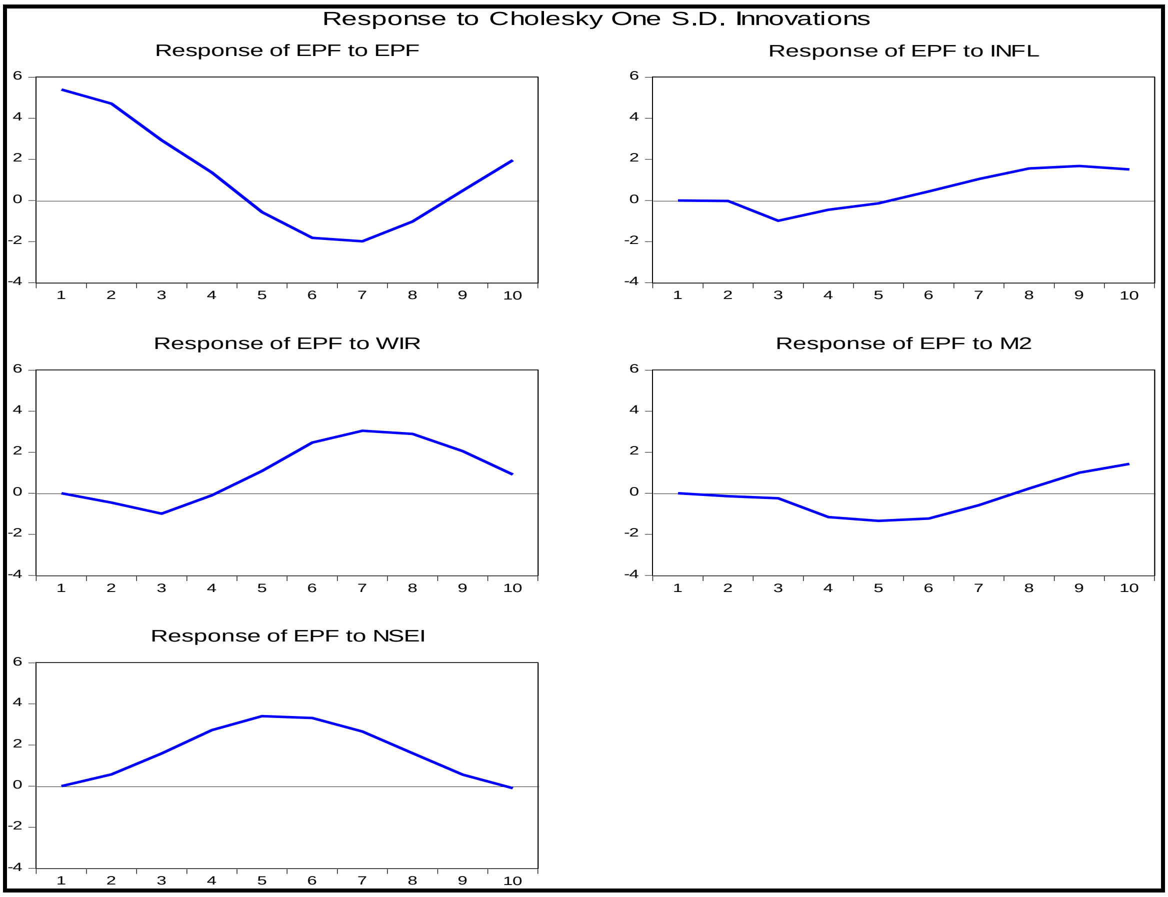
4.5.3 Impulse response functions

Figure 3 below present results for the impulse response functions for Cholesky one standard deviation innovation for 10 periods in this case 10 quarters. An impulse response function traces the effect of one or more standard deviation shock or innovation to one of the endogenous variables on the current and future values of the endogenous variables in the system. It presents results of the responses of the net asset values of equity pension funds to one standard deviation positive shock or innovation is given to itself, inflation rate, weighted interest rate, money supply and the stock exchange index. For the purpose of this research, the responses of net asset values of equity to one standard deviation positive shock to the independent variables was discussed but the full impulse response functions for all the variables in the system are provided in Figure 2 in Appendix II.

Looking at the EPF response to EPF graph, it was observed that the initial impact of one standard deviation positive shock to itself (EPF) is negative from the outset with peak negative response occurring at around the 7th quarter. The negative response however moderates at the 8th quarter and begins a positive course and leaves the negative territory at the 9th quarter.

FIGURE 3

Impulse Response Functions



***Source*: Author 2014**

Further, one standard deviation positive shock to inflation shows little evidence of any significant response from the net assets of equity pension funds. Initially there is no change between the 1st and the 2nd quarter but the shock leads to a negative response in the 3r quarter but does not last since the response changes course to eventually become positive by the 6th quarter. From the third graph of figure 5, it is observed that the initial response of EPF to one unit shock to the weighted interest rate is negative which peaks at the 3rd quarter but rapidly adjusts to become positive by the 4th quarter. Similarly, the response of EPF to one standard deviation positive shock to money supply indicates a slow and negative one and remains unchanged (does not go below -ve2) but adjusts to become positive by the 8th quarter. Finally, one standard deviation positive shock to the stock exchange index leads to a positive from equity pension funds. The bell shaped response shows a symmetrical positive response which begins at the 1st quarter, peaks at the 5th quarter and slowly drops zero by the 10th quarter.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the discussion and conclusions based on the findings in the previous chapter. We further make recommendations given the findings and highlight areas of further research.

5.2 Summary

The main objective of this study was to investigate and determine the effect of the selected macroeconomic variables and the stock exchange index on the net asset values of equity pension funds. This study was mainly motivated by the great belief among scheme participants - pension contributors and pension managers that there is a strong relationship between the net asset values of equity pension funds and the variables under the study. To the best of the knowledge of the researcher, this is the first study in Kenya to examine cointegration among the net asset values of equity and the selected macroeconomic variables and the stock market index. The study of macroeconomic variables and the stock exchange has been very extensive throughout the world and also in Kenya though none have delved on pension funds as an important institutional investor. It is further noted that research methodologies and data analysis approaches have been widely varied both locally and internationally.

To achieve the objective above, quarterly data for the selected Kenyan macroeconomic variables, the stock exchange index and the net asset values for equity pension funds were obtained for the period December 2001 upto and including December 2012. The time series data were then tested for stationarity which is a preliminary mandatory test before testing cointegration. To ascertain this, the Augmented Dickey

Fuller (ADF) and Kwiatkowski, Philips, Schmidt (KPSS) tests were conducted and it was established that all the data under consideration were all integrated of order one $I(1)$.

Having determined that the data were integrated of order one I (1), Johansens (1990) test for cointegration was carried with the optimal lag and cointegrating rank of two and one respectively as earlier determined. The concept of cointegration traces its origin to macroeconomics where series are usually seen not to diverge so much in either direction in the long run. The long run equilibrium relationship was obtained together with the short run coefficients of speedy adjustment. The main advantage of Johansens (1990) procedure is that it allows for correction of serial autocorrelation and it is for this reason that the procedure is adopted. The vector error correction (VEC) model was then fitted and their estimates obtained. Finally tests of serial autocorrelation and variance decomposition were done to determine whether the model was sufficient enough to be used for forecasting.

Results from cointegration test indicate that inflation rate, weighted interest rate and the stock market index were all significantly positively cointegrated with the net asset values of equity pension funds while money supply was found to have a negative significant long run relationship with the dependent variable. The overall cointegration equation was also found to be significant in explaining approximately 49.5% of the changes in the net asset values of equity pension funds in Kenya. Results from serial auto correlation test showed that there was no serious problem of auto correlation. Further, variance decomposition showed that the net asset values of equity were less exogenous in relation to other variables in the model reason being the revelation that 81% of its variance was indeed explained by its own shocks and innovations. Impulse response functions showed that one standard deviation shock to the independent variables showed that equity moved back to equilibrium by the 6th quarter save for the stock market index which produces a positive response from the net asset values of equity pension funds.

5.3 Policy Implication of Findings

The findings from this study will be important and be of great benefit to pension fund managers, scheme participants in making investment decisions as well as policy makers especially those charged with the responsibility managing the macroeconomic environment. This will be possible since they have a basis from which they will derive their buying, selling and switching decisions all with one aim of growing their fund. It therefore follows that their ability to predict the future of the net asset values of equity pension funds will be enhanced by continually observing the changes taking place in the macroeconomic environment with a keen eye on changes Nairobi Stock Market Index since it has the highest coefficient compared to the rest though all of them are significant.

Policy makers in this case, government of Kenya and the relevant regulatory bodies should put in place measures to ensure that they are more careful in making policy changes in a bid to bring stability to the macroeconomic environment through manipulation of variables such as inflation and interest rates. This is because whereas this may be done in good faith to correct a single macroeconomic problem such as increase in inflation, it may lead to negative ramifications on the stock market returns (price levels) and therefore on net asset values of equity pension funds. The government should also regulate the amount of money in circulation since empirical evidence show that money supply has a negative significant effect on the net asset values of equity funds. The results of a positive effect of the Stock market index on the net assets values of equity funds means that any drop in the index will also lead to a drop in such values of the dependent variable. Therefore regulators should also ensure that the market is strengthened on a continuous basis to avoid any negative effects.

5.4 Conclusion

The main objective of this study was to establish the effect of the selected macroeconomic variables, the stock exchange index on the net asset values of equity pension funds. The vector error correction model showed that the net asset values of equity pension funds adjusted by 44.3% in one quarter to the long run equilibrium. The result further showed that it took approximately two quarters or six months (1/0.443) to eliminate the disequilibrium. Results from variance decomposition showed that the net asset values of equity pension funds (EPF) were less exogenous in relation to other variables because 81% of its variance was explained by its own shocks or innovations after four quarters or one year.

Based on the findings of this research, the study concludes that the net asset values of equity pension funds in Kenya forms a significant positive equilibrium relationship with inflation rate, weighted interest rate and the Nairobi Securities Market Index and a significant negative equilibrium relationship with money supply. Fund managers should therefore continually observe the macroeconomic environment pay special attention to changes in money supply when allocating pension funds to the different investment classes given the negative effect it has on the net asset values of such funds.

5.4 Limitations of the Study and Recommendation for further research

This research intended to use monthly data due to its closeness to normal distribution but this was not possible. Whereas monthly data for all the other variables were available, those of equity pension funds were only available on quarterly basis. In future (when data does become available), it would be very important that the same research be done but this time using the monthly data. Further to this limitation is that the researcher encountered a literature gap since few if not none research has been done in Kenya specifically on pension funds and also employing the cointegration approach.

Another limitation is the adoption of Johansens' (1990) employed is widely known for its sensitivity to the number of lags used. To overcome these problems, this research could be done using the ARDL (autoregressive distribution lag) model as proposed by Pesaran and Shin (1997).This procedure could therefore be adopted rising the data available. The researcher further suggests that future studies could be done with the inclusion of more variables, such as the gross domestic product (GDP), production index and the exchange rate among other relevant variables. Future research could also use the Treasury bill rate instead of the weighted interest rate as used in this research and should also incorporate bivariate analysis and causality tests to assess specific impact or influence of each variable.

In terms of methodology, this research was based on the cointegration which investigates long term relationships between the variables in the cointegrating vector(s) that is between the net asset values of equity and the selected macroeconomic variables and the stock exchange index but the findings cannot be assumed to replicate in the short run. Engle and Granger's (1987) error correction can therefore be employed to capture short run dynamics. Correlation analysis may also be considered in future.

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APPENDICES

APPENDIX I

TABLE 12

Research Data

Quarter	EQUITY PENSION FUNDS in millions/1000	Inflation Rate	Weighted Interest Rates (%)	Money Supply(M2) in Millions/1000	NSE 20 Share Index/1000
1	1.72	53.42	19.49	322.33	1.36
2	1.75	52.29	18.86	320.95	1.18
3	1.57	53.30	18.38	331.63	1.09
4	2.61	54.60	18.14	335.87	1.04
5	6.22	54.97	18.34	350.73	1.36
6	8.21	56.45	18.49	352.75	1.61
7	10.44	60.46	15.73	362.6	1.93
8	16.15	59.53	14.82	370.33	2.38
9	22.46	59.80	13.47	395.12	2.74
10	20.73	61.59	13.12	394.79	2.77
11	18.84	64.11	12.17	407.3	2.64
12	19.29	68.09	12.27	416.96	2.67
13	19.56	70.32	12.25	432.57	2.95
14	26.63	70.41	12.84	434.91	3.13
15	26.05	73.22	13.09	442.4	3.97
16	29.11	73.23	12.83	453.77	3.83
17	28.79	73.43	13.16	474.49	3.97
18	33.16	76.35	13.33	492.84	4.1
19	37.54	76.39	13.79	521.96	4.26
20	42.7	76.80	13.54	537.67	4.88
21	46.4	78.27	13.74	553.91	5.65
22	45.4	78.90	13.56	576.28	5.13
23	46.53	78.46	13.14	605.55	5.15
24	55.22	80.90	12.87	631.14	5.15
25	56.32	82.68	13.32	666.88	5.44
26	49.92	87.18	14.06	697.12	4.84
27	69.04	92.14	14.06	715.97	5.19
28	65.57	93.75	13.66	736.33	4.18
29	59.11	96.38	14.87	766.47	3.52
30	55.88	99.50	14.87	780.51	3.81
31	52.65	101.91	15.09	812.06	3.29
32	52.71	102.90	14.76	897.98	3.25
33	63.21	104.07	14.8	959.01	4.07
34	73.72	105.01	14.39	1033.7	4.34
35	76.72	105.65	14.19	1055.99	4.48
36	79.73	106.32	13.98	1078.28	4.63
37	85.74	108.07	13.87	1099.23	4.43
38	83.23	112.41	13.92	1145	3.89
39	80.73	119.56	13.91	1183.86	3.97
40	71.29	123.88	14.79	1232.81	3.18
41	61.86	128.81	20.04	1253.96	3.21
42	69.07	131.36	20.34	1276.4	3.37
43	76.28	133.63	20.3	1339.07	3.7
44	94.39	131.78	19.73	1409.37	3.97
45	112.5	133.35	18.15	1469.04	4.13

TABLE 13

Sample Frame

No	Name of Fund Manger
1	AIG Pine Bridge
2	Genesis Kenya Investment Management Limited
3	CfC Stanbic Financial Services (EA) Limited*
5	Old Mutual Asset Managers (Kenya) Limited
6	COOP Trust Investment Services Limited
7	ICEA Asset Managers (Kenya) Limited
	***** *CFC and Stanbic recently merged. For the purpose of Sampling they are treated as two separate companies but their data is aggregated for the purpose of analysis*

Source: RBA Statistical Bulleting

APPENDIX II

DATA ANALYSIS RESULTS

FIGURE 4

Normality of Data

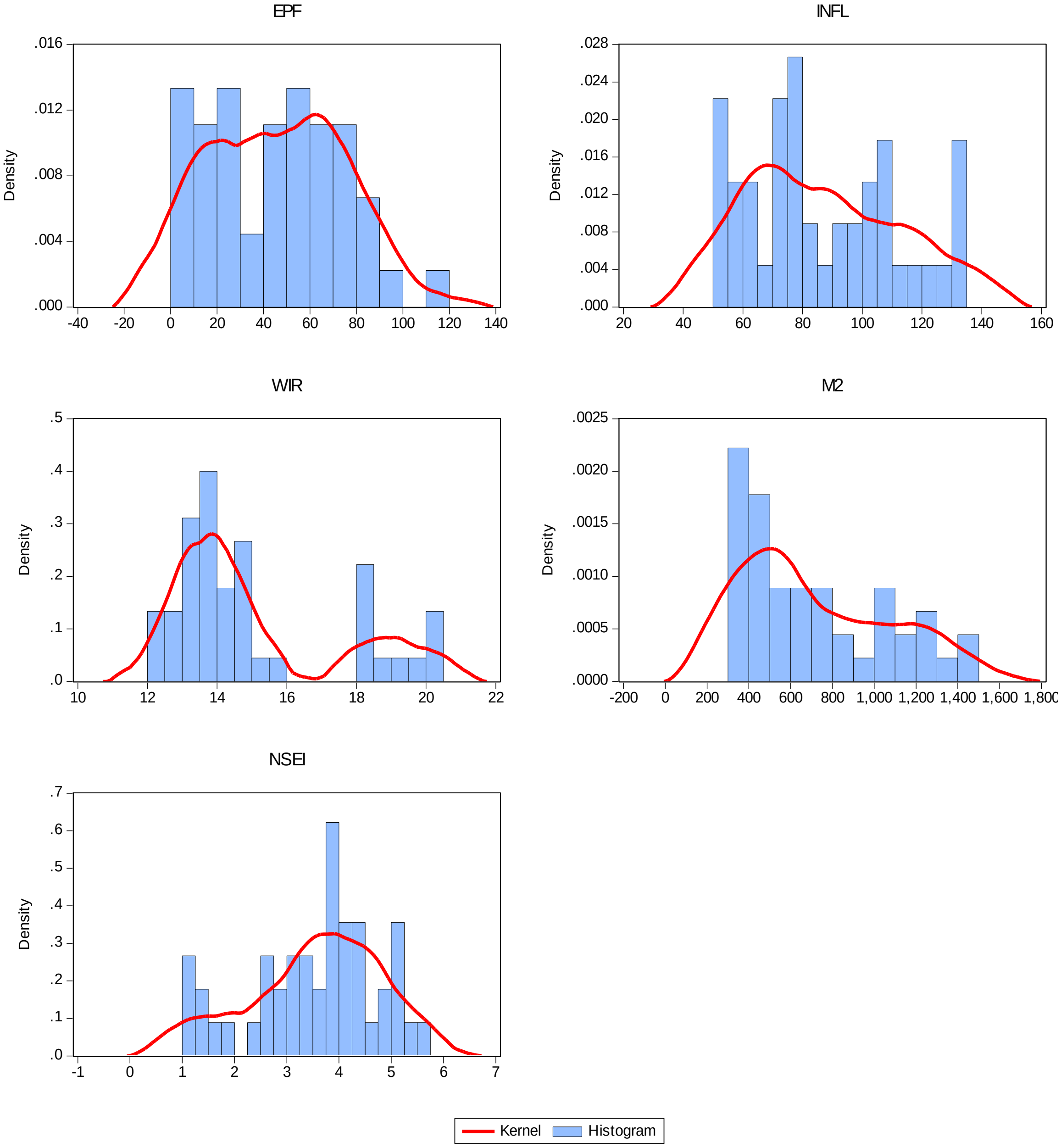


TABLE 14

Cointegration Test

Date: 09/21/14 Time: 14:08
Sample (adjusted): 2002Q3 2012Q4
Included observations: 42 after adjustments
Trend assumption: Linear deterministic trend

Series: EPF INFL WIR M2 NSEI
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.626443	89.18705	69.81889	0.0007
At most 1	0.415349	47.83032	47.85613	0.0503
At most 2	0.311144	25.28721	29.79707	0.1514
At most 3	0.156773	9.632847	15.49471	0.3100
At most 4	0.057137	2.471031	3.841466	0.1160

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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.626443	41.35673	33.87687	0.0053
At most 1	0.415349	22.54311	27.58434	0.1938
At most 2	0.311144	15.65436	21.13162	0.2457
At most 3	0.156773	7.161815	14.26460	0.4702
At most 4	0.057137	2.471031	3.841466	0.1160

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

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

EPF	INFL	WIR	M2	NSEI
-0.166513	0.291018	0.282899	-0.007742	1.186440
0.247830	0.066912	0.388661	-0.018471	-1.106726
-0.162054	-0.162037	-0.055340	0.023315	2.053062
-0.068798	0.157367	-0.726780	-0.001605	-0.551957
-0.007699	-0.045960	-0.116506	0.008152	-0.735827

Unrestricted Adjustment Coefficients (alpha):

D(EPF)	2.662356	-1.636748	0.699089	-0.952990	0.400445
D(INFL)	-0.853766	0.085614	0.268554	0.051682	0.194923

D(WIR)	-0.179472	-0.123035	0.172195	0.226795	-0.099489
D(M2)	6.807741	5.965871	0.224465	1.699981	1.452149
D(NSEI)	0.049622	-0.173919	-0.082179	0.019605	0.029651

1 Cointegrating Equation(s): Log likelihood -406.9285

Normalized cointegrating coefficients (standard error in parentheses)

EPF	INFL	WIR	M2	NSEI
1.000000	-1.747719	-1.698959	0.046496	-7.125215
	(0.31697)	(0.69664)	(0.02081)	(1.43612)

Adjustment coefficients (standard error in parentheses)

D(EPF)	-0.443316
	(0.13881)
D(INFL)	0.142163
	(0.03553)
D(WIR)	0.029884
	(0.02455)
D(M2)	-1.133576
	(0.39501)
D(NSEI)	-0.008263
	(0.01026)

2 Cointegrating Equation(s): Log likelihood -395.6569

Normalized cointegrating coefficients (standard error in parentheses)

EPF	INFL	WIR	M2	NSEI
1.000000	0.000000	1.131066	-0.058337	-4.821544
		(0.62809)	(0.00525)	(1.22071)
0.000000	1.000000	1.619268	-0.059983	1.318101
		(0.49484)	(0.00414)	(0.96174)
D(EPF)	-0.848952	0.665274		
	(0.23235)	(0.23238)		
D(INFL)	0.163381	-0.242732		
	(0.06354)	(0.06355)		
D(WIR)	-0.000607	-0.060462		
	(0.04351)	(0.04352)		
D(M2)	0.344945	2.380361		
	(0.62922)	(0.62930)		
D(NSEI)	-0.051365	0.002804		
	(0.01576)	(0.01576)		

3 Cointegrating Equation(s): Log likelihood -387.8297

Normalized cointegrating coefficients (standard error in parentheses)

EPF	INFL	WIR	M2	NSEI
1.000000	0.000000	0.000000	-0.070340	-9.125441
			(0.00516)	(0.86991)
0.000000	1.000000	0.000000	-0.077166	-4.843488
			(0.00730)	(1.23036)
0.000000	0.000000	1.000000	0.010612	3.805170
			(0.00523)	(0.88163)

Adjustment coefficients (standard error in parentheses)

D(EPF)	-0.962242	0.551996	0.078350

	(0.26079)	(0.26081)	(0.37147)	
D(INFL)	0.119860	-0.286248	-0.223116	
	(0.07035)	(0.07036)	(0.10021)	
D(WIR)	-0.028512	-0.088364	-0.108120	
	(0.04834)	(0.04835)	(0.06886)	
D(M2)	0.308570	2.343990	4.232177	
	(0.71580)	(0.71585)	(1.01958)	
D(NSEI)	-0.038048	0.016119	-0.049010	
	(0.01719)	(0.01719)	(0.02449)	

4 Cointegrating Equation(s): Log likelihood -384.2488

EPF	INFL	WIR	M2	NSEI
1.000000	0.000000	0.000000	0.000000	3.188946
				(4.24520)
0.000000	1.000000	0.000000	0.000000	8.665956
				(4.18661)
0.000000	0.000000	1.000000	0.000000	1.947346
				(0.43822)
0.000000	0.000000	0.000000	1.000000	175.0694

Adjustment coefficients (standard error in parentheses)

D(EPF)	-0.896678	0.402027	0.770964	0.027450
	(0.25916)	(0.27995)	(0.65283)	(0.02301)
D(INFL)	0.116305	-0.278115	-0.260677	0.011207
	(0.07171)	(0.07746)	(0.18064)	(0.00637)
D(WIR)	-0.044115	-0.052674	-0.272951	0.007313
	(0.04719)	(0.05097)	(0.11887)	(0.00419)
D(M2)	0.191615	2.611511	2.996664	-0.160399
	(0.72236)	(0.78031)	(1.81965)	(0.06414)
D(NSEI)	-0.039396	0.019205	-0.063258	0.000881
	(0.01750)	(0.01890)	(0.04408)	(0.00155)

TABLE 15

Vector Error Correction Estimates

Vector Error Correction Estimates
Date: 09/21/14 Time: 11:58
Sample (adjusted): 2002Q3 2012Q4
Included observations: 42 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	**CointEq1**				
EPF(-1)	1.000000				
INFL(-1)	-1.747719 (0.31697) [-5.51378]				
WIR(-1)	-1.698959 (0.69664) [-2.43881]				
M2(-1)	0.046496 (0.02081) [2.23467]				
NSEI(-1)	-7.125215 (1.43612) [-4.96145]				
C	124.2820				
Error Correction:	**D(EPF)**	**D(INFL)**	**D(WIR)**	**D(M2)**	**D(NSEI)**
CointEq1	-0.443316 (0.13881) [-3.19379]	0.142163 (0.03553) [4.00087]	0.029884 (0.02455) [1.21714]	-1.133576 (0.39501) [-2.86972]	-0.008263 (0.01026) [-0.80555]
D(EPF(-1))	0.218871 (0.22315) [0.98082]	-0.079778 (0.05712) [-1.39656]	-0.070549 (0.03947) [-1.78728]	0.902310 (0.63504) [1.42086]	-0.014393 (0.01649) [-0.87282]
D(EPF(-2))	-0.061331 (0.22384) [-0.27399]	-0.009466 (0.05730) [-0.16520]	-0.014642 (0.03959) [-0.36979]	-0.233257 (0.63701) [-0.36618]	-0.028308 (0.01654) [-1.71137]
D(INFL(-1))	-0.784532 (0.60456) [-1.29768]	0.141060 (0.15476) [0.91146]	0.040748 (0.10694) [0.38104]	0.610289 (1.72047) [0.35472]	-0.101489 (0.04467) [-2.27172]
D(INFL(-2))	-1.340649 (0.61810)	0.121602 (0.15823)	0.251113 (0.10933)	-1.076387 (1.75899)	-0.046978 (0.04568)

	[-2.16898]	[0.76852]	[2.29675]	[-0.61194]	[-1.02853]
D(WIR(-1))	-1.357570	0.776459	0.124510	-6.674652	-0.026802
	(1.25981)	(0.32250)	(0.22284)	(3.58515)	(0.09309)
	[-1.07760]	[2.40763]	[0.55873]	[-1.86175]	[-0.28790]
D(WIR(-2))	-1.505751	0.788982	0.143878	-2.765445	-0.031479
	(1.20631)	(0.30880)	(0.21338)	(3.43291)	(0.08914)
	[-1.24823]	[2.55496]	[0.67428]	[-0.80557]	[-0.35314]
D(M2(-1))	0.019923	0.025288	0.013596	0.254334	0.003289
	(0.06525)	(0.01670)	(0.01154)	(0.18570)	(0.00482)
	[0.30532]	[1.51382]	[1.17792]	[1.36959]	[0.68199]
D(M2(-2))	0.035052	0.001129	-0.000464	0.256571	-0.000216
	(0.06317)	(0.01617)	(0.01117)	(0.17976)	(0.00467)
	[0.55491]	[0.06984]	[-0.04153]	[1.42728]	[-0.04624]
D(NSEI(-1))	-1.517027	-0.402857	0.011375	-15.85961	-0.002833
	(3.03199)	(0.77616)	(0.53632)	(8.62843)	(0.22405)
	[-0.50034]	[-0.51904]	[0.02121]	[-1.83806]	[-0.01265]
D(NSEI(-2))	-0.086205	-0.410488	0.309592	-1.521153	0.188242
	(2.89644)	(0.74146)	(0.51234)	(8.24269)	(0.21404)
	[-0.02976]	[-0.55362]	[0.60427]	[-0.18455]	[0.87949]
C	5.110320	0.935186	-0.745029	14.93340	0.347043
	(2.15836)	(0.55252)	(0.38179)	(6.14226)	(0.15949)
	[2.36768]	[1.69258]	[-1.95143]	[2.43125]	[2.17589]
R-squared	0.494846	0.574573	0.413169	0.597009	0.307937
Adj. R-squared	0.309623	0.418584	0.197998	0.449246	0.054181
Sum sq. resids	875.5703	57.37736	27.39564	7090.853	4.781157
S.E. equation	5.402377	1.382960	0.955609	15.37406	0.399214
F-statistic	2.671624	3.683406	1.920186	4.040311	1.213516
Log likelihood	-123.3767	-66.14700	-50.62242	-167.3021	-13.96269
Akaike AIC	6.446511	3.721286	2.982020	8.538197	1.236319
Schwarz SC	6.942988	4.217763	3.478497	9.034674	1.732796
Mean dependent	2.641190	1.905952	-0.005476	27.08119	0.072381
S.D. dependent	6.501922	1.813703	1.067068	20.71619	0.410489
Determinant resid covariance (dof adj.)		963.4519			
Determinant resid covariance		179.1389			
Log likelihood		-406.9285			
Akaike information criterion		22.47278			
Schwarz criterion		25.16204			

TABLE 16

System Equations

D(EPF) = C(1)*(EPF(-1) - 1.74771857688*INFL(-1) - 1.69895929227*WIR(-1) + 0.0464955978126*M2(-1) - 7.1252146739*NSEI(-1) + 124.282027858) + C(2)*D(EPF(-1)) + C(3)*D(EPF(-2)) + C(4)*D(INFL(-1)) + C(5)*D(INFL(-2)) + C(6)*D(WIR(-1)) + C(7)*D(WIR(-2)) + C(8)*D(M2(-1)) + C(9)*D(M2(-2)) + C(10)*D(NSEI(-1)) + C(11)*D(NSEI(-2)) + C(12)

D(INFL) = C(13)*(EPF(-1) - 1.74771857688*INFL(-1) - 1.69895929227*WIR(-1) + 0.0464955978126*M2(-1) - 7.1252146739*NSEI(-1) + 124.282027858) + C(14)*D(EPF(-1)) + C(15)*D(EPF(-2)) + C(16)*D(INFL(-1)) + C(17)*D(INFL(-2)) + C(18)*D(WIR(-1)) + C(19)*D(WIR(-2)) + C(20)*D(M2(-1)) + C(21)*D(M2(-2)) + C(22)*D(NSEI(-1)) + C(23)*D(NSEI(-2)) + C(24)

D(WIR) = C(25)*(EPF(-1) - 1.74771857688*INFL(-1) - 1.69895929227*WIR(-1) + 0.0464955978126*M2(-1) - 7.1252146739*NSEI(-1) + 124.282027858) + C(26)*D(EPF(-1)) + C(27)*D(EPF(-2)) + C(28)*D(INFL(-1)) + C(29)*D(INFL(-2)) + C(30)*D(WIR(-1)) + C(31)*D(WIR(-2)) + C(32)*D(M2(-1)) + C(33)*D(M2(-2))
D(M2) = C(37)*(EPF(-1) - 1.74771857688*INFL(-1) - 1.69895929227*WIR(-1) + 0.0464955978126*M2(-1) - 7.1252146739*NSEI(-1) + 124.282027858) + C(38)*D(EPF(-1)) + C(39)*D(EPF(-2)) + C(40)*D(INFL(-1)) + C(41)*D(INFL(-2)) + C(42)*D(WIR(-1)) + C(43)*D(WIR(-2)) + C(44)*D(M2(-1)) + C(45)*D(M2(-2)) + C(46)*D(NSEI(-1)) + C(47)*D(NSEI(-2)) + C(48)

D(NSEI) = C(49)*(EPF(-1) - 1.74771857688*INFL(-1) - 1.69895929227*WIR(-1) + 0.0464955978126*M2(-1) - 7.1252146739*NSEI(-1) + 124.282027858) + C(50)*D(EPF(-1)) + C(51)*D(EPF(-2)) + C(52)*D(INFL(-1)) + C(53)*D(INFL(-2)) + C(54)*D(WIR(-1)) + C(55)*D(WIR(-2)) + C(56)*D(M2(-1)) + C(57)*D(M2(-2))

TABLE 17

System Equations - Probabilities

System: UNTITLED
Estimation Method: Least Squares
Date: 09/22/14 Time: 17:17
Sample: 2002Q3 2012Q4
Included observations: 42
Total system (balanced) observations 210

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.443316	0.138806	-3.193786	0.0017
C(2)	0.218871	0.223151	0.980817	0.3283
C(3)	-0.061331	0.223841	-0.273992	0.7845
C(4)	-0.784532	0.604565	-1.297681	0.1964
C(5)	-1.340649	0.618101	-2.168982	0.0317
C(6)	-1.357570	1.259806	-1.077602	0.2829
C(7)	-1.505751	1.206309	-1.248229	0.2139
C(8)	0.019923	0.065254	0.305317	0.7605
C(9)	0.035052	0.063168	0.554910	0.5798
C(10)	-1.517027	3.031992	-0.500340	0.6176
C(11)	-0.086205	2.896445	-0.029762	0.9763
C(12)	5.110320	2.158363	2.367683	0.0192
C(13)	0.142163	0.035533	4.000866	0.0001
C(14)	-0.079778	0.057125	-1.396558	0.1646
C(15)	-0.009466	0.057301	-0.165196	0.8690
C(16)	0.141060	0.154763	0.911455	0.3635
C(17)	0.121602	0.158228	0.768525	0.4434
C(18)	0.776459	0.322499	2.407631	0.0173
C(19)	0.788982	0.308804	2.554956	0.0116
C(20)	0.025288	0.016705	1.513823	0.1322
C(21)	0.001129	0.016170	0.069844	0.9444
C(22)	-0.402857	0.776163	-0.519036	0.6045
C(23)	-0.410488	0.741464	-0.553619	0.5807
C(24)	0.935186	0.552522	1.692577	0.0926
C(25)	0.029884	0.024553	1.217143	0.2255
C(26)	-0.070549	0.039473	-1.787283	0.0759
C(27)	-0.014642	0.039594	-0.369790	0.7121
C(28)	0.040748	0.106939	0.381041	0.7037
C(29)	0.251113	0.109334	2.296753	0.0230
C(30)	0.124510	0.222843	0.558734	0.5772
C(31)	0.143878	0.213380	0.674279	0.5012
C(32)	0.013596	0.011543	1.177917	0.2407
C(33)	-0.000464	0.011174	-0.041531	0.9669
C(34)	0.011375	0.536319	0.021210	0.9831
C(35)	0.309592	0.512343	0.604267	0.5466
C(36)	-0.745029	0.381786	-1.951433	0.0529
C(37)	-1.133576	0.395013	-2.869717	0.0047

C(38)	0.902310	0.635043	1.420864	0.1574
C(39)	-0.233257	0.637006	-0.366177	0.7147
C(40)	0.610289	1.720468	0.354723	0.7233
C(41)	-1.076387	1.758988	-0.611936	0.5415
C(42)	-6.674652	3.585152	-1.861749	0.0646
C(43)	-2.765445	3.432910	-0.805569	0.4218
C(44)	0.254334	0.185701	1.369592	0.1729
C(45)	0.256571	0.179762	1.427279	0.1556
C(46)	-15.85961	8.628430	-1.838064	0.0680
C(47)	-1.521153	8.242690	-0.184546	0.8538
C(48)	14.93340	6.142261	2.431254	0.0162
C(49)	-0.008263	0.010257	-0.805548	0.4218
C(50)	-0.014393	0.016490	-0.872820	0.3842
C(51)	-0.028308	0.016541	-1.711374	0.0891
C(52)	-0.101489	0.044675	-2.271725	0.0245
C(53)	-0.046978	0.045675	-1.028528	0.3054
C(54)	-0.026802	0.093095	-0.287900	0.7738
C(55)	-0.031479	0.089141	-0.353139	0.7245
C(56)	0.003289	0.004822	0.681989	0.4963
C(57)	-0.000216	0.004668	-0.046238	0.9632
C(58)	-0.002833	0.224052	-0.012645	0.9899
C(59)	0.188242	0.214036	0.879487	0.3805
C(60)	0.347043	0.159494	2.175892	0.0311
Determinant residual covariance		179.1389		

Equation: D(EPF) = C(1)*(EPF(-1) - 1.74771857688*INFL(-1) - 1.69895929227*WIR(-1) + 0.0464955978126*M2(-1) - 7.1252146739 *NSEI(-1) + 124.282027858) + C(2)*D(EPF(-1)) + C(3)*D(EPF(-2)) + C(4)*D(INFL(-1)) + C(5)*D(INFL(-2)) + C(6)*D(WIR(-1)) + C(7)*D(WIR(-2)) + C(8)*D(M2(-1)) + C(9)*D(M2(-2)) + C(10)*D(NSEI(-1)) + C(11) *D(NSEI(-2)) + C(12)

Observations: 42

R-squared	0.494846	Mean dependent var	2.641191
Adjusted R-squared	0.309623	S.D. dependent var	6.501923
S.E. of regression	5.402377	Sum squared resid	875.5703
Durbin-Watson stat	1.969444		

Equation: D(INFL) = C(13)*(EPF(-1) - 1.74771857688*INFL(-1) - 1.69895929227*WIR(-1) + 0.0464955978126*M2(-1) - 7.1252146739 *NSEI(-1) + 124.282027858) + C(14)*D(EPF(-1)) + C(15)*D(EPF(-2)) + C(16)*D(INFL(-1)) + C(17)*D(INFL(-2)) + C(18)*D(WIR(-1)) + C(19) *D(WIR(-2)) + C(20)*D(M2(-1)) + C(21)*D(M2(-2)) + C(22)*D(NSEI(-1)) + C(23)*D(NSEI(-2)) + C(24)

Observations: 42

R-squared	0.574573	Mean dependent var	1.905952
Adjusted R-squared	0.418584	S.D. dependent var	1.813703
S.E. of regression	1.382960	Sum squared resid	57.37737
Durbin-Watson stat	1.968220		

Equation: D(WIR) = C(25)*(EPF(-1) - 1.74771857688*INFL(-1) - 1.69895929227*WIR(-1) + 0.0464955978126*M2(-1) - 7.1252146739 *NSEI(-1) + 124.282027858) + C(26)*D(EPF(-1)) + C(27)*D(EPF(-2)) + C(28)*D(INFL(-1)) + C(29)*D(INFL(-2)) + C(30)*D(WIR(-1)) + C(31) *D(WIR(-2)) + C(32)*D(M2(-1)) + C(33)*D(M2(-2)) + C(34)*D(NSEI(-1)) + C(35)*D(NSEI(-2)) + C(36)

Observations: 42

R-squared	0.413169	Mean dependent var	-0.005476
Adjusted R-squared	0.197998	S.D. dependent var	1.067068
S.E. of regression	0.955609	Sum squared resid	27.39564
Durbin-Watson stat	1.984635		

Equation: D(M2) = C(37)*(EPF(-1) - 1.74771857688*INFL(-1) - 1.69895929227*WIR(-1) + 0.0464955978126*M2(-1) - 7.1252146739 *NSEI(-1) + 124.282027858) + C(38)*D(EPF(-1)) + C(39)*D(EPF(-2)) + C(40)*D(INFL(-1)) + C(41)*D(INFL(-2)) + C(42)*D(WIR(-1)) + C(43) *D(WIR(-2)) + C(44)*D(M2(-1)) + C(45)*D(M2(-2)) + C(46)*D(NSEI(-1)) + C(47)*D(NSEI(-2)) + C(48)

Observations: 42

R-squared	0.597009	Mean dependent var	27.08119
Adjusted R-squared	0.449246	S.D. dependent var	20.71619
S.E. of regression	15.37406	Sum squared resid	7090.853
Durbin-Watson stat	1.974407		

Equation: D(NSEI) = C(49)*(EPF(-1) - 1.74771857688*INFL(-1) - 1.69895929227*WIR(-1) + 0.0464955978126*M2(-1) - 7.1252146739 *NSEI(-1) + 124.282027858) + C(50)*D(EPF(-1)) + C(51)*D(EPF(-2)) + C(52)*D(INFL(-1)) + C(53)*D(INFL(-2)) + C(54)*D(WIR(-1)) + C(55) *D(WIR(-2)) + C(56)*D(M2(-1)) + C(57)*D(M2(-2)) + C(58)*D(NSEI(-1)) + C(59)*D(NSEI(-2)) + C(60)

Observations: 42

R-squared	0.307937	Mean dependent var	0.072381
Adjusted R-squared	0.054181	S.D. dependent var	0.410489
S.E. of regression	0.399214	Sum squared resid	4.781157
Durbin-Watson stat	1.981152		

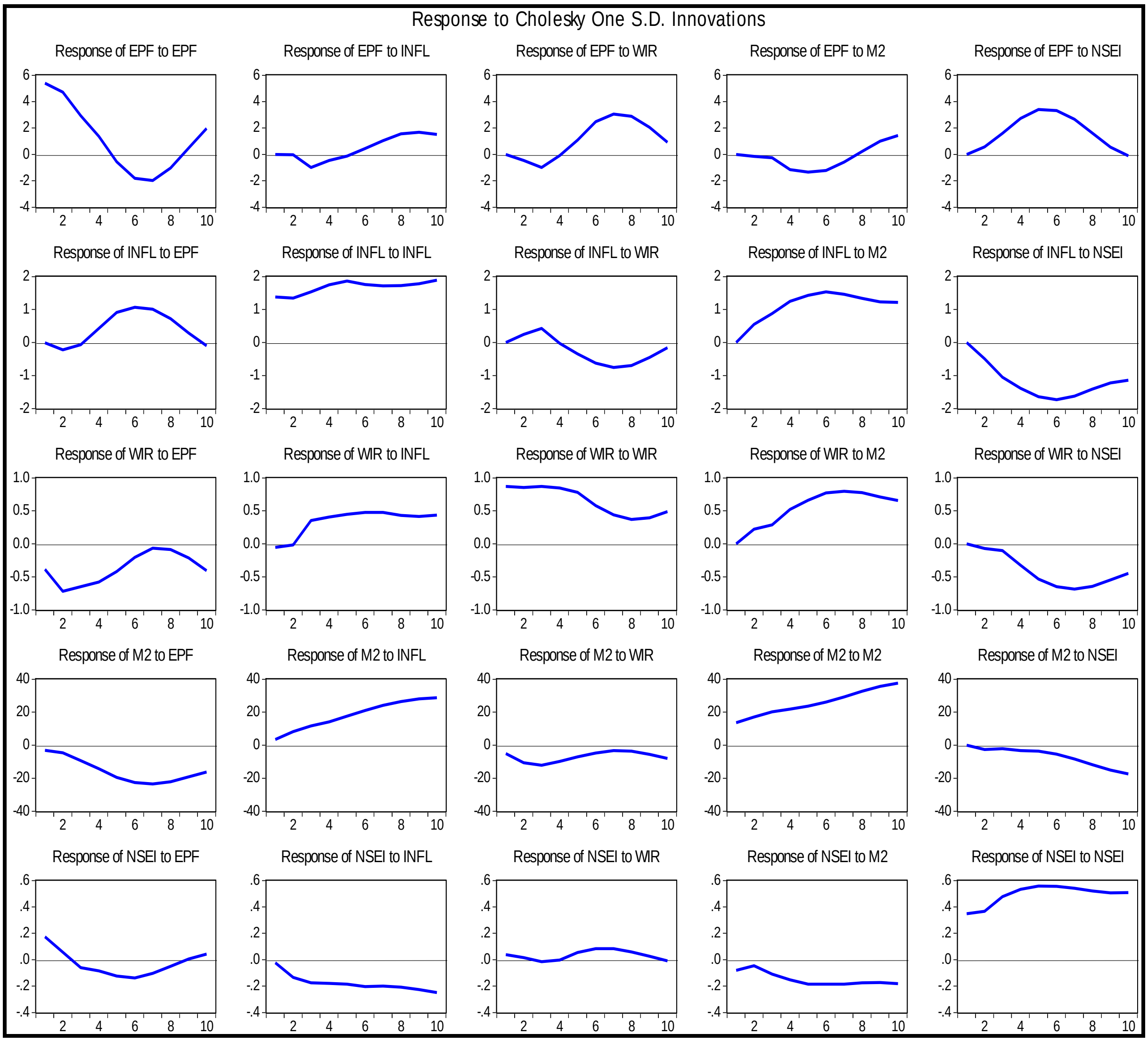
TABLE 18

Variance Decomposition

Variance Decomposition of EPF: Period	S.E.	EPF	INFL	WIR	M2	NSEI
1	5.402377	100.0000	0.000000	0.000000	0.000000	0.000000
2	7.205824	98.92584	0.000953	0.407322	0.039064	0.626824
3	8.067283	92.14238	1.503519	1.840294	0.123613	4.390191
4	8.714723	81.40387	1.558486	1.588796	1.876679	13.57217
Variance Decomposition of INFL: Period	S.E.	EPF	INFL	WIR	M2	NSEI
1	1.382960	0.004925	99.99507	0.000000	0.000000	0.000000
2	2.096537	1.157100	85.00765	1.403095	6.925037	5.507119
3	2.969569	0.629179	69.12997	2.735534	12.26923	15.23608
4	3.942100	1.542490	58.99749	1.555586	16.92825	20.97619
Variance Decomposition of WIR: Period	S.E.	EPF	INFL	WIR	M2	NSEI
1	0.955609	16.30721	0.311490	83.38130	0.000000	0.000000
2	1.485878	30.01632	0.140532	67.39579	2.225144	0.222207
3	1.898357	30.12655	3.526884	62.27890	3.633568	0.434090
4	2.280281	27.34429	5.625320	56.94042	7.744625	2.345344
Variance Decomposition of M2: Period	S.E.	EPF	INFL	WIR	M2	NSEI
1	15.37406	4.335977	5.160221	11.08384	79.41997	0.000000
2	27.15131	4.306095	10.81255	18.78799	65.10117	0.992197
3	39.01284	7.934354	14.12422	18.86564	58.27792	0.797863
4	50.14678	12.96408	16.41805	15.32845	54.38518	0.904238
Variance Decomposition of NSEI: Period	S.E.	EPF	INFL	WIR	M2	NSEI
1	0.399214	18.81021	0.346869	0.952918	4.116958	75.77304
2	0.563622	10.45695	5.859123	0.550327	2.724255	80.40934
3	0.769462	6.236649	8.375780	0.336146	3.497305	81.55412
4	0.969157	4.686445	8.725200	0.212462	4.651735	81.72416
Cholesky Ordering: EPF INFL WIR M2 NSEI						

FIGURE 5

Impulse Response Functions



Source: Author, 2014

APPENDIX III

TABLE 19

Research Time Frame

TASK/MONTH	APR	MAY	JUN	JUL	AUG	SEP	OCT
Identifying of Research Problem							
Identifying the Research Topic							
Writing of Research Proposal							
Proposal Defense							
Correction on Defense							
Data Collection							
Data Analysis							
Dissertation Defense							
Correction on Final Dissertation Copy and Submission of Final Copy							

APPENDIX IV

BUDGET

ITEM		ESTIMATED COST (KSHS)
1.	Printing Papers and Binding	5,000.00
2.	Printer Toners	3,000.00
3.	Transport and Fuel Expenses	4,500.00
4.	Telephone Expenses	2,500.00
5.	Internet Expenses	10,000.00
6.	Data Collection Expenses	5,000.00
7.	Data Analysis Tool – EViews 7.0	10,000.00
8.	Other related Expenses	10,000.00
	TOTAL ESTIMATED EXPENSES	**50,000.00**