Effect of Macroeconomic Variables on Stock Market Returns Ghana: An Analysis Using Arbitrage Pricing Model

By

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A thesis to the Institute of Distance Learning, Kwame Nkrumah University of Science and Technology in partial fulfilment of the requirement for the degree of

COMMONWEALTH EXECUTIVE MASTER OF BUSINESS ADMINISTRATION

Institute of Distance Learning, KNUST

September, 2012

CERTIFICATION

I hereby declare that this submission is my own work towards the CEMBA and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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Head of Department's Name Signature Date

DEDICATION

This thesis work is dedicated to The Almighty God, my mother, Mad. Felicia Yaa Amponsaa, my sweet wife, Irene A. Adu and to my two lovely boys Nana Kwabena Amponsah Adu and Nana Kwabena Duffuor.

ABSTRACT

This work attempts to use Arbitrage Pricing Theory framework to explain the variations on returns on the Ghana Stock Exchange. Ordinary Least Squares Regression and cointegration analysis were employed to model both the short- and long-run relationships. In addition, granger causality tests were used to examine the causality between the GSE All-Share index and seven macroeconomic variables namely money supply, rate of inflation, treasury bill rate, exchange rate, world crude oil prices, world cocoa prices and gold prices. Results from the Ordinary Least Squares regression analysis showed that four out of the seven macroeconomic variables possess statistically significant power for stock returns on the Ghana Stock Exchange: inflation rate, the treasury bill rate, money supply and world crude oil prices. On the other hand, the Foreign exchange rate, world cocoa prices and world gold prices do not appear to have a statistically significant effect on stock prices in Ghana. However, while the Engle and Granger cointegration test results signal the existence of an overall long-run relationship between stock returns and the observed variables on the GSE, the same could not be said of the long-run relationship between individual macroeconomic variables and stock returns. On the contrary, the Johansen and Juselius cointegration test shows the existence of at least two cointegrating relationships between stock returns and the macroeconomic variables. Additionally, the Engle and Granger causality test points to uni-directional causality between stock returns and the foreign exchange rate and the money supply. In the light of the above findings, Industry and academia should partner each other to conduct research which focuses on different aspects of the market and the findings should be made available to industry and the government should set realistic macroeconomic targets to limit chronic deviations which normally render fundamental analysis almost impossible in order to improve public confidence in government decisions.

ACKNOWLEDGEMENT

To God be the glory for the great things He has done. I am indeed very grateful to the Almighty God for all that He has done in my life and what He continues to do. This work could not have been completed without His care, guidance and protection.

Since the God Almighty works through people with the capacity to guide and direct, there is the need to extend my recognition to them for their support and advice. I therefore wish to express my profound and inexhaustible appreciations and thanks to my Supervisor, Mr. Benjamin Amoah for his excellent supervision, care, his brilliant advice and for his special interest in my work. Mr Amoah, you are an excellent supervisor and a brother indeed.

Sincere thanks also go to my Daddy and remodel Dr. Kwabena Duffuor, Minister of Finance and Economic Planning for his support and special interest in my life especially for encouraging me to major in finance which has been very fruitful and useful in my career. I am also very grateful to my brother Dr. Collins Ntim Gyakari of University of Glasgow, UK who has been very inspirational and supportive in my MBA course especially during the project work. I am very grateful for your support and advice. To Dr Mrs I. Oduro, Prof (Mrs) V.P. Dzogbefia, Dr Arthur and Mrs F.O.Mensah all of Biochemistry and Biotechnology department I say I am grateful for your guidance, care and interest in my life. Special thanks also go to Nana Adwoa, Mr. and Mrs. Williams, Richard, Michael, Philip, Peter, Kendrick and Mr. Asante my course mates. You made distance Executive MBA a better experience.

Sincere appreciation is expressed to my sweet mother, Mad Felicia Yaa Amponsaa and my late Dad, Mr Joseph Kwame Yamoah, my siblings Mrs. Joyce Agyeiwaa Nartey, Vida Saa Yamoah, George Asumadu-Sakyi and Joseph Bediako for their support, patience and tolerance during this course and in my entire life.

To Dr Kwabena Duffuor Jnr, Executive Director II, Mr. Samuel Sakyi- Hyde, Head of SME, Mrs Elizabeth Honny, Branch Manager, Osu, Gertrude Osekre, Branch Manager, Makola, Samuel Quartey, Branch Support Manager, Koforidua, Lambert Kwadwo Adjei and Fred Adajawah, Kaneshie all of UniBank Ghana Limited and Samuel Anum Okan, Head of SME and Charles Annan Kwofie, SME Coordinator both of FCSL, Eureka and Lawrence Owusu (PhD. student, China) I say thanks for their support and the assistance rendered during the course of this work.

Finally, I wish to leave on record my heartfelt thanks to my sweet wife Mrs Irene A. Adu for her unfailing support, unlimited patience, care and love during this course. To my two strong boys, Nana Kwabena Amponsah Adu and Nana Kwabena Duffuor I say you guys kept me awake to do my studies and I say well done.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

One of the most academically intriguing and challenging topics still being debated in the financial literature is the measurement of financial asset values. A financial asset is an intangible representation of the monetary value of a physical item. It obtains its monetary value from a contractual agreement of what it represents. While a real asset, such as land has physical value, a financial asset is a document that has no fundamental value of itself until it is converted to cash. Common types of financial assets include certificates, bonds, stocks and bank deposits.

One of the most common types of financial assets is a certificate of deposit (CD). A CD is an agreement between an investor and a bank in which the investor agrees to keep a set amount of money deposit in the bank in exchange for a guaranteed interest rate. The bank may offer a higher amount of interest payment since the money is to remain untouched for a set period of time. If the investor withdraws the CD before the end of the contract terms, the investor will lose out on the interest payments and be subject to financial penalties.

Another type of financial asset is a bond. Bonds are often sold by corporations or governments to investors in order to help fund long-term projects. They are a type of legal document detailing the amount of money an investor loaned a borrower and the length of time it needs to be paid. A bond represents how much interest is guaranteed to be returned to the investor along with the original loan amount. Stocks are one of the only financial assets that do not have an agreed upon ending date. Investing in stocks means the investor has part ownership of a company and shares in the

company's profits and losses. The investor can keep the stock for any length of time or decide to sell it to another investor.

Based on the modern portfolio theory originally conceptualized by Markowitz, (1952) the valuation of financial assets rests on two aspects of the assets, that is, risk and return. In fact, Markowitz, (1952) sets the golden rule underlining the theory of investment that "investors seek either to maximise returns at a given level of risk or to minimise risk at a given level of returns on their investment. Generally speaking, modern financial theory has priced financial assets mainly under the broad framework of the two financial valuation models: Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT). The Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT) fully adapt Markowitz's (1952). Modern Portfolio Theory explains asset returns from different perspectives. In particular, the CAPM is a one factor model which relies mostly on a measure, beta, which emphasises the sensitivity of asset volatility to the volatility of the whole market. On the other hand, the APT is a multifactor model, which traces the expected return on a number of securities to their sensitivities.

1.1.1 A Brief Overview of the Ghanaian Economy and Stock Market Development in Ghana

Ghana, the first Black Country sub of the Sahara to gain independence from its colonial masters: Great Britain which occurred in1957. The colonial masters (Great Britain) can best be described as a country with chequered history both politically and economically. With agriculture as its backbone, a leading exporter of Cocoa and Gold, per capita income of over $400, a population of nearly 5 million and external

reserves of over 3 billion Great Britain Pounds in 1957, Ghana was arguably the richest country in Sub-Sahara Africa ahead of even Oil rich and continental giant, Nigeria.

Indeed, the Bretton Wood institutions ranked Ghana as a middle-income country placing it even ahead of modern day Asian Tigers like Malaysia, Hong Kong, Thailand, Singapore and South Korea in 1956. However, after independence, economic mismanagement, over-spending, declining export revenue as a result of over-reliance on few primary exports, mainly cocoa and gold coupled with record low prices for them on the international market and four successive military coup d'états saw reserves reduced significantly since 1959. This economic deterioration continued into the 1970s and early 1980s leading to a general economic decline. Indeed, GDP was uncharacteristically negative, inflation hit record triple figures (110%, 1978). Further, not only was the financial sector totally in tatters but also commercial banks balance sheets were dominated by non-performing assets notwithstanding their financial and technological bankruptcy.

To address the country's economic decline, the then government pursued a World Bank backed Economic Recovery Programme (ERP) which was renamed locally as Structural Adjustment Programme (SAP) with the aim of liberalising the economy so as to encourage private sector participation in 1983. The emphasis here was on trade liberalisation and the diminution of the role of the state to promote the market approach to development. It was however; felt that for the programme to achieve the desired results there should be a dynamic financial sector to facilitate the payment system and to enhance the allocation of resources. This brought about the Financial Sector Adjustment Programme (FINSAP) as a key component of the ERP. The FINSAP was instituted in two phases: between 1988-1990 and 1990-1991 as a key

component of the ERP by the government to overhaul and revamp the financial sector as well as to create a financial sector that is more efficient and responsive to the needs of the productive sectors of the economy. The most important policies implemented concerned the development of money and capital or security markets and also the promotion and strengthening of the non-bank financial institutions.

The ERP adopted began bearing fruits. Inflation, interest rates decreased significantly to even single digits levels in the early 1990s and other macroeconomic variables generally stabilised. The World Bank described Ghana as a miracle and model case of success story in Africa. It became clear that the establishment of stock market could no longer be delayed.

Accordingly, the Ghana Stock Exchange (GSE) was incorporated in July 1989 as a private company limited by guarantee under the Ghana Companies Code, 1963 (Act 179). It is however, worthy to note that the idea of establishing a stock market in Ghana was mooted as early as 1968 when the Pearl report was submitted to the Second Republican Civilian Government in 1969 incorporated what became known as the Accra Stock Exchange. Unfortunately, this did not see the light of day due to lack of stable political and macroeconomic environment. The status of the Accra Stock Exchange has been changed to a public company limited by guarantee under the Companies Code in April 1994. The Exchange was given recognition as an authorised stock exchange under the Stock Exchange Act of 1971 (Act 384) in October 1990 and trading on the floor of the Exchange commenced on November 12, 1990.

And since its inception, it has been of tremendous help in terms of mobilising long-term funds for companies, thus facilitating resource flow to the appropriate investment opportunities sectors.

Table1.1: Top Five Listed Equities on the GSE

Name of Company	Year of Listing	Market Capitalisation (GH¢) million	Issued Shares (Million)
AngloGold Ashanti	2004	12,965.43	381.34
Ecobank Transnational Incorporation	2006	1,616.78	12,436.76
Tullow Oil Plc	2011	31,643.68	903.85
SG-SSB Limited	1995	146.91	333.89
Standard Chartered Bank	1991	995.29	19.25

Source of Data: Ghana Stock Exchange 2012.

Table1.1 above also presents the top five listed equities by company capitalisation and performance on the market accounting for over 50% of the total market capitalisation. The financial instruments traded on the Exchange currently are ordinary shares (common stock) and bonds. However, the Exchange's regulations allow other financial products such as collective investment schemes and municipal bonds to be listed and traded. Some of the requirements for listing on the GSE include capital adequacy, profitability, spread of shares, year of existence and management efficiency (Adjasi, 2009). The performance of the exchange is mainly assessed by the GSE All Share Index which is a weighted index. The GSE is governed by a council

with representation from licensed members, listed companies, insurance companies, banks, the money market and the general public. The activities of the GSE are mainly regulated by the Securities and Exchange Commission. The GSE enjoyed a buoyant run between 2002 and 2004, with the GSE All Share Index rallying to reach an all period high of 7,316.31 by close of August, 2004 (Adjasi, 2009). It was adjudged as the world's best-performing market at the end of the first quarter 2004; with a year return of 144 percent in US dollar terms compared to 30 percent return by Morgan Stanley Capital International Global Index, 26 percent Standard and poor in USA and 32 percent in Europe amongst others (Databank, 2004).There are currently 17-licensed stocks--broking firms trading on the Exchange. Common shares of 37 companies are listed and traded on the Exchange with the Government of Ghana 2-, 3-, and 5-year bonds as well as two corporate bonds issued HFC Housbond. Based on above enumerated developments, it is important to determine the effect of macroeconomic variables such as inflation, GDP, Interest rate, Treasury bill among others on stock returns in Ghana.

1.2 The Problem Statement and the need for the study

The stock exchange provides investors with an efficient mechanism to liquidate or make investments in securities (Monther and Kaothar, 2010). Modern financial theory has focused on systematic risk such as inflation, interest rate among others as sources of risk. This means that in the long run, the return on individual asset reflect the influence of systematic economic fundamentals. Many studies on the US, the UK and other advanced countries, have attempted to establish the relationship between security returns and economic indicators (Patra and Poshakwale, 2006, Wongbangpo and Subhash, 2002, Liow et al.,, 2006, Clare and Thomas, 1994, Mukherjee and Naka,

1995, Al-Jafari et al., 2011). The importance of establishing these relationships to investors is extremely important given that the risk faced by investors may be traced to the changing values of these economic factors. Several empirical studies have tested these relationships using the APT on US data e.g. Flanney and Protopadakis, (2002); Chen, 1991; Cheung and Ng, (1998), Humpe and Macmillan, (2007); and their results show that the theory has the potential for explaining returns in the US capital markets.

Capital markets of US, UK, Australia, Turkey and Japan among others have attracted the attention of many researchers in the past due to their size and prominence in the world capital markets (Gjerde and Saettem, (1999), Humpe and Macmillan, (2007), Kaplan, 2008, Mukherjee and Naka, (1995) and Clare and Thomas, (1995). The developing and emerging capital markets of Africa including that of Ghana are also attracting world attention as markets of the future with a lot of potential for investors. Yet, there are no comprehensive studies linking these capital markets returns with macroeconomic indicators such as interest rates, inflation, and money supply among others which to a large extent are expected to influence capital market activities.

1.3 Justification of the problem statement

The purpose of this research therefore is to fill in this yawning gap i.e. to establish the linkage between the changing levels of macro-economic fundamentals and Ghana Stock Exchange All Share Index as far as the Ghana stock market is concerned. In Ghana and elsewhere in Africa, where macroeconomic management has become problematic, such a research will be of great interest to current as well as potential investors wishing to invest on the capital market of Ghana in particular and Africa in

general. With increasing investor interest in Africa, the need for this research at this time is of paramount interest to all the stakeholders of the Ghana's capital market.

1.4 Objectives of Study

The main objective of this study is to examine the effect of macro-economic variables on the Ghana Stock Exchange All Share Index.

1.4.1 Specific objectives

i. To determine whether macroeconomic variables have any significant explanatory power of returns on the stock market.
ii. Attempt to ascertain whether there is a long-run association between the individual macro-economic variables and the GSE All Share Index.
iii. Seeks to throw light on the much reported problem of changing macro-economic variables significance on the Ghana stock exchange.

1.5 Hypothesis of the Study

This study attempts to prove that:

H_0: There is a weak relationship between All Share Index and macroeconomic variables.

H_1: There is a strong relationship between All share Index and macroeconomic variables.

Mathematically,

$H_0=0$

$H_1\neq0$

1.6 Significance of the study

The study has many policy and useful implications. If the study establishes that stock prices and economic activity are related for the Ghana stock market; then, it should be possible to predict the duration of recessions and expansions in the economy. It is possible to forecast the ideal time to buy stocks as well as the ideal time to sell stocks. To that effect, the role of the stock market as an economic indicator is properly understood. The research findings will also be useful to academia by assisting lecturers, students, instructors and other future researchers to approach the subject matter with deeper understanding as well as serving as a source of reference.

1.7 Scope of the study

The research focuses on Ross,(1976) APT and the GSE All Index Share from the period 1991-2009.The macroeconomic variables to be considered include Money supply, Exchange rate, Inflation, Treasury bill rate, the World gold, cocoa and crude oil prices. The period 1991-2009 has been chosen because it covers the period where the GSE experienced normal and abnormal growth in returns. It is hoped that this gives a true, fair and objective research result.

1.8 Limitations of the Study

Some of the limitations of the study include:

i. Generalization of the outcome of this research may not give an accurate reflection of what goes on in all other markets. This stems from the fact that one can hardly find two stock markets or even a group of stock markets that have the same features.

ii. The APT considers a lot of macroeconomic factors but this research is limited to seven macroeconomic variables namely Money supply, Exchange rate, Inflation, Treasury bill rate, the world gold, cocoa and crude oil prices.

iii. Using the GSE ALL-Share index to proxy for returns might not be ideal as it only captures the capital gains component of stock returns and leaves out the dividend portion of share returns.

1.9 Organisation of the Study

This dissertation is organised into five chapters. Chapter One gives a background to the study and provides an overview of the Ghanaian economy and its stock market development .The chapter also sets out the research problem and significance and scope of the study. Chapter two reviews the literature and provides the theoretical framework which forms the basis of the research. The philosophical assumptions underpinning the research and the research methodology are presented in chapter three while chapter four discusses the analysis and the research findings. Finally, Chapter five offers a number of concluding observations and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The pricing of financial assets emanates from Markowitz's (1952) Modern Portfolio Theory. This theory is concerned with the expected return and risk of a portfolio. Thus it is based on the assumption that investors are rational and that they choose to hold efficient portfolios which maximise return for a given degree of risk or minimise risk for a given return. Based on the theory, efficient portfolios can be identified by an analysis of information for each security regarding its expected return and variation. Macroeconomists have been concerned with the influences on stock returns as well as aggregate stock market returns. However most of these works are from the developed markets such as US and UK, whilst only mixed evidence exists for the case of developing markets like the GSE. This chapter therefore seeks to review existing literature on the relationship between macroeconomic variables and stock returns.

2.2 Pricing of Financial Asset

Financial asset – pricing theories try to understand why certain capital assets have higher expected returns than others and why the expected returns are different at different points in time. There are different financial asset pricing theories, based on different set of assumptions. Two such asset pricing theories are Capital Asset Pricing Model and Arbitrage Pricing Model. Capital Asset Pricing Model is the most basic asset pricing theory.

2.3 Capital Asset Pricing Model

The model was developed independently by Sharpe, (1964), Litner, (1965) and Mosin, (1966). The CAPM is based on very simplified assumptions. Basically, the theory ask the following question: what are the equilibrium rates of returns if all investor apply the mean-variance criterion to an identical mean-variance-effect set?

2.3.1 The Theory

The CAPM operates on the following important implications.

i. In equilibrium, investors, irrespective of the risk preference, hold the market portfolio of risky asset. Still different investors hold different combination of the market portfolio and the riskless asset. The property is called the separation principle (Post and Levy, 2005).

ii. Since everybody holds the market portfolio, the risk of an individual asset is characterised by co-variance with respect to the market; the remaining risk is diversified away. A standardised co-variance with the market is known as market beta. A beta is the correct measure of risk for dividing asset and portfolio. To that effect investors can use either beta or variance to size up risk without affecting the ranking of the portfolio by their risk (Post and Levy, 2005).

iii. Since non-systematic risk is diversified away, the investors need to be compensated for bearing systematic risk (as measured by market beta) but not for non-systematic risk (Post and Levy, 2005).

2.3.2 Assumption behind CAPM

The capital market is characterised by perfect competition. There are a large number of investors, each with wealth that is small relative to the total market value of all

capital asset. Thus, the portfolio choice of individual investors have no noticeable effect on the price of the securities: investors take the price as given.

i. All investor choose their portfolio according to the mean – variance criterion, that is each investor select the optimal portfolio the mean-variance efficient that is optimal given the investors expectation about the means variance and covariance of the asset and given the investors preference. The mean – variance criterion ignores practical consideration such as transaction cost and taxes (Post and Levy, 2005).

ii. All investors have the same expectation regarding the future, in terms of the mean, variances and co-variances that is homogeneous expectation. The assumption requires that all investors have access to the same information (Post and Levy, 2005).

iii. Investors can borrow and lend at a risk-free interest rate. The variance of the risk –free asset, as well as on the covariance with other asset is zero (Post and Levy, 2005).

Under these assumptions, all investor face an identical efficiency frontier. The only difference between investor is the amount of wealth they must invest and the personal trade – off they make between portfolio mean and portfolio variance.

2.4 Capital Asset Pricing Model Anomalies

The following three stock market anomalies are well-documented.

2.4.1 The Size Effect

Firm with a low market capitalisation (small caps) seem to earn positive abnormal returns, while large caps earn negative abnormal returns (Fama and French 1992). The size effect generally not very strong if the portfolio is sorted out only on size. This is

because size and beta are correlated very strongly: small firms typically have high betas. However, the size effect generally appears if a double sorting is performed first on beta and then on the size. Small caps generally outperform big caps of comparable beta. Estimate for the abnormal return on small caps are around 2-4% per annum (Post and Levy, 2005).

2.4.2 The Value Effect

The value effect denotes the fact that value stock seem to earn abnormal high average returns while growth stocks earn negative abnormal returns (Fama and French 1992). The abnormal return on the value stock is estimated at about 4-6% per annum (Post and Levy 2005).

2.4.3 The Momentum Effect

The momentum effect is even stronger than the size and value effects; estimated for the abnormal returns range from about 4-6% per annum. For example pure-momentum strategies involve very high turnover. Consequently, transaction cost and taxes can significantly erode momentum profit. Momentum effect is stronger among small-cap stocks, which tend to be less liquid (Post and Levy, 2005).

2.5 The theoretical framework of the Arbitrage Pricing Theory

The Arbitrage Pricing Theory (APT) was introduced by Ross (1976, 1977) as an alternative to the Capital Asset Pricing Model (CAPM) by Sharpe (1964), Lintner (1965) and Mossin (1966), and extended by Huberman, (1982), and Chamberlain and Rothschild, (1983). Now there is a lot of theoretical literature about the theory with various empirical studies. APT depends on the law of one price and categorizes the risk of an asset into two parts: systematic and unsystematic risks.

Indeed, Clare and Thomas, (1994) signal that macroeconomists for a long time have always been fascinated by the question: what macro-economic factors influence stock market returns? For example, Flanney and Protopadakis, (2002); and Singh et al., (2010) have all examined the role of inflation on stock returns. Other researchers including Gjerde and Frode, (1999), Gilbert, (2008), Karamustafa and Kucukkale, (2003), Destefano, (2004) and Butt et al., (2009); have also drawn attention to the possibility of the influence of un-exhaustive list of macroeconomic variables on stock returns. Osei (2001) claims that researchers interest in developing macroeconomic relationship to stock returns has arisen partly due to the fact that the Capital Asset Pricing Model (CAPM) assumes that the only risk that an investor must be concerned with is uncertainty about the future price of a security. Investors however, usually are concerned with other risks that will affect their ability to consume goods and services in the future. For example, uncertainty about macroeconomic conditions such as GNP, interest rates, inflation, and future labour income are all extra risk sources apart from the market risk. Merton, (1973) recognizing these extra-market sources of risk (also referred to as factors) extended the CAPM to multifactor CAPM.

The Arbitrage Pricing Theory (APT) is generally assumed to be an equilibrium-pricing model that expands the original CAPM from a single-factor to a multi-factor model. It avails many advantages over and above the traditional CAPM in terms of less stringent assumptions while retaining a higher degree of generality. Its intuitive content and formulation are quite appealing for empirical researchers in the field of finance. Macroeconomic factors are even more likely to influence African investment returns due to the fact that most of the African economies are developing economies

and as such very fragile and non resilient to both internal and global shocks. In view of these influences on African markets which are all mainly in transitional stage including that of Ghana, it will be in the interest of investors, government, academia, industry, regulatory bodies and many others to test the impact of macroeconomic variables on the Ghana stock market, particularly on the listed securities on the exchange under the broader framework of the Arbitrage Pricing Theory of Ross, 1976.

2.5.1 Arbitrage Pricing Theory

Ross, (1976) developed the Arbitrage Pricing Theory (APT) – a capital asset valuation technique that assumes that the return on an asset is a linear function of any number of macroeconomic factors. The APT states that the realized return on an asset is composed of the expected return on that asset at the beginning of a time period and the unexpected realization of *K* risk factors during that time period plus firm specific risk. The theory is basically based on two concepts. The first one is the generation of returns. A number of factors are assumed to generate the returns on risky assets. These factors are systematic in nature, that is, the affect all risky assets to some extent. Another concept of the APT is the principle of arbitrage. It is argued that in a well-functioning capital market any two assets that offer identical returns and risks will sell for the same price. If the assets were to sell at different prices then risk-free profits would be available to those investors who engage in arbitrage operations between the two assets, that is, simultaneously buy one asset and sell the other. As a result of this arbitrage activity the two prices will be driven to equality eventually. The Arbitrage Pricing Theory relates the expected return of an asset to the return from

the risk-free asset and a series of other common factors that systematically enhance or detract from that expected return, which can be formulated as:

$$E(R) = R_f + \beta_{j1} * E(RF_{1)} - R_f) + ... + \beta jk * E(RF_{k)} - R_f$$

Where

R= The return on the asset

R_f = The risk free rate of return,

β_j = The sensitivity of the asset to a particular factor – that is, the covariance of the asset's returns with the changes in the particular factor,

RF_k = The expected return on a portfolio with an average of 1.0 sensitivity to a factor. *k*, that systematically affects returns, a factor common to all asset returns,

J = An asset,

k = A factor,

E = An expected variable, Cheney and Moses, (1992).

The APT is not only ex-ante, expectation model, just like the CAPM, but also the model can be written in ex-post, realized terms. Realized returns, the returns the investor receives, are the sum of the returns expected as a result of that asset's sensitivity to the common factors, the returns that result from unexpected changes in the common factors and others from asset-specific or idiosyncratic events, that is, unsystematic risks:

$$E(R_j) = E(R_j) + \beta_{j1} * E(RF_1 - R_{f)} + ... + \beta_{kj} * E(RF_{k)} - R_{f)} + \varepsilon_i$$

Where;

$E(R_j)$ = The returns expected as a result of that asset's sensitivity to the common factors,

$\beta_{j1} * E(RF_{1)} - R_{f)} + ... \beta_{jk} * E(RF_{k)} - R_{f)} =$ the returns result from unexpected changes in the common factors, which compensated the systematic risks,

$\varepsilon_i =$ The returns that arise from asset-specific, or idiosyncratic events, assumed to be mutually independent over time and negligible for large numbers of assets.

The APT has fewer assumptions than CAPM amongst them are:

i. Investors are risk-averse and seek to maximise their terminal wealth
ii. Investors can borrow and lend at the risk-free rate
iii. There are no market frictions such as transaction costs, taxes, or restrictions on short-selling.
iv. Investors agree on the number and identity of the factors that are important systematically in pricing assets.
v. Riskless profitable opportunities above the risk free rates are immediately arbitraged away.

As the APT expands the original CAPM from the one-factor model to a multifactor model, it offers many advantages over the traditional CAPM in terms of less unrealistic assumptions and higher generality. However, the model only describes the factors that are important for a statement about the relationship between expected returns of securities and the common features of those securities, Fama, (1991). It says nothing about either the magnitudes or the signs of the factor coefficients, or the exact number of factors themselves.

This might be seen as both a strength and weakness. This is because it gives the researcher empirical challenge to determine the number of factors and identify the various economic theories underlying the selection of each factor (Opfer and Bessler,

(2004). On the other, it may be seen as granting the researcher the freedom to select macro-variables peculiar to the economy under consideration. Generally speaking, the APT emphasises the role of the covariance between asset returns and the endogenous market portfolio, Butt et al., (2010). Both the CAPM and APT are derived under restrictive assumptions. The truth is that none of them perfectly offers satisfactory explanation of security valuation due to the fact that the traditional CAPM is un-measurable, Roll (1977), just as the APT also fails to specify neither the number of important factors nor their identity, Clare and Thomas, (1994) even though on comparative basis, the APT offers a better explanatory power of stock returns and macro-variables than CAPM, Groenewold and Fraser, (1997).

2.6 Empirical Review on the Arbitrage Pricing Theory and Individual Macroeconomic Variables

How financial assets are priced in the capital markets has been one of the most popular but controversial topics in the financial literature for decades. The main streams of capital market pricing theories are based on the Modern Portfolio Theory of Markowitz (1952) and developed within the framework of Fama's (1970) Efficient Market Hypothesis. Modern Portfolio Theory deals with the two dominant characteristics of a portfolio: expected risk and return. It was assumed by Markowitz, (1952) that rational investors would choose to hold efficient portfolios with maximising expected returns for a given degree of risk or alternatively and equivalently, minimising risk for a given expected return. It is theoretically possible to identify efficient portfolio by the proper analysis of information for each security on its expected return, the variation or variance in that return and the relationships

between the return of a portfolio can be calculated according to individual return of every security in this portfolio and the correlations among them.

Modern Portfolio Theory is premised on market efficiency. Market efficiency suggests that all that is known and knowable by investors is incorporated into the price of the stock (or bond or other asset), (Fama, 1970). However, it has been argued that the market efficiency must be tested jointly with an equilibrium-pricing model (Fama, 1991). As a result, when academics find anomalous evidence on the behaviour of returns, it is hard to say if it is due to the market efficiency or a bad model of market equilibrium. Arnold, (1998) documents that even asset pricing theory does not place itself in the realm of tests of market efficiency, but this means that efficiency is a maintained hypothesis. Depending on the emphasis desired, the efficiency must be tested conditional on an asset-pricing model or that asset-pricing model must be tested conditional on efficiency. Such tests are always joint evidence on efficiency and an asset-pricing model. Clare and Thomas (1994) signal that macroeconomists have always enquired about what influences individual stock returns as well as aggregate stock market returns. Lintner (1965); Bulmash and Trivoli, (1991) and Choudhry (2000); have examined the role of inflation on stock returns. Other researchers including Singh et al., (2010); Adjasi, (2009) and Owusu-Nantwi and Kuwornu, (2011); have all drawn attention to the possibility of the influence of un-exhaustive list of macroeconomic variables on stock returns.

The idea that factor models generate returns has existed long before the introduction of the popular APT by Ross in 1976. The APT formulated by Ross (1976 and 1977) is put forward as a superior alternative to the more popular Capital Asset Pricing Model

(CAPM). The APT has recently attracted a lot of research on the valuation of risky assets. The reason is that there is a body of empirical evidence doubting the validity of its alternative theory the CAPM established by Sharpe (1964), Lintner (965), Mossin (1966). Indeed, CAPM has been questioned with respect to its testability as a scientific theory (Roll, 1977). This is because the empirical verification of the CAPM is impossible, since its tests rely upon the mean-variance efficiency of the market portfolio, which notwithstanding cannot be observed.

Despite the APT's theoretical advantages, it has also failed to replace the CAPM as it does not in itself identify the factors relevant to asset pricing nor even the exact number just as its empirical validation is difficult, primarily because the factors determining security returns are not associated with observable economic variables, Engsted and Tanggaard, (2002), Dhrymes et al., (1984).

2.7 The Economic Theory on the association between Individual Macroeconomic Variables and Stock returns

Basically, there are two components of stock returns, namely the regular dividends that are paid by the company and the price the investor receives for selling the stock. The work of Chan et al., (1986) has been influential test of the multifactor model. Due to the fact that no sound and satisfactory financial theory exist to argue the relationship between financial markets and the macroeconomic variables, they employ a simple theoretical guide to help choose likely candidates for pervasive state variables. They argue that the systematic forces that influence returns are those factors that can change discount rates and expected cash flows, hence market return. They

signal that Stock Prices (Po) can be written as the discounted sum of expected future dividend flows,

$$Po = \frac{E(Dt)}{(1+R)t}$$

Where E is the expectation operator, R is the appropriate discount rate, and Dt is the dividend paid at the end of period‘t’. It can be posited that any economic variable, which influences expected dividends or the discount rate, will affect stock prices. These factors can be separated into those which affect future anticipated cash flows, and factors that influences the discount rate, though such a distinction will be somewhat arbitrary if one considers a complete developing and hypothetical nature of the Ghanaian economy. Expected dividends will be affected by anything, which influences cash flows. Changes in the expected rate of inflation would affect both nominal cash flows and interest rates. Arguably, changes in cocoa prices, and industrial production would influence profits and hence dividends. Fama, (1981) finds a correlation between stock market returns and future growth rates of output. There is extensive evidence that relative prices change with inflation and hence sectoral and aggregate performance may change Driffill *et al*., (1989). Also, changes in exchange rate will affect the value of foreign earnings and export performance. Further, ‘surprises’ in the current account balance, exchange rates, the money supply, output, oil prices, or even the price of gold, could all alter the outlook for interest rates, and hence the discount rate.

Indeed, Lintner, (1965) points out that macroeconomic variables and share price exhibit a contemporaneous causal relation, which is valid for the short as well as long-terms. That is there may be conditions where changes in macroeconomic factors can alter the share price of a firm. Accordingly, daily experience seems to support the

view that individual asset prices are influenced by a wide variety of unanticipated events and that some events have a more pervasive effect on financial asset prices than others. Consistent with the ability of investors to diversify, modern financial theory has focused on the more common or 'systematic' influences such as inflation, exchange rates, oil prices, interest rates among others as the likely source of investment risk. The general conclusion of theory therefore is that macroeconomic variables present pervasive risks in any economy, which may not be rewarded through diversification. In such a market, firm or investor reward is positively correlated with amount of systematic risks that is borne. Undoubtedly, Ross (1976) APT's postulation that returns can be a function of several factors rather than just one has considerable intuitive appeal, providing an alternative framework to determine the expected returns on stocks. It is true to point out that on comparative basis, though still in its early stage of development, there are thousands of unanswered questions surrounding it more ostensibly, is its failure to tell what specific factors influence returns nor even indicate how many factors should appear in the model.

2.8 Macroeconomic variables and stock returns

Altay, (2003) signals that empirical studies of the Arbitrage Pricing Theory have generally been done under two broad approaches. The first form is the factor loading or factor-analytic or statistical APT model derived by Roll and Ross (1980), which involve using statistical technique factor analysis to isolate the unobservable factors from share return using time series and test whether these factors are priced. The estimated covariance matrix of returns is employed to determine the factor structure that underlies asset return behaviour. Estimates of the factors are determined in accordance with arbitrage pricing theory, that is, factors are calculated from the

features observed in the set of returns. The second form is an equilibrium model called macroeconomic variable model, which requires the arbitrary choice of a range of variables by economic intuition. Therefore, the method uses pre-specified factors to estimate factor loadings and then tests whether the loadings are associated with significant risk premia. Given the variety of methods that have been used in the literature, it is difficult to compare the results of the various studies and hence no clear-cut conclusion about the superiority of one model over the other can be drawn.

2.9 Evidence from Developed Markets

Empirical evidence on the APT was first formulated explicitly in the 1980s, Roll and Ross (1980), Fama (1981), Chen (1983), Fama and Gibbons (1982), but implicit in earlier thinking, Lintner (1965); Mossin (1966), Modigliani and Cohn (1979), to mention just a few. Chan, Chen and Hsieh "CCH" (1985), provides one of the well-cited pioneering empirical studies using the APT framework. Using US data, consisting of six variables including the equally weighted market index of the NYSE, change in the state of the economy as measured by the seasonally adjusted monthly growth rate of industrial production, change in expected inflation, unanticipated inflation, a measure of the changing risk premium and a measure of the change in the slope of the yield curve, CCH (1985) investigate the firm size effect for the period 1958 to 1977. After ranking the portfolios according to firm size, they use a variant of the Fama-MacBeth (1973) method to test the firm size effect. They first regress each of the 20 portfolios on the macroeconomic-variables in the first five years to estimate the variables' betas.

Their final results show a positive relationship for equally weighted NYSE market index, adjusted monthly growth rate of industrial production and a measure of the changing risk premium while a negative sign is reported for measure of the change in the slope of the yield curve, unanticipated inflation and change in expected inflation. Also the level of significance of the market index was found to be weak comparatively. Their results are consistent with the intuition that smaller firms are riskier than larger firms because they fluctuate more with economic expansions and contractions and concluded that the firm size anomaly is essentially captured by a multi-factor arbitrage pricing model. The higher average returns of smaller firms are justified by the additional risks borne in an efficient market.

Fama, et al., (1969) report that a significant amount of abnormal returns earned by investors could be attributed to events such as stock split but not due to size effect. In fact, Arbel and Jaggi (1982) indicate that significant price changes occur along with unusual trading volume prior to the occurrence of an event or publication of new information. And indeed, Keim (1986) points out that more than fifty percent of the magnitude of the size effect is due to the anomalous January returns. Hence, the estimation of the model leaving out all January observations in the time series estimates of sensitivities by CCH (1985) is highly laudable as it lends more credibility to the model as well as the results. This is because inclusion of January observations would have meant that the evidence could be attributed to the January rather than size effect for whose "correction demands which is unambiguous to explain".

More precisely, CCH (1985)'s ultimate goal was to investigate the firm size, naturally therefore, their procedure is bound to provide good estimate for those variables most

responsible the size effect. Also, the divergent sources of the data coupled with the fact that the timing may not always correspond with the market returns for the stock provides a fertile grounds to question their results. No doubt, it is interesting to note that they report contrasting evidence between the two ten-year sub-periods. In the first sub-period, risk premia and industrial production are significant, but in the second, the two inflation variables are significant and risk premia is also marginal.

Chen, Roll and Ross affectionately called "CRR" (1986) are also among the pioneers to analyse the relationship between asset prices and macroeconomic factors in the APT framework. They analysed the relationship between US stock prices and economic factors namely, industrial production, inflation, the term structure, market indices, and consumption and oil prices. After running a regression of portfolios of 20 US stocks from 1958-1984, they found that the stock market significantly affect prices a number of economic factors including industrial production, inflation, interest rate, oil prices, the changing state of the economy, inflation, yield curve shifts, and a measure of the market risk premium. They found a negative association between inflation, interest rate and stock prices and positive one for industrial production.

It is right to point out that CRR, (1986) provide evidence as to how the problem of time lag among financial data was handled. Published information may contain time lags that usually need to be addressed in order to obtain a more robust model. This is because some variables measure accurately with time lag such as inflation, industrial production, and trade balance among others. For instance, inflation is announced to the public at large normally with a month lag. Economic forces react to the shocks in the announcements of say January's inflation in February and adjust share prices

accordingly. Hence, by capturing the time lags in published information, market forces reaction to the shocks in the announcements of the macroeconomic variables are catered for.

However, Clare and Thomas, (1994) show that CRR, (1986) did not adequately justify the econometric modelling of the economic factors to derive innovations in the series used in their analysis, hence, tantamount to a simplistic presentation of the theory. That is, they simply used the changes in or the rates of growth of the variables to represent the surprises. In fact, CRR, (1986) admitted this and suggested that a VAR model might have been more suitable. The general belief is that single equations are usually more robust, Pagan, (1984). Evident from their autocorrelation test, a large amount of important lagged information was omitted from the generation of their innovations. The problem is that it creates inconsistencies in their interpretation of the variables, hence casting doubt over the validity of their results. Also, their theoretical underpinnings do not surmount to a complete model of all significant state variables affecting security returns. Again, the data was basically from the US and therefore significant generalisation globally may not be reflective of the true picture due to the unique nature of US investors and firms.

Similarly, Beenstock and Chan, (1988) identify four factors as being priced with respect to the UK market as interest rate or 3-month Treasury bill rate, sterling M3, export volume and relative export prices as risk factors and two inflation measures spanning the period 1977 to 1983. Beenstock and Chan, (1988) questioned the reliability and credibility of Chen et al., (1986) factor analytic approach; adopt an alternative time invariant technique, constructed out of 760 UK securities. They grouped the portfolios according to the average return unlike Chen et al., (1986).

Applying OLS technique, investigates whether expected returns depend linearly on the sensitivity of returns to changes in the systematic variables. Their findings generally are consistent with Chen et al., (1986) but reported positive instead of negative association between inflation and stock prices. Again, export volume and relative export prices as risk factors were found not to be significant.

Groenewold and Fraser, (1997) tested the macro-factor model on the Australian Stock Exchange. Highly influenced by the methodology and variables of Chen et al., (1986), Clare and Thomas, (1994) applied 19 monthly sectoral share-price indexes for the period 1979-1994. They estimated the factor sensitivities for each of the 19 portfolios for each of the factors applying OLS technique. Groenewold and Fraser, (1997) signal that the significance of factors identified on the Australian market hugely overlap with factors found in other countries. They found that the inflation rate was consistently negatively priced in explaining stock returns in particular while open economy factors such as balance of payment, exchange rates and economic activities like unemployment rate, industrial output were not priced at all. Other factors found to be significant on the market included short-term or 3-month Treasury bill rate and money growth rate, M3, also all inversely correlated in explaining average cross-sectional returns. However, the significance of these other factors depends on their choice of sample period and estimating model.

Further, a comparison of result of the three-models applied namely; CAPM, statistical and macroeconomic APTs confirm the superiority in explanatory power of both variants of the APT model over the CAPM for both within- and out-samples. However, the explanatory power of the CAPM is greatly improved by testing over

short period. In contrast to CAPM, they find that the explanatory power of both variants of APT falls significantly when it is tested over a short period as well as the APT's factor structure being unstable over time though it still possesses a higher R-squared than CAPM with the superiority increasing with the length of the sample period. Finally, between the two APT variants, the macroeconomic APT was found to have possessed statistically insignificant superior explanatory power for both within- and out-sample.

Berkowitz and Qiu, (2001) adopted Fama and French, (1992) methodology for determining the common risk factors in the returns of Canadian stocks. Their results suggest that three stock market factors, excess stock market returns, a size factor, and a book-to-market equity factor, explain most of the variation in Canadian equity returns over time. Unlike in the U.S. equity market, the addition of bond market variables provide little explanatory power for the average Canadian equity, suggesting that the underlying factors influencing stocks and bonds are more distinct in Canada. Further, a comparison of their results with those of Fama and French (1992), suggest differences across industries between Canada and the U.S. One notable distinction is that while the utilities in both countries exhibit interest rate sensitivity, as expected, it is also clear that Canadian utilities are subject to significantly less financial distress than their U.S. counterparts. The rhetorical question is why is it so? Clearly, this raises doubts as to reliability of the model and source of the data. Further, these analyses have different time periods, hence the evidence of more than one statistically significant factor explain the asset returns in both Stock Market.

2.10 Problem of Changing Macro-Economic Variables Significance on the Markets

Hamao, (1988) using a large sample of 1066 listed Japanese companies, presents empirical testing of the APT in the Japanese equity market using macro-economic factors highly influenced by the methodology of Chen *et.al*., (1986) in apparent attempt to test its robustness as well as identify priced macroeconomic variables on the Japanese market. The factors examined in his study included industrial production, inflation, investor confidence, interest rates, foreign exchange and oil prices perfectly paralleling those used by Chen *et.al*., (1986). He found that changes in expected inflation, unanticipated changes in risk premium and unanticipated changes in the slope of term structure appeared to have been priced on the Japanese market. Weaker evidence of the presence of a risk premium existed in changes in monthly production and changes in terms of trade. Just like Beenstock and Chan (1988), a direct relationship between inflation and stock prices is observed while an inverse association is found for interest rates. However, he reports the problem of changing significance for macro-economic variables in a multiple regression equations, which has been widely reported and confirmed in other empirical works.

Wasserfallen, (1989) applying a great number of macro-variables data from German, the UK, and Switzerland, empirically investigates whether they are priced on these stock markets by using the market index as an explanatory variable. He applies OLS estimation and t-tests. Just like Hamao (1988), he reports the problem of changing significance of macroeconomic factors in multiple regressions. Hence, his conclusion was that unexpected changes in macroeconomic factors do not have significant influence on the returns of the three comparative markets under consideration. The

problem of changing macroeconomic significance has been questioned by some recent researchers especially regarding the statistical strength and reliability of the OLS technique. This is due to the coincident application of OLS technique by most of these researchers.

Mukherjee and Naka (1993) have empirically challenged Hamao, (1988)'s findings on the Japanese market. They claim that Hamao's results might have been influenced highly by the statistical approach instead. Mukherjee and Naka (1993) have suggested using granger causality test approach to eliminate the problem of changing macroeconomic significance in a multiple regression equation. Highly influenced by the granger causality test approach, use vector error correction model to investigate whether co-integration exists between the Bombay Stock Exchange Index and six Indian macro-economic variables, namely; exchange rate, money supply, inflation, industrial production, long-term government bond rate and call money rate. They found that a co-integration relation existed and that stock prices contributed to this relation. The signs of the long-term elasticity of coefficients of the macroeconomic variables on stock prices were generally consistent with the hypothesized equilibrium relations.

Clare and Thomas, (1994) has also attribute the possibility of the problem of changing macroeconomic significance in a multiple regression equation to methods of ordering stocks to form portfolios. Clare and Thomas, (1994) present additional empirical evidence of the pricing of macroeconomic factors in the UK stock market between 1983 and 1990. Using 840 stocks, included 18 macro-economic factors namely default risk, term structure, 3month treasury-bill rate, price of gold, real retail sales,

industrial output and current account balance. The others include oil price, retail price index, dividend yield, unemployment, $/£ exchange rate, stock market turn over, debenture and loan yield, yield on long government bonds, yield on short government bonds, consol yield per day and private sector bank lending. They identified default risk, dollar/pound exchange rate, industrial production, narrow money supply, and retail sales as being significant in influencing stock prices on the UK market.

2.11 Empirical Evidence: The Case of Developing Markets

Arnold, (2002) defines an emerging market as security markets in newly industrialising countries with capital markets at early stage of development. By all intents and purposes, the Ghanaian economy mimics strongly the features of an economy in transition. Sinclair, (1987) claims that although a large number of studies have investigated the association between stock returns and macroeconomic factors under the broader umbrella of APT, they are hugely concentrated in the developed markets especially of UK and US. Sinclair (1987)'s argument is that any relationship uncovered in these economies may not exist in exact form for the returns of developing stock markets like Ghana. Indeed, Fifield*e.tal*., (2002) corroborate this by concluding that "the empirical evidence on the role of macroeconomic factors in emerging stock markets is scarce". The rhetorical question, are they right in their claim?

Ayadi, (1991) investigating whether aggregate stock prices in Nigeria deviate from their underlying fundamental values regresses the price deviation on macro variables including industrial production, real money supply, consumer price index, nominal long-term interest rate, nominal short-term interest rate (T-bill) and dividend

payments. His result finds no significant deviations from Chen *et al*., (1986), as was expected and concludes that macro-economic factors play significant role in stock price determination in Nigeria. On the contrary, Ekpenyong and Obieke (1994) investigating the functional relationship between macroeconomic aggregates and stock prices in the Nigerian economy identify ten macro-variables. These include, money supply, exchange rate, minimum rediscount rate, inflation rate, savings deposit rate, lending rate, manufacturing production, the number of industrial securities, the industrial production, and the value of industrial securities. The results of their study showed at the time that the Nigerian stock prices did not adjust to the following macro economic variables, namely money supply, exchange rate, inflation rate, rediscount rate, deposit rate, lending rate, manufacturing and industrial production in the same directions in developed countries. Perhaps, the conflicting evidence is not surprising. Indeed, the immature, small, emerging and less sophisticated nature of the market could have also prejudiced their results.

Oyama, (1997) examines the general relationship between stock prices and macroeconomic variables in Zimbabwe. Seven variables including the Zimbabwe stock Exchange (ZSE) index, monetary aggregate consisting of both narrow and broad money supply, commodity price index of precious metals, U.S stock market index, inflation, three-month treasury bill, and exchange rates are applied. Using the revised dividend discount; error-correction and multifactor return generating models, reports several interesting findings.

First, he reports that the relationship between the E/P ratio of the ZSE and other return rates in the Zimbabwean economy has experienced several changes since the

beginning of the 1990s, which appear to result from market liberalization policies during the period of research. Particularly, the convergence of risk premium, or the spread between the E/P ratio and real interest rates to the average level of emerging markets since late 1993, which seems to have been triggered by the partial capital market liberalization, resulted in a significant increase in stock prices in 1993 and 1994. Oyama's second finding is that the ECM model indicates that the association between stock returns, money growth and 3-month treasury bill rate has been quite stable since 1991 except during the period of partial capital liberalization. Finally, the analysis on individual stock returns indicates that the ZSE assimilate changes in some important macro-variables quite consistently.

Hence, Oyama (1997) concluded that despite the large fluctuations in stock prices since (1991), the Zimbabwe Stock Exchange has been functioning quite consistently during the period of research and signals that, sharp increases in stock prices during the 1993-94 were mainly due to the shift in risk premium that was caused by the partial capital account liberalization, the recent rapid increase in stock prices can be explained largely by the movements of monetary aggregates and market interest rates. Therefore, Oyama, (1997) recommends that the Zimbabwean government should work towards consolidating reducing inflation through tightening fiscal policies. However, Oyama (1997) failed to account precisely for the contributions of these macro-variables except money supply and Treasury bill rate as well as the factors explaining the volatile up and down movements of stock returns during the late 1993-94 periods.

Ozcam, (1997) empirically considers APT testing on Istanbul Stock Exchange. In this research, seven macroeconomic variables of Turkish economy are separated into expected and unexpected series by a regression process, and then two-step testing methodology is implemented on these series. A sample population of 54 stocks for the period of 1989-1995 is used. As a result, beta coefficients of expected factors are found significant for asset returns. In the first test, factor analysis method is employed in daily returns of period for each year and one dominant significant factor is found among several minor significant factors for each year. The second test employs multivariable regression process in order to examine the significance of macroeconomic variables on asset returns. As a result only expected Treasury bill interest rate beta is found significant for explaining asset returns.

Similar to the findings of Groenewold and Fraser, (1997) but in less statistical significant terms, also confirm the superiority of both macroeconomic and statistical APT's superior explanatory power of stock returns on the Turkish market. That is, after testing for the efficiency of the three models using the forecasting errors found that the traditional CAPM overestimated the returns, the three-factor statistical model as well as the five-factor macroeconomic APT found underestimating the actual returns. However, they report that the standard deviations of the errors are found relatively smaller in factor models than the traditional CAPM.

Diacogiannis et al., (2001) empirically investigate the multi-factor risk-return relationship for emerging Greek Stock Market that utilizes observable macroeconomic variables in the construction of the underlying factors. They

estimated systematic risks (beta coefficients) for each stock by following a procedure, which involved the performance of 140 time series regressions (70 for each period) using 28 quarterly observations with OLS. They tested for the stationarity of the variables involved of the time series regressions using the Augmented Dickey-Fuller (ADF) tests. Their empirical findings reveal that for the sub-period 1980-86 three factors, namely; inflation, current account balance and unemployment hold significant explanatory power for the Greek market returns are positively correlated. However, for the sub-period 1986-92, the tests show that security returns are not affected by three factors, hence, also documenting the changing significance of macroeconomic variables phenomenon.

Fifield*et al*,, (2002) empirically investigates the extent to which global and local economic factors explain returns in 13 emerging stock markets (ESMs) including Greece, Korea, Mexico, Portugal, Singapore, Thailand, India, Turkey, Chile, Hong Kong, Malaysia, the Philippines and South Africa from 1987–1996. They employ the method of principal components analysis, and in the spirit of Chen et al. (1986) and Goswami and Jung, (1997), selected six domestic factors; inflation, foreign exchange rates, short-term interest rates, gross domestic product, the money supply and the trade balance and six global variables of world market return, world inflation, commodity prices; world industrial production, oil prices and US interest rates. A principal components analysis is applied to a large set of domestic and world economic variables in order to reduce the dimensionality in the economic data set to a limited number of core factors and the dominant principal components are extracted and used as inputs into a regression analysis to explain index returns Goswami and Jung, (1997). The results suggest that three domestic factors including gross domestic

product, inflation, money supply and short-term interest rates are priced while only global variables; world industrial production and world inflation hold significant explanatory power of stock returns.

Additionally, the regression analysis indicates that while global variables play a crucial role in explaining returns in some countries (Greece, Korea, Mexico, Portugal, Singapore and Thailand), local factors are more important in other markets; domestic factors only are important in explaining returns in two markets (India and Turkey). Furthermore, the addition of the local variables to the world information variable set significantly increases the proportion of variation in return explained in four markets (Greece, Mexico, Portugal and Thailand). By contrast, neither world nor local factors are significant in five countries (Chile, Hong Kong, Malaysia, the Philippines and South Africa).

Given that investors diversify their portfolios internationally, it is reasonable to hypothesize that international, as well as domestic, factor will generate share returns; hence the selection of both domestic and global factors by Fifield*et al*., (2002) is a step in the right direction. However, a second look at their results raises important issues and contradictions. While their results for the domestic factors confirm the international evidence available, those for the world reject it. Harvey, (1995) and Spyrou, (2001) for instance report that the world industrial production, world market returns and world inflation provide significant explanatory power, these are not priced for most of the emerging stock markets studied. However, it is also true that most of those studies focused on developed markets. Perhaps, the logical question is, does maturity and other factors affect the relationship. A more serious revelation is the problem of changing macroeconomic significance even among developing markets.

Indeed, Karamustafa and Kucukkale (2003) in an attempt to empirically repeat the findings of Fama (1991), Geske and Roll (1983) that there is granger causality between money supply, exchange rate, industrial production and Treasury-bill rate on the Istanbul Stock Exchange, report otherwise. Hence, Karamustafa and Kucukkale (2003) attributed their result to the "emerging nature of the Istanbul market" and concluded that shareholders in ISE have completely different investment patterns from the shareholders in developed markets.

Karamustafa and Kucukkale (2003) empirically test the viability of the APT as an alternative asset-pricing framework on the Istanbul Stock Exchange by investigating whether current economic activities in Turkey have explanatory power over stock returns, or not. They used monthly data of stock price indexes of Istanbul Stock Exchange from January 1990 to November 2001 and four macroeconomic variables, including money supply, exchange rate of US Dollar, trade balance, and the industrial production index. Engel-Granger (1987) and Johansen-Juselius (1990) co-integration tests and granger Causality test were used in the study to explain the long-run relations among variables questioned. Karamustafa and Kucukkale (2003) concluded that stock returns are co-integrated with a set of macroeconomic variables by providing a direct long-run equilibrium relation.

However, the macroeconomic variables are not the leading indicators for the stock returns, because any causal relation from macroeconomic variables to the stock returns cannot determine in the sample period. Contrarily, stock returns are the leading indicator for the macroeconomic performance for the Turkish case by supporting emerging market case.

However, a critical look at the result of Karamustafa and Kucukkale (2003) show a significant statistical contradiction. While their VAR results indicate that there are co-integration relations between ISE and the other economical variables; money supply, exchange rate, industrial production and Treasury bill rate, the causality test results, however, show that ISE is not the result variable of current economic activities. Controversially, ISE is cause variable for money supply only. In contrast, similar studies from developed markets such as Fama (1991), Geske and Roll (1983), etc determine a relation directed from macroeconomic performance to share returns, the same relation could not be determined for the Turkish case. Further, Kwon and Shin (1999), show that share returns cannot be affected by macroeconomic fluctuations in emerging markets as it happens in Europe and South Asia. Therefore, the Turkish case can be included in the second group, namely "emerging market". Additionally, it can be said that the shareholders in ISE have completely different investment patterns from the shareholders in developed markets.

Research works from the developed markets such as UK, US among others have established that macroeconomic variables possess explanatory power on stock returns (Clare and Thomas, 1994). Developing markets like the Ghana Stock Exchange are also attracting world attention as markets of the future with a lot of potential for investors but there are few extensive studies linking the capital returns with macroeconomic indicators and it is this research gap that this work seeks to fill.

CHAPTER THREE

Methodology and Data

3.1 Introduction

This chapter presents the methods that were used to collect and analyse data for this research. The significance is that all scientific work has to be replicable and this can be done only if the researcher gives a laid down procedure as to how the study is carried out.

3.2 Methodology

3.2.1 The Model

The empirical research on the APT has identified two forms. The first form is the proposal derived by Roll and Ross (1980) that involve using statistical techniques to isolate the unobservable factors from share returns using time-series and test whether these factors are priced known as factor-analytic or statistical APT model.

The second form is an equilibrium model that requires the arbitrary choice of a range of macroeconomic variables that proxy the unobservable factors that determine prices suggested by Chan, Chen and Ross (1986), also called macroeconomic APT model.

The macroeconomic factor model is proposed to be used in this present study, which also assumes a linear relationship between stock returns and macroeconomic variables.

3.3 Method of Analysis

3.3.1 Ordinary Least Square Regression

To investigate the explanatory power of macroeconomic variables and stock returns on the GSE All Share Index and this is in accordance with the work and methodology

of Beenstock and Chan (1988), Groeneworld and Fraser (1997), who applied OLS technique in determining the relationship between stock returns and macroeconomic variables in UK and Australia respectively, an OLS regression, is proposed. Using Microfit.v.4.0.w, a time series OLS-regression of 228 monthly data of the seven macroeconomic variables were ran under the broader framework of the Arbitrage Pricing Theory developed by Ross (1976) against GSE-All Share index used as a proxy for stock returns. The regression equation is;

$$GSINDEX = C + \beta_{1DLINFR} + \beta_{2DLFXR} + \beta_{3DLMS} + \beta_{4DLTBR} + \beta_{5DLWCPX} + \beta_{6DLWCOPX} + \beta_{7DLWGPX} + ei \quad \text{.....equation (3.1)}$$

Where;

GSEINDEX= The GSE-All Share Index

LINFR = Inflation rate

LFXR= the exchange rate (Cedi-US dollar exchange rate)

LMS= Money Supply (Broad money supply)

LTBR = 91-Day Treasury bill rate

LWCPX= World Cocoa Price

LWCOPX = World Crude Oil Price

LWGPX = World Gold Price

C= Constant

ei = Idiosyncratic error term

(As suggested by Groeneworld and Fraser (1997).

3.4 Data Sources, Variable Selection and Description

3.4.1 Data Sources

Data for the study were mainly obtained from secondary sources. Monthly macroeconomic data that were collected include broad money supply (M2+), Cedi-US dollar exchange rate, inflation rate, 91day Treasury bill rates, the world gold, cocoa and crude oil prices in US dollars. The data on world gold prices were obtained from Gold Information Network and The London Gold Bullion Market. The world cocoa prices were obtained from International Cocoa Organisation where as the broad money supply (M2+), Cedi –US dollar exchange rate and 91 day Treasury bill rates were also obtained from Bank of Ghana. Inflation rates were obtained from the Ghana Statistical Services and data on World Crude Oil prices were obtained from Data Stream International. Data on the index were collected from the Ghana Stock Exchange. The study covered the period 1991 to 2009 using 228 monthly data.

3.5 Variable Selection and Description

The purpose of this research is to identify the factors that are significantly influencing the Ghanaian economy. Seven macroeconomic variables have intuitively been chosen as likely factors to posses the power of explaining stock returns on the market. This has mainly been done in line with previous research such as Roll and Ross (1980), Chen et al., (1986), Ayadi (1991), Clare and Thomas (1994), Oyama (1997), Groeneworld and Fraser (1997), Karamustafa and Kucukkale, (2003) to mention but a few whose works more or less have shown that these variables are correlated with stock returns but also partly due to their unique association with the Ghanaian economy.

3.5.1 Inflation Rate

Economic theory indicates that inflation decreases the purchasing power of business cash flow. Changes in inflation expectation therefore affect the purchasing power of businesses, hence it is expected that inflation will correlate negatively with stock returns. Ayadi, (1991) and Ekpenyong and Obieke, (1994) provide conflicting results. While Ayadi, (1991) provide evidence that inflation has a positive explanatory power, Ekpenyong and Obieke conclude that inflation was not priced in Nigeria. Chen *et al.,* (1986) records a negative association while Beenstock and Chan (1988), Hamao (1988), Clare and Thomas (1994) report a positive relationship with stock returns. Inflation rate figures were obtained from the Ghana Statistical Services.

3.5.2 Cedi-US Dollar Exchange Rate

The US Dollar is the main currency for international trade in Ghana. The cedi-dollar exchange rate is therefore important since this is translated into the cost for importing raw materials and other inputs. The exchange rate therefore affects business cash flow and hence the amount of dividend paid, thus it is hypothesised that exchange rate will inversely relate stock returns. Empirically, Tabak, 2006, Abugri, 2008, Clare and Thomas (1994), Ozeam (1997), Altay (2003), have given evidence on its explanatory power of stock returns. The Cedi-US dollar exchange rate data were obtained from Bank of Ghana.

3.5.3 91-Day Treasury Bill Rate

The level of interest rates influences economic activity through the capital investment process. Low interest rates encourage capital expenditures by individuals and businesses. These expenditures provide additional employment, increased output of

goods and services, and overall increases in GDP. Interest rates have been closely correlated with economic activity because they closely move with the business cycle. Accordingly the proposition is that it should negatively correlate stock returns. 91-day Treasury bill is used as proxy for interest rate since Treasury bill serves as the opportunity cost for of holding shares. Similarly, Chan *et al*., (1985), Chen *et.al*., (1986), Beenstock and Chan (1988), Ayadi (1991), Fifield et al., (2002), Karamustafa and Kucukkale (2003) provide evidence on their relationship. The 91-daytreasury bill rates data were obtained from Bank of Ghana.

3.5.4 Broad Money Supply (M2+)

There is considerable amount of work in the literature such as Tursoy et al., (2008), Tahir and Ghani, (2004), Karamustafa and Kucukkale (2003), Groeneworld and Fraser (1997) that have documented how money supply affects stock prices. Sprinkel, (1971) for example show that a decline in the rate of monetary growth precedes bear markets by an average of nine months, while an increase in monetary growth rate leads bull markets by an average of two months. Therefore, it is expected that money supply will positively relate stock returns. Broad Money supply data were obtained from Bank of Ghana.

3.5.5 World Cocoa and Gold prices

World Bank report (1997) reported that cocoa and gold constitute more than 70 percent of Ghana's foreign exchange earnings. In fact, Osei, (2001) signaled that cocoa has historically been a key economic sector and a major source of export and fiscal earnings in Ghana. In 2005, cocoa accounted for about 28 percent of total exports (Bank of Ghana, 2007).

Indeed, cocoa and gold are two major exports of Ghana and the main source of foreign exchange for corporate imports of machinery and raw materials. Changes in the price of these commodities affect business activity and profitability, and hence, it is assumed that they will be positively correlated with stock returns. The world Cocoa prices data were obtained from International Cocoa Organization. Data on world Gold prices were also obtained from Gold Information Network and the London Gold Bullion market.

3.5.6 World Crude Oil prices

Chen et al., (1985) and Chen and Jordan, (1993) provide evidence that oil prices affect stock returns. Butt et al., (2009) conclude that while increases in oil prices negatively affect industrial production and stock returns, the effect on stock returns is stronger than that on industrial production. Ghana is a major oil importing country. Changes in the price of oil will therefore affect corporate profitability and, in turn, dividend payments through their effect on industry operational costs. Hence, it is expected that oil price will be negatively correlated with stock returns. World crude oil prices data were obtained from Data Stream International.

3.6 Unit Root, Co-integration and Granger Causality Tests

To ascertain whether there is a long-run association between macroeconomic variables and stock returns, Engle and Granger and Johansen-Juselius (1990) co-integration tests and Engle and Granger (1987) causality tests were run. As indicated in Granger and Newbold (1974), using non-stationary macroeconomic variables in time series analysis causes superiority problems in regressions. To eliminate this problem, stationarity tests must be performed for each of the variables. There have

been a variety of proposed methods for implementing stationarity tests (for example, Dickey and Fuller, 1979; Phillips, 1987 among the others) and each has been widely used in the applied economics literature.

However, there is now a growing consensus that the stationarity test procedure due to Dickey and Fuller (1979) (hereafter ADF) has superior small sample properties compared to its alternatives, Karamustafa and Kucukkale (2003). Therefore, in this study, ADF test procedure was employed for implementing stationarity tests. The ADF test procedure requires to run the following regression for both level and the first difference of each variable, separately. If necessary, the ADF regression can be run for the higher levels of the variables

$$DL_X = \alpha + \gamma^t + \phi LX_{t-1} + \sum_{i=1}^{m} \partial i DLX_{t-1} + wi \quad \text{.....equation (3.2)}$$

Where "*LX*" is the logarithmic form of the variable in question, '*a'* and '*t'* are a constant term and a time trend, respectively, "D" is the first difference operator, "*w"*is the white noise residual and "m" is the lagged values of "*DLXt"* that are included to allow for serial correlation in the residuals. In the context of the ADF test, a test for non-stationarity of the series, 'LX', amounts to a t-test of $\Phi = 0$. The alternative hypothesis of stationarity requires that 'Φ be significantly negative. If the absolute value of the computed t-statistic for 'Φ' exceeds the absolute critical value given in McKinnon (1990), then the null hypothesis that the log level of '*X*' series is not stationary must be rejected against its alternative. If, on the other hand, it is less than the critical value, it is concluded that the logarithmic level of '*X'*, **'***LX'***,** is non-stationary. In this case, the same regression must be repeated for the first difference of the logarithmic value of the series. In estimating ADF regressions, the number of own

lags (m) was chosen by using the "Akaike Information Criterion" (AIC) due to Akaike (1969). If the series under consideration turn out to be integrated of the same order, it is possible to proceed by testing for co-integration relationships between the integrated variables. In this paper, co-integration tests were carried by means of the methods first developed by Engle and Granger (1987). The Engle-Granger co-integration method [Equation (3.3)] determines whether the residual terms obtained from the regression, which contain two non-stationary series [Equation (3.4)], are stationary, or not. If the residuals are stationary in their levels, two non-stationary series in question are co-integrated, and vice versa.

$$\log Y_t = \alpha + \beta \log X_t + RES_t \quad \text{.....equation} \quad (3.3)$$

$$DRES_t = \eta + \lambda RES_{t-1} + \sum_{i=1}^{k} \gamma i DRES_{t-i} = w_t \quad \text{.....equation} \quad (3.4)$$

Johansen and Juselius (1990) argue that the residual-based Engle and Granger (1987) co-integration test is inefficient and can lead to contradictory results, especially where there are more than two I (equation 3.2) variables under consideration. They proposed a more satisfactory approach, which provides a unified framework for estimating and testing of co-integrating relations in the context of vector autoregressive (VAR) error correction model, hence Johansen and Juselius (1990) co-integration tests is also applied. The Johansen-Juselius (1990) method applies the maximum likelihood procedure to determine the presence of co-integrating vectors in non-stationary time series as a vector autoregressive (VAR):

$$\Delta Z_t = C + \sum_{i=1}^{K} \Gamma i \Delta Z_{t-i} = \prod Z_{t-1} + \eta_t \quad \text{.....} \quad \text{equation (3.5)}$$

Where '*Zt*' is a vector of non-stationary (in log levels) variables and '*C*' is the constant term. The information on the coefficient matrix between the levels of the series 'Π' is decomposed as $\Pi = \alpha\beta$ where the relevant elements of the α matrix are adjustment coefficients and the β matrix contains the co-integrating vectors. Johansen and Juselius, (1990) specify two likelihood ratio test statistics to test for the number of co-integrating vectors. The first likelihood ratio statistics for the null of exactly ***r*** co-integrating vectors against the alternative of ***r+1***vectors is the maximum *eigenvalue statistic*. The second statistic for the hypothesis of at most ***r*** co-integrating vectors against the alternative is the *trace statistic*. Critical values for both test statistics are will be tabulated in Johansen and Juselius, (1990). The number of lags applied in the cointegration tests is based on the information provided by the multivariate generalization of the Akaike Information Criteria (1969). Further, if the variables are found to be co-integrated, then, it will be possible to run long run granger-causality relationships among the variables using the methodology based on Engle and Granger (1987). The Engle-Granger tests involve the estimation of the following equations.

$$DX_t = \alpha_0 + \sum_{s=1}^{k} a_{1s} DX_{t-s} + \sum \alpha_{2m} DY_{t-m} + \varepsilon_{1t} \quad \text{.....equation (3.6)}$$

$$DY_t = \beta_0 + \sum_{j=1}^{n} \beta_{1j} DX_{t-j} + \sum_{h=1}^{p} \beta_{2h} DY_{t-h} + \varepsilon_{2t} \quad \text{.....equation (3.7)}$$

Where DX_t and DY_t are variables to be tested, ε_{1t} and ε_{2t} are mutually uncorrelated white noise errors, and t denotes the time period and 'k' an '1' are the number of lags. The null hypothesis is $\alpha_{2m} = \beta_{2k} = 0$ for all $i's$ versus the alternative hypothesis that $\alpha_{2m} \neq 0$ and $\beta_{2k} \neq 0$ for at least some $i's$. If α_{2m} in the equation

(3.6) was found to be equal to zero as a group, the null hypothesis which proposed that Y is the "Cause Variable" for X could not be rejected. Similarly, if β_{1j} in the equation **(3.7)** is found to be equal to zero as a group, it could not be said that X is the "Cause Variable" for Y. It also proposes to follow the testing procedure suggested by Toda and Phillips (1994). Toda and Phillips (1994) suggested sequential testing procedures for three special cases; that is causalities from one variable to a set of variables, from a set of variables to one variable and from one variable to one variable respectively.

One of the prominent problems is that the individual stock's estimate of systematic risk and the average returns are affected by the errors. It was argued that the errors might come from the undiversified risk of the individual stocks and the possible skewness in ex-post individual security's return distributions**.** To overcome these problems, the usual procedure employs the grouped security portfolios to reduce the inefficiency associated with the individual risk estimated and to obtain the maximum dispersion in the independent variables, Toda and Philips, (1993). Most studies have used a two-stage procedure proposed by Fama and MacBeth (1973) and Roll and Ross (1980). In the first stage, measures of sensitivity to the risks are obtained by performing time-series regression for each security portfolio. Cross-sectional regressions are typically performed in the second stage, with conclusions about the about a premium based on those results.

However, this study will use the macroeconomic approach applied by Wasserfallen (1989), Groenewold and Fraser (1997), Chen, Chan and Roll (1986).

CHAPTER FOUR

4.0 ANALYSIS, INTERPRETATION AND DISCUSSION OF RESULTS

4.1 Introduction

This chapter presents the analyses, interpretations and discussion of the results of the various empirical tests.

4.2. Testing the explanatory power of the variables of the GSE returns

4.3 Results of Descriptive Statistics

Table 4.1 Summary of statistics of variables

Variable	Obs	Mean	Std. Dev.	Min.	Max.
GSEIND	228	2,500.65	2,975.46	57.70	11,0921.46
INFR	228	22.73	13.76	7.30	70.80
EXC	228	5,439.67	4,219.66	346.00	14,700.00
MSS	228	17,883.34	23,729.52	288.72	8831.00
TBR	228	28.87	13.41	9.60	93.10
WCPX	228	71.00	23.31	36.33	158.65
WCOPX	228	31.96	24.44	8.03	128.08
WGPX	228	439.35	198.38	256.95	1,127.90

Results of the descriptive statistics run on the seven macroeconomic variables and the GSE All Share Index (table 4.1) indicated that among the variables under study, money supply recorded the highest mean (17,883.34) with inflation recording the lowest (22.73). Therefore over the period under review, inflation rate stood at 22.73% averagely where as treasury bill recorded 28.87% over the same period. World cocoa, gold, and crude oil prices over the period averagely were 71.00, 439.35 and 31.96

dollars respectively where as the exchange rate for the US dollar and Cedi averagely stood at 5,439.67.

Treasury bill and inflation rates recorded the lowest in terms of standard deviation which were 13.76 for inflation and 13.41 for treasury bill. Money supply had the highest deviation with a standard deviation figure of 23,729.52.

Table 4.2 Correlation Matrix of Variables

	GSEIND	INFR	EXC	MSS	TBR	WCPX	WCOPX	WGPX
GSEIND	1.00							
INFR	-0.3757* 0.0000	1.0000						
EXC	0.8280* 0.0000	-0.3334* 0.0000	1.0000					
MSS	0.8812* 0.0000	-0.3193* 0.0000	0.8614* 0.0000	1.0000				
TBR	-0.2684* 0.0000	0.4407* 0.0000	-0.0790* 0.2350	0.0456 O.4934	1.0000			
WCPX	0.6903* 0.0000	-0.1730* 0.0000	0.6666* 0.0000	0.8325* 0.0000	0.2174* 0.0010	1.0000		
WCOPX	0.8543* 0.0000	-0.3366* 0.0000	0.7627* 0.0000	0.8554* 0.0000	-0.2417* 0.0002	0.7019* 0.0000	1.0000	
WGPX	0.7928* 0.0000	-0.2232* 0.0007	0.6783* 0.0000	0.9375* 0.0000	0.0534 0.4221	0.8332* 0.0000	0.8517* 0.000	1.000

Source Authors Estimation, 2012.

Note: Values with* are significant at 5%.

4.4 Estimated Correlation Matrix of Variables

Table 4.2 presents pairwise results of the correlations for the variables included in the study output of variables. The table show that, in general, correlations between independent variables are low and high correlation with the dependent variable; an indication of a reduced multicolinearity problem usually associated with time series data. However, there is a strong positive correlation between the Cedi-dollar exchange rates and the money supply. This is because naturally, an increase in the money supply could influence foreign exchange rates positively, ceteris paribus. Such a strong positive correlation is intuitively appealing and is in line with economic theory. Indeed Gunasekarage et al., (2004) corroborated this by saying that a strong correlation between money supply and the foreign exchange rate is always expected.

4.5 Results of Ordinary Least Squares Regression of Variables on GSE and Its Interpretation

After checking for unit root to ascertain stationarity of the time series data, which will be discussed later, the OLS regression is run.

$$GSINDEX = C + \beta_{1DLINFR} + \beta_{2DLFXR} + \beta_{3DLMS} + \beta_{4DLTBR} + \beta_{5DLWCPX} + \beta_{6DLWCOPX} + \beta_{7DLWGPX} + ei \quad \text{.....equation (4.1)}$$

Where;

GSEINDEX= The GSE-All Share Index

C= Constant

LINFR = Inflation rate

LFXR= the exchange rate (Cedi-US dollar exchange rate)

LMS= Money Supply (Broad money supply)

LTBR = 91-Day Treasury bill rate

LWCPX= World Cocoa Price

LWCOPX = World Crude Oil Price

LWGPX = World Gold Price

ei =Idiosyncratic error term

4.6 Substituted Equation and Its Interpretation

GSEINDEX=0.80073-0.391008LXFR+0.672927LINFR+1.279LMS-1.096857LTBR-0.303553LWCOPX+0.059423LWCPX-0.044796LWGPX.....Equation 4.2

From the above substituted equation, it can be inferred that if exchange rate, treasury bill rates, World Gold and Crude Oil prices should increase by 1 unit each, then the GSE All Share Index will decrease by 0.391, 1.10, 0.045 and 0.0305 units respectively. Alternatively, if Inflation rate, Money supply and World Cocoa price should increase by 1 unit each, the GSE All Share Index will experience an increase of 0.67, 1.28 and 0.059 units respectively.

4.7 Testing of Hypothesis

From the T-Statistics results (Fig 4.3), exchange rate, world cocoa and world gold prices were found to be insignificant and thus the null hypothesis is accepted. However, in the cases of inflation, Money supply, 91-day treasury and world crude oil prices, the null hypothesis is rejected since they were found to be significant from the T-Statistics.

From the OLS results, the R-squared was found to be 0.965717. This indicates that 97% of the variation has been accounted for and that only 3% of the variations were due to error. Again the F-statistics figure of 837 is also an indication that the overall equation is significant in explaining the macroeconomic variables. The Durbin-

Watson statistics was found to be less than 2 (0.10727). This is a limitation of time series.

Table 4.3:**Ordinary least squares results**

Dependant variable GSEINDEX				
Explanatory variable	**Coefficient**	**Std. Error**	**P-value**	**Test Statistics @ 5% level of significance**
Constant	0.080	1.616	0.961	0.0495
LFXR	-0.391	0.200	0.052	-1.9570
LINFR	0.673	0.263	0.011	2.5614*
LMS	1.280	0.152	0.000	8.4287*
LTBR	-1.097	0.396	0.006	-2.7690*
LWCOPX	-0.304	0.095	0.002	-3.2096*
LWCPX	0.059	0.131	0.652	0.4524
LWGPX	-0.045	0.274	0.870	-0.1635
R-Squared	0.9657			
Durbin-Watson stat	0.1073			
Adjusted R-squared	0.9646			
Akaikeinfo.Criterion	0.4090			

Note: * represent statistical significance at the 5% level.

Table 4.3 shows a positive relationship between Money supply, Inflation rate, and World cocoa price and a negative relationship for Foreign exchange rate, Treasury bill, World crude oil and Gold prices. This indicates that four out of seven

macroeconomic variables, (LINFR, LTBR, LMS, and LWCOPX) possess explanatory power for stock returns in Ghana. While LFR, LTBR, LWCOPX and LMS are statistically significant (at 5%), LFXR, LWGPX, and LWCPX are not significant at the 5% level. However, even though LWCPX and LWGPX possess a positive and a negative association with stock returns respectively, their association is not statistically significant. On the contrary, LWCOPX and LFXR are negatively correlated with stock returns but both possess weak explanatory power or are weakly priced by the GSE.

Generally, these results are consistent with findings from most previous research. After running a regression of portfolios of 20 US stocks from 1958-1984, Chen et.al (1986) found that the stock market significantly prices a number of economic factors including inflation, interest rate and oil prices. It can be posited that the negative signs found for world crude oil prices and 91day Treasury bill confirms their findings. On the contrary, the statistically insignificant power of world cocoa and gold prices makes it a weak rather than strong confirmation. Perhaps this supports the argument that local risk factors rather than world risk factors are the primary source of equity return in emerging stock markets, (Maysami et al., 2004). On the contrary, World Cocoa and Gold prices are found to be insignificant in Ghana.

The positive sign recorded for inflation is consistent with Beenstock and Chan (1988) who identify the 91-day treasury bill rate, the sterling –dollar exchange rate, m3 and inflation as important variables. Beenstock and Chan (1988) findings are in line with Chen et al., (1986) although they reported positive rather than negative association between inflation and stock prices.

Additionally, this work confirms the findings of Hamao (1988), Ayadi (1991) Clare and Thomas (1994) who provided evidence of a positive relationship between inflation and stock returns. This implies that shares can be a good hedge against inflation on the GSE as postulated by Khil and Lee (2000), Luintel and Paudyal (2006), whose findings revealed that shares are a good hedge against inflation in Malaysia and the UK, respectively. Mukherjee and Naka (1993), Clare and Thomas(1994), Kwon and Shin(1999), Fifield et al., (2002), Altay (2003), Gunasekarage et al., (2004), Humpe and Macmillan, (2009) provide empirical evidence that stock markets price money supply, interest rates, inflation, exchange rate, and world oil prices. More importantly, the finding that World Crude Oil price is negatively priced by the GSE has significant economic implication for investors and policy makers on the Ghanaian market.

However, a critical observation of the result reveals the problem of changing significance of macroeconomic variables in multiple regression equations reported by Hamao (1988) and Wasserfallen (1989).While most studies (Priestley (1996), Cheng (1995) found exchange rate to be statistically significant in pricing stock returns, it has been found to be weak on the GSE. Again, while most empirical test Priestley (1996), Cheng (1995) among others, establish a direct correlation between exchange rate and stock returns, an inverse association is observed on the GSE.

This finding is not empirically surprising but rather emphasises the problem of changing significance using the APT model. Indeed, Beenstock and Chan (1988) and Hamao (1988) in reviewing earlier empirical work using the same data, found changing results. Similarly, Ekpenyong and Obieke, (1994) in reviewing the results of

Ayadi (1991) rejected his finding that there was a strong association between macro-economic variables and the stock market using Nigerian data. Further, Poon and Taylor (1991), after reconsidering the methodology and the interpretation of Chen et al., (1986) concluded that macroeconomic variables do not influence UK stock prices in the way reported by for the US markets. These observations raises further issues regarding methodology, type of data , the size, activeness, maturity and sophistication of the stock market, geographic location, statistical packages, models and equation selection and many others and how they impact significantly on macroeconomic variables using APT model. This result also brings up the issue of the scientific testability and the so called superiority of the APT model to CAPM that has been raised by earlier researchers.

4.8 Diagnostic Test Statistics and Its Interpretation

Table 4.4. Diagnostic tests

HeteroskedasticityTest: White

F-statistic	5.539797	P-value	0.0000

Breusch-Godfrey Serial Correlation LM Test

F-statistic	199.3119	P-value	0.2136**

Note: ** means statistically significant at the 5% level

The results of the diagnostic tests are detailed in table 4.4. The White heteroskedasticity test has an F-statistic of 5.539797, with a null hypothesis of no evidence of heteroskedasticity. However a P-value of 0.0000 means this null hypothesis is rejected; that is, the assumption of homoscedasticity is violated. To rectify this anomaly, the White Heteroskedasticity-Consistent Standard Errors and Covariance was used when running the OLS regressions. On the other hand, Breusch-

Godfrey Serial Correlation LM Test has an F-statistic of 199.3119 with a P-value of 0.2136 hence the null hypothesis of no auto-correlation cannot be rejected at the 5% level of significance.

It is important to examine the variables under study in order to determine the relationship between them and to see if they are highly correlated. Chen et al., (1986) show that high correlation among dependent variables results in multicollinearity. This weakens the explanatory power of the individual variables. The econometric principle therefore, is that a low correlation between explanatory variables but a high correlation between independent variables and the dependent one is sound.

4.9 Johansen-Juselius Co-integration Test Results

Table 4.5: Johansen-Juselius Co-integration Test Results

Hypothesis	**Trace**			**Max- Eigenvalue**		
	Trace statistic	**0.05 Critical value**	**P-Value**	**Max-Eigen Statistic**	**0.05 Critical Value**	**P – Value**
None**	227.1320	159.5297	0.0000	57.12465	52.36261	0.0000
At most 1**	149.2499	125.6154	0.0008	36.53473	46.23142	0.0040
At most 2	93.80453	95.75366	0.0676	27.70386	40.07757	0.1884
At most 3	59.36846	69.81889	0.2553	20.33316	33.87687	0.3021
At most 4	33.05747	47.85613	0.5536	13.25073	27.58434	0.8121
At most 5	18.90722	29.79707	0.4996	8.958223	21.13162	0.5909
At most 6	7.342368	15.49471	0.5381	4.161477	14.26460	0.5272
At most 7	0.658686	3.841466	0.4170	0.450445	3.841466	0.4170

Note: ** represent statistical significance at the 5% level. The optimal lag length of the vector auto regression (VAR) for testing the co-integration is 3.

Table 4.5 shows both the trace and Max-Eigen test statistics. In both of these tests, the null of no co integrating vectors is rejected. Thus, in the first row (None), both the trace and Max-Eigen value have a test statistic greater than their critical values at 5%. Additionally, the fact that they all have a P-value less than 0.05 means there is a low probability that the null hypothesis of no co integrating vectors is true. Therefore, in both situations, (Trace, and Max-Eigen value) we cannot reject the null hypothesis of at most one co integrating vector at the 5% level of significance. The interpretation of this finding is that there is the possibility of at least one long run relationship between the GSE and the variable set. If we move to the next row, again the test statistic of 149.2499 is greater than the critical value of 125.6154 at the 5% level of significance. This is further evidenced by a P-value of 0.0008 and 0.0040 for the trace and max-eigen value respectively, meaning we can reject the null of at most one co integrating vector. The implication of this is that there are at least two co integrating vectors.

However this result contradicts the results of the Engle-Granger co integration test. Whilst the Engle Granger co-integration test results show no co integrating relationship between the various macroeconomic variables and the GSE All Share index at the 5% level of significance, the opposite is true for the Johansen Juselius Co integration test. Bahmani-Oskooee and Payesteh (1993) investigating the response of trade flows to exchange rate uncertainties using standard econometric methods found a negative relationship between exchange rate uncertainties and trade flows in emerging markets.

4.10 Engle-Granger Causality Test Results

The causal relations among these variables are reported in table 4.6. As can be seen from the results, the null hypothesis of non block Granger causality cannot be rejected in both directions for Inflation, Crude Oil prices, cocoa prices, gold prices, and 91-Day treasury bill rate as their P-values are not statistically significant. Alternatively, Broad money supply and the foreign exchange rate can be said to granger cause the GSE share index but the reverse hypothesis is rejected at the 5% level of significance.

This finding suggests that future share returns can be estimated using foreign exchange rates and the inflation rate for the Ghanaian case.

The results also show that GSE All Share index does not Granger causes any macroeconomic variable in Ghana within the sample period. Whilst this confirms the findings of Kwon and Shin (1999), it contradicts the empirical evidence from the developed markets of the US and Japan Fama (1991), Geske and Roll (1983). Overall the evidence is highly in agreement with the OLS output but rejects greatly the evidence of Karamustafa and Kucukkale (2003) who found no granger causality between the Istanbul stock exchange and macroeconomic variables.

Similarly, Basabi and Mukherje (2002), report that there is no causal linkage between stock prices and money supply, national income and short term interest rates using data from the Indian stock market. On the contrary, it is in line with the evidence of Naka and Mukherje (1993), Gursery and Alovsat, (2003), Salman and Ghazi (2003), who generally signal causality between macroeconomic variables and stock returns for India, Turkey, Sweden and Mexico respectively. Norma and Robins (2003) reported that strong granger causality existed between returns on the Bolsa Mexicana de Valores (BMV) and money supply, inflation, interest rate, and thus concluded that

macroeconomic variables were leading indicators of stock returns for the Mexican case. Accordingly, the findings observed for the Ghanaian market are generally consistent with theory and existing empirical evidence.

Table 4.6 Granger Causality Test Results

Direction of causality			F-Statistic	P-Values
GSEINDEX	→	LFXR	0.44877	0.7184
LFXR	→	GSEINDEX	2.66276	0.0491*
GSEINDEX	→	LINFR	0.68440	0.5625
LINFR	→	GSEINDEX	1.10731	0.3472
GSEINDEX	→	LMS	0.50444	0.6796
LMS	→	GSEINDEX	3.00233	0.0315*
GSEINDEX	→	LTBR	1.42897	0.2354
LTBR	→	GSEINDEX	1.67301	0.1739
GSEINDEX	→	LWCOPX	1.67805	0.1729
LWCOPX	→	GSEINDEX	0.14465	0.9330

Note: * represent statistical significance at the 5% level

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

5.2 Summary of Findings

i. Results of the Ordinary Least Square regression indicate that four out of seven macroeconomic variables, (LINFR, LTBR, LMS, and LWCOPX) possess explanatory power for stock returns in Ghana. While LFR, LTBR, LWCOPX and LMS are statistically significant (at 5%) and positively correlated with stock returns, LFXR, LWGPX, and LWCPX establish a negative association with share returns and are not significant at the 5% level.

ii. However, while the Engle and Granger co-integration test results signal the existence of an overall long-run relationship between stock returns and the observed variables on the GSE, the same could not be said of the long-run relationship between individual macroeconomic variables and stock returns. On the contrary, the Johansen and Juselius co-integration test shows the existence of at least two co-integrating relationships between stock returns and the macroeconomic variables. A positive long-run relationship is observed for the rate of inflation, world crude oil prices, world cocoa prices, and the foreign exchange rate whilst a long-run negative association is observed for the money supply, the treasury bill rate, and world gold prices. Additionally, the Engle and Granger causality test points to uni-directional causality between stock returns and the foreign exchange rate and the money supply.

iii. Thus macroeconomic variables hold a significant explanatory power for stock returns in Ghana in particular and emerging markets in general.

5.3 Conclusion

It has been tremendously documented by previous researchers that macroeconomic variables possess explanatory power for stock returns Chan et al., (1985), Chen et.al (1986), Ayadi (1991), Clare and Thomas (1994), Oyama, (1997); Fifield et al. ;(2002); Atlay (2003); Gunasekarage et al., (2004); Humpe and Mcmillan (2009); Maysami et al., (2004). Similarly, it is widely known that co- integrating relations and granger causality may exist between macroeconomic variables and stock returns Mukherjee and Naka (1993); Basabi and Mukherje (2002); Karamustafa and Kucukkale (2003); Thus, the overall conclusion is that macroeconomic variables hold a significant explanatory power for stock returns in Ghana in particular and emerging markets in general.

Further, and to a greater degree, the evidence found for the Ghanaian case is highly consistent with macroeconomic theory and previous evidence. However, these results must be explained in the light of the following observations. Most of the earliest researchers studied the relationship using OLS, Co integration and Granger causality techniques although it has been recognised that such procedures may be inadequate, and that conclusions based on these tests may yield misleading inferences Owoye, (1995). Further, Karamustafa and Kucukkale, (2003), posited that the emerging nature of the Turkish economy might have influenced their results as shareholders on the Istanbul market have completely different investment patterns from shareholders in the developed markets. Others, like Kwon and Shin(1999), and Naka and Mukherjee (1993), have accounted for their findings on issues of economic reform, low market activity, size of dataset, corruption , and mismanagement of the economy. The Ghanaian market is in a transitory stage and, the financial sector is still dominated by

the banking sector through which macroeconomic changes such as money supply primarily operate. Indeed, the general perception is that the full benefits of over a decade of economic reforms are yet to be realised. It therefore can be strongly concluded that macroeconomic variables possess significant explanatory power for stock returns on the GSE.

5.4 Recommendations

In the light of the above findings, a number of recommendations for investors, the government, exchange authorities, industry and academia, are made.

5.4.1 Investors

The study found that the 91-day Treasury bill rate, money supply, the inflation rate, crude oil prices and the cedi-dollar exchange rate are priced by the market .With the exception of the inflation rate, world crude oil prices, and money supply, all of the macroeconomic variables were negatively correlated with stock returns.

All other things being equal, improvements in these variables signal the possibility of earning higher returns. Accordingly, and in line with the recommendations of Ekpenyong and Obieke (1994), Atlay (2003) and, Norma and Robins (2003), an optimal investment strategy on the GSE may be that investors should buy shares immediately from the improvements of these macro variables and vice versa.

5.4.2 The Government

The foreign exchange rate, world crude oil prices and the Treasury bill rate were found to be negatively correlated with stock market returns on the GSE. The economic implication is that these variables possess the potential of limiting stock market returns and growth. On the other hand, broad money supply and the inflation

rate were positively associated with stock returns and, as such, implies that indication that they contribute to increases in returns and market growth.

To this end, the government should equip Ghanaian universities with the resources needed to train individuals in oil and gas extraction , management, and the legal framework to ensure that international oil hedging arrangements entered into during the period of production fully takes advantage of world oil price increases. More importantly, the government should set realistic macroeconomic targets to limit chronic deviations which normally render fundamental analysis almost impossible in order to improve public confidence in government decisions.

5.4.3 Sock Exchange Authorities

The Ghana Stock Exchange authorities must put in place measures to increase the listing of companies on the market in order to increase liquidity. The GSE should also consider developing other financial products like derivative instruments to meet the changing needs of investors and uphold investor sovereignty. Also, the creation of other indices should be considered. This will serve as a good measure of the various sectors of the stock market. Education on stock market activities should be intensified to attract more investors, and thus, increase market capitalization. Discussions and advertisements on stock market activities should be informative and must also be conducted in the most frequently spoken Ghanaian languages at public gatherings such as Schools, Churches and Market places. It is hoped that these recommendations, if implemented, will contribute significantly in improving market liquidity and activity.

5.4.4 Industry and Academia

Industry and academia should partner each other to conduct research which focuses on different aspects of the market and the findings should be made available to industry. Further, the current securities exchange courses should be extended nationwide in order to train professionals such as brokers, on the market. Indeed, it will be of great importance if the Ghana Journal of Finance is launched which focuses on research on capital market issues and how best these findings can be used by practitioners and stakeholders as it is for Ghana Journal of Science.

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APPENDICES

Microfit Analyses Outputs

1a:
Ordinary Least Square Regression results.

Dependent Variable: GSEINDEX
Included observations: 228
White Heteroskedasticity-Consistent Standard Errors & Covariance

	Coefficient	Std. Error	t-Statistic	Prob.
C	0.080073	1.616435	0.049537	0.9605
LFXR	-0.391008	0.199796	-1.957038	0.0517
LINFR	0.672927	0.262717	2.561411	0.0111
LMS	1.279600	0.151797	8.429681	0.0000
LTBR	-1.096857	0.396117	-2.769024	0.0061
LWCOPX	-0.303553	0.094575	-3.209647	0.0015
LWCPX	0.059423	0.131358	0.452373	0.6515
LWGPX	-0.044796	0.273977	-0.163503	0.8703

R-squared	0.965717	Mean dependent var	6.748976
Adjusted R-squared	0.964563	S.D. dependent var	1.548679
S.E. of regression	0.291534	Akaike info criterion	0.409013
Sum squared resid	17.67834	Schwarz criterion	0.534023
Log likelihood	-36.17340	Hannan-Quinn criter.	0.459517
F-statistic	837.0181	Durbin-Watson stat	0.107271
Prob(F-statistic)	0.000000		

1b:
Diagnostic Tests

Heteroskedasticity Test: White

F-statistic	6.199431	Prob. F(35,180)	0.0000
Obs*R-squared	118.0606	Prob. Chi-Square(35)	0.0000
Scaled explained SS	132.6046	Prob. Chi-Square(35)	0.0000

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	199.3119	Prob. F(2,206)	0.2136
Obs*R-squared	192.9150	Prob. Chi-Square(2)	0.2137

1c:

Wald Test

Test Statistic	Value	df	Probability
F-statistic	0.102324	(2, 208)	0.9028
Chi-square	0.204647	2	0.9027

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(7)	0.059423	0.131358
C(8)	-0.044796	0.273977

Restrictions are linear in coefficients.

1d:

Unit Root test

Levels with a constant

Null Hypothesis: GSEINDEX has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.676042	0.8491
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

Null Hypothesis: LFXR has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.755058	0.4021
Test critical values:	1% level	-3.461327	
	5% level	-2.875062	
	10% level	-2.574054	

Null Hypothesis: LINFR has a unit root
Exogenous: Constant
Lag Length: 13 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.767917	0.3957
Test critical values:	1% level	-3.462737	
	5% level	-2.875680	
	10% level	-2.574385	

Null Hypothesis: LTBR has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.814969	0.3726
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

Null Hypothesis: LMS has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.866427	0.7973
Test critical values:	1% level	-3.461178	
	5% level	-2.874997	
	10% level	-2.574019	

Null Hypothesis: LWCOPX has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.766904	0.3962
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

Null Hypothesis: LWCPX has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-1.551978	0.5054
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

Null Hypothesis: LWGPX has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.923387	0.9957
Test critical values:	1% level	-3.460739	
	5% level	-2.874804	
	10% level	-2.573917	

Levels with a constant and trend

Null Hypothesis: GSEINDEX has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.296166	0.4338
Test critical values:	1% level	-4.001516	
	5% level	-3.430963	
	10% level	-3.139114	

Null Hypothesis: LFXR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.711797	0.7429
Test critical values:	1% level	-4.002142	
	5% level	-3.431265	
	10% level	-3.139292	

Null Hypothesis: LTBR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.173175	0.5016
Test critical values:	1% level	-4.001516	
	5% level	-3.430963	
	10% level	-3.139114	

Null Hypothesis: LMS has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.115360	0.5339
Test critical values:	1% level	-4.001931	
	5% level	-3.431163	
	10% level	-3.139232	

Null Hypothesis: LINFR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 13 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.416695	0.3698
Test critical values:	1% level	-4.004132	
	5% level	-3.432226	
	10% level	-3.139858	

Null Hypothesis: LWCOPX has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.720730	0.2294
Test critical values:	1% level	-4.001516	
	5% level	-3.430963	
	10% level	-3.139114	

Null Hypothesis: LWGPX has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.586768	0.9785
Test critical values:	1% level	-4.001311	
	5% level	-3.430864	
	10% level	-3.139056	

Null Hypothesis: LWCPX has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.338954	0.4107
Test critical values:	1% level	-4.001516	
	5% level	-3.430963	
	10% level	-3.139114	

First difference

With constant

Null Hypothesis: D(GSEINDEX) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.486287	0.0000
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

Null Hypothesis: D(LINFR) has a unit root
Exogenous: Constant
Lag Length: 12 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.472253	0.0000
Test critical values:	1% level	-3.462737	
	5% level	-2.875680	
	10% level	-2.574385	

Null Hypothesis: D(LFXR) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.444235	0.0105
Test critical values:	1% level	-3.461327	
	5% level	-2.875062	
	10% level	-2.574054	

Null Hypothesis: D(LTBR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.89953	0.0000
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

Null Hypothesis: D(LMS) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.56885	0.0000
Test critical values:	1% level	-3.461178	
	5% level	-2.874997	
	10% level	-2.574019	

Null Hypothesis: D(LWCOPX) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.392317	0.0000
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

Null Hypothesis: D(LWCPX) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.70346	0.0000
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

Null Hypothesis: D(LWGPX) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.65308	0.0000
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

First Difference with constant and trend

Null Hypothesis: D(GSEINDEX) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.464992	0.0000
Test critical values:	1% level	-4.001516	
	5% level	-3.430963	
	10% level	-3.139114	

Null Hypothesis: D(LINFR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 12 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.499898	0.0000
Test critical values:	1% level	-4.004132	
	5% level	-3.432226	
	10% level	-3.139858	

Null Hypothesis: D(LMS) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.58197	0.0000
Test critical values:	1% level	-4.001931	
	5% level	-3.431163	
	10% level	-3.139232	

Null Hypothesis: D(LFXR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.537251	0.0000
Test critical values:	1% level	-4.001516	
	5% level	-3.430963	
	10% level	-3.139114	

Null Hypothesis: D(LTBR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.87264	0.0000
Test critical values:	1% level	-4.001516	
	5% level	-3.430963	
	10% level	-3.139114	

Null Hypothesis: D(LWCOPX) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented D ickey-Fuller test statistic		-8.337270	0.0000
Test critical values:	1% level	-4.001516	
	5% level	-3.430963	
	10% level	-3.139114	

Null Hypothesis: D(LWCPX) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.70069	0.0000
Test critical values:	1% level	-4.001516	
	5% level	-3.430963	
	10% level	-3.139114	

Null Hypothesis: D(LWGPX) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.95831	0.0000
Test critical values:	1% level	-4.001516	
	5% level	-3.430963	
	10% level	-3.139114	

1e:

Engle Granger Cointegration Test

Test of regression residuals for unit root.

Unit root test of mainresid from the regression equation:gseindex c lfxrlinfrltbrlmslwcopxlwcpxlwgpx

Null Hypothesis: MAINRESID has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.147557	0.0247
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

Unit root test of lfxrresidfrom the regression equation: gseindex c lfxr

Null Hypothesis: LFXRRESID has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.511680	0.5260
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

Unit root test of linfrresid from the regression equation: lsindex c linfr

Null Hypothesis: LINFRRESID has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.849640	0.8024
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

Unit root test of ltbrresid from the regression equation: gseindex c ltbr

Null Hypothesis: LTBRRESID has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.336788	0.6124
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

Unit root test of lmsresid from the regression equation: gseindex c lms

Null Hypothesis: LMSRESID has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.641952	0.0862
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

Unit root test of lwcopxresid from the regression equation: gseindex c lwcopx

Null Hypothesis: LWCOPXRESID has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.986673	0.2926
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

Unit root test of lwgpxresid from the regression equation: gseindex c lwgpx

Null Hypothesis: LWGPXRESID has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.856088	0.3527
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

Unit root test of lwcpxresid from the regression equation: gseindex c lwcpx

Null Hypothesis: LWCPXRESID has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on AIC, MAXLAG=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.995885	0.2886
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

1f:
Johansen JuseliusCointegration results.

Included observations: 228 after adjustments
Trend assumption: Linear deterministic trend
Series: LFXR LINFR LMS GSEINDEX LTBR LWCOPX LWCPX LWGPX
Lags interval (in first differences): 1 to 3

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.307446	227.1320	159.5297	0.0000
At most 1 *	0.230131	149.2499	125.6154	0.0008
At most 2	0.149928	93.80453	95.75366	0.0676
At most 3	0.116716	59.36846	69.81889	0.2553
At most 4	0.064568	33.05747	47.85613	0.5536
At most 5	0.053090	18.90722	29.79707	0.4996
At most 6	0.031035	7.342368	15.49471	0.5381
At most 7	0.003102	0.658686	3.841466	0.4170

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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.307446	77.88211	52.36261	0.0000
At most 1 *	0.230131	55.44533	46.23142	0.0040
At most 2	0.149928	34.43606	40.07757	0.1884
At most 3	0.116716	26.31099	33.87687	0.3021
At most 4	0.064568	14.15026	27.58434	0.8121
At most 5	0.053090	11.56485	21.13162	0.5909
At most 6	0.031035	6.683682	14.26460	0.5272
At most 7	0.003102	0.658686	3.841466	0.4170

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

1g:
Granger Causality Test

Pairwise Granger Causality Tests
Lags: 3

Null Hypothesis:	Obs	F-Statistic	Prob.
LINFR does not Granger Cause LFXR	228	1.10180	0.3494
LFXR does not Granger Cause LINFR		1.49668	0.2166
LMS does not Granger Cause LFXR	228	0.80563	0.4920
LFXR does not Granger Cause LMS		1.33777	0.2632
GSEINDEX does not Granger Cause LFXR	228	0.44877	0.7184
LFXR does not Granger Cause GSEINDEX		2.66276	0.0491
LTBR does not Granger Cause LFXR	228	0.04432	0.9876
LFXR does not Granger Cause LTBR		1.10515	0.3481
LWCOPX does not Granger Cause LFXR	228	0.32833	0.8049
LFXR does not Granger Cause LWCOPX		0.92579	0.4292
LWCPX does not Granger Cause LFXR	228	0.91015	0.4370
LFXR does not Granger Cause LWCPX		1.48435	0.2199
LWGPX does not Granger Cause LFXR	228	2.23049	0.0858
LFXR does not Granger Cause LWGPX		3.86430	0.0102
LMS does not Granger Cause LINFR	228	0.72790	0.5364
LINFR does not Granger Cause LMS		0.15439	0.9268
GSEINDEX does not Granger Cause LINFR	228	0.68440	0.5625
LINFR does not Granger Cause GSEINDEX		1.10731	0.3472

LTBR does not Granger Cause LINFR	228	0.97161	0.4071
LINFR does not Granger Cause LTBR		4.43648	0.0048
LWCOPX does not Granger Cause LINFR	228	0.37135	0.7738
LINFR does not Granger Cause LWCOPX		1.20191	0.3101
LWCPX does not Granger Cause LINFR	228	0.35991	0.7820
LINFR does not Granger Cause LWCPX		0.32964	0.8039
LWGPX does not Granger Cause LINFR	228	0.51827	0.6702
LINFR does not Granger Cause LWGPX		0.59769	0.6172
GSEINDEX does not Granger Cause LMS	228	0.50444	0.6796
LMS does not Granger Cause GSEINDEX		3.00233	0.0315
LTBR does not Granger Cause LMS	228	0.20525	0.8927
LMS does not Granger Cause LTBR		0.79571	0.4975
LWCOPX does not Granger Cause LMS	228	0.70351	0.5509
LMS does not Granger Cause LWCOPX		1.80454	0.1475
LWCPX does not Granger Cause LMS	228	0.43242	0.7300
LMS does not Granger Cause LWCPX		2.13897	0.0964
LWGPX does not Granger Cause LMS	228	1.13058	0.3377
LMS does not Granger Cause LWGPX		1.68733	0.1709
LTBR does not Granger Cause GSEINDEX	228	1.67301	0.1739
GSEINDEX does not Granger Cause LTBR		1.42897	0.2354
LWCOPX does not Granger Cause GSEINDEX	228	0.14465	0.9330
GSEINDEX does not Granger Cause LWCOPX		1.67805	0.1729
LWCPX does not Granger Cause GSEINDEX	228	0.90872	0.4377
GSEINDEX does not Granger Cause LWCPX		1.31551	0.2704
LWGPX does not Granger Cause GSEINDEX	228	1.22587	0.3013
GSEINDEX does not Granger Cause LWGPX		1.38992	0.2469

LWCOPX does not Granger Cause LTBR	228	0.57174	0.6342
LTBR does not Granger Cause LWCOPX		4.65650	0.0036
LWCPX does not Granger Cause LTBR	228	2.15050	0.0950
LTBR does not Granger Cause LWCPX		0.57725	0.6306
LWGPX does not Granger Cause LTBR	228	0.86630	0.4594
LTBR does not Granger Cause LWGPX		2.93014	0.0347
LWCPX does not Granger Cause LWCOPX	228	0.12716	0.9439
LWCOPX does not Granger Cause LWCPX		1.77618	0.1528
LWGPX does not Granger Cause LWCOPX	228	0.09476	0.9629
LWCOPX does not Granger Cause LWGPX		1.81116	0.1462
LWGPX does not Granger Cause LWCPX	228	1.94306	0.1238
LWCPX does not Granger Cause LWGPX		1.31176	0.2716