UNIVERSITY OF CAPE COAST

STOCK MARKET PERFORMANCE AND ECONOMIC GROWTH: EVIDENCE FROM GHANA

BY

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

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Candidate's Signature: ……..... Date: ...…….....

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

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ABSTRACT

This study empirically examines the relationship between stock market performance and economic growth in Ghana using quarterly time series data from 1991 to 2012 for four stock market performance indicators, namely; stock market capitalization ratio, stock market turnover ratio, total value traded ratio and the Ghana Stock Exchange market index with three other control variables. The study employed the Johansen and Juselius (1990) multivariate cointegration technique and vector error correction model to investigate the long and short-run relationships amongst the variables. The standard Granger causality test is performed to establish the direction of causality. The impulse response functions (IRFs) and forecast error variance decomposition (FEVD) are used to assess shocks and the relative importance of each variable in the system.

The results indicate a positive and significant relationship between stock market performance and economic growth. The Granger causality results suggest a unidirectional causality in general from stock market performance to economic growth. This substantiates the supply leading finance hypothesis. The IRFs and the FEVD results reinforce the positive link between stock market performance and economic growth. The study concludes that to tap into the growth enhancing capacity of the Ghana Stock Exchange, the government should initiate policies to promote the supply (tax incentives to companies to list on the GSE) of and demand (using the GSE as a source of finance for all government projects) of securities. This would ensure continuous and sustained economic growth in Ghana.

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DEDICATION

To the loving memory of my late mother

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

ADF	Augmented Dickey–Fuller
AGC	Ashanti Goldfields Company
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
ASML	Accra Stock Market Limited
BOG	Bank of Ghana
CFAO	Compagnie Française de l'Afrique Occidentale
CPI	Consumer Price Index
DANIDA	Danish International Development Agency
DOLS	Dynamic Ordinary Least Squares
ECM	Error Correction Model
ECT	Error Correction Term
EGARCH	Engle-Generalized Autoregressive Conditional Heteroscedasticity
ERP	Economic Recovery Programme
FDI	Foreign Direct Investment
FEVD	Forecast Error Variance Decomposition
FINSAP	Financial Sector Adjustment Programme
FPE	Final Prediction Error
GDP	Gross Domestic Product
GLS	Generalized Least Squares
GNI	Gross National Income

GSE	Ghana Stock Exchange
GSEMI	Ghana Stock Exchange market Index
GVA	Gross Value Added
HD	Harrod-Domar
HQ	Hannan-Quinn Information Criterion
IMF	International Monetary Fund
IPOs	Initial Public Offers
IRFs	Impulse Response Function
ISSER	Institute of Statistical, Social and Economic Research
LA-VAR	Lag-Augmented Vector Autoregressive
LR	Likelihood Ratio
MA	Moving Average
MC	Market Capitalization
MDGs	Millennium Development Goals
NTHC	National Trust Holding Company Limited
OFS	Offer for Sale
OLS	Ordinary Least Square
OTC	Over the Counter
RESET	Regression Equation Specification Error Test
RGDP	Real Gross Domestic Product
SAP	Structural Adjustment Programme
SBC	Schwarz Bayesian Criterion
SIC	Schwarz Information Criterion

SIC	State Insurance Company
SMCAR	Stock Market Capitalization Ratio
STR	Stock Market Turnover Ratio
TFP	Total Factor Productivity
TVR	Total Value Traded Ratio
UK	United Kingdom
USA	United States of America
UT	Unique Trust
VAR	Vector Autoregression
VECM	Vector Error Correction Model
VMA	Vector Moving Average
VT	Value Traded
WB	World Bank
WDI	World Development Indicators
WWW	World Wide Web

CHAPTER ONE

INTRODUCTION

Background to the Study

According to Renelt (1991), economists have long been interested in the factors that cause different countries to grow at different rates and achieve different levels of wealth. This he said is evident in Adam Smith's "*An Inquiry into the Nature and Causes of the Wealth of Nations*" in (1776). This issue is especially relevant today. A 1990 World Bank World Development Report highlights the scale of global poverty and the importance of economic growth in alleviating it.

Economists, traditionally, have considered factors such as capital, labour and technology as the only factors which are relevant to the process of economic growth. But recent developments in economic growth theory show that there has been a shift in the focus of the growth literature from the traditional factors of capital, labour and technology to other factors that might also contribute to the growth process. These other factors include financial development, the macroeconomic environment, political stability and foreign direct investment (FDI), among others. This study is interested in looking at one of these other factors, namely stock market performance, which is captured broadly under financial development, and how it impacts on economic growth in Ghana.

The stock market or equity market is considered as one of the most vital areas of modern market economy as it provides deficit spending units

(companies) in the economy with access to huge capital and gives surplus lending units (investors) in the economy with the opportunity to be part owners of these companies and receive returns on the basis of the future performance of these companies. The government also raises capital by floating government bonds in the market which it uses to finance its development projects. The stock market is part of the broader market referred to as the financial market.

Financial systems help to mobilize and pool savings, provide payments services that facilitate the exchange of goods and services as well as efficient allocation of capital among others which enhance long-term economic growth (Demirguc-kunt, 2006). Long-term capital is very important in the economic development process of a country.

According to Levine and Zervos (1996) and Ezeoha, Ogamba and Oyiuke (2009), the capital market has no doubt contributed significantly in national economic growth and development, especially in developed and emerging markets. As economies grow, more funds are required to meet the rapid expansion and sustain economic growth. The capital market is expected to provide long-term funds for sustainable economic growth in developing countries, especially in Sub-Saharan Africa which, hitherto, has depended heavily on short-term funds provided by the banking sector (Popiel, 1991 & Jefferis, 1995).

In principle, a well-functioning stock market is expected to accelerate economic growth by providing a boost to domestic savings and increasing the quantity and the quality of investment (Singh, 1997). A good performing stock market is expected to theoretically increase savings by enhancing the set of

financial securities available to savers to diversify their portfolios thus reducing risks and effectively allocating capital to the productive units in an efficient manner. The outcome from this will be an increase in the rate of economic growth. Also, well-functioning stock markets greatly help in reducing the principal-agent problem, information asymmetry and consequently boosting an efficient allocation of resources and growth. Pagano (1993) and Levine and Zervos (1998) concurred that although some analysts view stock markets in the developing countries as "casinos" that have little positive impact on economic growth; recent evidence suggests that stock markets may give a big boost to economic development.

Over the past two decades, the importance of the stock market as a financial intermediary in the mobilization of domestic savings and foreign capital for investment has ignited a renewed interest in research into the role of stock market development in promoting economic growth. As a result, some studies have focused on the linkage between stock market development and economic growth using time series data (Hondroyiannis,Lolos & Papapetrou, 2004). These studies have, however, failed to yield homogenous results. The divergent views on the nature of the relationship between stock market development and economic growth on one hand and the nature and direction of causal relationship between the two variables on the other hand may well be described as the "hen and egg puzzle – which is older"?

This issue has stirred up debates in academic circles and often left policy analysts confused. While Shaw (1973), McKinnon (1973), Chen, Roll and Ross

(1986), Demirguc-Kunt and Levine (1996) and Levine and Zervos (1996; 1998) stressed the propulsive role the financial sector plays in the process of economic growth and development, researchers such as Robinson (1952), Shleifer and Summers (1988), Mayer (1988) and Stiglitz (1994) argue that the role of stock markets in raising long term capital for firms to boost economic growth is overemphasized.

The stock market-economic growth linkage is traceable through the mechanism of liquidity creation. In this regard, Levine (1991) and Bencivenga, Smith and Starr (1996) observed that market liquidity and the ability to trade equity easily plays a key role in economic growth. They affirmed that the stock market provides assets to savers who would easily and readily liquidate them whenever they desire, while simultaneously allowing firms permanent access to capital raised through equity issue. This way the capital available to firms does not fluctuate, thus, ensuring a continuous flow of capital to firms for continuous production.

Similarly, Levine (1996) asserted that liquid equity markets make investment less risky and more attractive because they allow savers to sell their equities quickly and cheaply if they need access to their savings or if they want to alter the constitution of their portfolios. In other words, investors will have confidence in markets that are accessible whenever the need arises. The more accessible the participants are to the market, the more liquid the market will become and the more liquid the market becomes the greater its influence on firms and productivity in the country.

The Ghana Stock Exchange was incorporated in July 1989 as a company limited by guarantee which commenced trading on 12th November, 1990. Initially, eleven securities were listed and that increased to thirty-four ordinary shares, one preference share and depository share by the end of 2012. There are also corporate and government bonds listed on the Ghana Stock Exchange. The listed companies represent a cross-section of the economy ranging from mining and manufacturing through pharmaceutical to financial, agriculture and agro-processing.

The Ghana Stock Exchange (GSE) in recent times has attracted the attention of foreign investors and international institutions due to its sterling performance in terms of returns on investment to investors and capital appreciation since 1994. It has provided an avenue for raising long-term capital by both the listed companies and government for investment. It has also promoted the saving and investment habit of investors of the country (Ziorklui, 2001). So, can we say that the GSE has promoted the growth of the economy? The answer to this question among others will be provided by this thesis.

It is anticipated that as the stock market develops in Ghana, it would play the important role of mobilizing domestic savings and foreign capital for investment leading to improvements in GDP growth, thus, ensuring sustained economic growth and development.

From the forgone, it is absolutely clear that understanding stock market performance is crucial for macroeconomists, financial analysts, policy makers, investors and academicians. This coupled with the fact that the relationship

between stock market performance and economic growth in Ghana has received little attention. This study thus, seeks to examine the relationship between stock market performance and economic growth in Ghana.

Statement of the Problem

The Ghana Stock Exchange has chalked a lot of successes in the area of performance as compared to its counterparts. Although, it is relatively young in the market, it has performed remarkably well in terms of returns on investment. For example, according to Birinyi Associates, a research group based in the USA as cited by Quaidoo (2011), the GSE in 1994 was rated the 6th best performing stock market amongst all the emerging markets, with the index gaining about 124.3 percent.

The GSE was also voted best performer among all stock markets in Africa and the third best amongst emerging markets in 1998 in terms of capital appreciation by the Standard Chartered Bank London Limited (Economic Commission for Africa, 1999).

The GSE was again adjudged the world's best-performing market at the end of 2003 with a yearly return of about 154.7 percent (or 144 % in US dollar terms) compared with 30 percent return by Morgan Stanley Capital International Global Index as indicated in Yartey and Adjasi (2007).

In the first half of 2013, the market again was adjudged by Bloomberg (A reputable international body based in the USA that monitors and report on businesses and financial markets across the world) as the best performing market

in Sub-Saharan Africa (Graphic Business Report published on the Ghanaweb, 28th August, 2013).

So then, the questions to ask are, "what are the implications of these sterling performances of the GSE on the economy of Ghana? Has these performances any significance on economic growth or is the stock market just following the activities of the real sector?" According to Kyereboah-Coleman and Agyire-Tettey (2008), one of the major reasons for the establishment of the GSE was to enable corporate institutions and the government to raise quick capital for accelerated development while reducing their reliance on donor funds for developmental projects. If this is so, then these sterling performances of the GSE ought to impact on the economy.

Economic growth theory (that is, the endogenous growth theory) posits the existence of a consistent positive relationship between stock markets and economic growth. As far as the literature is concerned, however, the relationship between stock markets and economic growth is not clear and there is even less clarity of the impact of stock markets on economic growth in emerging markets, of which Ghana is one (Osinubi & Amaghionyeodiwe, 2003; Wang 2010).

In Ghana, fewer studies have been conducted on the stock market and economic growth relationship and there seems to be a lack of clarity in the literature. The literature reports mixed results on the relationship between the two variables. For example Osei (2005), using quarterly data from 1991 to 2003 within the VAR and Granger causality frameworks, concluded that the GSE impacts positively on economic growth in Ghana and by contrast, Quaidoo (2011)

using quarterly data from 1991 to 2006 within the VAR-VECM and Granger causality frameworks concluded that, the GSE merely follows the activities of the real sector and that the direction of causality is from economic growth to the stock market. His findings thus, contradict Osei (2005). Other studies that found similar results to that of Osei (2005) are Ashante, Agyapong and Adam (2011), Akomea-Bonsu and Sampong (2013) and Dziwornu and Awunyo-Victor (2013)

Another study by Osamwonyi and Kasimu (2013) contradicts all the above studies. They concluded that, there are no long-run and causal relationships between stock market performance and economic growth in Ghana.

These results from Osei (2005), Quaidoo (2011) and Osamwonyi and Kasimu (2013) are puzzling, because an emerging stock market like the GSE should provide unique, consistent results for the relationship between stock market performance and economic growth but to yield different results from different studies is interesting and provides an opportunity for an in-depth investigation into this interesting phenomenon by looking at four stock market performance indicators together. Based on these conflicting findings, a gap has been created in this area**.**

Beside these mixed results, some of the studies have their individual flaws which might have affected their results and hence their reliability for policy. For instance, Rousseau and Wachtel (2000) opined that stock markets are “forward looking”, thus, market capitalization is affected by the price effect of stock markets. Therefore, the use of nominal stock market capitalization and market

capitalization ratio may lead to spurious relationship or effects. This implicates Osei's (2005) findings.

Also, Quaidoo's (2011) use of the Calderon-Rossell's (1991) behavioural structural model of stock market development is criticized in the literature as the model assumes economic growth as the main determinant or driver of stock market development. Thus, his outcome was envisaged. In all the above studies on Ghana, the sample sizes were small compared to this study and this could have affected their outcomes especially with regard to their methods of estimation. Also, apart from Quaidoo (2011), none of the studies examined the short-run implications of the GSE on economic growth.

From the forgone, it is absolutely clear that a yawning gap exists in the literature in the case of Ghana. The conflicting findings, coupled with the individual weaknesses mentioned, a gap has been created and this presents a prima facie for further investigations into this area for a proper understanding of the relationship between stock market performance and economic growth in Ghana. It is against this backdrop that this study seeks to examine the relationship between stock market performance and economic growth in Ghana.

Objectives

The objectives of the study are categorized into general and specific objectives. The general objective of the study is to examine the relationship between stock market performance and economic growth in Ghana using four

stock market performance indicators, namely; stock market capitalization ratio, stock market turnover ratio, total value traded ratio and the GSE market index.

The specific objectives of the study include:

1. To identify the long-run relationship between the four stock market performance indicators and economic growth in Ghana.
2. To identify the short-run relationship between the four stock market performance indicators and economic growth in Ghana.
3. To establish the direction of causality between the four stock market performance indicators and economic growth in Ghana.
4. To make recommendations to guide policy formulation and policy implementation.

Research Hypotheses

Based on the above objectives, the following hypotheses are stated. $\mathbf{H_0}$ and $\mathbf{H_A}$ are the null and alternative hypotheses respectively.

1. **H_0:** There is no positive relationship between stock market capitalization ratio and economic growth.

   H_A: There is a positive relationship between stock market capitalization ratio and economic growth.

2. **H_0:** There is no positive relationship between stock market turnover ratio and economic growth.

   H_A: There is a positive relationship between stock market turnover ratio and economic growth.

3. **H_0:** There is no positive relationship between total value traded ratio and economic growth.

   H_A: There is a positive relationship between total value traded ratio and economic growth.

4. **H_0:** There is no positive relationship between the GSE market index and economic growth.

   H_A: There is a positive relationship between the GSE market index and economic growth.

Significance of the Study

An in-depth analysis of the relationship between stock market performance and economic growth is crucial for understanding how the market impacts economic growth in the country, thus, giving empirical guidance for policy formulation. If the development of stock market in Ghana can be an engine for growth, then policy makers will focus attention on and direct resources towards establishing and sustaining a dynamic market in the country in order to foster sound and continuous economic growth. In view of this, it is necessary to know whether the stock market in Ghana plays a part in the growth of the Ghanaian economy so as to give it the necessary boost and support. Thus, the study will offer some depths of insight to guide policy, economic planners, portfolio managers and even non listed firms planning to float shares or initial public offers (IPOs) in the market. The study also seeks to contribute to the

existing stock of literature on the ongoing debate on the subject and thus, help increase the stock of knowledge.

Scope of the Study

In pursuit of the above objectives, the study first examined the literature on both the theoretical and empirical on the topic with the aim of understanding how other researchers have situated their views on the issue. The study used four key stock market performance variables to examine their effect on economic growth using quarterly time series data spanning from 1991:1 to 2012:4. This period is chosen because, first, it reflects the period of existence of the GSE. Secondly, it is the period in which the gains of liberalization and deregulation are manifesting in the economy. Thirdly, it reflects the period where the stock market has experienced tremendous successes and lastly because of the availability of data on the variables chosen for the period.

Purely econometric tools of analysis are applied in the analysis of the relationship among the variables while descriptive statistics are used to describe relationships. Secondary data from the Ghana Stock Exchange, the Bank of Ghana and the World Development Indicators is used. This includes facts, figures and graphs from published annual reports and relevant periodicals and daily newspapers.

The Johansen and Juselius (1990) multivariate cointegration test and VECM method of estimation within the VAR framework is employed for the study. These methods have several advantages over the other methods of

cointegration and very appropriate for dealing with the endogeneity issues in the literature (Andrikopoulos & Gkountanis, 2011). All estimations were conducted using EViews 7.0 econometric software.

Organization of the Study

This thesis is organized into six chapters. Chapter one comprises the background to the study, the statement of the problem, objectives of the study, statement of the hypotheses, significance of the study, scope of the study and the organization of the study.

Chapter two is divided into two sections. The first section presents the overview of the Ghanaian economy whilst the second section deals with the overview and performance of the Ghana Stock Exchange.

Chapter three provides a review of related and relevant literature. This is decomposed into review of the theoretical literature and empirical literature.

Chapter four spells out the methodology of the study. It includes: the research design, data and data sources, model specification, justification of the model, estimation techniques, pre-estimation diagnostics, Granger causality test, post estimation techniques among others.

Chapter five deals with the interpretation and discussion of the results of the study and

Chapter six presents the summary, main contributions of the study, conclusions, recommendations of the study and direction for future research

CHAPTER TWO

OVERVIEW AND PERFORMANCE OF THE GHANAIAN ECONOMY AND THE GHANA STOCK EXCHANGE

Introduction

This chapter is divided into three main parts. The first part presents the overview of the Ghanaian economy whilst the second deals with the overview and performance of the Ghana Stock Exchange (GSE). The last part gives the summary and conclusion of the chapter.

Overview of the Ghanaian Economy

This section looks at the structure and performance of the Ghanaian economy from the 1990s to 2012.

Structure of the Economy and Sectoral Contribution to GDP

The general consensus in Aryeetey and Kanbur (2008) is that sustained economic growth would normally be accompanied by a significant structural transformation of the economy. The structure of the Ghanaian economy according to pundits hasn't changed much since 1911. In this regard, a Ghana News Agency report on the 18th of May, 2013 cites Professor Ernest Aryeetey, Director of the Institute of Statistical, Social and Economic Research (ISSER) as saying, Ghana's economy risked stagnation if its economic structures that had remained the same since 1911 were not changed.

The real sector of the Ghanaian economy is divided into three sectors namely; agriculture, industry and services. A review of the historical records on the structure of the Ghanaian economy shows that agriculture was the leading contributor to real GDP followed by services and then industry. The share of agriculture to real GDP in the 1990s was about 48.4 percent before declining in subsequent years to reach 22.7 percent in 2012.

The share of both industry and services to GDP started picking up after 1995 with the share of industrial output to GDP being 21.7 percent and then increasing gradually to reach 27.3 percent in 2012. The share of the services sector to GDP increased from 34.5 percent in 1990 to about 50.0 percent in 2012, making the services sector the highest contributor to GDP in the country in recent times. This indicates a shift in the dominance of the agriculture sector to services sector in recent times, thus, suggesting a marginal change in the structure of the economy.

Sectoral contribution to real GDP-periods average and distribution of GDP at basis prices by economic activity is shown in Appendix I and II respectively.

Performance of the Ghanaian Economy

The economy of Ghana has experienced both prosperity and declines (Bequele, 1983). By the 1990s, the country had started stabilizing with gains in growth. An average growth rate of about 4.3 percent is reported for the period 1990 to 2000. Between 2001 and 2006, the economy maintained a relatively high average growth rate of 5.2 percent (ISSER, 2007). Between 2006 and 2010,

Ghana experienced real GDP growth at an average rate of seven percent per annum. This translated into an average real per capita GDP growth rate of about 3.6 percent per annum. There had been significant growth in real GDP from 4.0 percent in 2009 to 7.7 percent in 2010 and almost 13.6 percent in 2011, making Ghana one of the fastest growing economies in the world in 2011 (DANIDA, 2012).

The report further asserts that, the jump in Ghana's real GDP from 7.7 percent in 2010 to 13.6 percent in 2011 was due to the commencement of commercial crude oil production. The oil sector is estimated to have contributed about 5.6 percent to GDP growth whilst the non-oil sector contributed 8.0 percent to GDP in 2011. GDP growth rate in 2012 was projected to fall to 9.4 percent and decrease further to 7.0 percent by the year 2015 following a drop in peak crude oil production between 2013 and 2015. Actual GDP growth rate was 7.1 percent in 2012, indicating a fall as predicted.

The country's economy grew ahead of the average for the Africa region, with GDP growth at 15 percent in 2011 and 7.1 percent in 2012, prompted by strong cocoa production, construction and transport, continued increased gold output and the commercialization of oil (DANIDA, 2012).

Figure 1 shows the trend of the annual growth rate of GDP of Ghana from 1990 to 2012

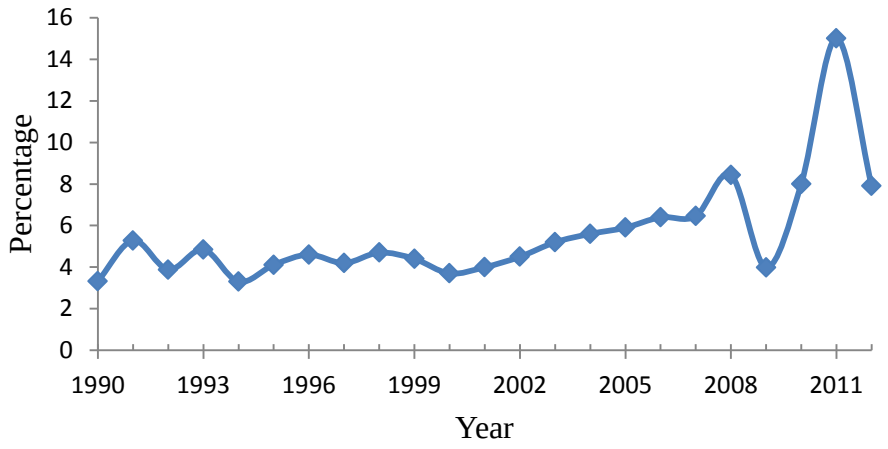

Figure 1: Trend of Annual GDP Growth in Percentages from 1990 to 2012
Source: World Development Indicators (2012)

Overview and Performance of the Ghana Stock Exchange

This section explores the historical background, developments and performance of the Ghana Stock Exchange from its inception in July 1989 to 2012.

History and Development of the Ghana Stock Exchange

As part of the Financial Sector Adjustment Programme (FINSAP), the Ghana Stock Exchange was established in July, 1989, as a private company limited by guarantee under the country's Companies' Code of 1963 (Act 179). Plans of the establishment dates back to the 1960s, when a government study concluded that the establishment of a stock market was essential for the economic development of the country. This led to the promulgation of the Stock Market Act of 1971. The act laid the foundation for the establishment of the Accra Stock Market Ltd. (ASML) in 1971 (www.gse.com.gh).

However, the idea of establishing a stock market failed largely because of political tensions, unfavourable economic environment and the lack of government support (Yartey, 2006). In spite of these unsuccessful attempts, two stock brokerage firms, namely National Trust Holding Company Ltd. (NTHC) and National Stockbrokers Ltd., now Merban Stockbrokers Ltd. did Over-the-Counter (OTC) trading in shares of some foreign-owned companies prior to the establishment of the Ghana Stock Exchange (www.gse.com.gh).

On the 12th of November, 1990, trading commenced on the floor of the exchange with 11 listed companies and one government bond. The exchange later changed its status to a public company limited by guarantee in April, 1994. Total number of listed companies on the stock exchange reached a maximum of 36 companies in 2010 but it currently has a total of 34 companies. This drop in number is as a result of the delisting of Accra Breweries and CFAO Ghana in 2011.

Since the establishment of the Ghana Stock Exchange, five companies have delisted outright. These are: UTC Estates Ghana, Metalloplastica Ghana, British American Tobacco, Accra Brewery and CFAO Ghana whiles five mergers and acquisitions involving the following GSE-listed companies also took place. They are: Ghana Breweries merging with Guinness Ghana to become Guinness Ghana Breweries. Kumasi Breweries merged with Ghana Breweries to become Ghana Breweries. Ashanti Goldfields merged with AngloGold to become AngloGold Ashanti, Mobil Oil Ghana and Total Ghana to become Total

Petroleum Ghana and Unique Trust Financial Services with UT Bank to become UT Bank (www.gse.com.gh).

Performance of the Ghana Stock Exchange

The Ghana Stock Exchange, although relatively young has performed remarkably well in terms of returns on investment. For example, in 1994, it was ranked the 6th best performing stock market index among all the emerging markets, gaining 124.3 percent; an assertion made by Birinyi Associates, a Research Group based in the USA. It was also adjudged the best performer among all stock markets in Africa and the third best in emerging markets in 1998 in terms of capital appreciation by the Standard Chartered Bank London Limited (Economic Commission for Africa, 1999).

The GSE was again adjudged the world's best-performing market at the end of 2003 with a yearly return of about 154.7 percent (or 144 % in US dollar terms) compared with 30 percent return by Morgan Stanley Capital International Global Index as indicated in Yartey and Adjasi (2007).

The performance of the index has, however, not always been remarkable. For instance, in 1999, 2005, 2009 and 2011, the index experienced negative returns with -15.22 percent, -30 percent, -47 percent and -3.1 percent respectively. The growth rate of almost -47 percent in 2009 was the worst since trading commenced on the exchange. Financial analysts attribute it to the spillover effects of the global financial crisis of 2007 and 2008. The 2005 performance was

attributed to rising oil prices, inflation and interest rates (ISSER, 2006; GSE, 2006).

The index rose sharply from 69.77 points in 1991 to 334.02 points in 1994 representing a gain of 124.34 percent before fluctuating in 1995 to 6.33 percent. The fall is attributed to high levels of inflation and interest rate at the period. Thereafter, the trend of the index showed both increasing and decreasing trends but the most significant of the period is in 2003 and 2004, where it gained 154.67 percent and 91.33 percent respectively. The index's performance in 2008 is also worth mentioning. It reached 10,931.36 points representing a gain of 58.06 percent in the index.

The GSE market index summary from 1991 to 2012 is shown in Appendix III. The good performance of the stock market in 1994, 1998, 2003 and 2008 is attributed partly to favourable macroeconomic indicators (inflation, interest rate) and mainly to the listing of the Ashanti Goldfields Company Limited in 1994. In 1998 in particular, there was high demand for equity shares on the market that led to a remarkable increase in share prices on the market.

The trend of the index as shown in figure 2 indicates a steady rise from 1991 through the years to 2002, before rising sharply in 2003 to peak initially at 2004. It then decreased in 2005 and 2006 before increasing again in 2007 to reach an all-time high in 2008. It again decreased in 2009, 2010 and 2011 before increasing marginally in 2012.

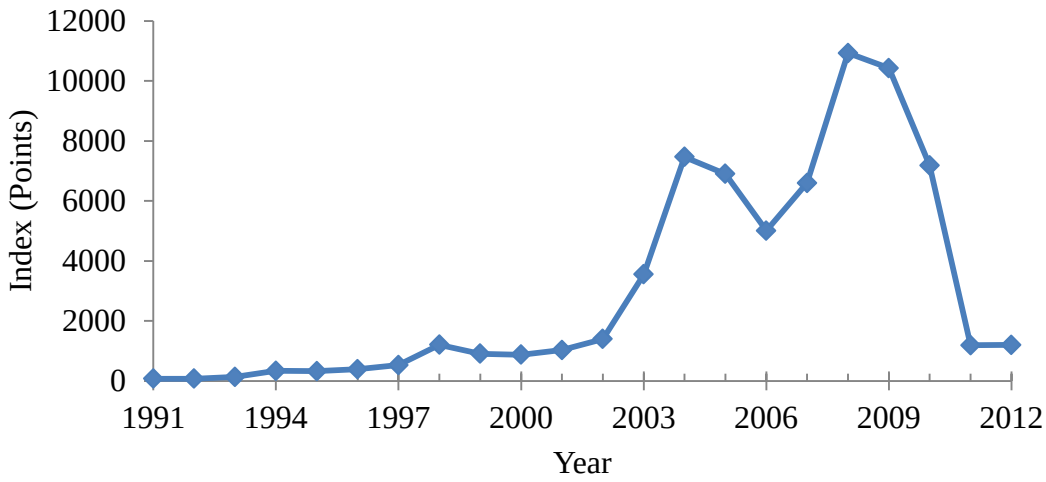

Figure 2: Trend of the GSE Market Index from 1991 to 2012
Source: GSE Market Report (August 2013)

Market Activities (Market's Performance Indicators from 1991 to 2012)

The market's performance indicators considered here include; size, liquidity and efficiency. The GSE recorded very impressive performance in the first half of 2013 as against the whole 2012. All its indices recorded remarkable upward movements. For instance, the GSE Composite Index was 61.39 percent, as against 6.06 percent for the whole of 2012. The GSE Financial Stock Index was 61.66 percent, as against 0.53 percent for the entire 2012. (Graphic Business report on Ghanaweb, 28th August, 2013).

The Size of the GSE/Market

Stock market capitalization to GDP ratio is used to measure the size of the Ghana Stock Exchange. It is the value of domestic equities traded on the exchange divided by GDP. The assumption behind this measure is that the overall market size is positively correlated with the ability to mobilize capital and

consequently diversify risk on an economy-wide basis (Demirguc-Kunt & Levine, 1996). Market capitalization, which also measures the depth of the market, increased gradually from GH¢ 2.96 million in 1991 to GH¢ 196.84 in 1994. This big jump in market capitalization was attributed mainly to the off-loading of the government's shares in Ashanti Goldfields Company Limited in March, 1994. The highest market capitalization of GH¢ 57,264.22 million was in 2012, although it showed fluctuations in 1997, 1999 and 2005 respectively. The market's capitalization ratio increased from 1.15 percent in 1991 to a remarkable 37.82 percent in 1994, but decreased gradually in subsequent years before picking up in 2002. The index reached an all-time high of 122.2 percent in 2004 but fell to 94.44 percent in 2005. It then dipped through the years to 2010 before rising through to 2012, although, it showed a marginal increase in 2008. The trend of the GSE's market capitalization ratio is shown in Figure 3.

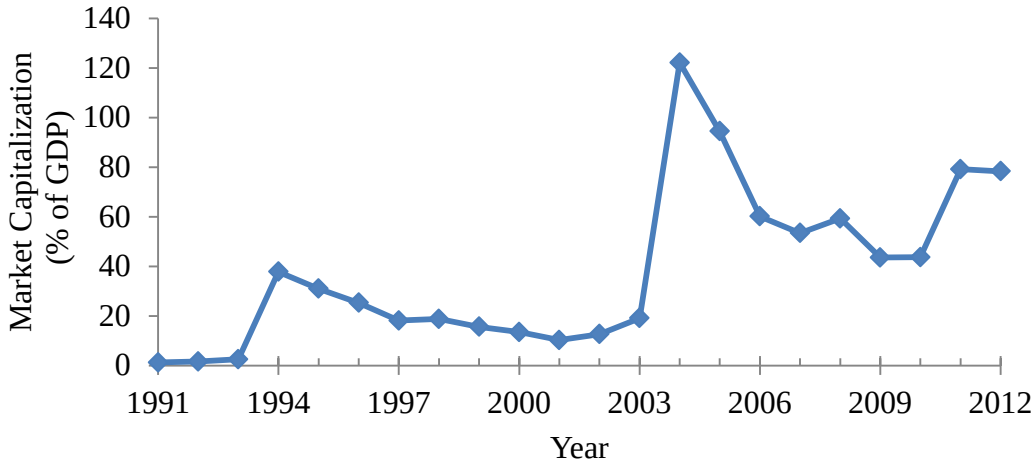

Figure 3: The Size of the GSE from 1991 to 2012
Source: GSE Market Report (August 2013)

From figure 3, the trend shows a sharp rise in market capitalization ratio between 1993 and 1994 after marginal increases in the ratio between 1991 and 1992. The ratio fell continuously in the years that followed before rising very sharply again in 2003 to reach its peak in 2004. It again fell in the following years that ensued till 2009 but made a marginal increase in 2008. The ratio then increased slightly from 43.69 percent in 2010 to 79.15 percent in 2011 before falling again in 2012 to 78.33 percent.

The outstanding performance of the indicator in 2004 was attributed to the merger of Ashanti Goldfields with AngloGold (GSE market report, 2005). The average market capitalization ratio for the GSE stood at 38.2 percent which is just the same as the 1990s world's average of 38.2 percent. The market capitalization ratio of 122.2 percent recorded for 2004 is more than thrice the average capitalization ratio of the 1990s world's average. The indicator also shows that most of the ratios of the years after 2004 were far above the 1990s world average. Thus, suggesting a tremendous increase in the size of the exchange in this period. It can also be observed that the Ghana Stock Exchange was relatively small in the 1990s and early 2000s as compared with the world's average. This is partly because it had not existed for long as suggested by Yartey (2006).

Liquidity of the GSE

Liquidity generally refers to the ability to buy and sell securities easily (Demirguc-Kunt & Levine, 1996; Mala & White, 2006). Two main traditional stock market performance indicators used to gauge market liquidity are total value

traded ratio and turnover ratio. The volume and value of shares traded have improved considerably over the years. The value of shares traded in particular rose substantially to about GH¢7.31 million in 1994 and GH¢ 65.59 million in 2004 primarily due to the listing of the Ashanti Goldfields Limited and AngloGold Ashanti through a merger as noted earlier and other companies.

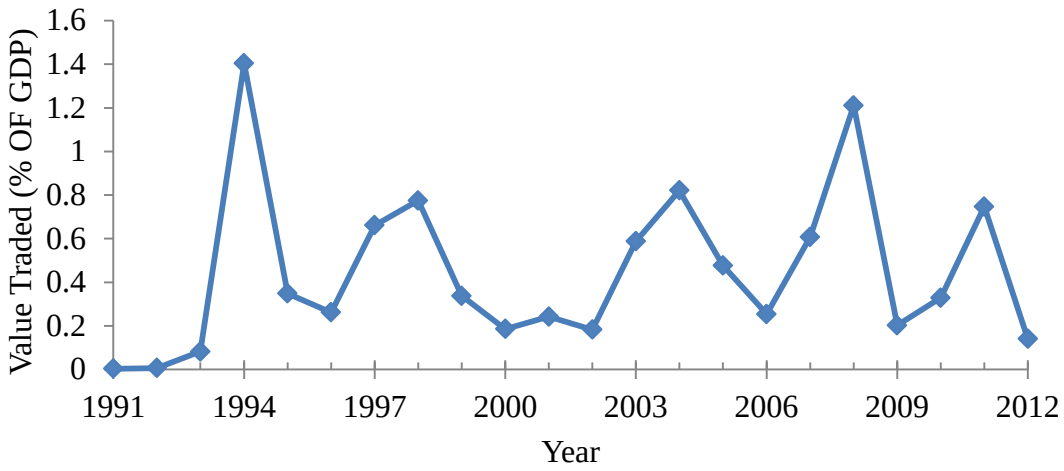

Figure 4: The Liquidity of the GSE from 1991 to 2012
Source: GSE Market Report (August 2013)

The trend of the liquidity of the GSE relative to the size of the economy shows a rising and falling trend through the various years. Its highest point was in 1994 with a market liquidity of 1.40 percent. The second highest peak is in 2008 with a market liquidity of 1.21 percent. Its lowest was in 2012 with a liquidity of 0.14 percent. The liquidity of the GSE relative to the economy of Ghana as a whole has been relatively small, especially, with periods prior to 1994 before jumping to 1.4 percent in 1994.

The average liquidity of 0.45 percent of the Ghana Stock Exchange is far below the 1990s world average of 31 percent which is indicative of the fact that the Ghana Stock Exchange is relatively small relative to the size of the economy as already indicated in Yartey (2006).

The other indicator of stock market liquidity is the turnover ratio. The turnover ratio is the total value of shares traded during the period divided by the market capitalization for the period. It measures the activity of the stock market relative to its size. The turnover ratio is often used to capture the efficiency of the domestic stock market. High turnover ratio is used as an indicator of low transaction costs.

Figure 5 shows the trend of the liquidity of the GSE relative to its size. The trend is similar to the trend of the liquidity of the GSE relative to the size of the economy. Its highest point was in 1998 with a liquidity of 4.13 percent and its lowest was in 2012 with a liquidity of 0.18 percent. This trend indicates that the efficiency of the Ghana Stock Exchange rises and falls through the years.

Information on the stock market performance indicators including Gross Domestic Product (GDP) are shown in Appendix IV.

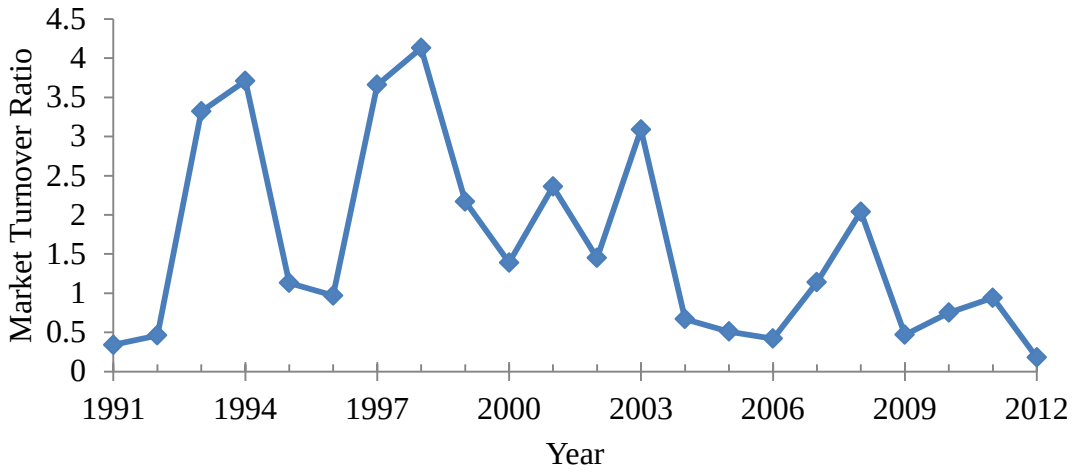

Figure 5: The Efficiency of the GSE from 1991 to 2012
Source: GSE Market Report (August 2013)

Primary Capital Issues and Corporate Actions

The primary market deals with the issue of new securities by government and corporate bodies. The new capital raised by corporate bodies through equity issues on the market between 1991 and 2012 totalled GH¢ 825.01 million. In 1991, 1993 and 2001 there was virtually no activity in the primary market. However, the bulk of equity was raised between 2011 and 2012 with that of 2012 being the highest ever with a total new capital of about GH¢ 286.79 million. Out of the total equity capital raised, Initial Public Offers (IPOs) accounted for about GH¢ 262.53 million representing 31.82 percent. Right issue accounted for GH¢ 274.99 million representing 26.9 percent. Bonus shares amounted to about GH¢115.51 million representing 14.00 percent of the total equity raised in the period. In all, these offers constituted about 79.15 percent of the total equity capital raised on the Ghana Stock Exchange.

Similarly, private placement accounted for about GH¢ 171.74 million representing 20.82 percent. This means that the institutional investment is increasing. The rest of the 0.03 percent of the new capital raised is OFS. This is an indication of the public confidence and willingness to participate in the Ghana Stock Exchange through saving and investment of their resources. It also suggests that the resource mobilization ability of the GSE is enhanced greatly, thus, its ability to fund viable investment projects to increase economic growth. It also suggests that the GSE is becoming robust in offering the cheapest means of raising capital in order to reduce the dependence on the banking sector for financing.

Corporate bond issued on the market was also non-existent in the first five years. The bond market became active from 1996, but not much was raised. Only Home Finance Company raised US$ 20.44 million. This excludes the £1.20 million raised by it and the GH ¢ 35.00 million by Standard Chartered Bank Medium Term Note. The market went dormant again between 2009 and 2012. The rest of the information on primary capital issues and corporate actions are displayed in Appendix V.

Summary and Conclusion

The chapter discussed the structure and performance of the economy from 1990 to 2012 and also the history and performance of the Ghana Stock Exchange within the period with the view of providing the background for the subsequent

investigation of the relationship between stock market performance and economic growth in Ghana.

The country has experienced periods of stable growth, but it is not reported anywhere in the literature to the best of my knowledge that the growth was as a result of the stock market. The performance of the GSE suggests that it is robust in offering the cheapest means of raising capital for investment projects, thus, with the right policy mix, a country may develop its stock market, however, the questions that remain are, will the stock market impact on economic growth? And, if it does, what is the direction of causality and the relative importance of each of the four stock market performance indicators in explaining economic growth in Ghana?

CHAPTER THREE

REVIEW OF RELATED LITERATURE

Introduction

This chapter gives a review of both the theoretical and empirical literature on the study. The chapter starts with the theoretical literature review, followed by the empirical evidence of the stock market performance and economic growth relationship and concludes with a summary and conclusion of the chapter.

Theoretical Literature Review

Since Smith (1776), several growth theories have been developed and used extensively in economic analysis as economists try to understand the factors that cause the growth of a country. Some of the growth theories that are relevant to this study are discussed briefly.

Review of Relevant Economic Growth Models and Theories of Financial Development

This section provides an overview of the Solow growth model, endogenous growth theory, and theories of financial development.

The Neoclassical Growth Theory

The Neoclassical theory of growth according to Chizea (2012), is traced to the works of Marshall (1898), Ramsey (1928), Solow (1956), Swan (1956), Cass

(1965) and Koopmans (1965). This theory requires a diminishing return to every input, which includes a smooth elasticity of substitution between inputs; economic growth is dependent on technological progress, labour as well as the amounts of capital stock. It assumes that, in the long run, increases in per worker output can be maintained only by growth in productivity. In the neoclassical growth model, long-run growth is determined by elements entirely outside of the model, that is, they are exogenous to the model.

The Solow Growth Model

The Solow growth model is a long-run economic growth model set within the framework of neoclassical economics. Solow (1956) and Swan (1956) resorted to the neoclassical production function with varying shares of labour and capital inputs. The major innovation introduced especially by Solow was to allow for factor substitutability so that stable equilibrium growth could be obtained. This model is consistent with a number of stylized facts related to economic growth such as the relative constancy over time of the capital-output ratio and factor income shares (Renelt, 1991).

The Endogenous Growth Model

The Endogenous growth theory is of the view that economic growth is primarily the result of endogenous and not external factors (Romer, 1994). The theory argues that investments in human capital, innovation and knowledge are significant contributors to economic growth. It also focuses on positive

externalities and spillover effects of a knowledge-based economy which will lead to economic development. Perhaps the most important feature of these models is that they give space for policies affecting saving and investment to affect the countries' long term growth rates (Ang, 2007).

Patrick's (1966) Supply Leading- Demand Following Finance Hypothesis

Patrick (1966) identified two possible directions of causality between financial development and economic growth. These relationships were labelled as the 'supply-leading finance' and 'demand following finance' hypotheses. The supply leading view postulates a positive impact of financial development on economic growth. The supply-leading finance will cause economic development through the transfer of scarce resources from savers to investors according to the highest rates of return on investment. The McKinnon-Shaw hypothesis supports this view.

The demand-following view postulates a causal relationship from economic growth to financial development. Patrick (1966) argues that the creation of modern financial institutions, their financial assets and liabilities and related financial services are a response to the demand for these services by investors and savers in the real economy. Thus, economic growth creates a demand for developed financial institutions and services.

The McKinnon-Shaw Hypothesis

McKinnon (1973) and Shaw (1973) are the most influential works that underpin Patrick's (1966) hypotheses and suggest that better functioning financial systems lead to more robust economic growth (Moore, 2009). The McKinnon model, assumes that investment in a typical developing economy is mostly self-financed. Given its lumpy nature, investment cannot materialize unless sufficient saving is accumulated in the form of deposits. Such a complementary role between money and physical capital is termed the "complementarity hypothesis".

The "debt-intermediation" view by Shaw (1973) similarly, postulates that financial intermediaries promote investment and raise output growth through borrowing and lending. These theories suggest that distortions in the financial systems, such as loans issued at an artificially low interest rate, directed credit programs and high reserve requirements are unwise and unnecessary. These can reduce saving, retard capital accumulation, and prevent efficient resource allocation. By allowing interest rates to adjust freely according to market mechanisms, entrepreneurs have more incentives to invest in high-yield projects. As such, higher economic growth is expected. Therefore, they called for financial liberalization, which refers to the process of eliminating or significantly alleviating financial system distortions. This was dubbed the "financial liberalization view" (Fry, 1988).

Stock Markets and Economic Growth: Theoretical Review

Considerable literature exists on the ongoing debate in finance on the questions: Are financial systems important for economic growth? Do they play a causal role in economic development? Or the financial sector merely follows the developments in the real sector? One school of thought stresses the role of financial system in mobilizing savings, allocating capital, exerting corporate control and easing risk management. This school of thought is referred to as Keynesian economic thought. Economic theory from the 1930s to the 1970s was dominated by the thinking of John Maynard Keynes, in whose theories money and interest rate matter a great deal. The following economists share similar views with those of Keynes; Schumpeter (1911), Goldsmith (1969), Mckinnon (1973) and Shaw (1973). They provide conceptual descriptions and empirical examples of how and when financial system affect economic growth and some of these have been explained already.

Stock markets perform the important financial functions of ensuring efficiency in capital allocation to induce economic growth. Levine and Zervos (1996) observe that stock markets influence economic growth through savings mobilization, provision of liquidity, risk diversification, information acquisition about firms and corporate control. Stock markets are also expected to promote economic growth through encouraging both domestic savings and foreign capital inflow by providing opportunities for investors with financial instruments that may better meet their risk preferences and liquidity needs. They also provide avenues for firms to raise capital through equity issue at lower cost for financing

their businesses (Feldman & Kumar, 1995; Rousseau & Wachtel, 2000). Greenwood and Smith (1996) in particular, showed that stock markets lower the costs of mobilizing savings thereby facilitating investment into the most productive technologies

Stock markets may also influence economic growth through their liquidity which ensures that investment in firms is not disrupted. Since high-return projects require a commitment of long-term capital, liquid equity markets help investors who cannot cope with liquidity risk and are therefore reluctant to commit their savings for long periods to easily and quickly sell their shares to those who are not suffering from liquidity shock. In this case, capital is not prematurely removed from firms to satisfy short-run liquidity needs (Levine, 1991; Levine & Zervos, 1996). It is important to point out that theory is unclear about the exact effects of greater stock market liquidity on economic growth. In this regard, Levine (1997) opined that increased stock market liquidity can hurt economic growth. For example, Bencivenga and Smith (1991) demonstrated that by reducing uncertainty, greater liquidity may reduce savings rates which will have adverse effect on the rate of economic growth.

Furthermore, stock market development can serve as an important vehicle for risk diversification through internationally integrated stock markets. Devereux and Smith (1994) and Obstfeld (1994) showed that stock market development can influence economic growth through risk diversification in the internationally integrated stock markets. They showed that greater risk diversification can influence growth by shifting investment into higher return projects, thereby

improving resource allocation and accelerating economic growth. On the contrary, theory suggests that greater risk sharing can slow down economic growth. In line with this view, Devereux and Smith (1994) and Obstfeld (1994) again demonstrate that reduced risk through internationally integrated stock markets can lower savings rates, slow growth, and reduce economic welfare.

Stock markets can also promote economic growth by aggregating information about firms' prospects, thereby directing capital to investment with higher returns (Holmstrom & Tirole, 1993). The efficient stock markets, by reducing the costs of acquiring information and providing better information about firms, will enable investors to acquire information about investment opportunities and monitor firms. This will improve resource allocation and result in a higher rate of economic growth (Levine & Zervos, 1996). Stiglitz (1985) on the other hand, casts doubts on the role of stock markets in stimulating information acquisition and hence improving informational asymmetries. He argues that well-developed stock markets quickly reveal information through price changes, creating a free-rider problem that reduces investor incentives to conduct costly search for information. Again, in spite of the fact that the efficient stock markets may reflect all available information, that information has little effect on resource allocation (Stiglitz, 1989).

The stock market development is expected to foster corporate governance by ensuring that resources are used efficiently (Jensen & Meckling, 1976). As in Jensen and Murphy (1990), well-functioning stock markets help mitigate the principal-agent problem as they will help align the interests of managers to

owners, thereby spurring efficient resource allocation and economic growth. This will be effective when it is easier to tie the managers' compensation to stock performance. Moreover, the threat of a takeover will induce managers to maximize firm's value, since it has the ability to help align managerial incentives with those of the owners (Scharfstein, 1988). In contrast, Shleifer and Vishny (1986) and Bhide (1993) argue that well-functioning stock markets will not improve corporate governance; instead, more liquid stock markets may adversely influence corporate control and ultimately impede effective resource allocation and productivity growth. They maintain that greater stock market liquidity encourages investor myopia and this adversely affects corporate governance. Thus, with more liquid stock markets, dissatisfied investors can quickly and easily sell their shares in a company, weakening their long-term commitment with firms, incentive to monitor managers and incentive to exert corporate control.

From the foregoing discussion, it is evident that stock markets, although, have their limitations, provide several financial services that promote long-run economic growth.

Stock Market Variables: Theoretical and Empirical Review

The appropriate choice of stock market performance indicators is critical in guiding empirical research. As observed by Levine and Zervos (1996), stock market development is a multi-dimensional concept. Theory, however, does not provide a unique concept or measure of stock market performance. Theory suggests that stock market size, liquidity, volatility, concentration, integration

with world capital markets and the legal rule or institutional development (regulation and supervision in the market) may affect economic growth (Demirguc-Kunt & Levine, 1996). It is also worth mentioning that no single indicator captures all aspects of stock market performance.

In line with the underlying theoretical arguments, some researchers use composite indexes of stock market development whilst others prefer using a combination of stock market indicators or only one indicator. Since a bulk of the theoretical and empirical studies conducted on the linkage between stock market development and economic growth employed a variety of the main traditional indicators (measures of stock market size, liquidity and the All Share index etc.). Thus, the study employed stock market size, liquidity and the GSE market index. Apart from the GSE market index, all the variables of stock market performance used are derived variables and thus, not unique concepts.

Because theory does not provide us with unique indicators of stock market performance coupled with the fact that most of the stock market variables are derived, there is no theoretical literature on these individual variables to best of my knowledge as is the case with traditionally unique concepts or variables like GDP, interest rate, inflation, money supply, employment etc.

Empirical Evidence of the Stock Market Performance and Economic Growth Relationship

Generally, with regard to the causal relationship between stock market performance and economic growth, the literature has documented four views;

supply leading finance, demand following finance, mutual impact of finance and growth and those that suggest that the role of finance in promoting economic growth is overemphasized (Kargbo & Adamu, 2009).

The empirics on the subject can be broadly categorized into four different types of studies, as identified by Demirguc-Kunt and Levine (2008); cross-country growth regressions, panel techniques that make use of both time-series and cross-country types of data, microeconomic studies that explore the various channels by which finance can affect economic growth and the single country or country-specific studies.

Cross-Country Growth Regression Studies

This type of study forms the bulk of the available literature on the study and it usually involves the use of standard explanatory variables, like human and physical capital. Cross-country studies allow for a large number of countries to be examined at the same time, providing a general idea of what the relationship between stock market and economic growth could be. They are easier to investigate because they require a shorter length of data. Examples of such studies include Atje and Jovanovic (1993), Harris (1997) and Levine and Zervos (1998) whose cross-sectional studies demonstrate that stock markets positively impact on economic growth for developed countries. Similarly, Rousseau and Wachtel (2000) and Beck and Levine (2002) within a cross-sectional study framework provide further evidence which indicates that stock market development can foster economic growth in the long-run for developed counties.

On the contrary, Adjasi and Biekpe (2006), while investigating the effect of stock market development on economic growth in a group of 14 African countries, found that only some of the stock markets play a significant role in economic growth. They concluded that the income level of a country affects the level of impact the stock market has on economic growth.

Cross-country studies are, however, not without flaws and as Ang (2008) points out, the standards of the econometric techniques employed in cross-country investigation of the stock market economic growth relationships are often subject to criticism. Owing to averaging, the degree of accuracy of the information is lost and the implication is that the reliability of the result is called into question. Secondly, many of these cross-country studies do not take into account specific information regarding the structure and conditions of the economies of individual countries.

Panel Technique Studies

The second type of approach is the panel technique studies, that make use of both time-series and cross-country type of data. This approach tries to improve on the shortcomings observed in the econometric specification associated with studies that use the cross-sectional techniques by accounting for the impact of the time dimension through using the dynamic panel estimation techniques. Examples of such studies include Rousseau and Wachtel (2000), Rioja and Valev (2004), Christopoulos and Tsionas (2004) and Beck and Levine's (2004) panel type study,

which demonstrate that stock markets positively impact on economic growth for developed countries.

Although the dynamic panel techniques approach attempts to reduce some of the econometric problems associated with the pure cross-country approach, it is not without its own flaws. Panel techniques suffer from problems associated with heterogeneity (omitted variables) bias, particularly as the country-specific effects are not taken into account. Pesaran and Smith, (1995) observed that these omissions can cause inconsistencies and bias in the parameter estimate of such studies and render the result unusable. Secondly, many of these panel techniques studies hold the observable country-specific effects constantly and, as Wachtel (2003) demonstrates, any detected relationship between financial development and economic growth in this technique may be due to a falsely generated aggregate relationship, caused by differences between the countries rather than differences within the countries, making the results obtained from such broad comparative studies unreliable for policy decision-making purposes.

Microeconomic Level Studies

The third type of approach is the microeconomic level studies technique that explores the various channels through which finance may affect economic growth. This approach makes use of industry and firm level data in examining the effect of stock market development on industry and firm performance. Microeconomic level studies techniques seek to avoid the identified flaws in cross-country and panel studies approaches by resolving issues with causality and

providing a more detailed account of the effect and mechanism through which stock markets impact on economic growth.

Examples of such studies include Rajan and Zingales (1998) and Beck and Levine (2002). While microeconomic level studies techniques help solve some of the problems specific to methods like cross-country and panel studies approaches, they also generate some issues of their own. Firstly, microeconomic level data have specific endogeneity problems, namely the fact that access variables cannot be considered to be determined exogenously. Secondly, there are problems with determining sample (both size and population), which can be constrained by cost, time and relevance to the study. These are decisions often subjective in nature.

Single Country Time Series Studies

The fourth type of approach is the single country studies technique that explores the finance growth relationship in a single country. This approach analyzes the impact of a specific institution or policy changes on economic growth within a country. The results generated from such studies are very effective for policy decisions, as they are tailored specifically to the country under analysis, which allows for careful in-depth examination of historical and institutional characteristics within the study.

Earlier empirical studies, such as Patrick (1966), McKinnon (1988), Demetriades and Hussein (1996) and Arestis and Demetriades (1997), point to the superiority of the quality of time-series over the cross-sectional studies. Their argument is that cross-sectional regressions studies are not in tune with the

individual countries' situations. Also, it allows for a comprehensive explanation of the dynamic evolution of the economy, as data sets utilized in such studies are of the highest and most appropriate quality of the measures under analysis.

Examples of such studies include Osei (2005), Van Nieuwerburgh, Buelens and Cuyvers (2006), Bahadur and Neupane (2006), Brasoveanu, Dragota, Catarama and Semenescu (2008) and Shahbaz, Ahmed and Ali (2008), who in their separate single country-specific studies on Ghana, Belgium, Nepal, Romania and Pakistan respectively found evidence in support of a positive relationship between stock market performance and economic growth. Their respective results provide support for the assertion in economic theory that stock markets enhance growth. On the contrary, Asai and Shiba (1995), while investigating the effect of stock market on macroeconomic variables in Japan, found that they could not detect a statistically significant causal relationship between the stock market and the macroeconomic variables used in the study.

Although, single country time-series studies approach has several advantages which make it superior to the other methods discussed in the study, it is not without its challenges. The major challenge of the method is that most times the results of such studies cannot be generalized easily for other countries, as the exact structures of the economies may be different, thereby making the results of such studies difficult to use in policy decisions of other countries than the initial country analyzed.

With reference to the above flaws discussed with regard to the various approaches used in examining the relationship between stock market performance

and economic growth, a country-specific approach is recommended. Levine and Zervos (1996) point to the adoption of single country studies as a way to circumvent the conceptual, statistical and measurement flaws in these other types of studies on the stock market performance and economic growth relationship.

The literature that follows below provides an overview of single country time-series studies on the relationship between financial development in general and stock markets in particular and economic growth in both developed and developing countries.

Empirical Studies on Developed Countries

This section focuses on time series and some of the empirical studies that relate to this study. These studies adopt and use various time-series methods like correlation analysis, Ordinary Least Square (OLS), Generalized Least Squares (GLS), Vector Autoregression (VAR) and Autoregressive Distributed Lag (ARDL) modelling approaches with varying degrees of success. Each method has its own weaknesses and strengths, thus influencing their choice of use.

Asteriou and Price (2000) employed a VAR model in their study to determine the relationship between financial development and economic growth in the UK. They also utilized real GDP per capita as a measure of growth. They found evidence that supported the existence of a relationship between financial development and economic growth, with the direction being from financial development to economic growth. The result indicates that, contrary to what

happens in the Japanese economy, financial development drives economic growth in the UK.

Similarly, Hondroyiannis *et al.* (2004) employed a VAR model to investigate the financial development-economic growth relationship for Greece. They utilized monthly time-series data from 1986 to 1999 and found that, there exists a two-way causal relationship between the financial development proxies and growth in the long-run. The results further showed that the effect from the stock market measure was smaller than the effect from the bank measure on economic growth.

Thangavelu and Ang (2004) also employed a VAR model in examining the financial development and economic growth relationship for Australia. Their results revealed that, for banking measures of financial development, the causal relationship runs from economic growth to financial development, indicating that Australian banks do not drive economic growth. When stock market measures of financial development are utilized, the reverse is the case, indicating that stock markets in Australia impact on economic growth positively.

Similar results were obtained by Van Nieuwerburgh *et al.* (2006) after an extensive empirical investigation of the long-term relationship between stock market development and economic growth in Belgium using annual time-series data for 1830 to 2000. The study used real per capita gross domestic product (GDP) to proxy growth and used five measures of stock market development, based on different groups of stocks. The results provide evidence that the stock

market development caused economic growth in Belgium in the 1873 to 1935 period.

Antonios (2010) applying the Johansen cointegration and Granger causality tests within the framework of the Vector Error Correction Model (VECM) obtained similar results for the relationship between the variables for Germany for the period 1965 to 2007 using the stock market overall price index, gross domestic product (GDP) and bank lending rate. The results indicate that there is a unidirectional causality from the stock market to economic growth. The results are realistic, as theory tells us that, in the short-run, the stock market takes the lead until the feedback mechanism take effect. However, his use of GDP as proxy for growth is criticized, as GDP is not a good proxy for economic growth.

Fundamentally, the consensus from empirical studies conducted on the stock market performance and economic growth relationship for developed countries provides evidence in support of the view that stock markets have a positive impact on economic growth. However, the key issue is; will the same results be obtained for developing countries like Ghana, taking into account the specific economic environment of these countries?

Empirical Studies on Developing Countries

In this section, the empirical literature review focuses briefly on the effect of stock markets on economic growth and the causal relationship between stock markets and economic growth.

Osinubi (2001) using annual time series data from 1980 to 2000 for Nigeria on the following variables; growth rate of GDP, openness, debt overload, growth rate of public capital expenditures, debt to export ratio, growth of value traded ratio, value of shares traded ratio, turnover ratio, market capitalization ratio, new issues and gross capital formation. He used the Ordinary Least Squares and found that 98 percent of the variations in the growth of economic activity in Nigeria is explained by the independent variables. Thus, there is a positive link between the stock market and economic growth in Nigeria.

Nowbutsing and Odit (2009) investigated the impact of stock market on economic growth in Mauritius over the time period of 1989 to 2006. The study used stock market capitalization ratio and stock market turnover ratios as proxies of size and liquidity and Foreign Direct Investment (FDI) and Human Capital Development were used as proxies for economic growth. The two-step Engle and Granger procedure was applied because of the small sample size. The findings showed that stock market growth impacted positively on economic growth, both in the short and long-run in Mauritius. However, the studies use of Human Capital Development and FDI as measures of economic growth is somewhat difficult to justify, as there are better measures of economic growth identified by the literature, such as GDP, real GDP, GDP per capita or change in GDP per capita.

Nazir, Nawaz and Gilani (2010) investigated the stock market development and economic growth relationship in Pakistan using time series data from 1986 to 2008. They used two measures of stock market development, namely market capitalization and value traded ratios as proxies for market size

and liquidity. The results show that both measures of stock market development impacted positively on economic growth in Pakistan for the period of study.

Oskooe (2010) also investigated the impact of stock market on economic growth in the Iranian economy using quarterly time series data from 1997 to 2008. He used Johansen's cointegration test as well as VECM. The results of the study revealed that economic activity was the driving force in the movement of stock prices in the long-run, while the stock market played a leading role in economic growth in the short-run.

Olweny and Kimani (2011) examined the stock market economic growth relationship in Kenya using quarterly time series data for the period 2001 to 2010 for rate of growth in real GDP, stock market index and consumer price index within VAR and Granger causality test frameworks. The study concluded that there is a one-way causality from stock market to economic growth in Kenya.

Ihendinihu and Onwuchekwa (2012) using annual time series data for Nigeria for the period 1984 to 2011, examined the stock market economic growth relationship with variables such as growth rate of GDP, market capitalization, All Share index, value of transactions and number of listed companies. They employed the Ordinary Least Squares and the ECM in their analysis. The results of the study showed that in the short and long-run market capitalization and value of transactions have significant impact on economic growth in Nigeria. The All-Share index failed to sustain its predictive power in the long-run, while total number of listed companies was insignificant. The study further established that shocks in the stock market trigger off severe negative consequences on investors'

confidence and this takes a long period of time to restore. This largely explains why the Nigeria stock market has been very slow in picking up for the past few years.

Empirical works that have tested the causal relationship between stock markets and economic growth in developing countries to ascertain whether stock markets drive economic growth or if the reverse is the case. In this regard, Bahadur and Neupane (2006) investigated the direction of the causality between the two variables in Nepal using annual time series data from 1988 to 2005. The study used market capitalization to GDP ratio, the annual market turnover to market capitalization ratio and annual turnover to GDP ratio as proxies of stock market development and Gross Domestic Product (GDP) for economic growth. Using the Granger causality test, the results revealed that the stock market Granger causes economic growth in Nepal.

Shahbaz *et al.* (2008) also obtained similar results whiles investigating the relationship between the variables in Pakistan using annual time series data from 1971 to 2006. Using the Engle-Granger causality test, the findings of the study indicate the presence of a strong bi-directional causality between the stock market and economic growth in the long-run in Pakistan. However, in the short-run, the study found a unidirectional causality from the stock market to economic growth.

However, Wang (2010) obtained contrasting results using monthly data from 1992 to 2008 when examining the relationship between the stock market and the Chinese economy. He used the Engle-generalized autoregressive conditional heteroscedasticity (EGARCH) model as well as a lag-augmented vector

autoregressive (LA-VAR) model to investigate the volatility and causality respectively. The findings showed no causality between stock market volatility and real GDP which measured economic activity; however, the study revealed the existence of a feedback effect, evidenced by a bi-directional relationship between stock market volatility and inflation volatility. The findings, however, do not conform to economic theory for the period under study.

Odhiambo (2010) examined the causal relationship between stock market development and economic growth for the South African economy. The study used annual time-series data for the period 1971-2007 and autoregressive distributed lag (ARDL)-bounds testing method was employed. The study employed the proxies' stock market capitalization; stock market traded value and stock market turnover were used to represent stock market development, while the proxy real GDP per capita represented economic growth.

The results showed that the direction of causality is influenced by the choice of proxy used to measure stock market development. Economic growth Granger caused stock market development when market capitalization was used as a proxy for stock market development. The reverse was the case where the stock market development proxies' stock market traded value and stock market turnover were used. Overall, causality running from stock market development to economic growth was stronger. The results were valid both in the short-run and long-run.

Osuala, Okereke and Nwansi (2013) employed the OLS, Johansen cointegration and VECM frameworks in their analysis. They used annual time

series data from 1985 to 2011 for Nigeria on real GDP, market capitalization ratio, turnover ratio, total number of deals, financial structure, minimum rediscount rate and trade openness. They found evidence of long-run cointegration between economic growth and stock market performance. With regard to the causal relationship, a unidirectional causality from the stock market to economic growth was evident only in the long-run. In the short-run, there was no causal relationship between economic growth and stock market performance.

These results have shown that the effect of the stock market on economic growth depends on each country's economic characteristics. Essentially, there is no clear consensus from empirical studies on the relationship between stock markets development and economic growth for developing countries.

The bulk of these studies establish a positive role for stock market development on economic growth, with a few finding negative role for stock markets, thus making the effect of stock markets on economic growth in developing countries a far from concluded matter.

Empirical Studies on Ghana.

Fewer studies have been conducted on the relationship between the two variables in Ghana. This is partly because of the young nature of the market. These studies are reviewed below.

Osei (1998) analyzed the institutional factors affecting the development of the GSE. The institutional factors include legal and regulatory framework, information disclosure requirements, transparency of transactions and barriers to

entry and exit. He also conducts efficiency tests on daily and weekly returns for the GSE before and after the listing of the AGC for the period 1993-1995 and came out with revealing results. The study established that the institutional factors particularly the legal and regulatory frameworks that ensure the protection and security of investors were strongly enforced. In instances where some brokerage firms failed to comply with the rules governing the operations of the GSE, they were fined and suspended.

The results also show that there is mandatory disclosure of information on the part of the listed companies to the general public and that the call-over system of transaction is very satisfactory. His random walk tests suggest that the GSE is "weak-form" inefficient. This implies that investors can profit from trading by predicting the market prices of shares using past or historical prices because of the serial dependency between the past and future prices. The study further found that the listing of the Ashanti Goldfields Company impacted tremendously on the GSE in many ways including improvement in the market liquidity and turnover.

Osei (2005) employed a VAR technique developed by Sims (1972) based on Granger's (1969) definition of causality to investigate the relationship between the stock market development and economic growth using quarterly data for the period 1991 to 2003 on nominal market capitalization and market capitalization ratio as measures of stock market development and real GDP as a proxy for economic growth. The results of the Granger-causality test indicate that the stock market Granger causes economic growth in Ghana at five percent level of significance. However, since nominal market capitalization is affected by the

price effect of stock markets, the use of nominal stock market capitalization and market capitalization ratio may not be the appropriate indicators for the study because they may lead to spurious relationship (Rousseau & Wachtel, 2000).

Yartey (2006) examined the financing practices of all non-financial listed firms based on their balance sheets between 1995 and 2005. He reports that the average listed Ghanaian firms financed about 12 percent of growth of total assets from internal sources. External debt, however, financed 48 percent of the growth of total assets while new issues of equity financed 41 percent of the growth in total assets. He also found that the new equity issues compares favourably with those of the developed and even advanced countries like Germany, the Netherlands, Ireland, and Japan. He further noted that, the stock market is the most important source of long-term finance for listed Ghanaian firms. He, therefore, concluded that, the stock market has played a great role in financing the growth of large Ghanaian corporations and that stock market development in Ghana has been important.

Asante *et al.* (2011) using annual time series data from 1992 to 2009 for real GDP growth, stock market capitalization ratio, bank competition, domestic bank credit as a percentage of GDP within the frameworks of Dynamic Ordinary Least Squares (DOLS), ARDL and Granger causality test, concluded that bank competition and stock market development proxied by market capitalization causes economic growth in Ghana.

Quaidoo (2011) used quarterly time series on real stock market capitalization ratio, real GDP, real total value traded ratio, real domestic credit to

the private sector, real gross investment to GDP from 1991 to 2006 within the Johansen cointegration, VAR-VECM frameworks and Granger causality test. The results of the study showed that there is a positive relationship between stock market capitalization and economic growth and a unidirectional causality from economic growth to stock market capitalization. The study confirmed the demand following finance hypothesis.

Dziwornu and Awunyo-Victor (2013) examined the causal link between stock exchange performance and economic growth in Ghana, using the GSE-All Share/Composite index as proxy for stock market performance and real GDP growth as a proxy for economic growth with annual time series data for the period 1990 to 2012 within the framework of ADF test and Granger causality test. The results suggest a unidirectional causality from stock market performance to economic growth in Ghana. The study substantiates the supply leading finance hypothesis.

Clearly as seem in the problem statement, there are inconsistencies in Ghanaian literature. This coupled with the weaknesses of the individual studies is the motivation for this study.

Summary and Conclusion

The theoretical literature focused on the review of relevant economic growth models and theories of financial development with special emphasis on the Solow growth model. On the empirical literature review, the study first looked at the empirical evidence of the stock market and economic growth relationship based on evidence from cross-country studies, panel techniques, microeconomic

studies and country-specific studies and also highlighted their advantages and disadvantages. We also looked at empirical studies on developed countries, developing countries and Ghana.

The review revealed that generally, four views underpin the causal relationship between financial development in general and stock markets in particular and economic growth. The bulk of the literature maintains that stock markets induce economic growth through the provision of financial functions such as savings mobilization, liquidity, risk diversification, information acquisition about firms and corporate control.

The bulk of the literature on Ghana shows that although, the exchange is relatively small in size, it has helped to mobilize domestic savings and foreign capital for long-term investments to sustain growth in Ghana.

CHAPTER FOUR

METHODOLOGY

Introduction

The purpose of this chapter is the formulation of a model for the study. In doing this, cognizance is taken of existing theoretical and empirical literature since this helps in developing a systematic approach to the topic at hand. The chapter starts with the research design and then develops and specifies an empirical model that captures the relationship between stock market performance and economic growth as well as the various techniques of estimating the model.

Research Design

The study employed both quantitative and descriptive statistics in the data analysis. The rationale behind this choice of research design is guided by the Positivist philosophy. The Positivists believe that reality is stable and can be observed and described from an objective viewpoint using methods which are quantifiable (Levin, 1988).

Data and Data Sources

The study relied wholly on secondary data sourced from the Ghana Stock Exchange (GSE), the Bank of Ghana (BOG) online data base (2012) and the World Development Indicators (WDI) data base (2012). Quarterly time series data spanning from 1991:1 to 2012:4 for Real Gross Domestic Product (RGDP),

stock market capitalization ratio (SMCAR), stock market turnover ratio (STR), total value traded ratio (TVR), Ghana Stock Exchange market index (GSEMI) and three control variables namely: consumer price index (CPI), capital stock (K) and labour force (L) were used.

Table 1: Summary Description of Variables, What they proxy, Expected Signs and their Sources

Variable	Concept	What it Proxies	Expected Sign	Source
RGDP	Real GDP	Economic Growth	+	WDI
SMCAR	Stock Market Capitalization Ratio	Size of the market	+	GSE
STR	Stock Market Turnover Ratio	Liquidity of the market relative its size/Efficiency of the market	+	GSE
TVR	Total Value Traded Ratio	Liquidity of the market relative to the size of the economy	+	GSE
GSEMI	GSE Market Index	The market's performance	+	GSE
CPI	Consumer Price Index	Inflation	-	BOG
K	Gross fixed capital formation	Capital	+	WDI
L	Labour force participation rate	Labour	+	WDI

Source: Compiled by Author (2014)

Table 1 gives a summary description of the variables, what they proxy, their expected signs in both the long and short-run and their sources. With the exception of CPI which was already in quarterly form, all the other data series were sourced as annual time series variables and the Gandolfo (1981) algorithm was used to interpolate the quarterly series.

Pre-Estimation Diagnostics

Unit Root Test

According to Nelson and Plosser (1982), most macroeconomic data are non-stationary or have a unit root. A non-stationary series according to Harvey (1990) is one where the moments (mean, variance and covariance) of the distribution from which series observations were drawn are time-variant. They depend on the point in time at which the observations were realized. A combination of variables that are non-stationary may lead to spurious regression results. Therefore, it was important to test for the stationarity of the variables employed for the study.

The stationarity of a data series is a prerequisite for drawing meaningful inferences in a time series analysis and to enhance the accuracy and reliability of the models constructed. Generally, a data series is called a stationary series if its mean and variance are constant over a given period of time and the covariance between the two extreme time periods does not depend on the actual time at which it is computed, but on lag amidst the two extreme time periods (Dasgupta, 2012). The correlation between a series and its lagged values are assumed to

depend only on the length of the lag and not when the series started. This property is known as stationarity and any series obeying this is called a stationary time series.

Various tests have been developed to test for the stationarity of macroeconomic time series data. These include the Dickey–Fuller (1979) test, Augmented Dickey–Fuller (1981) test and Phillips–Perron (1988) test. The Augmented Dickey–Fuller (ADF) test which is widely used due to its simplicity and thoroughness is employed to test for the presence of unit root in all the variables while the Phillips–Perron (PP) test is conducted to check for the robustness of the ADF unit root test.

Augmented Dickey-Fuller (ADF) Test

The ADF test is a modified version of the Dickey Fuller test. The ADF test is conducted on condition that errors must have constant variance and be identically and independently distributed. In the following equation, the null hypothesis of $\rho = 0$ is tested against the alternative hypothesis of $\rho \neq 0$

$$\Delta Y_t = \alpha_0 + \beta_t + \rho Y_{t-1} + \sum_{i=1}^{q} \varphi_i \Delta Y_{t-1} + \varepsilon_t \qquad (1)$$

Where Δ denotes the first difference operator, Y_t is the variable in question, ε_t is a random variable and q is the number of lags which are added to the model to make ε_t white noise. Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) are used to determine the optimal lag length q. If the p-value of ρ (the ADF test statistic) is rejected at one percent or five percent or 10 percent respectively, then the null hypothesis that the series has a unit root is rejected.

Non-rejection of the null hypothesis implies that the series is non-stationary, whereas a rejection indicates that the series is stationary.

Phillips-Perron (PP) Test

The test regression for the Phillips-Perron (PP) test is the AR (*1*) process. The PP test makes a nonparametric correction to the *t*-statistic of the coefficient from the AR (*1*) regression to counter the serial correlation in error term. Like the ADF test, the use of the PP test requires specification of a lag order. In the latter, the lag order designates the number of lags to be included in the long-run variance estimate. The PP test allows for dependence among disturbances of either AR or MA form, but has been shown to exhibit serious size distortions in the presence of negative autocorrelations. One advantage of the PP test over the ADF test is that the PP test is robust to general forms of heteroskedasticity in the error term (Sharma, 2012). The PP test complements the ADF test hence their deployment in this study to check for the unit root properties of the variables used in the study.

Cointegration Test

According to Haley (1995) the purpose of co-integration estimation is to determine whether a stationary linear combination of two (or more) non-stationary variables exists. This involves testing for the existence of a stable or long-run equilibrium relationship between the variables. The underlying premise of co-integration analysis is that while time series may be non-stationary, a linear combination of the variables may be stationary (Haley, 1993).

Non-stationary series are said to be cointegrated if they can be transformed into a single series that exhibits stationarity (Engle & Granger, 1987). Cointegration analysis proceeds by first determining whether the variables under consideration are individually integrated of order one, i.e. *I*(1). If it is determined that the variables are *I*(1), then co-integration test can be performed to know whether a linear combination of the variables will be stationary, i.e. *I*(0). Cointegration exists if a linear combination of non-stationary variables is stationary. According to Shahbaz *et al.* (2008), co-integration tests can be conducted by using the Engle-Granger (1987) two-stage procedure, Autoregressive Distributed Lag (ARDL) approach proposed by Pesaran, Shin and Smith (2001) or the Johansen maximum likelihood approach (Johansen 1988; Johansen & Juselius, 1992).

Since this study aims to investigate the long and short-run relationships amongst more than two variables, the discussion on cointegration in chapter five is restricted to the Johansen and Juselius (1990) cointegration test.

Theoretical Model Specification and Justification

In pursuance of the objectives of this study, the study employed the Solow (1956) growth model within the framework of a Cobb-Douglas production function. This approach has the advantage of linking inputs or output in one period to others or across periods. More precisely it links population/labour force, productivity and in particular capital stock in year *t* to labour force, productivity and capital stock in year *t+1*. This helps or makes it possible for us to understand

the growth differences over time for different regions within a particular country or across countries.

The major innovation introduced especially by Solow was to allow for factor substitutability so that stable equilibrium growth could be obtained. This model is consistent with a number of stylized facts related to economic growth such as the relative constancy over time of the capital-output ratio and factor income shares (Renelt, 1991).

According to Osinubi (2001), this approach has a wide application in econometric analysis and cites Obstfeld (1994), Levine and Zervos (1996), Akinlo and Odusola (2000) as some of the studies that have used this approach. The special case of the Solow (1956) growth model within the framework of a Cobb-Douglas production function at any time *t* is specified as follows:

$$Y_t = K_t^{\alpha} \left(A_t L_t \right)^{1-\alpha} \qquad (2)$$

Where, Y_t is output at time *t*, K_t is capital stock (which may include human capital as well as physical capital) at time *t*, L_t is labour at time *t* and A_t represents the productivity of labour which grows at over time at an exogenous rate. It is also known as the total factor productivity (TFP). Also the exponents α and $1-\alpha$ denote the output elasticities of capital and labour respectively.

Marginal product of each factor is very large when its amount is sufficiently small, and becomes very small when the amount becomes large. This satisfies the *Inada-conditions* (Barro & Sala-i-Martin 1995, following Inada 1963) of the production function, in particular that the limit of the derivative towards

zero is positive infinity, and that the limit of the derivative towards positive infinity is zero. These conditions are fulfilled by equation (2) above.

Total Factor Productivity (TFP)

Total Factor Productivity has several definitions in the growth literature. In this regard, Sala-I-Martin (1997) opined that, the problem faced by empirical growth economists is that growth theories are not explicit enough about what variables belong in the "true" regression that reflects growth. Since the true variables that should be included are not known, one, according to Sala-I-Martin, is left with the question: "What are the variables that are really correlated with growth?" Moreover, Easterly and Levine (2002) point out that, while TFP refers to "something else" (besides physical factor accumulation) that accounts for economic growth differences across countries both in the level of GDP per capita and the growth rate of GDP per capita. Different theories provide very different conceptions of TFP. For some models, TFP is seen as changes in technology. Others highlight the role of externalities. Some focus on changes in the sector composition of production, while others see TFP as reflecting the adoption of lower cost production methods. Because these different theories provide very different views of TFP, they don't provide very clear guidance to policymakers and to growth theorists.

From equation (2) above, the TFP can be derived as follows:

$$Y = K^{\alpha}\left(AL\right)^{1-\alpha} \qquad (3)$$

For convenience the *t* is dropped.

$$Y = A^{1-\alpha} K^{\alpha} L^{1-\alpha} \quad (4)$$

$$Y = BK^{\alpha} L^{1-\alpha} \quad (5)$$

Where, $B \equiv A^{1-\alpha}$, which is referred to as the total factor productivity.

$$B = \frac{Y}{K^{\alpha} L^{1-\alpha}} \quad (6)$$

B is output per unit of all factors suitably combined. Over time, if total income *Y* grows, it must be because of growth in *B, K* or *L*

$$\ln Y_t = \ln B_t + \alpha \ln K_t + (1-\alpha) \ln L_t \quad (7)$$

$$\frac{\dot{Y}}{Y} = \frac{\dot{B}}{B} + \alpha \frac{\dot{K}}{K} + (1-\alpha) \frac{\dot{L}}{L} \quad (8)$$

Where, a dot over variable denotes a derivative with respect to time. *Y, K, L* and *α* are all quantities that we can observe, however with *B* we cannot. So we consider the following:

$$\frac{\dot{B}}{B} = \frac{\dot{Y}}{Y} - \alpha \frac{\dot{K}}{K} - (1-\alpha) \frac{\dot{L}}{L} \quad (9)$$

This is sometimes referred to as the "Solow Residual" and it is a measure of total factor productivity (and labour-augmenting technological change). That is, a measure of the unexplained or the not so easily measured components of economic growth as explained above. This is why Hornstein and Krusell (1996) argued that growth in TFP represents output growth not accounted for by the growth in inputs.

From the foregone with respect to the objectives of this thesis, a more special form of equation (2) above is specified as followed:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha} \ell^{\varepsilon_t} \quad (10)$$

Where all variables carry their usually meaning and ε_t is the error term.

Empirical Model Specification

Given the definition of TFP above, the TFP function is specified as follows:

$$A_t = f\left(SMCAR, STR, TVR, GSEMI, CPI\right) \quad (11)$$

Where, A_t is TFP at time *t*, *SMCAR* is stock market capitalization ratio, *STR* is stock market turnover ratio, *TVR* is total value traded ratio, *GSEMI* is the GSE market index. *CPI* is a proxy for inflation.

$$A_t = SMCAR_t^{\beta_1} STR_t^{\beta_2} TVR_t^{\beta_3} GSEMI_t^{\beta_4} CPI_t^{\beta_5} \quad (12)$$

Substituting equation (12) into equation (10) gives the following equation:

$$Y_t = \pi SMCAR_t^{\beta_1} STR_t^{\beta_2} TVR_t^{\beta_3} GSEMI_t^{\beta_4} CPI_t^{\beta_5} K_t^{\beta_6} L_t^{\beta_7} \ell^{\varepsilon_t} \quad (13)$$

Note that $\alpha = \beta_6$ and 1- $\alpha = \beta_7$

The Long Run Model

By taking the logs of the appropriate variables in equation (13) we obtain equation (14) below.

$$\begin{aligned} \ln Y_t = {} & \ln \pi + \beta_1 \ln SMCAR_t + \beta_2 \ln STR_t + \beta_3 \ln TVR_t \\ & + \beta_4 \ln GSEMI_t + \beta_5 \ln CPI_t + \beta_6 \ln K_t + \beta_7 L_t + \varepsilon_t \ln \ell \end{aligned} \quad (14)$$

By setting $ln\pi = \beta_0$ and $ln\ell = 1$ in equation (14), we obtain the long-run model in equation (15).

$$\ln Y_t = \beta_0 + \beta_1 \ln SMCAR_t + \beta_2 \ln STR_t + \beta_3 \ln TVR_t + \beta_4 \ln GSEMI_t + \beta_5 \ln CPI_t + \beta_6 \ln K_t + \beta_7 L_t + \varepsilon_t \quad (15)$$

Note: L_t, labour force participation rate at time *t* is not logged because it is sourced as a change variable. Thus, its coefficient is interpreted as a unit change. The coefficient estimates of the log variables are interpreted as elasticities which essentially capture the sensitivity of the dependent variable to a percentage change in each of the explanatory variables.

By differencing equation (15), we obtain the growth rate function, which is specified below.

$$\Delta \ln Y_t = \beta_0 + \beta_1 \Delta \ln SMCAR_t + \beta_2 \Delta \ln STR_t + \beta_3 \Delta \ln TVR_t + \beta_4 \Delta \ln GSEMI_t + \beta_5 \Delta \ln CPI_t + \beta_6 \Delta \ln K_t + \beta_7 \Delta L_t + \varepsilon_t \quad (16)$$

Where, *ln* denotes natural logarithms, Y_t is economic growth at time *t*, β_0 is the drift component, *t* represents time, *K* is capital stock and *L* is labour. *CPI*, *K* and *L* are control variables and ε is the error term. The expected signs based on the empirical literature reviewed are as follows:

$$\beta_1 > 0; \beta_2 > 0; \beta_3 > 0; \beta_4 > 0; \beta_5 < 0; \beta_6 > 0; \beta_7 > 0$$

The Short-Run Model

In estimating the short run model for the study, it is important to estimate the error correction model whose results will demonstrate the speed of adjustment back to long-run equilibrium after any disequilibrium in the short-run. The error correction model (ECM) is specified as follows:

$$\Delta \ln RGDP_t = \sum_{i=1}^{n} \lambda_{1i} \Delta \ln RGDP_{t-1} + \sum_{i=1}^{n} \lambda_{2i} \Delta \ln SMCAR_{t-1} + \sum_{i=1}^{n} \lambda_{3i} \Delta \ln STR_{t-1}$$
$$+ \sum_{i=1}^{n} \lambda_{4i} \Delta \ln TVR_{t-1} + \sum_{i=1}^{n} \lambda_{5i} \Delta \ln GSEMI_{t-1} + \sum_{i=1}^{n} \lambda_{6i} \Delta \ln CPI_{t-1} \quad \textbf{(17)}$$
$$+ \sum_{i=1}^{n} \lambda_{7i} \Delta \ln K_{t-1} + \sum_{i=1}^{n} \lambda_{8i} \Delta L_{t-1} + \Phi ECM_{t-1} + \varepsilon_{t-1}$$

Where Δ is the difference operator, ECM_{t-1} is the error correction term, the residuals from the error correction term lagged one period. λ_1, λ_2, λ_3, λ_4, λ_5, λ_6, $\lambda_7$and λ_8 are the coefficients of the short-run dynamics while Φ is the speed of adjustment to the long-run equilibrium following a shock to the system.

Variable Description and Justification

Stock market performance covers a variety of factors, such as the market's ability to mobilize saving, risk management, increase the set of financial instruments available to savers and quickly allocate capital to productive investments, etc. These entire functions cannot be captured by a single measurement. The literature identified the size of the stock market, its liquidity as well as a set of other important factors in its ability to stimulate economic growth. Demirguc-Kunt and Levine (1996), Levine and Zervos (1998) and Mohtadi and Agarwal (2004) agree that, it is best to use several different measures of stock market performance as opposed to a single measure or a single composite measure. They argue that this provides a richer picture of the potential link between stock markets and economic growth than if a single measure was used as a proxy for stock market performance.

The study identified and utilized four stock market performance variables namely stock market capitalization ratio for size, stock market turnover ratio for liquidity of the market relative to its size which also measures efficiency of the market, total value traded ratio for liquidity of the market relative to the size of the economy and the GSE market index for performance of the market's index. By using these indicators, it allows for the testing to be robust which gives the exact manner in which the stock market impacts on economic growth. These variables together with real GDP, a proxy for economic growth are used to assess the existence of any possible influence of stock market performance on economic growth. Studies that have used these variables include; Ohiomu and Godfrey (2011), Chizea (2012) and Ihendinihu and Onwuchekwa (2012).

Real GDP (RGDP)

This variable is the dependent variable and a proxy for economic growth. It is used to measure activities in the real sector. The choice of this variable is guided by theory. Researchers such as Levine, Loayza and Beck (2000) and Beck and Levine (2002) used this variable as proxy for economic growth. Real GDP and stock market performance are expected to be positively correlated since from the literature, both are positively correlated. The data on the variable was collected in the local currency (The Ghana Cedis) and was not converted.

Stock Market Capitalization Ratio (SMCAR)

The size of the GSE is measured using the typical index of stock market capitalization to GDP ratio. The index is defined as the value of domestic equities traded on the exchange divided by GDP. Stock market capitalization of about 50 percent of GDP and more is an indication of a well-developed stock market. The idea behind the selection of this variable is that it provides a measure of the amount of finance the market is capable of providing, as well as the market's ability to mobilize capital, diversify risk and allocate resources (Shahbaz *et al.*, 2008).

Market capitalization is a stock variable while GDP is a flow variable. Thus, simply dividing stock market capitalization by GDP can produce misleading measures of stock market performance, especially in highly inflationary environments. As a result, the variable is carefully deflated using the method suggested by Beck and Levine (2004). The formula is specified in Appendix VI. Studies that have used this variable include Osei (2005), Bahadur and Neupane (2006) and Ihendinihu and Onwuchekwa (2012). From the literature, this variable is expected to have a positive *a prior* sign.

Stock Market Turnover Ratio (STR)

This indicator measures the liquidity of the market relative to its size. (It reflects how active the stock market is. An exchange may have many listed companies but few active trades. Conversely, there may be few listed companies

but many trades). Stock market liquidity generally refers to the ability to buy and sell securities easily (Demirguc-Kunt & Levine, 1996) and (Mala & White, 2006).

The two main traditional stock market indicators used to gauge market liquidity are total value traded ratio and the turnover ratio. Theoretically, it is believed that liquid markets will improve the mobilization of resources and efficiency of capital allocation which promote long-term economic growth (Levine, 1991) and (Bencivenga *et al.* 1996).

Turnover ratio is the total value traded during the period divided by the market capitalization for the period. Turnover ratio is often used to capture the efficiency of the domestic stock market. High turnover ratio is used as an indicator of low transaction costs. An active or a liquid market will have a high turnover ratio, but a small market capitalization ratio (Demirguc-kunt & Levine, 1996). Excessively high turnover ratio may represent inefficiency or excessive speculative trading. This variable is also affected by the stock-flow problem and as such is deflated using the formula specified in Appendix VI. Studies that have used this variable include; Bahadur and Neupane (2006), Nowbutsing and Odit (2009), Odhiambo (2010), Augustine and Salami (2010) and Nazir *et al.* (2010). From the literature, this variable is expected to have a positive *a prior* sign.

Total Value Traded Ratio (TVR)

This indicator, just like turnover ratio, also measures the liquidity of the market but this time relative to the whole economy. Total value traded ratio equals total value of shares traded on the stock market divided by GDP. This

variable is not deflated since both numerator and denominator are flow variables. Studies that have used this variable include; Quaidoo (2011) and Ozurumba and Chigbu (2013). This variable is expected to have a positive *a prior* sign.

GSE Market Index (GSEMI)

This index hitherto known as the GSE-All Share Index but now the GSE Composite Index is the principal stock index of the Ghana Stock Exchange. The index shows the changing average value of the share prices of all companies on the exchange. That is, it captures the movements in share prices and it's been observed that movements in share prices play a significant role in directing economic activities in both the medium and long-term. For example, studies by Nasseh and Strauss (2000) and Adjasi and Biekpe (2006) agree that stock prices reflect the expectations of the public towards the future economic activity and if for instance a recession is expected, the stock prices will reflect this by decreasing in value, whereas an increase in value may reflect the expectations towards future prospects in economic growth. Studies that used this variable include; Olweny and Kimani (2011), Ihendinihu and Onwuchekwa (2012), Ozurumba and Chigbu (2013) and Dziwornu and Awunyo-Victor (2013). The expected *a prior* sign is positive from the literature.

Consumer Price Index (CPI)

Changes in economic situations such as unexpected changes in economic policies like monetary policy, fiscal policy, exchange rate policy and trade policy

can impact on stock market performance. Greater changes in these variables in the economy create fewer incentives for firms and surplus lending units to participate in the stock market. This also affects the profitability of corporations. Thus, to assess this, the study uses the CPI as a proxy for inflation to gauge its effect on the stock market as previous studies have highlighted its importance (Garcia & Liu, 1999).

High rates of inflation increase the cost of living and a shift of resources from stock market instruments to consumables so that savings and investments are negatively affected. This leads to a reduction in the demand for stock market instruments which tends to reduce the volume of trading and thus value of traded stocks with no price increase. Market capital may therefore fall as the demand for shares falls due to the substitution process. The expected *a prior* sign will be negative with the dependent variable.

Capital Stock (K)

The amount of capital stock available within any economy impacts on the level of production. The measure of capital stock used in this analysis is gross fixed capital formation. The expected *a prior* sign is positive.

Labour (L)

Labour *L* is measured by the labour force participation rate. The expected *a prior* sign is positive. *CPI, K* and *L* are control variables.

Estimation Techniques

Since the focus of the study is to establish the relationship between stock market performance and economic growth, an appropriate technique is to adopt cointegration analysis and error correction modelling.

According to Shahbaz *et al.* (2008), cointegration tests can be conducted using the Engle-Granger (1987) two-stage procedure, the Fully Modified Ordinary Least Squares (FMOLS) procedures of Phillips and Hansen (1990), Johansen (1988, 1991) or the Johansen and Juselius (1990, 1992) and the Autoregressive Distributed Lag (ARDL) approach by Pesaran and Shin (1999) and Pesaran *et al.* (2001) to determine the long-run relationships in bi-variate and multivariate frameworks. In particular, Johansen (1988) and Johansen and Juselius (1990) developed multivariate methods that explicitly use the vector autoregressive method (VAR) framework for testing the presence of cointegration and estimation of long-run relationships amongst macroeconomic time series.

The VAR provides a useful framework for the investigation of both long-run (cointegration) relationships and short-run dynamics (via an equilibrium correction model, the ECM) of the variables in the system. The VAR and VECM also provide useful frameworks to study the impact of unanticipated shocks (individual and system) on the endogenous variables (Impulse Response Functions-IRFs). Additionally, it is possible to identify the relative importance of each variable in explaining the variations of endogenous variables (Forecast Error Variance Decomposition Analysis).

The study utilized the Johansen and Juselius (1990) approach to test the existence of cointegration and the VECM framework for the short-run dynamics.

Johansen and Juselius (1990) Cointegration Test

The Johansen-Juselius approach is based on a VAR model of order p to examine the long-run relationships that may exist among the variables. The approach does not require the choice of dependent and independent variables. All variables entering the VAR models are treated as endogenous variables. The approach is a one-step calculation; free from carrying forward any bias introduced in the first step as in the case of the two-step Engle-Granger methodology (1987). The Johansen-Juselius approach can be expressed mathematically in the following general form:

$$Y_t = \mu + A_1 Y_{t-1} + A_2 Y_{t-2} + A_3 Y_{t-3} + \cdots + A_p Y_{t-p} + \varepsilon_t \qquad (18)$$

Where, Y_t is a vector containing n variables, all of which are integrated of order one and the subscript *t* denotes the time period. μ is an (n *x 1*) vector of constants, A_p is an (n *x* n) matrix of coefficients where *p* is the maximum lag included in the model, and ε_t is an (n *x 1*) vector of error terms. This can be written in the form of the error correction model assuming cointegration of order p. Enders (2004) shows how to rewrite equation (18) as follows:

$$\Delta Y_t = \mu + \left(A_1 - I\right) Y_{t-1} + A_2 Y_{t-2} + A_3 Y_{t-3} + \cdots + A_p Y_{t-p} + \varepsilon_t \qquad (19)$$

Or in a final broad form as:

$$\Delta Y_t = \mu + \Gamma_1 \Delta Y_{t-1} + \cdots + \Gamma_{p-1} \Delta Y_{t-p+1} + \Pi Y_{t-p} + \varepsilon_t \qquad (20)$$

Where, $\Gamma_i = \left(A_1 + A_2 + \cdots + A_{p-1} - I \right)$ represents the dynamics of the model in the short-run and $\Pi = \left(A_1 + A_2 + \cdots + A_p - I \right)$, represents the long-run relationship among the variables included in the vector Y_t, and *I* is the identity vector. The key idea of the Johansen-Juselius approach is to determine the rank of the matrix Π, which represents the number of independent cointegration vectors.

The rank of the matrix Π is found by determining the number of eigen values Π that are significantly different from zero. In this regard, the Johansen-Juselius approach distinguishes between three cases depending on the values of the rank of $\Pi(r)$. The first case is when r = 0. This implies that the variables included in the model are not cointegrated. In other words, there is no linear combination of the variables in the vector Y_t.

The second case is when $r = n$, where n is the number of variables in the system, indicates that the vector process Y_t is stationary, and there is no stochastic trend in the series under consideration. In other words, Π is of full rank, which implies that the initial assumption that all variables included in the Y_t vector are *I*(1) is no longer valid (Johansen & Juselius ,1990). Unlike the above two extreme cases, the typical case is to find r greater than zero but less than n, which implies that a stationary number of linear combinations exist among the vector process Y_t, (Enders, 2004). The approach suggests two likelihood ratio statistics to examine

the rank of matrix Π. These are the trace and maximum eigenvalues tests commonly given by the following formulas:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln\left(1-\hat{\lambda}_i\right) \quad (21)$$

$$\lambda_{max}(r, r+1) = -T \ln(1-\hat{\lambda}_{r+1}) \quad (22)$$

Where, T is the sample size and $\hat{\lambda}_i$ is the eigenvalues, or characteristic roots, which have been obtained from the matrix Π. For the trace test (equation 21), the null hypothesis is that the number of cointegrating vectors is less than or equal to r, and the alternative hypothesis is that Π is of the full rank, $r = n$ cointegrating vectors. However, in the maximum eigenvalue test (equation 22), the null hypothesis $r = 1$, is tested against the alternative of $r > 1$. The trace and maximum eigenvalue statistics are compared with the critical values tabulated in Osterwald-Lenum (1992) for any meaningful decision to be made.

The Johansen-Juselius approach is potentially sensitive to the lag length and to the type of deterministic components included in the VAR system. Thus, it is important to determine the appropriate lag length and deterministic components. Otherwise, hypothesis testing may be misleading (Enders, 2004).

Also, according to Bhasin (2004), the lag length plays an important role in the diagnostic tests as well as in the estimation of VECM and VAR models. But the selection of an appropriate lag length for the estimation of the VAR and VEC models have been a major problem for most researchers as such some select lag lengths in an arbitrary manner. As a result, an appropriate lag length (p) is chosen for this study using the standard model selection criteria Akaike Information

Criterion (AIC) and Schwarz information criterion (SIC) that ensure normally distributed white noise errors with no serial correlation.

The Error Correction Model

The second step of the cointegration estimation is the error correction model. A VECM is estimated to investigate the short and long-run dynamic adjustment of a system of cointegrated variables. The tight link between cointegration and error correction models stems from the Granger representation theorem. According to this theorem, a set of integrated time series that are cointegrated have an error correction representation, and a set of time series that are error correcting are cointegrated (Engle & Granger 1987). This implies that when integrated series are cointegrated the appropriate procedure for estimation is the error correction model.

The short-run error correction model is captured by differencing the dependent and independent variables once and including the lagged value of the long-run relationship. The estimation equation is:

$$\Delta X_t = \delta + \sum_{i=1}^{p} \Gamma \Delta X_{t-i} + \Pi X_{t-i} + \nu_t \qquad (23)$$

Where ΔX_t is an (*n x 1*) vector of variables and δ is an (*n x 1*) vector of constants. Π is the error-correction mechanism, which has two components: $\Pi = \alpha\beta'$ where α is an (*n x 1*) column vector representing the speed of the short-run adjustment to the long-run equilibrium, and β' is a (*1 x n*) cointegrating vector with the matrix of long-run coefficients. Γ is an (*n x n*) matrix representing the coefficients of the short-run dynamics. Finally, ν_t is an (*n x 1*) vector of white noise error terms, and

p is the order of the autoregression. Since the VECM technique is a more general case of the standard VAR model, the analysis proceeded to determine the lag length p for the dynamic terms, using the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC).

Granger Causality Test

The existence of cointegration between variables does not necessarily indicate causation. To do this, we require a Granger-causality test to examine the direction of causation between the four stock market indicators and economic growth. The traditional Granger causality test developed by Granger (1969) is employed for this study.

The traditional pairwise Granger-causality test states that if the inclusion of the past values of a variable, *Y* significantly contributes to forecast the future value of another variable, *X* (in a regression of *X* on its own past values) then *Y* is said to Granger cause *X*. Conversely, if past values of *X* statistically improve the prediction of *Y*, then *X* is said Granger causes *Y* (Granger, 1969).

The test is conducted based on the following two regression equations on the assumption that the series are stationary:

$$Y_t = \sum_{i=1}^{n} \alpha_i X_{t-i} + \sum_{j=1}^{n} \beta_j Y_{t-j} + u_t \qquad (24)$$

$$X_t = \sum_{i=1}^{n} \lambda_i X_{t-i} + \sum_{j=1}^{n} \delta_j Y_{t-j} + v_t \qquad (25)$$

Where Y_t and X_t are assumed to be stationary time series, and u_t and v_t are mutually uncorrelated error terms. The n is the optimal lag order while the

subscripts *t* and *t-i* denote the current and lagged values of the series. The null hypothesis of $\alpha_i = 0$ and $\delta_j = 0$ is tested against the alternative hypothesis of $\alpha_i \neq 0$ and $\delta_j \neq 0$. Equation (24) postulates that current *Y* is related to its own past values as that of *X* and next equation (25) postulates a similar behaviour of *X*. These are the following four possibilities of cause and effect:

1. Unidirectional causality from *X* to *Y* is indicated if the estimated coefficients on the lagged *X* in equation (24) are statistically different from zero as a group (i.e. $\sum \alpha_i \neq 0$) and the set of estimated coefficients on the lagged *Y* in equation (24) is not statistically different from zero (i.e. $\sum \delta_j \neq 0$).
2. Unidirectional causality from *Y* to *X* is indicated if the estimated coefficients on the lagged *X* in equation (25) are statistically different from zero as a group (i.e. $\sum \alpha_i \neq 0$) and the set of estimated coefficients on the lagged *Y* in equation(25) is statistically different from zero (i.e. $\sum \delta_j \neq 0$).
3. Feedback, or bilateral causality is suggested when the sets of *X* and *Y* coefficients are statistically significantly different from zero in both the regression equations.
4. Independence is suggested when the sets of *X* and *Y* coefficients are not statistically significant in both the cases (Kumar, 2011)

These hypotheses are tested using an F-test given by the following formula as in Brandt and Williams (2006)

$$F_{Calculated} = \left[\frac{(RSS_R - RSS_{UR})/p}{(RSS_{UR}/n-k-1)} \right] \qquad (26)$$

Where, p is the number of lagged terms, k is the number of parameters estimated in the unrestricted model, n is the number of observations, and RSS_R and RSS_{UR} are residual sum of squares of the restricted and unrestricted models, respectively. The calculated F-statistic is compared with the critical F-value at a chosen level of significance. The null hypothesis is rejected if the calculated F-statistic exceeds the critical F-value. The appropriate lag length is established by Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC).

Impulse Response Functions

The Impulse Response Functions (IRFs) is a useful tool for determining the magnitude, direction, and the length of time that the variables in the system are affected by a shock to another variable. In the case of a VAR model with two variables included, the form of the IRFs can be written as shown in Enders (2004):

$$\begin{bmatrix} Y_t \\ z_t \end{bmatrix} = \begin{bmatrix} \overline{Y} \\ \overline{Z} \end{bmatrix} + \sum_{i=0}^{\infty} \frac{A^i}{1-b_{12}b_{21}} \begin{bmatrix} 1 & -b_{12} \\ -b_{21} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{Y_{t-i}} \\ \varepsilon_{Z_{t-i}} \end{bmatrix} \tag{27}$$

$$\begin{bmatrix} Y_t \\ z_t \end{bmatrix} = \begin{bmatrix} \overline{Y} \\ \overline{Z} \end{bmatrix} + \sum_{i=0}^{\infty} \begin{bmatrix} \theta^i_{11} & \theta^i_{12} \\ \theta^i_{21} & \theta^i_{22} \end{bmatrix}^i \begin{bmatrix} \varepsilon_{Y_{t-i}} \\ \varepsilon_{Z_{t-i}} \end{bmatrix} \tag{28}$$

$$X_t = \mu + \sum_{i=0}^{\infty} \theta_i \varepsilon_{t-i} \tag{29}$$

Where, θ_i is the IRFs of disturbances. Therefore, the IRF is found by reading off the coefficients in the moving average representation of the process. When

estimating the VAR model to identify the IRFs, the Cholesky decomposition is applied to overcome the problem of contemporaneous relationships among the innovations error terms within the estimated VAR model by identifying the structural shocks such that the covariance matrix of the estimated residuals is lower triangular. The Cholesky decomposition suggests that there is no contemporaneous pass-through from Y_t to the other variable, z_t. More formally, in the VAR model, the matrix error structure becomes left triangular, $\begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} = \begin{bmatrix} 1 & -b_{12} \\ 0 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{Y_t} \\ \varepsilon_{Z_t} \end{bmatrix}$. In practice, this means that the Cholesky decomposition attributes all the effect to the variable that comes first to the target variable in the VAR system.

Forecast Error Variance Decomposition

For any variable, short-run variations are due to its own shocks, but over time other shocks contribute to these changes as well. Forecast error variance decomposition (FEVD) allows us to examine this interesting phenomenon. While the IRFs analyze the dynamic behaviour of the target variables due to unanticipated shocks within a VAR model, FEVD determines the relative importance of each innovation to the variables in the system. (Enders, 2010) show how to write FEVD to conditionally calculate *n*-period forecast error X_{t+n} considering the VMA representation of VAR presented in equation (28) as:

$$X_{t+n} - E_t X_{t+n} = \mu + \sum_{i=0}^{n-1} \theta_i \varepsilon_{t+n-i} \qquad (30)$$

Considering Y_t, the first element of the X_{t+n} matrix in equation (28), the variance of the *n*-step-ahead forecast error can be calculated as:

$$\begin{aligned} Y_{t+n} - E_t Y_{t+n} = {} & \theta_{11}(0)\varepsilon_{Y_{t+n}} + \theta_{11}(1)\varepsilon_{Y_{t+n-1}} + \cdots + \theta_{11}(n-1)\varepsilon_{Y_{t+1}} \\ & + \theta_{12}(0)\varepsilon_{Z_{t+n}} + \theta_{12}(1)\varepsilon_{Z_{t+n-1}} + \cdots + \theta_{12}(n-1)\varepsilon_{Z_{t+1}} \end{aligned} \tag{31}$$

Or

$$\begin{aligned} \sigma_y(n)^2 = {} & \sigma_y{}^2[\theta_{11}(0)^2 + \theta_{11}(1)^2 + \cdots + \theta_{11}(n-1)^2] \\ & + \sigma_z{}^2[\theta_{12}(0)^2 + \theta_{12}(1)^2 + \cdots + \theta_{12}(n-1)^2] \end{aligned} \tag{32}$$

Where $\sigma_y(n)^2$ and $\sigma_z(n)^2$ denote the *n*-step-ahead forecast error variance of Y_{t+n} and Z_{t+n}, respectively. The first part of equation (31) shows the proportion of variance due to the variables own shock Y_t, while the second part shows the proportion of variance due to the other variables shock, z_t. Theoretically, the first part decreases over time while the second part of the variance increases, (Enders, 2010).

Post Estimation Diagnostics (Evaluation of the model)

An empirical research is usually an interactive process. The process begins with a specification of the relationship to be estimated. Selecting a specification usually involves several choices: the variables to be included, the functional form connecting these variables, and if the data are time series, the dynamic structure of the relationship between the variables. Inevitably, there is uncertainty regarding the appropriateness of this initial specification. Once the equation is estimated, diagnostic tests are conducted to evaluate the quality of the specification along a

number of dimensions. These include the normality, stability, serial correlation, CUSUM and CUSUM of squares tests.

Multivariate Normality Test

This assumption is required in order to conduct hypothesis testing, particularly if the sample size is small. For sample sizes that are sufficiently large, violation of the normality assumption is virtually inconsequential. Based on the central limit theorem, the test statistic will asymptotically follow the appropriate distribution even in the absence of error normality. In smaller samples it is important to meet this assumption for the p-values of the t-test to be valid. To detect non-normal errors one can estimate the values of skewness and kurtosis. These values can be obtained from the descriptive statistics. The Bera-Jarque test was used to ascertain the normality of the distribution in this study.

Stability Tests

The Ramsey Regression Equation Specification Error Test (RESET) (Ramsey, 1969) is a general specification test for the linear regression model. It implicitly assumes that the appropriate functional form is linear. More specifically, it tests whether non-linear combinations of the fitted values help explain the response variable. The intuition behind the test is that if non-linear combinations of the explanatory variables have any power in explaining the response variable, then the model is mis-specified. The study employed this test to check whether the model is correctly specified.

Serial Correlation Test

Serial correlation occurs in time-series studies when the errors associated with a given time period are carried over into future time periods. There are different types of serial correlation. With first-order serial correlation, errors in one time period are correlated directly with errors in the ensuing time period. Serial correlation will not affect the unbiasedness or consistency of estimators, but it does affect their efficiency. With positive serial correlation, the estimates of the standard errors will be smaller than the true standard errors. This will lead to the conclusion that the parameter estimates are more precise than they really are and there will be a tendency to reject the null hypothesis when it should not be rejected. To avoid this problem, the LM test was used to check for serial correlation in the model.

CUSUM and CUSUM of Squares Test

The CUSUM test is based on the cumulative sum of the recursive residuals. This option plots the cumulative sum and the cumulative sum of squares together with the five percent critical lines. The test finds parameter instability if the cumulative sum and cumulative sum of squares lies outside the area between the two critical lines.

Data Analysis

The study employed both descriptive and quantitative analysis using charts such as graphs and tables to aid in the descriptive analysis. Unit roots tests

were conducted on all variables to ascertain their order of integration. Furthermore, the study employed the Johansen-Juselius multivariate cointegration and VECM to obtain both the long and short-run estimates of the variables.

Summary and Conclusion

The chapter developed and presented the methodological framework suitable for conducting the study. The empirical model was developed based on the theoretical framework of the Solow (1956) Growth model. The chapter also specified the stationarity tests, the Johansen cointegration test, VECM, Granger-causality test, the impulse response functions, forecast error variance decomposition employed for the study and the diagnostic tests to check the validity and stability of the model.

CHAPTER FIVE

RESULTS AND DISCUSSION

Introduction

This chapter presents and analyzes the regression results of the functions specified in chapter four. The main objective of this study is to examine the long-run and short-run relationship between the four stock market performance indicators and economic growth in Ghana. Chapter five starts with an examination of the results of the descriptive statistics of the variables. This is followed with an examination of the time series properties of the variables with the results of both the ADF and the PP unit root tests and then the results of the VAR lag length selection criteria. The rest of the chapter is specified as follows: presentation and discussion of the results of the estimated long-run equation and the VECM, evaluation of the model, the discussions on the results of the Granger causality test, the impulse response functions and the forecast error variance decomposition and the last but not the least is the summary and conclusion of the chapter. These results are discussed in relation to the hypotheses of the study.

Descriptive Statistics of the Variables

In this section, the characteristics of the distribution are presented. The various descriptive statistics looked at include; the mean, median, maximum, minimum, standard deviation, skewness, kurtosis, Jarque-Bera, probability, sum,

sum squared deviation and number of observation. Table 2 captures the summary information on the descriptive statistics of the variables at levels.

Skewness which is a measure of the shape of the distribution shows that real GDP (RGDP), stock market turnover ratio (STR) and labour force participation rate (L) are bell-shaped or asymmetric while those of stock market capitalization ratio (SMCAR), total value traded ratio (TVR), Ghana Stock Exchange market index (GSEMI), consumer price index (CPI) and gross fixed capital formation (K) are negatively skewed or suggest long tails to the left.

Kurtosis on the other hand, measures the peakedness and flatness of the distribution of the series. From the Table 2, real GDP, stock market capitalization ratio, stock market turnover ratio, Ghana Stock Exchange market index, consumer price index and gross fixed capital formation are platykurtic relative to the normal distribution since their kurtosis values are less than three. However, total value traded ratio and labour force participation rate are leptokurtic since their kurtosis values are greater than three suggesting that their distributions are peaked relative to the normal distribution.

Jarque-Bera is a statistical test that determines whether a series is normally distributed. From Table 2, the Jarque-Bera statistic which tests the null hypothesis that all the series are drawn from normally distributed random process cannot be rejected for real GDP, stock market capitalization ratio, stock market turnover ratio, total value traded ratio, the GSE market index, consumer price index, gross fixed capital formation and labour force participation rate.

Table 2: Descriptive Statistics of Variables at Level

	LRGDP	LSMCAR	LSTR	LTVR	LGSEMI	LCPI	LK	L
Mean	8.255349	1.936889	0.750029	2.007801	5.608218	5.081343	1.908064	5.619678
Median	8.207229	1.983584	0.712590	2.265961	5.421478	5.335209	1.983584	5.496886
Maximum	9.140780	3.522465	4.579362	8.633137	7.942997	7.930870	3.522465	8.994875
Minimum	7.766286	0.425943	2.447951	3.137577	2.550884	2.025513	0.596066	2.828657
Std. Dev.	0.336293	0.896198	1.481422	2.417304	1.547486	1.553339	0.956701	1.075773
Skewness	0.488026	-0.285582	0.132105	-0.157359	-0.305693	-0.156367	-0.529584	0.094425
Kurtosis	2.422257	2.483842	2.451754	3.414437	2.066498	2.258044	2.938392	3.967680
Jarque-Bera	4.717035	2.173040	1.358061	0.992954	4.565799	2.377105	4.127315	3.564257
Probability	0.094560	0.337389	0.507108	0.608671	0.101988	0.304662	0.126989	0.168280
Sum	726.4707	170.4463	66.00258	176.6865	493.5231	447.1582	167.9096	494.5317
Sum Sq.Dev.	9.839068	69.87579	190.9312	508.3721	208.3401	209.9191	79.62907	100.6840
Observations	88	88	88	88	88	88	88	88

Source: Computed by the author using EViews 7.0 econometric software.

Results of the Unit Root Tests

Determining the order of integration for each variable included in the system is the first step to understanding the long-run relationships amongst these variables. To this end, the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) unit root tests were conducted to examine the time series properties of the variables and to establish whether all variables are integrated of the same order. Both tests test the null hypothesis that the series under investigation have unit root against the alternative hypothesis that the series have no unit root.

In order to understand this trend, the study first analyzed the unit root properties using graphs. The time series plot which gives some idea about the nature of the stationarity of the series is shown in Appendices VII and VIII respectively. It can be observed that all the variables in their log-levels seem to be non- stationary. However, all the series in their first log differenced levels show no trend and this suggests stationarity. Notwithstanding the graphical examination, a more formal stationarity test was conducted to ascertain the order of integration of the variables and the results are presented in Tables 3 and 4 for the ADF and the PP unit root tests respectively.

TABLE 3: ADF Test Results (With Intercept Only)

Levels (Intercept)			1st Difference (Intercept)			
Variable	ADF Statistic	Lag	Variable	ADF Statistic	Lag	*OI*
LRGDP	2.130015 (0.9999)	4	D(LRGDP)	-2.934733 (0.0457)**	3	*I*(1)
LSMCAR	-2.372903 (0.1524)	0	D(LSMCAR)	-8.575580 (0.0000)***	0	*I*(1)
LSTR	-3.020291 (0.0369)	1	D(LSTR)	-6.478825 (0.0000)***	0	*I*(1)
LTVR	-2.030575 (0.2735)	0	D(LTVR)	-7.865783 (0.0000)***	0	*I*(1)
LGSEMI	-1.938695 (0.3134)	0	D(LGSEMI)	-8.880143 (0.0000)***	0	*I*(1)
LCPI	-3.198315 (0.0237)	6	D(LCPI)	-2.747872 (0.0705)*	4	*I*(1)
LK	-1.310688 (0.6216)	0	D(LK)	-9.566656 (0.0000)***	0	*I*(1)
L	1.604289 (0.9994)	10	D(L)	-17.09772 (0.0001)***	8	*I*(1)

Source: Computed by the author using EViews 7.0 econometric software.
Note: *OI* represents the order of integration, D denotes first difference and ***, ** and * represents the levels of significance at one percent, five percent and 10 percent respectively.

TABLE 4: PP Test Results (With Intercept Only)

Levels (Intercept)			1st Difference (Intercept)			
Variable	PP Statistic	BW	Variable	PP Statistic	BW	*OI*
LRGDP	-1.274065 (0.6385)	6	D(LRGDP)	-10.41103 (0.0000)***	5	*I*(1)
LSMCAR	-2.568778 (0.1034)	1	D(LSMCAR)	-8.550197 (0.0000)***	4	*I*(1)
LSTR	-2.393824 (0.1464)	2	D(LSTR)	-6.429295 (0.0000)***	3	*I*(1)
LTVR	-2.068926 (0.2577)	3	D(LTVR)	-7.888191 (0.0000)***	2	*I*(1)
LGSEMI	-1.859038 (0.3500)	7	D(LGSEMI)	-9.026746 (0.0000)***	8	*I*(1)
LCPI	-2.534061 (0.1110)	3	D(LCPI)	-6.182670 (0.0000)***	5	*I*(1)
LK	-1.296471 (0.6282)	1	D(LK)	-9.569521 (0.0000)***	2	*I*(1)
L	-0.291690 (0.5780)	24	D(L)	-10.28796 (0.0000)***	27	*I*(1)

Source: Computed by the author using EViews 7.0 econometric software.
Note: *OI* represents the order of integration, D denotes first difference and *** represents the levels of significance at one percent.

The Schwartz Information Criterion (SIC) and Akaike Information Criterion (AIC) were used to determine the optimal number of lags included in the tests. The study presented and used the *p*-values for making the unit root decision which also gives similar results or conclusions as with the MacKinnon critical values which also has wide usage in the literature.

The results of the ADF test reported in Table 3 indicate that some of the series are non-stationary in their respective levels. However, after first differencing the variables, the null hypothesis of a unit root in the ADF test is rejected at one percent significance level for all the series except for economic growth and inflation, which had their null hypotheses of the presence of unit root rejected at five percent and 10 percent respectively. This implies that all the series became stationary after first differencing, indicating that all the series are integrated of order one, i.e. $I(1)$.

To confirm the robustness of the ADF unit root test, the PP test was conducted on all the series and the results presented in Table 4. The PP test results also show that the series are non-stationary in their respective levels. They, however, become stationary at one percent significance level after first differencing, suggesting that they are all integrated of order one, i.e. $I(1)$. Thus, confirming the results of the ADF test. One can therefore conclude that all the variables are integrated of order one $I(1)$ and in order to avoid spurious regression the first difference of all the variable must be employed in the estimation of the short-run equation.

Optimal VAR Lag Length Selection

The second step for establishing the presence of a long-run relationship amongst these variables is to determine the optimal lag length for the VAR system. This ensures normally distributed white noise errors with no serial correlation. Lag-length misspecification for the VAR model often generates autocorrelated errors (Lütkepohl, 2005). To perform the second step, five different information criteria including the sequential modified likelihood ratio (LR) test statistic, the final prediction error criteria (FPE), the Akaike information criterion (AIC), the Schwarz information criterion (SIC), and the Hannan-Quinn information criterion (HQ) are used to determine the appropriate lag length (*p*). These criteria are widely used in the literature (Lütkepohl, 2005 & Enders, 2010).

The results of the VAR lag selection criteria are presented in Table 5. In Table 5, the result for each criterion with a maximum of 7 lags is reported. To identify the appropriate lag, we check for the asterisks attached to the statistics of each of the six lag selection criteria (LogL, AIC, LR, SC, FPE and HQ). The lag number with most asterisks attached to its statistics for the various lag selection criteria (LogL, AIC, LR, SC, FPE and HQ) becomes the lag to be used. Thus, tracing these statistics against the first column labelled lag, shows that the lag number 7 has four asterisks attached to the statistics of the (LR, FPE, AIC and HQ). This implies that the appropriate lag length chosen is 7.

Table 5: Results of the Optimal VAR Lag Length Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	170.4015	NA	2.65e-05	12.16629	12.40278	12.26117
1	265.0012	1164.687	1.23e-11	-2.429666	-0.301267	-1.575725
2	467.4094	149.4909	6.01e-12	-3.185215	0.835094	-1.572214
3	484.7348	279.8731	2.21e-13	-6.602702	-0.690481*	-4.230641
4	588.8512	143.9310	6.78e-14	-8.021017	-0.216886	-4.889898
5	720.5727	130.0953	1.94e-14	-9.693153	0.002888	-5.802974
6	820.4531	78.91783	1.63e-14	-10.57909	1.008863	-5.929850
7	978.4652	93.63684*	5.31e-15*	-12.90038*	0.579486	-7.492079*

Source**:** Computed by the author using EViews 7.0 econometric software.
*indicates lag order selected by the criteria
LR: sequential modified LR test statistic (each test at five percent level)
FPE: Final prediction error
AIC: Akaike information criteria
SC: Schwarz information criteria
HQ: Hannan-Quinn information criteria

Results of the Johansen-Juselius (1990) Cointegration Test

The final step for the Johansen-Juselius cointegration test is to determine the number of cointegration vectors. A necessary but not sufficient condition for cointegration test is that each of the variables should be integrated of the same order. For non-stationary series with unit root, first differencing appears to provide an appropriate solution to the problems. But, first differencing will eliminate all the long-run information which mostly is of interest to economists.

According to Johansen (1991), cointegration can be used to establish whether there exists a linear long-term economic relationship among variables. Given that the series are $I(1)$, the cointegration of the series is a necessary condition for the existence of a long-run relationship. The cointegration test is sensitive to the presence of deterministic trends (Johansen, 1991, 1995). We thus, assumed an intercept only in the data and that there is no deterministic trends in the VAR and that the cointegrating relationship has an intercept and no trend. The results of both the trace and maximum eigenvalue statistics of the Johansen cointegration test are presented in Tables 6 and 7.

Table 6: Unrestricted Cointegration Rank Test (Trace) Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None*	0.943551	922.9232	187.4701	0.0001
At most 1*	0.911458	692.9693	150.5585	0.0001
At most 2*	0.877120	499.0272	117.7082	0.0000
At most 3*	0.788168	331.3036	88.80380	0.0000
At most 4*	0.723646	207.1468	63.87610	0.0000
At most 5*	0.531496	104.2609	42.91525	0.0000
At most 6*	0.320191	43.60405	25.87211	0.0001
At most 7*	0.147095	12.72856	12.51798	0.0461

Source: Computed by the author using EViews 7.0 econometric software.
Trace test indicates 8 co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

In Table 6, the first column is the hypothesized number of cointegrating equations amongst the variables. In this column, we have the hypothesized number of cointegrating equation(s) of none, at most one, at most two, at most three and so on to at most seven. The second, third, fourth and fifth columns are the eigenvalues, the trace statistics, the critical values and the p-values respectively.

Table 7: Unrestricted Cointegration Rank Test (Max. Eigenvalue) Results

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None*	0.943551	229.9539	56.70519	0.0001
At most 1*	0.911458	193.9421	50.59985	0.0001
At most 2*	0.877120	167.7236	44.49720	0.0000
At most 3*	0.788168	124.1568	38.33101	0.0000
At most 4*	0.723646	102.8858	32.11832	0.0000
At most 5*	0.531496	60.65686	25.82321	0.0000
At most 6*	0.320191	30.87549	19.38704	0.0007
At most 7*	0.147095	12.72856	12.51798	0.0461

Source: Computed by the author using EViews 7.0 econometric software.
Max-eigenvalue test indicates 8 co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Similarly in Table 7, the first column is the hypothesized number of cointegrating equations amongst the variables. In this column, we have the hypothesized number of cointegrating equation(s) of none, at most one, at most two, at most three and so on to at most seven. The second, third, fourth and fifth columns are the eigenvalues, the Max-eigen statistics, the critical values and the p-values respectively. Based on these statistics of both tests decisions are made.

There are two decision criteria to either fail to accept or fail to reject the hypothesized number of cointegrating equation(s) amongst the variables for both the trace and maximum eigenvalue tests. The first is to compare the trace or the

maximum eigenvalue statistics with their respective critical values. If at any particular hypothesized number of cointegrating equation(s), the trace or the maximum eigenvalue statistic exceeds its respective critical value, we fail to accept same and conclude that there is no cointegration at that particular hypothesized number of cointegrating equation(s). However, if at any particular hypothesized number of cointegrating equation(s), the trace or the maximum eigenvalue statistic is less than its respective critical value, we fail to reject same and conclude that there is cointegration at that particular hypothesized number of cointegrating equation(s).

The second scenario is the use of the MacKinnon-Haug-Michelis (1999) p-values. If the p-value is less than five percent for any particular hypothesized number of cointegrating equation(s), we fail to accept same and conclude that there is no cointegration at that particular hypothesized number of cointegrating equation(s). However, if the p-value is greater than five percent for any particular hypothesized number of cointegrating equation(s), we fail to reject same and conclude that there is cointegration at that particular hypothesized number of cointegrating equation(s).

The Long-Run Relationship

From Tables 6 and 7, the hypothesized number of cointegrating equation(s) are; none, at most one, at most two, at most three and so on to at most seven. Using both criteria explained, the hypothesis of no cointegrating relationship or vector (r = 0, i.e. none) is rejected. This implies the presence of

cointegration. Our duty then, is to find out the number of cointegrating relationships or equations amongst the variables. We also note that the various hypothesized number of cointegrating equation(s) of at most one, at most two, at most three and so on to at most seven are rejected by both criteria explained.

Thus, both the trace and maximum eigenvalue tests suggest the existence of eight cointegrating vectors amongst the variables at five percent significance level. This is a confirmation of a stable long-run relationship amongst the variables. Our analysis therefore, normalized the cointegrating vector on economic growth.

The choice of this vector is based on two reasons. First, Johansen and Juselius (1990) suggested that in the presence of more than one cointegration vector, the first eigenvector is the most useful to use in examining the long-run relationship among the variables in the system (Mukherjee & Naka, 1995). Secondly, based on the objectives of the study coupled with the manner in which the empirical model is specified with economic growth as the dependent variable and all the other variables as explanatory variables and finally based on the *a prior* expectations of the long-run relationships. Based on these arguments, the analysis of the long-run estimates is restricted to the first eigenvector which has economic growth as the dependent variable. As a result, only one error correction term (ECT) which links short-run distortions in the relationship to the long-run equilibrium relationship is reported. Both the unnormalized vectors and the normalized cointegrating vector are presented in Appendices IX and X.

$$LRGDP = \underset{[3.0834]}{0.091118}LSMCAR + \underset{[2.7327]}{0.038504}LSTR + \underset{[0.0577]}{0.000986}LTVR + \underset{[6.9522]}{0.321124}LGSEMI - \underset{[-4.7274]}{0.357777}LCPI + \underset{[5.1785]}{0.875952}LK + \underset{[8.8525]}{1.991209}L \quad (33)$$

Note: *t*-statistics in square brackets.

The error correction term of equation (33) can be expressed as:

$$ECT = LRGDP - 0.091118LSMCAR - 0.038504LSTR - 0.000986LTVR - 0.321124LGSEMI + 0.357777LCPI - 0.875952LK - 1.991209L \quad (34)$$

From equation (33) all the normalized coefficients have the expected signs except total value traded ratio (TVR) which has a positive but insignificant impact on economic growth. Stock market capitalization ratio (SMCAR), stock market turnover ratio (STR), Ghana Stock Exchange market index (GSEMI), capital (K) and labour (L) have a positive and significant impact on economic growth. Inflation (CPI) has a negative and significant impact on economic growth as expected.

The positive long-run relationship between economic growth and the stock market performance indicators is consistent with the results reported by Atje and Jovanovic (1993), Levine and Zervos (1996), Osei (2005), Yartey (2008) and Kolapo and Adaramola (2012).

From equation (33), the size of the GSE measured by stock market capitalization ratio is statistically significant and positive in determining the long-run growth. This finding is consistent with Osei (2005), Ashante *et al.* (2011), Nazir *et al.* (2010) and Ihendinihu and Onwuchekwa (2012), who in their respective studies concluded that stock market capitalization ratio facilitates

economic growth. This finding, however, contradicts Quaidoo (2011), who found the reverse. The coefficient of 0.091118 indicates that for every one percent increase in stock market capitalization ratio holding all other factors constant in the long-run, economic growth would increase by approximately 0.091118 percent. With 34 securities listed and a market capitalization valued at approximately at GH¢ 55.78 billion, the Ghana Stock Exchange may still be regarded as a small market relative to international standards, nevertheless, its ability to mobilize capital and diversify risk on an economy-wide basis cannot be overlooked as it impacts economic growth in the economy as depicted by the data.

This result shows that the level of economic growth and for that matter the level of real income is greatly influenced by stock market capitalization ratio in Ghana. An increase in the stock market capitalization ratio of the GSE would aid its ability to channel capital quickly to productive and investible projects. This would increase productivity which would lead to increases in economic growth and hence real income. The increases in real income would further boost the public's participation in the activities of the GSE raising the market capitalization further, which leads to an even higher rate of economic growth and real income. Thus, enhancing the mobilization of more funds and channeling of more capital into more investible projects. This would ensure sustained growth.

In equation (33), the liquidity of the GSE relative to its size is statistically significant and has a positive impact on economic growth. The coefficient of 0.038504 indicates that a one percent increase in turnover ratio would cause approximately 0.038504 percent increase in economic growth in the long-run

holding all other factors constant. None of the studies done in Ghana to the best of my knowledge used this indicator to measure stock market performance. The results conform to studies such as Bahadur and Neupane (2006), Nowbutsing and Odit (2009), Nazir *et al.* (2010) and Augustine and Salami (2010).

Total value traded ratio in equation (33) has a positive but insignificant effect on economic growth. The positive effect of total value traded ratio on economic growth is in conformity with theory. The insignificant outcome was, however, not surprising given that the annual average liquidity of the GSE for the period under study was only 0.45 percent which is way below the World's 1990s average of 31 percent. This is indicative of the fact the GSE is relatively illiquid relative to the whole economy. This was also noted by Yartey (2006). Other studies that found similar results include Alajekwu and Achugbu (2012) and Odetayo and Sayuyibe (2012).

This finding is also in line with Adetunji (1997) as cited in Chinwuba and Amos (2011) who argued that "African markets basically lack depth and breadth with most of them trading only in traditional instruments. The level of awareness by the populace is low while not much is known about our markets by outsiders". Also, in the views of Ilaboya and Ibrahim (2004) "The insignificant relationship reflects the fact that majority of key investors prefer to invest in other sectors of the economy other than the capital market". The following studies Oke and Mokuolu (2005), Odhiambo (2010) and Ozurumba and Chigbu (2013), however, found a significant positive correlation between total value traded ratio and economic growth in the long-run.

The GSE market index in equation (33) exerts a positive influence on economic growth in the long-run and is statistically significant. This is consistent with the findings of Brasoveanu *et al.* (2008), Olweny and Kimani (2011) and Dziwornu and Awunyo-Victor (2013), who in their individual studies found the All Share Index among other variables to be positively correlated with and capable of influencing economic growth in the long-run. This, however, contradicts the findings of Ihendinihu and Onwuchekwa (2012), who concluded that the index does not influence growth. The coefficient of 0.321124 indicates that a one percent increase in the GSE market index holding all other factors constant would cause economic growth to increase by approximately 0.321124 percent in the long-run.

Inflation is observed to be statistically significant and has a negative impact on economic growth. The coefficient of 0.357777 implies a one percent increase in the price level causes a decrease in long-run economic growth by approximately 0.357777 percent. This is in conformity with theory. High inflation rates deter investors from investing in the market thus reducing the resource mobilization ability of the market and capital to productive investments causing economic growth to decrease. Capital and labour on the other hand have positive effects on economic growth and are statistically significant. Thus, a coefficient of 0.875952 for capital, implies a one percent increase in capital increases economic growth by 0.875952 percent holding all other factors constant and the coefficient of 1.991209 for labour, implies a 1 unit increase in labour other things being equal increases economic growth by approximately 1.991209 units in the long-run.

Short Run Dynamics

When variables are cointegrated, their dynamic relationship can be specified by an error correction representation in which an error correction term (ECT) computed from the long-run equation must be incorporated in order to capture both the short-run and long-run relationships Engel and Granger (1987).

The error correction term indicates the speed of adjustment to long-run equilibrium in the dynamic model. In other words, its magnitude shows how quickly variables converge to equilibrium when they are disturbed. It is expected to be statistically significant with a negative sign. The negative sign implies that any shock that occurs in the short-run will be corrected in the long-run. However, if it is positive, it shows that the disequilibrium that occurs in the short-run cannot be corrected in the long-run. Given that our variables are non-stationary but cointegrated, estimation of the VECM, which included a first differenced VAR with one period, lagged error correction term yielded an over-parameterized model as presented in Appendix XI. To arrive at a more parsimonious model, insignificant variables were deleted using the t-ratios and the p-values. The final model is presented in table 8.

Table 8: Results of the Parsimonious VECM

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECT(-1)	-0.783079	0.098033	-7.987927	0.0000
D(LRGDP(-3))	0.299234	0.130641	2.290506	0.0272
D(LRGDP(-4))	-0.439293	0.148733	-2.953574	0.0052

Table 8 continued.

D(LRGDP(-5))	0.656995	0.145264	4.522756	0.0001
D(LRGDP(-6))	-0.750390	0.189685	-3.955976	0.0003
D(LSMCAR(-1))	0.008247	0.002422	3.404974	0.0015
D(LSMCAR(-2))	-0.007981	0.002111	-3.781371	0.0005
D(LSMCAR(-3))	-0.004346	0.001818	-2.390169	0.0215
D(LSMCAR(-6))	0.003299	0.001545	2.135457	0.0387
D(LSTR(-5))	0.006565	0.003124	2.101735	0.0418
D(LSTR(-6))	-0.006891	0.002734	-2.520484	0.0157
D(LTVR(-1))	-0.009899	0.003886	-2.547516	0.0147
D(LTVR(-2))	-0.010982	0.003481	-3.154638	0.0030
D(LTVR(-3))	-0.014717	0.003523	-4.176919	0.0002
D(LTVR(-4))	0.000552	0.003250	2.938638	0.0054
D(LTVR(-5))	0.004937	0.002035	2.425508	0.0189
D(LTVR(-6))	0.005888	0.002993	1.967085	0.0547
D(LGSEMI(-1))	-0.019396	0.005407	-3.587313	0.0009
D(LGSEMI(-2))	0.019772	0.006454	3.063598	0.0039
D(LGSEMI(-3))	-0.014481	0.006928	-2.090326	0.0428
D(LGSEMI(-4))	-0.023669	0.007361	-3.215531	0.0025
D(LGSEMI(-6))	0.028197	0.010618	2.655585	0.0112
D(LGSEMI(-7))	-0.021275	0.008878	-2.396310	0.0212
D(LCPI(-3))	-0.081753	0.029560	-2.765636	0.0085
D(LCPI(-4))	0.078074	0.026357	2.962110	0.0051

Table 8 continued.

D(LCPI(-7))	0.082562	0.026060	3.168110	0.0029
D(LK(-1))	0.122009	0.018432	6.619487	0.0000
D(LK(-4))	0.035310	0.014604	2.417786	0.0201
D(LK(-5))	0.048312	0.019390	2.491529	0.0169
D(L(-1))	-0.145292	0.017247	-8.424018	0.0000
D(L(-2))	-0.126604	0.015629	-8.100628	0.0000
D(L(-3))	0.133536	0.016830	7.934166	0.0000
D(L(-4))	-0.118307	0.014414	-8.207805	0.0000
D(L(-5))	0.121614	0.011078	10.97765	0.0000
D(L(-6))	-0.096809	0.008973	-10.78903	0.0000
D(L(-7))	-0.067408	0.007120	-9.467559	0.0000
C	0.089645	0.009575	9.362543	0.0000

R-squared	0.992840
Adjusted R-squared	0.986203
F-statistic	149.6037
Prob (F-statistic)	0.0000
Durbin- Watson statistic	1.952027

Source: Computed by the author using EViews 7.0 econometric software.

The results of the VECM in Table 8 indicates that the third, fourth, fifth and sixth quarters economic growth influence current quarter economic growth. Whereas the third and fifth quarters economic growth have a positive and significant impact in explaining changes in current economic growth in the short-run, the fourth and sixth quarters economic growth exert a negative and significant impact in explaining changes in current quarter economic growth in

the short-run. With a one percent increase in the third and fifth quarter's economic growth, holding all other factors constant current quarter economic growth in the short-run will increase by about approximately 0.299234 percent and 0.656995 percent respectively. This conforms to Regmi (2012), whose economic growth lag one period was relevant in explaining current changes in economic growth in the short-run. Conversely, however, a one percent increase in the fourth and sixth quarter's economic growth causes current quarter growth to decrease by approximately 0.439293 percent and 0.750390 percent respectively in the short-run, holding all other factors constant. The negative effect of the fourth and sixth quarter's economic growth conforms to Osuala *et al.* (2013).

The VECM results further indicate that the first, second, third and sixth quarters stock market capitalization ratio influence current quarter economic growth. Whereas the first and sixth quarters exert a positive and significant impact in explaining changes in current economic growth in the short-run, the second and third quarters have a negative and significant impact in explaining changes in current economic growth in the short-run. With a one percent increase in the first and sixth quarter's stock market capitalization ratio, holding all other factors constant, current economic growth in the short-run will increase by approximately 0.008247 percent and 0.003299 percent respectively. This positive effect of stock market capitalization ratio on current economic growth is consistent with Ihendinihu and Onwuchekwa (2012) and Okodua and Ewetan (2013), who found this variable relevant in explaining current economic growth in the short-run. Conversely, however, a one percent increase in the second and third

quarter's stock market capitalization ratio causes current growth to decrease by approximately 0.007981 percent and 0.004346 percent respectively in the short-run, holding all other factors constant. This negative effect conforms to Osuala *et al.* (2013). The positive effect of the first and sixth quarter's stock market capitalization ratio on economic growth in the short-run confirms the long-run effect of stock market capitalization ratio on economic growth.

The results also show that, stock market turnover ratio is statistically significant and has a positive impact on current growth at lag five. Holding all factors constant, a one percent increase in turnover ratio of the fifth quarter will increase current economic growth by about 0.006565 percent. This positive influence of stock market turnover ratio of the fifth quarter, however, deteriorates in the sixth quarter. The sixth quarter exerts a negative impact on current growth, so that a one percent increase in turnover ratio causes about 0.006891 percent decrease in current growth. This negative impact of turnover ratio in the short-run conforms to Nurudeen (2009). The positive effect of the fifth quarter stock market turnover ratio on current growth in the short-run reinforces the long-run effect of stock market turnover ratio on economic growth and this is consistent with Chizea (2012).

From Table 8, the first, second, third, fourth, fifth and sixth quarters total value traded ratio influence current quarter economic growth. Whereas the first, second and third quarters exert a negative and significant impact in explaining changes in current economic growth in the short-run, the fourth, fifth and sixth quarter's total value traded ratio have a positive and significant effect in

explaining changes in current economic growth in the short-run. With a one percent increase in the first, second and third quarters total value traded ratio, holding all other factors constant, current economic growth in the short-run will decrease by about approximately 0.009899 percent, 0.010982 percent and 0.014717 percent respectively. The negative effect of total value traded ratio in the short-run is consistent with Ihendinihu and Onwuchekwa (2012). Conversely, a one percent increase in the fourth, fifth and sixth quarters total value traded ratio would cause current growth to increase by approximately 0.000552 percent, 0.004937 percent and 0.005888 percent respectively in the short-run, holding all other factors constant. The positive effect of total value traded ratio in the short-run is in conformity with Okodua and Ewetan (2013) and also substantiates its long-run effect on economic growth. How be it, it was insignificant in the long-run.

The GSE market index exerts both positive and negative significant effects on current growth in the short-run. The rate of change in the first quarter has a significant negative effect on current growth but this improves in the second quarter, then it deteriorates in the third and fourth quarters before picking up in the sixth quarter and then deteriorating again in the seventh quarter. Thus, a one percent increase in the GSE market index, holding all other factors constant, would cause current economic growth to decrease by approximately 0.019396 percent, 0.014481 percent, 0.023669 percent and 0.021275 percent for the first, third, fourth and seventh quarters respectively.

Conversely, a one percent increase in the GSE market index, holding all other factors constant, causes current economic growth to increase by approximately 0.019772 percent, 0.028197 percent for the second and sixth quarters respectively. The positive effect of this index in the short-run is in conformity with Ihendinihu and Onwuchekwa (2012) and Hossain, Hossain and Sadi (2013) and also substantiates the long-run effect of the index on economic growth as explained above.

The short-run results further indicate that inflation is statistically significant and has a decreasing effect on current growth at lag three so that for every one percent increase in inflation, current growth declines by approximately 0.081753 percent holding all other factors constant. This conforms to Jecheche (2011). However, inflation at four and seven are statistically significant and have an increasing effect on current growth so that for every one percent increase in inflation, current growth increases by approximately 0.078074 percent and 0.082562 percent holding all other factors constant in the short-run. The positive effect may be as a result of investors hedging against inflation in the market.

In the short-run, both capital and labour exerts positive and significant influences on current growth. Capital lagged one, four and five quarters causes current growth to increase by approximately 0.122009 percent, 0.035310 percent and 0.048312 percent respectively with a one percent increase in capital and Labour lagged one, two, four, six and seven quarters causes current growth to decrease by approximately 0.145292 units, 0.126604 units, 0.118307 units, 0.096809 units and 0.067408 units respectively with a 1 unit increase in labour in

the short-run, whilst, labour lagged three and five quarters causes current growth to increase by approximately 0.133536 units and 0.121614 units.

The VECM results shows that, the estimated coefficient of the error correction term (ECT) which is -0.783097, has the expected sign and it is significant at one percent. This is an indication of the joint significance of the long-run coefficients. As stated earlier with reasons, that the analyses of the long-run and short-run dynamics are restricted to the first eigenvector which has economic growth as the dependent variable, only one error correction term (ECT) which links short-run distortions in the relationship to the long-run equilibrium relationship is reported. According to Kremers, Ericsson and Dolado (1992) and Bahmani-Oskooee (2001), a relatively more efficient way of establishing cointegration is through the ECT. The estimated coefficient of -0.783097 implies that the speed of adjustment is approximately 78 percent per quarter. This negative and significant coefficient of the ECT is an indication that cointegration exists amongst the variables.

The size of the coefficient of the ECT denotes that about 78 percent of the disequilibrium in the system by previous quarters' shocks converges back to the long-run equilibrium in the current quarter. The magnitude of the coefficient in the model shows evidence of a quick response to equilibrium whenever a shock occurs in the short-run. The larger the error correction coefficient (in absolute term), the faster the variables equilibrate in the long-run when shocked Acheampong (2007). This high speed of adjustment is indicative of the fact that stock markets are very volatile and if shocks are not corrected immediately,

investors would lose confidence in the market and this could have dire consequences for the market.

In conclusion, the GSE in the short-run impacts significantly on economic growth and this is consistent with Ihendinihu and Onwuchekwa (2012), Chizea (2012), Hossain *et al.* (2013) and Okodua and Ewetan (2013). This, however, is inconsistent with Men and Li (2006) and Hongbin (2007), who in their individual studies concluded that the stock market has no impact on economic growth in the short-run. The adjusted R^2 of 0.986203 suggests the exogenous variables adequately explain 98 percent of the total variations in economic growth. This is an indication that the model is well fitted.

Evaluation of the Model

The study conducted the following diagnostic tests of the VECM and a summary of the results are presented in table 9. The results show that the VECM passed all the diagnostic test of multivariate normality, heteroskedasticity, Breusch-Godfrey serial correlation LM test, Ramsey RESET test residual and stability test.

Table 9: Results of Model Diagnostic Tests

Test	Statistics	Conclusion
Multivariate Normality	Jarque-Bera =2.868606 (0.238281)	Residuals are normal
Heteroskedasticity: ARCH	F-statistic=0.214161(0.6448) Obs*R-squared=0.219114(0.6397)	Residuals are homoskedastic
Breusch-Godfrey Serial Correlation LM Test	F-statistic=0.336508 (0.7164) Obs*R-squared=1.429174(0.4894)	No Serial Correlation
Ramsey RESET Test	F-statistic=0.003214(0.9551) Log Likelihood Ratio=0.006765 (0.9344)	Equation is stable and correctly specified

Source: Computed by the author using EViews 7.0 econometric software.

Evidence from Causality Analysis

The existence of equilibrium relationship among the variables does not give any indication about the nature and direction of causality between economic growth and the four stock market performance indicators and the other control variables. Granger causality test allows us to test for the actual direction of a relationship between the varaibles without having a prior specification in the model. The pairwise Granger-causality test, test the null hypothesis that the dependent variable does not Granger-cause the independent variable against the alternative hypothesis that the dependent variable Granger-causes the independent variable.

The results of the pairwise Granger-causality test are reported in Table 10 below. The F-ratios and p-values were used to decide on the rejection or otherwise of the null hypothesis.

Table 10: Results of the Pairwise Granger-Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
LSMCAR does not Granger Cause LRGDP	86	2.56269	0.0213**
LRGDP does not Granger Cause LSMCAR		0.61043	0.7453
LSTR does not Granger Cause LRGDP	86	3.42356	0.0374**
LRGDP does not Granger Cause LSTR		2.44747	0.0929*
LTVR does not Granger Cause LRGDP	86	2.17552	0.0476**
LRGDP does not Granger Cause LTVR		0.42522	0.6551

Table 10 continued.

LGSEMI does not Granger Cause LRGDP	86	2.19648	0.0456**
LRGDP does not Granger Cause LGSEMI		1.40479	0.2183
LCPI does not Granger Cause LRGDP	86	4.69299	0.0118**
LRGDP does not Granger Cause LCPI		0.58809	0.5577
LK does not Granger Cause LRGDP	86	4.62668	0.0286**
LRGDP does not Granger Cause LK		3.71631	0.0286**
L does not Granger Cause LRGDP	86	6.65972	0.0021***
LRGDP does not Granger Cause L		12.7256	2.E-05***

Source: Computed by the author using EViews 7.0 econometric software.
Note: ***, ** and * denote rejection of the null hypothesis at one percent, five percent and 10 percent levels of significance respectively and Obs denote the number of observations.

The results from Table 10 show that, stock market capitalization ratio Granger-causes economic growth without feedback. This means that past values of stock market capitalization ratio help to predict current economic growth at five percent significance level. This is a confirmation of the "supply-leading finance hypothesis" of Patrick (1966). The results further support the long-run positive relationship between stock market capitalization ratio and economic growth. This finding is consistent with Osei (2005), who found a unidirectional causality from the stock market to economic growth in Ghana but contradicts Quaidoo (2011), who found a unidirectional causality from economic growth to stock market development.

The reason for Quaidoo's (2011) findings is that in the literature, it is argued that if stock market capitalization ratio is used as the dependent variable, the outcome is always a unidirectional causality from economic growth to stock market development (Hossain *et al.*, 2013). His results may also have been influenced by the fact that market capitalization of his sample period was small (1991 to 2006). From 2007 to date, huge companies with huge capital from the manufacturing, extraction and the banking sectors such as Golden Star Resources Ltd, Tullow Oil Plc, UT Bank Ltd, SIC insurance Company Ltd among others, have listed on the GSE. This together with the pension funds have increased market capitalization greatly and raised the capital base of the market and made it more vibrant, hence our results.

The results also indicate a bi-directional causality between stock market turnover ratio and economic growth at five percent and 10 percent respectively. But the feedback from economic growth to turnover ratio is a weak one. Also, at five percent level of significance, total value traded ratio Granger causes economic growth but economic growth does not Granger cause total value traded ratio at the same level of significance. Thus, it is concluded that there is a unidirectional causality between total value traded ratio and economic growth. That is, past values of total value traded ratio help in predicting current economic growth and this is consistent with the VECM results.

At five percent level of significance, the GSE market index Granger causes economic growth but economic growth does not Granger cause the GSE market index at the same level of significance. Thus, it is concluded that there is a

unidirectional causality between the GSE market index and economic growth. This substantiates the VECM results and is consistent with Olweny and Kimani (2011) and Dziwornu and Awunyo-Victor (2013).

At five percent level of significance, inflation Granger cause economic growth but economic growth does not Granger cause inflation at the same level of significance. Thus, it can be concluded that there is a unidirectional causality between inflation and economic growth and at five percent level of significance, there is a bi-directional causality between capital and economic growth. This means capital Granger causes economic growth and vice versa. Similarly, at one percent level of significance, there is a bi-directional causality between labour and economic growth. That is, labour Granger causes economic growth and vice versa.

Impulse Response Function Analysis

Despite the importance of conducting causality tests, a causality test, by definition, does not determine the strength of the relationships between the variables nor does it describe the relationship between these variables over time. For this reason, the response of economic growth is examined to shocks to the four stock market performance indicators and the control variables. This will allow us to determine the magnitude, direction, and length of time that economic growth is affected by a shock of a variable in the system, holding all other variables constant. The impulse response functions are identified using a

Cholesky decomposition with economic growth ordered first, i.e., it is contemporaneously affected by all other variable shocks in the VAR system.

Generally, the response of economic growth to a transitory shock associated with the four stock market performance indicators and the control variables in the VAR system were as expected and their signs consistent with the VECM results. This response of economic growth to these shocks is shown in Appendix XII. Starting with economic growth, the short-run response of economic growth to its own shock is statistically significant but less persistent. It initially response positively to changes in itself, however, after about two and half years into a shock, its response become negative to its own shocks. By the fifteenth quarter it rises gradually but still negative. This is consistent with the VECM results.

Short-run innovations from stock market capitalization ratio tend to have a positive effect on economic growth. It initially response positively to changes in stock market capitalization ratio, however, after about two years into a shock, it response negatively to shocks in stock market capitalization ratio and then by the fifteenth quarter its response become positive to shocks in stock market capitalization ratio. This is consistent with the VECM results.

With turnover ratio, the initial response of economic growth is negative but becomes positive almost five quarters into the shock and then by the sixth quarter, it response negatively again to shocks in stock market turnover ratio but by the fifteenth quarter, it response positively. This is also consistent with the VECM results.

Again, economic growth initially response negatively to short-run shocks in total value traded ratio but by the end of the tenth quarter, its effect on economic growth is positive and this persists for a while. This also reinforces the VECM results.

A short-run innovation from the GSE market index tends to have a negative effect on economic growth, though marginally positive initially but two years into a shock and its response is positive to shocks in the GSE market index. This is also consistent with the VECM results.

The effect of economic growth to a short-run inflationary shock is almost non-responsive in the first two quarters, it, however, response negatively in the third quarter. By the end of the fourth quarter, its response is positive to changes in inflation. This is also consistent with the VECM results.

Economic growth initially response negatively to short-run shocks in capital but by the end of the thirteenth quarter, its effect on economic growth is positive and then by the 21st quarter, economic growth response negatively to capital. Its effects, however, die off after the thirty first quarter. This is inconsistent with the VECM results and the last but not the least, economic growth initially response positively to short-run shocks in labour but between the fifth quarter and the tenth quarter, its effect on economic growth taper off but is still positive. This effect persists for a while. This also reinforces the VECM results.

Forecast Error Variance Decompositions (FEVDs)

In this study, the FEVDs determine the percentage of variation in the forecast error of economic growth that is due to its own shocks versus shocks by the other four stock market performance variables and the control variables in the system. The FEVDs for economic growth over a ten year period using the same identification restrictions (ordering of the variables) that were used for the IRF analysis is reported in Appendix XIII. This kind of ordering of the variables is necessary as the FEVD is sensitive to the order of the variables in the system. In this study, the variables were ordered just as the long-run equation is specified in equation (33)

In the first quarter as expected, there is no contribution of other variables in the system to the variance of the forecast error of economic growth. The results show that shocks in economic growth are the main drives of economic growth for the sample period under study.

The results indicate that in the immediate period (at the end of the first quarter), changes in economic growth are due mainly to its own variations. However, by the end of the 20th quarter, specifically at the end of the fifth year into a shock, variations in economic growth are mostly accounted for by 41.3 percent of variation in itself, 4.9 percent of variation in stock market capitalization ratio, 3.4 percent of variation in stock market turnover ratio and 1.9 percent of variation in total value traded ratio. Whilst the GSE market index, inflation, capital and labour accounted for 16.5 percent, 3.7 percent, 26.5 percent and 1.8 percent of variation in economic growth respectively.

Ten years ahead or forty quarters into a shock, the strongest influence on economic growth variation among the stock market performance indicators is the GSE market index (16.2%), followed by stock market capitalization ratio (7.2%), then stock market turnover ratio (3.4%) and the total value traded ratio (3.2%). The rest being the control variables contributed 6.2 percent, 23.0 percent and 2.7 percent for inflation, capital and labour respectively to the variations in economic growth.

Thus, the GSE market index and stock market capitalization ratio are the most important determinants of economic growth in the short-run followed by stock market turnover ratio and the total value traded ratio. The Ghana Stock Exchange no doubt has impacted positively on economic growth during the sample period, how be it, its size, liquidity and a host of other factors such as its efficiency are important if it is to champion economic growth in the country.

Summary and Conclusion

This chapter examined the time series characteristics of the data used for estimation and discussed the estimated results. Stationarity tests were conducted on all the variables in their log-levels and log-differenced forms to determine the order of integration using ADF and PP tests. The results showed that all the series were integrated of order one, i.e. $I(1)$.

The long-run equilibrium was established within the Johansen cointegration test. The results indicated the existence of cointegration amongst the variables in the system. All the variables had their expected signs and the

coefficients revealed that stock market capitalization ratio, stock market turnover ratio and the GSE market index are all statistically significant in determining economic growth in the long-run. However, total value traded ratio was insignificant in determining economic growth in the long-run.

The error correction model based on the VECM approach captured the short-run dynamics and the results showed that, changes in the past values of economic growth, stock market capitalization ratio, stock market turnover ratio, total value traded ratio, GSE market index and the other variables are statistically significant in explaining current economic growth in the short-run. The error correction term was found to be negative and statistically significant at one percent. Its coefficient suggests that the adjustment process is quick with about 78 percent of the previous quarter's disequilibrium corrected in the current quarter.

The results of the Granger-causality showed evidence of a unidirectional causality from stock market capitalization ratio, the GSE market index and total value traded ratio to economic growth but a bi-directional causality between stock market turnover ratio and economic growth. Thus, in general there is a unidirectional causality between stock market performance and economic growth in Ghana. The results of the IRFs substantiated the VECM results and the FEVDs results show that, the GSE market index and stock market capitalization ratio are the most important determinants of economic growth in the short-run followed by stock market turnover ratio and the total value traded ratio. The model estimated passed all the tests conducted including the CUSUM and CUSUM of squares test of stability which are presented in Appendix XIV.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter provides the summary, conclusion and the main findings of the study. It also highlights the main contributions of this thesis, presents some policy implications and proffers some recommendations on ways to improve the contributions of the stock market to economic growth. It then finishes by presenting the limitations of the study and proffers suggestions for further research into the stock market and economic growth relationship.

Summary

The purpose of the study is to examine the relationship between stock market performance and economic growth in Ghana using quarterly time series data from 1991:1 to 2012:4. The study employed the Johansen and Juselius (1990) multivariate cointegration technique and VECM to examine the long-run equilibrium and short-run dynamics among the variables.

We examined the causal relationships amongst the variables using the traditional pairwise Granger-causality test. We also examined how economic growth response to shocks from each variable in the system and the relative importance of each variable in explaining economic growth using impulse response functions (IRFs) and forecast error variance decompositions (FEVDs) respectively.

All tests and estimations were conducted using EViews version 7.0 econometric package.

The review of the Ghanaian economy revealed that the historical structure of the Ghanaian economy showed hardly any change, though the dominance of the agriculture sector's contributions to GDP has dwindled over years given way to the service sector. The review of the GSE shows that in general it has performed remarkably well amongst emerging markets chalking numerous successes in 1994, 1998, 2003 and the first half 2013 respectively, making it one of the best performing markets in Africa in particular and the world as a whole.

The empirics generally document four views with regard to the causal relationship between stock market performance and economic growth; supply leading finance hypothesis, demand following finance hypothesis, mutual impact of finance and growth and those that suggest that the market's performance and economic growth are uncorrelated. Generally, however, the empirical literature review showed that market performance and economic growth are positively correlated, though a few studies have reported a negative relationship between the variables.

To allow for robustness, the study utilized four measures of stock market performance, stock market capitalization ratio (SMCAR), stock market turnover (STR), total value traded ratio (TVR) and GSE market index (GSEMI) together with three control variables; consumer price index (CPI), capital (K) and labour (L). The estimated results showed that there is long-run relationship amongst the variables. This is consistent with Quaidoo (2011), Ashante *et al.* (2011) and

Ihendinihu and Onwuchekwa (2012) but contradicts Osamwonyi and Kasimu (2013) who concluded that there is no long-run relationship amongst the variables.

All the four measures of stock market performance used in this study point to the existence of a positive and significant relationship between stock market performance and economic growth except total value traded ratio which was positive but insignificant in explaining long-run economic growth. The control variables also yielded their expected *a prior* signs.

The results of the VECM showed that all the variables were significant in explaining economic growth in the short-run, except that changes in some quarters had positive impact on short-run economic growth whilst others had a negative impact.

The findings from the Granger causality tests suggest a unidirectional causality from stock market capitalization ratio, total value traded ratio and the GSE market index to economic growth but a bi-directional causality between stock market turnover ratio and economic growth. With the control variables, the findings show a unidirectional causality from inflation to economic growth but a bi-directional causality between capital and economic growth and labour and economic growth. The Granger causality test in general confirms Patrick's (1966) supply leading finance hypothesis.

The IRFs results were consistent with the findings of the VECM whilst the FEVD results suggested that the GSE market index and stock market capitalization ratio are the most important determinants of economic growth

amongst the four stock market performance indicators in the short-run. This is then followed by turnover ratio and total value traded ratio. The FEVD conclusion was consistent in general with the IRFs analysis and the VECM.

Conclusions

Based on the results of the study, the following conclusions were reached. The empirical evidence showed that there is a positive relationship between the four stock market performance indicators and economic growth although total value traded ratio is insignificant in the long-run. It is, thus, concluded that there is a positive relationship between stock market performance and economic growth in Ghana.

The Granger causality results reinforce the positive link between stock market performance and economic growth in Ghana. The results substantiate the supply leading finance hypothesis if stock market capitalization ratio, total value traded ratio and the GSE market index are used as proxies for stock market performance but both the supply leading and demand following finance hypotheses is palpable if turnover ratio is used as a proxy for stock market performance, although the causality from economic growth to turnover ratio is weak. This suggests that stock market performance in general drives economic growth in Ghana. This conforms to the findings of Osei (2005), Asante *et al.* (2011) but not Quaidoo (2011) who found the reverse.

The IRFs and the FEVD results also reinforce the positive link between stock market performance and economic growth in Ghana. Thus, it can be

concluded that in Ghana, although, the Ghana Stock Exchange is relatively young, its impact on economic growth is positive and statistically significant and that the direction of the causality is from the stock market to economic growth in general, although a bi-directional causality between turnover ratio and economic growth is evident.

Recommendations

Based on the findings of the study, the following recommendations are made to improve the activities of the Ghana Stock Exchange. The study revealed a positive relationship between stock market performance and economic growth which is an indication that the Ghana Stock Exchange plays an important role in driving economic growth in Ghana. In respect of this, the government should initiate favourable policies to foster stock market performance in order to strengthen and enlarge the role of the stock market in mobilizing and allocating capital to productive investments in the economy.

Stock market capitalization ratio and economic growth have a positive relationship, thus, policies to enhance the supply of securities should be encouraged. This could be tax incentives to companies to list on the GSE. This would increase both the quality and quantity of the securities available on the market, consequently improving the liquidity and capitalization of the market which would ensure accelerated economic growth.

Also, stock market turnover ratio and the GSE market index have a positive relationship with economic growth, thus, policies that support the

demand of securities should be pursued. This could include using the stock market as a source of finance for projects and programmes by all levels of governments. This will increase the demand for securities and the ability of the stock market to generate capital, hence, increasing the depth and liquidity of the market. The increased volume of transactions will ensure accelerated economic growth. In conclusion, in order to ensure sustained economic growth in Ghana, the government should pursue the above recommendations.

Main Contributions of the Study

This thesis makes a contribution by providing time series evidence for Ghana on the stock market-economic growth relationship, using a multivariate VAR approach, as opposed to the bivariate VAR model approach used by Osei (2005) and in most of the studies on developing countries. Only Quaidoo (2011) utilized the multivariate VAR approach but not with a higher dimension system like this thesis. This study departs from his study and other studies by using a higher dimension system of eight variables. Previous studies on Ghana have used less than three different stock market performance variables.

This study improves on all the works done in Ghana by looking at a single country and using four stock market measures instead of the two used by Osei (2005) and Quaidoo (2011). The approach in this thesis is unique in the study of the stock market performance and economic growth relationship in Ghana.

This study also addresses the stock and flow variable problems by utilizing the technique proposed by Beck and Levine (2004) to deflate the

variables where necessary to avoid bias in the results. Another contribution of this thesis is its use of the IRFs and the FEVD to examine the impact of shocks and the relative importance of each of the four stock market performance variables in explaining economic growth. This is unique compared to previous studies.

Limitations of the Study

The main limitation of this study which is typical of time series studies in developing countries had to do with the quality and limited availability of quarterly data on key variables used in the study such as real GDP, and the four stock market performance indicators. This necessitated the interpolation of the series into quarterly data which is methodologically problematic. This however, did not pose any danger to the reliability of the results because other authors such as Osei (2005) and Quaidoo (2011) employed similar approaches and arrived at reliable results.

Direction for Future Research

Future research should examine the impact of the Ghana Stock Exchange on individual firms and how these firms impact economic growth in Ghana. Firm level (microeconomic) analysis of the relationship between stock market performance and economic growth will be desirable to supplement the findings of this research.

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APPENDICES

APPENDIX I

Sectoral Contribution to Real GDP-Period Averages (in %)

	1965	1966-1970	1971-1975	1976-1980	1981-1985	1986-1990	1991-1995	1996-2000	2001-2006
Agriculture	43.5	43.5	47.7	57.1	52.9	48.4	40.8	36.7	36.2*
Industry	18.6	19.3	18.7	14.2	9.9	16.7	21.7	25.1	24.9*
Services	37.9	37.2	37.9	28.7	37.3	34.9	37.5	38.2	29.8*
Total	100	100	100	100	100	100	100	100	90.9*

Source: Adapted from Fosu and Aryeetey, 2008; ISSER, 2007.
*Excludes indirect taxes.

APPENDIX II

Distribution of GDP (at Basis Prices) by Economic Activity

	2006	2007	2008	2009	2010	2011*	2012**
AGRICULTURE	**30.4**	**29.1**	**31.0**	**31.8**	**29.8**	**25.3**	**22.7**
1. Crops	21.3	20.3	22.4	23.6	21.7	19.1	16.9
o.w. Cocoa	3.0	2.7	2.5	2.5	3.2	3.6	3.0
2. Livestock	2.5	2.3	2.1	2.0	2.0	1.8	1.7
3. Forestry & Logging	4.1	4.2	3.7	3.7	3.7	2.8	2.5
4. Fishing	2.5	2.3	2.7	2.5	2.3	1.7	1.6
INDUSTRY	**20.8**	**20.7**	**20.4**	**19.0**	**19.1**	**25.6**	**27.3**
1. Mining & Quarrying	2.8	2.8	2.4	2.1	2.3	8.4	8.8
o.w. Crude Oil	-	-	0.0	0.0	0.4	6.7	6.8
2. Manufacturing	10.2	9.1	7.9	6.9	6.8	6.9	6.9
3. Electricity	0.8	0.6	0.5	0.5	0.6	0.5	0.5

	2006	2007	2008	2009	2010	2011*	2012**
4. Water & Sewerage	1.3	1.0	0.8	0.7	0.8	0.8	0.7
5. Construction	5.7	7.2	8.7	8.8	8.5	8.9	10.5
SERVICES	**48.8**	**50.2**	**48.6**	**49.2**	**51.1**	**49.1**	**50.0**
1. Trade; Repair of Vehicles, Household Goods	6.4	6.1	6.0	5.9	6.2	5.9	5.4
2. Hostels & Restaurants	5.0	5.6	6.0	6.2	6.0	5.4	5.3
3. Transport & Storage	13.2	13.1	11.4	10.5	10.6	10.7	11.3
4. Information & Communication	2.7	2.4	2.2	1.8	1.9	1.8	1.8
5. Financial & Intermediation	2.7	3.4	3.8	4.3	5.2	4.4	5.0
6. Business, Real estate and others services	5.1	4.7	4.1	4.1	4.5	4.6	4.8
7. Public Administration & Defence; Social Security	4.8	5.9	6.3	7.0	7.0	7.0	7.2
8. Education	3.7	3.9	3.9	4.2	4.3	4.1	4.0
9. Health & Social Work	1.4	1.4	1.3	1.4	1.6	1.3	1.3

	2006	2007	2008	2009	2010	2011*	2012**
10. Community, Social & Personal Service Activity	3.7	3.7	3.6	3.7	4.0	3.9	3.7
GDP at basic prices	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Ghana Statistical Service-Revised & Provisional GDP for 2010 and 2013 bulletins respectively
* *2011 finalized* and
** *2012 revised*

APPENDIX III

The GSE Market Index Summary from 1991 to 2012

Year	High	Date	Low	Date	Index	% Change
1991	69.77	Jan-04	55.49	May-17	64.51	-7.95
1992	72.90	Oct-06	60.15	Jun-23	62.17	-3.63
1993	132.88	Dec-30	63.29	Jan-05	132.88	113.74
1994	334.02	May-17	132.91	Jan-04	298.10	124.34
1995	322.11	Oct-25	296.32	Mar-22	316.97	6.33
1996	385.80	Sept-13	307.42	Jan--12	360.76	13.82
1997	524.21	Dec-08	346.66	Jan-31	511.74	41.85
1998	1,201.08	May-06	511.66	Jan-07	868.35	69.69
1999	903.17	Feb-05	735.39	Dec-22	736.16	-15.22
2000	873.35	Sept-22	737.16	Jan-03	857.98	16.55
2001	1,025.78	Aug-01	856.00	Feb-07	955.95	11.42
2002	1,395.31	Dec-30	955.95	Jan-02	1,395.31	45.96
2003	3,553.42	Dec-31	1,395.36	Jan-02	3,553.42	154.67
2004	7,469.04	Aug-25	3,558.96	Jan-02	6,798.59	91.33
2005	6,901.36	Jan-28	4,751.17	Dec-22	4,769.02	-29.85
2006	5,006.02	Dec-29	4,692.84	Jan-31	5,006.02	4.97
2007	6,599.77	Dec-31	5,001.15	Jan-11	6,599.77	31.84
2008	10,931.36	Oct-03	6,595.92	Jan-02	10,431.64	58.06
2009	10,431.64	Jan-02	5,098.92	Aug-17	5,572.34	-46.58
2010	7,185.05	Jan-01	5,463.83	Jan-14	6,886.31	32.25

Year	High	Date	Low	Date	Index	% Change
2011	1,189.77	May-17	940.04	Dec-16	969.03	-3.10
2012	1,199.72	Dec-31	968.08	Jan-05	1,199.72	23.81

Source: GSE market report- August 2013

APPENDIX IV

Market Activities-Market's Performance Indicators from 1991 to 2012

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Year	Volume Traded (m)	Value Traded (VT) (GH¢ m)	Market Cap. (MC) (GH¢ m)	GDP (GH¢ m)	MC/ GDP (3÷4) (%)	VT/ MC (2÷3) (%)	VT/ GDP (2÷4) (%)
1991	1.83	0.01	2.96	242.75	1.22	0.34	0.004
1992	2.04	0.02	4.38	280.29	1.56	0.46	0.007
1993	37.95	0.32	9.65	387.21	2.49	3.32	0.082
1994	93.04	7.31	196.84	520.50	37.82	3.71	1.404
1995	55.84	2.71	239.9	775.17	30.95	1.13	0.349
1996	35.75	2.79	286.27	1,133.87	25.25	0.97	0.262
1997	127.63	9.34	255.28	1,411.34	18.09	3.66	0.661
1998	91.45	13.40	324.56	1,729.60	18.77	4.13	0.775
1999	49.57	6.96	320.54	2,057.98	15.58	2.17	0.338
2000	30.72	5.06	365.50	2,715.25	13.46	1.39	0.186
2001	55.30	9.23	390.40	3,807.07	10.25	2.36	0.242
2002	44.12	8.94	618.38	4,886.20	12.65	1.45	0.183
2003	96.33	38.93	1,261.68	6,615.77	19.07	3.09	0.588
2004	104.35	65.59	9,761.48	7,988.79	122.19	0.67	0.821
2005	81.40	46.44	9,185.73	9,726.08	94.44	0.51	0.477
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**

Year	Volume Traded (m)	Value Traded (VT) (GH¢ m)	Market Cap. (MC) (GH¢ m)	GDP (GH¢ m)	MC/ GDP (3÷4) (%)	VT/ MC (2÷3) (%)	VT/ GDP (2÷4) (%)
2006	98.29	47.60	11,249.60	18,705.00	60.14	0.42	0.254
2007	287.22	140.71	12,368.60	23,154.50	53.41	1.14	0.608
2008	531.67	365.51	17,895.12	30,178.60	59.30	2.04	1.211
2009	96.77	74.19	15,941.92	36,598.60	43.56	0.47	0.203
2010	330.62	151.29	20,116.70	46,042.10	43.69	0.75	0.329
2011	419.80	446.56	47,347.23	59,816.30	79.15	0.94	0.747
2012	218.13	102.20	57,264.22	73,109.10	78.33	0.18	0.140

Source: GSE market report- August 2013, World Development Indicators and the author's own computations.

APPENDIX V

Primary Capital Issues (Capital Raised)

YEAR	EQUITY (GH¢ MILLION)	CORPORATE BOND (IN MILLIONS)
1991	-	-
1992	0.21	-
1993	-	-
1994	6.31	-
1995	2.61	-
1996	4.24	US$ 2.55
1997	0.20	US$ 2.25
1998	1.56	US$ 2.00
1999	0.29	US$ 2.70
2000	7.93	US$ 1.51
2001	-	£ 1.20*
2002	13.66	US$ 3.03
2003	11.60	-
2004	24.46	US$ 2.5
2005	0.55	-
2006	15.05	-
2007	55.79	US$ 3.9
2008	33.22	GH¢ 35*
2009	160.91	-

YEAR	EQUITY (GH¢ MILLION)	CORPORATE BOND (IN MILLIONS)
2010	20.15	-
2011	179.48	-
2012	286.79	-
TOTAL	**825.01**	**US$ 20.44**

Source: GSE market report- August 2013

APPENDIX VI

THE FORMULAS FOR DEFLATING SMCAR AND STR

1. The formula used in deflating stock market capitalization ratio is as follows:

$$SMCAR_t = \frac{0.5 * \left[\left(\frac{MC_t}{CPI_{e,t}} \right) + \left(\frac{MC_{t-1}}{CPI_{e,t-1}} \right) \right]}{\frac{GDP_t}{CPI_{a,t}}}$$

Where $SMCAR_t$ is stock market capitalization ratio at time *t*, MC_t is market capitalization at time *t*, MC_{t-1} is market capitalization lagged one period, $CPI_{e,t}$ is end of period (December) CPI, $CPI_{e,t-1}$ is end of period CPI lagged one period, GDP_t is GDP at time *t* and $CPI_{a,t}$ is average annual *CPI* at period *t.*

2. The formula used in deflating stock market turnover ratio is as follows:

$$STR_t = \frac{\frac{VT_t}{CPI_{a,t}}}{0.5 * \left[\left(\frac{MC_t}{CPI_t} \right) + \left(\frac{MC_{t-1}}{CPI_{t-1}} \right) \right]}$$

Where VT_t is the value of total shares traded on the GSE at time *t*, MC_t is market capitalization of the GSE at time *t*, MC_{t-1} is market capitalization of the GSE lagged one period, $CPI_{e,t}$ is end of period (December) *CPI*, $CPI_{e,t-1}$ is end of period CPI lagged one period and $CPI_{a,t}$ is average annual CPI at time *t.*

APPENDIX VII

Plot of Variables at Levels

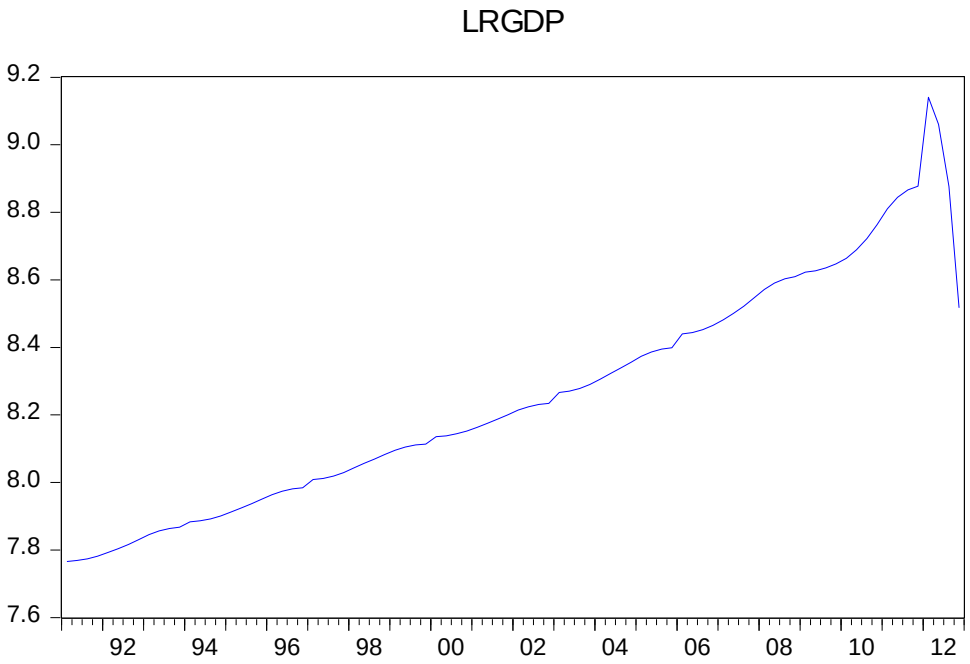


Figure 1: Plot of Log of RGDP

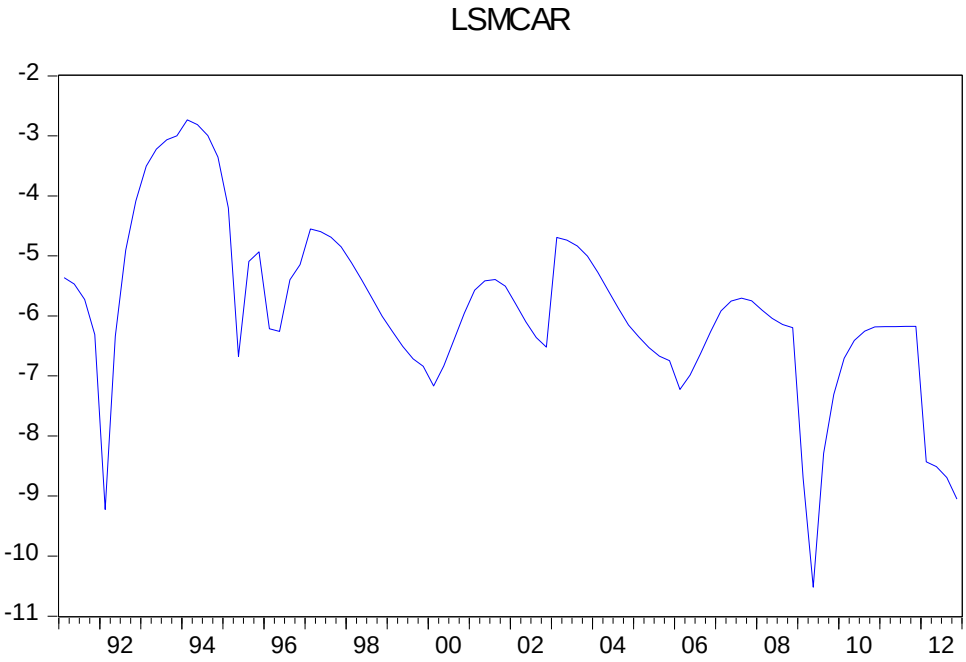


Figure 2: Plot of Log of SMCAR

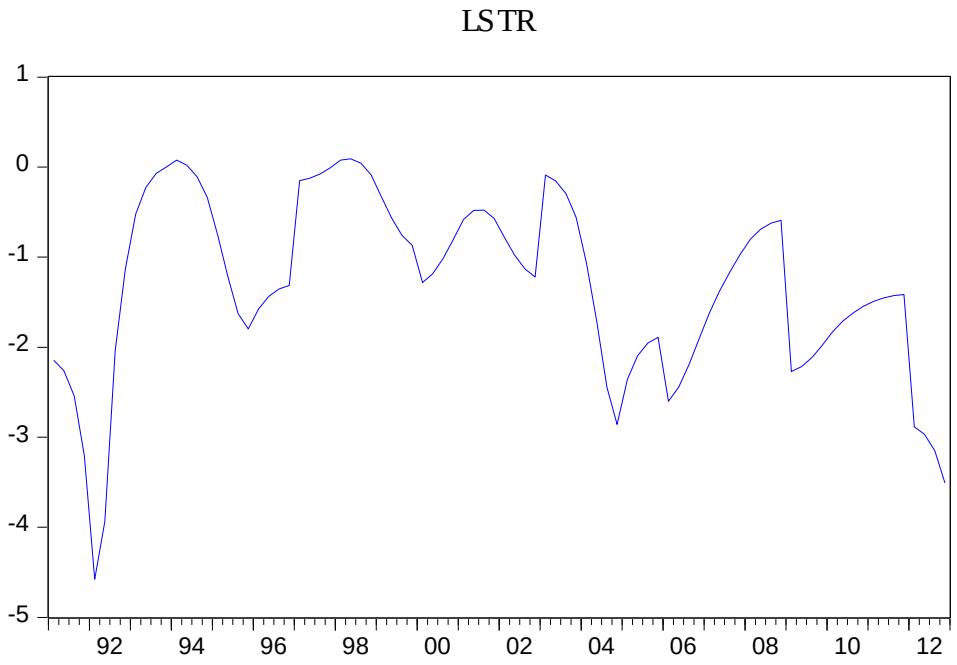


Figure 3: Plot of Log of STR

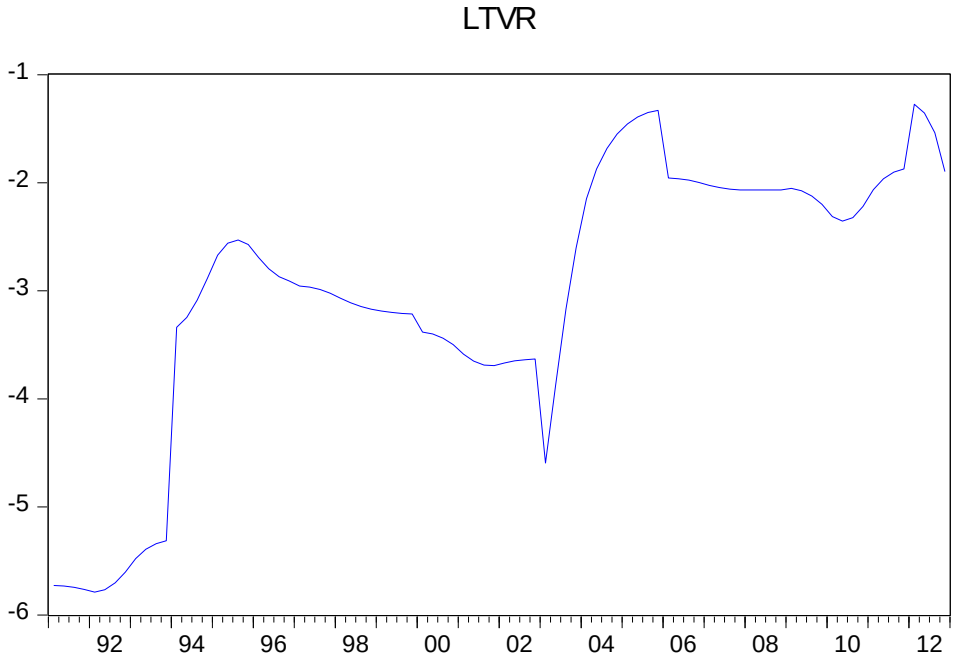


Figure 4: Plot of Log of TVR

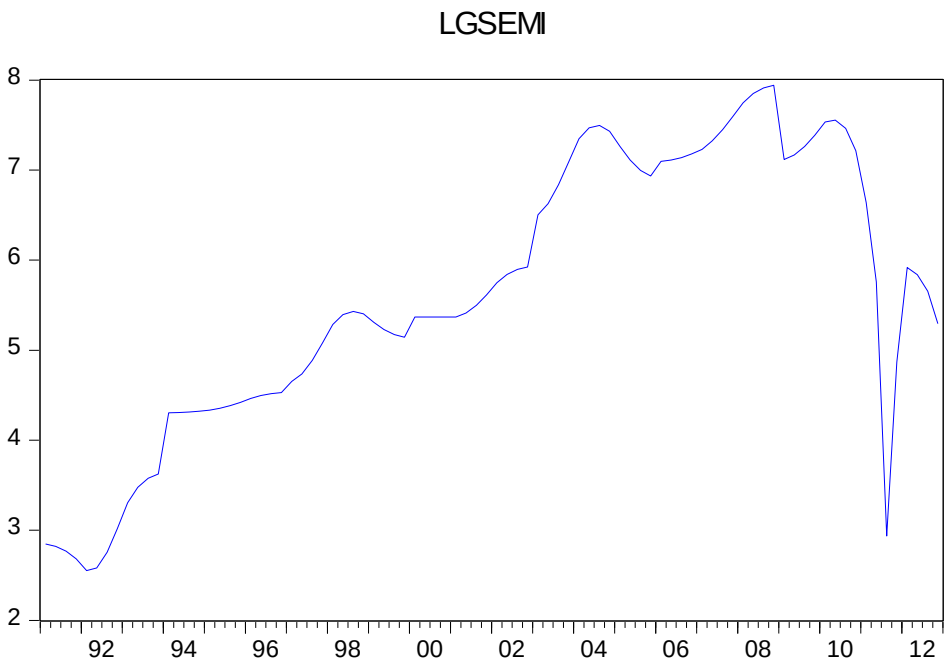


Figure 5: Plot of Log of GSEMI

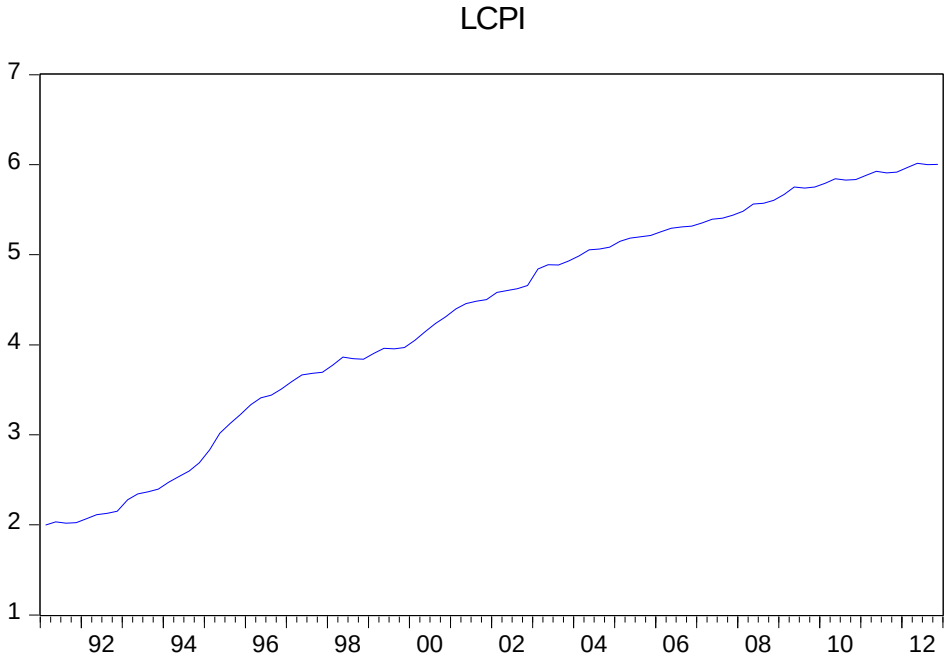


Figure 6: Plot of Log of CPI

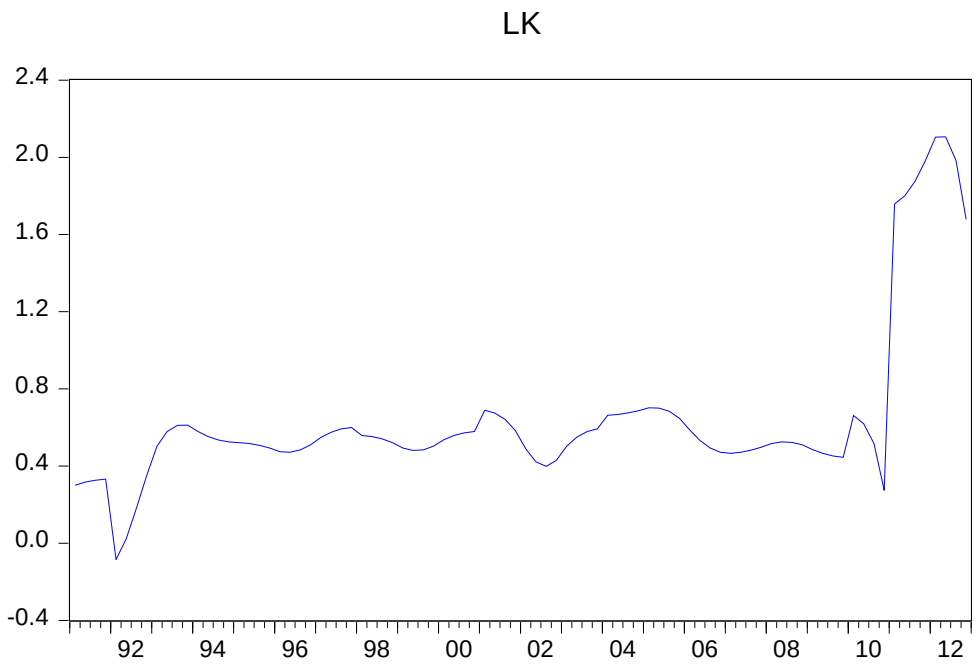


Figure 7: Plot of Log of LK

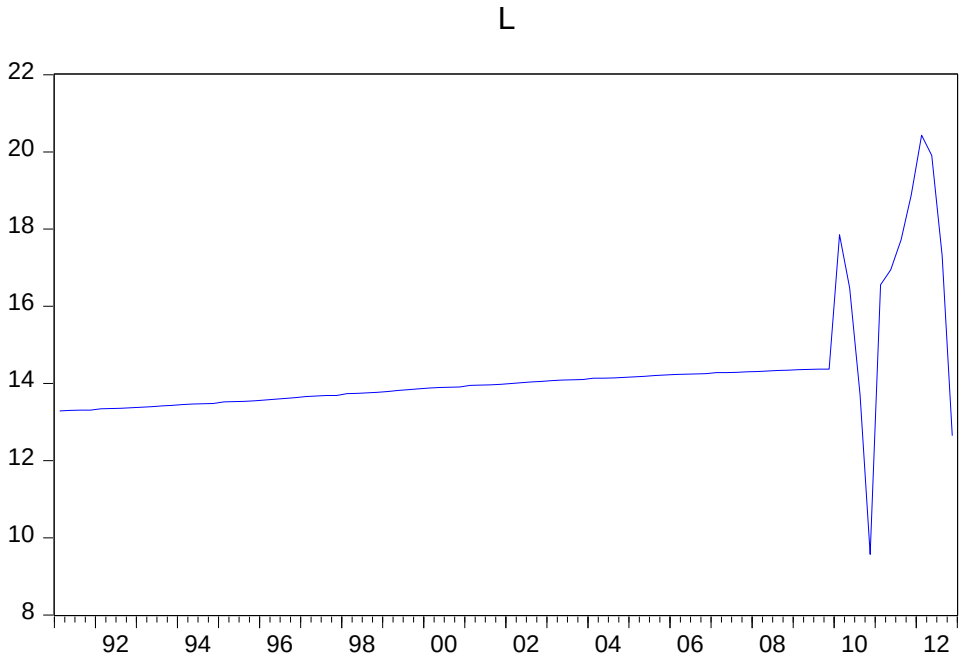


Figure 8: Plot of L

APPENDIX VIII

Plot of Variables after First Difference

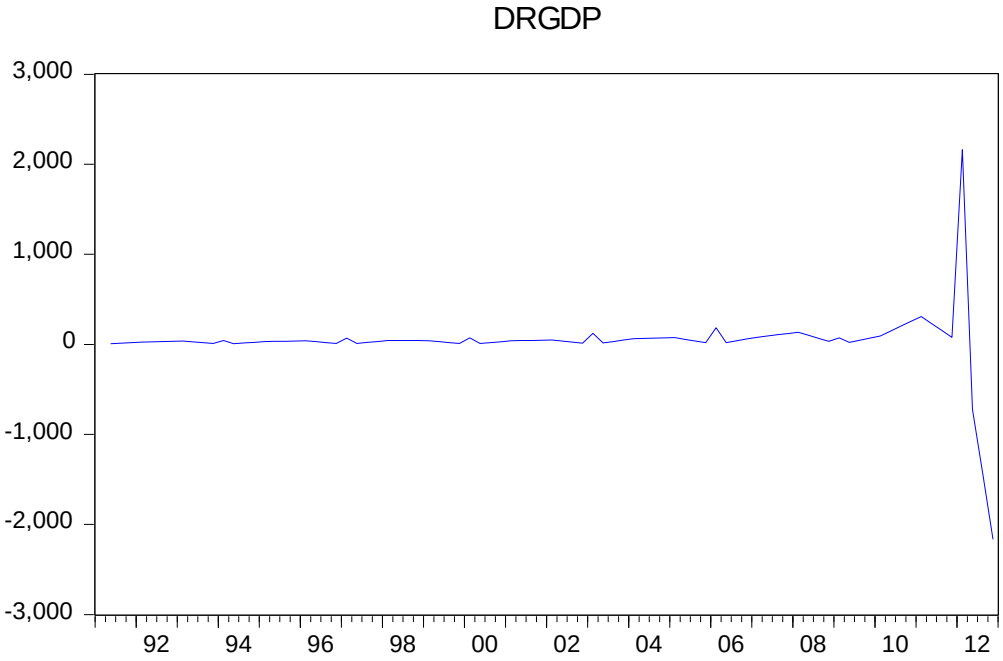


Figure 9: Plot of DRGDP

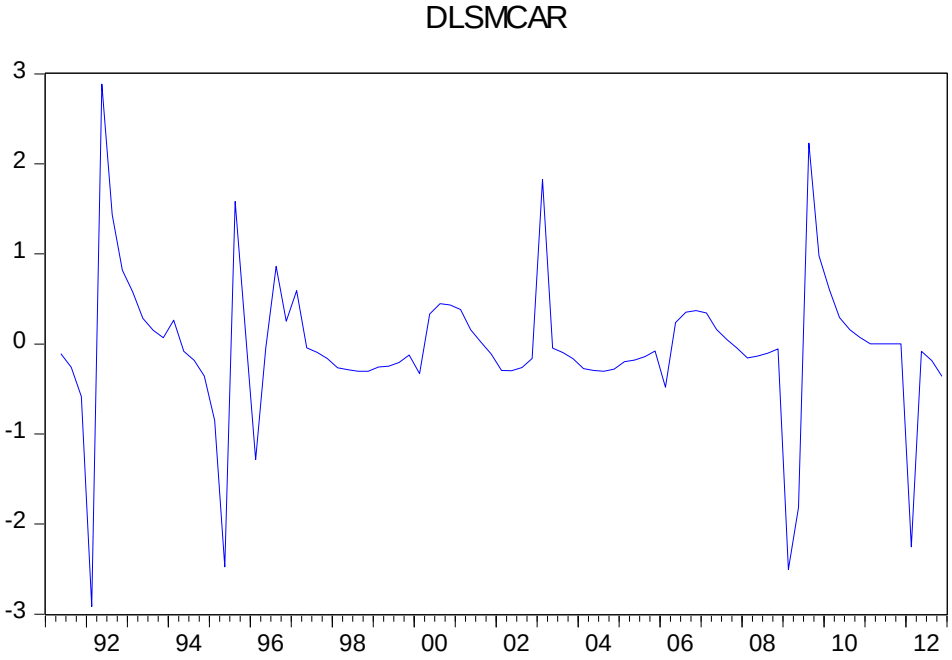


Figure 10: Plot of DSMCAR

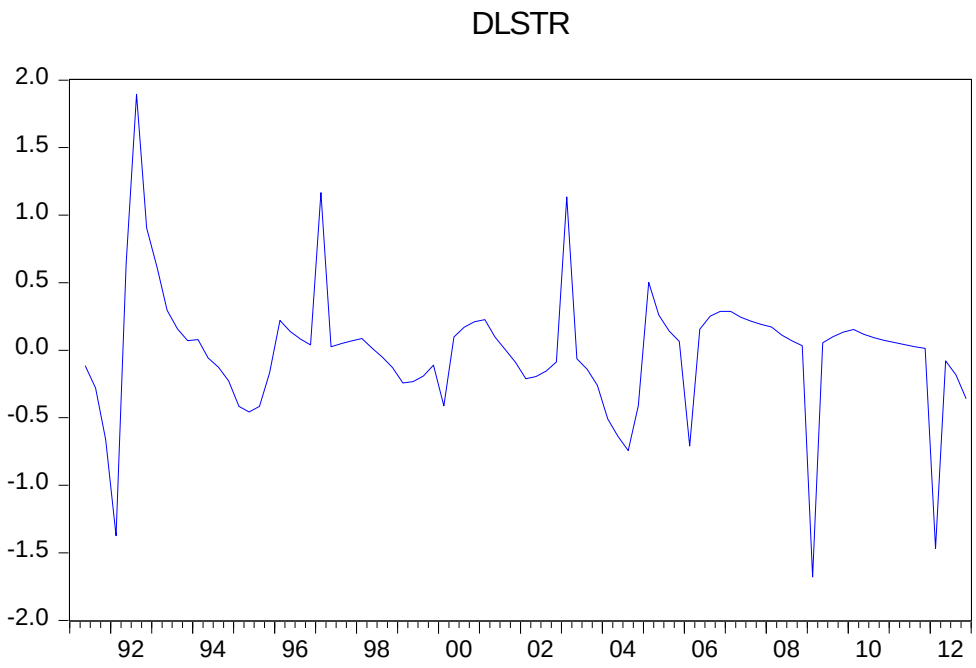


Figure 11: Plot of DSTR

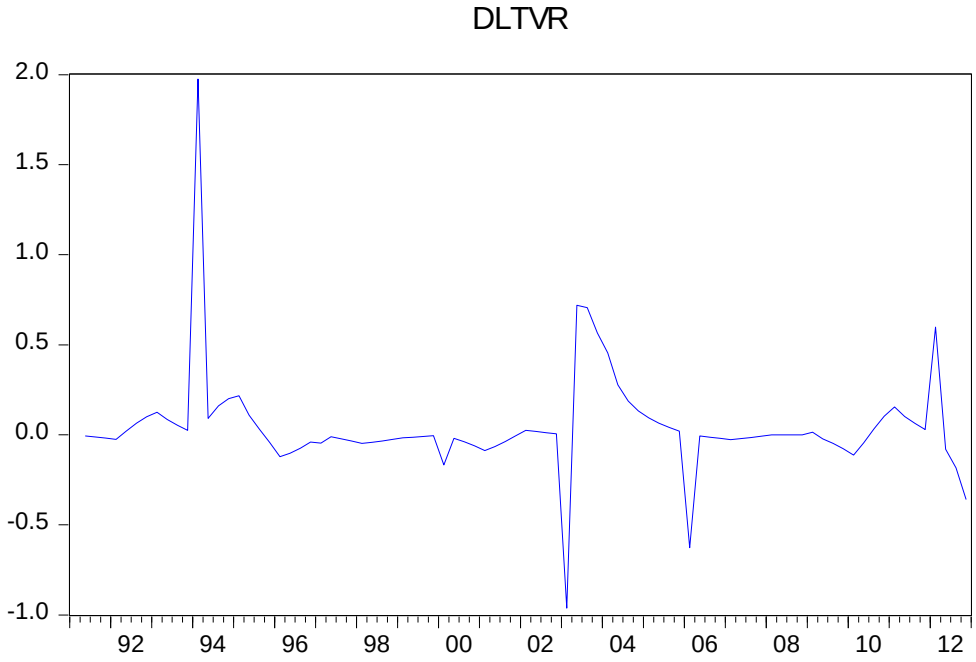


Figure 12: Plot of DTVR

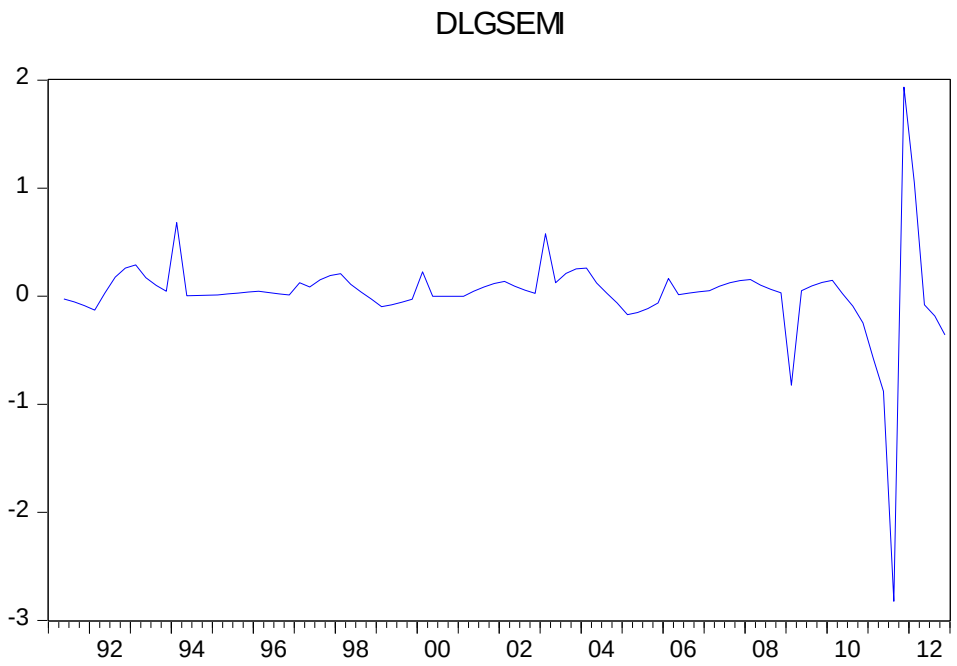


Figure 13: Plot of DGSEMI

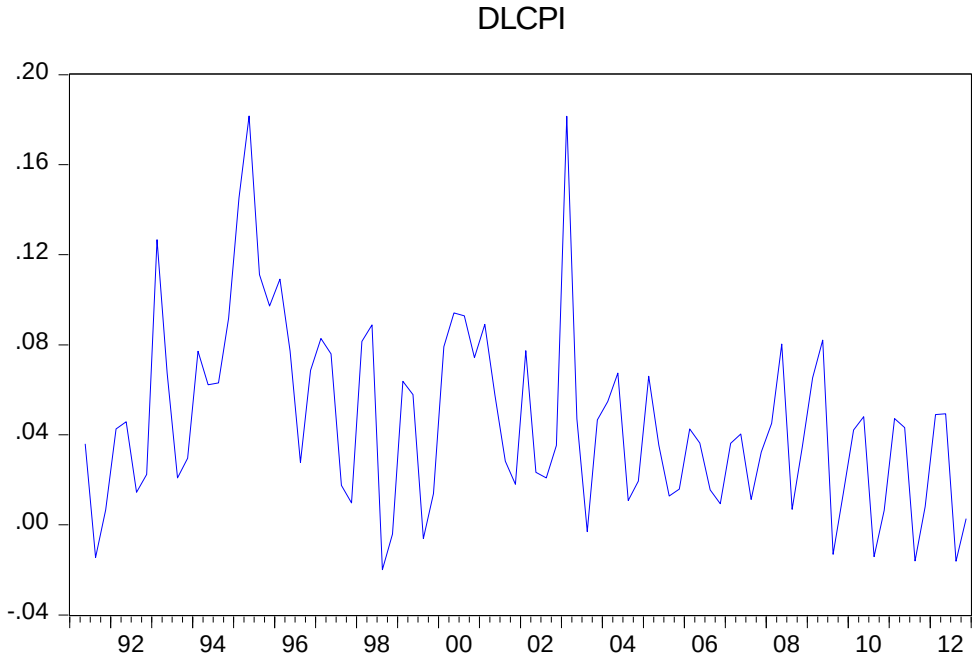


Figure 14: Plot of DCPI

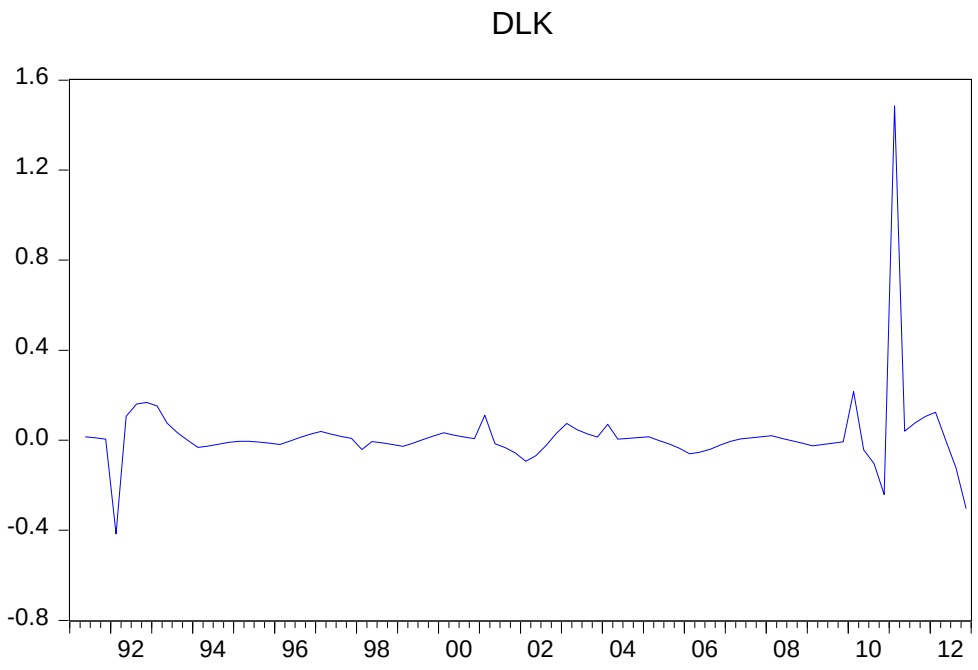


Figure 15: Plot of DLK

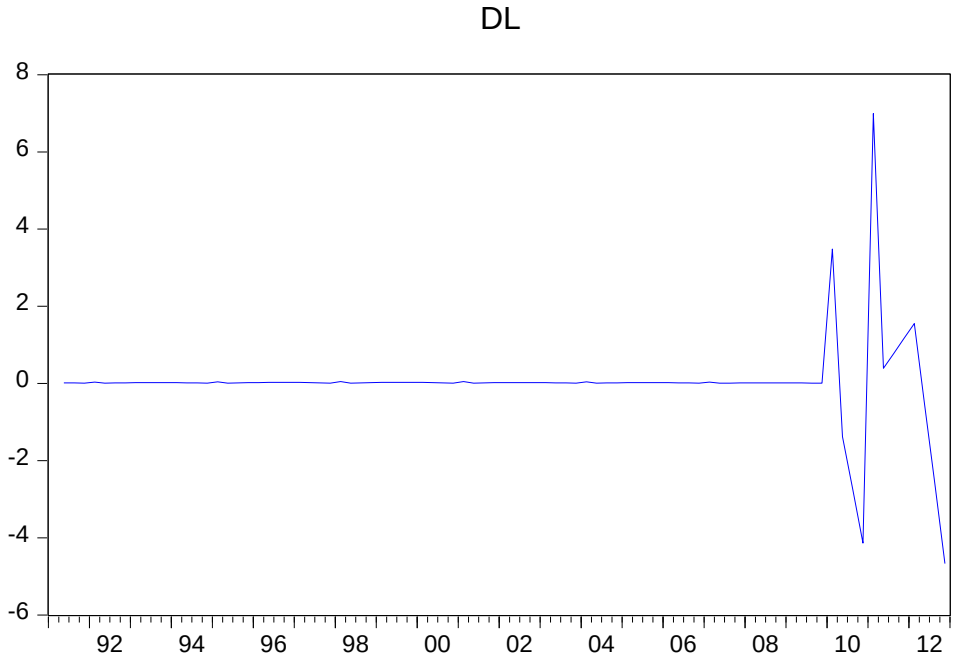


Figure 16: Plot of DL

APPENDIX IX

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

LRGDP	LSMCAR	LSTR	LTVR	LGSEMI	LCPI	LK	L
24.90332	2.269136	-0.958871	0.024547	7.997058	-8.909846	-21.81411	49.58772
-6.163599	-7.751230	1.335803	6.430560	-15.52424	7.394763	-19.51839	49.91451
-85.58174	1.746902	-1.787980	2.333042	-9.719516	-36.06983	66.21744	-66.03197
-443.0895	3.069273	3.388427	8.178308	-20.57821	-36.47808	-12.04359	-32.86579
-305.1269	8.837577	-2.230290	9.064528	-25.57219	-17.68461	-31.14734	-54.17463
-36.89495	-5.285741	-2.337907	-1.309486	4.839444	-10.90315	18.33305	11.64357
-127.7232	-6.228854	3.914891	1.433513	-0.146561	-22.47322	3.091555	-1.656967
-27.15207	-2.287180	1.271657	3.815320	-2.640133	-2.024596	-1.251711	-0.416033

Source: Computed by the author using EViews 7.0 econometric software

APPENDIX X

1 Cointegrating Equation(s): Log likelihood 1010.915

Normalized cointegrating coefficients (standard error in parentheses)

LRGDP	LSMCAR	LSTR	LTVR	LGSEMI	LCPI	LK	L
1.000000	0.091118	0.038504	0.000986	0.321124	-0.357777	0.875952	1.991209
	(0.02955)	(0.01409)	(0.01708)	(0.04619)	(0.07568)	(0.16915)	(0.22493)

Source: Computed by the author using EViews 7.0 econometric software

APPENDIX XI

General VEC Model for Economic Growth

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECT(-1)	-1.000000	0.193694	-5.162793	0.0000
D(LRGDP(-1))	-0.405602	0.208439	-1.945907	0.0646
D(LRGDP(-2))	0.063833	0.241130	0.264724	0.7937
D(LRGDP(-3))	0.350578	0.222182	1.577888	0.1289
D(LRGDP(-4))	-0.507575	0.254652	-1.993214	0.0588
D(LRGDP(-5))	0.574507	0.290421	1.978188	0.0606
D(LRGDP(-6))	-1.002706	0.360251	-2.783351	0.0108
D(LRGDP(-7))	-0.232023	0.304058	-0.763089	0.4535
D(LSMCAR(-1))	0.008624	0.005073	-1.700047	0.1032
D(LSMCAR(-2))	-0.011662	0.004195	-2.780209	0.0109
D(LSMCAR(-3))	-0.005321	0.003476	-1.530767	0.1401
D(LSMCAR(-4))	-0.003126	0.003256	-0.960075	0.3475
D(LSMCAR(-5))	-0.001057	0.003177	-0.332737	0.7425
D(LSMCAR(-6))	0.002195	0.003235	0.678337	0.5046
D(LSMCAR(-7))	0.001693	0.003073	0.550966	0.5872
D(LSTR(-1))	-0.004004	0.005844	-0.685096	0.5004
D(LSTR(-2))	-0.001995	0.005723	-0.348581	0.7307
D(LSTR(-3))	-0.002417	0.005201	-0.464713	0.6467
D(LSTR(-4))	-0.000809	0.004870	-0.166193	0.8695
D(LSTR(-5))	0.006091	0.004862	1.252682	0.2235

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LSTR(-6))	-0.012089	0.005021	-2.407829	0.0249
D(LSTR(-7))	-0.003870	0.004312	-0.897488	0.3792
D(LTVR(-1))	-0.013424	0.006429	-2.088132	0.0486
D(LTVR(-2))	-0.015044	0.007258	-2.072899	0.0501
D(LTVR(-3))	-0.020511	0.006551	-3.130923	0.0049
D(LTVR(-4))	0.016432	0.005832	2.817621	0.0100
D(LTVR(-5))	0.012375	0.010417	1.188025	0.2475
D(LTVR(-6))	0.007292	0.010885	0.669952	0.5099
D(LTVR(-7))	-0.001738	0.007138	-0.243462	0.8099
D(LGSEMI(-1))	-0.020575	0.009459	-2.175091	0.0407
D(LGSEMI(-2))	0.018963	0.012837	1.477188	0.1538
D(LGSEMI(-3))	-0.014636	0.015342	-0.953947	0.3505
D(LGSEMI(-4))	-0.024323	0.013306	-1.827908	0.0812
D(LGSEMI(-5))	-0.015387	0.023545	-0.653542	0.5202
D(LGSEMI(-6))	0.045915	0.026939	1.704390	0.1024
D(LGSEMI(-7))	-0.024622	0.021559	-1.142098	0.2657
D(LCPI(-1))	0.025442	0.052514	0.484481	0.6328
D(LCPI(-2))	0.037413	0.055107	0.678916	0.5043
D(LCPI(-3))	-0.091851	0.048257	-1.903390	0.0702
D(LCPI(-4))	0.060470	0.051659	1.170555	0.2543
D(LCPI(-5))	0.010526	0.065799	0.159975	0.8744
D(LCPI(-6))	-0.062744	0.062407	-1.005397	0.3256

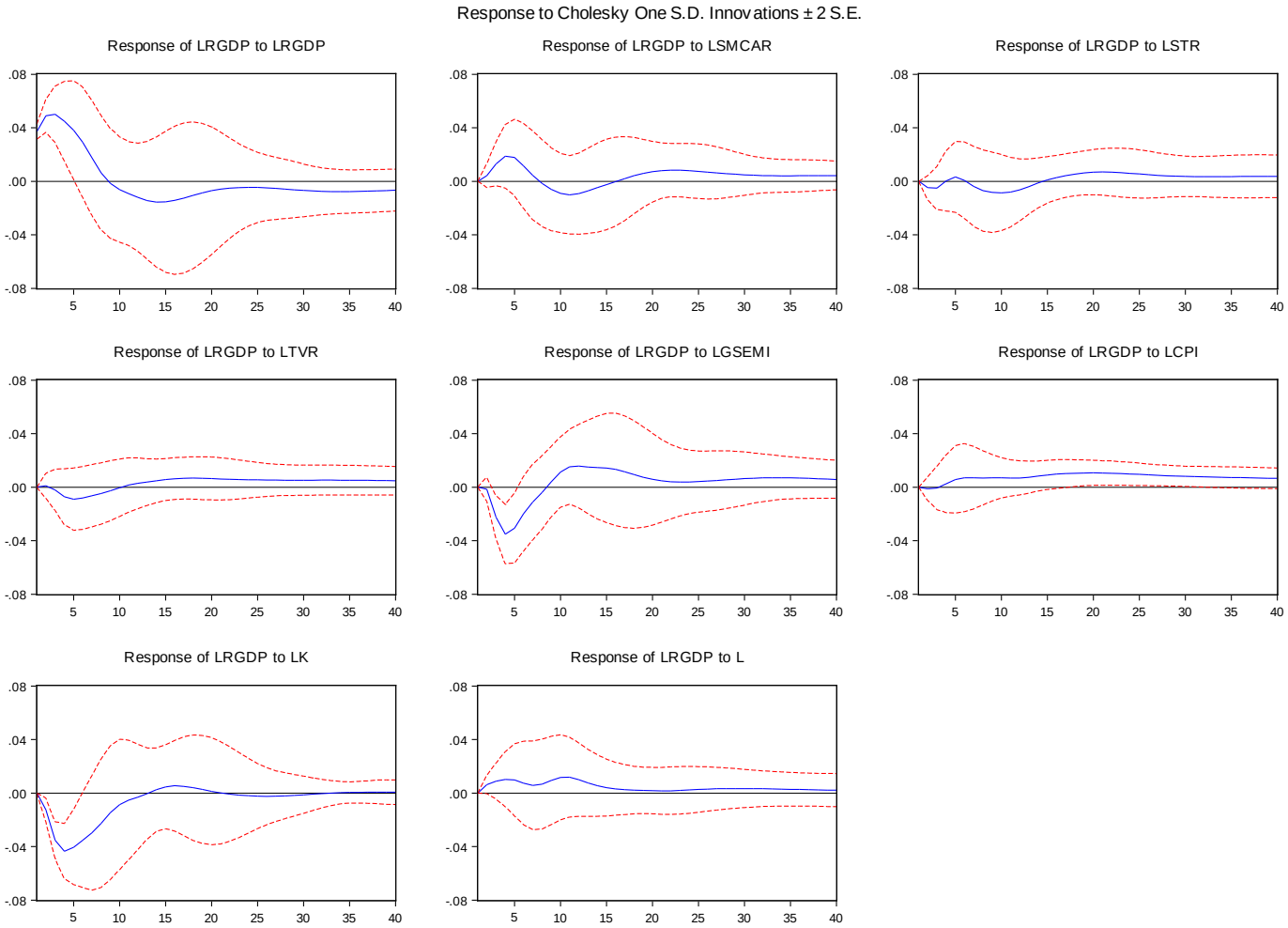
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-7))	0.124859	0.052775	2.365879	0.0272
D(LK(-1))	0.135640	0.045135	3.005177	0.0065
D(LK(-2))	0.006987	0.051841	0.134787	0.8940
D(LK(-3))	0.063157	0.054430	1.160320	0.2584
D(LK(-4))	0.063100	0.029014	2.174795	0.0407
D(LK(-5))	0.058450	0.033349	1.752700	0.0936
D(LK(-6))	0.033880	0.035962	0.942104	0.3564
D(LK(-7))	0.011922	0.034466	0.345899	0.7327
D(L(-1))	-0.188574	0.034802	-5.418437	0.0000
D(L(-2))	-0.163411	0.033647	-4.856623	0.0001
D(L(-3))	0.174157	0.034256	5.083935	0.0000
D(L(-4))	-0.158337	0.029655	-5.339301	0.0000
D(L(-5))	0.145827	0.024996	5.834046	0.0000
D(L(-6))	-0.127998	0.020223	-6.329422	0.0000
D(L(-7))	-0.086114	0.017946	-4.798470	0.0001
C	0.110951	0.017811	6.229352	0.0000

R-squared	0.994788	Mean dependent var	0.008584
Adjusted R-squared	0.981285	S.D. dependent var	0.056686
S.E. of regression	0.007755	Akaike info criterion	-6.721989
Sum squared resid	0.001323	Schwarz criterion	-4.995020
Log likelihood	326.8796	Hannan-Quinn criter.	-6.029598
F-statistic	73.66955	Durbin-Watson stat	1.940980
Prob(F-statistic)	0.000000		

Source: Computed by the author using EViews 7.0 econometric software

APPENDIX XII

Results of the Impulse Response Functions



APPENDIX XIII

Forecast Error Variance Decomposition.

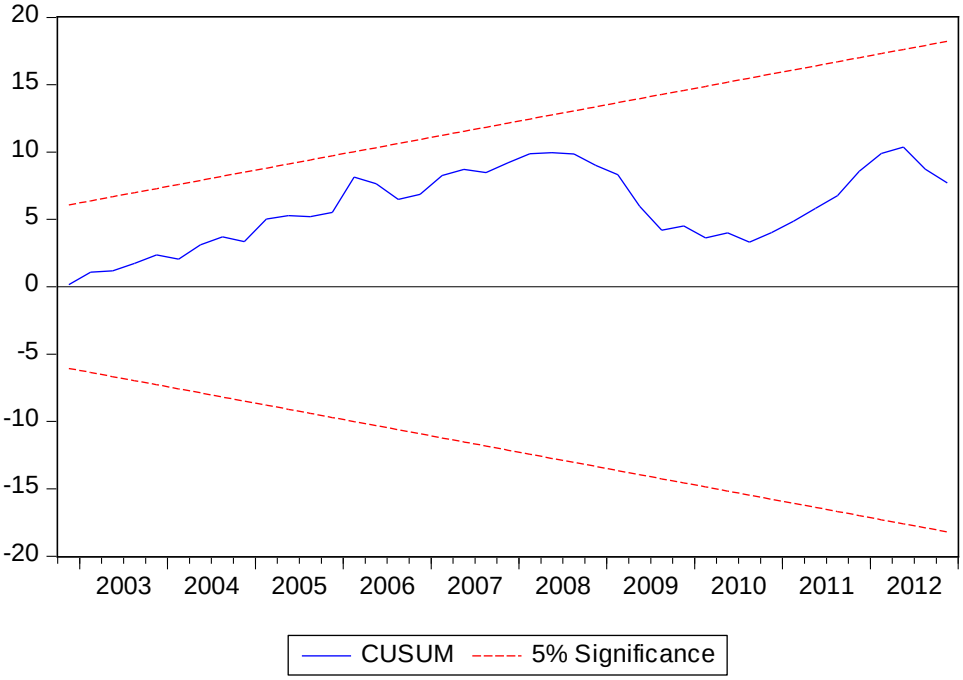
QTR	LRGDP	LSMCAR	LSTR	LTVR	LGSEMI	LCPI	LK	L
2	93.92014	0.422305	0.971627	0.025302	0.059818	0.033325	3.999092	0.568389
4	58.33421	3.748280	1.559343	0.393691	12.30825	0.055536	23.25560	0.345096
6	49.11839	4.535392	1.728951	0.941167	14.30591	0.422391	28.67044	0.277361
8	46.02473	4.202150	1.885617	1.118816	13.56763	0.787333	31.89189	0.521839
10	44.21970	4.490939	2.719239	1.101609	13.57185	1.142590	31.67982	1.074255
12	42.76578	4.970023	3.485381	1.082443	14.67492	1.436546	30.15132	1.433588
14	42.47681	5.020542	3.642256	1.166068	15.62248	1.823494	28.81822	1.430127
16	42.29183	4.838498	3.580934	1.369129	16.32034	2.370931	27.82642	1.401917
18	41.89945	4.761429	3.508988	1.631133	16.56185	3.015084	27.10927	1.512803
20	41.32841	4.932478	3.449083	1.872103	16.47053	3.689274	26.50109	1.757028
22	40.69242	5.259641	3.396419	2.070176	16.26063	4.326793	25.96716	2.026756

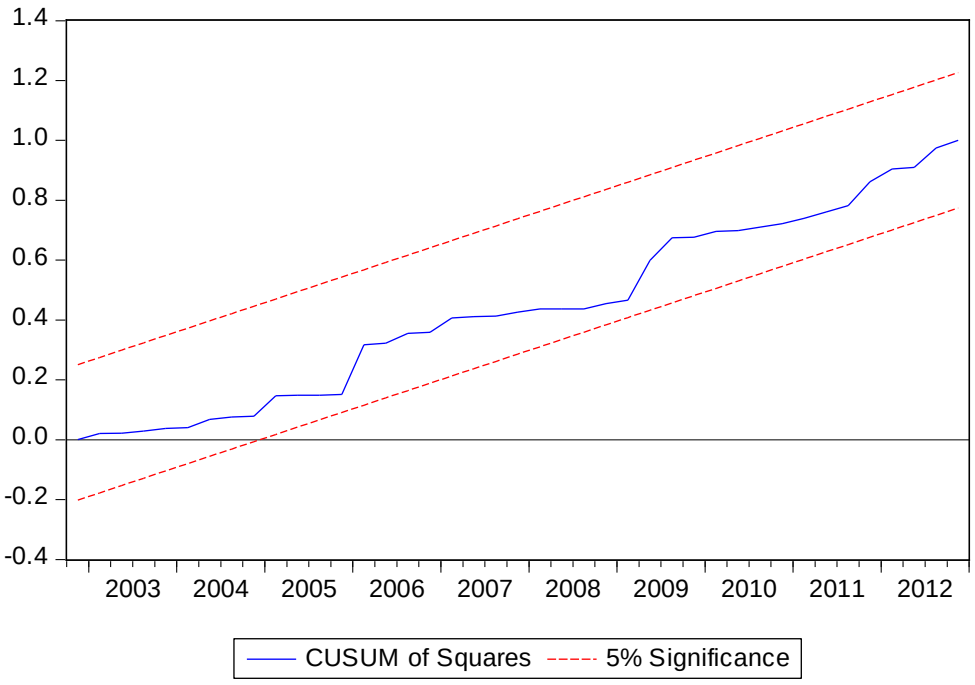
QTR	LRGDP	LSMCAR	LSTR	LTVR	LGSEMI	LCPI	LK	L
24	40.10586	5.583323	3.364178	2.235190	16.06180	4.889222	25.52431	2.236113
26	39.62160	5.818185	3.361388	2.380926	15.92672	5.362480	25.16067	2.368026
28	39.24830	5.959377	3.378009	2.515319	15.86583	5.754448	24.83266	2.446055
30	38.97028	6.081586	3.398984	2.644856	15.87622	6.030887	24.50277	2.494415
32	38.75876	6.358817	3.415243	2.772215	15.93601	6.062367	24.16667	2.529925
34	38.58569	6.599540	3.422831	2.896213	16.01240	6.079578	23.83911	2.564643
36	38.43164	6.814094	3.421678	3.014250	16.07964	6.099295	23.53424	2.605164
38	38.28563	7.008376	3.414878	3.123907	16.12694	6.128858	23.25896	2.652449
40	38.14440	7.184563	3.406055	3.223574	16.15488	6.168356	23.01458	2.703596

Cholesky Ordering: LRGDP LSMCAR LSTR LTVR LGSEMI LCPI LK L
Source: Computed by the author using EViews 7.0 econometric software.

APPENDIX XIV

Results of the CUSUM and the CUSUM of squares





APPENDIX XV

Quarterly Data on Variables Used in the Estimation

YEAR/Q	RGDP	SMCAR	STR	TVR	GSEMI	CPI	K	L
1991Q1	2359.691	0.297293	0.116754	0.001842	17.23052	7.37	1.350345	13.28541
1991Q2	2365.917	0.300376	0.104052	0.001505	16.78931	7.64	1.371684	13.29706
1991Q3	2378.369	0.306541	0.078649	0.000832	15.9069	7.53	1.385662	13.30482
1991Q4	2397.047	0.31579	0.040545	0.000178	14.58327	7.58	1.392578	13.30871
1992Q1	2421.951	0.328121	0.010261	0.001525	12.81843	7.91	0.918488	13.34223
1992Q2	2450.093	0.357805	0.019521	0.000753	13.20212	8.28	1.021335	13.34628
1992Q3	2481.473	0.404842	0.129891	0.002136	15.73435	8.4	1.199875	13.35437
1992Q4	2516.091	0.469232	0.32085	0.007142	20.4151	8.59	1.419222	13.36651
1993Q1	2553.947	0.550975	0.592397	0.014266	27.24438	9.75	1.652402	13.38269
1993Q2	2582.339	0.612282	0.796057	0.019609	32.36634	10.43	1.782466	13.39934
1993Q3	2601.267	0.653154	0.93183	0.023172	35.78098	10.65	1.841959	13.41647

YEAR/Q	RGDP	SMCAR	STR	TVR	GSEMI	CPI	K	L
1993Q4	2610.731	0.673589	0.999717	0.024953	37.4883	10.97	1.842558	13.43406
1994Q1	2653.081	9.788987	1.079897	0.413023	73.99071	11.85	1.784372	13.45212
1994Q2	2660.826	9.655392	1.018938	0.388214	74.20443	12.61	1.738397	13.46567
1994Q3	2676.317	9.388203	0.897021	0.338595	74.63186	13.43	1.706529	13.4747
1994Q4	2699.553	8.987418	0.714145	0.264167	75.273	14.72	1.690206	13.47921
1995Q1	2730.534	8.453039	0.47031	0.16493	76.12786	17.02	1.682824	13.51986
1995Q2	2763.652	7.953072	0.297653	0.094163	77.71566	20.41	1.675511	13.52494
1995Q3	2798.905	7.487516	0.196171	0.051867	80.0364	22.81	1.660722	13.53508
1995Q4	2836.294	7.056373	0.165866	0.038041	83.09008	25.14	1.63812	13.5503
1996Q1	2875.818	6.659641	0.206737	0.052686	86.8767	28.04	1.607167	13.57058
1996Q2	2905.462	6.362092	0.237391	0.063669	89.71667	30.29	1.601472	13.59132
1996Q3	2925.224	6.163725	0.257827	0.070992	91.60998	31.14	1.621466	13.6125
1996Q4	2935.106	6.064542	0.268045	0.074653	92.55664	33.35	1.665662	13.63413

YEAR/Q	RGDP	SMCAR	STR	TVR	GSEMI	CPI	K	L
1997Q1	3005.982	4.438322	0.860153	0.152469	104.7695	36.23	1.731009	13.6562
1997Q2	3016.603	4.471993	0.882092	0.157582	114.0357	39.09	1.777361	13.67276
1997Q3	3037.844	4.539336	0.925969	0.167806	132.5681	39.78	1.80711	13.68379
1997Q4	3069.705	4.640349	0.991786	0.183143	160.3667	40.17	1.82166	13.68931
1998Q1	3112.187	4.775033	1.079542	0.203592	197.4315	43.58	1.747513	13.7367
1998Q2	3154.334	4.795893	1.095828	0.207834	220.1198	47.63	1.737047	13.74225
1998Q3	3196.148	4.70293	1.040643	0.195871	228.4317	46.69	1.715779	13.75334
1998Q4	3237.628	4.496144	0.913987	0.167703	222.367	46.5	1.683004	13.76999
1999Q1	3278.775	4.175534	0.715861	0.123328	201.926	49.56	1.637563	13.79218
1999Q2	3309.634	3.935076	0.567266	0.090047	186.5951	52.51	1.616749	13.814
1999Q3	3330.207	3.774771	0.468203	0.067859	176.3746	52.19	1.622136	13.83544
1999Q4	3340.494	3.694619	0.418671	0.056766	171.2643	52.92	1.65331	13.85652
2000Q1	3413.235	3.59	0.276993	0.042342	214.6079	57.28	1.707967	13.87722

YEAR/Q	RGDP	SMCAR	STR	TVR	GSEMI	CPI	K	L
2000Q2	3422.911	3.5	0.305196	0.044005	214.5627	62.93	1.747084	13.89274
2000Q3	3442.262	3.32	0.361601	0.047332	214.4724	69.05	1.772337	13.90309
2000Q4	3471.289	3.05	0.446209	0.052322	214.3369	74.37	1.784729	13.90827
2001Q1	3509.992	2.69	0.55902	0.058975	214.1563	81.3	1.993005	13.95045
2001Q2	3551.445	2.495	0.616536	0.062247	224.0165	86.12	1.962181	13.95525
2001Q3	3595.648	2.465	0.618758	0.062136	243.9176	88.59	1.897525	13.96484
2001Q4	3642.6	2.6	0.565686	0.058642	273.8596	90.2	1.791956	13.97923
2002Q1	3692.303	2.9	0.45732	0.051766	313.8425	97.45	1.631251	13.99842
2002Q2	3729.58	3.125	0.376046	0.046609	343.8296	99.75	1.523288	14.01715
2002Q3	3754.431	3.275	0.321863	0.043172	363.8211	101.85	1.488907	14.03542
2002Q4	3766.857	3.35	0.294771	0.041453	373.8168	105.5	1.535824	14.05325
2003Q1	3890.647	1.788573	0.91531	0.128356	666.2911	126.5	1.653645	14.07061
2003Q2	3906.41	0.833856	0.858186	0.135814	755.1167	132.6	1.733711	14.08364

YEAR/Q	RGDP	SMCAR	STR	TVR	GSEMI	CPI	K	L
2003Q3	3937.935	6.078715	0.743938	0.150729	932.7678	132.2	1.783735	14.09232
2003Q4	3985.223	13.946	0.572565	0.173101	1199.244	138.5	1.807839	14.09666
2004Q1	4048.274	24.43572	0.344069	0.202931	1554.547	146.3	1.939698	14.13175
2004Q2	4114.24	31.07632	0.182042	0.215791	1754.709	156.5	1.947586	14.13565
2004Q3	4183.12	33.8678	0.086487	0.21168	1799.731	158.2	1.963178	14.14346
2004Q4	4254.915	32.81016	0.057402	0.190598	1689.613	161.3	1.986119	14.15517
2005Q1	4329.624	27.90341	0.094788	0.152546	1424.356	172.3	2.015911	14.17079
2005Q2	4385.657	24.22334	0.122827	0.124007	1225.412	178.5	2.013956	14.18598
2005Q3	4423.011	21.76997	0.14152	0.10498	1092.783	180.8	1.980063	14.20075
2005Q4	4441.689	20.54328	0.150866	0.095467	1026.469	183.7	1.910798	14.2151
2006Q1	4626.742	15.51842	0.074118	0.050502	1208.196	191.7	1.798192	14.22902
2006Q2	4646.555	15.32505	0.086471	0.055701	1225.519	198.8	1.704549	14.23946
2006Q3	4686.182	14.93832	0.111176	0.0661	1260.167	201.9	1.636864	14.24642

YEAR/Q	RGDP	SMCAR	STR	TVR	GSEMI	CPI	K	L
2006Q4	4745.622	14.35822	0.148235	0.081698	1312.138	203.8	1.601222	14.2499
2007Q1	4824.875	13.58475	0.197647	0.102495	1381.433	211.3	1.593467	14.27811
2007Q2	4917.966	13.18247	0.252353	0.130616	1516.555	220	1.602058	14.28125
2007Q3	5024.896	13.15136	0.312353	0.16606	1717.503	222.5	1.619022	14.28754
2007Q4	5145.664	13.49142	0.377647	0.208828	1984.279	229.8	1.64394	14.29697
2008Q1	5280.27	14.20266	0.448235	0.25892	2316.882	240.4	1.676227	14.30954
2008Q2	5381.224	14.73609	0.501176	0.296489	2566.335	260.5	1.690165	14.3217
2008Q3	5448.527	15.09172	0.536471	0.321534	2732.636	262.3	1.686507	14.33346
2008Q4	5482.179	15.26953	0.554118	0.334057	2815.787	271.5	1.66506	14.3448
2009Q1	5555.34	11.36505	0.103312	0.048893	1233.788	289.8	1.624638	14.35574
2009Q2	5578.604	11.17503	0.108987	0.049636	1297.507	314.6	1.593213	14.36394
2009Q3	5625.132	10.79499	0.120338	0.051121	1424.944	310.5	1.5717	14.36941
2009Q4	5694.924	10.22492	0.137364	0.05335	1616.1	314.8	1.560767	14.37214

YEAR/Q	RGDP	SMCAR	STR	TVR	GSEMI	CPI	K	L
2010Q1	5787.98	9.464837	0.160065	0.056322	1870.975	328.35	1.937811	17.85113
2010Q2	5935.2	9.743867	0.18012	0.067882	1913.166	344.52	1.857329	16.47072
2010Q3	6136.585	11.06202	0.197527	0.08803	1742.673	339.66	1.673864	13.70992
2010Q4	6392.135	13.41928	0.212288	0.116766	1359.496	341.83	1.314243	9.568706
2011Q1	6701.85	16.81566	0.224401	0.154091	763.6355	358.34	5.80185	16.55577
2011Q2	6934.136	19.36295	0.233486	0.182084	316.7401	374.13	6.041817	16.94346
2011Q3	7088.993	21.06114	0.239542	0.200747	18.80977	368.18	6.52175	17.71885
2011Q4	7166.422	21.91024	0.242571	0.210078	130.1554	371.16	7.24165	18.88192
2012Q1	9328.036	24.27547	0.055784	0.043388	371.8086	389.79	8.201517	20.43268
2012Q2	8606.712	22.39828	0.051471	0.040033	343.0572	409.5	8.207245	19.90991
2012Q3	7164.063	18.64391	0.042843	0.033322	285.5543	402.91	7.258835	17.31362
2012Q4	5000.09	13.01234	0.029902	0.023257	199.2999	404	5.356287	12.64379

Source: Computed by the author using Gandolfo (1981) algorithm.

YEAR/Q	RGDP	SMCAR	STR	TVR	GSEMI	CPI	K	L
1991Q1	2359.691	0.297293	0.116754	0.001842	17.23052	7.37	1.350345	13.28541
1991Q2	2365.917	0.300376	0.104052	0.001505	16.78931	7.64	1.371684	13.29706
1991Q3	2378.369	0.306541	0.078649	0.000832	15.9069	7.53	1.385662	13.30482
1991Q4	2397.047	0.31579	0.040545	0.000178	14.58327	7.58	1.392578	13.30871
1992Q1	2421.951	0.328121	0.010261	0.001525	12.81843	7.91	0.918488	13.34223
1992Q2	2450.093	0.357805	0.019521	0.000753	13.20212	8.28	1.021335	13.34628
1992Q3	2481.473	0.404842	0.129891	0.002136	15.73435	8.4	1.199875	13.35437
1992Q4	2516.091	0.469232	0.32085	0.007142	20.4151	8.59	1.419222	13.36651
1993Q1	2553.947	0.550975	0.592397	0.014266	27.24438	9.75	1.652402	13.38269
1993Q2	2582.339	0.612282	0.796057	0.019609	32.36634	10.43	1.782466	13.39934
1993Q3	2601.267	0.653154	0.93183	0.023172	35.78098	10.65	1.841959	13.41647
1993Q4	2610.731	0.673589	0.999717	0.024953	37.4883	10.97	1.842558	13.43406
1994Q1	2653.081	9.788987	1.079897	0.413023	73.99071	11.85	1.784372	13.45212
1994Q2	2660.826	9.655392	1.018938	0.388214	74.20443	12.61	1.738397	13.46567
1994Q3	2676.317	9.388203	0.897021	0.338595	74.63186	13.43	1.706529	13.4747
1994Q4	2699.553	8.987418	0.714145	0.264167	75.273	14.72	1.690206	13.47921
1995Q1	2730.534	8.453039	0.47031	0.16493	76.12786	17.02	1.682824	13.51986
1995Q2	2763.652	7.953072	0.297653	0.094163	77.71566	20.41	1.675511	13.52494
1995Q3	2798.905	7.487516	0.196171	0.051867	80.0364	22.81	1.660722	13.53508
1995Q4	2836.294	7.056373	0.165866	0.038041	83.09008	25.14	1.63812	13.5503
1996Q1	2875.818	6.659641	0.206737	0.052686	86.8767	28.04	1.607167	13.57058
1996Q2	2905.462	6.362092	0.237391	0.063669	89.71667	30.29	1.601472	13.59132
1996Q3	2925.224	6.163725	0.257827	0.070992	91.60998	31.14	1.621466	13.6125
1996Q4	2935.106	6.064542	0.268045	0.074653	92.55664	33.35	1.665662	13.63413
1997Q1	3005.982	4.438322	0.860153	0.152469	104.7695	36.23	1.731009	13.6562
1997Q2	3016.603	4.471993	0.882092	0.157582	114.0357	39.09	1.777361	13.67276
1997Q3	3037.844	4.539336	0.925969	0.167806	132.5681	39.78	1.80711	13.68379
1997Q4	3069.705	4.640349	0.991786	0.183143	160.3667	40.17	1.82166	13.68931
1998Q1	3112.187	4.775033	1.079542	0.203592	197.4315	43.58	1.747513	13.7367
1998Q2	3154.334	4.795893	1.095828	0.207834	220.1198	47.63	1.737047	13.74225
1998Q3	3196.148	4.70293	1.040643	0.195871	228.4317	46.69	1.715779	13.75334
1998Q4	3237.628	4.496144	0.913987	0.167703	222.367	46.5	1.683004	13.76999
1999Q1	3278.775	4.175534	0.715861	0.123328	201.926	49.56	1.637563	13.79218
1999Q2	3309.634	3.935076	0.567266	0.090047	186.5951	52.51	1.616749	13.814
1999Q3	3330.207	3.774771	0.468203	0.067859	176.3746	52.19	1.622136	13.83544
1999Q4	3340.494	3.694619	0.418671	0.056766	171.2643	52.92	1.65331	13.85652
2000Q1	3413.235	3.59	0.276993	0.042342	214.6079	57.28	1.707967	13.87722
2000Q2	3422.911	3.5	0.305196	0.044005	214.5627	62.93	1.747084	13.89274
2000Q3	3442.262	3.32	0.361601	0.047332	214.4724	69.05	1.772337	13.90309
2000Q4	3471.289	3.05	0.446209	0.052322	214.3369	74.37	1.784729	13.90827
2001Q1	3509.992	2.69	0.55902	0.058975	214.1563	81.3	1.993005	13.95045
2001Q2	3551.445	2.495	0.616536	0.062247	224.0165	86.12	1.962181	13.95525
2001Q3	3595.648	2.465	0.618758	0.062136	243.9176	88.59	1.897525	13.96484
2001Q4	3642.6	2.6	0.565686	0.058642	273.8596	90.2	1.791956	13.97923
2002Q1	3692.303	2.9	0.45732	0.051766	313.8425	97.45	1.631251	13.99842
2002Q2	3729.58	3.125	0.376046	0.046609	343.8296	99.75	1.523288	14.01715

2002Q3	3754.431	3.275	0.321863	0.043172	363.8211	101.85	1.488907	14.03542
2002Q4	3766.857	3.35	0.294771	0.041453	373.8168	105.5	1.535824	14.05325
2003Q1	3890.647	1.788573	0.91531	0.128356	666.2911	126.5	1.653645	14.07061
2003Q2	3906.41	0.833856	0.858186	0.135814	755.1167	132.6	1.733711	14.08364
2003Q3	3937.935	6.078715	0.743938	0.150729	932.7678	132.2	1.783735	14.09232
2003Q4	3985.223	13.946	0.572565	0.173101	1199.244	138.5	1.807839	14.09666
2004Q1	4048.274	24.43572	0.344069	0.202931	1554.547	146.3	1.939698	14.13175
2004Q2	4114.24	31.07632	0.182042	0.215791	1754.709	156.5	1.947586	14.13565
2004Q3	4183.12	33.8678	0.086487	0.21168	1799.731	158.2	1.963178	14.14346
2004Q4	4254.915	32.81016	0.057402	0.190598	1689.613	161.3	1.986119	14.15517
2005Q1	4329.624	27.90341	0.094788	0.152546	1424.356	172.3	2.015911	14.17079
2005Q2	4385.657	24.22334	0.122827	0.124007	1225.412	178.5	2.013956	14.18598
2005Q3	4423.011	21.76997	0.14152	0.10498	1092.783	180.8	1.980063	14.20075
2005Q4	4441.689	20.54328	0.150866	0.095467	1026.469	183.7	1.910798	14.2151
2006Q1	4626.742	15.51842	0.074118	0.050502	1208.196	191.7	1.798192	14.22902
2006Q2	4646.555	15.32505	0.086471	0.055701	1225.519	198.8	1.704549	14.23946
2006Q3	4686.182	14.93832	0.111176	0.0661	1260.167	201.9	1.636864	14.24642
2006Q4	4745.622	14.35822	0.148235	0.081698	1312.138	203.8	1.601222	14.2499
2007Q1	4824.875	13.58475	0.197647	0.102495	1381.433	211.3	1.593467	14.27811
2007Q2	4917.966	13.18247	0.252353	0.130616	1516.555	220	1.602058	14.28125
2007Q3	5024.896	13.15136	0.312353	0.16606	1717.503	222.5	1.619022	14.28754
2007Q4	5145.664	13.49142	0.377647	0.208828	1984.279	229.8	1.64394	14.29697
2008Q1	5280.27	14.20266	0.448235	0.25892	2316.882	240.4	1.676227	14.30954
2008Q2	5381.224	14.73609	0.501176	0.296489	2566.335	260.5	1.690165	14.3217
2008Q3	5448.527	15.09172	0.536471	0.321534	2732.636	262.3	1.686507	14.33346
2008Q4	5482.179	15.26953	0.554118	0.334057	2815.787	271.5	1.66506	14.3448
2009Q1	5555.34	11.36505	0.103312	0.048893	1233.788	289.8	1.624638	14.35574
2009Q2	5578.604	11.17503	0.108987	0.049636	1297.507	314.6	1.593213	14.36394
2009Q3	5625.132	10.79499	0.120338	0.051121	1424.944	310.5	1.5717	14.36941
2009Q4	5694.924	10.22492	0.137364	0.05335	1616.1	314.8	1.560767	14.37214
2010Q1	5787.98	9.464837	0.160065	0.056322	1870.975	328.35	1.937811	17.85113
2010Q2	5935.2	9.743867	0.18012	0.067882	1913.166	344.52	1.857329	16.47072
2010Q3	6136.585	11.06202	0.197527	0.08803	1742.673	339.66	1.673864	13.70992
2010Q4	6392.135	13.41928	0.212288	0.116766	1359.496	341.83	1.314243	9.568706
2011Q1	6701.85	16.81566	0.224401	0.154091	763.6355	358.34	5.80185	16.55577
2011Q2	6934.136	19.36295	0.233486	0.182084	316.7401	374.13	6.041817	16.94346
2011Q3	7088.993	21.06114	0.239542	0.200747	18.80977	368.18	6.52175	17.71885
2011Q4	7166.422	21.91024	0.242571	0.210078	130.1554	371.16	7.24165	18.88192
2012Q1	9328.036	24.27547	0.055784	0.043388	371.8086	389.79	8.201517	20.43268
2012Q2	8606.712	22.39828	0.051471	0.040033	343.0572	409.5	8.207245	19.90991
2012Q3	7164.063	18.64391	0.042843	0.033322	285.5543	402.91	7.258835	17.31362
2012Q4	5000.09	13.01234	0.029902	0.023257	199.2999	404	5.356287	12.64379