Ashesi University College

Performance of the Ghana Stock Exchange and Economic Growth

By

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Declaration

I hereby declare that this thesis is my original work and that no part of it has been

presented for another degree in this university or elsewhere.

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I hereby declare that the preparation and presentation of this undergraduate thesis was

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Abstract

Stock markets in developing countries have been likened to "casinos" as a result of the general perception that they do not contribute to economic growth. Very few studies have tried to specifically examine the situation in Ghana with varying results. Most studies employing OLS have found a positive relationship between the variables whiles those that have employed ADRL or VEC, have often found a negative stock market and growth nexus in Ghana. Research, however, shows that, OLS regression analysis involving economic and financial data could suffer spurious regression due to presence of unit root in most of these variables.

Therefore, to examine the effect of stock market performance on economic growth in Ghana, the study employed VECM and Granger causality test, using market capitalisation ratio as stock market indicator, and GDP as economic growth indicator. Results from the VECM regression analysis showed that, the Stock Market contributes positively to economic growth only in the short-run. In the long-run, the Exchange does not affect economic growth in Ghana.

The Granger causality test, on the other hand, revealed a unidirectional causal link between market capitalisation ratio and GDP, running from development in the size of the Stock Market to economic growth. The study also found the service sector to be the only sector benefiting from the Exchange's performance with agriculture and industry being unaffected.

Keywords: Ghana Stock Exchange, Economic Growth, Market Capitalisation, GDP.

List of Abbreviations

1. GDP --- Gross Domestic Product

2. GSE --- Ghana Stock Exchange

3. VAR --- Vector Auto Regression

4. VEC --- Vector Error Correction

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CHAPTER 1: INTRODUCTION

Background of the Study

Achieving economic growth has been the central part of the development strategies of many African countries over the last two decades (Nafziger. 2006). Several factors have thus been established as necessary for the attainment of growth objectives in a country. These include the natural and human resource of a country, technological advancement as well as other social-political factors. Prominent among these factors, however, as shown in many growth theories is the level of capital accumulation in a country. According to Todaro (2016), this is achieved by saving and investing some portion of present income in order to augment future output. Capital accumulation raises output, hence economic growth, by increasing the capital/labor ratio through the available capital per worker. Consequently, the efficiency of labour improves resulting in output increase. For this reason, the capital market, which facilitates access to long-term funds, is viewed as a vital catalyst for economic growth.

In view of the capital market's importance to the economy, the 1990s saw a new wave of stock market establishments across the Africa continent under the Structural Adjustment Programs (SAP) of the International Monetary Fund (IMF) and the World Bank. Ghana was no exception. In 1988, the country embarked on a comprehensive Financial Sector Adjustment Program (FINSAP) under the SAP. This decision was aimed at addressing the existing challenges in the financial sector (Sowa, 2002). Ghana's capital market was established in 1989 under FINSAP. It began operation in 1990 with eleven equities and one commemorative bond.

After 25 years of operations, the Exchange currently lists 42 equities and 97 Government bonds with 21 licenced dealing members. Among the development on the Exchange so far, includes the automation of the bourse, the establishment of an alternative market for SMEs, and the creation of a fixed income market for trading in fixed income securities. The Exchange is also considering the establishment of a commodities market in 2017 to facilitate easy access to capital to the agricultural sector. There is also an on-going discussion between the Ghana Stock Exchange and three other markets in the West African region; Cote D'Ivoire, Nigeria and Liberia, on the pursuit of an integrated capital market. According to Yamoah (2016), this integration will foster greater investor and issuer access to stock markets in the region. Thus, promote investment activities on the bourse (Central Securities Depository, 2016).

These developments are expected to improve performance of the exchange and increase businesses' access to capital. Consequently, productivity should increase, all other things being equal, leading to growth in the economy. Given the vital role of the Stock Market to Ghana's economy, it is important to know whether the Exchange is fulfilling its purpose in economic growth or not, so that the necessary steps be taken to ensure the maximum benefit of having a stock market is reaped especially in a time like this when the country's economy is in shambles. Against this background, this study seeks to acquire insight into the impact of Ghana's capital market to the economy by conducting an empirical study on the relevance of the Ghana Stock Exchange to the national economy.

Problem Statement

Levine (1996) contends that, although emerging markets account largely to the world's stock market boom, there may be a chance that developing countries are not benefitting as much from their own stock markets as some foreign investors are. Thus, the question that needs to be answered is, does stock markets in developing countries add any value to the economy of these countries? While the contribution of stock markets in economic growth is well documented in countries with advanced capital markets, few studies have been done on emerging markets in developing countries. Levine (1996) reports the reason for this occurrence as that, some analysts perceive markets in emerging economies as "casinos" with very little or no economic impact. As such, they see no need to conduct studies on such ineffectual markets.

Nsiah (2009) argues that, in as much as stock markets, whether advanced or emerging, may behave in some similar ways, findings related to studies on advanced markets may not apply to emerging markets due to differences in macroeconomic stability and institutional efficiency such as information inaccessibility and weak regulations.

Osei (2005), Osamwonyi & Kasimu, (2013), and Dziwornu and Awunyo-Vitor (2013), Darkoh (2006), Adusie (2014) and Ayensu, Musah, Opare & Osafo (2012), are among few studies on the Ghana Stock Exchange and economic growth, however, producing varying findings. For example, Osamwonyi et al. (2013) analysed the causal direction between stock market performance and economic growth, in three emerging markets namely, Ghana, Nigeria and Kenya using the cross-country approach. From their Granger causality test, they found that, there exist no causal affiliation between emerging markets and economic growth in these three countries.

However, when Osei (2005) and Dziwornu et al. (2013) performed the same Granger causality test, but rather employed time series approach using data from only Ghana, both studies found a causal link between the variables, running from stock market advancement to economic growth. Yet, their study would have been enhanced if they had gone ahead to show the sort of relation between the variables, whether negative or positive, long-term or short-term.

Darkoh (2006), Ayensu et al. (2012) Adusie (2014) and Ofori-Abebrese, et al. (2016) tried to establish the relation between the two variables using time series approach. While Darkoh (2006) and Ayensu et al. (2012) found a substantial positive relationship between the market and economic growth, employing Ordinary Least Squares models, Adusie (2014) and Ofori-Abebrese, et al. (2016) employed a Vector Error Correction models and Autoregressive Distributed Lag models respectively, and found a negative long-run relationship between the two variables.

There is the likelihood that the findings of both Darkoh (2006) and Ayensu et al. (2012) may have suffered the problem of *spurious regression* which is a regression that has evidence of one or more non-stationary time series (a common feature of many macroeconomic variables) in the linear model. Since the authors did not de-trend their time series variables (de-trending activities include logging time series variables, adding a time index as an independent variable, or differencing) or perform a unit root test to check the existence of this problem in their model, generalising their findings from the OLS model may be inappropriate (Binh, 2013).

Non-stationary time series requires sophisticated models such as the Vector Autoregressive (VAR) and Vector Error Correction models (VECM) employed in Adusie (2014) and Ofori-Abebrese, et al. (2016). This is because an important part of

the process of fitting these models, is ensuring stationary in the time series. Therefore, the models employed in these two studies may have provided a better view of the stock market and economic growth relationship in Ghana. However, the disagreement in their findings, in relation to the direction of causality between the variables, calls for more work on the subject to determine the exact relationship between the two variables.

Another area of research involving the Exchange and the economy, that existing literature have not considered, is the impact of the Exchange's performance on the individual sectors of the economy. It is not known which sectors of the economy benefit most or least, from the Exchange's activities so as to know which areas need more attention in achieving absolute growth in the country.

Therefore, based on the research gap identified, the study distinguishes itself from previous studies by adopting time series approach as against the cross-country method, to test the direction of causality between stock exchange performance and economic growth in Ghana. The study employs VEC model and the Johansen Cointegration test, to estimate the long-run and short-run relationship between the variables. The study also examines the impact of the Stock Market on the individual sectors of the economy namely, service, agriculture and industry.

Objectives of the Study

In examining the exchange and growth nexus in Ghana, the study will:

- Examine the short-run and long-run connection between the Exchange and economic growth.

- Investigate the causal direction between the performance of the Capital Market in Ghana and the growth of the Ghanaian economy.

- Analyse the impact of the Stock Exchange activities on the sectors of the economy.

Theoretical Framework

The role of financial markets in the advancement of an economy is well-established in many growth models. In traditional growth theory, early works of Solow (1956) for which Robert Solow of the Massachusetts Institute of Technology received the Noble Prize, ascribes long-run economic growth to exogenous technical progress. This is to say; growth rates are taken as given by forces outside the economic system. Consequently, in the Solow growth model, financial development can only be linked to the rate of capital stock per worker (K/L), but not to their respective growth rates (K/Y) (Pagano, 1993).

Since the current research seeks to establish the hypothesis that stock markets affect long-run economic growth, the study adopts the new growth theory developed by Paul M. Romer and Robert B. Lucas. The new growth theory challenges neoclassical growth theory and provide a model in which endogenous forces within the economy are the drivers of long-run growth. The Romer model is the principal model of the new growth theory, and it states that output is dependent on technology/knowledge, physical capital, human capital and labour. The main argument of the model is that investment in research and development which is financed by capital, is what drives growth in the long-run. As applied to our study, this theory holds that, capital markets contribute to long-run growth rates through

investment. Levine and Zervous (1995) and Caporale et al (2013) are among the researches that have empirically proven the postulations of this theory. Chapter 2 provides a detailed discussion of the new growth theory and its criticisms.

Research Hypothesis

From the above theoretical framework, this study hypothesizes that the performance of Ghana's Capital Market will positively affect economic growth through investment. The hypothesis to be tested is stated below as;

H_0: The size of the Capital Market does not contribute to economic growth in Ghana.

H_1: The size of the Capital Market contributes to economic growth in Ghana.

Significance of the Study

Ghana's GDP growth rate has seen a downward turn over the last five years from 14% in 2011 to 3.9% in 2015 (Ghana Statistical Service, 2016). The nation, which used to be one of Africa's success stories in economic growth around the 80s and 90s, is being saddled with a weakening economy. Reviving the economy requires prudent investment in areas that contribute significantly to growth. However, knowing the level of impact these areas have on the economy is as necessary as determining the amount of investment needed in those sectors.

This study therefore helps to determine the extent to which Ghana's Capital Market affects the economy and help foster the assimilation of the securities market into policies aimed at promoting economic growth in Ghana.

Information from this research, could serve as performance appraisal of the exchange's management system, and guide their decisions going forward.

In addition, the findings of this research could help investors know how their activities on the market contribute to economic growth, which could boost their confidence and thus participation in the market. It will also help investors know how their funds are being managed by the Ghana Stock Exchange.

Researchers studying stock markets and economic growth will also benefit from this study as the information here will serve as a reference point for their research work.

Lastly, the study augments existing literature on the significance of the Ghana Stock Exchange to the national economy.

Scope of the Study

This research serves to add to existing literature on the subject. However, caution must be exercised when making generalisation based on findings from this paper as both limitations and delimitations apply to the study. The research is limited to the impact of stock exchange performance and economic growth in Ghana. The performance of the market is indicated herein by the market capitalisation to GDP ratio. Other market indicators, such as the total value of shares traded and the number of new listing and volatility, which in totality would have been a better representation of the market, were not included. Furthermore, growth in the economy was also measured by the Gross Domestic Product.

The research also covers the period from 1990 to 2015, as such, the regression model best explains trends within the scope of the data periods. Findings are best limited to Ghana and to the years under review or years that are reasonably close to those observed in this paper.

Methodology

The study is a quantitative research that employs annual secondary data on market capitalisation, GDP, and two control variables namely, gross secondary school enrolment and inflation rate, in a multiple regression analysis. The study covers the period from 1990 to 2015. The basic specification of the model used in this study is grounded on the aggregate production function of the Romer endogenous growth model. The model attributes long run and short run output increase to labour, human and physical capital, and knowledge (which is considered a public good). Augmenting this model as adapted in Levine and Zervos (1998), Tang (2006), Caporale at al. (2003), we arrived at the model below.

GDP = f(Stock Market Size, Gross Secondary School Enrolment, Inflation rate)

Outlook of the Thesis Report

The research is structured in the following outline. The paper is sectioned into five chapters. Chapter one, captures the background of the study, the problem statement, research objectives and questions, theoretical framework, research hypothesis, the significance of the study, scope and limitations of the study, and methodology. Chapter two proceeds with the review of both theoretical and empirical

literature on the topic statement and operational definitions of concepts. Chapter three focuses on the research's methodology. It includes the research design, target population, the sampling framework, data collection and data analysis. The chapter also introduces the regression models that will be used in explaining the observed relationship.

Chapter four focuses on the analysis of the project research and a detailed discussion of the results obtained. The fifth and final chapter winds up with a summary of the findings as well as conclusions and recommendations from the results.

CHAPTER 2: LITERATURE REVIEW

Introduction

This chapter is a review of literature on the subject. The chapter provides detailed analysis of the study's theoretical framework together with established notional and empirical evidence on the link between stock markets and growth. The chapter also gives a background of the Ghana Stock Exchange and the three sectors of the economy. The chapter ends with operational definitions of key concepts and terms used in the study.

Theoretical Perspective

The New Growth Theory

The advent of growth theory spans over thirty decades and like many other subjects in economics, the field has had its own ups and downs in the past. Economic growth has been a major focus of attention from the classical economic doctrines of Adam Smith and Karl Marx, to the neoclassical growth doctrines of Robert Solow and then to the current new growth doctrines of Paul Romer. Many of these theories were introduced to challenge or fill the gaps in the previous theories. The new growth theory, for example, challenges the neoclassical view that ascribes long-term growth to some exogenous technological progress and provides a framework where long-term growth can be achieved through internal technological progress, in the form of knowledge.

The new growth theory was pioneered by the early works of Paul Romer in 1986 and Robert Lucas in 1988. A major distinguishing feature of the theory, is the concept of endogeneity, which views technical progress as a product of economic

activities rather than some external force. According to the new growth theory, diminishing returns associated with physical objects are offset by increasing returns on knowledge and technology. Since knowledge is transferable and can be reused, it can thus be unlimitedly gathered, and the increasing returns associated with knowledge is what will propel growth.

The Romer Model

One major contribution to the endogenous growth theory is the Romer model presented by Paul Romer in 1986. The Romer model is considered in this study because it the seminal model of the endogenous growth theory. It is also relevant in the industrialisation process of developing countries because it addresses technological spill-overs, which is when one firm's productivity gains are replicated in another firm or industry (Todaro & Smith 2006). Romer provides a model of increasing returns by first assuming that growth processes derive from the firm or industry level. Within the Romer model, each industry or firm produces at constant returns. However, the knowledge part of the capital stock $(\bar{K})$, which is a public good, affects output at the industry level. As such, the increasing returns to scale on knowledge, which shifts over rapidly to the other firms in the form of spill-overs, may result in an economy-wide output growth. Thus, the model is said to view *'learning-by-doing' as 'learning-by-investment'* (Todaro & Smith, 2006*)*. This is because, it is the investment in learning or knowledge that determines economic growth in the Romer model. This model is represented in a Cobb-Douglas aggregate production function as;

$$Y = AK^{\alpha+\beta}L^{1-\alpha}$$

Y represents output, *A* is knowledge or technology, *K* is both physical and human

capital with α representing the elasticity of output with respect to capital and β

representing the spill-over effects of knowledge which is assumed to be greater than

zero. *L* is labour.

A policy implication of this model is that, sustainable growth rates can be

achieved by forces within the economic system such as improvement in

technology/knowledge and human, the accumulation of physical capital as well as

increase in the labour force. Since the model allows for the stock of physical capital to

impact growth rate in a country, then, stock market performance could contribute to

economic growth by facilitating the accumulation of physical capital for investment in

productive projects which consequently increases productivity and output growth of

the economy. This has been the basis upon which past studies like Bencivenga &

Smith (1991), Levine (1991) & King and Levine (1993), have linked the new growth

theory to stock markets and economic growth rates.

Criticisms of Endogenous Growth Theory

Criticisms against the new growth theory include the model's reliance on

several neoclassical assumptions which often do not apply to developing countries.

An example of such assumption is the single sector assumption or the assumption that

all sectors of the economy are symmetrical. This implies that, the redistribution of

capital and labour among transmuting sectors as countries experience growth in their

economies, is unexplained by the model. Moreover, the actual factors that inhibit

growth in developing countries such as corruption, poor structures, weak institutions

and inefficient markets are not captured in the model. As such, its applicability in

explaining growth in developing countries is inadequate (Todaro & Smith, 2011).

Theoretical Link between Stock Markets and Economic Growth

Earlier works on finance and growth, did not cogitate the different roles of stock markets and banks. According to Caporale et al (2003), financial markets are commonly believed to contribute to growth through savings and investment. Yet, stock markets have been found to perform poorly in the savings function as compared to the banks. In an empirical study, to find the exact channel through which stock markets induce growth, Caporale et al (2003) found a causal link between stock markets and investments. The authors therefore conclude that the later affects the former through investment and not savings.

According to Levine (1996), liquid stock markets provide a quick and inexpensive way to sell and buy securities as and when desired. This situation on the other hand helps investors mitigate the risk associated with tying up their funds in long term investments (Levine, 1991). A liquid stock markets also allows companies to easily raise capital for productive investments. The reduction in investors' exposed risk encourages more investments, whereas the ease in raising capital by the companies improves the allocation of capital. Both processes subsequently lead to economic growth (Arestis et al, 2001).

Jensen & Murphy (1990) also contend that an efficient stock market allows a company to increase its shareholders. This boost corporate governance and thus, lessen the agency problem by inducing mangers to act in the interest of shareholders. The end product of this is an improvement in firm management, and the avoidance of waste, which then leads to increase in output and growth.

Mishkin (2001) & Levine (1991) provide the evidence that stock markets boost investment opportunities by allowing risk diversification, the creation of

liquidity, improving the acquisition and dissemination of information, identifying and

funding profitable projects, allocating capital proficiently and facilitating corporate

control

Nonetheless, opposing theories on the importance of capital markets to

economic growth do exist. Mayer (1988), contends that even advanced markets are

not a reliable source of corporate finance. Demirguc-Kunt & Levine (1996) also argue

that market liquidity somewhat hurts the economy because dissatisfied investors could

swiftly sell-off their securities, and even leave the market. This, on the other hand,

reduces investor commitment, which is needed to improve the performance of

managers through the exertion of corporate control. Finally, Shleifer & Summers

(1988) present the logic that capital markets hurt the economy by making it easier for

unproductive business takeovers.

Empirical Evidence

The link between stock markets and economic growth, have been extensively

studied with findings that sometimes differ. Some studies have found a significant

relationship between the two, whiles others have witnessed no connection. Even

within studies that found a relationship between the two, there is still the confusion of

whether the relationship is positive or negative, significant or insignificant. One

common thing among these studies, however, is the method of analysis employed.

Studies on stock markets and economic growth, are usually done in either cross-

country or time series regression analysis. According to Arestis et al. (2001), the use

of time series growth analysis is however more recent and it came about as a result of

the growing scepticism about cross-country regression findings.

Cross-Country Approach

King & Levine (1993) is one of the prominent studies in the empirical literature on stock markets and economic growth, which followed cross-country analysis. Using eight countries and data from 1960 to 1989, the authors employed four bank-related indicators to measure financial market performance, and another four measures of growth. From their findings, the financial indicators considered were positively correlated with the growth indicators. The authors concluded that the financial performance of an economy affects its growth.

Other cross-country studies on stock markets and growth are Roubini and Sala-i Martin (1992) Fry (1997) and Barro (1991). The findings of all these studies in line with King and Levine (1993), established a positive stock market influence on economic progress.

A great deal of scepticism, however, have been raised regarding the sturdiness of econometrics findings obtained from growth regressions, employing the cross-country framework. The cross-country approach to growth analysis is excellent at providing a general view of the stock markets and growth relationship. However, specifics of the market-growth nexus in each country, which is likely to differ considerable across regions conditional on circumstances and institutional dynamics, are not provided (Arestis et al. 2001).

There are many other problems of econometric nature in cross-country analysis which needs mentioning. Evans (1995) argues that the heterogeneity in slope estimates from country to country is one major weakness in the cross-country framework. Harris (1997) also contends that the problem of endogeneity associated

with cross-country regressions also play out in stock market and growth analysis to lessen the predicted effect of market indicators on growth. Furthermore, Lee et al. (1996), found that the presence of asymptotic bias in the coefficients of the estimators renders the convergence test in cross-county results deceptive. Finally, Quah (1993) also showed, using a 118-country sample that the assumption of stable growth paths in cross-country regressions is non-existent.

It is against these criticisms of cross-country study, that this paper is motivated to employ time series analysis in studying the stock market and growth relationship in Ghana. According to Arestis et al (2001), there are a number of important econometric advantages in using time series growth regression. These include their ability to better address the issues of causality and endogeneity. Their likelihood to suffer from other cross-country limitations is also minimal. Then again, details concealed in cross-country growth regressions are also revealed in time series growth regressions.

Time Series Approach

Since the time series method is employed in this paper, it is important to also review some studies on stock market performance and growth in Ghana as well as those on other emerging markets which follow the time series trend of analysis.

Nyong (1997) employed a time series growth regression to establish the stock market and growth relationship in Nigeria. A composite index was used as a performance indicator of the Stock Market, and GDP as a measure of growth. The data covered the period from 1970 to 1994. The methods of analysis that were employed in the study were Ordinary Least Square (OLS) regression and Granger causality analysis. Whiles the Granger causality test showed a bi-directional causality

between the variables, the OLS regression output showed a significant and negative relationship between the Nigerian Stock Market and its economy.

Owiti (2012) performed the same study in Kenya employing yearly data covering the years 1990 -2010. However, unlike Nyong (1997), GDP per capita was used here instead of Gross Domestic Product. Market capitalisation and turnover ratios were the two indicator of stock market performance. Control variables in the model were Foreign Direct Investments and inflation. Contrary to Nyong (1997), the study found a significant and positive relationship between the market indicators and GDP per capita. However, the Granger causality test showed two different results. Market capitalisation was found to granger cause GDP per capita without feedback whereas GDP per capita was rather found to granger cause turnover ratio without feedback. The author thus conclude that Kenya's stock market contributes to growth in the country.

Results from both Nyong (1997) and Owiti (2012) show that stock markets in emerging markets affect economic growth. However, applying such findings in Ghana, though it is also an emerging market, could be misleading due to situational and institutional difference. The next paragraphs will review some studies on the Ghana Stock Exchange and economic growth, using time series regression approach.

Osei (2005) studies the relationship in Ghana using quarterly time series data from 1991 to 2003. Market capitalisation ratio was the measures of stock market performance and growth in Ghana was proxied as GDP. This study performed only a Granger causality test based on the vector autoregressive (VAR) technique. The study found a causal relationship between the variables, where the performance of the Stock Market in Ghana causes economic growth. However, the author did not establish the

correlation between the market and growth rates. Moreover, given recent developments in the market, the findings of this study when applied today, may not give a true picture of the current stock market and growth relationship in Ghana, since the study dates as far back as 13 years ago.

Dziwornu and Awunyo-Vitor (2013), made use of yearly time series data from 1990-2012 to investigate the direction of causality between the Bourse and economic growth. The GSE-All Shares index and GDP growth were respectively the proxies for the Stock Market and economic growth. Conducting a Granger causality analysis, the study revealed a one-way causality between the Stock Market and the economy of Ghana. Though this study employed a more recent data as compared to Osei (2005), the study also failed to establish the extent to which the performance of the Securities Market affects economic growth.

Darkoh (2006) employed Ordinary Least Squares (OLS) regression analysis to probe relationship in Ghana. The market variables considered were market capitalisation and total value traded. GDP growth rate was the measure of economic growth and control variables in the model were government expenditure, inflation and trade openness. Quarterly time series data covering the period from 1993 to 2004 was used to accomplish the task. The regression results revealed a significant and positive effect of Stock Market performance on economic growth in Ghana. This study, however, did not address the issue of causality nor consider the possibility of spurious regression due to the existence of one or more non-stationary time series as pointed out earlier in the problem statement. Thus, reducing the potential robustness of his findings.

Ayensu, Musah, Opare and Osafo (2012) also performed a similar study like Darkoh (2006). However, the authors employed annual time series data from 1993 to 2010. Market capitalisation ratio and GDP were the proxies for market performance and growth respectively. Yearly time series data from 1993 to 2010 was used in an Ordinary Least Square (OLS) regression analysis. Findings from the study suggests a very strong relationship between capital market development and economic growth. Since regression estimates are more accurate when the data points are large, the use of annual data in this study, resulted in only 18 data points, which may limit the potential robustness of the findings of the study.

Adusie (2014) found a different story from a cointegration and Granger causality test based on a Vector Error Correction model, using quarterly data from 2006 to 2013. The GSE All-Share Index and GDP at 2006 constant prices were the proxies for stock market and growth respectively. The results of the cointegration test showed a long-run relationship between the two variables. However, the regression outcome showed that the relationship between the variables is significantly negative. This means the Stock Market performance over the period studied, contributed negatively to Ghana's economy. The author concludes that stock market development does not promote economic growth in Ghana.

Ofori-Abebrese, Kamasa & Pickson (2016), also employed a sophisticated model, which is the Autoregressive Distributed Lag model (ARDL) to uncover the causal association and correlation between market capitalisation and economic growth in Ghana. The data earmarked for this study was annual data covering the period from 1991 to 2011. Using GDP as the proxy for growth, the authors found a positive relationship between market capitalisation ratio and GDP in the short-run but a

negative relationship between the two variables in the long-run. However, they did not witness any causal affiliation between the two variables.

Though the findings of Adusie (2014) and Ofori-Abebrese, Kamasa & Pickson (2016), agree on the negative long-run relationship between the Stock Market and economic growth, the papers, however, disagree on the causal link between the variables. Thus, more work needs to be done to unravel the exact causal link between the variables. Furthermore, such sophisticated models could also be employed to assess the impact of other stock exchange indicators such as total value traded and the turnover ratio on the economy. The data period could likewise be expanded to include data from 1991 and 2015, so as to generate more data points for a more accurate estimation. These are some of the things the current study will address in its analysis, to achieve the stated objectives.

Overview of the Ghana Stock Exchange

The Ghana Stock Exchange is the major stock market in Ghana, established in 1989. The Exchange began operating as a private company limited by guarantee in 1990 and later converted to a public company limited by guarantee in 1994. Regulated by the Securities and Exchange Commission (SEC), the Exchange seeks to *build resilient markets for a developing economy* (Ghana Stock Exchange, 2016). It currently controls three markets; Equity Market, Ghana Alternative Market and Fixed Income Market. It is also a member of the West African Capital Market Integration Council (WACMIC) and the World Federation of Exchanges (WFE).

In 2008, the Exchange embarked on a process of automation which was
completed in 2009. To enable the implementation of the Automated Trading System,
the Exchange created a Depository, the Ghana Stock Exchange Securities Depository
Company Ltd in 2008 to ensure fast and efficient supply and clearance system for
shares and corporate bonds on the Exchange.

The Securities Market has over the years raised a total of GHS 2.1 billion in
equity finance. Market capitalisation has also increased from GHS 3.05million in
1990 to GHS 57,116.87million in 2015, with an all-time high of GHS 64,352.42
million in 2014. At present, the capital market lists 40 companies and 42 equities.
The main market indices for the Ghana Stock Exchange are GSE-CI and GSE-FSI.
The GSE-CI is the major index of the Stock Market in Ghana and it includes all
ordinary shares listed on the exchange. The GSE-FSI on the other hand, comprises of
listed financial stocks only. The GSE-CI has gone up from 70.08 in 1990 to 1,994.91
in 2015, with an all-time high and all-time low of 10,431.64 in 2008 and 62.17 in
1992 respectively.

Challenges of the Exchange

In spite of its performance over the years, the Bourse still faces a number of
challenges which are likely to hinder the growth of the Exchange. In the process, it is
feared that the potential benefit of the Stock Market to the economy may not be fully
gleaned.

The first is the problem of low liquidity and high volatility. According to
Mensah (2016), the Exchange's liquidity is well below that of key African markets
like South Africa, Botswana, Nigeria and Kenya. This means it is relatively more

difficult and expensive to trade on the Ghana Stock Market. The second problem is

the limited number of listings. Though the Exchange's listing has increased from 11

equities to 42 equities over the 25 years of operations, this represents an average of

one new listing per year. There is also the problem of limited number of instruments

with equities being the major traded security on the Bourse. Finally, investor

participation in the Market is also very low.

In addition to the above challenges, is the government's quest to remove the capital

gains tax exemption, which initially served as an incentive for trading on the

Exchange. According to Agyare (2016), this decision by the government could derail

the Exchange's progress over the years by discouraging both investors and companies

from coming into the market.

Sectorial Distribution of Listed Companies

One objective of this study is to investigate the sectorial impact of the Capital

Market's performance on the economy. Thus, this sub-section briefly discusses the

sectors of the economy and their contribution to GDP. It also explains how companies

on the Exchange, were grouped under the sectors of the economy to derive their

performance on the Bourse based on their value traded in 2014 and 2015.

Ghana's economy is divided into three broad sectors; Agriculture, Industry

and Services. The agriculture sector, which used to be the largest contributor to GDP

has experienced a continuous decline in its contribution over the years, from 22.4% in

2013 to 19% in 2015. The service sector is currently the largest sector of the

economy, followed by the industry sector. The contribution of the service sector rose

from 49.8% in 2013 to 54.1 % 2015. That of the industry sector, however, has been

quite inconsistent over the last three years, as it declined from 27.8% in 2013 to

26.6% in 2014, and rose slightly to 26.9% in 2015 (PricewaterhouseCoopers, 2015).

To examine sector performance on the Ghana Stock Exchange, listed

companies were grouped under agriculture, services and industry. Companies on the

bourse are initially grouped under Finance, Insurance, ICT, Education, Food and

Beverages, Manufacturing, Mining, Exchange Traded Funds, Distribution,

Agriculture. However, for the purpose of our analysis, the service sector was made to

comprise of companies under Finance, Insurance, ICT, Education, Distribution and

Exchange Traded Funds. The industry sector also included companies under

Manufacturing, Food and Beverages and Mining. Lastly agriculture was linked to the

agriculture category of the Capital Market which consists of only one company.

Table 1

Sectorial distribution of total value traded in 2014 and 2015

Sectors	Total Value Traded in 2014 (GH₵)	Total Value Traded in 2015 (GH₵)
Agriculture	2,860,049.69	3,700,774.00
Industry	44,686,923.91	44,566,594.00
Services	298,416,815.17	199,369,255.00

Source: Market Report, by the Ghana Stock Exchange, 2015.

Table 1 indicates that, the service sector has the highest value of trade on the

Stock Market followed by industry and then, the agriculture sector. The low value of

trade of the agriculture sector can be attributed to the small number of agriculture-based companies on the Exchange, compared to the other two sectors. The industrial sector has the highest number of companies on the exchange yet, its value of trade is well below that of the service sector.

It seems the service sector stakes out a greater share of the Stock Market activities in relation to the other sectors, which may explain the sector's high contribution to GDP. The study will therefore conduct an empirical analysis to investigate whether the service sector is indeed the major beneficiary of the Capital Market activities relative to the other sectors.

Operational Definitions, Constructs and Concepts

Stock and Stock Exchange

Stock or shares, are a form of financial assets that represent part ownership in a company and thus allows the holder to make claims on part of the firm's assets and earnings (Eakins & Mishkin, 2009). The issue of stocks is another way, besides debt, by which firm's raise capital, and the market in which stocks are sold and bought is called a stock exchange, a capital market or a bourse.

Economic Growth

According to Todaro (1992), economic growth, can be defined as the gradual process through which the economy's ability to produce is enhanced over time such that national output and income begins to rise. Kuznet (1971) also defines economic growth as the significant and sustained rise in national output, population and real per

capita income. For the purpose of this study, economic growth is the rise in the Gross

Domestic Product of a state.

Market Capitalisation

A common indicator of a stock market size is its market capitalization. Stock

market capitalisation refers to the sum product of all shares listed on a stock exchange

and their corresponding market prices at a particular point in time (World Federation

of Exchanges, 2013). The amount usually represents the substantial worth of a Stock

Market at any given time. The higher a Stock Market capitalisation figure, in relation

to other Stock Markets, the larger the market is perceived to be and vice versa.

Human Capital

Human capital refers to the stock of knowledge and skills possessed by a

country's labour force, which is expected to increase their productivity. This is

usually perceived as some form of investment in labour through education and health

(Goldin, 2014). Most studies including Barro (1991) & Barro and Lee (1993) adopted

school enrolment rate as a measure of human capital. However, this study will adopt

life expectancy rate as a measure of human capital development. This measure is

employed in Chen, Lee, Chang & Chi-Feng (2016).

Technology

Technology, according to *the American Heritage Dictionary* (2010), is a

collection of ideas or knowledge, accessible to an entire community which is of use in

the creation of new things and improving existing ones. Romer (1989) also describes

technological change as the enhancement in the process of raw-materials mixing

which is a fundamental driver of growth. Technology as used in this study is a non-

rival and non-excludable public good available to society for the production of goods and services.

Labour

According to the WebFinance Inc. (2016) labour is defined as "the aggregate of all physical and mental effort, used in the production of goods and services". Many growth theories agree on the critical nature of labour in the production process. The larger the labour force, the more output is expected to increase.

CHAPTER 3: METHODOLOGY

Introduction

This chapter expounds on the research design and procedures utilized to accomplish the purpose of the study. The data, period and interval as well as the data collection procedure are discussed in this chapter. The chapter also addresses the method of data analysis and the statistical tools employed in the analyses.

Research Design

Based on the research hypothesis, the methodology of the study follows the process of a quantitative research design. Under quantitative research, the study adopts the correlational research approach to assess the relationship between the stock market variables and output increase. The correlational approach is used because it is the most appropriate method for determining statistical relationships between two variables, and it also allows for prediction. Accordingly, this approach is used to establish the relationship between the size of the Stock Market and economic growth whiles providing a model for predicting the variables.

Time series research design is employed in this study because, as detailed in Chapter Two, the time series is able to overcome the limitations of the cross-country analysis and it also provides detailed information on the market-growth nexus in a country (Quah, 1993; Arestis et al., 2001).

Data Sources

The research uses mainly secondary data collected from recognised financial and economic institutions. Three macroeconomic variables and one stock market variable were used. Data on total and sectorial GDP at current prices and inflation

rate, were obtained from the Ghana Statistical Service (GSS), and the Bank of

Ghana's statistical bulletins. Data on gross secondary school enrolment were obtained

from the World Bank database (WDI). Due to the integral nature of the stock market

data in this study, the market capitalisation amounts for the period were collated

directly from the Ghana Stock Exchange.

Data Period and Interval

The data period assigned to this research begins from 1990 to 2015. The

period was basically chosen as a result of the availability of data on all the variables in

the model. Moreover, due to the unavailability of quarterly data for most of the

variables, the study used annual data instead of quarterly data. This was to avoid the

problems associated with data disaggregation which could affect the statistical

inference ability of the regression result (Evans , 1995; Harris R. , 1997; Quah, 1993).

Data Analysis

The study adopts two estimation techniques which are, Vector Error

Correction (VEC) regression analysis and Granger causality test based on the VEC

approach. Owing to the inability of the OLS model to control for non-stationarity in

most economic and financial time series data, the VEC model is employed in here to

study the relationship between the capital market and economic growth because, it

accounts for unit root in time series. A time series is said to have a unit root or is non-

stationary if it tends to grow at a regular rate such that its mean is continually rising

over time (site). OLS regressions with non-stationary time series, could render the

results spurious by returning very high R^2s and t-ratios, whiles there exists no such

real relationship between the variables (Granger & Newbold, 1974). In such

situations, the OLS estimators are no longer BLUE (Best Linear Unbiased,

Estimates). As such other estimators that account for unit root in time series at level must be considered. Hence the decision to adopt the VECM in this work.

The multivariate Granger causality test on the other hand, is used to test the direction of causality between the variables. It is also used to find the economic sector which is most or least affected by the stock market activities. The concept of Granger causality was introduced by Professor Clive Granger in the 1960s and has since gained popular use especially in the neuroscience. The concept is based on prediction and it argues that, when a variable (x) is said to Granger cause another (y), then the past values of x should have information that can help to predict values of y better than the past values of y alone Causality is therefore inferred when current or past knowledge on a variable can be used to predict another variable better than past information on the second variable only.

A series of diagnostic tests are also performed to assess the validity of the model. These include, unit root test, normality test, heteroscedasticity test, serial correlation test, multi-collinearity test and Johansen Cointegration test.

The statistical tools used in carrying out these analyses and tests are Microsoft Excel and E-Views statistical software.

Analytical Model

In investigating the stock market and economic growth nexus in Ghana, the study augments the aggregate production function of the Romer endogenous growth model adopted in Levine and Zervos (1998) and Osinubi (200). The general specification of the model is,

$$Yt = f(\text{SMD}_t, \text{HUMAN}_t, \text{INFL}_t)$$

Yt represent Gross Domestic Product at current prices, SMD represent Stock Market Development measured by the size of the Exchange, HUMAN represents human capital development measured by the percentage of gross secondary school enrolment and *INFL* represents the inflation rate.

The reduced form of the model is stated as,

$$GDPt = \beta_0 + \beta_1 \text{MCR}_t + \beta_2 \text{GSSE}_t + \beta_3 \text{INFL}_t + \varepsilon_t$$

GDP is the dependent variable, MCR is market capitalisation ratio, GSSE is gross secondary school enrolment and INFL is Inflation rate. MCR, GSSE and INFL are the explanatory/independent variables, β_0 is the constant term, β_n is the coefficient of the independent variables, ε is the stochastic error term and t is the ith observation since the data is time serial.

Due to the huge values of the dependent variable compared to those of the other variables in the model, the dependent variable, which is GDP, is logged in order to standardise it. The reduced form log-level equation is stated below as;

$$LnGDPt = \beta_0 + \beta_1 \text{MCR}_t + \beta_2 \text{GSSE}_t + \beta_3 \text{INFL}_t + \varepsilon_t$$

Variable Justification

Cresswell (2014), defines a variable as the measurable attribute of an object which varies among the different observations of the object. Variables are distinguished by either their measurement or their temporal order usage. Temporal order refers to the idea that the occurrence of one variable precedes the other, as such a variable could be the effect or the cause of another. Under temporal order, variables are distinguished as independent, dependent, intervening, moderating and

confounding variables. For the purpose of our study, variables are distinguished as just dependent, independent and control variables.

Dependent Variable

A dependent variable is an outcome of a study or what is being affected in an experiment. The dependent variable in this study is economic growth, measured by the annual growth rate in Ghana's GDP at current prices. GDP refers to *the value of all goods and services domestically produced in a country at a given period of time* (Saleh, 1997). Studies that have employed GDP as a measure of economic growth include, Nyong (1997), Osei (2005) and Adusie (2014).

Independent Variables

Independent variables in a model are those that cause, influence or affect the outcome, which is the dependent variable. Independent variables in this study include market capitalisation to GDP ratio, gross secondary school enrolment and inflation rate. Market capitalisation to GDP ratio is the independent variable of concern, whereas the rest are control variables.

Independent Variable of Concern

Market capitalisation to GDP ratio measures the size of a stock market which is determined by expressing market capitalisation of the exchange in a particular period as a percentage of GDP in that same period. Previous studies like King and Levine (1993), Levine (1991) and Fry (1997), have shown that stock market size, as proxied in many studies by the market capitalisation to GDP ratio, exerts positive influence on the economy. Thus, our study expects this variable to have a positive relationship with the dependent variable which is GDP.

Control Variables

Control variables in a study are variables believed to affect the dependent variable and thus needs to be held constant in order to derive the ceteris paribus relationship between the independent and dependent variable. From the Romer endogenous growth model, the study adopts gross secondary school enrolment and inflation rate as control variables with expected influence on GDP. Growth studies that have adopted these variables as controls include Levine (1991), Levine & Zervos (1998), Caporale et al (2004), Nyong (1997) and Kagochi, Al Nasser, & Kebede, (2013).

Summary of Expected Signs

Table 2 below provides a summary of the expected sign for the independent variables as well as the empirics behind the chosen signs.

Table 2

Summary of Expected Signs

Independent variable	Empirics	Expected sign
MCR	King and Levine (1993),	+
GSSE	Barro (1991)	+
INFL	Fisher and Modigliani	+/-

Source: Field Data

Procedure

The analysis of the data is done following the steps below.

- A unit root test is first performed to test stationarity in time series followed by a selection of appropriate lag length for the models.

- Residual diagnostic tests are then performed to test the validity of the models.

- The next is a Johansen cointegration test to check for long-run relationships in the model.

- A VECM is estimated to show the short-run and long-run relationship between the variables.

- The Granger causality test is finally done to assess the direction of causality between the variables as well as indicate which sector(s) is/are affected by the stock market indicators.

CHAPTER 4: DATA ANALYSIS

Introduction

This section of the study presents the statistical and empirical analysis of the data. The statistical aspects of the analysis is done through the descriptive statistics of the data, whereas the empirical analysis captures the process of fitting and running the VEC model and well as the Granger causality tests for the direction of causality and sector impact. Results from the analysis is presented and extensively discussed, also in this chapter.

Descriptive Statistics

Descriptive statistics of the data on the variables is summarized below in Table 3.

Table 3.

Descriptive Statistics Summary of Data

	GDP	*MCR*	*GSSE*	*INFL*
Mean	26147646412	0.3860	0.46540	0.21046
Median	5751005609	0.34380	0.4171	0.167
Standard Deviation	38891665507	0.3156	0.1099	0.13608
Sample Variance	1.51256E+21	0.09964	0.0120	0.01851
Kurtosis	2.1955228	0.3969	-0.71192	6.23737
Skewness	1.729248807	0.86460	0.7102	2.2053
Minimum	203168630	0.011	0.3538	0.0858
Maximum	1.38748E+11	1.2219	0.71036	0.708
Observations	26	26	26	26

Source: Field data calculated through EViews

In all, there were twenty-six (26) observations. Comparing the gap between the means and medians of each variable's data, all the variables seem to have quite a

small gap between their means and medians except for GDP, which has a wider gap,

thus making it highly skewed to the right. This could be as a result of the highest GDP

of the period which was recorded in 2015. The standard deviation on the other hand

measures the dispersion or spread of the data about its mean. The results in Table 3,

show that the variables have quite spread out data. For example, the standard

deviation of MCR show that on average, the size of the Exchange deviates from its

mean by about 0.3176.

The minimum and the maximum values of each variable is also given in Table 3.

GDP was at an all-time low in 1990 and all-time high in 2015. The Stock Market was

at its lowest size (MCR) in 1990 and highest in 2004.

VECM Regression Analysis

The equation used in testing the hypothesis of the study as detailed in the

preceding chapter is states below as,

$$\mathrm{Ln}GDP = \beta_0 + \beta_1 \mathrm{MCR}_t + \beta_2 \mathrm{GSSE}_t + \beta_3 \mathrm{INFL}_t + \varepsilon_t$$

In fitting a VEC model for the equation, a number of tests need to be performed to

arrive at the right model for a more reliable estimate. The first test is the unit root test

which tests for the order of integration of all the variables in model. The second is the

lag selection test which is used to determine the appropriate lag period for the model.

The third is a residual diagnostic test for the suitability of the model, and the fourth

and final test is the Johansen cointegration test which is used to check for the long-run

relationships between the variables in the model.

Unit Root Test

One requirement of fitting a VEC model is that, all the variables or time series should be integrated of the same order. This means that, the time series must all be stationary at level (I(0)) or all at first differencing (I(1)). To find the order of integration of the time series in the model, a group unit root test was conducted at level and at first differencing using the Augmented Dickey Fuller (ADF) unit root test. The ADF is a hypothesis test with a null hypothesis of unit root in time series and an alternative hypothesis of no unit root in time series. The null hypothesis is rejected or accepted if the p-value of the test is less than or greater than 0.05 respectively. The results of the Augmented Dickey Fuller (ADF) unit root test for the equation is summarised below in Table 4.1.

Table 4.1

Results of Augmented Dickey Fuller Unit Root Test

	Level	First Differencing
ADF Chi-square	0.8296	0.0000

Source: Field data calculated through EViews

The test shows that at level, the null hypothesis of unit root in the variables is accepted. This means that at level, the time series in the model are not integrated of the same order. However, at first differencing, we reject the null hypothesis of unit root in time series and accept the alternative of no unit root in time series. This means that, all the variables in the model become stationary at first differencing. Thus, we conclude that all the variables are integrated of the same order which is I (1), at first differencing.

Selecting a Lag Length for the Models

An appropriate lag length is selected for the model by performing a lag length

criteria test in EViews. Results of the test is presented below in Table 4.2.

Table 4.2

Lag Length Selection for the Equation

Lag	LogL	LR	FPE	AIC	SC	HQ
0	22.02093	NA	2.45e-06	-1.567037	-1.369560	-1.517372
1	111.9321	140.7306	4.08e-09	-7.994100	-7.006713*	-7.745775
2	133.6291	26.41370*	2.88e-09*	-8.489488*	-6.712193	-8.042504*
3	142.9047	8.065744	7.92e-09	-7.904759	-5.337554	-7.259114

* indicates lag order selected by the criterion

From Table 4.2 above, the appropriate lag length under each criterion is

indicated by "*" which is attached to the lag number. The Table shows that the

appropriate lag length for the equation, as indicated by the Akaike (AIC) and Hannan-

Quinn (HQ) information criterion is two (2). Thus, in fitting the VEC model, the

independent variables in the equation will be lagged by a period of two years.

Multicollinearity Test

Multicollinearity occurs when there is a very high correlation between two or

more independent variables such that, they provide redundant or misleading

information about the response. One way of detecting multicollinearity is to compute

correlations between all pairs of the independent variables. If a pair of variables is

found to have a high correlation of close to 1 or -1 (usually 0.9 0r -0.9), there is said

to be a multicollinearity problem in the model. Thus, one or both variables ought to be

dropped out of the model. Tables 4.3 show the correlation results for model.

Table 4.3

Correlation Analysis for Market Size Equation

Correlation	GSSE	INF	MCR
GSSE	1.000000		
INF	-0.456332	1.000000	
MCR	0.576110	-0.324253	1.000000

From the table above (Table 4.3), none of the correlations are close to 1 or -1 thus there exist no such multicollinearity problem in the model. Consequently, all the variables in the model can be retained for subsequent analysis.

Residual Diagnostic Test

Assumptions of the VECM include having normally distributed residuals which are not serially correlated and are homoscedastic. Residuals analysis helps to detect any deviations from the model's assumptions and detect the fitness of the model. Three residuals diagnostic test are performed; normality test, serial correlation test and heteroscedasticity test.

Normality Test

To be able to make inference from a regression analysis, the residuals of the model are expected to be normally distributed. Normality in residuals can be tested by plotting a histogram of the residuals or by performing the Jarque-Bera (JB) normality test. When using the histogram approach, normality is inferred when the histogram gives a bell shape. On the other hand, the JB test is a hypothesis test in which the null hypothesis of normally distributed residuals is accepted when the p-value of the test is less than 0.05. Figure 1, shows both the histogram and JB test for the equation.
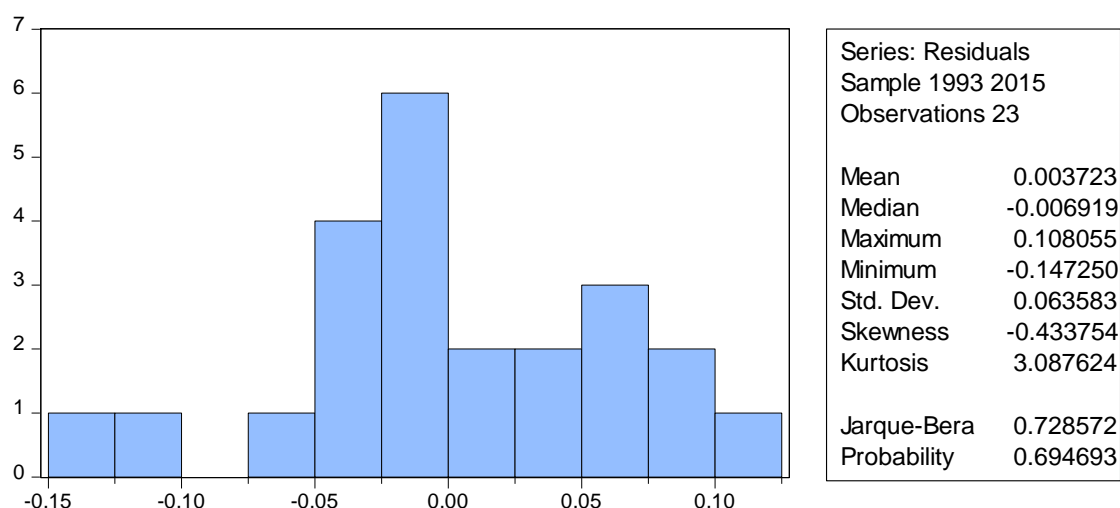
Figure 1.1. Residuals Normality Test Results

Source: *Field Data calculated through EViews*

The probability of the Jarque-Bera normality test in Figure 1 is greater than the significant level which is 0.05, thus we accept the null hypothesis of residuals being multivariate normal. Moreover, the histogram of the residuals also exhibits a bell shape figure, showing that the residuals are normally distributed.

Serial Correlation Test

The serial correlation test is one of the residuals diagnostic test used to check the relationship between the error term and itself over the various time interval. The null hypothesis of test states that, there is no serial correlation in the residuals and it is rejected when the p-value of the test is less than the 0.05 significant level.

Table 4.4

Results of the Serial Correlation Test

Lags	LM-Stat	Prob
1	10.30399	0.8503
2	14.13045	0.5890
3	16.80828	0.3981
4	13.01518	0.6716

Source: Field data

The results of the serial correlation test for the equation is provided in Table 4.4 above. Since the probability of the LM-Statistics is greater than 0.05, we accept the null hypothesis of no serial correlation in the residuals. This means that there is no relationship between the residuals and itself in the model.

Heteroscedasticity Test

When the variance of the error term is unequal across the different values of the independent variables, the model is said to exhibit heteroscedasticity or non-constant variance. When the variance of the error term is non-constant, it makes it difficult to generate an unbiased estimator of the *ceteris paribus* effect of a particular explanatory variable on the dependent variable. To check for this problem in the model, the Breusch-Pagan-Godfrey test was performed in EViews, with a null hypothesis of no heteroscedasticity in model which is reject at a p-value of less than 0.05. The result of the test is shown below in Table 4.5.

Table 4.5

Residuals Heteroscedasticity Test for Market Size Equation

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.426944	Prob. F(12,10)	0.9177
Obs*R-squared	7.791709	Prob. Chi-Square(12)	0.8012
Scaled explained SS	2.863579	Prob. Chi-Square(12)	0.9964

From the table above, the p-value of the test, indicated by the Prob. Chi-Square of the Obs*R-square, is greater than 0.05. Thus, we accept the null hypothesis of no heteroscedasticity in the model. This means that, the error term in the equation has a constant variance across all values of the independent variables.

Johansen Cointegration Test

The Johansen cointegration test is a test for long-run relationship between variables in a model. The purpose of the cointegrating test to estimate all cointegrating vectors when there is a multivariate model. Two tests statistics, are reported in a Johansen cointegration test, one is the Trace test value and the second is the Max Eigen test value. At 0.05 significant level, the null hypothesis of r = n, is rejected when the p-value is less than 0.05, where r is cointegrating vector(s) and n is the number of cointegrating vectors. Table 4.6 provides a summary results of the test.

Table 4.6

Results of the Johansen Cointegration Test

H0	H1	Trace Value	Prob.	Max Eigenvalue	Prob.
r=0	r=1	163.831	0.0000	83.45859	0.0000
r=1	r=2	0.730799	0.1217	31.49511	0.2588
r=2	r=3	48.87733	0.2380	28.34208	0.5033

Source: Field data

The results in the table above shows that at 0.05 significant level, there is only one cointegrating relationship in the model according to both the Trace and the Max Eigen tests. Since there is at least one cointegrating relationship in each equation, it means there is a long-run relationship between the variables. Thus, we can go ahead to estimate a VEC model to assess the long-run and short run relationship between the variables.

The Regression Output

A Vector Error Correction (VEC) model is a restricted model intended for use with time variant variables which are cointegrated. The design of the VEC is such that, it has a built in cointegrating relations that allows it to control the long-run behaviour of the endogenous variables by causing them to assemble at their cointegrating points while permitting for short-run adjustment dynamics (EViews, 2016). The results of the VEC regression for the model is provided below. Statistics of the VEC regression is first provided in Table 5.1.

Table 5.1

Regression Statistics for the Equation

R-squared	0.622292
Adj. R-squared	0.406459
Sum sq. resids	0.089260
S.E. equation	0.079848
F-statistic	2.883212

The overall significance of the models is tested by comparing the F-statistic in the table to the critical value at 0.05 significant level which is 1.96. The F-statistic is generated from a hypothesis test that the coefficients of all independent variables in a regression are zero. The null hypothesis is accepted when the F-statistic is less than the critical value and rejected when the F-statistic is greater than the critical value (1.96). Since the F-statistic (2.888) is greater than the critical value (1.96), we reject the null hypothesis that all of the regression coefficients in each model are zero. This means that, there is a significant relationship between the dependent variable and the independent variables in the equation.

The predictive power of the model is also tested using the R-squared and the adjusted R-squared. The R-squared statistic measures the success of the regression in predicting the values of the dependent variable within the sample. The statistic will be one, if the regression fits perfectly. However, one problem with using the R-squared as a measure of goodness of fit is that, it does not control for irrelevant explanatory variables in a model. As more independent variables are added in a regression model, the closer the R-squared gets to one, even though the added variables may be irrelevant to the explanatory power of the model. Therefore, the adjusted R-squared is a better measure of goodness of fit because it accounts for the addition of unimportant regressors. Thus, the adjusted R-squared is always less than the R-squared.

From Table 5.1, the adjusted R-squared indicates that the independent variables in the model explains about 41% of the changes in the dependent variable. The low figures (less than 0.5) of the adjusted R-square indicates that, the model does not account for other relevant explanatory variables which might have been included in the error term of the equation. Consequently, the predictive power of the models is restricted to about 41%.

Aside the unavailability of data on some of the explanatory variables, Darkoh (2006), explains why the predictive power of a GDP and stock market regression model, may be reduced. According to the author, the informal sector of Ghana which forms the largest section of the economy is usually not captured in the model due to the model's absolute reliance of the formal sector of the economy. Moreover, the informal sector is not reflected either in the activities of the stock market. Therefore, the power of the stock market to predict changes in the growth of the economy is relegated to a small

margin. Hence the relatively low nature of the adjusted R-square statistic in a GDP-

stock market regression.

The Short-Run Regression Model

The short run relationship between the variables in the equation is presented in

Table 5.2 below.

Table 5.2

Short Run Regression Output for Market Size Equation

Dependent Variable: DLnGDP

Variables	Coefficients	p-value
ECT-1	-0.03300	0.0339
DMCR(-2)	0.511932	0.0001
DGSSE(-2)	1.971644	0.1565
DINFL(-2)	0.078846	0.5896

Source: *Field data calculated through EViews*

The "D" attached to the variables in the table above, means the variables are in

first differencing, and (-2) is the lag period of two years for the explanatory variables

in the model. The term ECT-1 is the error correction term which is also known as the

cointegration term. It is called the error correction term because, it is the deviations

from the long-run equilibrium, generated through series of partial short-run

adjustments. Its presence indicates the existence of a long-run relationship in the

model.

For the model to be appropriate, the coefficient of the error correction term

must be negative. This is because negative indicates a movement towards equilibrium

which is desirable, and positive means a movement away from equilibrium which is

undesirable. The coefficient must also be between 0 and -1, 0 indicating no

adjustment whiles 1 indicates full adjustment, and it must also be significant at 0.05 significant level (Brooks, 2008). From the table above, the coefficient of 0.033 means that the speed at which disequilibrium in the short-term is corrected in the long-run is about 3.3% which is quite low. However, the coefficient of the Error Correction Term satisfies all the above requirements therefore the results of the VEC regression is valid for decision making.

If the coefficients and the intercept of the regression output in Table 4.2 are inserted into the model, the short-run relationship between the size of the market and economic growth is generated as,

$ln\text{DGDP}_t = -0.033 + 0.5119\text{DMCR}_{t-1} + 1.9716\text{DGSSE}_{t-2} + 0.078846\text{DINFL}_{t-1}$

The result of the regression shows that, in the short-run, market capitalisation has a positive and significant relationship with GDP. This means that an increase in the size of the Stock Market, will result in an increase in the growth of GDP. This meets the expectation of the priori sign in Table 2 and the coefficients of the variables indicate that at *ceteris paribus,* a unit increase or decrease in the change in market capitalisation ratio (DMCR) results in a 51% (0.15*100) increase or decrease, in the change in annual GDP (DGDP). From this result, we reject the null hypothesis of no short run relationship between the size of the Exchange and economic growth, and accept the alternative hypothesis that, there exist a short-run relationship between the size of the Capital Market and economic growth in Ghana.

Considering certain assertions that have been made concerning the performance of the Exchange, the positive contribution of the Stock Market to economic growth in the short-run as witnessed here is expected. For example, in 2016, the Stock Market was asserted to have returned, on a compounded basis, a rate

of 199% to investors from January 1995 to December 2014 which was higher than the return on 91-day treasury bills of 126% (Government of Ghana, 2016). With this, the income to individual investors, corporate entities and the Exchange itself, are expected to positively reflect in the economy through production and consumption. Given, a return on the stock exchange, income to investors will increase which will allow them to consume more thus, forcing producers to increase production. A high return on investment is also expected to attract more investments and increase available capital to listed firms which goes into expanding production. Consequently, the Exchange is expected to positively contribute to economic growth in the short-run.

This finding is consistent with that of Ayensu, et al. (2012) and Darko (2006). Although both studies employed OLS in their analysis, the authors also found a positive and significant relationship between market capitalisation and GDP in the short-run. Nonetheless Adusie (2014) rather found a negative and significant relationship between market capitalisation and GDP in the short-run employing VEC regression analysis.

The result also shows that gross secondary school enrolment, as expected, exerts a positive influence on GDP but the effect is insignificant in short-run. This may mean that, impact of an increase in secondary school enrolment is felt on economic growth after some time, which could be ascribed to the learning period before human capital is developed. Through the new growth theory mechanism, the study of Ofori-Abebrese et al. (2016) also found an insignificant relationship between secondary school enrolment and GDP but contrary to the finding here, the relationship was negative in that study.

Inflation rate is also shown, from the table to be positively related to GDP, such that a unit increase in the change in inflation will result in a 7.9% (0.0788*100) increase in the change in annual GDP. This meets our expectation in Table 2 even though the relationship is insignificant in the short-run. The insignificance of inflation to GDP in the long-run was confirmed by Ofori-Abebrese et al. (2016) and the positive relationship is contrary to findings of Fisher & Modigliani (1978).

Long Run Regression Results

The long-run relationship for the equation is presented below in Table 5.3.

Table 5.3

Long Run Regression Output for the Market Size Equation

Dependent Variable: DlnGDP

Variables	Coefficients	t-statistic	Critical value
Constant	18.5312	4.2498	1.96
DMCR (-1)	-5.3894	1.51816	1.96
DGSSE (-1)	15.20858	1.9800	1.96
DINFL (-1)	-16.7812	3.7138	1.96

Source: *Field data calculated through EViews*

Inserting the coefficient into the model, the long-run relationship between market capitalisation ratio and GDP is stated as:

$ln\text{DGDP}_t = 18.5312 - 5.3894\ \text{DMCR}_{t-1} + 15.20858\text{DGSSE}_{t-1} - 16.7812\text{DINFL}_{t-1}$

Since the t-statistics of DMCR (-1), is less than the critical value (1.96), we accept the null hypothesis of no relationship between the market capitalisation ratio and GDP. Contrary to our expectation, the model indicates that, there is a negative but

insignificant long-run relationship between market capitalisation ratio (MCR) and GDP at 0.05 significant level. From the coefficient of the variable, at *ceteris paribus*, a unit increase or decrease in the change in market capitalisation ratio (DMCR) results in a 539% (5.39*100) increase or decrease, in the change in annual GDP (DGDP), which is nonetheless insignificant. Thus, we reject the alternative hypothesis of a long-run relationship between the variables and accept the null hypothesis of no long-run relationship between the size of the Exchange and economic growth.

The insignificance of market capitalisation to GDP in the long-run shows that, the Stock Market in Ghana contributes to growth only in the short-run but unable to enhance growth in the long-run. This could be attributed to several factors. First of all, the nature of the Ghanaian economy is such that, the informal sector is the major driving force behind growth in this economy. However, activities of the informal sector are excluded from the Exchange, thus, relegating the impact of the Exchange on economic growth to be insignificant in the long-run.

Also, the insignificance of the Exchange's contribution to economic growth in the long-run could be as a result of the inability of the developments on the Stock Market to create new wealth through growth (Ofori-Abebrese et al. (2016). In addition to that Singh (1997) attributes this situation to the unwillingness of managers of the Exchange to undertake long-term investments, especially, since they are judged by the performance of the company's financial assets. Thus, they prefer short term investments over long-term investments. Consequently, the stock market undervalues long-term investment and are, therefore, unable to contribute to long-term growth in the economy.

It can therefore be deduced that the benefits of stock market development have been short-term rather than long-term growth of the economy in Ghana. This finding is confirmed by that of studies like Ofori-Abebrese et al. (2016) but disagrees with those of studies like Adusie (2014) who found a negative and significant effect of the GSE All-share index on economic growth in the long-run.

The model also shows that in the long-run gross secondary school enrolment exerts a positive and significant effect on GDP. This is in line with our expectations as the learning process turns to prolong the effect of increase in gross secondary school on economic growth. Thus, making the impact felt only in the long-run.

Inflation rate was, however, found to negatively affect GDP in the long-run at a significant rate. This means that, increase in the inflation rate hurts economic growth in the long-run which quite expected due to the adverse effect of inflation on production and consumption. Inflation increases cost of production thus raising prices of goods which reduces demand and consequently shrinks production as well.

Granger Causality Test

In establishing the effect of the stock market activities on economic growth in Ghana, we apply the Granger causality test to determine the direction of causality between the size of the Stock Market and GDP. However, to control for the effect of other explanatory variables, the multivariate Granger causality test is based on the VECM approach is employed. The result of the test is summarised in Table 6 below.

Table 6

VECM Short-Run Granger Causality Results

Null hypothesis	P-values	Lag
D(GDP)does not Granger cause D(MCR)	0.4898	2
D(MCR) does not Granger cause D(GDP)	0.0000	2
D(GDP) does not Granger cause D(GSSE)	0.2951	2
D(GSSE) does not Granger cause D(GDP)	0.2914	2
D(GDP) does not Granger cause D(INFL)	0.0057	2
D(INFL) does not Granger cause D(GDP)	0.3545	2

Source: Field data calculated through EViews

The Granger causality test is a hypothesis test with a null hypothesis of no granger causality between the variables. The null hypothesis of the test is rejected at a p-value less than 0.05 significant level. The result of the Granger causality test above indicates that, market capitalisation ratio (MCR) Granger causes GDP but GDP does not Granger cause MCR. This means that there is a unidirectional causality between the size of the Exchange and economic growth running from stock market size to economic growth. There is however no granger causality between gross secondary school enrolment (GSSE), and GDP. On the other hand, there is a causal relationship between inflation rate (INFL) and GDP, running from GDP to inflation rate (INFL).

In summary, the Granger causality shows that, there is a unidirectional causality between market capitalisation ratio and GDP, running from stock market development to economic growth. This result is in line with that of Osei (2005) and Dziwornu et al.

(2013), who both found a unidirectional causality between the variables, running from market capitalisation ratio to economic growth. However, while studies like Ofori-Abebrese et al. (2016) have found no causal relationship between the size of the Exchange and economic growth, findings of studies like Nyong (1997) who found a bi-directional causality between market capitalisation and GDP in Nigeria.

The Stock Market and Economic Sectors

After establishing the relationship between the Stock Market and economic growth, the effect of the Exchange's performance on the individual sectors of the economy is also examined using a VECM Granger causality test. GDP contributions of the three sectors, services, industry and agriculture were collected from the Ghana Statistical Service (GSS) for this purpose. The table below gives a summary result of the test.

Table 7

Granger Causality Test between Stock Market and Sectors of the Economy

Null Hypothesis	p-value	Lags
MCR does not Granger cause IND	0.9137	2
IND does not Granger cause MCR	0.0585	2
MCR does not Granger cause AG	0.4427	2
AG does not Granger cause MCR	0.9961	2
MCR does not Granger cause SR	0.0000	2
SR does not Granger cause MCR	0.1267	2

Source: Field data calculated through EViews

In relation to the table above, MCR is the annual market capitalisation ratio, IND is annual GDP from industry, AG is annual GDP from agriculture and SR is annual GDP from services. The result of the test shows that, the null hypotheses of no Granger causality between market capitalisation ratio (MCR) and industry (IND) are accepted. This means that, there is no causal effect between the size of the Stock Market and growth in the industry sector of Ghana. Similar, we accept the null hypotheses of no Granger causality between the market capitalisation ratio (MCR) and the agriculture sector (AG). This also suggests that the size of the Stock Market has no causal effect on the performance of agriculture sector in Ghana. However, the null hypotheses of no causal direction between the market capitalisation ratio (MCR) and service sector GDP (SR), are rejected. This implies that the size of the Stock Market has a causal effect on the growth of the service sector in Ghana.

In summary, the Granger causality test between the market capitalisation ratio and the sectors of the economy revealed that, the service sector is most affected by the performance of the Exchange with the other two sectors being least affected. This finding was expected because, as was shown in Table 1 under literature review, it seemed the most traded stocks on the Exchange are those of the service-based companies, even though the number of service-based companies on the Exchange is only second to that of the industry-based companies. This means that majority of the capital allocation on the Exchange is channelled into the service sector of the economy which explains why this sector receives the highest impact from the Exchange compared to the others.

One is also likely to expect agriculture to be unaffected due to the less involvement of agriculture-based companies on the Exchange. There is currently only

one company under this section which is the Benso Oil Palm Plantation (BOPP) Ltd.

However, for the Exchange's impact on this sector to be felt, the number of

agriculture-based companies on the Exchange must be increased and actively

engaged, in order to allow capital flow into this sector for the sector's development.

The government's plan to establish a commodity market, the Ghana Commodities

Exchange, could help foster a wide-scale promotion of agriculture by making it easier

for local agricultural firms to raise capital for production. In the end, this could

strengthen the link between the Capital Market and the agriculture sector of the

country, as the effect of the former on the latter will begin to be significant.

Limitations

One major limitation of this study is the number of data points. The author

could only get annual data from 1990 to 2015 for all the variables in the model. This

resulted in only twenty-six data points and with parameters set at four inclusive of the

constant term, the degrees of freedom became twenty-two which was quite small.

Therefore, a larger data points could have given a better estimate.

Also, other relevant variables affecting GDP according to the Romer model,

such as technology and labour, and other variables affecting GDP in Ghana such as

FDI and Trade openness, were not captured in the model due to data unavailability

and multicollinearity issues.

CHAPTER 5: CONCLUSION

Introduction

The concluding chapter of this study, presents a summary of the findings, followed by conclusions drawn from the study. Recommendations are also given in this chapter as well as directions for future studies.

Summary of Findings

The research sort to find the impact of the performance of the Ghana Stock Exchange on economic growth. The objectives of the study were, therefore, to finding the short-run and long run relationship between the variables, examine the direction of causality between them and also identify the sectors of the economy that most affected and those that are least affected by the performance of the Exchange. The hypothesis developed was;

H_0: The size of the Capital Market does not contribute to economic growth in Ghana.

H_1: The size of the Capital Market contributes to economic growth in Ghana.

Findings from the Johansen cointegration test showed that there exists a long-run relationship between the Stock Market and economic growth. From the VEC regression analysis, the relationship between the variables was found to be significant and positive in the short-run but insignificant and negative in the long-run.

The short-run VECM Granger causality also found a unidirectional causality between the size of the market and economic growth, running from stock market development to economic growth. Breaking down the impact of the Exchange on the three sectors of the economy, the service sector was found to be the most affected sector with agriculture and industry being the least affected sectors.

Conclusions

The evidence that, the capital market affects economic growth have been examined through the VEC model, employing market capitalisation as a measure of stock market performance. The crux of this study maintains that, there exist such a positive relationship between the Ghana Stock Exchange and economic growth in the short run but no significant relationship between the variables in the long-run. However, the service sector receives the most impact from the Exchange's performance.

Recommendation

Despite the insignificant of the Exchange's performance to economic growth in the long-run, the Stock Market has shown to contribute to economic growth in the short-run. This means that with the right measures in place, the impact of the Exchange could be made significant also in the long-run. Efforts such as increasing the number of companies on Exchange could improve liquidity and raise the size of the market through the capitalisation ratio. The government could also use other forms of tax incentives to attract more investors on the Exchange. In addition to that, an attempt by the government to reduce interest rates on treasury bills and governments bonds, could also attract investors who are looking for higher returns, on to Exchange. Lastly, the establishment of the commodities market must be taken seriously because, it will improve access to capital in the agriculture sector and also help to capture some of the informal activities in the economy unto Exchange. Consequently, the impact of the Exchange's performance on agriculture and the economy at large will improve.

Directions for Future Studies

Future studies on the Ghana Stock Exchange and economic growth could employ quarterly data instead of annual data to generate larger data points and examine how the relationship observed here will differ. Other stock market indicators, such as, turnover ratio, total value traded and number of new listing could also be considered in future studies. Five or ten years after the establishment of the Ghana Commodity Market, future studies could assess the impact of the Market on the agricultural sector, to investigate if there has been any impact on this sector. Finally, the entire study could be replicated in five years' time, with the aim of assessing any improvement in the contributions of the Exchange to the economy.

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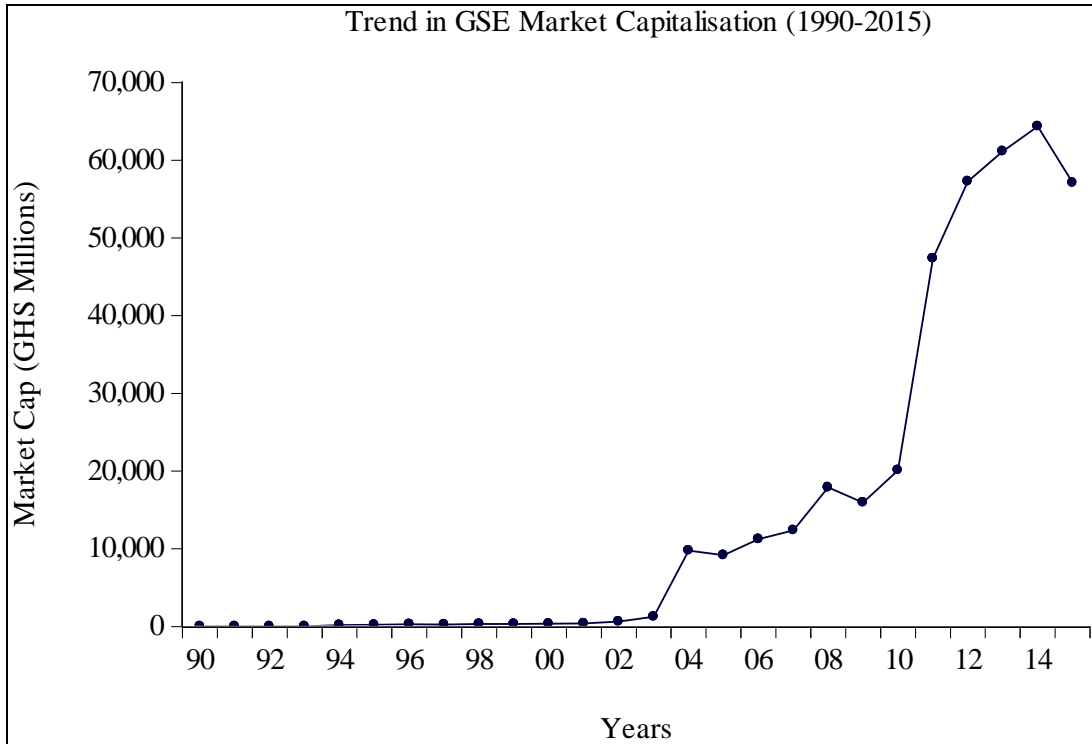Harris, R. (1997). Stock Markets and Development: A Re-assessment. *European Economic Review, 41*, 139-46.

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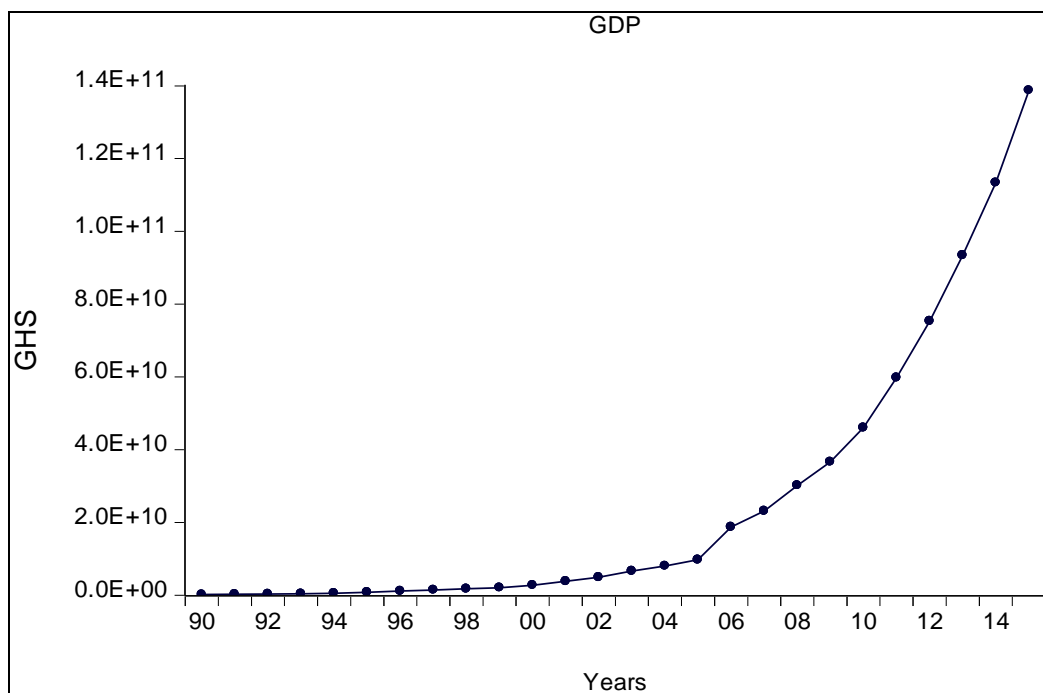
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Appendix

A

Trend in GSE Market Capitalisation (1990-2015)

C

GDP

C

Group Unit Root Test

Unit Root Test at Level

Group unit root test: Summary
Series: LNGDP, GSSE, INF, MCR
Date: 04/17/17   Time: 16:02
Sample: 1990 2015
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.47512	0.6827	4	96
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	2.58816	0.9952	4	96
ADF - Fisher Chi-square	4.29452	0.8296	4	96
PP - Fisher Chi-square	11.2028	0.1905	4	100

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

Unit Root Test at 1st Differencing (C, Cont'd)

Group unit root test: Summary
Series: LNGDP, GSSE, INF, MCR
Date: 04/17/17   Time: 16:06
Sample: 1990 2015
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 3
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.98674	0.0000	4	93
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-6.80454	0.0000	4	93
ADF - Fisher Chi-square	53.7622	0.0000	4	93
PP - Fisher Chi-square	66.9734	0.0000	4	96

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

D

Cointegration Test for Market Size Equation

Date: 04/17/17   Time: 17:52
Sample (adjusted): 1992 2015
Included observations: 24 after adjustments
Trend assumption: No deterministic trend (restricted constant)
Series: LNGDP GSSE INFL MCR
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.886079	83.51796	54.07904	0.0000
At most 1	0.498906	31.38399	35.19275	0.1217
At most 2	0.294660	14.80090	20.26184	0.2380
At most 3	0.234808	6.423081	9.164546	0.1605

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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.886079	52.13397	28.58808	0.0000
At most 1	0.498906	16.58309	22.29962	0.2588
At most 2	0.294660	8.377816	15.89210	0.5033
At most 3	0.234808	6.423081	9.164546	0.1605

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

E

VECM Regression Result for Market Liquidity Equation

Short-Run Regression Results

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.033002	0.014033	-2.351702	0.0339
C(2)	0.596945	0.159499	3.742635	0.0022
C(3)	0.608261	0.153479	3.963149	0.0014
C(4)	0.140916	0.083365	1.690337	0.1131
C(5)	0.511932	0.089802	5.700663	0.0001
C(6)	-0.312671	1.177267	-0.265590	0.7944
C(7)	1.971644	1.316611	1.497514	0.1565
C(8)	0.357451	0.156547	2.283346	0.0385
C(9)	0.078846	0.142827	0.552038	0.5896

R-squared	0.622292	Mean dependent var	0.266683
Adjusted R-squared	0.406459	S.D. dependent var	0.103643
S.E. of regression	0.079848	Akaike info criterion	-1.931216
Sum squared resid	0.089260	Schwarz criterion	-1.486892
Log likelihood	31.20898	Hannan-Quinn criter.	-1.819469
Durbin-Watson stat	2.225076		

Long-Run Regression Results

Cointegrating Eq:	CointEq1
LNGDP(-1)	1.000000
MCR(-1)	5.389366 (3.54992) [1.51816]
GSSE(-1)	-15.20858 (7.68100) [-1.98003]
INFL(-1)	16.78182 (4.51953) [3.71318]
C	-18.53120 (4.36039) [-4.24989]

F

VECM Granger Causality Test

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 04/17/17   Time: 23:01
Sample: 1990 2015
Included observations: 23

Dependent variable: D(LNGDP)

Excluded	Chi-sq	df	Prob.
D(MCR)	33.01240	2	0.0000
D(GSSE)	2.466352	2	0.2914
D(INFL)	5.749057	2	0.0564
All	41.27064	6	0.0000

Dependent variable: D(MCR)

Excluded	Chi-sq	df	Prob.
D(LNGDP)	1.427606	2	0.4898
D(GSSE)	1.311961	2	0.5189
D(INFL)	2.233512	2	0.3273
All	3.681060	6	0.7197

Dependent variable: D(GSSE)

Excluded	Chi-sq	df	Prob.
D(LNGDP)	2.440858	2	0.2951
D(MCR)	0.099764	2	0.9513
D(INFL)	1.063220	2	0.5877
All	5.409142	6	0.4925

Dependent variable: D(INFL)

Excluded	Chi-sq	df	Prob.
D(LNGDP)	10.32672	2	0.0057
D(MCR)	9.285767	2	0.0096
D(GSSE)	4.216580	2	0.1214
All	17.79034	6	0.0068

G

VECM Granger Test for GSE Market Cap and Economic Sectors

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 04/02/17 Time: 17:32
Sample: 1990 2015
Included observations: 23

Dependent variable: D(LNAG)

Excluded	Chi-sq	df	Prob.
D(MCR)	0.258679	1	0.6110
All	0.258679	1	0.6110

Dependent variable: D(MCR)

Excluded	Chi-sq	df	Prob.
D(LNAG)	0.004997	1	0.9436
All	0.004997	1	0.9436

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 04/02/17 Time: 17:34
Sample: 1990 2015
Included observations: 23

Dependent variable: D(LNSR)

Excluded	Chi-sq	df	Prob.
D(MCR)	20.51609	1	0.0000
All	20.51609	1	0.0000

Dependent variable: D(MCR)

Excluded	Chi-sq	df	Prob.
D(LNSR)	0.031116	1	0.8600
All	0.031116	1	0.8600

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 04/02/17 Time: 17:33
Sample: 1990 2015
Included observations: 23

Dependent variable: D(LNID)

Excluded	Chi-sq	df	Prob.
D(MCR)	0.069373	1	0.7923
All	0.069373	1	0.7923

Dependent variable: D(MCR)

Excluded	Chi-sq	df	Prob.
D(LNID)	0.994321	1	0.3187
All	0.994321	1	0.3187