LINKS BETWEEN STOCK MARKET DEVELOPMENT AND KEY ECONOMIC GROWTH VARIABLES: THE CASE OF SELECTED AFRICAN COUNTRIES

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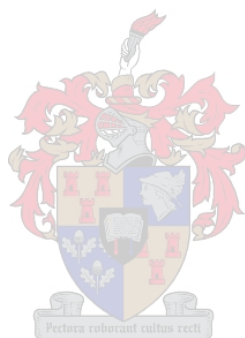
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March 2007

DECLARATION

I, the undersigned, hereby declare that the work contained in this dissertation is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.

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ABSTRACT

This thesis is a collection of eight essays on links between stock market development and economic growth in selected African countries. In the first essay an overall index of stock market development shows that South Africa, Mauritius, Zimbabwe, Morocco and the BRVM in Cote d'Ivoire have the most developed stock markets in terms of market size, liquidity and transactions cost indicators. However, Nigeria and Egypt also emerge when institutional development is considered. Ghana, Malawi and Namibia have the least developed stock markets. Results from the second essay on stock markets and growth show a positive relationship between stock market development and economic growth. This positive influence is significant for countries classified as upper-middle-income economies. On the basis of market capitalization groupings, stock market developments play a significant role in growth only for moderately capitalized markets.

Form the third essay exchange rate depreciation in the long-run leads to increases in stock market returns in Tunisia. Exchange rate movement leads to stock market returns in Egypt, while stock market returns lead to exchange rate movement in Kenya and Mauritius. Shocks induced by either stock market returns or exchange rate changes are more protracted in Ghana, Kenya, Mauritius and Nigeria than in South Africa and Egypt. Cointegration analysis in the fourth essay reveals a negative relationship between inflation and stock market prices for three out of seven countries: Egypt, Mauritius and South Africa. Short-run models for these countries show a negative response of stock returns to instantaneous change in inflation. In Ghana, Kenya, Nigeria and Tunisia, where cointegration is absent, there is unidirectional causality from inflation to stock returns for Ghana, bidirectional causality between inflation and stock returns for Kenya, and no significant results for Nigeria and Tunisia.

Results from the fifth essay show that investment in the selected countries grows significantly with an increase in stock market returns. Even without the inclusion of South Africa in the panel, stock market returns in the other relatively less developed African economies impact positively on investment growth. Cointegration tests from the sixth essay indicate a long-run relationship between interest rate and stock prices for Kenya and South Africa. In the short-run there is unidirectional causality from stock

returns to interest rate in Kenya and bidirectional causality in South Africa. Responses to shocks have long-lasting effects in Egypt, Ghana, Nigeria and Tunisia and are short-lived in Mauritius.

The seventh essay shows that countries with more developed stock markets (Cote d'Ivoire, South Africa, Mauritius, Tunisia and Morocco), have the most developed financial intermediation system. There is evidence from correlation analysis of complementarity between stock market development and bank developments in the selected countries. Finally from the eighth essay two long-run stable cointegration relations are found, one hinging on a larger market (South Africa) and the other on a smaller market (Ghana). The short-run error correction framework shows significant feedback and causal effects both ways from smaller to larger markets.
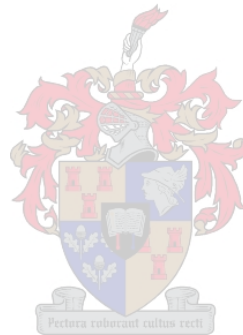
OPSOMMING

Hierdie tesis bestaan uit 'n versameling van agt essays oor verwantskappe tussen aandelemarkontwikkling en ekonomiese groei in geselekteerde Afrika-lande. In die eerste essay toon 'n algehele indeks van aandelemarkontwikkeling aan dat Suid-Afrika, Mauritius, Zimbabwe, Marokko en die BRVM in die Ivoorkus die mees ontwikkelde aandelemarkte het wat grootte, likiditeit en transaksiekoste-aanwysers betref. Nigerië en Egipte kom egter ook te voorskyn wanneer institusionele ontwikkeling in ag geneem word. Ghana, Malawi en Namibië se aandelemarkte is die minste ontwikkel. Die resultate van die tweede essay oor aandelemarkte en groei toon 'n positiewe verwantskap tussen aandelemarkontwikkeling en ekonomiese groei. Hierdie positiewe invloed is beduidend vir lande wat as hoër-middelinkomste ekonomieë geklassifiseer word. Aandelemarkontwikkelings speel op grond van markkapitalisasiegroeperinge net in matig gekapitaliseerde markte 'n beduidende rol in groei.

In die derde essay word aangetoon dat wisselkoersdepresiasie op lang termyn tot 'n toename in aandelemarkopbrengste in Tunisië gelei het. Wisselkoersbeweging lei tot aandelemarkopbrengste in Egipte terwyl aandelemarkopbrengste tot wisselkoersbeweging in Kenia en Mauritius lei. Skokke wat deur aandelemarkopbrengste of wisselkoersveranderings veroorsaak word, is meer langdurig in Ghana, Kenia, Mauritius en Nigerië as in Suid-Afrika en Egipte. In die vierde essay bring koïntegrasie 'n negatiewe verwantskap tussen inflasie en aandelemarkpryse aan die lig vir drie van die sewe lande: Egipte, Mauritius en Suid-Afrika. Korttermynmodelle vir hierdie lande dui op 'n negatiewe respons van aandelemarkte op 'n oombliklike verandering in inflasie. In Ghana, Kenia, Nigerië en Tunisië, waar koïntegrasie afwesig is, is daar 'n eenrigting oorsaaklikheid van inflasie na aandele-opbrengste vir Ghana, 'n tweerigting oorsaaklikheid tussen inflasie en aandele-opbrengste vir Kenia, en geen beduidende resultate vir Nigerië en Tunisië nie.

Die resultate in die vyfde essay toon aan dat belegging in die geselekteerde lande beduidend groei met 'n toename in aandelemarkopbrengste. Selfs sonder om Suid-Afrika by die paneel in te sluit, het aandelemarkopbrengste in ander betreklik minder ontwikkelde Afrika-ekonomieë 'n positiewe uitwerking op ekonomiese groei gehad. Die koïntegrasietoetse van die sesde essay dui op 'n langtermynverwantskap tussen

rentekoerse en aandelepryse in Kenia en Suid-Afrika. Daar is op kort termyn 'n eenrigting oorsaaklikheid van aandele-opbrengste na rentekoerse in Kenia, en tweerigting oorsaaklikheid in Suid-Afrika. Response op skokke het 'n langdurige uitwerking in Egipte, Ghana, Nigerië en Tunisië, maar is van korte duur in Mauritius.

Die sewende essay toon aan dat lande met meer ontwikkelde aandelemarkte (Ivoorkus, Suid-Afrika, Mauritius, Tunisië en Marokko) die mees ontwikkelde finansiële bemiddelingstelsel het. Korrelasieontleding in die geselekteerde lande toon bewyse van van komplementariteit tussen aandelemarkontwikkeling en bankontwikkeling. Laastens is daar in die agste essay twee langtermyn stabiele koïntegrasieverhoudings gevind – een wat van 'n groter mark (Suid-Afrika) afhang en een wat van 'n kleiner mark (Ghana) afhang. Die korttermyn-foutkorreksieraamwerk toon beduidende terugvoer en kousale uitwerkings in albei rigtings van kleiner tot groter markte.

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CHAPTER ONE

INTRODUCTION

The importance of finance in economic growth and development has been advanced following the works of Schumpeter (1932), Bagehot (1962), Cameron, Patrick and Tilly (1967), Goldsmith (1969) and McKinnon (1973). Financial sector growth helps mobilize savings necessary for the production process, thereby providing the channel for supplying much-needed finance for economic growth. Financial intermediation helps mobilize domestic and international savings for investment activities by firms. An increase in investment results in increased economic activity and economic growth. Financial intermediaries consist of banks, non-bank financial institutions (NBFIs) and capital markets.

From the literature, three main channels through which financial development influences economic growth has been identified by King and Levine (1993) and Levine and Zervos (1998). These are the level of intermediation, efficiency and composition. The level of intermediation is frequently measured by the size of bank credit to GDP, stock market capitalization ratio, efficiency is measured by private sector credit to GDP ratio, total value of shares traded on the stock market to GDP ratio, turnover ratio, legal and institutional development and composition by maturity of bank credit as a ratio of fixed income securities.

Traditionally the role of finance in economic growth has been centred on bank-based systems. However the increasing importance of non-bank financial institutions and capital markets in financial intermediation has generated a lot of research into the role of different perspectives of financial structure in economic activity. Firm productivity has been increased through greater capital acquisitions on stock markets and this has translated into higher productivity for economies globally. More specifically, the impact of stock market development on economic activity globally has resulted in heightened interest in the role of stock market activity in economic activity.

1.1 Development of African Stock Markets

Most African countries have undertaken wide financial sector reforms to deregulate hitherto repressed systems and more importantly to develop and strengthen NBFIs and capital markets. The main motivation behind these reforms has been the desire to deepen financial intermediation through NBFIs and stock markets to reap higher economic growth. Indeed the emergence of stock markets in developing economies is also indicative of the belief in a link between stock market development and economic growth. The development and growth of stock markets in emerging economies has therefore been rapid in recent times, especially in Africa. Africa has been noted to have developed an equity market within a short period of time. From thirteen stock markets by end of 1992 Sub-Saharan Africa (SSA) bourses had increased to nineteen by 2004.

The nineteen existing stock markets in Africa are namely, The Botswana Stock Exchange, The Ghana Stock Exchange, The Cairo and Alexandria Stock Exchange (Egypt), the Douala Stock Exchange (Cameroun), The BRVM-Bourse Régionale des Valeurs Mobilières-The West African Regional Bourse (Cote d'Ivoire) and comprising of eight French speaking West African countries[1], Nairobi Stock Exchange (Kenya), Namibian Stock Exchange, The Stock Exchange Mauritius, Casablanca Stock Exchange (Morocco), Maputo Stock Exchange (Mozambique), Johannesburg Stock Exchange (South Africa), Khartoum Stock Exchange (Sudan), Swaziland Exchange, Tanzanian Stock Exchange, Tunis Stock Exchange (Tunisia), Uganda Stock Exchange, Lusaka Stock Exchange (Zambia) and Zimbabwe Exchange.

Though most African stock markets are relatively young and started operating in the 1990s, there are a couple of markets which have been in existence for longer periods. The Johannesburg Stock Exchange began operations in 1886, Cairo and Alexandra Exchange in 1888, and Casablanca Stock Exchange in 1929. Others are the Nairobi Stock Exchange (1954), Nigeria Stock Exchange (1960) and the Tunis Stock Exchange (1969). The youngest stock exchange in Africa is the Douala Stock Exchange (2003)

These African stock markets, with the exception of South Africa, doubled and in some cases more than doubled their capitalization in between the 1992-2002 periods (S&P

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[1] Benin, Burkina Faso, Cote d'Ivoire, Guinea Bissau, Mali, Niger Senegal and Togo

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Emerging Markets Handbook). Total market capitalization for Africa (1992-2002) also more than doubled from US$113,423 million to US$ 244,672 million. Significantly African stock markets have also been performing remarkably and yielding substantial returns in investment. The Ghana Stock Exchange was adjudged as the world's best-performing market at end of the first quarter 2004; with a year return of 144% in US dollar terms compared to 30% return by Morgan Stanley Capital International Global Index, 26% Standard & Poor in US, and 32% in Europe, amongst others (Databank Group 2004). Within the continent itself five other bourses; Uganda, Kenya, Egypt, Mauritius and Nigeria apart from Ghana, were amongst the best performers in the year. Zimbabwe was, however, the worst performer, with an abysmal return of -84%.

The rapidity of African bourse development is quite evident. Plausible reasons for these developments lie in the importance of stock markets in economic development. Stock markets are known to help in capital allocation and corporate monitoring, and they provide for market-based rather than direct fiscal and monetary policies for governments (Pardy, 1992). Even in less-developed countries capital markets are able to mobilize domestic savings and to allocate funds more efficiently.

Significantly the leading stock market performers have had good growth and economic growth and development, thus indicating a highly plausible causal link between stock market development and growth. In Africa studies have been conducted variously largely to test for market efficiency and the development of stock markets (Bundoo, 2000; Osei, 2002; Mlambo, Biekpe and Smit, 2003). There is need as well for an in-depth study of the African situation to ascertain the role that stock markets play in economic growth and development, and to guide and shape policy on market development where necessary.

1.2 Linking Stock Market Development Channels to Economic Growth
Stock market development affects economic activity through two main channels, historical evolution, infrastructure and management and market activity. Historical evolution and infrastructural developments comprise of the fundamentals underlying the development of the market, maturity of the market, trading facilities, operations and logistics and the role of the market.

Market activity refers to the trading activities and provision of liquidity, hence deals with trends in the stock prices, market index and market returns movement, market capitalization and market turnover. This thesis dwells mainly on the linkages between stock market activity and economic growth variables in African countries. In this regard the thesis focuses on the link between business cycle models, mainly the link between stock market cycles and economic growth cycles. It also attempts to examine and compare some of the infrastructural and trading facilities development of these markets as well. The essence is to capture the linkages between business cycle models within stock market and economic growth cycles.

For the purpose of this study fourteen[2] African countries out of the total of the nineteen countries with existing stock markets are chosen. The chosen sample was due to availability of reliable data especially on stock market development. Furthermore some of the markets are relatively young with very few data points e.g. Douala stock Exchange in Cameroun established in 2003, and Maputo Stock Exchange in Mozambique established in 1999. The main stock market activity variables of interest for this study are stock market returns, stock market capitalization ratio, value of traded shares to GDP ratio and the turnover ratio.

With respect to the economic growth variables, investment, interest rate, exchange rate, inflation, the ratio of liquid liabilities to GDP, the ratio of private credit by deposit money banks to GDP, the ratio of deposit money banks' assets to GDP and GDP growth are considered for the study. These variables are identified based on literature and the theoretical linkages with stock markets discussed in details in each chapter.

As indicated earlier the thrust of the study is to examine the linkage and effect of stock market development on economic growth. A total of eight essays are written to study African stock markets and determine their linkages with economic growth variables. The analysis for six of the essays is done in either of two main ways; dynamic time series modelling and dynamic panel data modelling where necessary. The effect of stock

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[2] Botswana, Egypt, Cote d'Ivoire Ghana, Kenya, Namibia, Nigeria, Mauritius, Morocco, South Africa, Swaziland, Tunisia, Zambia and Zimbabwe

market development on economic growth and investment are analysed via dynamic panel data modelling for the fourteen chosen countries.

The link between stock market returns and interest rate, exchange rate, and inflation are examined via vector error correction modelling (VECM). Similarly the dynamic causal links between African stock markets is also done within a VECM. However here the sample of countries is further reduced from fourteen to seven[3] countries due mainly to the availability of high frequency data on stock market prices. For the remaining two essays, the link between stock market development and banking intermediation is done via correlations and the comparison of the level of development amongst African stock markets is done via the construction of an overall index of stock market development.

1.3 Motivation

Stock markets are noted to influence growth and development in a number of diverse ways due to market liquidity and the ability to mobilize resources for projects and long-term investment. An upsurge in stock market activity positively influences economic growth by encouraging savings, boosting investment activities, and allocating and utilizing resources in a more efficient manner. There are divergent views, however, as to whether stock markets really play a pivotal role in economic growth. Stiglitz (1985, 1994) is of the view that stock market development may hurt economic growth.

By allowing investors to sell their stocks easily, monitoring of firms for good corporate performance is loose and may result in poor firm management and hamper firm growth. Stock market development can also affect and be affected by economic growth variables. Inflation, exchange rates and interest rates are key macroeconomic variables which are noted to influence stock market activity. At the same time these key variables could also be influenced significantly by stock market activity. Clearly there is a channel through which stock market activity is linked to economic growth. However, the nature and direction of linkage between stock market development and economic growth variables remain a largely empirical issue, with little evidence on the African situation.

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[3] Egypt, Ghana, Kenya, Nigeria, Mauritius, South Africa, Tunisia

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Stock markets activities nevertheless continue to flourish and Africa has not been left out of this burgeoning phenomenon. It is, however, imperative to conduct more empirical studies to ascertain the relationship between stock market development and economic growth variables in Africa. African economies in particular have been in dire need of growth-augmenting factors to spur growth and development in a speedy manner.

If stock market developments spur growth and if economic variables influence stock market activity significantly, then it will be prudent to put in place policies to introduce synergy between stock market activity and economic policy. The evidence could further provide an impetus to help develop African stock markets to become efficient so as to reap the highly desired economic benefits.

1.4 Research Objectives

This thesis therefore investigates the links between stock market development and economic growth variables in Africa. The links between stock market development and economic growth hinges of various strands of literature and also demand variegated empirical and methodological approaches therefore the investigation is carried out via a collection of eight essays based on some overall broad objectives. The overall broad objectives are to:
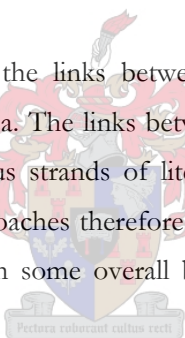
1. Determine if stock markets in Africa play a causal role in economic growth;
2. Determine the relationship between stock market returns and investment growth;
3. Conduct detailed time series studies on the causal dynamics between stock market returns and selected macroeconomic growth variables;
4. Document stylized facts on African stock markets and rank African stock markets based on an index of stock market development;
5. Document stylized facts on the nature of the development between African stock markets and financial intermediation;
6. Examine the level of dynamic causal linkages between African stock markets.

1.5 Research Questions

Following from the research objectives outlined above eight research questions are formulated and enumerated as follows:

1. Do stock market activities influence economic growth positively in African countries?
2. Does stock market activity have a positive relationship with investment growth in African countries
3. Is there a dynamic relationship between stock market returns and exchange rate movement?
4. Is there a dynamic relationship between stock market returns and interest rate movement?
5. How do African stock markets respond to inflation movement in the short and long-run?
6. Are there comparable or relative differences in the development of African stock markets
7. What is the relationship between stock market development and banking development in Africa? Is it one of substitutability or complementarity?
8. Are there dynamic long and short-run causal linkages between African stock markets?
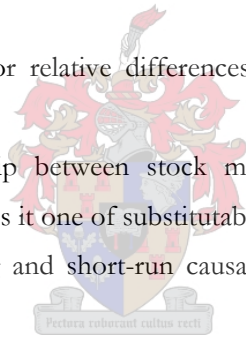
1.6 Rationale for each Essay

The eight essays are written out of the research questions. For each essay there are specific motivations and theoretical underpinnings for studying the hypothesized relationships underlying the research questions. Therefore in the case of the role of stock markets in economic growth, it is expected that generally stock markets promote economic growth through a series of channels; the provision of finance for firm investment, the injection of liquidity, the creation of wealth and the mobilization of savings. An increase in investment and savings creates further source of credit and finance for economic activity. Similarly the creation of wealth increases aggregate demand for goods and services. The combined effects of increased wealth, investment and savings add up to increase GDP. Therefore stock market activity should positively cause economic growth.

Again stock markets influence exchange rates through liquidity and wealth effect. For instance a reduction in stock prices reduces wealth of investors, and liquidity in the economy and consequently dampens interest rates. This creates an environment favouring capital outflows causing exchange rate depreciation. Exchange rate movement can also influence stock market returns due to a shift of investors away from domestic assets (stocks) to foreign assets in the event of exchange rate depreciation.

From the exchange rate link highlighted above it is clear that stock market returns are influenced by interest rates, with the reverse also holding. Thus there is the debate whether interest rates can be used to stabilize stock price bubbles; however the volatile nature of stock prices also makes it difficult to use interest rates as stabilizers. From these two relationships it is important that analysts and policy makers understand the empirical dynamics between stock market returns and interest rate as well as stock market returns and exchange rate movements.

It is also argued that since stocks are a hedge against inflation, stock market returns should have a one-to-one positive relationship with inflation. However empirical results, which have largely yielded a negative relationship, have challenged this hypothesis. Three main theoretical explanations have been offered to back the negative relations between stock market returns and inflation; the Tax Effect, The Proxy Effect and the Reverse Causality Effect.

The Tax Effect argues from the dampening effect that inflation has on real after tax earnings, whilst the Proxy and the Reverse Causality Effects argue mainly across the lines of the relationship between real economic activity, stock market returns and inflation. In this regard since real economic activity is positively related to stock market activity but negatively related to inflation, stock market returns will also be negatively related to inflation. This effect is investigated for the selected group of African countries to determine whether there is a one-to-one relationship between stock returns and inflation, and to determine the direction of the relationship.

Stock prices are also noted to have a positive correlation with investment activity. As stock prices increase, the book to market value of firms appreciates and consequently the marginal product of capital of these firms increase. This results in increased ability of

firms to undertake higher investment projects, thus increasing the firm investment. Total investment in the economy therefore is likely to increase. In this regard the possibility of a positive effect of stock prices on investment is analysed for the selected African countries.

Another important issue investigated is the relationship between stock market development and banking sector development. Whilst stock market development is noted as part of overall financial sector development as discussed earlier and hence complements other financial sector intermediaries, there is an opposing view to this. There are arguments pointing to the fact that stock market development can hamper banking sector development by substituting bank finance with stock finance. Thus developments in stock markets will correlate negatively with developments in the banking sector.

Nonetheless there are arguments in favour of a complementarity role between stock market financing and bank financing. Basically financing, it is argued is in the form of equity and debt, going for one form of financing does not necessarily entail a substitution process. Given that financial intermediation in Africa has largely been bank based over a long period (with the exception of countries like South Africa and Egypt) the study therefore examines whether current developments in stock markets across the African continent correlate negatively with banking sector development. Thus the study examines stock market development and financial intermediation in Africa.

The study also documents stylized facts about stock market development in the selected African countries. The essence is to measure the level of development of each market using a composite index and to compare the development of the markets across countries. In this regard the countries are ranked according to the magnitude of the indexes computed. This particular essay seeks to contextualise African stock markets in terms of their regulations, operations, trading facilities and market activity. Finally the study examines if there are dynamic causal linkages between African stock markets. Essentially apart from a few countries, African countries are largely similar in their economic characteristics.

Furthermore African countries have similar structural endowments which in the long run will result in structural co movement in economic activity. In this sense, stock market activities in African countries are likely to move together in the same direction in the long-run. To determine if this is plausible cointegration analysis is carried out amongst selected African countries to determine if there is a long-run movement between the stock prices and to determine the nature of the movement. In addition dynamic short-run possible causal effects are investigated to ascertain if temporary movements in any of the stock markets have temporary effects on others.

1.7 Organization

The thesis is organized into ten chapters, eight of which are essays on the thesis topic. Chapter One provides the introduction to the study, Chapter Two is the first essay on stock market development in Africa. Chapter Three is an essay on stock market development and economic growth in Africa and Chapter Four an essay on stock market returns and exchange rate dynamics in selected African countries. An essay on the response of African stock markets to inflation movement constitutes Chapter Five.

The sixth chapter examines stock markets and investment growth in Africa, whilst Chapter Seven is a study on interest rates and stock market returns in Africa. Chapter Eight is on stock market development and financial intermediation in Africa, and Chapter Nine is an essay on cointegration and dynamic causal linkages amongst African stock markets and Chapter Ten draws conclusions and recommendations from the essays. In terms of tables and figures, these are included in the main text of chapters where these are minimal. However in cases (for instance Chapters four, five and seven) where there are lots of such tables and figures most and in some cases are all shifted to the appendix to enhance a smooth flow in reading.

CHAPTER TWO

STOCK MARKET DEVELOPMENT IN AFRICA: SOME STYLIZED FACTS

2.1 Introduction

Africa's development and economic growth in the past two decades has been seen to be an improvement on that of the late 1970s and the 1980s. GDP growth (with the exception of current trends in Zimbabwe and Cote d'Ivoire) has been largely positive and in most cases averaged 3% and above (Table 2.1). Investment formation has been generally modest at, at least 10% of GDP with some countries (Botswana, Namibia, Ghana, Mauritius and Tunisia), achieving more than 20% of GDP. Trade intensity has also improved, whilst inflation and exchange rate management have generally been commendable. Thus the 1990s appear to have been characterized by modest growth and general improvements in the economies of most African countries.

Incidentally, the 1990s also witnessed policy moves by a number of African economies towards the establishment of stock markets. Prior to this period, stock markets existed only in Egypt, South Africa, Tunisia, Kenya, Zimbabwe and Nigeria. The early to mid-1990s therefore witnessed rapid growth in the number of stock markets in Africa. Thus the financial structure of African economies is now characterized by not only money markets, but also capital markets. There are currently over 18 stock markets in Africa.

Though most of these markets are young, less developed, inactive, small and fraught with institutional and infrastructural bottlenecks; they have survived such problems and performed remarkably well. For instance, the Botswana and Ghana stock exchanges have in recent times been judged as amongst the best-performing markets globally in terms of high market returns. The benefits from stock market activity are numerous and include capital acquisition, savings and investment growth, amongst others. Indeed most African governments are reforming their domestic financial regulations to attract foreign portfolios for enhanced investment through stock markets. Thus African stock markets may just represent the final frontier of global capital.

However, with the exception of the Johannesburg Stock Exchange of South Africa, relatively little is known about the degree of development of most African stock markets. It is important to know how other African markets are also faring and compare the level of development across these markets. There is a host of stock market development indicators, yet there has been hardly any systematic effort at documenting stylized facts about African stock markets. The aim of this paper is to highlight and put into perspective the level of development amongst African stock markets within a simple framework. In addition, a composite stock market development index is computed and African stock markets are ranked based on this index. Specifically the paper seeks to test the hypothesis that apart from the Johannesburg Stock Exchange in South Africa other African stock markets also have comparative levels of development.

The rest of this chapter is structured as follows: the next section compares African stock markets using various stock market indicators and the computed composite index. The third and final section draws conclusions on the findings.

Table 2-1 Selected Macroeconomic Indicators

	GDP	GDP growth	Invest	Exports	Imports	TII	Infl	Exch
Egypt								
1995-1998	64912.25	4.93	17.93	13705.50	17240.50	46.16	7.93	3.39
1999-2002	78856.50	4.47	17.58	15040.25	17957.50	39.14	2.69	3.84
Ghana								
1995-1998	6904.75	4.40	21.91	2089.63	3146.48	73.91	37.13	1800.48
1999-2002	8168.20	4.20	22.37	2708.90	3817.85	101.32	21.33	5806.98
South Africa								
1995-1998	158382.50	2.71	16.41	38399.00	36688.00	47.78	7.88	4.52
1999-2002	174440.00	2.83	15.02	44595.00	38218.25	56.36	6.35	8.05
Mauritius								
1995-1998	4150.13	5.28	25.78	2485.75	2697.18	126.48	6.56	20.10
1999-2002	5113.48	5.10	24.02	3045.45	3326.40	126.82	5.80	27.63
Nigeria								
1995-1998	29552.75	2.84	18.01	13822.50	12974.75	79.09	30.16	21.89
1999-2002	32383.25	1.83	20.83	12585.25	18108.75	82.68	11.28	106.46
Kenya								
1995-1998	9464.9	3.06	16.05	2792.5	3557.33	65.68	7.13	56.91
1999-2002	9969.1	0.82	14.25	3020.3	3670.33	59.37	5.86	75.95
Tunisia								
1995-1998	19705.5	4.90	24.24	8488.78	9075.55	89.65	4.19	1.04
1999-2002	24032	4.32	25.82	10719.65	11490.25	92.99	2.58	1.35
Cote d'Ivoire								
1995-1998	12125.25	6.33	12.78	4904.55	3888.15	74.17	6.37	546.08
1999-2002	13047.50	-0.59	11.60	5557.43	3582.38	74.10	2.66	689.43
Namibia								
1995-1998	3694.3	3.70	22.09	1742.45	2263.2	105.84	8.25	4.52
1999-2002	4201.78	2.96	21.57	1776.83	2592.08	98.64	9.63	8.05
Zambia								
1995-1998	3702.3	1.39	12.89	1463.25	1384.8	69.33	31.72	1312.16
1999-2002	4090	3.50	16.99	1837.53	1424.13	62.75	24.11	3377.08
Zimbabwe								
1995-1998	7827.15	4.02	19.56	3034.18	3252.7	81.78	23.65	13.61
1999-2002	7501.75	-4.90	10.98	3249.7	3164.4	59.43	82.79	48.20
Botswana								
1995-1998	5227.23	5.72	25.67	2700.9	2209.68	93.74	8.99	3.49
1999-2002	6581.23	5.32	23.57	3236.7	2585.38	93.56	7.74	5.47

GDP, Exports and Imports are in constant US$ 1995 prices. Investment is measured by Gross Capital Formation/GDP. Exchange rate is local currency unit per US$ (period average). TII: Trade intensity index= [exports + imports]/GDP SOURCE: World Development Indicators 2004.

2.2 Comparing African Stock Markets

Fourteen countries have been chosen for this study[4] and they have been selected on the basis of available and consistent data on stock market indicators. The data were obtained over the period 1995-2002 from the World Development Indicators 2004. A variety of indicators (see Demirguc-Kunt and Levine, 1996) have been found to signify stock market development. Notable amongst these indicators is the market capitalization ratio, which measures the stock market size (measured frequently as the ratio of value listed shares to GDP), liquidity (the ratio of total value traded to GDP), turnover ratio, which improves the allocation of capital and investment, thus influencing growth as well as reveal transaction costs, and concentration ratio to ascertain the degree of dominance of one or a group of firms.

Other indicators include volatility, which reveals further the information usage and asset pricing to ascertain the degree of efficiency in the pricing of stocks based on the asset pricing theory. The last but not the least of indicators is the regulatory and institutional indicators. Following Pagano (1993), institutional infrastructure is defined to deal with the operational mechanism, intermediaries for trading, transactions, clearance and settlement, accounting, auditing, investment management and information services, the existence of a Securities and Exchange Commission, and restrictions on dividend repatriation, amongst others. The effectiveness of this type of infrastructure is crucial in maintaining speedy trading and robust stock market existence.

These indicators define the level of maturity and developments of stock markets. There is substantial literature on the importance of these indicators (Devereux and Smith, 1994; Obstfeld, 1994; Levine 1991; Bencivenga, Smith and Starr, 1996; Pagano, 1993; and Demirguc-Kunt and Maksimovic, 1996). For the purpose of this study, the indicators used are market capitalization ratio, defined as the value of listed shares to GDP, the total value of shares trade to GDP, the turnover ratio, defined as the total value of shares traded divided by market capitalization, institutional and regulatory developments, and volatility, defined as the generated conditional variance from an Autoregressive Conditional Heteroskedastic (ARCH) model of monthly stock market indices.

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[4] Botswana, Egypt, Cote d'Ivoire, Ghana, Kenya, Morocco, Mauritius, Namibia, Nigeria, Swaziland, Tunisia, South Africa, Zambia, Zimbabwe.

Market capitalization ratio measures the size of a stock market; the larger the size the larger the market capitalization ratio and the greater the potential to mobilize capital. Total value of shares traded to GDP ratio is a measure of stock market liquidity, or the ease with which stocks are traded on the market. The turnover ratio, another liquidity indicator, is also a measure of transactions cost, where a high turnover implies lower transactions cost. These 3 measures complement each other, and it is important to note that a large stock market might not necessarily be liquid.

High volatility is an indicator of a developed stock market. However, this is wholly true only in the case of well-functioning markets, where volatility is implied from the revealed information Bekaert and Harvey (1995). A case for such well-functioning markets cannot be made for Africa. Thus following Demirguc-Kunt and Levine (1996), "less volatility" is associated with "greater stock market development". The institutional development indicators examine regulatory and trading structures to determine if these are investor enhancing.

Table 2.2 shows the computed mean values for market capitalization ratio, the total value of shares trade to GDP, the turnover ratio, and the average number of listed for the selected countries. The mean market capitalization ratio (23%), value of shares traded to GDP (3.4%) and turnover ratios (12%) show that on the whole stock markets in Africa are small, illiquid and not very active. Across the countries the mean market capitalization ratio shows that the top five stock markets in terms of size are South Africa (142%), Mauritius (28%), Zimbabwe (24%), Morocco (21%) and BRVM in Cote d'Ivoire (16%). Clearly South Africa stands out as a dominant market. The bottom three stock markets by market capitalization ratio are Namibia (8.5%), Egypt (8.4%) and Nigeria (6%). In terms of liquidity (value of shares traded to GDP), the most liquid stock markets are South Africa (28%), Mauritius (6%), BRVM in Cote d'Ivoire (5%), Zimbabwe (4%), and Tunisia (1.4%).

Though the markets in Mauritius, Zimbabwe, and Morocco are bigger than the BRVM, the BRVM is more liquid. Similarly, Tunisia may be a small market, but it is relatively liquid. With respect to stock market activity and transactions cost (measured here by turnover ratio), the top five markets are Zimbabwe (33%), BRVM (26%), Swaziland

(24%), South Africa (20%) and Tunisia (11%). Thus it appears trading costs in Zimbabwe, BRVM and Swaziland are lower than in South Africa. In addition Egypt (910), South Africa (605), Nigeria (189), Zimbabwe (68) and Kenya (57) had the largest average number of listed companies on their stock markets. Institutional developments in the selected markets are shown in Table 2.3. In all, eleven indicators (existence of a market regulator, a governing law, nature of clearing and settlement, settlement cycle, existence of an international custodian, foreign participation, exchange control, nature of trading systems, existence of a central depository, number of trading days, and accounting and auditing reporting system) are considered and a composite index developed from the 11 indicators.

The following indicators are judged by assigning a value of 0 or 1. A value of 0 is assigned separately and to each country, if there is no market regulator, no governing law, no international custodian, restriction on foreign participation, no central depository and if the accounting and auditing reporting system is structured not according to the International Accounting and Auditing System, and a 1 is assigned, if otherwise. In the case of the clearing and settlement and trading systems, a value of 0 is assigned each if the system is manual, and 1 if electronic.

With respect to the settlement cycle, a value of 0 is assigned if this is greater than T+5, a value of 1 is assigned if the settlement cycle is T+4 or T+5, and a value of 2 is assigned if the system is T+3. Finally, in the case of the number of trading days a value of 0 is assigned if there are fewer than three trading days per week; a value of 1 is assigned for three to four trading days and a value of 2 for five trading days. The overall institutional development index is a simple average of the assigned values. A limitation of this approach is the use of equal weighting for all institutional indicators. It would be desirable to allocate weights to different institutional indicators due to their differences in the level of importance. However this is not done since it would be difficult to justify the relative importance of some indicators over others and empirically allocate such weights.

The index (denoted as Av. Score in the 13th column of Table 2.3) shows that Nigeria, Mauritius, South Africa, Morocco and Mauritius had a very high level of institutional development. In contrast, institutional development was very low in Algeria, Zimbabwe,

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Ghana, Malawi and Namibia. This was mainly due to manual processes, longer settlement cycles and lack of central depositaries. Finally, volatility as computed using an ARCH[5] process varies across the countries (Table 2.4), with Mauritius recording the lowest volatility (0.001), whilst Zimbabwe recorded the highest volatility (0.035).

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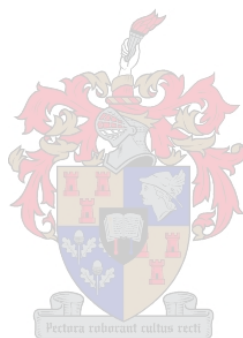
[5] $y_t = \delta + \sum_{i=1}^{p} \rho_i y_{t-i} + u_t$ $y_t =$ log difference of stock market indices.

$u_t = \varepsilon_t \left(\alpha_0 + \sum_{i=1}^{q} \alpha_i u^2_{t-i} \right)^{1/2}$ $u_t =$ conditional variance

$\varepsilon_t \sim$ IID(0,1) Lag lengths chosen vary across countries and are based on Schwartz and Akaike Information criterion. Graphical representations of the conditional variances from the ARCH series are plotted in Figure 1.

Table 2-2 Selected Stock Market Indicators

	Value of shares traded		Value of listed shares		Market capitalization		Turnover ratio		Value of shares traded/GDP		Av. No. [a] of listed firms	
	Value	R	Value	R	Value	R	Value	R	Value	R	Value	R
Botswana	34.176	10	425.754	11	0.090	10	0.089	7	0.007	8	14	11
Egypt	26.529	12	1033.4	8	0.084	12	0.023	14	0.002	13	910	1
Cote d'Ivoire	3008.7	2	10205.7	2	0.157	5	0.256	2	0.046	2	36	9
Ghana	27.309	11	903.088	9	0.129	8	0.048	12	0.004	11	22	10
Kenya	39.989	9	1068.29	7	0.137	6	0.036	13	0.005	9	57	5
Morocco	261.35	4	4742.10	3	0.205	4	0.097	6	0.012	7	55	6
Mauritius	42.123	8	709.648	10	0.280	2	0.060	9	0.016	5	39	7
Namibia	18.336	13	288.911	12	0.085	11	0.065	10	0.005	10	13	12
Nigeria	84.920	6	1589.77	6	0.055	14	0.048	11	0.003	12	189	3
Swaziland	52.387	7	147.134	14	0.132	7	0.242	3	0.045	3	6	14
Tunisia	293.44	3	2253.65	4	0.113	9	0.112	5	0.014	6	39	8
South Africa	41349.6	1	202285	1	1.422	1	0.197	4	0.275	1	604	2
Zambia	14.878	14	285.960	13	0.083	13	0.068	8	0.004	11	8	13
Zimbabwe	248.532	5	1599.48	5	0.244	3	0.327	1	0.037	4	68	4
Average	3250.162		16252.71		0.230		0.119		0.034		147	

Values of shares traded and listed shares are in nominal US$. R=rank based on value a. 1995-2002.

Table 2- 3 Institutional development indicators

	Market regulator	Gov. Law	Clearing & Settlement	Settlement cycle	International custodian	Foreign participation	Exchange control	Trading system	Central depository	Trading days	Reporting system	AV. Score	RANK
Algeria	√	√	Electronic	4	None	√	None	Electronic	None	1	Local S	0.636364	13e
Botswana	√	√	Manual	5	√	√	None	Manual	None	5	Local S	0.727273	7d
Cote d'Ivoire	√	√	Manual	5	√	√	None	Electronic	None	3	Local S	0.727273	8d
Egypt	√	None	Manual	4	√	√	None	Electronic	√	5	Intern. S	0.909091	6c
Ghana	√	√	Manual	5	√	None	None	Manual	None	3	Local S	0.545455	15f
Kenya	√	√	Manual	5	√	None	None	Manual	None	5	Intern. S	0.727273	9d
Malawi	√	√	Manual	7	None	None	None	Manual	None	5	Intern. S	0.545455	16f
Mauritius	√	√	Electronic	3	√	None	None	Electronic	√	5	Intern. S	1.181818	2a
Morocco	√	None	Manual	3	√	√	None	Electronic	√	5	Intern. S	1	4b
Namibia	None	None	Manual	5	None	None	None	Electronic	None	5	Local S	0.454545	17
Nigeria	√	√	Electronic	3	√	None	None	Electronic	√	5	Intern. S	1.181818	1a
South Africa	√	√	Electronic	5	√	√	None	Electronic	√	5	Local S	1	3b
Swaziland	√	√	Manual	5	√	√	√	Manual	None	5	Intern. S	0.727273	10d
Tanzania	√	√	Electronic	5	None	None	None	Manual	√	3	Intern. S	0.727273	11d
Tunisia	√	None	Electronic	5	None	None	None	Electronic	√	5	Local S	0.727273	12d
Uganda	√	None	Manual	5	None	√	√	Manual	None	2	Intern. S	0.363636	18
Zambia	√	√	Electronic	3	√	√	√	Manual	√	5	Local S	0.909091	5c
Zimbabwe	√	√	Manual	7	√	None	None	Manual	None	5	Intern. S	0.636364	14e

√ denotes the existence of related indicator. AV Score is the institutional development index computed as described in section 2; a, b, c, d, e, f for each letter and value imply that score values are the same. Local S: local accounting and auditing reporting system. Intern. S: international accounting and auditing reporting system. Source UNDP African Stock Markets Handbook, 2003.

Table 2-4 Stock Market Volatility

	Mean	*Maximum*	*Minimum*
Botswana	0.002	0.027	0.000
BRVM	0.002	0.005	0.000
Egypt	0.007	0.032	0.001
Ghana	0.007	0.088	0.002
South Africa	0.005	0.089	0.001
Kenya	0.003	0.009	0.000
Mauritius	0.001	0.006	0.000
Namibia	0.004	0.014	0.000
Nigeria	0.003	0.011	0.000
Tunisia	0.003	0.010	0.000
Zambia	0.008	0.047	0.000
Zimbabwe	0.035	0.213	0.006
Average	0.007	0.048	0.001

Computed from 1997(11)-2005(8), with the exception of 1999(7))-2005(8)
for BRVM, 2003(5)-2005(8) for NAMIBIA, and 1998(11)-2005(8) for BOTSWANA.

2.3 Stock Market Development Index

The overall stock market development index is computed using the method followed by Demirguc-Kunt and Levine (1996). The overall index is computed as follows:

For each country i means-removed values of each stock market development indicator $x(i)^m$ is computed and given as

$$x(i)^m = \frac{\{X(i) - mean(X)\}}{\{ABS[meanX]\}}$$ $X(i) =$ stock   market   indicator

$ABS[meanX] =$ absolute value of average value of X across countries from (1990-2001). Next, the overall index is computed as a simple average of the means-removed stock market indicators and given as:

$$INDEX = \sum_{i=1}^{14} \bar{x}(i)^m$$ $INDEX =$ overall stock market development index[6]

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[6] Demirguc-Kunt and Levine (1996) add 2 pricing error measures (APT and ICAPM) as additional indicators and obtain 2 additional INDEXES. These are not included due to paucity of data on the countries considered here. Volatility measures are also not included, because the periods available for their calculation vary from those of the other market indicators.

Figure 2-1 Volatility Graphs
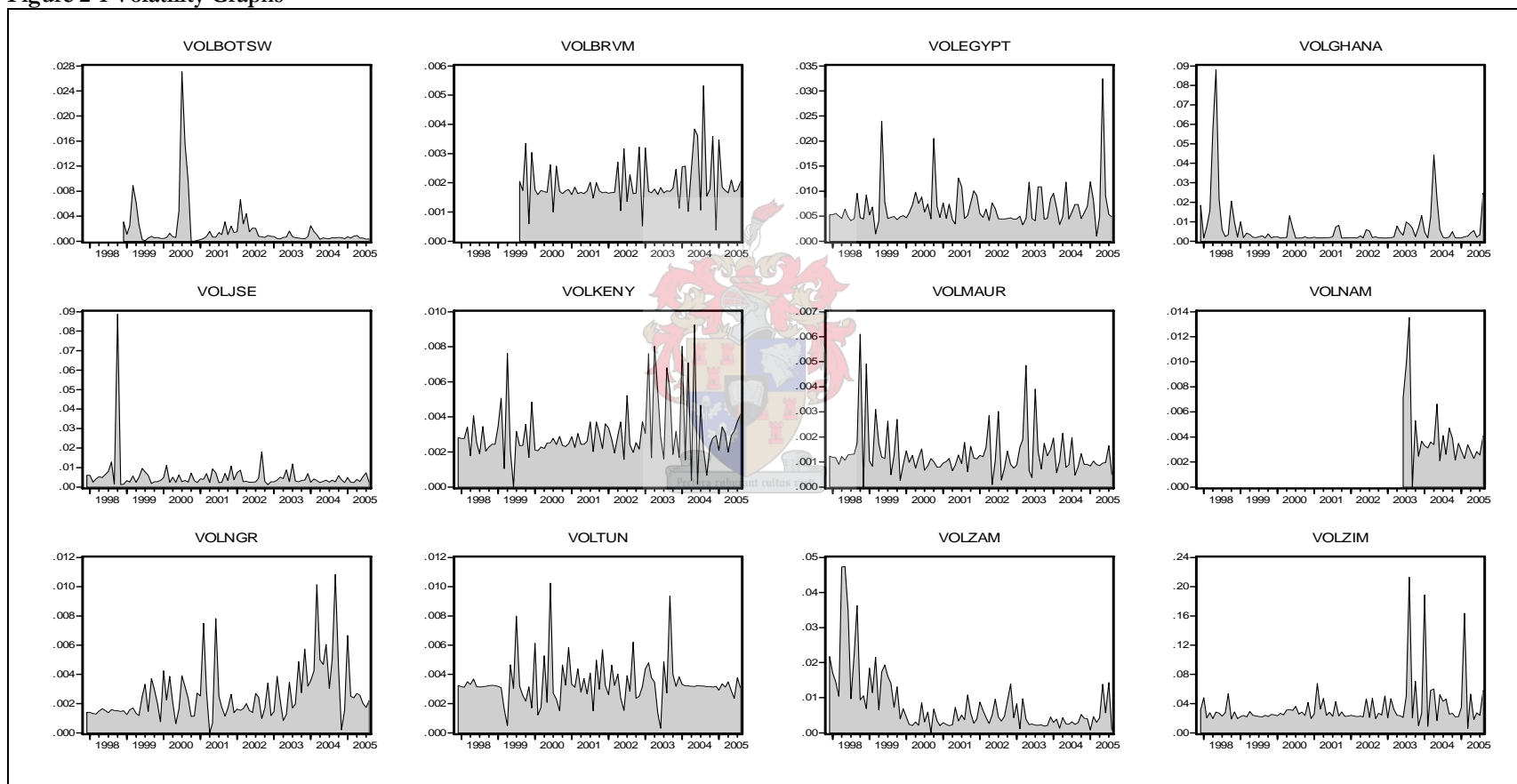
Table 2- 5 Overall Stock Market Development Index

	INDEX1[a]		INDEX2[b]	
	Value	*Rank*	*Value*	*Rank*
Botswana	-0.202	9	-0.124	11
Egypt	-0.217	10	-0.012	5
Cote d'Ivoire	-0.118	5	-0.082	8
Ghana	-0.150	7	-0.217	13
Kenya	-0.145	6	-0.096	9
Morocco	-0.051	4	0.130	3
Mauritius	0.020	2	0.285	2
Namibia	-0.287	13	-0.345	14
Nigeria	-0.258	12	0.146	4
Swaziland	-0.376	14	-0.211	12
Tunisia	-0.179	8	-0.113	10
South Africa	1.622	1	0.967	1
Zambia	-0.219	11	-0.013	6
Zimbabwe	0.002	3	-0.082	7

a. INDEX1 is the average of market capitalization ratio, total value traded/GDP, and turnover
b. INDEX2 adds institutional development index to INDEX1.

The computed stock market development index (INDEX1) in Table 2.5 shows that the most developed stock market in Africa is the South African market. The top five most developed stock markets are South Africa, Mauritius, Zimbabwe, Morocco and the BRVM. The most poorly developed markets appear to be Nigeria, Namibia and Swaziland. These rankings are based on market size, liquidity and transactions cost indicators which are used in computing INDEX1.

However, there is a slight twist in the rankings when viewed from INDEX2 (which includes the institutional development index). Here South Africa, Mauritius and Morocco maintain their positions as amongst the top five, but BRVM and Zimbabwe lose their positions amongst the top five. Nigeria and Egypt emerge as amongst the top five developed stock markets in addition to South Africa, Mauritius and Morocco. Whilst Namibia and Swaziland maintain their position as the most poorly developed stock markets, Nigeria's institutional development appear to be remarkable, thus bolstering it from amongst the worst to amongst the best.

2.4 Conclusion

This brief study examined and highlighted some stylized facts amongst African stock markets. Clearly South Africa stands out as a dominant market in terms of size and liquidity. However, there are other markets in Africa which are developing quite rapidly,

but little is known of them. For instance, though the markets in Mauritius, Zimbabwe and Morocco are bigger than the BRVM, the BRVM is more liquid. Similarly, Tunisia may be a small market, but it is relatively liquid. It also appears that trading costs in Zimbabwe, BRVM and Swaziland are lower than in South Africa. Institutional development in Nigeria, Mauritius, South Africa, Morocco and Mauritius was very high. In contrast, institutional development was very low in Algeria, Zimbabwe, Ghana, Malawi and Namibia. This was mainly due to manual processes, longer settlement cycles and lack of central depositaries.

The overall index of stock market development (based on market size, liquidity and transactions cost indicators) indicates that South Africa, Mauritius, Zimbabwe, Morocco and the BRVM are the most developed stock markets. However, when institutional development is considered in addition to market size, liquidity and transactions cost indicators, then Nigeria and Egypt emerge in addition to South Africa, Mauritius, and Morocco as the most developed. Ghana, Namibia and Swaziland are the least developed stock markets.

Whilst this study helps to reveal the development of other African stock markets (Mauritius, Morocco, BRVM, Nigeria and Egypt), it also points out pertinent areas which require further development in most African stock markets. The poor institutional features, especially manual processes, longer settlement cycles and lack of central depositaries, are obstacles to the development of a number of markets, notably Algeria, Zimbabwe, Ghana, Malawi and Namibia.

Transactions costs appear to be very high in Ghana, Kenya and Egypt. Even though, on the whole, African stock markets are not liquid (3.4%), liquidity levels in Botswana, Kenya, Namibia, Ghana, Zambia, Nigeria and Egypt are excessively low at less than 1%. Finally, the performance of the BRVM in Cote d'Ivoire could be indicative of the merits to be reaped from forming regional stock markets in Africa.

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STOCK MARKET DEVELOPMENT AND ECONOMIC GROWTH: THE CASE OF SELECTED AFRICAN COUNTRIES[7]

3.1 Introduction

Stock market development has assumed a developmental role in global economics and finance following the impact stock markets have exerted in corporate finance and economic activity. For instance, due to their liquidity, stock markets enable firms acquire much needed capital quickly, hence facilitating capital allocation, investment and growth. Stock markets also help to reduce investment risk due to the ease with which equities are traded. Stock market activity is thus rapidly playing an important role in helping to determine the level of economic activities in most economies.

In Africa the development and growth of stock markets has been rampant in recent times. From 9 markets by end of 1992 the number of stock markets in Africa had increased to 18 in 2002. There are currently 19 stock markets in Africa. African stock markets are fairly young, with the oldest exchanges being in Egypt, South Africa, Kenya and Zimbabwe. With the exception of South Africa, which has the largest stock market in the continent, most other African stock markets are small, illiquid and thinly traded. Despite the size and illiquid nature of the stock markets, their continued existence and development could have important implications for economic activity.

Empirical investigations into the link between stock market development and economic growth is therefore important. Studies on the link between stock markets and growth have varied in methods and results. Atje and Jovanic (1993), using cross-sectional regressions, conclude that stock markets have long-run impacts on economic growth. Harris (1997) also shows within a cross-sectional framework that stock markets promote growth, though this occurs only for developed countries. Rousseau and Wachtel (2000) also find that stock markets influence growth via value traded of shares, whilst Arestis,

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Demetriades and Luintel (2001), using time-series on five industrialized countries, also indicate that stock markets play a role in growth.

Most of these studies have focused largely on developed countries, and for the ones that touch on developing countries, the emphasis has not been exclusively on Africa. For most of the studies on stock markets in Africa the emphasis has been on testing for market efficiency, development of stock markets (Bundoo, 2000; Osei, 2002; Mlambo and Biekpe, 2003; Mlambo, Biekpe and Smit, 2003) and the impact of economic variables on stock markets (Jefferis and Okeahalam, 2000). There is need therefore for an in-depth study of the African situation to ascertain the role that stock markets play in economic growth and development.

This chapter contributes to the empirical literature on stock markets in Africa by investigating the link between African stock markets and economic growth. It goes further to analyse the link based on a classification of African countries according to income groupings and stock market capitalization. The chapter tests the hypothesis that stock market activity causes economic growth. It also tests if the stock market-growth linkage varies according to income levels and market capitalization. The rest of the chapter is organized as follows: Section two reviews the relevant literature, the analysis and results are discussed in section three, and the conclusion is presented in section four.

3.2 Literature Review

The link between stock markets and economic growth hinges on a major strand of the finance-growth thesis (Schumpeter, 1932; Mckinnon, 1973), with an insight into how finance facilitates growth. In this light stock markets influence growth through a number of channels: liquidity, risk diversification, acquisition of information about firms, corporate governance and savings mobilization (Levine and Zervos, 1996). Bencivenga, Smith and Starr (1995), for instance, show that stock markets make financial assets tradable, thus reducing the liquidity risk. Levine (1991) also shows that stock markets help protect investors against idiosyncratic risk by providing firms with the opportunity to hold diversified portfolios.

The diversification of risk also promotes investment in higher-return projects and generates higher overall output growth (Saint-Paul, 1992; Devereux and Smith, 1994; and Obstfeld, 1994). Again due to the availability of portfolio diversification, firms have the opportunity to specialize in production activities, thus increasing firm efficiency (Acemoglu and Zilibotti, 1997). Perotti and Van Oijen (1999) go even further to show that the existence of diverse equity ownership helps create political stability, which further spurs growth.

Stock markets also spur growth through the regular provision of information about firms. The ease and timeliness of release of information affecting prices and profits of shares of listed firms enhances research and development, which further boosts growth. In terms of corporate governance, efficient stock markets promote efficient resource allocation and growth by mitigating the principal-agent problem. Managers' compensation is tied to stock performance, and thus managers are induced to maximize the firm's equity price, thereby enhancing firm growth (Diamond and Venechia, 1982; Scharfstein, 1988; Laffont and Tirole, 1988; and Jensen and Murphy, 1990). These effects of stock markets increase resource mobilization by firms, which in turn increases productivity and overall growth.

There are also alternative views about the role stock markets play in economic growth. Apart from the view that stock markets may be having no real effect on growth, there are theoretical constructs that show that stock market development may actually hurt economic growth. For instance Stiglitz (1985, 1994), Shleifer and Vishny (1986), Bencivenga and Smith (1991) and Bhide (1993) note that stock markets can actually impair economic growth. They argue that, due to their liquidity, stock markets may hurt growth, since savings rates may reduce due to externalities in capital accumulation. Diffuse ownership may also negatively affect corporate governance and invariably the performance of listed firms, thus impeding the growth of stock markets.

Despite these alternative views, empirical works continue to show largely some degree of positive relationship between stock markets and growth. Kenny and Moss (2001) conclude that stock market activity generates positive effects which far outstrip any negative effect. Levine and Zervos (1998) also observe that the speed of economic growth hinges on active and developed stock markets and banks. Bekaert, Harvey and

Lundblad (2004) also go further to show the importance equity market liberalization plays in boosting economic growth. For emerging markets such as those in Africa, further studies on the link between stock markets and economic growth become more appealing, given the potential benefits in terms of additional growth points.

3.3 Analysis and Results

Data for stock market indicators have been obtained from Reuters Services and Emerging Stock Markets Fact Book and for the macroeconomic indicators data the International Monetary Fund (IMF) International Financial Statistics CD-ROM. Stock market indicators include the following: market capitalization to GDP (the ratio of the total value of listed shares to constant GDP); total value of shares traded to GDP ratio, and turnover ratio.

The stock-flow problem with financial variables is dealt with[8] according to Beck, Demirgüç-Kunt and Levine (1999). The macroeconomic variables include GDP, investment (gross domestic fixed capital formation as a proxy) and trade (sum of exports and imports to GDP ratio). The data are an unbalanced panel and analysed for 14 African countries, each with a stock market (see Appendix for countries and years covered). The unbalanced nature of the panel could have undesirable effects. These effects may, however, be minimal compared to the loss of sample data and efficiency, if the sample is restricted to a balanced panel.

The modelling and estimation are done within the framework of Levine and Zervos (1996). As noted by Khan and Senhadji (2000), this framework has been the basic equation used to test for the finance-growth linkage. The model is given as:

$$Y_{it} = \alpha_1 + \alpha_2 SM_{it} + \alpha_3 X_{it} + e_{it}$$
$$1$$

$Y_{it} =$ Economic growth measured as $\ln\left(\dfrac{percapGDP_t}{percapGDP_{t-1}}\right)$ in country i and time t.

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[8] See Appendix for calculation of stock market indicators.

SM_{it} = Stock market indicator for country i in time t, X_{it} contains control variables and e_{it} the error term. Various estimation methods of this model have been proposed to deal with the likely problems of bias and inconsistent estimates of a dynamic estimation (Nerlove 1967; Anderson and Hsiao, 1981; Arellano and Bond, 1991; Kiviet, 1995).

The essential issue is to estimate the model in a manner dynamic enough, but at the same time removing all country-specific and time effects which may be correlated with the explanatory variables, hence introducing errors and biases. In this regard the study adopts the Arellano and Bond (1991) Generalized Method of Moments (GMM) dynamic instrumental variable modelling approach, where the lagged values of the dependent variable (growth) and differences of the independent variables are suitably used as a valid instrument to control for this bias.

The use of instruments is important because in the dynamic panel the lagged dependent variable $[y_{it} - y_{it-1}]$ will be correlated with the lagged error terms $[e_{it} - e_{it-1}]$ by construct and induces the possibility of endogeneity of some explanatory variables. Based on the assumptions of no serial correlation in the error terms and weak exogeneity of explanatory variables, the following moments condition applies
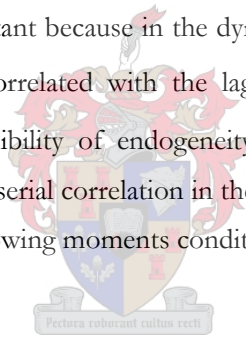
$$E[y_{it-j}\Delta e_{it}] = 0 \text{ for } j = 2,3,...,(T-1) ; i = 1....14 \qquad 2$$

$$E[z_{it-j}\Delta e_{it}] = 0 \text{ for } j = 1,2,3,...,(T-1) ; i=1.....14 \qquad 3$$

where z_{it} is a set of explanatory variables. The GMM estimation is based on these moment conditions and is consistent, if lagged values of explanatory variables are valid instruments. The validity of the use of instruments is checked using a Sargan test of over-identifying restrictions, which tests for correlation between the instruments and the model residuals. Further tests include an autoregressive test (AR) test to check if the differenced error terms are first- and second-order serially correlated. The model is estimated in a heteroskedastic consistent standard error robust manner given the cross-sectional dimension.

Indeed though there is the possibility of economic growth causing stock market activity, disentangling the effect in the current modelling framework may prove difficult hence the focus is exclusively on testing the causal effect of stock market activity on economic growth. From the literature an increase in stock market activity should increase economic growth through liquidity injection, savings mobilization and equity financing for firms. Thus it is expected a priori that $\alpha_2 > 0$, in equation 1. That is an increase in market capitalization ratio, turnover ratio or value of shares traded/GDP should increase economic growth. The other control variables for GDP growth are investment (Gross Capital Formation), trade intensity (exports+imports/GDP) past GDP growth values. Again as per growth literature it is expected that $\alpha_3 > 0$. The analysis is first done on the common panel of all 14 countries, then on sub-panels of countries classified according to income groupings and finally based on market capitalization[9]. The three stock market indicators enter the model separately in order to determine which indicator is the best channel through which stock markets influence growth. This in tune with Filer and Campos (1999), Boyd *et al.* (2001) and Bekaert *et al.* (2001; 2004), who have variously noted the relevance of turnover ratio and value traded over market capitalization.

Table 3.4 in the appendix shows the pooled summary statistics of selected stock market and economic indicators of the 14 African countries (1975-2001). The average market size (capitalization) to GDP ratio across the cross-sections over time for the period was 24% and gives an indication of the low level of integration of African stock markets in African economies.

The average, however, does not show the cross-sectional variations. The ranges between the countries varied from 4.4% to 118.9%. In the case of value traded of shares/GDP ratio, the mean value of 2.8% is indicative of the overall low liquidity levels in the African stock exchanges. Here again there is a wide gap between the minimum of almost no trading and the maximum of 63.4% trading activity. The turnover ratio, which is

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[9] The relatively small sample for the GMM estimation is noted. A larger sample size for the estimation would be more desirable. However, the sample size is constrained by the number of stock markets in Africa. The GMM method is the most feasible estimation method, given the endogeneity issues. I thank Johannes Fedderke of University of Cape Town for his advice.

another measure of stock market liquidity, has an average of 9.58%, and a range from 2.6% to 24%. With respect to the macroeconomic variables, average per capita GDP amongst the 14 countries over the period was US$1 342 but ranged from US$333.33 to as high as US$3 480. Average GDP growth for the period was at 3.5% and varied from 1.5% to 9.3%. Average investment was estimated at US$4 934.34 and ranged from US$255 to US$18 592 between the countries.

The background summary statistic analysis is also shown by income levels and market size[10]. For income groupings the World Bank classification of low income (per capita GDP less than US$765), low-middle income (per capita GDP between US$765 and US$3035) and upper-middle income (per capita GDP more than US$9385) are used. With respect to market size classifications, this is somewhat arbitrary. All market capitalization to GDP ratios below the group average of 24% are classified as small, whilst those above the average are classified as moderately capitalized markets. The summary statistics on these are shown in the Appendix (Tables 3.4 to 3.8).

The model is first estimated on the group of 14 African economies and the results are shown in Table 3.1. In Equation 1, which uses the ratio of market capitalization to GDP as the stock market development indicator, it is noted that stock market development does not play a significant role in economic growth. The most significant variables here are lagged growth and investment which positively influences growth.

In Equation 2, however, stock market development plays a significantly positive role in economic growth alongside investment and past growth levels. The stock market development indicator used here is the total value of shares traded/GDP, which is indicative of both size and more importantly liquidity on the markets. An increase in stock market activity via higher liquidity augments GDP growth significantly by a substantial 3.7%. In the case of the third equation, stock markets (turnover ratio) do not seem to play a role in economic growth. One important finding is that improvements in trading of shares (in the number of shares traded, frequency and efficiency in trading) or liquidity on African stock markets will on the whole boost economic growth by 3.7%. It must be added, however, that the inclusion of South Africa in this group could have led

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[10] See Appendix (Tables 3.4 and 3.11) for countries and classification groups.

to a heavy bias towards this result. Nonetheless, this finding is suggestive of where policy should be directed with regards to stock markets in Africa. Subsequent estimation of the model separates South Africa from the group[11].

Table 3-1 Model Results Common Panel

Dependant Variable Growth	Equation 1	Equation 2	Equation 3
Growth(-1)	0.0652	0.0757	0.0790
	{0.049}	{0.012}	{0.012}
Investment	0.0256	0.0227	0.0269
	{0.022}	{0.056}	{0.021}
Trade	-0.0072	-0.0031	-0.0064
	{0.685}	{0.884}	{0.760}
Market Size	-0.0386		
	{0.581}		
Value of Shares Traded		0.0379	
		{0.082}	
Turnover Ratio			-0.0037
			{0.769}
Constant	-0.0008	-0.001	-0.0037
	{0.291}	{0.076}	{0.768}
Observations	189	183	181
Sargan	0.89	0.81	0.82
AR(1)	0.06	0.10	0.08
AR(2)	0.56	0.66	0.53

Figures in curly brackets give the level of significance at which coefficients would be significantly different from zero.
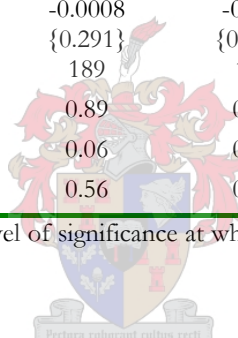
The analysis is continued by estimating the model via a decomposition of the sample into sub-samples which, in turn, are based on income and market capitalization classifications as discussed earlier. The results for the income groupings in Table 2 show that none of the stock market indicators is significant in influencing economic growth in the low-income and low-middle-income countries. The most significant variable influencing growth in the low and low-mid-income countries is investment.

However, when the estimation is done solely on the upper-middle-income countries, the stock market indicators become significant in influencing growth. Undoubtedly stock

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[11] It is important to also note that the Stock Exchange in South Africa is one of the oldest exchanges in Africa. The history of the exchange also involves a complex development process highly linked to the booming mining industry and financial companies, and the high exposure of domestic firms to share capital. These developments on the South African market over a substantial period have resulted in the unique characteristics of the Johannesburg Stock Exchange in South Africa.

markets seem to play a significant causal role in economic growth only within high-income (upper-middle-income) countries. The concern here is that not many African countries are in the upper-middle-income classification bracket. However, this also implies that low-income African economies must not lose their grip on sustaining achievements in economic growth so far. This is because there are further gains to be made indirectly from growth through stock markets, more especially when growth is able to induce rapid and higher stock market activity.
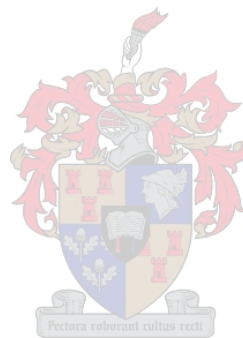
Table 3-2 Model Results by Income Groupings

	Low	Low-Mid	Upp-Mid	Low	Low-Mid	Upp-Mid	Low	Low-Mid	Upp-Mid
Growth (-1)	0.073	-0.047	0.112	0.065	-0.033	0.109	0.061	-0.037	0.137
	{0.399}	{0.139}	{0.289}	{0.424}	{0.385}	{0.429}	{0.458}	{0.287}	{0.325}
Investment	0.051	0.033	-0.042	0.050	0.019	-0.007	0.0466	0.037	-0.129
	{0.005}	{0.039}	{0.17}	{0.009}	{0.293}	{0.882}	{0.018}	{0.025}	{0.806}
Trade	-0.08	0.008	-0.147	-0.082	-0.006	-0.146	-0.080	-0.014	-0.142
	{0.117}	{0.715}	{0.435}	{0.118}	{0.862}	{0.418}	{0.128}	{0.599}	{0.482}
Market Size	0.025	-0.083	0.107						
	{0.612}	{0.389}	{0.000}						
Value of Shares Traded				0.534	0.204	0.109			
				{0.700}	{0.255}	{0.007}			
Turnover Ratio							-0.008	0.048	0.064
							{0.500}	{0.225}	{0.017}
Constant	-0.003	-0.002	-0.002	-0.003	-0.003	-0.004	-0.003	-0.004	-0.003
	{0.113}	{0.075}	{0.394}	{0.050}	{0.292}	{0.061}	{0.03}	{0.120}	{0.352}
Sargan	0.95	0.89	0.91	0.97	0.89	0.92	0.9	0.8	0.9
AR(1)	0.07	0.08	0.10	0.11	0.08	0.10	0.11	0.08	0.09
AR(2)	0.65	0.75	0.23	0.59	0.86	0.35	0.26	0.4	0.6

Figures in curly brackets give the level of significance at which coefficients would be significantly different from zero.
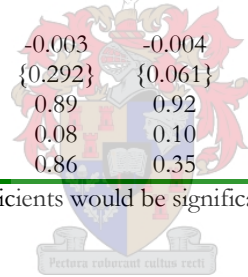
With respect to the model results based on market size classifications, the results (Table 3.3) show that none of the stock market indicators is significant in influencing economic growth in small markets. For small markets the most significant variables are past growth levels and investment. However, when the estimation is done only on the excluded moderately capitalized markets, two of the stock market indicators (market size and value of shares traded) significantly influence economic growth in a positive manner.

The overall trend here is that stock markets significantly influence growth only in the case of moderately capitalized markets. The important factor at this point is that for stock markets to play an active and significant role in economic growth and development, attention must be devoted to the development of these markets. A highly developed market which has more shares and trades frequently at a relatively lower cost will boost confidence and productivity in the industrial set-up of these countries. An increase in productivity of industrial activity also boosts overall economic growth.
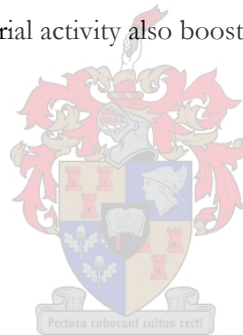
Table 3-3 Model Results by Market Capitalization Groupings

	Small	Mod Cap	Small	Mod Cap	Small	Mod Cap
Growth (-1)	0.082	-0.084	0.079	-0.106	0.076	-0.090
	{0.038}	{0.522}	{0.025}	{0.416}	{0.032}	{0.491}
Investment	0.035	0.053	0.028	0.055	0.029	0.052
	{0.100}	{0.001}	{0.128}	{0.001}	{0.130}	{0.008}
Trade	-0.043	-0.226	-0.045	-0.185	-0.044	-0.210
	{0.140}	{0.127}	{0.171}	{0.185}	{0.191}	{0.145}
Market Size	-0.017	0.043				
	{0.749}	{0.068}				
Value of Shares Traded			0.022	0.063		
			{0.792}	{0.016}		
Turnover Ratio					-0.010	0.0013
					{0.688}	{0.887}
Constant	-0.004	-0.002	0.001	-0.001	0.001	0.007
	{0.701}	{0.794}	{0.930}	{0.409}	{0.995}	{0.483}
Obs	143	46	136	47	135	46
Sargan	0.69	0.89	0.78	0.91	0.80	0.8
AR(1)	0.09	0.10	0.11	0.10	0.09	0.12
AR(2)	0.64	0.27	0.79	0.52	0.65	0.72

Figures in curly brackets give the level of significance at which coefficients would be significantly different from zero.

3.4 Conclusion

The paper investigated the role that stock markets play in economic growth from African countries' perspective. The exclusively African focus provides good grounds for panel data analysis, given the similarities in these countries. The paper examined the relationship further, based on income groupings and market capitalization. The findings of this study from the investigations are threefold.

First, on the whole, stock markets play a significant role in the economic growth of the group of African countries. This significant role is only evident in an improvement in the total value of shares traded. This signals the importance of liquidity and active trading to economic growth. Secondly, stock markets only play a significant positive role in the growth of African countries that can be classified as upper-middle–income countries. Here both market capitalization to GDP and value of shares traded significantly influence growth. Finally, stock markets are more significant in countries with moderately capitalized markets in Africa.

These results suggest some policy recommendations. African economies need to ensure that stock markets, where they exist, are developed to become incorporated into the economic system. It is clear that the level of integration of African stock markets into the economies is still weak. The trading activities on African stock markets need to be enhanced via education and the promotion of the need to raise capital through stock markets. The efficiency and productivity effects of the stock market on economic growth are robust when markets are liquid and active. Finally, in the pursuit of these market development policies, there must be consolidation and indeed an improvement on current growth and investment patterns in African economies to infuse higher demand for capital market activities, which in turn augment economic growth.

Appendix

Stock market indicators (SM) are calculated as follows:

$$SM = 0.5 * \left[\frac{\dfrac{SM_t}{CPI_t} + \dfrac{SM_{t-1}}{CPI_{t-1}}}{\dfrac{GDP}{CPI_t}} \right]$$

CPI_t = Consumer price index in year t.

Table 3-4 Summary Statistics on Group Panel

Variable		Mean	Std. Dev.	Min	Max
Selected Stock Market Indicators					
Market Cap/GDP	overall	0.2424	0.3775	0.0083	1.7882
	between		0.2917	0.0448	1.1894
	within		0.1360	-0.3882	0.8412
Total Value Traded/GDP	overall	0.0281	0.0818	0.00002	0.63497
	between		0.0383	0.0013	0.14825
	within		0.0679	-0.0991	0.5148
Turnover	overall	0.0958	0.2023	0.0011	2.34308
	between		0.0693	0.0260	0.2420
	within		0.1913	-0.1449	2.2146
Selected Macroeconomic Indicators					
GDP Per capita	overall	1342.34	1068.007	210	3930
	between		1131.17	333.333	3480
	within		272.406	352.342	2151.888
GDP Growth	overall	0.0352	0.0620	-0.1202	0.61437
	between		0.0201	0.0159	0.0931
	within		0.0590	-0.1301	0.5564
Investment	overall	4934.346	5965.343	166.95	27173.1
	between		5208.262	255.096	18592.09
	within		2157.296	-5054.601	13515.36

Table 3-5 Country Classifications by Income Groupings

Low-Income Countries	*Low-Middle-Income Countries*	*Upper-Middle-Income Countries*
Ghana (1991-2001)	Cote d'Ivoire (1981-2001)	Botswana (1991-2001)
Kenya (1987-2001)	Egypt (1980-2001)	Mauritius (1990-2001)
Nigeria (1976-2001)	Morocco (1982-2001)	South Africa (1975-2001)
Zambia (1996-2001)	Namibia (1993-2001)	
Zimbabwe (1976-2001)	Swaziland (1989-2001)	
	Tunisia (1986-2001)	

Figures in parenthesis are time-series coverage of data.

Table 3-6 Country Classifications by Market Groupings

Small Markets	Moderately Capitalized Markets
Ghana	South Africa
Kenya	Mauritius
Nigeria	
Zambia	
Zimbabwe	
Cote d'Ivoire	
Egypt	
Morocco	
Namibia	
Swaziland	
Tunisia	
Botswana	

Table 3-7 Summary Statistics on Low-Income Group

Variable		Mean	Std Dev	Min	Max
Selected Stock Market Indicators					
Market Cap/GDP	overall	0.0959	0.0861	0.010	0.4892
	between		0.0618	0.0181	0.2068
	within		0.0639	-0.0647	0.3783
Total Value Traded/GDP	overall	0.0073	0.0202	0.00004	0.1689
	between		0.0109	0.0008	0.0334
	within		0.0169	-0.0246	0.1427
Turnover	overall	0.0787	0.2580	0.00370	2.3430
	between		0.0933	0.0176	0.3040
	within		0.2390	-0.2076	2.1178
Economic Growth					
GDP Per capita	overall	468.44	177.87	210	760
	between		168.81	312	698.46
	within		77.69	285.36	896.44
GDP Growth	overall	0.0295	0.0534	-0.0921	0.3639
	between		0.0175	0.0100	0.06315
	within		0.0514	-0.1136	0.34253

Table 3-8 Summary Statistics on Low-Middle-Income Group

Variable		Mean	Std Dev	Min	Max
Selected Stock Market Indicators					
Market Cap/GDP	overall	0.2447	0.3567	0.0083	1.3861
	between		0.3166	0.0396	1.1452
	within		0.1017	0.0171	0.4855
Total Value Traded/GDP	overall	0.0273	0.0704	0.0001	0.6138
	between		0.0313	0.0001	0.1051
	within		0.0624	-0.0440	0.5360
Turnover	overall	0.1103	0.1689	0.0011	1.3072
	between		0.0743	0.0034	0.2420
	within		0.1545	-0.1304	1.1755
Economic Growth					
GDP Per Capita	overall	1499.80	638.69	780	3020
	between		800.80	780	3020
	within		217.68	914.80	1991.80
GDP Growth	overall	0.0399	0.0730	-0.1202	0.6143
	between		0.0853	-0.1109	0.2585
	Within		0.0595	-0.1674	0.3957

Table 3-9 Summary Statistics on Upper-Middle-Income Groups

Variable		Mean	Std Dev	Min	Max
Selected Stock Market Indicators					
Market Cap/GDP	overall	0.6509	0.6330	0.0608	1.7882
	between		0.7308	0.0913	1.4549
	within		0.1407	0.2448	0.9842
Total Value Traded/GDP	overall	0.0991	0.1696	0.0021	0.6349
	between		0.1428	0.0072	0.2612
	within		0.1201	-0.1026	0.4728
Turnover	overall	0.1158	0.1056	0.0454	0.4325
	between		0.0617	0.0685	0.1837
	within		0.0919	-0.0153	0.3646
Economic Growth					
GDP Per Capita	overall	3495.17	264.82	3050	3930
	between		64.27	3423	3541.11
	within		259.33	3004.06	3899.17
GDP Growth	overall	0.0365	0.0410	-0.0519	0.1386
	between		0.0179	0.0179	0.0538
	within		0.0381	-0.0534	0.1371

Table 3-10 Summary Statistics on Small Market Group

Variable		Mean	Std Dev	Min	Max
Selected Stock Market Indicators					
Market Cap/GDP	overall	0.0812	0.05303	0.00838	0.22838
	between		0.03016	0.04482	0.15673
	within		0.04568	-0.01571	0.23455
Total Value Traded/GDP	overall	0.0086	0.02348	0.00006	0.26313
	between		0.01885	0.00145	0.07360
	within		0.02047	-0.05746	0.19814
Turnover	overall	0.0775	0.12878	0.00302	1.3072
	between		0.09831	0.02600	0.40417
	within		0.11105	-0.24419	0.98056

		Economic Growth			
GDP Per Cap	overall	1077.68	891.70	210	3930
	between		1058.1	333.33	3520
	within		187.40	560.18	1860.18
GDP Growth	overall	0.0361	0.04825	-0.11093	0.36398
	between		0.01553	0.01599	0.07356
	within		0.04536	-0.12952	0.32662

Table 3-11 Summary Statistics on Moderately Capitalized Market Group

Variable		Mean	Std Dev	Min	Max
Selected Stock Market Indicators					
Market Cap/GDP	overall	0.7472	0.49606	0.249368	1.7882
	between		0.31282	0.271152	1.1894
	within		0.23152	0.116544	1.3460
Total Value	overall	0.0722	0.13404	0.000021	0.63497
Traded/GDP	between				
	within		0.04508	0.000028	0.14825
			0.11805	-0.055072	0.55896
Turnover	overall	0.1498	0.33231	0.001175	2.3430
	between		0.21733	0.008024	0.63484
	within		0.28484	-0.40999	1.858
Economic Growth					
GDP Per Cap	overall	2090.69	1173.57	250	3800
	between		1150.47	255	3411.25
	within		392.86	979.43	2900.23
GDP Growth	overall	0.0326	0.09147	-0.1202	0.61437
	between		0.04139	-0.0211	0.1198
	within		0.08165	-0.1391	.5271
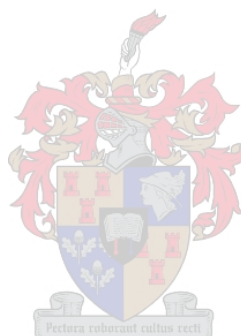
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CHAPTER FOUR

STOCK MARKET RETURNS AND EXCHANGE RATE DYNAMICS IN SELECTED AFRICAN COUNTRIES: A BIVARIATE ANALYSIS[12]

4.1 Introduction

Exchange rates are important in determining trends in exports and imports of an economy. Exchange rate movement has an effect on the economy's stock market returns. The effect is either on the cost of inputs, for an import-dependent firm, or the price of products, for an export-oriented firm. For listed firms, changes in the exchange rate would therefore influence their share prices. The empirical direction of the link between exchange rate movement and stock market returns remains unclear and warrants further empirical investigation.

In Africa, movements in stock market returns have been encouraging within the last decade. In terms of individual market performance, during the first quarter of 2004 Ghana, Uganda, Kenya, Egypt, Mauritius and Nigeria recorded remarkable gains in stock returns. Though most of these stock markets (apart from South Africa) are small and illiquid, they have the potential to mobilize resources for investment in Africa.

Exchange rate development prior to the early 1990s in most African countries was largely characterized by rigid and fixed exchange rate regimes. By the early to mid-1990s these African countries introduced reforms aimed at liberalizing exchange rate regimes. The exchange rate movements in Africa, however, have not been desirable compared to stock returns. Currency fluctuations in these African economies have been erratic since the 1990 reforms. The erratic movements of the exchange rate are of great concern when viewed within the context of the effect this has on firms' growth. For instance, for an import-dependent firm a rapid depreciation of the exchange rate tends to inflate the cost of importing raw materials and machinery for firms. By the same token, a rapid appreciation of the exchange rate also increases the international price of products in an

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[12] This paper was presented at The African Finance Journal Conference July 2005, Cape Town, South Africa.

exporting firm and could make its products uncompetitive. Thus movements in the exchange rate tend to have an effect on the operational costs of firms and this, in turn, has implications for the share price movements of such firms on the stock market. With a substantial number of the major firms in African countries listed on the stock exchange, rapid exchange rate movements influence the share prices of these firms and the stock market returns.

It is important to also note that different economic environments could yield different results with respect to the reaction of stock returns to exchange rate movements and vice versa. In Africa very little empirical work has been done on determining the causal link between stock returns and exchange rate movements. This paper contributes to the rather meagre literature on Africa by examining the response of stock returns to movements in exchange rates in selected African countries. More importantly, it is not enough to know the effect of exchange rate movement on stock returns and vice versa.

The chapter tests the hypothesis that there is a long-run relationship between stock market returns and exchange returns. It also tests the hypothesis that shocks to stock market returns cause shocks to exchange rate movements and vice versa. It is necessary to investigate whether the relationship between exchange rate movements and stock returns in Africa is a stable long-run economic phenomenon. Ascertaining the behaviour and time path of each variable (stock market return, exchange rate movement) in response to sudden shocks from the other is also very important. In addition, country case time-series analysis helps to reveal country dynamics better than cross-sectional studies. The rest of the chapter is organized as follows: section 4.2 gives an overview of the related empirical literature, section 4.3 discusses the data, methods and results, and section 4.4 draws conclusions.

4.2 Overview of Literature

The linkage between the stock market returns and the exchange rate movement has been explained within the context of two portfolio models of exchange rate transmission mechanism within an economy. Namely the "Flow-Oriented" model (Dornbusch and Fischer, 1980; and Gavin, 1989) and the "Stock-Oriented" model (Branson, 1983; and Frankel, 1983). According to the "Flow-Oriented" model, exchange rate movement

affects output levels of firms and also the trade balance of an economy. Share price movements on the stock market also affect aggregate demand through wealth, liquidity effects and, indirectly, the exchange rate. Specifically a reduction in stock prices reduces wealth of local investors and further reduces liquidity in the economy. The reduction in liquidity also reduces interest rates, which in turn induces capital outflows and causes currency depreciation.

In the case of the "Stock-Oriented" model, the stock market exchange rate link is explained through a country's capital accounts. In this model the exchange rate equates demand and supply for assets (bonds and stocks). Therefore expectations of relative currency movements have a significant impact on price movements of financially held assets. Thus stock price movements may influence or be influenced by exchange rate movements. For instance, the depreciation of a domestic currency against a foreign currency (for example, US dollar) increases returns on the foreign currency (for instance, US dollar). This induces investors to shift funds from domestic assets (stocks) towards US dollar assets, depressing stock prices. Thus a depreciating currency has a negative impact on stock market returns.

The relationship between stock market returns and exchange rate movement is also explained within the context of exporting and importing firms. For a firm heavily involved in exports, depreciation in the exchange rate makes its products competitive, increasing both its performance and stock price. This may be useful in so far as the exporting firm's products remain competitive on the international market.

On the other hand, for heavily importing firms any exchange rate depreciation makes imports expensive, dampening firm performance and reducing their stock prices. The impact of the exchange rate depreciation on a firm heavily involved in both exports and imports will, however, depend on the effect on each side of the traded item. This relationship is akin to the "import/export-dominant economies" explanation for the sign of the effect of exchange rate movements on stock return by Ma and Kao (1990). According to them, for an import-dominant economy an appreciation of the exchange rate boosts stock market returns.

In the case of an export-dominant economy, on the other hand, Ma and Kao (1990) suggest that an appreciation of the exchange rate would dampen stock market returns. Senbet and Otchere (2005) have also suggested an increase in the listing of export-based firms on African stock exchanges due to the exposure of these firms to hard currency exports. In their view this will help African economies further to hedge significantly against exchange rate depreciation. Most African firms are also heavily dependent on imported machinery and in some cases raw materials, thus rampant depreciations in the exchange rate would also affect production cost.

Methodologies and results from empirical works on the relationship between exchange rate movements and stock market returns have been mixed. Earlier analyses using correlations show different results. For instance, whilst Aggarwal (1981) finds a positive relationship between stock price movements and exchange rate movement in the US, Soenen and Heninigar (1988) detect a negative relationship. Meanwhile, using regression analysis, Solnik (1987) establishes both a positive and negative effect between stock returns and exchange rate movements over different sample periods.

Following further developments in econometric theory, subsequent analyses have been based on testing for causality between stock price movements and exchange rate movements. Using causality tests, Bahmani-Oskooee and Sohrabian (1992) find evidence of bidirectional causality between changes in the exchange rate and stock price movements. Further tests by Ajayi, Friedman and Mehdian (1998) also show that causality runs from stock returns to movements in the exchange rates in the case of advanced markets, whilst there is no significant causality either way for emerging markets. Bhattacharya and Muharjee (2002) also find no causal link between exchange rate and stock prices in India.

Other studies have gone further to investigate the possibility of a long-run relationship using cointegration analysis between stock price movements and exchange rate movements. In this regard Ratner (1993) does not detect cointegration between stock prices and exchange rate using a group of industrialized countries. On the other hand, Ajayi and Mougué (1996) establish a long-run relationship using eight industrialized countries and conclude that currency depreciation leads to negative effects. Granger,

Huang and Yang (2000) find no evidence of cointegration between stock prices and exchange rate for a group of Asian countries.

However, their study finds significant feedback effects in a number of the countries using Granger causality tests and impulse response functional analysis. Nieh and Lee (2001) also do not find evidence of cointegration between exchange rates and stock prices for G7 countries, but find significant short-run relations. Muhammad and Rasheed (2002) also find mixed cointegration results amongst four Asian countries.

4.3 Data and Estimation Methods

Data for stock market indexes are acquired from REUTERS and for exchange rates the International Monetary Fund's International Financial Statistics CD ROM. The exchange rate is expressed as units of local currencies per unit of the US dollar (for easy comparison). All data are in monthly frequencies. The data were collected for seven African countries (Egypt, Ghana, Kenya, Mauritius, Nigeria, South Africa and Tunisia). These countries are chosen purely on the basis of consistency of data and their availability.

The analytical framework for testing the link between stock returns and exchange rate movement is based on the influence of the exchange rate on firm profitability and share prices of firms (Jorion, 1990). In this regard the exchange rate influences a firm's stock returns through the model:

$$R_{it} = \beta_{0i} + \beta_{1i}E_t + \beta_{2i}R_{mt} + \varepsilon_{it} \qquad\qquad 1$$

$R_{it} =$ rate of return on common stock of company i $\quad E_t =$ rate of change in the exchange rate $\quad R_{mt} =$ market returns. At the macro level the relationship can be represented as:

$$S = a_1 + a_2EX + u_i \qquad\qquad 2$$

$S =$ stock market returns; $EX =$ exchange rate movement.

It has been argued that the modelling of the response of stock returns to exchange rate movement should allow for the incorporation of macroeconomic variables (Smith, 1992). Results from such approaches have, however, been mixed and failed to show clear trends. More importantly, the causality between stock returns and exchange rate movement is a topical issue which remains largely unexplored and requires further study (Abdalla and Murinde, 1999; Granger, Huang and Yang, 2000). Thus it is important to address the causality issues as well as the long-run and short-run dynamics to form a basis for understanding better the linkage between stock returns and exchange rate movements. The model adopted for this study follows a bivariate Granger representation vector autoregressive theorem as used by Abdalla and Murinde (1999) and Granger, Huang and Yang (2000). The model, an augmented form of equation 2, is of the form:

$$e_t = \sum_{j=1}^{k} \alpha_1 e_{t-j} + \sum_{j=1}^{k} \alpha_2 s_{t-j} + \varepsilon_t \qquad\qquad 3$$

$$s_t = \sum_{j=1}^{k} \beta_1 e_{t-j} + \sum_{j=1}^{k} \beta_2 s_{t-j} + u_t \qquad\qquad 4$$

$e_t = $ log of exchange rate $\quad s_t = $ log of stock market index, the log difference of the stock market index yields stock market returns, whilst the log difference of the exchange rate yields exchange rate movement.[13]

Equations 3 and 4 form the model for testing the relationship between stock market returns and exchange rate movement. A cointegration test is also conducted to determine whether there is a stable long-run economic relationship between stock returns and exchange rate. The cointegration test is done in the multivariate Johansen and Juselius JJ (1990) framework. An error correction model is used to capture short-run dynamics and the adjustment from the short-run disequilibrium towards the long-run equilibrium.

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[13] An increase in e represents a depreciation in the exchange rate, and a decrease an appreciation

In the absence of cointegration, impulse response analyses are conducted within the vector autoregression (VAR) framework to identify the response and behaviour of stock market returns to shocks induced by exchange rate movements and vice versa. This approach helps identify the impact of each variable's shock on the other.

Table 4.1 gives a snapshot view of descriptive statistics of the returns of the stock market and exchange rate for the selected countries. Egypt recorded mean stock returns of -0.43% and a maximum return of 26.99% within the period. Movements in the exchange rate at the same time indicate a mean depreciation of 0.46% of the Egyptian currency against the US dollar.

The maximum depreciation of the Egyptian currency recorded was 17.86%. In Ghana stock market returns recorded a mean return of 2.79%, with a high of 44% during the period. Mean exchange rate movements in Ghana show a depreciation of 1.95% of the exchange rate, with a maximum depreciation of 15.6%. With regards to the Kenyan stock market, the mean stock return was 0.02%, whilst the Kenyan exchange rate also depreciated on average by 0.18%. The average stock returns recorded in Mauritius are 0.18%, with the Mauritian exchange rate depreciating on average by 0.5%.

The Nigerian stock market returns also recorded an average of 2.3%, whilst the exchange rate for the same period depreciated by an average of 1.9%. In South Africa the average stock market return over the period was 0.78%, whilst the exchange rate depreciated on average by 0.43% during the same period. Finally, in Tunisia the mean return on the stock exchange was 0.08%, with the exchange rate depreciating on average by 0.25%. Interestingly, the descriptive statistics depict that mean exchange rate changes have been smaller in countries where average stock returns have also been marginal, irrespective of the different time periods for different countries.

The unit roots tests are conducted using the Augmented Dickey Fuller (ADF) and Philips Perron (PP) tests to determine the stationarity or otherwise of the stock market indices and the exchange rates of all countries. Results (see Table 4.2) show that all the variables are not stationary, but become stationary in their first differences. Having determined the stationarity of the variables, a cointegration test is conducted on the

$I(1)$ variables. Given the sensitivity of the JJ cointegration test to lag lengths, various tests are performed to choose the optimal lag length for each country (see Table 4.3 in Appendix). The cointegration test results (Table 4.4 in appendix) show that the trace statistics indicate the presence of cointegration only for Tunisia. Thus amongst the 7 countries Tunisia alone exhibits a stable long-run relationship between stock market prices and exchange rates.

The long-run equation for Tunisia (Table 4.5) shows a positive and significant relationship between stock market prices and exchange rate. Thus an increase in the exchange rate (depreciation) leads to increases in stock market prices in Tunisia. A short-run error-correction model is thus estimated for the relationship between the exchange rate movement and stock market returns for Tunisia.

The short-run model results (Table 4.6 in appendix) show a deviation in terms of the direction of response of stock market returns to exchange rate movement. The exchange rate has a negative relationship with stock market returns. This implies that, in the short run, exchange rate depreciations reduce stock market returns. The error-correction term is significant and also indicates the presence of Granger causality from exchange rate movement to stock market returns. Diagnostic tests on the short-run model show a stable and robust model.
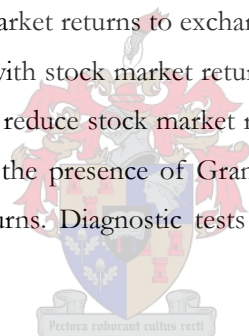
For the rest of the countries where cointegration does not exist between stock market returns and the exchange rate, bivariate Granger causality tests (shown in appendix) and VAR impulse response analyses are conducted on the first difference of the variables. The lag lengths for the Granger causality tests are based on the optimal lag lengths chosen for each of the countries for the cointegration tests. The Granger causality tests reveal that the exchange rate movement Granger causes stock market returns in Egypt. On the other hand, Granger causality from stock market returns to exchange rate movement exists for Kenya and Mauritius. There is no statistically significant causality for the rest of the countries. The results, however, indicate that, whilst exchange rate movements help explain stock market returns significantly in Egypt, it is rather the stock market returns which help explain exchange rate returns in Kenya and Mauritius.

Prior to estimating the VAR for impulse response analyses, a VAR lag length stability check is performed following Lütkepohl, (1991) to check if the VAR models are stable. The test reports[14] reveal that the inverse roots of characteristics polynomials for the various lag lengths chosen for each country have modulus less than one. Again no roots lie outside the unit circle, thus the VAR is stationary and satisfies stability conditions.

The impulse response analyses are next modelled using the generalized impulses as described by Pesaran and Shin (1998). Graphical reports of the impulse response analyses (Figures 4.2-4.7) show that stock market returns in Ghana, Kenya, Mauritius and Nigeria reduce (within the first month of the shock) with a shock induced by the exchange rate. For Egypt and South Africa the stock market returns responds positively to a shock induced by the exchange rate within the first month of the shock. The impulse response patterns of exchange rate to shocks induced by stock market returns in each of the countries are no different.

The impulse responses are also shown in Table 4.9, with their Monte Carlo standard errors. None of the responses is statistically significant for all the countries. However, in terms of magnitude Egypt has the highest response of stock returns to exchange rate shocks (1.27%), whilst Mauritius has the lowest response of 0.018%. An interesting pattern from the impulse responses is that shocks induced by either stock market returns or exchange rate changes seem to be more protracted in Ghana (11 months), Kenya (10 months), Mauritius (8 months) and Nigeria (10 months) than in South Africa (4 months) and Egypt (5 months). This implies that misalignments in the movements of exchange rate and stock market returns leave longer-lasting distortions in the economy in Ghana, Kenya, Mauritius and Nigeria.

4.4 Conclusion

The paper examined the dynamic relationship between stock market prices and exchange rates movements for 7 African countries. Amongst the 7 countries, Tunisia alone exhibits a stable long-run relationship between stock market prices and exchange rates. The long-run equation for Tunisia shows that exchange rate depreciation leads to increases in stock market prices in Tunisia. In the short run, however, exchange rate

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[14] Not shown for the sake of brevity.

depreciations reduce stock market returns. The error-correction term also indicates the presence of Granger causality from exchange rate movement to stock market returns. For Tunisia these results imply that there are some anomalies which in the short run result in exchange rate depreciation dampening stock market returns. In the long run these anomalies are corrected, though at low speed.

For the rest of the countries where there is no long-run relationship between stock market prices and exchange rate, Granger causality tests reveal that the exchange rate movement Granger causes stock market returns in Egypt. On the other hand, Granger causality from stock market returns to exchange rate movement is evident for Kenya and Mauritius. VAR impulse response analyses also show that stock market returns in Ghana, Kenya, Mauritius and Nigeria reduce within the first month of the shock to a shock induced by the exchange rate. For Egypt and South Africa the stock market returns increase in response to a shock induced by the exchange rate within the first month of the shock.

Interestingly, shocks induced by either stock market returns or exchange rate changes seem to be more protracted in Ghana (11 months), Kenya (10 months), Mauritius (8 months) and Nigeria (10 months) than in South Africa (4 months) and Egypt (5 months). These results show that, even though there is no long-run stable relationship between stock market prices and exchange rates for Egypt, Ghana, Kenya, Mauritius, Nigeria and South Africa, there are substantial short-run interactions between exchange rate movements and stock market returns. Finally, the results also show that different economic environments within different countries could result in different responses of stock market returns to exchange rate movements and vice versa.

Appendix

Table 4-1 Descriptive Statistics of Monthly Movement of Stock Market Index and Exchange Rate

	Egypt	Ghana	Kenya	Mauritius	Nigeria	S Africa	Tunisia
				Stock market index			
Mean	-0.0043	0.0279	0.0002	0.0018	0.0231	0.0078	0.0008
Maximum	0.2699	0.4430	0.1601	0.1219	0.1659	0.1319	0.1917
Minimum	-0.1926	-0.141	-0.136	-0.108	-0.093	-0.351	-0.059
Std deviation	0.074	0.073	0.055	0.037	0.036	0.064	0.039
Skewness	0.840	2.060	0.721	0.457	0.393	-1.406	2.047
Kurtosis	4.80	11.06	3.89	4.65	4.99	9.61	10.78
Jarque-Bera	25.07	571.16	10.58	13.60	34.46	253.79	196.48
				Exchange rate			
Mean	0.0046	0.0195	0.0018	0.0053	0.0190	0.0043	0.0025
Maximum	0.1786	0.1562	0.0545	0.1300	1.3633	0.1615	0.0512
Minimum	-0.002	-0.108	-0.058	-0.117	-0.123	-0.108	-0.044
Std deviation	0.021	0.028	0.019	0.024	0.115	0.044	0.020
Skewness	6.430	1.510	-0.40	0.901	9.547	0.322	-0.286
Kurtosis	48.96	10.80	4.54	18.78	106.66	4.288	2.722
Jarque-Bera	9395.78	487.56	11.18	957.13	82864.02	10.19	1.03
Obs	99	167	88	91	179	118	61
Time Period	10/1995 01/2003	01/1992 12/2004	11/1998 03/2003	06/1996 01/2003	01/1988 12/2003	06/1996 04/2004	12/1998 01/2003

Table 4-2 Unit Roots Test

			Stock Market Prices		
	ADF	PP	First Diff ADF	First Diff PP	Order of integration
Egypt	-1.6547	-1.6887	-5.2751***	-8.4706***	*I(1)*
Ghana	-2.5214	-1.4971	-6.3228***	-7.9993***	*I(1)*
Kenya	-1.3627	-0.4411	-5.0172***	-6.7333***	*I(1)*
Mauritius	-1.79953	-1.7969	-6.3821***	-7.5049***	*I(1)*
Nigeria	-1.4432	-0.7444	-4.887***	-5.3748***	*I(1)*
S Africa	-1.295	-1.211	-7.8623***	-10.8221***	*I(1)*
Tunisia	-1.290	-1.282	-5.83***	-8.05***	*I(1)*
			Exchange Rate		
	ADF	PP	First Diff ADF	First Diff PP	Order of integration
Egypt	1.8355	1.1059	-3.14177***	-5.8369***	*I(1)*
Ghana	-2.1659	-0.6713	-4.3049***	-6.2592***	*I(1)*
Kenya	-2.7280	-1.1389	-5.4323***	-8.5989***	*I(1)*
Mauritius	-0.7060	-0.8264	-6.9274***	-11.5713***	*I(1)*
Nigeria	-2.3455	-2.4039	-9.002***	-12.826***	*I(1)*
S Africa	-1.13496	-0.6012	-6.3353***	-10.4396***	*I(1)*
Tunisia	-0.3887	-0.7861	-5.0916***	-5.91075***	*I(1)*

** (***) indicate significance at 5% and 1% respectively.

Table 4-3 Lag Length Criteria

		Criteria				
Country	Lag length	LR	FPE	AIC	SC	HQ
Egypt	1		X	X	X	X
Ghana	2		X	X	X	X
Kenya	2		X	X		
Mauritius	1		X	X	X	X
Nigeria	2		X			X
South Africa	1	X	X	X		
Tunisia	2	X	X	X	X	X

X indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion
These lag lengths are chosen for the cointegration and Granger causality tests.

Table 4-4 Cointegration Tests

H_0	λ_{max}	*95% critical value*	*trace*	*95% critical value*
		Egypt		
$r = 0$	9.075472	14.26460	11.80335	15.49471
$r \leq 1$	2.727879	3.841466	2.727879	3.841466
		Ghana		
$r = 0$	2.212071	14.26460	3.734171	15.49471
$r \leq 1$	1.522100	3.841466	1.522100	3.841466
		Kenya		
$r = 0$	6.197909	14.26460	7.249964	15.49471
$r \leq 1$	1.052056	3.841466	1.052056	3.841466
		Mauritius		
$r = 0$	3.312192	14.26460	6.430453	15.49471
$r \leq 1$	3.118261	3.841466	3.118261	3.841466
		Nigeria		
$r = 0$	5.016790	14.26460	6.593292	15.49471
$r \leq 1$	1.576502	3.841466	1.576502	3.841466
		South Africa		
$r = 0$	4.326254	14.26460	5.702749	15.49471
$r \leq 1$	1.376495	3.841466	1.376495	3.841466
		Tunisia		
$r = 0$	12.91801	14.26460	16.55862*	15.49471
$r \leq 1$	3.640608	3.841466	3.640608	3.841466

* denotes rejection of the hypothesis of no cointegration at the 0.05 level using MacKinnon-Haug-Michelis (1999) p-values; trace test indicates 1 cointegration equation at 0.05% significance level.

Table 4-5 Granger Causality Tests

		Egypt	
<u>Null Hypothesis:</u>	<u>Obs</u>	<u>F-Statistic</u>	<u>Probability</u>
Δe_t does not Granger Cause Δs_t	98	2.96630	0.08827
Δs_t does not Granger Cause Δe_t		0.01994	0.88800
		Ghana	
<u>Null Hypothesis:</u>	<u>Obs</u>	<u>F-Statistic</u>	<u>Probability</u>
Δe_t does not Granger Cause Δs_t	165	0.41435	0.66148
Δs_t does not Granger Cause Δe_t		1.04184	0.35518
		Kenya	
<u>Null Hypothesis:</u>	<u>Obs</u>	<u>F-Statistic</u>	<u>Probability</u>
Δe_t does not Granger Cause Δs_t	86	0.04514	0.95589
Δs_t does not Granger Cause Δe_t		2.40564	0.09663
		Mauritius	
<u>Null Hypothesis:</u>	<u>Obs</u>	<u>F-Statistic</u>	<u>Probability</u>
Δe_t does not Granger Cause Δs_t	89	1.33847	0.26778
Δs_t does not Granger Cause Δe_t		3.27753	0.04260
		Nigeria	
<u>Null Hypothesis:</u>	<u>Obs</u>	F-Statistic	Probability
Δe_t does not Granger Cause Δs_t	177	0.17778	0.83728
Δs_t does not Granger Cause Δe_t		0.34815	0.70649
		South Africa	
<u>Null Hypothesis:</u>	<u>Obs</u>	F-Statistic	Probability
Δe_t does not Granger Cause Δs_t	117	0.67110	0.41438
Δs_t does not Granger Cause Δe_t		0.88618	0.34851

Table 4-6 Long-Run Equation for Tunisia

Normalized cointegrating coefficients (standard error in parentheses)		
$\log s_t$	$\log e_t$	Constant
1.000000	-1.405162	-6.7825
	(0.18342)	

Adjustment coefficients (standard error in parentheses)	
Δs_t	0.050573 (0.07144)
Δe_t	0.123525 (0.03176)

Table 4-7 Short-Run Dynamic Model for Tunisia

Variable	Coefficient	Std. Error	t-Statistic	Prob.
White Heteroskedasticity-Consistent Standard Errors & Covariance				
$\Delta\hat{s}_{t-1}$	0.221724	0.138441	1.601577	0.1149
$\Delta\hat{e}_{t-1}$	-1.026793**	0.444839	-2.308236	0.0247
ect_{t-1}	-0.114036*	0.062895	-1.813115	0.0752
C	0.014960	0.013676	1.093860	0.2787
R^2	0.130867	Mean dependent var		0.015417
Adjusted R^2	0.084306	S.D. dependent var		0.112537
S.E. of regression	0.107689	F-statistic		2.810664
Durbin-Watson stat	2.065419	Prob(F-statistic)		0.047624

**, * denote significance of coefficients at 5% and 10% respectively. The dependent variable is Δs_t, the max lag lengths are chosen based on FPE, AIC and SC criteria. ect_{t-1} is the error correction term to capture deviations from the short-run to long-run equilibrium.

Table 4-8 Diagnostic Tests

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.6653	Probability	0.4181
ARCH Test:			
F-statistic	0.2333	Probability	0.6308
White Heteroskedasticity Test:			
F-statistic	1.2315	Probability	0.3051
Ramsey RESET Test:			
F-statistic	0.1005	Probability	0.7523
Normality Jarque-Bera	1.2907	Probability	0.5244

Figure 4-1 Recursive Residuals for Short-Run Model
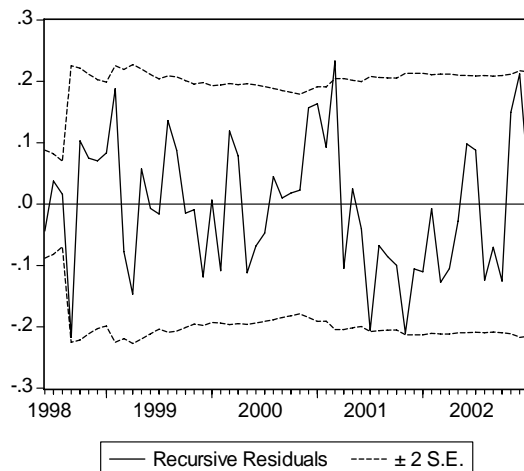
Table 4-9 Generalized Impulse Responses

Months	Egypt	Ghana	Kenya	Mauritius	Nigeria	S Africa
Response of stock returns to a unit shock in exchange rate returns						
1	0.012767	-0.003123	-0.003071	-0.000183	-0.002053	0.000333
	(0.00829)	(0.00591)	(0.00667)	(0.00436)	(0.00239)	(0.00600)
2	-0.021522	0.003072	-6.72E-05	0.002341	-0.002581	-0.005023
	(0.01579)	(0.00656)	(0.00639)	(0.00390)	(0.00302)	(0.00651)
3	-0.003276	0.003078	-0.001813	-0.000399	-0.001688	-2.10E-05
	(0.00609)	(0.00467)	(0.00613)	(0.00074)	(0.00291)	(0.00122)
4	-0.000397	0.002576	-0.000439	0.000220	-0.000910	3.04E-05
	(0.00235)	(0.00346)	(0.00311)	(0.00052)	(0.00167)	(0.00029)
5	-4.53E-05	0.001782	-0.000491	-6.27E-05	-0.000492	2.43E-07
	(0.00085)	(0.00269)	(0.00235)	(0.00018)	(0.00105)	(7.6E-05)
6	-5.06E-06	0.001177	-0.000179	2.49E-05	-0.000268	-1.84E-07
	(0.00029)	(0.00181)	(0.00135)	(0.00012)	(0.00069)	(1.8E-05)
7	-5.61E-07	0.000740	-0.000122	-8.25E-06	-0.000147	-2.17E-09
	(0.00012)	(0.00122)	(0.00095)	(5.2E-05)	(0.00048)	(4.4E-06)
8	-6.21E-08	0.000455	-5.27E-05	3.00E-06	-8.01E-05	1.11E-09
	(5.7E-05)	(0.00078)	(0.00058)	(3.3E-05)	(0.00034)	(1.3E-06)
9	-6.86E-09	0.000275	-2.97E-05	-1.04E-06	-4.37E-05	1.74E-11
	(2.7E-05)	(0.00051)	(0.00042)	(1.7E-05)	(0.00025)	(3.5E-07)
10	-7.58E-10	0.000164	-1.38E-05	3.70E-07	-2.39E-05	-6.67E-12
	(1.2E-05)	(0.00035)	(0.00027)	(1.0E-05)	(0.00018)	(9.5E-08)
11	-8.38E-11	9.69E-05	-7.17E-06	-1.30E-07	-1.30E-05	-1.31E-13
	(4.8E-06)	(0.00025)	(0.00020)	(5.8E-06)	(0.00013)	(2.9E-08)
12	-9.26E-12	5.69E-05	-3.42E-06	4.58E-08	-7.12E-06	4.00E-14
	(2.0E-06)	(0.00018)	(0.00014)	(3.5E-06)	(0.00010)	(8.2E-09)
Response of exchange rate returns to a unit shock in stock returns						
	Egypt	Ghana	Kenya	Mauritius	Nigeria	S Africa
1	0.003737	-0.001143	-0.001059	-0.000112	-0.007830	0.000230
	(0.00239)	(0.00217)	(0.00233)	(0.00267)	(0.00897)	(0.00414)
2	0.000304	-0.001172	-0.004556	0.005752	-0.001435	0.003997
	(0.00248)	(0.00212)	(0.00227)	(0.00252)	(0.00973)	(0.00448)
3	2.93E-05	-0.003196	-0.000297	-0.000959	-0.005969	1.37E-05
	(0.00055)	(0.00239)	(0.00213)	(0.00099)	(0.00837)	(0.00091)
4	3.07E-06	-0.002244	-0.001077	0.000537	-0.003550	-2.42E-05
	(0.00030)	(0.00176)	(0.00115)	(0.00051)	(0.00493)	(0.00016)
5	3.33E-07	-0.001680	-0.000209	-0.000152	-0.001865	-1.75E-07
	(8.3E-05)	(0.00143)	(0.00082)	(0.00027)	(0.00288)	(4.9E-05)
6	3.65E-08	-0.001082	-0.000229	6.06E-05	-0.001010	1.47E-07
	(4.9E-05)	(0.00104)	(0.00048)	(0.00015)	(0.00178)	(1.2E-05)
7	4.03E-09	-0.000691	-7.24E-05	-2.00E-05	-0.000552	1.62E-09
	(1.7E-05)	(0.00077)	(0.00036)	(8.3E-05)	(0.00123)	(2.0E-06)
8	4.45E-10	-0.000424	-5.01E-05	7.30E-06	-0.000302	-8.84E-10
	(1.1E-05)	(0.00057)	(0.00024)	(4.8E-05)	(0.00086)	(8.7E-07)
9	4.91E-11	-0.000257	-2.01E-05	-2.53E-06	-0.000165	-1.32E-11
	(4.2E-06)	(0.00041)	(0.00019)	(2.8E-05)	(0.00063)	(2.3E-07)
10	5.43E-12	-0.000153	-1.14E-05	8.99E-07	-8.99E-05	5.32E-12
	(2.4E-06)	(0.00030)	(0.00013)	(1.7E-05)	(0.00046)	(4.4E-08)
11	6.00E-13	-9.06E-05	-5.08E-06	-3.15E-07	-4.91E-05	1.00E-13
	(1.0E-06)	(0.00022)	(0.00011)	(1.0E-05)	(0.00035)	(1.8E-08)
12	6.63E-14	-5.32E-05	-2.64E-06	1.11E-07	-2.68E-05	-3.19E-14
	(5.8E-07)	(0.00016)	(7.7E-05)	(6.1E-06)	(0.00026)	(4.7E-09)

Monte Carlo Standard errors in parenthesis

Figure 4-2 Impulse Response Egypt
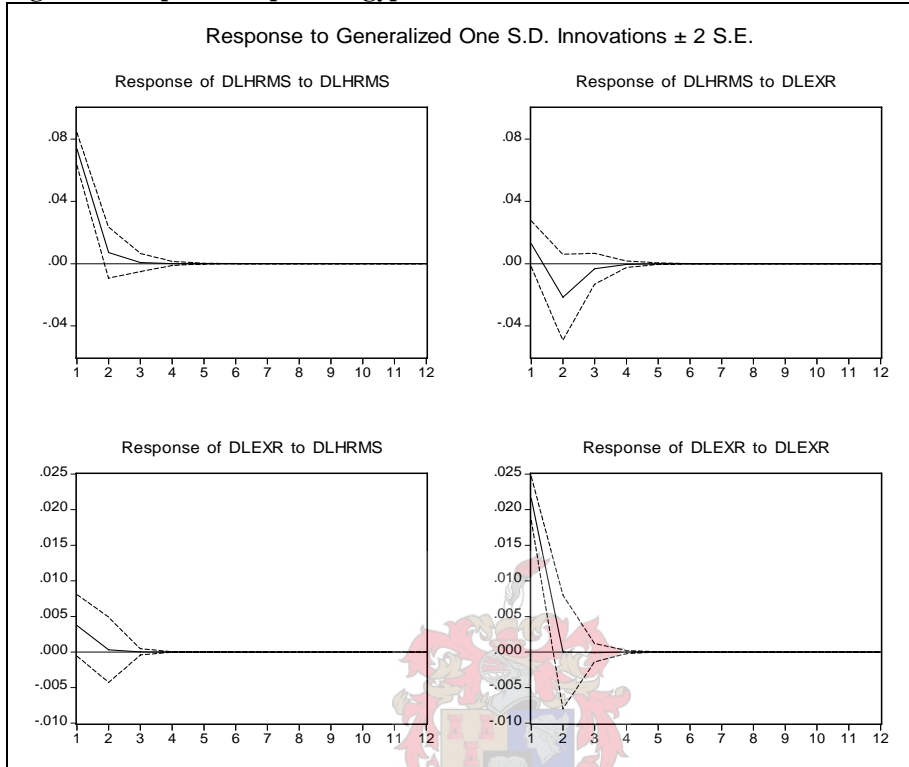
Figure 4-3 Impulse Response Ghana
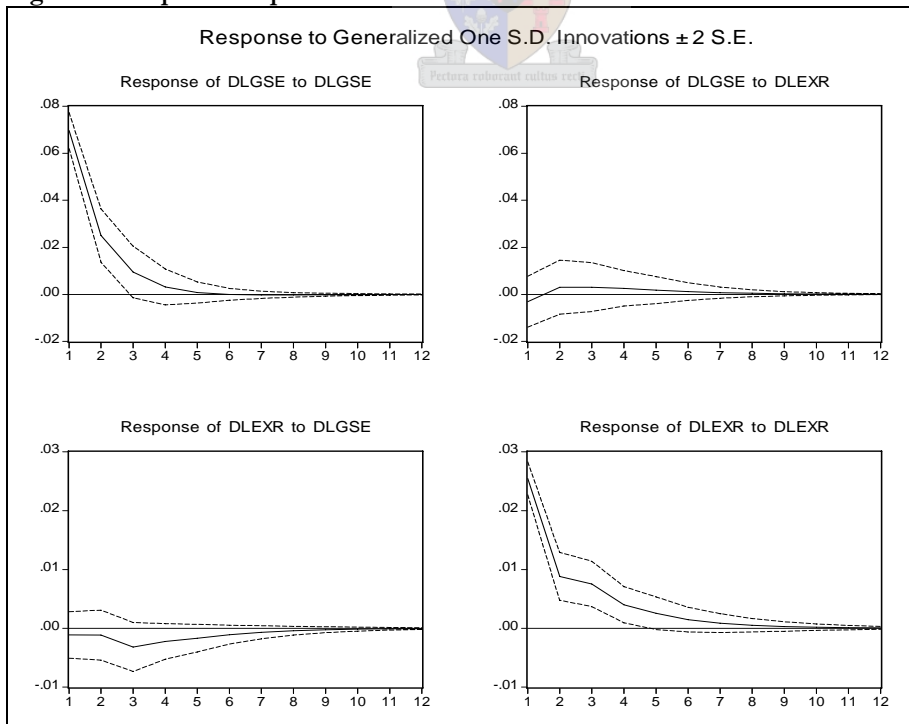
Figure 4-4 Impulse Response Kenya

Response to Generalized One S.D. Innovations ± 2 S.E.
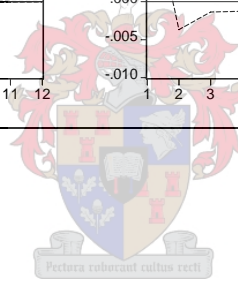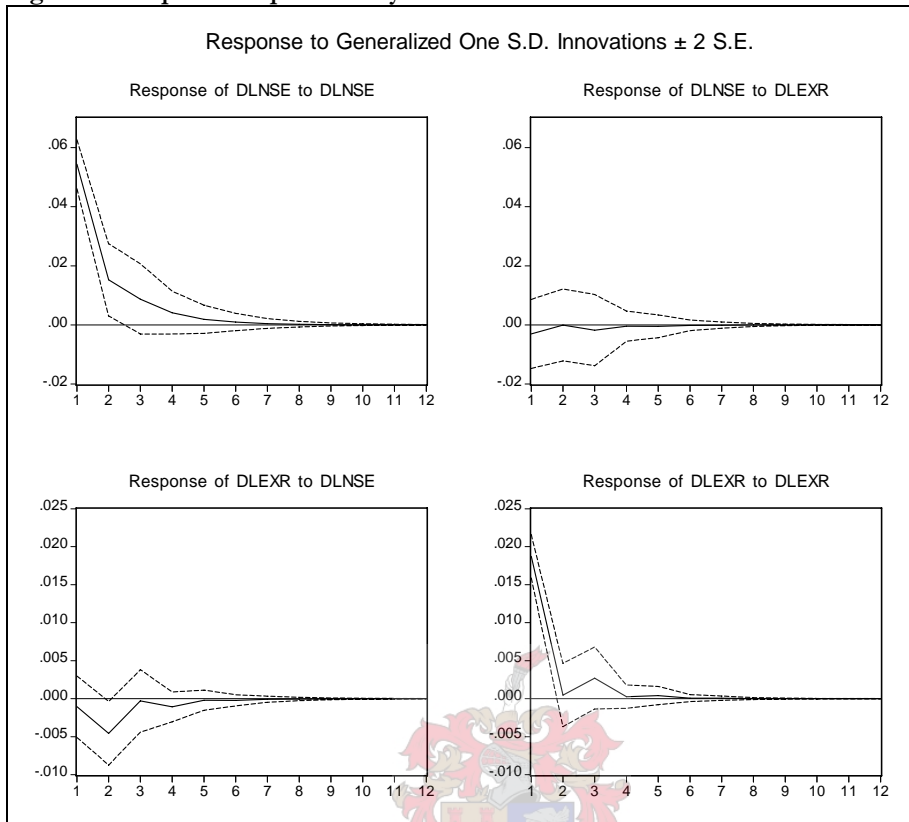
Figure 4-5 Impulse Response Mauritius

Response to Generalized One S.D. Innovations ± 2 S.E.
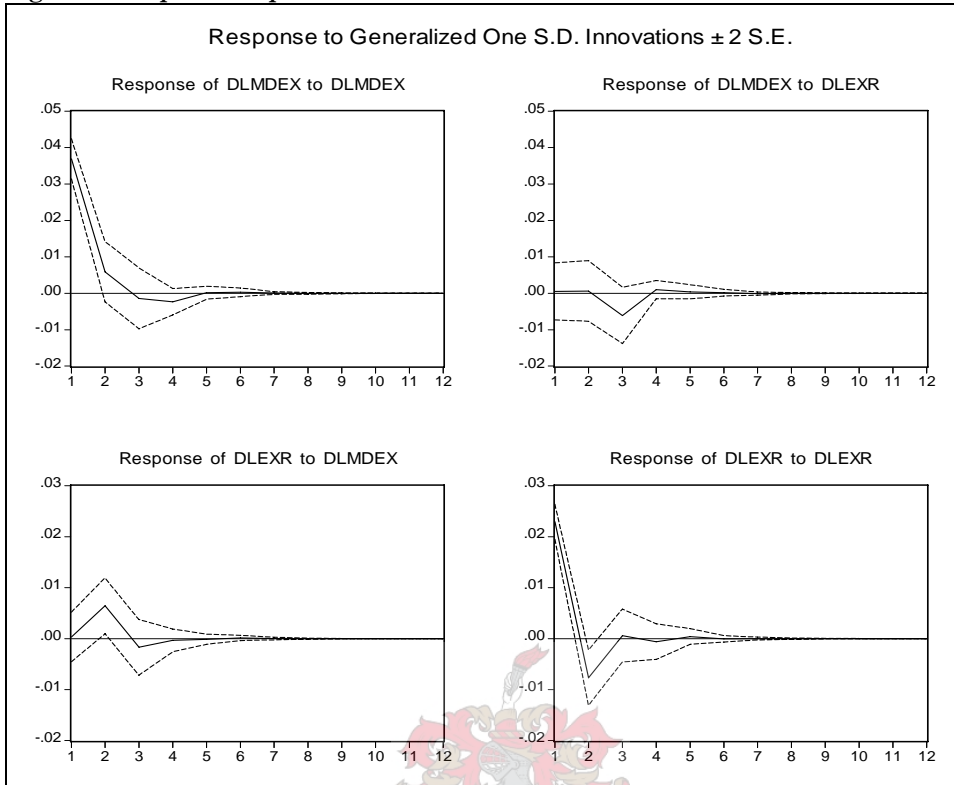
Figure 4-6 Impulse Response Nigeria

Response to Generalized One S.D. Innovations ± 2 S.E.
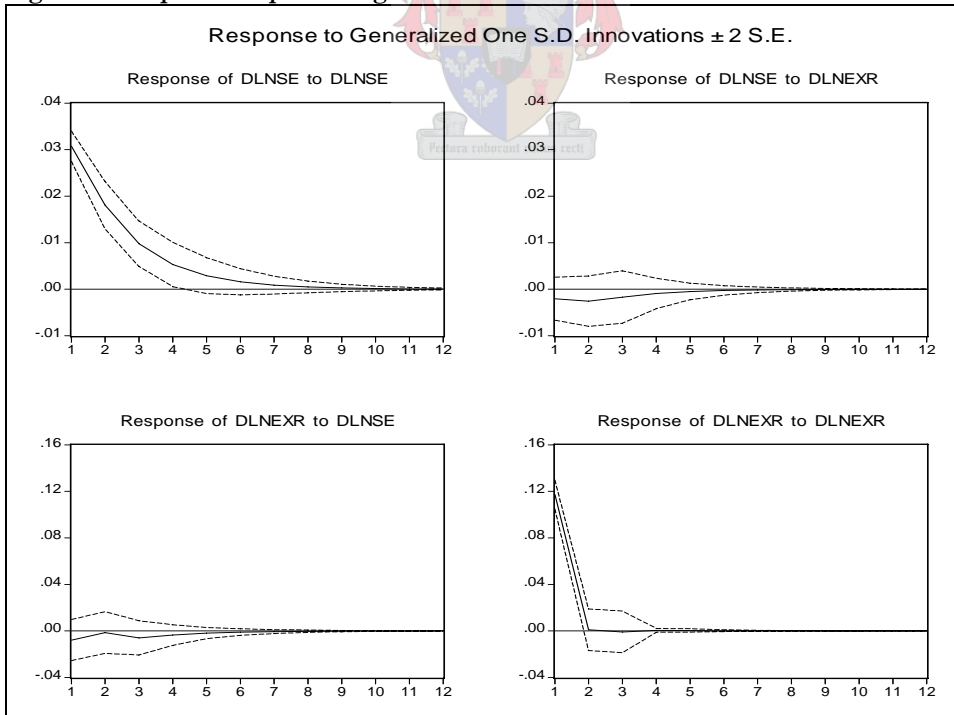
Figure 4-7 Impulse Response South Africa

Response to Generalized One S.D. Innovations ± 2 S.E.

Response of DLJALS to DLJALS

Response of DLJALS to DLEXR

Response of DLEXR to DLJALS

Response of DLEXR to DLEXR
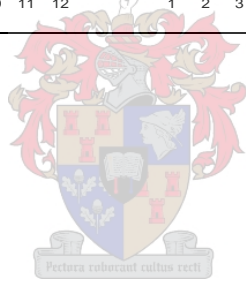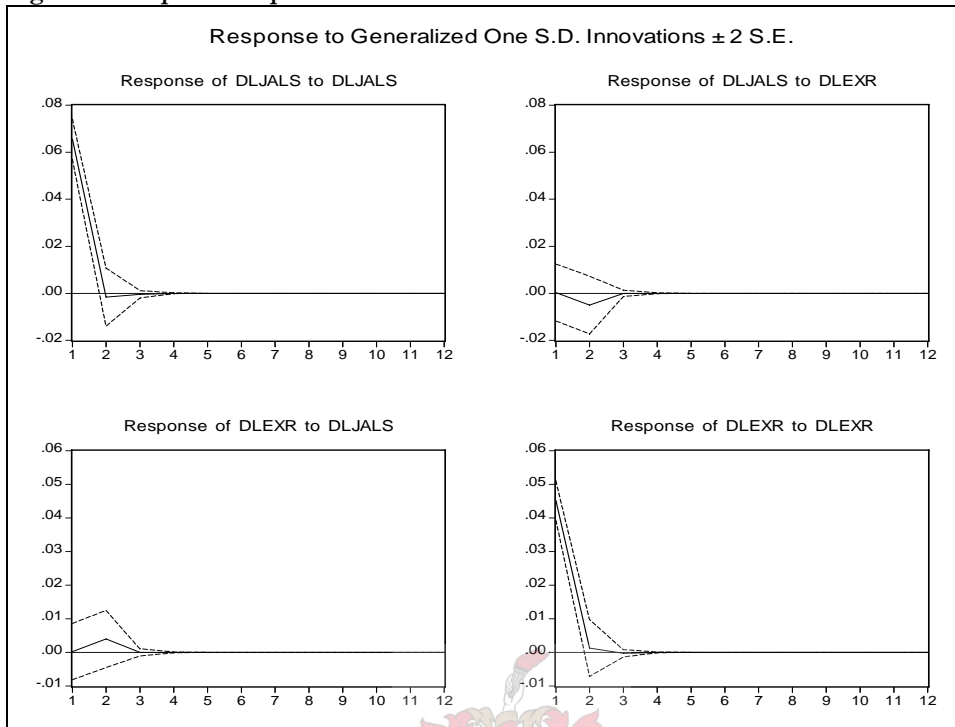
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CHAPTER FIVE

**THE RESPONSE OF AFRICAN STOCK MARKET RETURNS TO
INFLATION MOVEMENT**[15]

5.1 Introduction

Economists and financial analysts have generally expected that stock returns should
increase with an increase in inflation. This is because stocks are supposed to be an
effective hedge against inflation. Thus there should be a positive one-to-one relationship
between stock market returns and inflation. This expectation is an extension of the
Fisher hypothesis, which states that the ex-ante nominal returns on an asset should fully
anticipate changes in expected inflation. Thus inflation should not affect real stock
prices.

Empirical studies, however, have largely documented a negative relationship between
stock market returns and inflation (Bodie, 1976; Fama, 1981, 1990). This negative
relationship has generated substantial debate and further investigations into the response
of stock returns to inflation movement. Various explanations have been given for the
negative relationship between inflation and stock returns (Feldstein, 1980; Fama, 1981;
and Geske and Roll, 1983). These explanations have centred on the importance of taking
into consideration the macroeconomic environment within which stock markets operate.
Interestingly, subsequent empirical works have also shown that the Fisher hypothesis of
a positive relationship between inflation and stock returns is indeed true.

There is therefore a need for further investigations into the response of stock returns to
inflation given the current trend of both a negative and positive relationship between
inflation and stock returns. It is important to note that this relationship could also be an
observed empirical phenomenon which occurs within specific economic environments
and therefore could vary over time and across countries. Most of the empirical studies
on the response of stock returns to inflation have been largely conducted in developed
economies and some emerging developing economies, with little on Africa.

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[15] This paper was presented at The Economic Society of Southern Africa Biennial Conference 7-9
September 2005, Durban, South Africa.

There are 19 stock markets in Africa, most of which are young but budding markets. Whilst the performance of most of these African markets has been impressive over the last decade, the same cannot be said of the general inflation trends in the respective African countries. The prime objective of this paper is to establish the response of African stock markets to inflationary trends. The specific hypothesis tested in this chapter is whether African stock markets provide an effective hedge against inflation. The possibility of a non-linear relationship between inflation and stock returns is also investigated. The rest of the paper is organized as follows: section 5.2 reviews the relevant literature; the model, analysis and results are discussed in section 5.3 and the conclusion is presented in section 5.4.

5.2 Literature Overview

The first set of empirical tests on inflation and stock returns were conducted by Jaffe and Mandelker (1976), Bodie (1976), Nelson (1976) and Fama and Schwert (1976), with results indicating a negative relationship between inflation and stock returns. This was contrary to a priori expectations, which rejected the Fisher hypothesis of a one-to-one increasing relationship between stock returns and inflation. Further empirical tests on the response of stock returns to inflation in the 1980s by Fama (1981), Gertler and Grinols (1982) and Solnik (1983), amongst others, also yielded similar results of a negative relationship. These results led to several hypotheses emerging to explain the negative relationship between stock returns and inflation.

Three dominant hypotheses which have emerged since then are the tax-effect, proxy effect and the reverse causality hypotheses. The tax-effect hypothesis proposed by Feldstein (1980) argues that inflation lowers stock market returns due to the fact that the tax assessment of depreciations and inventory valuation are done in a non-neutral manner. Hence inflation introduces a corporate tax liability and reduces real after-tax earnings, thus reducing stock returns. The proxy effect studied by Fama (1981) explains that the negative effect of inflation on stock returns occurs through the effect of inflation on real activity. Real activity is positively correlated with stock returns, but

negatively correlated with inflation through the money demand effect; therefore there will be a negative relationship between stock returns and inflation.

The reverse causality hypothesis through money supply shocks studied by Geske and Roll (1983), on the other hand, emphasizes the role of money supply in helping to explain the inflation-stock returns relationship. They explain that the reaction of stock markets to future economic activity is correlated with government revenue. In the event of a budget deficit and a decline of real activity, there is increased domestic borrowing or increased supply of money through the central bank to balance the budget.

The increase in domestic borrowing or issuance of money has inflationary effects which dampen real activity. In the end stock market returns also fall due to a fall in real activity and the inflationary effect, hence the negative relationship between stock market returns and inflation. Other related explanations for the negative response of stock returns to inflation have also been put forth by Benderly and Zwick (1985), Kaul (1987), and Titman and Wanga (1989).

Further empirical works have also concluded differently on the response of stock returns to inflation. For instance, Gultekin (1983), using a number of countries, finds the existence of a positive relationship between stock returns and inflation in a cross-sectional framework, but a negative relationship in a time-series framework. Solnik (1983) also finds a negative relationship between inflation and stock returns, and attributes it to the reverse causality hypothesis. Liu, Hsueh and Clayton (1993), however, reject the negative relationship as well as the proxy hypothesis. Boudoukh and Richardson (1993) and Boudoukh, Richardson and Whitelaw (1994) also observe that the positive relationship between inflation and stock market returns holds in the long run, and that the short run may be fraught with anomalies which result in the negative relationship.

However, Ely and Robinson (1994), using multivariate cointegration analysis, find no long-run relationship between inflation and stock returns. Groenewold, O'Rouke and Thomas (1997) and Caporale and Jung (1997), amongst others, also find a negative response of stock returns to inflation. Other authors such as Barnes, Boyd and Smith (1999) and Boyd, Levine and Smith (2001) further observe that the negative relationship

between inflation and stock returns occurs within low-to-moderate inflation economies, whilst the positive relationship occurs in high-inflation economies.

Given that the trend of empirical results on the relationship between stock returns and inflation is still mixed, it is relevant to investigate the issue further and from different perspectives. Most importantly, the mixed results produced by empirical studies imply that investors react differently to economic variables. It is, therefore, important to understand that stock returns may react differently to inflation, depending on the macroeconomic factors underling their specific environment. The present chapter, thus, examines the relationship from an African perspective, using 7 African countries.

5.3 Model, Analysis and Results

The analytical framework adopted for investigating the relationship between inflation and stock market returns follows the conventional money demand function:

$$m = a_1 + a_2 y + a_3 p + a_4 i + e \qquad\qquad 1$$

where, $m =$ money balances, $p =$ inflation, $y =$ income (GDP as proxy), and $i =$ interest rate. The introduction of stock market prices s into the model results in an augmented money demand model:

$$m = a_1 + a_2 y + a_3 p + a_4 i + a_5 s + u \qquad\qquad 2$$

Following Benderley and Zwick (1985), and Siklos and Kwok (1999), equation 2 could be re-written as:

$$s = b_1 + b_2 y + b_3 p + b_4 i + b_5 m + v \qquad\qquad 3$$

Equation (3) is also an augmented asset demand model framework and has been used in a number of studies to test for the relationship between inflation and stock returns. A priori it is expected that $b_2 > 0$, thus an increase in income levels results in an increase

in demand for stocks and hence increases stock prices, and *either* $b_3 > 0$ *or* $b_3 < 0$ that is if stocks are an effective hedge against inflation then there should be a positive one-to-one relationship between stock prices and inflation. However the reverse holds if stocks do not hedge against inflation, in which case the Tax, Proxy or Reverse Causality Effects are present. It is also expected that $b_4 < 0$, thus an increase in interest rates will result in investors switching from the stock market to the money market hence depressing stock prices. Finally due to the direct positive relationship between money supply and inflation it is expected that *either* $b_5 > 0$ *or* $b_5 < 0$. Equation 3 forms the basic model for testing the relationship between inflation and stock returns in this chapter. To investigate the long-run and short-run effects, a dynamic specification of equation 3 is necessary. The dynamic representation of equation 3 (in first difference for stationarity) follows a general re-parameterized autoregressive distributed lag model of the form:

$$\Delta s_t = \alpha_0 + \sum_{k=1}^{m} \left(\alpha_{1k} \Delta s_{t-k} + \alpha_{2k} \Delta p_{t-k} + \alpha_{3k} \Delta m_{t-k} + \alpha_{4k} \Delta i_{t-k} \right) + \lambda ECT_{t-1} + \varepsilon_t \quad 4$$

The variable ECT in equation 4 is the error-correction term and captures the short-run deviations of the model from long-run equilibrium. It also provides information on the possibility of Granger causality from output, inflation, money supply and interest to stock returns.

Based on the availability of high frequency data for each country different time periods are chosen (see Table 5.1 for time periods). The study uses monthly data on money supply, GDP in constant local prices, consumer price index[16] and interest rates (Treasury bill rates) in Egypt, Ghana, Kenya, Mauritius, Nigeria, South Africa and Tunisia from the International Monetary Fund's International Financial Statistics CD-ROM. The monthly stock market index was obtained from Reuters. Real stock market indices, measured as stock market index/inflation, are used for the analysis. However in the case of GDP, monthly GDP is unavailable for the countries, even in the case of quarterly GDP this is difficult to access and indeed is nonexistent in Ghana. Again though some of the

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[16] change in CPI measures inflation

countries report quarterly GDP figures these do not have long history for robust time-series analysis, thus monthly GDP is computed based on Ginsburgh (1973) interpolation methods from the annual series using EViews 5 (2004) software[17]. See Appendix Table 5.1 for a summary of descriptive statistics of the variables and the time period used for the study.

Unit roots tests (see Appendix Table 5.2) conducted on the log levels of the variables using both Augmented Dickey Fuller (ADF) and Philips Perron (PP) tests indicate that all series are integrated of order one and become stationary after first differencing. A cointegration test is also conducted to determine whether there is a stable long-run vector for the series. The cointegration test is done in the multivariate Johansen and Juselius (1990, 1991) framework. Given the sensitivity of the Johansen and Juselius cointegration tests to lag lengths, various lag-length tests are performed to choose the optimal lag length (see Appendix Table 5.3).

Results of the cointegration tests in each country are presented in Table 5.3 in the Appendix. The results suggest that at the 5% significance level there is at least a cointegration equation spanning the variables in 3 of the 7 countries: Egypt, Mauritius and South Africa. In a few cases the maximum eigen value statistic and the trace test provide conflicting results; the decision on the number of the cointegration equation is thus based on the trace test, following Johansen and Juselius (1990). The results imply that a long-run relationship between CPI and stock market prices exists for Egypt, Mauritius and South Africa, but not Ghana, Kenya, Nigeria and Tunisia.

An interpretation of the cointegrating (β) vectors tends to be difficult and is, therefore, guided by economic intuition, based on an expectation of a long-run relationship between stock returns and CPI. In this regard the estimated normalized cointegrated vectors are chosen to reflect normalization on stock prices[18]. The long-run equations

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[17] The interpolation in EViews is based on a quadratic match average method, which fills observations of high-frequency series, such that average frequency points match low-frequency data observed. This method has been chosen since it suits situations with few data points due to the fact that resulting interpolation curves are not constrained to be continuous at the boundaries between adjacent periods.

[18] Indeed, since the focus of this paper is on testing the response of stock returns to inflation, this normalization is also appropriate.

based on the normalizations are shown in Table 5.4 in the Appendix. The results show that there is a negative and significant relationship between CPI and stock market prices for Mauritius and South Africa. The CPI variable is not significant for Egypt. The results, however, imply a rejection of the Fisher hypothesis for the three countries.

It is interesting to note that there is also a positive relationship between output and stock market prices for the three countries (Egypt, Mauritius and South Africa); at the same time the effect of inflation on stock market price is also a decreasing one, thus confirming the presence of a proxy effect in these countries. To investigate the possibility of a non-linear relationship between inflation and stock market prices, a new variable, the inverse of inflation, is introduced (having been tested for unit roots) into the estimation to examine the effect[19]. There is generally very little change in the cointegration test results, except for obvious mirror reflective changes in the sign of each variable when compared to the analysis with the inflation variable.

Having determined the long-run relationship between the variables[20], the dynamic relationship for Egypt, Mauritius and South Africa is investigated via error-correction modelling for stock returns. The dynamic modelling process begins with a general over-parameterized model[21] for each country, which incorporates all the stationary variables up to a maximum lag length. The reduction of the over-parameterized model to parsimony is based on the Hendry (1994) procedure[22] and results in the dynamic short-run model shown in Table 5.6 in the Appendix. Diagnostic tests on the parsimonious model in each country all show a well-behaved model (Appendix Table 5.7).

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[19] Results not shown for the sake of brevity.

[20] Block exogeneity tests were conducted and results showed that at the 5% and 10% significance level output, inflation, money supply and interest rates could enter the stock return equation weakly.

[21] Note, the short-run error correction could be estimated in a full information parsimonious vector error-correction form. However, given the focus of the chapter, the parsimonious model concentrates on the equation based on the stationary stock market prices as the dependent variable.

[22] The F tests (not shown) for the reduction process in each country show that the final parsimonious model in each country is robust.

With respect to the short-run dynamics, there is a negative relationship between the instantaneous change in inflation and stock returns[23] for Egypt, Mauritius and South Africa. Thereafter lagged changes vary in direction for Egypt. The changing dynamics with respect to the effect of money supply and interest rates also reflect and confirm the changing dynamics and their varying effects on stock returns in these countries. Finally, the error-correction term for each short-run model in each country is significant and has the right sign.

This confirms the presence of Granger causality from output, inflation, money supply and interest rates to stock returns. In general, the disequilibrium from the short run to the long run is corrected at a low speed, as indicated by the size of the error terms. Thus it takes a long time for economic agents to assimilate information from the short-run dynamics. The fastest correction speed is 24% for South Africa and the lowest 8.8% for Egypt.

In the case of Ghana, Kenya, Nigeria and Tunisia, where there is no relationship between inflation and stock market prices, Granger causality tests are performed on the first difference of the stock market prices and inflation. The Granger causality test results (Table 5.5) indicate that there is unidirectional causality from inflation to stock returns in Ghana and bidirectional causality between inflation and stock returns in Kenya. There are no significant test results for Nigeria and Tunisia.

5.4 Conclusion

The negative relationship between stock market returns and inflation has been documented largely by studies conducted in developed countries and a number of Asian economies. This chapter investigates the relationship between stock market returns and inflation for 7 African countries in a time-series manner to ascertain if the results found in most of the developing economies also pertain to the African context. Using a conventional asset demand analytical framework, the analysis produces some interesting findings.

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[23] The first difference of the log levels of the stock market index yields stock returns:
$Stock \operatorname{Re} turn = \Delta s = (\ln s_t - \ln s_{t-1})$.

There is a long-run relationship between stock market prices and inflation for three of the countries, namely Egypt, Mauritius and South Africa. The long-run relationship between inflation and stock market prices is negative for these three countries, but only significant statistically for Mauritius and South Africa. Interestingly, there is a positive relationship between output and stock market prices in Egypt, Mauritius and South Africa, at the same time the effect of inflation on stock market prices is also a decreasing one, thus confirming the presence of a proxy effect in these countries.

The short-run dynamics reveal that there is a negative relationship between the instantaneous change in inflation and stock returns for all three countries. Thus stock returns fall with increases in inflation. The significance of the error-correction term also confirms the presence of Granger causality from output, inflation, money supply and interest rates to stock returns. In general the disequilibrium from the short run to the long run is corrected at a low speed, as indicated by the size of the error terms.

Both long-run and short-run dynamics show that inflation impacts negatively on stock markets development in Egypt, Mauritius and South Africa. This implies that stock markets in these countries are unable to hedge effectively against inflation. Finally, for Ghana, Kenya, Nigeria and Tunisia there is no long-run relationship between inflation and stock prices. Bivariate Granger causality tests show that there is significant causality from inflation to stock returns in Ghana and bidirectional causality between inflation and stock returns in Kenya. The results for Nigeria and Tunisia are insignificant.

Appendix

Table 5. 1 Descriptive Summary Statistics (GDP and money supply are in constant 1997 local prices)

	GDP	Stock Market Index	Inflation	Interest Rate	Money Supply
	Egypt (1994:10-2003:01)				
Mean	260878.7	8908.902	5.399899	9.793636	54816.84
Median	262216.2	8589.100	3.820000	9.500000	57592.00
Maximum	345635.9	15561.03	17.89000	11.00000	87234.00
Minimum	183979.2	4849.830	2.130000	9.000000	37570.60
Std. Dev.	36223.23	2770.462	4.361564	0.622055	11200.64
Skewness	-0.281419	0.417070	1.744941	0.846245	0.414880
Kurtosis	2.335189	2.252952	4.806149	2.274552	2.551676
	Ghana (1991:01-2004:12)				
Mean	4717668.	1061.120	25.53752	31.02023	5878.841
Median	4638024.	562.8257	22.40650	32.00000	3318.800
Maximum	6341456.	7360.462	70.80000	42.80000	26685.90
Minimum	3501655.	57.69947	7.300000	16.60000	288.7150
Std. Dev.	811601.6	1608.773	14.88896	7.899548	6729.414
Skewness	0.279420	2.812100	1.474331	-0.161106	1.439071
Kurtosis	1.932544	10.28267	4.906699	2.051515	4.034071
	Kenya (1997:11-2004:12)				
Mean	893669.1	2239.435	7.426507	7.971523	119539.4
Median	893690.3	2299.070	8.100133	6.635000	120105.5
Maximum	1450056.	3362.230	17.43570	21.45000	142001.0
Minimum	651221.4	1043.380	-0.470000	0.830000	84511.00
Std. Dev.	183885.8	672.5030	4.078189	5.137071	17929.22
Skewness	1.128979	-0.233343	-0.050031	1.007837	-0.415697
Kurtosis	3.945538	1.840155	2.201335	3.390675	1.876265
	Mauritius (1995:06-2003:01)				
Mean	104625.4	388.7130	6.171839	10.11931	10600.26
Median	103892.8	390.9500	6.040000	10.00000	10493.50
Maximum	144743.7	526.3700	9.350000	12.75000	15451.70
Minimum	68721.66	317.1600	2.870000	8.130000	7288.100
Std. Dev.	22869.83	43.08069	1.531127	1.244563	2057.123
Skewness	0.120748	0.607552	0.149753	0.721196	0.583320
Kurtosis	1.817912	3.511631	2.502019	2.654198	2.658804
	Nigeria (1988:01-2002:12)				
Mean	2174.945	3997.833	30.85341	14.43960	247859.2
Median	1824.427	2805.450	20.09500	13.41000	177401.0
Maximum	5886.075	12458.23	89.57000	27.00000	1042240.
Minimum	95.97273	191.1000	-2.490000	5.080000	14467.10
Std. Dev.	1894.518	3562.602	24.50855	4.112201	250881.0
Skewness	0.642884	0.623755	0.508065	0.556650	1.324272
Kurtosis	2.151544	2.266316	1.980066	3.361850	3.843044
	South Africa (1995:06-2003:01)				
Mean	920259.2	7891.474	6.282087	11.93104	527372.1
Median	855546.8	7679.880	6.530000	11.56000	461982.0
Maximum	1567862.	12656.86	15.28000	21.60000	1042240.
Minimum	547527.4	4581.150	0.200000	7.100000	179322.0
Std. Dev.	271263.9	1939.994	3.181344	3.212225	268827.5
Skewness	0.655999	0.396215	0.118229	0.424095	0.168208
Kurtosis	2.474919	2.201128	2.948201	2.516063	1.390139

Tunisia (1997:12-2003:01)					
Mean	26797.20	1191.345	2.688500	6.146167	5749.960
Median	26338.28	1197.695	2.755000	5.940000	5966.045
Maximum	34908.39	1445.300	3.710000	6.940000	7014.000
Minimum	21564.76	916.7600	1.300000	5.880000	4159.100
Std. Dev.	3519.090	159.4909	0.566475	0.400843	920.6309
Skewness	0.688803	-0.254893	-0.655757	1.238910	-0.308630
Kurtosis	2.877318	1.911961	2.872063	2.685160	1.674661

Table 5-2 Unit Roots Tests

	Egypt	Ghana	Kenya	Maur	Nigeria	South Africa	Tunis
y	0.01	-2.99	-0.27	-1.07	-1.88	1.233	2.17
Δy	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$
	-6.40*	-14.20*	-7.63*	-2.89*	-4.85*	-2.16*	-3.35*
s	-2.11	-2.52	-1.36	-1.79	-1.44	2.63	-2.19
Δs	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$
	-5.27*	-6.32*	-5.01*	-6.38*	-4.88*	-7.86*	-5.83*
p	-1.47	-3.11	-2.04	-2.79	-2.03	-2.59	-2.26
Δp	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$
	-6.74*	-6.44*	-5.35*	-5.91*	-9.45*	-7.72*	-5.61*
m	-2.13	-2.26	-2.01	-1.19	-1.78	-1.46	0.25
Δs	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$
	-7.22*	-4.19*	-9.44*	-9.81*	-6.71*	-5.65*	-6.93*
i	-1.15	-2.09	-3.23	-2.64	-2.60	-2.96	-1.64
Δi	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$
	-10.23*	-7.05*	-5.80*	-5.42*	-8.56*	-4.97*	-5.28*
pi	-1.47	-3.11	-2.04	-2.79	-2.03	-2.59	-2.26
Δpi	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$	$I(1)$
	-6.74*	-6.44*	-5.35*	-5.91*	-9.45*	-7.72*	-5.61*
	-3.14*	-4.30*	-5.43*	-6.92*	-9.00*	-6.33*	-5.09*

* indicates significance at 5%; only ADF tests are reported for brevity pi=inverse of inflation.

Table 5-3 Lag-Length Criteria

Country	Lag length	LR	FPE	AIC	SC	HQ
		Criteria				
Egypt	1		X	X	X	X
Ghana	2		X	X	X	X
Kenya	2		X	X		
Mauritius	1		X	X	X	X
Nigeria	2		X			X
South Africa	8	X	X	X		
Tunisia	2	X	X	X	X	X

X indicates lag order selected by the criterion LR: sequential modified LR test statistic (each test at 5% level) FPE: Final prediction error AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

These lag lengths are chosen for the unit roots, cointegration and Granger causality tests.

Table 5-4 Cointegration Tests

H_0	$\lambda_{\max}$	95% critical value	trace	95% critical value
		Egypt		
$r = 0$	36.75499*	33.46	74.25558*	68.52
$r \leq 1$	22.18974	27.07	37.50059	47.21
$r \leq 2$	11.45889	20.97	15.31085	29.68
$r \leq 3$	3.376611	14.07	3.851965	15.41
$r \leq 4$	0.475354	3.76	0.475354	3.76
		Ghana		
$r = 0$	24.48825	33.87	52.48914	69.81
$r \leq 1$	15.30392	27.58	28.00088	47.85
$r \leq 2$	8.359362	21.13	12.69696	29.79
$r \leq 3$	4.164078	14.26	4.337602	15.49
$r \leq 4$	0.173524	3.841	0.173524	3.84
		Kenya		
$r = 0$	19.17120	33.87	40.45892	69.81
$r \leq 1$	9.702913	27.58	21.28772	47.85
$r \leq 2$	8.339768	21.13	11.58481	29.79
$r \leq 3$	2.756677	14.26	3.245040	15.49
$r \leq 4$	0.488363	3.84	0.488363	3.84
		Mauritius		
$r = 0$	29.30323	33.87	83.55220*	69.81
$r \leq 1$	23.28376	27.58	54.24897*	47.85
$r \leq 2$	17.04248	21.13	30.96521*	29.79
$r \leq 3$	8.902890	14.26	13.92273	15.49
$r \leq 4$	5.019839*	3.84	5.019839*	3.84
		Nigeria		
$r = 0$	17.30097	33.87	36.22004	69.81
$r \leq 1$	10.54619	27.58	18.91908	47.85
$r \leq 2$	5.811331	21.13	8.372886	29.79
$r \leq 3$	1.881395	14.26	2.561556	15.49
$r \leq 4$	0.680161	3.84	0.680161	3.84
		South Africa		
$r = 0$	45.61*	33.87	101.16*	69.81
$r \leq 1$	23.88	27.58	55.54*	47.85
$r \leq 2$	21.70*	21.13	31.66*	29.79
$r \leq 3$	7.23	14.26	9.95	15.49
$r \leq 4$	2.72	3.84	2.72	3.84
		Tunisia		
$r = 0$	16.89636	33.87	45.92596	69.81
$r \leq 1$	12.19999	27.58	29.02961	47.85
$r \leq 2$	8.917757	21.13	16.82962	29.79
$r \leq 3$	7.288504	14.26	7.911863	15.49
$r \leq 4$	0.623359	3.84	0.623359	3.84

* denotes rejection of the hypothesis of no cointegration at the 0.05 level using MacKinnon-Haug-Michelis (1999) p-values.

Table 5-5 Granger Causality Tests

		Ghana	
Null Hypothesis:	Obs	F-Statistic	Probability
Δp does not Granger Cause Δs	164	2.28628	0.08086
Δs does not Granger Cause Δp		0.92051	0.43243
		Kenya	
Null Hypothesis:	Obs	F-Statistic	Probability
Δp does not Granger Cause Δs	82	2.42438	0.09526
Δs does not Granger Cause Δp		2.93525	0.05909
		Nigeria	
Null Hypothesis:		F-Statistic	Probability
Δp does not Granger Cause Δs	168	0.58424	0.55869
Δs does not Granger Cause Δp		0.12526	0.88236
		Tunisia	
Null Hypothesis:	Obs	F-Statistic	Probability
Δp does not Granger Cause Δs	59	0.59379	0.55579
Δs does not Granger Cause Δp		0.15042	0.86071

Table 5-6 Cointegration Equations Normalized on Stock Market Prices (β) Loadings

	$\log s$	$\log y$	$\log p$	$\log m$	$\log i$	C
Egypt	1.000000	-1.540480	1.782115	1.87845	-0.159290	-8.1
		(0.93147)	(1.33673)	(3.57923)	(6.43615)	
Mauritius	1.000000	-0.420097	1.031193	1.007172	0.700974	-11.74
		(0.65394)	(0.17330)	(0.76342)	(0.30729)	
S. Africa	1.000000	-1.173885	0.715821	0.198901	0.365505	-11.37
		(0.52429)	(0.07724)	(0.26870)	(0.26026)	

Standard errors in parenthesis; each row shows the long-run equation for each country.

Table 5-7 Dynamic Error-Correction Parsimonious Model

Variable	Egypt	Mauritius	S Africa
$\Delta\hat{s}_{t-1}$	0.405***	0.091	0.010
$\Delta\hat{y}_t$	0.041	1.228**	
$\Delta\hat{y}_{t-1}$	-0.048		2.131*
$\Delta\hat{y}_{t-2}$		1.314	
$\Delta\hat{y}_{t-3}$	-0.053	1.166	
$\Delta\hat{y}_{t-4}$	0.108		
$\Delta\hat{p}_t$	-0.901***	-0.993***	-0.977***
$\Delta\hat{p}_{t-1}$	0.419***	0.090	
$\Delta\hat{p}_{t-2}$	-0.132*		
$\Delta\hat{p}_{t-3}$		-0.050	
$\Delta\hat{p}_{t-4}$	0.093*		
$\Delta\hat{m}_t$			-0.182
$\Delta\hat{m}_{t-1}$		0.127**	
$\Delta\hat{m}_{t-2}$	0.795**	0.123**	0.178
$\Delta\hat{m}_{t-3}$	-0.710*		
$\Delta\hat{m}_{t-4}$	-0.312		
$\Delta\hat{i}_t$	-0.880		-0.359*
$\Delta\hat{i}_{t-1}$			
$\Delta\hat{i}_{t-2}$	1.237***	0.094	
$\Delta\hat{i}_{t-3}$		0.112*	
$\Delta\hat{i}_{t-4}$		0.074	
ECT_{t-1}	-0.088**	-0.097**	-0.241***
C	0.005	-0.032	-0.013
R^2	0.767	0.894	0.896
S.E	0.065	0.034	0.056
DW	2.261	2.00	2.007
F-stat	13.22***	97.59***	447.89***

***, **, * denote significance of coefficients at 1%, 5%, and 10% respectively. The dependent variable is Δs, the max lag lengths are chosen based on FPE, AIC and SC criteria.

Table 5-8 Model Diagnostic Test Results

	RESET	Breusch-Godfrey LM	ARCH LM	White Heteroskedasticity	Normality
Egypt	0.018	1.538	0.544	1.105	0.987
	[0.890]	[0.183]	[0.741]	[0.374]	[0.359]
Mauritius	0.808	0.280	0.181	0.905	5.716
	[0.371]	[0.756]	[0.968]	[0.598]	[0.111]
S. Africa	1.171	0.130	0.781	0.509	3.609
	[0.281]	[0.878]	[0.565]	[0.975]	[0.164]

Figures in square parenthesis represent probability values of significance level.
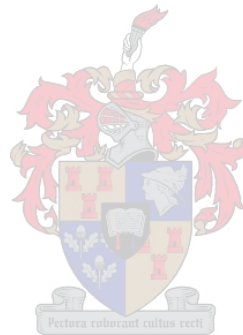
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CHAPTER SIX

STOCK MARKETS AND INVESTMENT GROWTH IN AFRICA

6.1 Introduction

Stock market development is increasingly becoming an important aspect of the financial market development of most emerging economies. The importance of stock markets lies in the contributions they make to the development of countries' economies in a number of ways. For instance, stock markets enable firms to acquire capital quickly and efficiently by creating an open-market platform for transparent and efficient business transactions to take place. The acquired capital can be channelled into profitable projects to help facilitate investment activities, thus leading to the promotion of sustainable investment growth. Tobin (1969) and von Furstenberg (1977) have noted that stock market activity is positively correlated with investment. Subsequently, a host of empirical and theoretical studies have attempted to study the link between stock markets and investment. For emerging market countries and African economies in particular, a positive investment impact of stock market activity is important due to the quest for investment growth in Africa.

Though African stock markets are mostly small and illiquid (apart from the Johannesburg Stock Exchange in South Africa), they nonetheless have made significant strides in their respective domestic markets. For instance, average market capitalization of these stock markets (with the exception of South Africa) in the period 1999-2002 ranged from a substantial US$305 million in the Lusaka Stock Exchange in Zambia to US$16.87 billion in the Cairo Stock Exchange in Egypt. The total value of stocks traded also ranged from US$19.6 million in the Ghana Stock Exchange to US$5.54 billion in the Cairo Stock Exchange within the same period. Similarly market returns in these stock markets have been impressive.

These developments on the stock markets have a great potential for increasing the investment portfolio of African economies. Though there is a broad and substantial empirical work on the role of stock markets in the promotion of investment growth in developed markets, there is a dearth of such studies on developing markets and, in

particular, the African markets. This study seeks to contribute to and stimulate further the issue of the investment growth potential of Africa stock markets. Thus the objective of this chapter is to test the effect of stock market returns on investment growth in Africa.

The rest of the paper is structured as follows: section 6.2 is an overview of related literature on stock markets and investment; section 6.3 deals with estimation method, and results and conclusions are presented in section 6.4.

6.2 Overview of Literature

The relationship between stock market activity and investment has been noted to be based on the link between stock prices and marginal productivity of capital (Tobin, 1969; and von Furstenberg, 1977). Stock prices reflect the marginal productivity of capital; thus increases in stock prices will result in an increase in the marginal productivity of capital. An increase in the marginal productivity of capital is directly linked to an increase in investment activities.

Thus stock markets, through changes in stock prices, should be positively correlated with investment growth. Fama (1981) and Barro (1989) also explain that changes in stock prices form an important component of variation in the market value of capital. Thus changes in stock prices would cause changes in the market value of capital and changes in investment. In this regard, one can infer a positive relationship between stock market returns and investment growth. Barro (1990) further shows that, since increases in contemporaneous and lagged stock prices are associated with investment expansion, stock markets significantly predict investment.

Other authors, for instance Morck, Shleifer and Vishny (1990), Blanchard, Rhee and Summers (1993), Stein (1996) and Baker, Stein and Wurgler (2003), also document a positive relationship between stock prices and investment, and attribute it to the merits of equity financing by stock markets. It has also been noted that the rationality or otherwise of stock prices does not affect the positive investment response to stock prices (Fischer and Merton, 1984; and Stein, 1996).

Lamont (2000) also observes that lagged stock market returns are positively correlated with investment growth. However, the study also concludes that there is a negative contemporaneous relationship between investment growth and stock market returns. The explanation given for this effect is based on "*lags between the decision to invest and the actual investment expenditure. Lags prevent firms from immediately adjusting investment when the discount rate changes, and can temporally shift the covariance of investment and returns*"(Lamont, 2000: pp: 2720). Therefore, due to lags in investment, which arise from planning and delivery delays, actual investment could be negatively correlated with current stock returns. This relationship notwithstanding, the positive investment effect of stock market returns, therefore, cannot be ignored.

6.3 Estimation Method and Results

Following Lamont (2000) and other empirical studies, the estimation of the effect of stock market returns on investment growth is done using a typical neoclassical investment model, where investment growth is largely dependent on past investment and macroeconomic fundamentals. In the empirical literature the stock market return variable is included in the explanatory variables, because of the theoretical linkage between investment and stock market returns as already outlined. The model adopted for this study follows that of Lamont (2000) and is of the form:

$$G_{it} = \alpha + \beta I_{i,t-1} + \delta X_{it} + \varepsilon_{it} \qquad \qquad 1$$

$G_{it} = \log$ of investment growth[24] in country i at time t, where $i = 1,...,14$

$t = 1992 - 2001$

$I_{i,t-1} = \log$ of lagged investment level

$X_{it} = $ vector of explanatory variables; GDP, inflation and stock market prices. All variables are in their log levels.

$\varepsilon_{it} = $ composite error term

where $\varepsilon_{it} = \mu_i + \nu_{it}$ \qquad \qquad 2

μ_i and ν_{it} are time-invariant and time-variant error components respectively.

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[24] Gross Capital Formation is used as a proxy for investment, all macro economic variables are in US$ constant 1995 prices

Data for macroeconomic indicators in this study were obtained from the World Development Indicators (2004). The stock market indicators were obtained from Reuters. The analysis is in an unbalanced panel format with 14 African countries[25] selected based purely on data availability over the period 1992-2001.

Substituting equation 2 into equation 1 yields:
$$G_{it} = \alpha + \beta I_{i,t-1} + \delta X_{it} + \mu_i + \nu_{it} \qquad\qquad 3$$

Rewriting equation 3,
$$I_{it} - I_{i,t-1} = \alpha + \beta I_{i,t-1} + \delta X_{it} + \mu_i + \nu_{it} \qquad\qquad 4$$

Equation 4 can also be rewritten as:
$$I_{it} = \beta^* I_{i,t-1} + \delta X_{it} + \mu_i + \nu_{it} \qquad\qquad 5$$
where $\beta^* = (\beta + 1)$ $\qquad\qquad 6$

Taking the first difference of equation 5, we obtain
$$\Delta I_{it} = \beta^* \Delta I_{i,t-1} + \delta \Delta X_{it} + \Delta \nu_{it} \qquad\qquad 7$$

It is assumed that errors are independent across countries and serially uncorrelated
$$E(\nu_{it}\nu_{ij}) = 0 \text{ for } i = 1,...,N \text{ and } j \neq t \qquad\qquad 8$$

Initial conditions I_{i1} are predetermined and satisfy the condition
$$E(y_{i1}\nu_{it}) = 0 \text{ for } i = 1,...,N \text{ and } t = 2,...T \qquad\qquad 9$$

Equation 7 then forms the final model to be used to estimate the response of investment growth to stock market returns. Note here that the log differences of the stock market prices in the X_{it} vector of explanatory variables (income (GDP), previous investment level and inflation)[26] yield stock market returns. It is expected that an increase in income results in extra resources for increased investment, similarly previous level investment helps to increase current investment. Finally it is expected that inflation (being a cost factor) has a negative impact on investment. To correct for the obvious endogeneity

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[25] Botswana, Egypt, Ghana, Kenya, Morocco, Mauritius, Namibia, Nigeria, Swaziland, Tunisia, South Africa, Zambia, Zimbabwe.
[26] Though other variables may impact on investment, these are left out due to sample size problems. Indeed the model also performs well under tests of robustness.

between $I_{i,t-1}$ and $v_{i,t-1}$ the Arellano and Bond (1991) GMM instruments-based estimation is used with the following orthogonal moments restrictions:

$$E[I_{i,t-j}\Delta v_{it}] = 0 \text{ for } j = 2,3,...,(T-1) \qquad\qquad 10$$
$$E[X_{i,t-k}\Delta v_{it}] = 0 \text{ for } k = 2,3,...,(T-1) \qquad\qquad 11$$

Thus the estimation is done using the Difference GMM, where suitably lagged levels of I_{it} and X_{it} are used as instruments. The validity of the instruments used is checked using the Sargan test. A serial correlation test is also performed on the residuals.

Table 6.1 shows summary statistics of selected economic and stock market indicators. Mean market capitalization for the period was US$176.57 billion, with average investment amounting to US$46.35 billion and average GDP US$240.62 billion. From these figures, the importance of stock markets in Africa in terms of resource mobilization cannot be over-emphasized. Indeed, the ratio of mean market capitalization to mean investment is an impressive 78.38%.

Table 6-1 Summary Statistics on Selected Macroeconomic and Stock Market Indicators in Africa

Variable	Mean	Std Dev	Min	Max	Observations
Stock market indicators					
Market index	3122.03	7572.49	74.8	64440.5	N = 121 i =14
Market capitalization	17657.88	55451.11	23.46	246688.5	N = 135 i = 14
Macroeconomic indicators					
GDP	24062.66	37785.69	980.2	162141.7	N = 135 i =14
Investment	4635.601	6236.79	166.98	27173.1	N = 135 i =14
Inflation	14.11	15.07	1	77	N = 135 i =14

N is the total panel sample size, i, is the cross-sections. Market capitalization, GDP and investment are in ,000s of million US$ in constant 1995 prices.

However, the inclusion of South Africa in the sample could depict a biased situation, given the unique characteristics of the South African stock exchange and the economy as a whole. In this regard, Table 6.2 gives summary statistics of the stock market and macroeconomic indicators, with South Africa excluded from the sample. As expected,

mean market capitalization reduces drastically to US$22.6 billion and average GDP also reduces to US$144.5 billion.

Mean investment also drops to US$32.52 billion. Nonetheless, the ratio of mean market capitalization to mean investment is still substantial at 15.64%. By implication, even in countries where stock markets are small, thinly traded and inactive, there is an important resource mobilization role being played by these stock markets. Returns on these stock markets (percentage changes in the market indices) could therefore impact positively and significantly on investment growth.

Table 6-2 Summary Statistics on Selected Macroeconomic and Stock Market Indicators (Excluding South Africa)

Variable	Mean	Std. Dev.	Min	Max	Observations
Stock market indicators					
Market index	2810.07	7811.75	74.8	64440.5	N =111
					i =13
Market capitalization	2260.255	3910.29	23.46	22049.4	N =125
					i =13
Macroeconomic indicators					
GDP	14450.78	16612.38	980.2	76684.42	N =125
					i =13
Investment	3252.884	3916.04	166.97	18289.09	N =125
					i =13
Inflation	14.59	15.55	1	77	N =125
					i =13

See notes under Table 6.1

Having briefly examined descriptive summary statistics on market and economic indicators, the chapter estimates the effect of stock market returns on investment growth using the model in equation 7. The results, as shown in Table 6.3, indicate that growth in previous investment levels $(\Delta LINV_{t-1})$ is highly significant in explaining current investment growth.

Significantly, stock market returns (ΔLSM) are also influential in contributing positively to investment growth. This finding confirms the results by previous studies, for instance Barro (1990), Cochrane (1991), Campbell (1991) and Stein (1996). This implies that stock market returns are positive predictors of investment growth and are influential in investment expansion. A robust stock market performance results in rapid

expansion and acquisition of capital by firms at a relatively low cost. This acquired capital is invested in new projects as well as expansion of existing ones, which results in an increase in investment formation. Thus investment formation increases with stock market performance.

The diagnostics tests in Table 6.3 report tests on the validity and robustness of the GMM estimator. For a consistent GMM estimator, Arellano and Bond (1998) indicate that the model should not exhibit second-order correlation, although the first-order correlation need not be zero. The test results show that the model passes the test for second-order serial correlation. The Sargan test for over-identifying restrictions indicates that the instruments are appropriate. All diagnostic tests therefore show that the GMM estimator for the model is valid.

Table 6-3 Estimates of Model of Investment Growth and Stock Market Returns (South Africa Inclusive)

	Coefficient	Std. Err.	t	P>|t|
$\Delta LINV_{t-1}$	0.9007	0.1108	8.13	0.000***
ΔLSM	0.1949	0.1044	1.87	0.065*
$\Delta LGDP$	0.7219	0.4791	1.51	0.135
ΔLP	-0.0353	0.0343	-1.03	0.305
Constant	-0.0705	0.0228	-3.10	0.003
Observations	107			
F(4, 102)	110.63			
Diagnostic Tests				
m_1	$z = -2.18$	$p > z = 0.0291$**		
m_2	$z = 0.97$	$p > z = 0.3326$		
Sargan	$\chi^2(12) = 7.93$	$p > \chi^2 = 0.7905$		

***, **, * denote significance at 1%, 5% and 10% respectively. m_1 and m_2 are Arellano-Bond tests that the first- and second-order serial correlations in the first-differenced residuals are zero. The test results are z scores and associated $p-values$ showing the probability of correctly rejecting the null hypothesis of no serial correlation. The Sargan test is for the validity of instruments. ΔLP -log difference of inflation

It is important also to note that the history of the Johannesburg Stock Exchange in South Africa involves a complex development process strongly linked to the domestic credit market and the mining industry. These developments on the South African market over a substantial period have produced the unique characteristics of the Johannesburg Stock Exchange compared to the other African stock exchanges. In addition this, the level of economic development in South Africa largely outpaces that of other African

countries. Thus the inclusion of South Africa in the panel could bias the model results; hence the model is re-estimated excluding South Africa, with results shown in Table 6.4.

Table 6-4 Estimates Investment Growth and Stock Market Returns (Excluding South Africa)

	Coefficient	Std. Err.	t	P>|t|
$\Delta LINV_{t-1}$	0.8744	0.1074	8.14	0.000***
ΔLSM	0.1865	0.0974	1.92	0.059**
$\Delta LGDP$	0.7560	0.4533	1.67	0.099*
ΔLP	-0.0393	0.0353	-1.11	0.269
Constant	-0.0718	0.0243	-2.96	0.004
Observations	98			
F(4, 93)	108.58			
Diagnostic Tests				
m_1	$z = -1.77$	$p > z = 0.0762*$		
m_2	$z = 1.16$	$p > z = 0.2476$		
Sargan	$\chi^2(12) = 7.93$	$p > \chi^2 = 0.8439$		

See notes under Table 6.3

The results in Table 6.4 show that stock market returns influence investment growth positively. Thus investment grows by 18.65% with a one percent increase in stock market returns. Previous investment growth levels, coupled with GDP growth $(\Delta LGDP)$, are the most significant drivers of investment growth. The most interesting finding here is that, even without the inclusion of South Africa in the panel, stock market returns in the other relatively less developed African economies continue to impact positively on investment growth. Thus despite the size, liquidity and trading constraints faced by most African stock markets, they play an important role in mobilizing capital for investment activities. Diagnostic tests on the robustness of the model reveal a stable and valid GMM estimator.

6.4 Conclusion

The chapter investigated the effect of stock market returns on investment growth using dynamic panel data analysis of selected African countries. The results show that stock markets returns influence investment growth positively and significantly. This implies that robust stock market performance adds to capital formation for investment. More importantly, the results imply that despite the size, trading and liquidity constraints faced by most African stock markets, their impact on investment mobilization is significant. Stock markets in Africa are also potential sources of investment growth.

Apart from the traditional channels of sourcing for investment, African economies can tap investment finance from their young and fledgling stock markets. Thus to boost investment growth in the selected African countries, it is important that these African countries pay particular attention to developing their stock markets. It would also be interesting to isolate the effect of stock market returns on private investment and public investment separately in future studies.
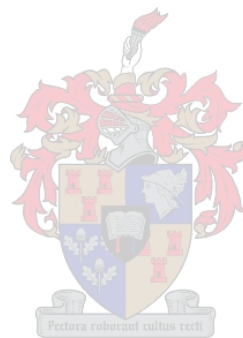
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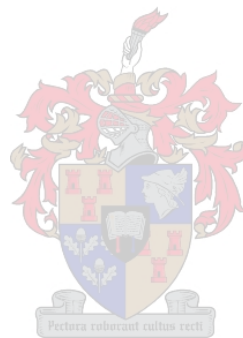
CHAPTER SEVEN

INTEREST RATE AND STOCK MARKET RETURNS IN AFRICA[27]

7.1 Introduction

Interest rate policy affects the economy, mostly through prices of goods and services. One sector of the economy that is affected by interest rate changes is the stock market. Stock prices change with changes in interest rates. Due to the competition between interest-bearing debt securities and stocks on the stock exchange, a policy action which leads to increases in interest rates will result in a shift of funds away from stocks to debt securities, thus depressing the prices of stocks. On the other hand, the negative effect that asset price bubbles and misalignments of equity prices have on economies around the globe implies that interest rate policy could also be responsive to changes in stock market prices[28].

In Africa the growth in stock market activity and the increase in the listings of companies on the stock markets have important economic implications. Interest rate policies are also becoming important tools for directing macroeconomic policies in African economies. Interest rate changes in Africa could, therefore, influence stock market returns significantly. On the other hand, stock price changes could also influence interest rate movements. It has been observed that investors and analysts on stock markets seem to react more to comments by Central Bank Chairpersons on interest rate directions.

Therefore a question that arises is whether monetary authorities should manage interest rate policies in reaction to stock price movements. Should Central Banks also react to stock price movements? This is a question that has concerned economists, financial analysts and monetary authorities. The objective of this chapter is to test the hypothesis that stock market returns and interest rate changes have dynamic interrelations in selected African countries. The rest of the chapter is organized as follows: the next

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[27] This paper is forthcoming in *African Finance Journal* Vol 8 (2) 2006 and was also presented at the African Finance Journal Conference, Cape Town, July 2005.
[28] Changes in stock market prices yield stock market returns.

section gives an overview of the research literature, section 7.2 discusses the empirical methods and results, and the last section draws conclusions.

7.2 Overview of the Literature

Whether interest rates should be responsive to stock market price movements depends on empirical evidence and the economic environment. Thorbecke (1997) finds that reducing interest rates is helpful in increasing stock market returns. Smal and de Jager (2001) observe that a reduction in interest rates induces an injection of liquidity into the economy. This extra liquidity could be channelled to the stock market, driving up the demand and prices of stocks. Patelis (1997) notes that interest rate changes are helpful in predicting stock market returns over a long period. Thus, there is evidence to conclude that interest rate policies should also target stock market price movements.

There are, however, counterarguments which seek to show that interest rate changes may not be enough to influence stock price misalignments. Fair (2000); for instance, is of the view that the negative effects of rapid stock price declines outweigh the positive effects of interest rate changes to curtail such stock price declines. Bernanke and Gertler (1999, 2001) also observe that the volatile nature of asset prices makes them hard to predict and that monetary authorities should only change interest rates in reaction to stock price movements, when they expect such movements to affect inflation.

Moreover, the credibility of interest rate policy may reduce, if interest rates change rapidly in response to asset price movements. Goodfriend (2003) also notes that, since there is no stable correlation between stock price returns and short-term interest rates, it would be difficult for interest rates to respond appropriately to stock price changes. Bernanke and Kuttner (2003) also note that stock markets do not react much to interest rate changes.

However, Bordo and Jeanne (2001) show that interest rate policies should be responsive to stock price movements, since stock price misalignments could be costly to economic activity. Rapid increases in stock prices could be inflationary, whilst rapid declines in stock prices could depress economic activity. Blanchard (2000) is also of the view that central banks should be mindful of the occurrence of asset price misalignments. Rigobon

and Sack (2003) also observe that variations in the stock market have significant effects on short-term interest rates, though they do not conclude that monetary authorities should directly target or react to stock market price changes. Thus far there is no clear direction on the response of interest rates to stock market price changes and vice versa. What is clear, however, is that the two variables could interact; the extent and direction of interaction therefore remains an empirical issue.

7.3 Empirical Analysis

The analytical model for the study is based on a basic model as modified and used by Ehrmann and Fratzscher (2004) and Bernanke and Kuttner (2005):

$$R_t = a + bi_t + e_t \qquad\qquad 1$$

R_t = Stock market returns on day t, i_t = discount rate changes[29] and e = disturbance term.

Equation 1 above is likely to be affected by causality problems between interest rate changes and stock market returns. To deal with the causality issues and also identify the long-run and short-run linkages between interest rate policies and stock market returns, a simple vector-autoregressive (VAR) form is adopted and estimated. Indeed Jensen, Mercer and Johnson (1996) and Jensen and Mercer (2002) used a VAR analysis to examine the response of stock markets to discount rate changes. The present study adopts a dynamic VAR which explores both cointegration and Granger causality possibilities. The essence is to capture the causal dynamics between interest rate and stock market returns, and at the same time observe the long-run dynamics. For instance, given a VAR with possible long-run cointegration amongst a set of variables, we can examine the nature of the relationship between the cointegrated variables via a Granger representation theorem Vector Error-Correction Model (VECM) specified as:

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[29] In the case of Ehrmann and Fratzscher (2004) and Bernanke and Kuttner (2005), the interest rate element is decomposed into a surprise and expected movement to capture monetary policy surprise.

$$\Delta X_t = \sum_{i=1}^{n} \beta_i \Delta X_{t-i} + \sum_{i=1}^{r} \xi_i \Phi_{t-1} + v_t \qquad\qquad 2$$

X_t is a $(n \times 1)$ vector of variables (interest rate and stock market prices), βs are the parameters to be estimated, and ξ_i is a vector of impulse responses in X_t. Given r cointegrating vectors via the Johansen and Juselius JJ? (1990) cointegration framework, we can extract $(n-r)$, with Φ_t containing the individual error terms from the r cointegrating vectors, $E(v_t, v_t') = \Omega$. With this formulation we are able to test for the existence of a long-run relationship between interest rate and stock market prices, and infer the nature of the Granger causality, as shown by Sims, Stock and Watson (1990). A Granger causality channel is detected either through the joint F-tests of the lagged differences of the variables or the statistical significance of the error-correction terms. Thus even if the error correction term is not significant, there still exists an active Granger causality channel, if the joint tests of the lagged differenced variables are significant.

In the case of countries where there is no cointegration, that is where $r = 0$ the VAR is run on the stationary data. Bivariate Granger causality analyses are also conducted to determine the direction of Granger causality. In addition, impulse response functions are estimated to determine the time path of response of variables to generalized shocks induced by the system.

Data for stock market indexes were obtained from REUTERS and for interest rates (central bank discount rates) from the International Monetary Fund's International Financial Statistics CD ROM. All data are in monthly frequencies. The data were collected for 7 African countries (Egypt, Ghana, Kenya, Mauritius, Nigeria, South Africa and Tunisia). These countries were chosen purely on the basis of consistency and availability of data (see Table 7.1 in Appendix for descriptive statistics and time span of data for each country).

A cursory examination of the descriptive statistics on Table 7.1 shows that interest rates have been very high in Ghana, with a maximum of 42.8%; Nigeria has also had relatively high interest rates, with a maximum of 27%. The standard deviations for the interest

rates also show high deviations for Ghana, Kenya and Nigeria, whilst Tunisia and Egypt have a relatively more stable interest rate variation.

The unit roots tests are conducted using the Augmented Dickey Fuller (ADF) and Philips Perron (PP) tests to determine the stationarity or otherwise of the stock market index and the interest rates of all countries. Results from the test indicate that all the stock prices in the 7 countries are $I(1)$ [30]. Having determined the stationarity of the variables, a cointegration test is conducted on the $I(1)$ variables. Given the sensitivity of the JJ cointegration test to lag lengths, various tests are performed to choose the optimal lag length for each country (see Table 7.3 in Appendix). Out of the 7 countries, the trace statistics in Table 7.4 reject the null hypothesis of no cointegration for Kenya and South Africa. This implies that there exists a long-run relationship between stock market prices and interest rates only for Kenya and South Africa. In the other countries there is no stable long-run relation between stock market price movements and interest rates.

The normalized cointegration equation on stock market prices for Kenya in Table 7.5 shows a rather puzzling positive relationship between stock market prices and interest rates. Thus stock market prices in Kenya increase with an increase in the interest rates. Possible explanations for this result could lie in the fact that higher interest rates send signals to the stock market in Kenya of higher government domestic borrowing and associated inflationary pressures. Therefore, the stock market prices may be edging up in response to higher interest rates to hedge against the inflationary impacts. An inspection of the absolute values of the adjustment coefficients shows that the interest rates also adjust faster (0.10) to long-run equilibrium than stock prices (0.004) in Kenya. This also implies a lag in the adjustment process of the stock market prices.

The normalized long-run equation for South Africa (Table 7.6), on the other hand, shows a negative relationship between stock market prices and interest rate. Thus as interest rates increase, funds are shifted away from the stock market to interest-bearing debt securities, hence dampening stock market prices in South Africa. In terms of the

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[30] The PP test for the interest rate in Egypt indicates that it is stationary, whilst the ADF test shows it is $I(1)$. For Mauritius the ADF test also indicates that interest rate is stationary, whilst the PP test shows it is $I(1)$. The selection criterion adopted is that at least one of the 2 tests rejects stationarity.

adjustment to long run, the stock market in South Africa adjusts faster (0.175) to the long-run equilibrium than the interest rate (0.0105). Compared to Kenya, it is obvious that the stock market in South Africa adjusts faster to misalignments in the economy.

The VECM Granger causality short-run dynamics are next estimated for Kenya, with results shown in Table 7.7. The results show that there is no active Granger causality either from interest rate changes to stock market returns[31] or the associated error-correction term. However, there is significant Granger causality, which is evident from movements in stock market returns to changes in the interest rate and also the significance of the associated error-correction term.

This implies that in the short run stock market returns Granger causes interest rate changes; thus stock market returns explain, in part, movements in interest rate changes in Kenya. The results of the VECM for South Africa as shown in Table 7.8, on the other hand, indicate that there is an active channel of causality either way from interest rate changes to stock market returns and vice versa. Thus in the short run interest rate changes tend to influence stock market returns in South Africa; at the same time changes in stock market returns also influence interest rate changes.

For Egypt, Ghana, Mauritius and Nigeria, where there is no cointegration between interest rates and stock market prices, bivariate Granger causality tests were conducted on the differenced variables as well as impulse response analysis from the VAR. The bivariate Granger causality tests (Table 7.9) show that Granger causality from interest rate changes to stock market return is strongly significant for Ghana and weakly significant for Egypt. In terms of Granger causality from stock market returns to interest rates, this exists only for Nigeria. Thus, whilst interest rate changes are influential in explaining stock market returns in Ghana and Egypt, it is rather stock market returns which influence interest rate changes in Nigeria. There are no significant test results for Mauritius and Tunisia.

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[31] The first difference of the log levels of the stock market index yields stock market returns:
$Stock\,\mathrm{Re}\,turn = \Delta s = (\ln s_t - \ln s_{t-1})$.

Prior to the impulse response analyses, a VAR lag-length stability check is performed following Lütkepohl (1991) to check if the VAR models are stable. The test reports[32] reveal that the inverse roots of characteristics polynomials for the various lag lengths chosen for each country have modulus less than one. Again, no roots lie outside the unit circle thus the VAR is stationary and satisfies stability conditions. The impulse response analyses are next modelled using the generalized impulses as described by Pesaran and Shin (1998). The time paths of the response of each variable to shocks induced from the system within each of the countries show a trend (Figures 7.1-7.5).

Responses to shocks in the system have long-lasting effects in Egypt, Ghana, Nigeria and Tunisia (it takes approximately 12 months for shocks to die off). In the case of Mauritius, responses are short lived and settle quickly (approximately 5 months) after shocks. Furthermore, the coefficients of the impulse responses and the Monte Carlo derived standard errors are shown in Table 7.10. The table shows that the responses of stock market returns to interest rate shocks are significant only for Egypt (1st and 3rd month of the shock), Ghana, (1st, 2nd and 3rd month of the shock), Nigeria (2nd, 3rd, 4th and 5th month of the shock) and Tunisia (1st and 2nd month of the shock).

Similarly responses of interest changes to stock market returns shock are significant only for Egypt (1st and 2nd month of the shock), Ghana (1st month of the shock), Nigeria (2nd month of the shock) and Tunisia (1st and 2nd month of the shock). Neither the responses of the interest rate nor stock market returns to shocks are significant for Mauritius. Thus it appears there is very little interaction between interest rate changes and stock market returns in Mauritius.

7.4 Conclusion
The paper examined the dynamic relationship between interest rate policy and stock market returns for 7 African countries in a VAR Granger representation framework. Cointegration tests indicate the existence of a long-run relationship between interest rate and stock market prices for Kenya and South Africa. For Kenya there is a rather puzzling positive relationship between stock market prices and interest rates, implying that stock market prices increase with increases in the interest rates. In South Africa, on

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[32] Results not shown for the sake of brevity.

the other hand, there is a negative long-run relationship between stock market prices and interest rate. Thus increases in the interest rates have adverse impacts on stock market activity, resulting in the diversion of funds away from the market.

In terms of the adjustment to long run, the stock market in South Africa adjusts faster to the long-run equilibrium than the interest rate, whilst the interest rates adjust faster than the stock market in Kenya. For the short-run dynamic VECM there is significant Granger causality from stock market returns to changes in the interest rate in Kenya. This implies that in the short run stock market returns Granger cause interest rates; thus stock market returns explain in part movements in interest rate changes in Kenya. The results of the VECM for South Africa, on the other hand, show that there is an active channel of causality either way from interest rate changes to stock market returns and vice versa.

For the five remaining countries where there is no cointegration between interest rates and stock market prices, bivariate Granger causality tests on the differenced variables show Granger causality from interest rate changes to stock market returns as strongly significant for Ghana and weakly significant for Egypt. In terms of Granger causality from stock market returns to interest rates, this exists only for Nigeria. Impulse response functions derived from the VAR estimates show that responses to shocks in the system have long-lasting effects in Egypt, Ghana, Nigeria and Tunisia (it takes approximately 12 months for shocks to die off). In the case of Mauritius, responses are short lived and settle quickly (approximately 5 months) after shocks. Neither the responses of the interest rate nor stock market returns to shocks are significant for Mauritius. Thus it appears there is very little interaction between interest rate changes and stock market returns in Mauritius.

Overall the results reveal that, even though there are some similarities in the relationship between interest rates and stock market returns in the selected African countries, there are also inherent differences in the dynamics between interest rates and stock market returns across the different countries studied. Thus shocks to either interest rates or stock market returns tend to take a longer time to filter through the system for Egypt, Ghana, Nigeria and Tunisia. A long-run relationship between interest rates and stock

market prices exists only for 2 out of the 7 countries. Furthermore, whilst stock market returns appear to lead interest rate changes in Kenya, the reverse occurs in South Africa.
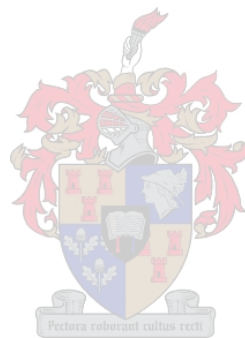
Appendix

Table 7-1 Descriptive Statistics of Stock Market Index and Interest Rate

	Egypt	Ghana	Kenya	Mauritius	Nigeria	S Africa	Tunisia
			Stock Market Index				
Mean	8914.426	1055.197	2248.504	388.586	4112.886	8064.279	1188.208
Maximum	15561.03	7360.462	3362.230	526.370	12458.23	13476.59	1445.300
Minimum	4849.830	57.699	1043.380	317.160	191.100	4581.150	916.760
Std. deviation	2756.987	1605.785	674.122	42.150	3642.009	2122.841	160.042
			Interest Rate				
Mean	9.815	31.015	7.971	10.111	14.470	11.768	6.158
Maximum	12.000	42.800	21.450	12.750	27.000	21.600	6.940
Minimum	9.000	16.600	0.830	8.130	5.080	6.750	5.880
Std. deviation	0.657	7.876	5.137	1.217	4.096	3.276	0.408
Time Period	10/1995 01/2003	01/1992 12/2004	11/1998 03/2003	06/1996 01/2003	01/1988 12/2003	06/1996 04/2004	12/1998 01/2003

Table 7-2 Unit Root Test

			Stock Market Prices		
	ADF	PP	First Diff ADF	First Diff PP	Order of integration
Egypt	-1.6547	-1.6887	-5.2751***	-8.4706***	*I(1)*
Ghana	-2.5214	-1.4971	-6.3228***	-7.9993***	*I(1)*
Kenya	-1.3627	-0.4411	-5.0172***	-6.7333***	*I(1)*
Mauritius	-1.79953	-1.7969	-6.3821***	-7.5049***	*I(1)*
Nigeria	-1.4432	-0.7444	-4.887***	-5.3748***	*I(1)*
S Africa	-1.295	-1.211	-7.8623***	-10.8221***	*I(1)*
Tunisia	-1.290	-1.282	-5.83***	-8.05***	*I(1)*
			Interest Rate		
	ADF	PP	First Diff ADF	First Diff PP	Order of integration
Egypt	-1.753	-3.544***	-10.29***	-18.409***	*I(1)*
Ghana	-1.886	-1.757	-7.979***	-7.980***	*I(1)*
Kenya	-1.980	-1.893	-6.775***	-6.895***	*I(1)*
Mauritius	-2.704*	-2.507	-8.375***	-11.540***	*I(1)*
Nigeria	-1.966	-2.535	-16.952***	-16.519***	*I(1)*
S Africa	-1.684	-1.242	-5.614***	-7.834***	*I(1)*
Tunisia	-1.290	-1.282	-5.473***	-5.313***	*I(1)*

, * indicate significance at 5% and 1% respectively The PP test for the interest rate in Egypt indicates that it is stationary, whilst the ADF test shows it is $I(1)$. For Mauritius the ADF test also indicates that interest rate is stationary, whilst the PP test shows it is $I(1)$. The selection criterion adopted is that at least one of the 2 tests rejects stationarity.

Table 7-3 Lag-Length Criteria for VAR JJ Cointegration Test

Country	Lag length	LR	FPE	AIC	SC	HQ
				Criteria		
Egypt	3	X	X	X		X
Ghana	2	X	X	X	X	X
Kenya	2				X	X
Mauritius	1	X	X	X	X	X
Nigeria	2	X	X	X	X	X
South Africa	2		X	X		X
Tunisia	2	X	X	X	X	X

X indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion
These lag lengths are chosen for the unit roots and cointegration tests.

Table 7-4 Cointegration Tests

H_0	λ_{max}	95% critical value	trace	95% critical value
		Egypt		
$r = 0$	3.247678	14.26460	5.896386	15.49471
$r \leq 1$	2.648707	3.841466	2.648707	3.841466
		Ghana		
$r = 0$	4.356062	14.26460	4.371761	15.49471
$r \leq 1$	0.015698	3.841466	0.015698	3.841466
		Kenya		
$r = 0$	13.31969	14.26460	16.13439*	15.49471
$r \leq 1$	2.814705	3.841466	2.814705	3.841466
		Mauritius		
$r = 0$	8.273900	14.26460	12.20047	15.49471
$r \leq 1$	3.926565	3.841466	3.926565	3.841466
		Nigeria		
$r = 0$	10.27621	14.26460	13.24044	15.49471
$r \leq 1$	2.964225	3.841466	2.964225	3.841466
		South Africa		
$r = 0$	15.79458*	14.26460	16.55039*	15.49471
$r \leq 1$	0.755813	3.841466	0.755813	3.841466
		Tunisia		
$r = 0$	5.547043	14.26460	9.918617	15.49471
$r \leq 1$	4.371574	3.841466	4.371574	3.841466

* denotes rejection of the hypothesis of no cointegration at the 0.05 level using MacKinnon-Haug-Michelis (1999) p-values; trace test indicates 1 cointegration equation at 0.05% significance level.

Table 7-5 Long-Run Equation for Kenya

Normalized cointegrating coefficients (standard error in parentheses)	
$\log s_t$	$\log i_t$
1.000000	-0.833109
	(0.25584)
	[-3.25643]
Adjustment coefficients (standard error in parentheses)	
$\Delta(\log s_t)$	-0.004624
	(0.01148)
$\Delta(\log i_t)$	0.102361
	(0.03093)

t-statistic in square brackets $\log s_t$ is the log of the Nairobi Stock Exchange Index $\log i_t$ log of Kenya central bank's discount rate.

Table 7-6 Long-Run Equation for South Africa

Normalized cointegrating coefficients (standard error in parentheses)	
$\log s_t$	$\log i_t$
1.000000	0.919232
	(0.11337)
	[8.10841]
Adjustment coefficients (standard error in parentheses)	
$\Delta(\log s_t)$	-0.175706
	(0.04547)
$\Delta(\log i_t)$	0.010544
	(0.03520)

t-statistic in square brackets $\log s_t$ is the log of the Johannesburg Stock Exchange All Share Index $\log i_t$ log of South African Reserve Bank's discount rate.

Table 7-7 Temporal VECM Granger Causality for Kenya

Short-run lagged differences			Lagged error-correction term
	Δs	Δi	ξ_{t-1}
Dependent variable	$\chi^2(6)$		t-statistic
Δs	-	6.70	-0.402
Δi	17.55***	-	3.30***

VEC Granger Causality test results from the estimated VECM. The VECM is estimated with an optimal lag length of 6 based on FPE criterion for all lagged difference terms and an intercept term. Figures in the 3rd and 4th columns are χ^2 test statistic distributions for the VEC Granger causality tests with r degrees of freedom. *** denotes significance at 1% significance. The last column reports the t-statistic of the error-correction term ξ_{t-1} derived by normalizing the cointegrating vector on stock market prices, with the residuals from the VECM checked for serial correlation.

Table 7-8 Temporal VECM Granger Causality for South Africa

Short-run lagged differences			Lagged error-correction term
	Δs	Δi	ξ_{t-1}
Dependent variable	$\chi^2(5)$		t-statistic
Δs	-	2.858	-3.86418***
Δi	12.206***	-	0.29958

Notes: See notes to Table 7.7

Table 7-9 Granger Causality Tests for Non-Cointegrating VAR

		Egypt	
Null Hypothesis:	Obs	F-Statistic	Probability
Δi_t does not Granger Cause Δs_t	96	2.10378	0.10538
Δs_t does not Granger Cause Δi_t		0.47791	0.69846
		Ghana	
Null Hypothesis:	Obs	F-Statistic	Probability
Δi_t does not Granger Cause Δs_t	165	2.50435	0.08493
Δs_t does not Granger Cause Δi_t		1.08760	0.33950
		Mauritius	
Null Hypothesis:	Obs	F-Statistic	Probability
Δi_t does not Granger Cause Δs_t	89	1.24734	0.26717
Δs_t does not Granger Cause Δi_t		1.18242	0.27990
		Nigeria	
Null Hypothesis:	Obs	F-Statistic	Probability
Δi_t does not Granger Cause Δs_t	177	1.78910	0.17021
Δs_t does not Granger Cause Δi_t		2.82777	0.06190
		Tunisia	
Null Hypothesis:	Obs	F-Statistic	Probability
Δi_t does not Granger Cause Δs_t	58	1.87490	0.16340
Δs_t does not Granger Cause Δi_t		1.83943	0.16891

These bivariate Granger causality tests on the stationary values of interest rates and stock market indices are for countries where there is no cointegration between stock market prices and interest rates. Lag lengths are chosen based on optimal lag-length selection criteria as reported in Table 3.

Table 7-10 Generalized Impulse Responses

Response of stock market returns to interest rate shock					
Months	Egypt	Ghana	Mauritius	Nigeria	Tunisia
1	-0.014921*	0.008007*	-0.000325	-0.002193	-0.024600*
	(0.00692)	(0.00489)	(0.00378)	(0.00201)	(0.00522)
2	-0.007875	0.006099	-0.004203	-0.004919*	0.009439*
	(0.00691)	(0.00502)	(0.00369)	(0.00295)	(0.00596)
3	0.013898*	-0.007861*	4.50E-05	-0.005233*	0.004379
	(0.00760)	(0.00504)	(0.00093)	(0.00281)	(0.00564)
4	-0.002751	-0.007901*	-2.19E-05	-0.003028*	-0.000319

	(0.00710)	(0.00454)	(0.00027)	(0.00157)	(0.00389)
5	-0.000411	-0.004880	4.73E-07	-0.001842*	-0.001405
	(0.00373)	(0.00342)	(7.2E-05)	(0.00107)	(0.00222)
6	-0.000572	-0.002371	-1.17E-07	-0.000973	-0.000325
	(0.00230)	(0.00243)	(2.6E-05)	(0.00069)	(0.00177)
7	0.001354	-0.001163	3.71E-09	-0.000519	0.000244
	(0.00213)	(0.00183)	(7.6E-06)	(0.00050)	(0.00125)
8	-0.000539	-0.000660	-6.39E-10	-0.000263	0.000158
	(0.00136)	(0.00139)	(2.9E-06)	(0.00035)	(0.00092)
9	-3.66E-05	-0.000420	2.60E-11	-0.000133	-1.29E-05
	(0.00106)	(0.00110)	(8.2E-07)	(0.00024)	(0.00069)
10	2.70E-07	-0.000268	-3.55E-12	-6.59E-05	-4.37E-05
	(0.00068)	(0.00089)	(3.6E-07)	(0.00016)	(0.00045)
11	0.000106	-0.000164	1.72E-13	-3.25E-05	-1.03E-05
	(0.00056)	(0.00072)	(9.1E-08)	(0.00010)	(0.00042)
12	-6.53E-05	-9.73E-05	-2.00E-14	-1.59E-05	7.82E-06
	(0.00044)	(0.00058)	(4.5E-08)	(7.0E-05)	(0.00022)

Response of interest rate changes to stock market returns shock

Months	Egypt	Ghana	Mauritius	Nigeria	Tunisia
1	-0.003312*	0.006182*	-0.000571	-0.006701	-0.009914*
	(0.00156)	(0.00381)	(0.00662)	(0.00626)	(0.00187)
2	0.003305*	0.003685	0.007292	-0.016304*	-0.007358*
	(0.00201)	(0.00517)	(0.00815)	(0.00746)	(0.00255)
3	-0.001595	-0.004200	-8.38E-05	-0.000818	-0.000319
	(0.00189)	(0.00479)	(0.00174)	(0.00533)	(0.00267)
4	-0.000740	-0.004307	3.81E-05	-0.002005	0.001545
	(0.00212)	(0.00373)	(0.00055)	(0.00339)	(0.00181)
5	5.59E-05	-0.002640	-8.51E-07	-0.000215	0.000529
	(0.00089)	(0.00241)	(0.00014)	(0.00232)	(0.00118)
6	0.000262	-0.001268	2.04E-07	-0.000237	-0.000235
	(0.00062)	(0.00155)	(5.3E-05)	(0.00131)	(0.00069)
7	-0.000144	-0.000616	-6.61E-09	-3.55E-05	-0.000207
	(0.00046)	(0.00114)	(1.3E-05)	(0.00082)	(0.00059)
8	-4.69E-05	-0.000349	1.11E-09	-2.65E-05	-5.36E-06
	(0.00036)	(0.00087)	(6.1E-06)	(0.00049)	(0.00037)
9	3.88E-05	-0.000223	-4.61E-11	-4.19E-06	5.03E-05
	(0.00025)	(0.00069)	(1.5E-06)	(0.00034)	(0.00031)
10	1.66E-05	-0.000143	6.20E-12	-2.44E-06	1.69E-05
	(0.00017)	(0.00054)	(7.1E-07)	(0.00022)	(0.00022)
11	-1.65E-05	-8.78E-05	-3.04E-13	-1.93E-07	-7.45E-06
	(0.00012)	(0.00043)	(1.8E-07)	(0.00016)	(0.00015)
12	-1.71E-06	-5.20E-05	3.50E-14	-6.44E-08	-6.55E-06
	(0.00012)	(0.00034)	(8.9E-08)	(0.00010)	(0.00012)

Monte Carlo Standard errors in parenthesis; * indicates significance at 10% level or less.

Figure 7. 1 Impulse response functions for Egypt

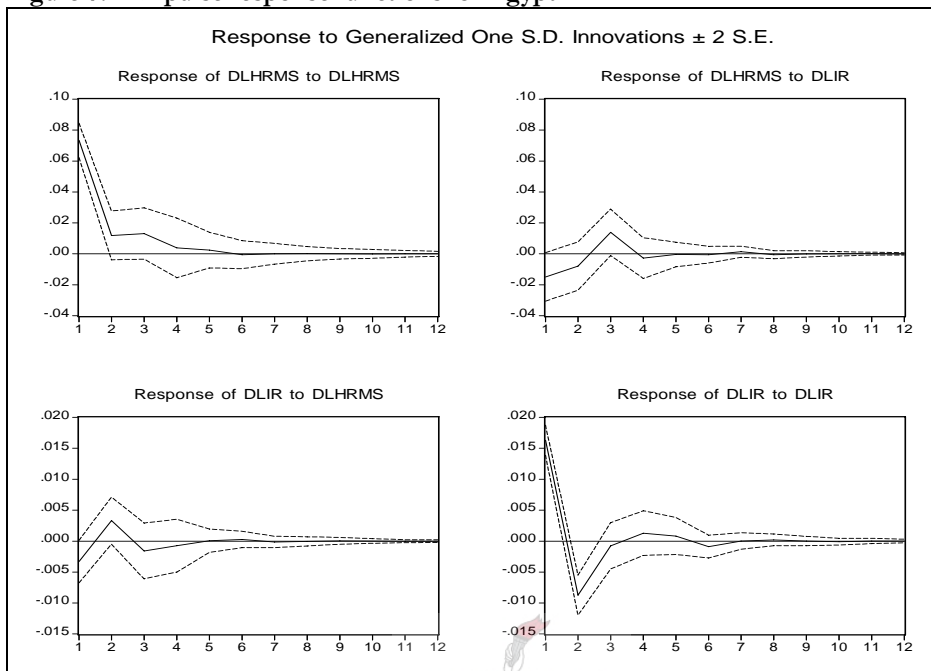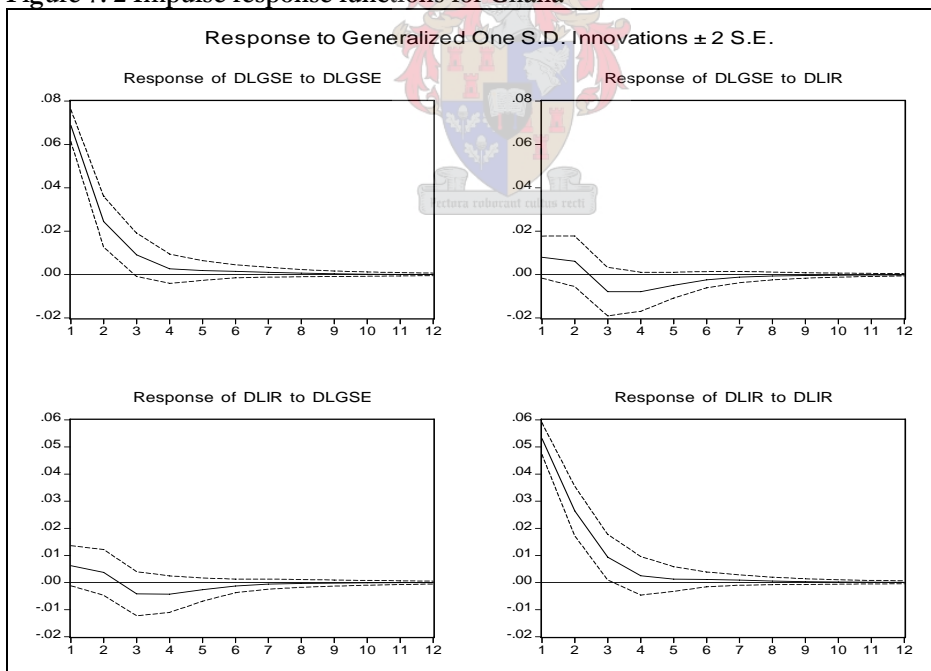**Figure 7. 2 Impulse response functions for Ghana**

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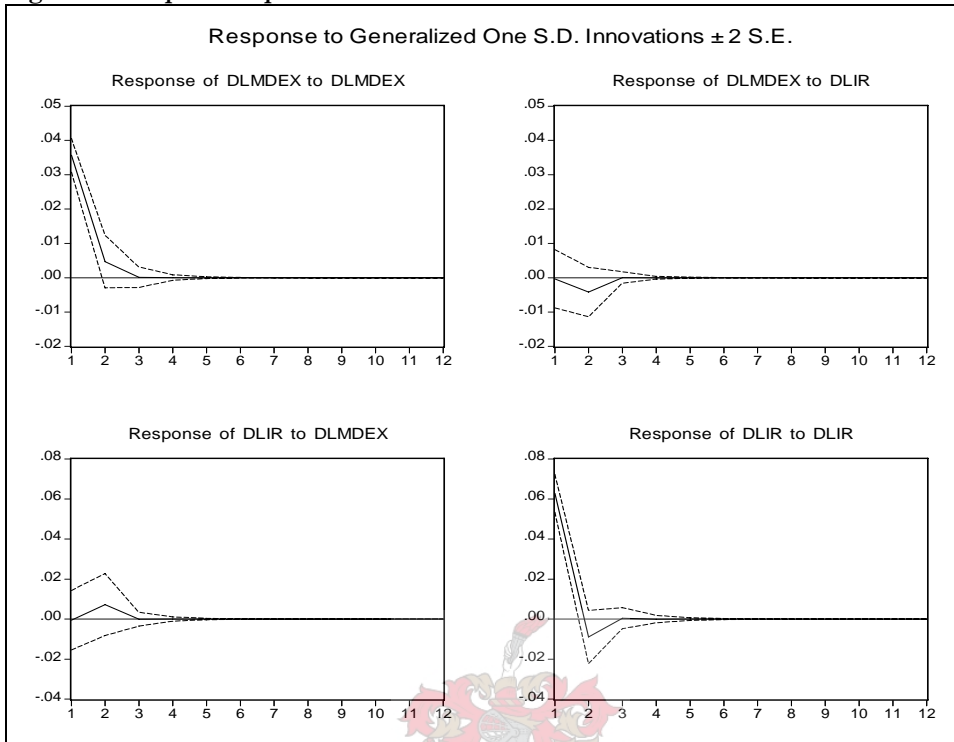**Figure 7. 3 Impulse response functions for Mauritius**

Figure 7. 4 Impulse response functions for Nigeria
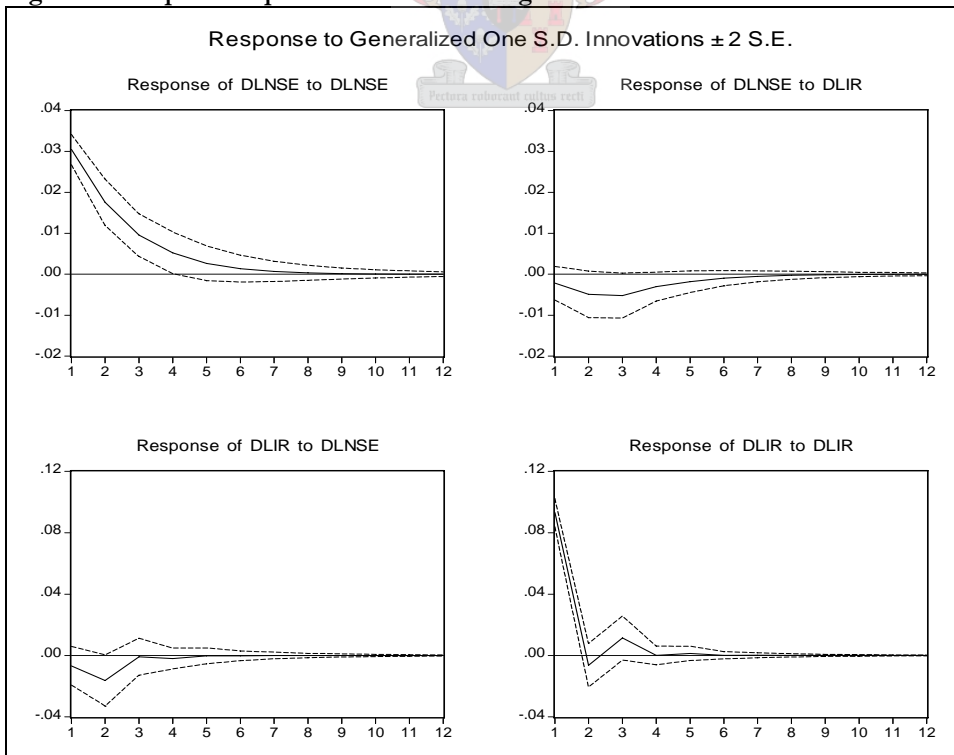
Figure 7. 5 Impulse response functions for Tunisia

Response to Generalized One S.D. Innovations ± 2 S.E.

Response of DLTUNINDEX to DLTUNINDEX

Response of DLTUNINDEX to DLIR

Response of DLIR to DLTUNINDEX
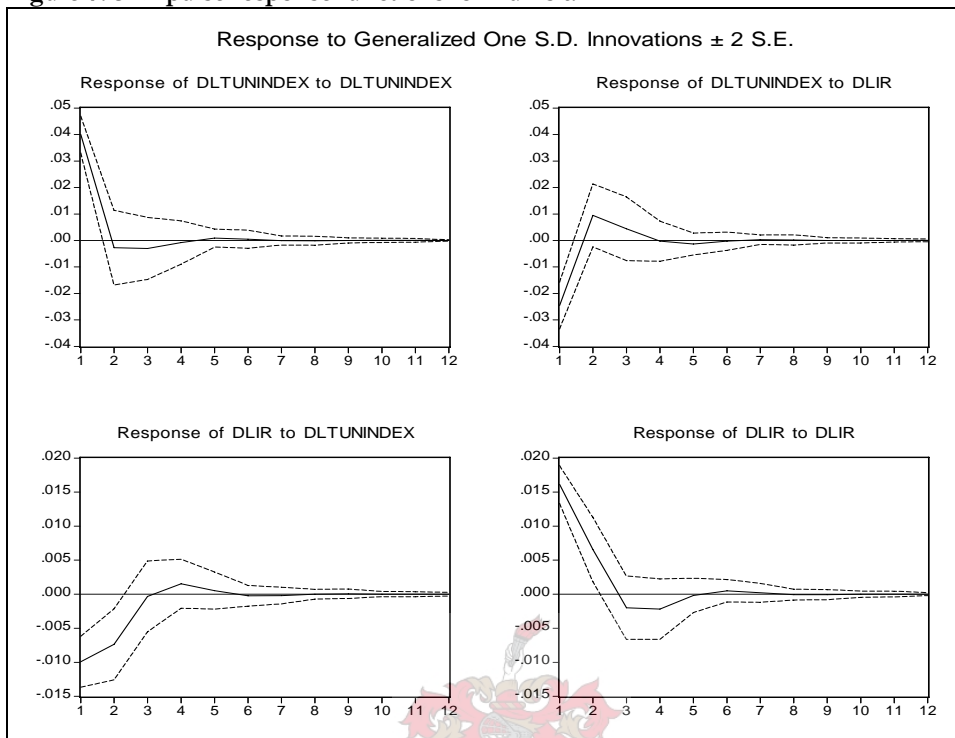
Response of DLIR to DLIR
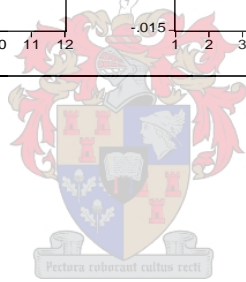
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CHAPTER EIGHT

STOCK MARKET DEVELOPMENT AND FINANCIAL INTERMEDIATION IN AFRICA: SOME STYLIZED FACTS

8.1 Introduction

This brief paper seeks to profile some stylized facts on stock market development and financial sector development in Africa. It also seeks to find out if there is any correlation between stock market development and financial intermediaries' development in Africa. It is well known that the development of the banking sector in Africa, as in most economies, preceded that of stock markets. Indeed, in most African countries the banking sector is older and more developed than the stock markets. Whilst the stock market provides equity finance, the banking sector provides debt finance.

However, proponents of bank-based financial systems (Stiglitz, 1985; Shleifer and Vishny, 1986) argue for bank-based systems for economic development. In their view stock market development can hamper firm performance and stunt firm finance. For instance, stock market liquidity can result in firm collapse, since discontented stockholders can sell off their shares easily. Again managers and board members collude and tend to marginalize small outside investors in running the affairs of listed companies. These proponents argue that banks reduce such risks and problems because of their long-term and committed relationship with firms. Advocates of stock market development however, argue that banks tend to encourage firms to be conservative in investment. This conservatism results in little room for innovation and yields low profits. Banks also extract large and prohibitive rents from firms and indirectly control firms through debt financing, (Weinstein and Yafeh, 1998; Black and Moersch, 1998).

Investment financing, however, can be done by debt and or equity. Thus debt may not necessarily always be substituted for equity, or vice versa. Boyd and Smith (1996), for instance, show that debt and equity markets can exist as complements and not substitutes. Consequently investment incomes increase as stock markets emerge to complement bank lending, hence enriching and deepening the financial system.

Demirguc-Kunt and Levine (1996) confirm this in a study amongst a group of developing countries. Levine (1997) also argues further that there is no choice between going for bank financing or stock market equity; both provide complementary financial services for growth.

Whilst the aim of this paper is to provide stylized facts about stock market and bank development in Africa, it also investigates the nature of the correlation between stock market development and bank development. This chapter specifically tests the hypothesis of complementarity between stock markets and banking sector development in Africa. The rest of the paper is organized as follows: section 8.2 compares African countries based on financial intermediation indicators and stock market development indicators; section 8.3 discusses the correlation between stock market development indicators and selected financial intermediaries indicators. Finally section 8.4 offers conclusions on the paper.

8.2 Comparing African Countries using Financial Intermediaries and Stock Market Development Indicators

Three measures of financial intermediaries' development (the ratio of liquid liabilities to GDP, the ratio of private credit by deposit money banks to GDP, and the ratio of deposit money banks' assets to GDP) are considered in comparing the level of banking sector development in Africa, following King and Levine (1993) and Demigurc-Kunt and Levine (1996). The data for the components of these indicators are obtained from the International Monetary Fund's International Financial Statistics (IMF IFS) from 1995-2002. Fourteen African countries[33] are chosen for this study based on the availability of consistent data.

The ratio of liquid liabilities to GDP is computed as money supply (M2) divided by GDP, and measures the overall size of the financial system. The ratio of private credit by deposit money banks to GDP measures the provision of efficient financial intermediation to the private sector and is computed using claims on private sector IMF's IFS line 32d. Unfortunately these claims also include credit to public entities in

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[33] Botswana, Egypt, Cote d'Ivoire (BRVM), Ghana, Kenya, Morocco, Mauritius, Namibia, Nigeria, Swaziland, Tunisia, South Africa, Zambia, Zimbabwe.

some countries. The ratio of deposit money banks' assets to GDP measures the level of development of the banking sector. The stock market development indicators considered include market capitalization ratio (value listed shares to GDP), liquidity (total value traded to GDP), and turnover ratio (total value of shares traded divided by market capitalization). These are computed for the periods 1995-2002 for the selected countries from the World Development Indicators 2004.

Table 8-1. Selected Financial Intermediaries Indicators

	DMB assets/GDP		*Liquid Liabilities/GDP*		*Private credit by DMB/GDP*	
	Value	*Rank*	*Value*	*Rank*	*Value*	*Rank*
Botswana	0.142	11	0.250	11	0.131	11
Egypt	0.297	7	0.268	9	0.240	7
Cote d'Ivoire	0.672	1	0.806	1	0.336	5
Ghana	0.062	14	0.180	13	0.047	14
Kenya	0.309	7	0.459	5	0.225	8
Morocco	0.489	5	0.702	3	0.349	4
Mauritius	0.570	3	0.706	2	0.440	3
Namibia	0.353	6	0.399	7	0.332	6
Nigeria	0.134	12	0.195	12	0.106	12
Swaziland	0.186	10	0.260	10	0.177	10
Tunisia	0.551	4	0.492	4	0.514	2
South Africa	0.647	2	0.412	6	0.597	1
Zambia	0.134	13	0.156	14	0.075	13
Zimbabwe	0.238	9	0.361	8	0.181	9
Average	0.342		0.403		0.268	

DMB= deposit money banks

The computed indicators are displayed in Table 8.1. From the table Cote d'Ivoire (81%), Mauritius (71%), Morocco (70%), Tunisia (49%) and Kenya (46%) had the most developed financial systems as measured by the liquid liabilities to GDP. With respect to private credit to GDP, South Africa, Tunisia, Mauritius, Morocco and Cote d'Ivoire have the most developed and efficient bank systems. The banking sector development indicator, deposit money banks' assets to GDP shows that Cote d'Ivoire (67%), South Africa (65%), Mauritius (57%), Tunisia (55%) and Morocco (49%) have the most developed banking sectors. In contrast Nigeria, Ghana and Zambia had underdeveloped financial systems as well as low levels of bank development.

Table 8-2 Selected Stock Market Indicators

	Value of shares traded		Value of listed shares		Market capitalization		Turnover ratio		Value of shares traded/GDP	
	Value	R	Value	R	Value	R	Value	R	Value	R
Botswana	34.176	10	425.75	11	0.090	10	0.089	7	0.007	8
Egypt	26.529	12	1033.4	8	0.084	12	0.023	14	0.002	13
Cote d'Ivoire	3008.7	2	10205.7	2	0.157	5	0.256	2	0.046	2
Ghana	27.309	11	903.08	9	0.129	8	0.048	12	0.004	11
Kenya	39.989	9	1068.29	7	0.137	6	0.036	13	0.005	9
Morocco	261.35	4	4742.10	3	0.205	4	0.097	6	0.012	7
Mauritius	42.123	8	709.648	10	0.280	2	0.060	9	0.016	5
Namibia	18.336	13	288.911	12	0.085	11	0.065	10	0.005	10
Nigeria	84.920	6	1589.77	6	0.055	14	0.048	11	0.003	12
Swaziland	52.387	7	147.134	14	0.132	7	0.242	3	0.045	3
Tunisia	293.44	3	2253.65	4	0.113	9	0.112	5	0.014	6
S Africa	41349.6	1	202285	1	1.422	1	0.197	4	0.275	1
Zambia	14.878	14	285.960	13	0.083	13	0.068	8	0.004	11
Zimb	248.532	5	1599.48	5	0.244	3	0.327	1	0.037	4
Average	3250.16		16252.7		0.230		0.119		0.034	

Values of shares traded and listed shares are in nominal US$. R=rank based on value 1995-2002

Table 8.2 also shows the computed mean values for market capitalization ratio, the total value of shares trade to GDP, and the turnover ratio. These indicators measure size, liquidity and transactions cost of stock markets respectively. From the mean market capitalization ratio, the top five largest stock markets are South Africa (142%), Mauritius (28%), Zimbabwe (24%), Morocco (21%) and BRVM in Cote d'Ivoire (16%).

The smallest are Namibia (8.5%), Egypt (8.4%) and Nigeria (6%). Furthermore, in terms of liquidity (value of shares traded to GDP), the most liquid stock markets are those of South Africa (28%), BRVM in Cote d'Ivoire (5%), Zimbabwe (4%), Mauritius (6%) and Tunisia (1.4%). Though the markets in Mauritius, Zimbabwe, and Morocco are bigger than the BRVM, the BRVM is more liquid. Similarly, Tunisia may be a small market but it is relatively liquid. Finally, the top five markets with respect to stock market activity and transactions cost (measured here by turnover ratio) are the Zimbabwe (33%), BRVM (26%), Swaziland (24%), South Africa (20%) and Tunisia (11%).

Cote d'Ivoire, South Africa, Mauritius, Tunisia and Morocco, incidentally, stand out as having the most developed stock markets and financial intermediation system. It appears that stock market development moves alongside the development of other financial intermediaries. Specifically, there appears to be an association between stock market

development and bank sector development. To further investigate this correlation, an analysis is conducted of the relationship between the various stock market indicators and financial intermediary indicators.

A positive correlation coefficient between stock market development indicators and financial sector intermediary indicators is indicative of complementarity between stock market and financial intermediation, especially the banking sector. A negative correlation, on the other hand, implies the presence of substitution between stock market development and financial intermediation. The correlation results are reported in Table 8.3.

8.3 Correlation between Stock Market Development and Financial Intermediation

From Table 8.3 there is evidence for the group of African countries of a positive and significant correlation between private credit by deposit money banks to GDP and market capitalization ratio (58%), and between private credit by deposit money banks to GDP and value of shares traded to GDP (49%).

Table 8. 3 Correlation between Stock Market Development and Financial Intermediation

	Liquid Liabilities to GDP	DMBGDP	Private Credit DMB to GDP
Africa			
Market CAP		0.4611*** {0.0000}	0.5803*** {0.0000}
Value of shares traded/GDP		0.4037*** {0.0000}	0.4933*** {0.0000}
Turnover ratio		0.2843** {0.0119}	
Egypt			
	Liquid Liabilities to GDP	DMBGDP	Private Credit DMB to GDP
Market CAP	-0.6186** {0.0419}	-0.8657*** {0.0000}	-0.8356*** {0.0000}
Value of shares traded/GDP			
Turnover ratio			
Cote d'Ivoire			
	Liquid Liabilities to GDP	DMBGDP	Private Credit DMB to GDP
Market CAP		0.8957*** {0.0000}	0.9650*** {0.0000}
Value of shares traded/GDP		0.8532*** {0.0000}	0.8408*** {0.0000}
Turnover ratio		0.7982***	0.5511

	Liquid Liabilities to GDP	DMBGDP	Private Credit DMB to GDP
		{0.0002}	{0.1442}
Kenya			
	Liquid Liabilities to GDP	DMBGDP	Private Credit DMB to GDP
Market CAP	0.8618*** {0.0005}		
Value of shares traded/GDP	0.8272** {0.0135}		
Turnover ratio		0.8917*** {0.0015}	0.8972*** {0.0011}
Morocco			
	Liquid Liabilities to GDP	DMBGDP	Private Credit DMB to GDP
Market CAP	0.8113*** {0.0004}	0.9372*** {0.0000}	0.9426*** {0.0000}
Value of shares traded/GDP			
Turnover ratio			
Mauritius			
	Liquid Liabilities to GDP	DMBGDP	Private Credit DMB to GDP
Market CAP	0.7782* {0.0718}		
Value of shares traded/GDP	0.7771** {0.0441}		
Turnover ratio			
Namibia			
	Liquid Liabilities to GDP	DMBGDP	Private Credit DMB to GDP
Market CAP	0.8366* {0.0740}	0.8698** {0.0346}	0.8700** {0.0344}
Value of shares traded/GDP			
Turnover ratio			
Nigeria			
	Liquid Liabilities to GDP	DMBGDP	Private Credit by DMB to GDP
Market CAP	-0.5985** {0.0301}		
Value of shares traded/GDP			
Turnover ratio			
South Africa			
	Liquid Liabilities to GDP	DMBGDP	Private Credit by DMB to GDP
Market CAP	-0.9175*** {0.0000}		0.6462*** {0.0097}
Value of shares traded/GDP		0.9280*** {0.0000}	0.9212*** {0.0000}
Turnover ratio		0.9267*** {0.0000}	0.9024*** {0.0000}

	Zimbabwe		
	Liquid Liabilities to GDP	*DMBGDP*	*Private Credit by DMB to GDP*
Market CAP			0.7317** {0.0126}
Value of shares traded/GDP			
Turnover ratio		0.7522*** {0.0020}	0.7618*** {0.0014}

*, **, *** denote significance at 1%, 5% and 10% level respectively. Figures in curly brackets are probabilities of significance levels.

This implies a positive correlation between stock market development and financial intermediary development. Similarly, there is a positive and significant correlation between deposit money banks and all three indicators of stock market development. Hence developments in the stock market complement developments in the banking sector in Africa. A disaggregation across countries, however, reveals some interesting trends.

Out of the 14 countries, there is significant correlation between stock market indicators and financial intermediaries' indicators for eight countries: Egypt, Cote d'Ivoire, Kenya, Morocco, Mauritius, Namibia, Nigeria, South Africa and Zimbabwe. There is a positive correlation between liquid liabilities to GDP ratio and stock market indicators in Kenya, Morocco, Mauritius and Namibia. However, in the case of Egypt, South Africa and Nigeria there is negative correlation between liquid liabilities to GDP ratio and market capitalization ratio. There is therefore evidence of some form of substitution between stock market development and the financial system in these countries.

In the case of South Africa, though, other measures of financial intermediaries' development correlate positively with stock market development. Private sector credit to GDP, and deposit money banks asset to GDP is positively correlated with stock market indicators in South Africa. This is indicative of complementarity between the stock market and the banking sector in South Africa. In contrast, Egypt records a persistently negative correlation for all financial intermediary development indicators and market capitalization ratio. It therefore appears that there is substitution between capital mobilization and financial system intermediary development in Egypt. Though a similar

situation occurs for South Africa and Nigeria, it is only for liquid liabilities and market capitalization ratios.

In terms of bank sector development, there is also a positive correlation between deposit money banks' assets to GDP, and private sector credit to GDP and stock market indicators in Cote d'Ivoire, Kenya, Morocco, Mauritius, Namibia and Zimbabwe. Thus developments in the stock market complement developments in the banking sector in these countries.

8.4 Conclusion

This brief paper examined the level of financial sector development alongside stock market development in Africa. The findings show that Cote d'Ivoire, South Africa, Mauritius, Tunisia and Morocco stand out as having the most developed stock markets and financial intermediation system. It appears that stock market development moves alongside the development of other financial intermediaries. There is evidence for the whole group of African countries of a positive and significant correlation between financial intermediaries and stock market development.

Thus stock market development indeed complements the development of the financial system in Africa. At the country level there is a positive correlation between liquid liabilities to GDP ratio and stock market indicators in Kenya, Kenya, Morocco, Mauritius and Namibia. Developments in the stock market complement developments in the banking sector in Cote d'Ivoire, Kenya, Morocco, Mauritius, Namibia, South Africa and Zimbabwe. There is, however, evidence of some form of substitution between stock market development and the financial system in Egypt.

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CHAPTER NINE

COINTEGRATION AND DYNAMIC CAUSAL LINKS AMONGST AFRICAN
STOCK MARKETS[e]

9.1 Introduction

Recent developments in international finance, especially the relaxation of exchange controls on investments, have induced greater interaction and interdependence between stock markets across the globe. Interdependence amongst stock markets is useful in determining the causal links amongst markets. Stock market interdependence occurs if there are common underlying structural endowments driving stock markets. The existence of common underlying structural endowments amongst a set of stock markets is indicative of a common stochastic trend or cointegration amongst the markets. It is also possible to ascertain the nature of the short- run and long-run causal dynamics amongst stock markets from cointegration analysis.

There has therefore been a growing interest amongst financial analysts and economists in the studying of stock market cointegration. However, most empirical works have focused on either developed markets or developing markets of South East Asia, with few studies focusing on Africa. This chapter investigates the long-run linkages amongst African stock markets, as well as the short-run dynamic inferences which may be present. It is also important to add that though African stock markets may be responding to global market trends, it is essential to also find out if there are underlying dynamic causal links between the African stock markets themselves. Indeed the presence of a common stochastic trend between the African stock markets implies that there is the existence of long-run causal links. The aim of this chapter is therefore to test the hypothesis that there are short and long run dynamic linkages between African stock markets. The existence of cointegration opportunities can be potentially useful for the development of regional stock markets.

The rest of the chapter is organized as follows: the next section gives an overview of the research literature, section 9.3 discusses the empirical methods and results, and the last section draws conclusions.

9.2 Overview of Empirical Research Literature

A number of authors, notably Kasa (1992), Chung and Lin(1994), Richards(1995), Gonzalo and Granger (1995), Masih and Mashi (2001), Piesse and Hearn (2002), Pascual (2003), Phylaktis and Ravazolo (2005) have conducted studies into cointegration amongst stock markets. These authors have mostly used cointegration analysis to infer the level of integration between stock markets. The underlying assumption in this method is that the existence of a single common stochastic trend amongst a group in stock markets implies high long-run correlations and integration amongst the markets. Authors such as Phylaktis and Ravazzolo (2005) use moving average representations of an error correction model in their analyses to determine underlying stochastic and deterministic trends that drive cointegration. In their view cointegration implies common arbitrage, which links stock markets in the short run and long run.

However, as noted by Lence and Falk(2005), even though two stock markets can be cointegrated, they may not be necessarily be integrated. Cointegration amongst stock markets provides information on the underlying structural endowments common to the two markets and can lead to inferences on the long- and short-run dynamic causalities. Again, conclusions about cointegration do not lend themselves necessarily to understanding market efficiency or integration, as noted by Dwyer and Wallace (1992) and Lence and Falk (2005). In addition, cointegration helps in analysing the long-run relationship between stock markets (Masih and Masih, 2001).

In Africa a number of studies (Appiah-Kusi and Pescetto, 1998; Piesse and Hearn, 2002; Wang, Yang and Bessler, 2003; Collins and Abraham, 2004; and Piesse and Hearn, 2005) have variously studied the integration of African stock markets into the global market and drawn inferences on the volatility spillovers between the markets and the dynamic impulse response. Collins and Biekpe (2003) also examined the degree of exposure of African stock markets to the Asian financial crisis. There has, however, been little empirical work on analysing the dynamic long-run and short-run linkages amongst

African stock markets. The thrust of this chapter, therefore, is to provide more empirical evidence on the dynamic short-run and long-run causal linkages amongst African stock markets. In addition, the nature of feedback or correction from disequilibrium to long-run equilibrium is also investigated.

9.3 Empirical Analysis and Results

The study adopts a dynamic vector autoregressive regression (VAR), which explores both cointegration and Granger causality possibilities. The essence is to capture the causal dynamics between stock market returns and at the same observe the long-run dynamics. For instance, given a VAR with possible long-run cointegration amongst a set of variables:

$$Y_t = \beta_1 Y_{t-1} + \ldots + \beta_k Y_{t-k} + \varepsilon_t \qquad\qquad 1$$

Y_t is a $(n \times 1)$ vector of stock market prices in log form, $n = 7$), βs are the parameters to be estimated and ε_t the random errors. We can examine the nature of the relationship between the cointegrated variables via a Granger representation theorem Vector Error-Correction Model (VECM) specified as:

$$\Delta Y_t = \alpha \beta' Y_{t-k} + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \varepsilon_t \qquad\qquad 2$$

Where β' is a vector of parameters of the cointegrating vectors; $\beta' Y_{t-k}$ the long-run relationships; α is the vector of the speed of adjustment or equilibrium corrections; Γ_i is the vector of short-run parameters; and ε_t the vector of error terms. With this formulation we are able to test for the existence of a long-run relationship between selected stock market prices and infer the nature of the short-run dynamic causal relations as well.

Data on the stock market indexes from 7 African countries in monthly frequencies (1997-11 to 2005-8) were obtained from the REUTERS database. The countries[34] are chosen purely on the basis of data consistency.

Prior to the cointegration analysis, unit roots tests are conducted to determine the stationarity or otherwise of the stock market indices. The unit roots tests are conducted on log levels of the stock market indexes using the Augmented Dickey Fuller (ADF) and Philips Perron (PP). Results from the test (Table 9.1) indicate that all the stock prices in the 7 countries are $I(1)$.

Table 9-1 Unit Root Test

| | | | Stock Market Prices | | |
	ADF	PP	First Diff ADF	First Diff PP	Order of integration
$legypt$	-1.6547	-1.6887	-5.2751***	-8.4706***	I(1)
$\lg hana$	-2.5214	-1.4971	-6.3228***	-7.9993***	I(1)
$lken$	-1.3627	-0.4411	-5.0172***	-6.7333***	I(1)
$lmaur$	-1.79953	-1.7969	-6.3821***	-7.5049***	I(1)
$\ln gr$	-1.4432	-0.7444	-4.887***	-5.3748***	I(1)
$lsafrica$	-1.295	-1.211	-7.8623***	-10.8221***	I(1)
$ltunisia$	-1.290	-1.282	-5.83***	-8.05***	I(1)

$legypt$, $\lg hana$, $lken$, $lmaur$, $\ln gr$, $lsafrica$, $ltunisia$ are log levels of stock market indexes in Egypt, Ghana Kenya, Mauritius, Nigeria, South Africa and Tunisia respectively. **, *** indicate significance at 5% and 1% respectively.

The cointegration analysis is carried out within the Johansen (1992), Johansen and Juselius (1992) framework. Given the sensitivity of the cointegration test to lag lengths, various tests are performed to choose the optimal lag length for each country (Table 9.2). From the test results in Table 9.3, the trace test indicates the presence of 2 cointegrating equations. The presence of cointegration implies that technological and structural endowments amongst the countries involved are cointegrated. This also implies that there are dynamic long-run causal relationships between stock markets in the countries.

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[34] Egypt, Ghana, Kenya, Mauritius, Nigeria, South Africa and Tunisia.

Table 9-2 VAR Lag Order Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	208.028	NA	2.20e-11	-4.675	-4.475	-4.595
1	971.082	1384.14	1.36e-18*	-21.281	-19.683*	-20.638*
2	1009.210	62.956	1.78e-18	-21.028	-18.032	-19.822
3	1049.469	59.921	2.31e-18	-20.825	-16.431	-19.056
4	1102.472	70.261	2.35e-18	-20.918	-15.125	-18.586
5	1159.069	65.811	2.39e-18	-21.095	-13.903	-18.200
6	1197.832	38.763	4.12e-18	-20.857	-12.266	-17.399
7	1288.202	75.658*	2.53e-18	-21.819	-11.830	-17.799
8	1350.323	41.896	3.85e-18	-22.124*	-10.737	-17.541

* indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion.

Intuitively it is expected that the 2 long-run relations will be hinged, first on a smaller market influencing a larger market, and secondly, on a smaller market being influenced by a relatively larger market. Two long-run equations are therefore derived from the cointegration analysis; the first is normalized on the Johannesburg Stock Exchange in South Africa and the second on the Ghana Stock Exchange. The first equation is normalized on the South African stock market, since it is the most active and largest exchange, and the second equation normalized on Ghana, the smaller and relatively less developed market amongst the group.

Table 9-3 Cointegration Tests

H_0	λ_{max}	95% critical value	trace	95% critical value
$r = 0$	56.884*	46.231	153.925*	125.615
$r \leq 1$	30.662	40.078	97.041*	95.754
$r \leq 2$	25.824	33.877	66.379	69.819
$r \leq 3$	22.368	27.584	40.555	47.856
$r \leq 4$	11.576	21.132	18.187	29.797
$r \leq 5$	6.579	14.265	6.611	15.495
$r \leq 6$	0.032	3.841	0.032	3.841

* denotes rejection of the hypothesis of no cointegration at the 0.05 level using MacKinnon-Haug-Michelis (1999) p-values; trace test indicates 2 cointegration equation at 0.05% significance level.

However, the cointegration relations may not necessarily be uniquely identified, so restrictions are placed on the β vector to identify the cointegration relations. The

assumptions for the restrictions on the β vector are motivated by the assumptions underlying the normalization of the β vector for the cointegration equations. In addition, it is assumed that the South African stock market will react more rapidly to the largest market in the subgroup (in this case Egypt) on a one-to-one relationship. In the case of the second cointegration relation based on Ghana, it is assumed that the Ghanaian market will also react more rapidly to the two largest markets in the group (South Africa and Egypt) on a one-to-one basis[35]. Finally, based on exclusions tests[36] on the significance of the cointegration coefficients to each of the 2 markets, it is evident that the Tunisian stock market may be redundant in the second cointegration space.

Table 9-4 α Vector coefficients from Normalized β Vectors

$\Delta lsafrica$	-0.205 [2.444]*	0.146 [-3.054]*
$\Delta legypt$	0.174 [-1.834]*	-0.111 [2.058]*
$\Delta \lg hana$	-0.166 [2.051]*	0.125 [-2.701]*
$\Delta \ln gr$	0.066 [-0.992]	-0.033 [0.870]
$\Delta lken$	-0.148 [2.162]*	0.069 [-1.752]*
$\Delta lmaur$	0.048 [-1.112]	-0.010 [0.421]
$\Delta ltunisia$	-0.115 [1.498]	0.054 [-1.221]

* indicates significance of at least 10%.Figures in square brackets are t-values of α vector.

Following Harris and Sollis (2003, p. 142), individual weak exogeneity tests are not performed for the α coefficients, since they are reported with t-values, upon which inferences can be drawn on weak exogeneity. Thus restrictions on the α vector are based on an inspection of the t-value. The t-values (Table 9.4) suggest that weak exogeneity for Nigeria; Mauritius and Kenyan stock markets are likely to hold. Based on the assumptions and information from the α and β vectors, the following initial restrictions on the vector $\Pi_r = \alpha_r \beta'_r$ are likely to hold, with $r =$ cointegration rank or number of cointegrating equations $r = 2$

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[35] The existence of substantial cross/dual listings of firms across the markets may have had significant influence on the direction of linkages. However the absence of such listings does not preclude the possibility of one market reacting to changes in other markets.
[36] The test results, not shown for the sake of brevity, indicate that the Tunisian market may not be participating in the cointegration space.

$$\alpha_r \beta_r' = \begin{pmatrix} \alpha_{11} & \alpha_{21} \\ \alpha_{12} & \alpha_{22} \\ \alpha_{13} & \alpha_{23} \\ 0 & 0 \\ \alpha_{15} & \alpha_{25} \\ 0 & 0 \\ 0 & 0 \end{pmatrix} \begin{pmatrix} 1 & -1 & \beta_{13} & \beta_{14} & \beta_{15} & \beta_{16} & \beta_{17} \\ -1 & -1 & 1 & \beta_{24} & \beta_{25} & \beta_{26} & 0 \end{pmatrix}$$

LR test of restrictions: $\chi^2(8) = 9.120$ Probability: [0.332]

The overall Likelihood Ratio (LR) test statistics do not reject the null hypothesis, thus the restrictions are binding and accepted. An additional test for weak exogeneity of the Ghana stock market in the South African cointegrating relationship is also conducted and the LR test $\chi^2(9) = 13.038\,[0.161]$ indicates that this additional restriction is binding.

**Table 9-5 Restricted Eigenvectors and Adjustment Coefficients**

β	β_1	β_2	α	α_1	α_2
lsafrica	1	-1	Δlsafrica	-0.231 (0.072)	0.044 (0.02)
legypt	-1	-1	Δlegypt	0.123 (0.079)	-0.013 (0.021)
lg hana	0.428 [3.445]	1	Δlg hana	0	-0.019 (0.006)
ln gr	-1.552 [-6.649]	-3.200 [-3.931]	Δln gr	0	0
lken	-0.954 [-2.843]	-5.388 [-4.278]	Δlken	-0.189 (0.050)	0.066 (0.014)
lmaur	4.472 [5.663]	12.925 [4.665]	Δlmaur	0	0
ltunisia	-0.086 [-1.541]	0	Δltunisia	0	0

Figures in square brackets are t-statistics of unrestricted long-run coefficient estimates and figures in parenthesis are standard errors of unrestricted coefficient estimates. LR test of restrictions: $\chi^2(9) = 13.038\,[0.161]$.

The resulting restricted long-run cointegration relations are reported in Table 9.5. The first equation (column 2) shows that the Nigerian, Kenyan and Tunisian stock markets positively influence the South African stock market, whilst the Ghana and Mauritian stock markets have a negative long-run influence on the South African stock market. The second equation (column 3) shows that, with exception of the Mauritian market, all other markets have a positive long-run influence on the Ghana stock market. A plot of

the two cointegrating relations (Figure 9.1) shows a fairly stable relationship in each equation.

Figure 9-1 Plot of Cointegrating Relations
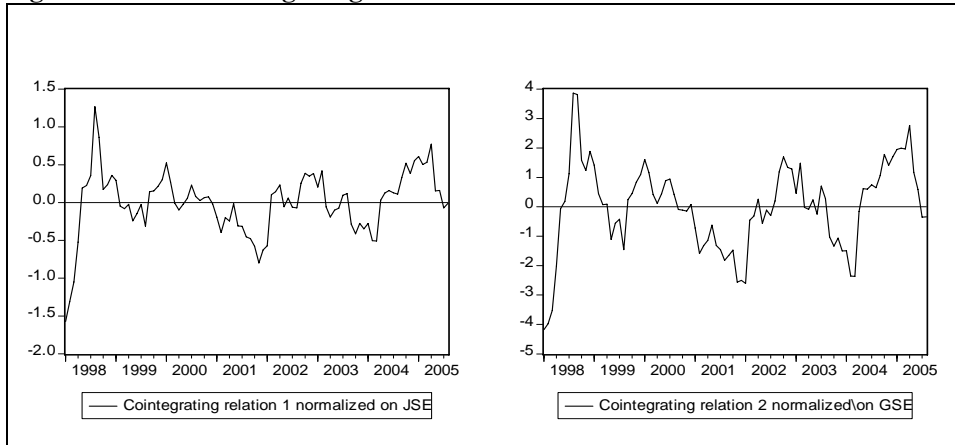
JSE: The South African stock market (Johannesburg Stock Exchange); GSE: The Ghana Stock market (Ghana Stock Exchange).

Having obtained the long-run relations, the short-run models are now formulated in a VECM framework and are of the form:

$$\Delta Y_t = \sum_{i=0}^{k-1} \gamma_i \Delta Y_{t-i} + \alpha \left[\delta_1 ect1 + \delta_2 ect2 \right]_{t-k} + \mu_t \qquad 3$$

where $ect1_{t-1}$, $ect2_{t-1}$ are the error terms representing the speed of adjustment from short-run disequilibrium in the South African and Ghanaian stock market cointegration relationships respectively. Given that all restrictions on the relevant vectors are binding, ordinary least squares (OLS) is an efficient way to estimate the VECM. The optimal lag length 4 for the short-run models is based on tests for lag-length criteria. The model diagnostics from the VECM in Table 9.6 show that generally the model is congruent and is devoid of serious misspecification.

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Table 9-6 VECM Residual Diagnostics

	White Heteroskedasticity	Normality	Serial Correlation LM
Test-statistic	1687.76	60.941	33.579
Probability	0.442	0.000***	0.954

***, **,* denote significance at 1%, 5% and 10% respectively.

Insignificant regressors are also removed in the error-correction-models based on the Hendry general-to-specific approach to modelling to achieve parsimony. The model reduction process is guided by inspection of F test results, and the Schwartz and Akaike Information Criteria. Final[37] results of OLS estimates for each short-run equation are shown in Tables 7 and 8.

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[37] The general models are shown in Tables A9.1-A9.2 in the Appendix.

**Table 9-7 Error-Correction Model on the South African Stock Market**

Dependent Variable: $\Delta lsafrica$

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\Delta lsafrica_{t-1}$	0.269	0.090	2.973	0.004***
$\Delta lsafrica_{t-2}$	0.251	0.096	2.613	0.011**
$\Delta lsafrica_{t-3}$	0.330	0.077	4.315	0.000***
$\Delta legypt$	0.331	0.079	4.172	0.000***
$\Delta legypt_{t-2}$	-0.132	0.075	-1.772	0.081*
$\Delta \lg hana$	-0.145	0.126	-1.145	0.256
$\Delta \lg hana_{t-2}$	-0.233	0.083	-2.801	0.007***
$\Delta \lg hana_{t-3}$	0.275	0.111	2.479	0.016**
$\Delta \lg hana_{t-4}$	-0.224	0.110	-2.027	0.046**
$\Delta \ln gr$	0.186	0.106	1.756	0.083*
$\Delta lken$	-0.439	0.098	-4.471	0.000***
$\Delta lken_{t-4}$	0.169	0.112	1.513	0.135
$\Delta ltunisia$	-0.171	0.088	-1.935	0.057*
$\Delta ltunisia_{t-4}$	-0.207	0.096	-2.143	0.036**
$ect1_{t-1}$	-0.597	0.089	-6.730	0.000***
$ect2_{t-1}$	0.027	0.051	0.526	0.601
Constant	0.008	0.006	1.312	0.194

R-squared	0.568	Akaike info criterion		-2.904
Adjusted R-squared	0.472	Schwarz criterion		-2.429
S.E. of regression	0.052	F-statistic		5.908 [0.000]***

Diagnostic Tests

Breusch-Godfrey Serial Correlation LM	1.098 [0.373]	Normality	0.051 [0.975]
ARCH	0.922 [0.484]	Chow Breakpoint	0.901 [0.576]
White Heteroskedasticity	1.342 [0.165]	RESET	4.983[0.029]**

***, **,* denote significance at 1%, 5% and 10% respectively. $ect1_{t-1}$, $ect2_{t-1}$ are the error terms representing the speed of adjustment from short-run disequilibrium in the South African and Ghanaian stock market cointegration relationships respectively.

The structure of the error-correction-model for the South African market (Table 9.7) is validated by the significance of the error-correction term ($ect1_{t-1}$). The error correction shows significant correction of approximately 60% from short-run disequilibrium to the

long-run equilibrium. The term $ect2_{t-1}$, which represents disturbances from the second short-run error-correction model (the error-correction model for Ghana), however, is insignificant. This implies that disturbances from the short run in the Ghanaian equation do not significantly influence the South African short-run dynamics. The model diagnostics also show a fairly robust model. Generally, in the short run, instantaneous increases in stock returns in Egypt, Ghana and Nigeria result in increases in stock returns in the South African stock market. However, thereafter changes in lagged stock returns in Egypt, Ghana and Nigeria result in a depression in stock returns on the South African stock market. In addition, changes in stock returns in Tunisia appear to depress stock returns in the South African market.

Figure 9-2. Forecast for South African Stock market ECM
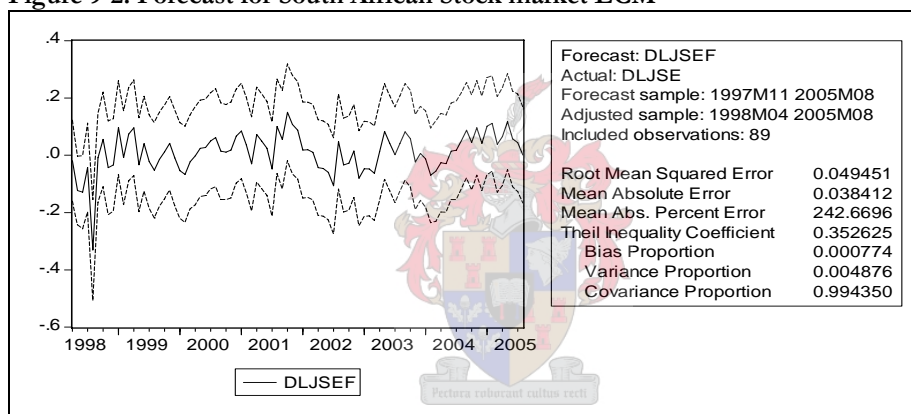
DLSEF=dynamic forecast of log difference of South African stock market index (Johannesburg All Share Index).

Dynamic forecast estimates (Figure 9.2) of the stock returns on the South African market also show good forecasting as shown by the size of the bias and variance proportions of 0.00077 and 0.00487 respectively. These show that the mean of forecast does a good job in tracking the mean stock returns on the South African stock market. The Mean Absolute Error of 0.038 is also evidence of a good forecast. A graphical representation of the forecast also shows a stable forecast.

**Table 9-8 Error-Correction Model on Ghana Stock Market**

Dependent Variable: $\Delta \lg hana$

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\Delta \lg hana_{t-1}$	0.454	0.167	2.718	0.008***
$\Delta \lg hana_{t-3}$	0.130	0.083	1.572	0.120
$\Delta lsafrica_{t-1}$	0.264	0.074	3.585	0.001***
$\Delta lsafrica_{t-2}$	0.198	0.077	2.580	0.012**
$\Delta lsafrica_{t-3}$	0.216	0.071	3.054	0.003***
$\Delta lmaur$	0.773	0.255	3.029	0.003***
$\Delta lken$	-0.268	0.140	-1.909	0.060*
$ect1_{t-1}$	-0.312	0.126	-2.476	0.015**
$ect2_{t-1}$	-0.296	0.074	-4.021	0.000***
Constant	0.001	0.006	0.090	0.929
R-squared	0.503	Akaike info criterion		-2.832
Adjusted R-squared	0.447	Schwarz criterion		-2.554
S.E. of regression	0.056	F-statistic		8.995 [0.000]***

Diagnostic Tests				
Breusch-Godfrey Serial Correlation LM	0.562 [0.759]	Normality		0.051 [0.975]
ARCH	0.877 [0.516]	Chow Breakpoint		1.770 [0.082]*
White Heteroskedasticity	6.551 [0.000]***	RESET		20.430 [0.000]***

***, **,* denote significance at 1%, 5% and 10% respectively. $ect1_{t-1}$, $ect2_{t-1}$ are the error terms representing the speed of adjustment from short-run disequilibrium in the South African and Ghanaian stock market cointegration relationships respectively.

The equilibrium structure of the error-correction model for the Ghana stock market (Table 9.8) is also validated by the significance of the error-correction term ($ect2_{t-1}$). The error correction shows a slow but significant feedback of approximately 30% from short-run disequilibrium to the long-run equilibrium. Interestingly, disturbances from the short-run South African stock market model ($ect2_{t-1}$) significantly influence the short-run model for the Ghana stock market returns. Thus there are dynamic short-run impacts of short-run misalignments in the South African stock market. The model diagnostics, though not as good as that of the South African situation, also show a fairly

robust model. Generally, in the short-run the most significant stock markets that influence stock returns on the Ghana stock market are stock returns in South Africa, Mauritius and Kenya. Stock returns in these markets are positively related to stock returns on the Ghana stock market, with Mauritius stock returns having a fairly large effect on returns on the Ghana stock market. Stock returns in Kenya, however, have a negative relationship with stock returns in Ghana.

Figure 9-3 Forecast for Ghana Stock Market ECM
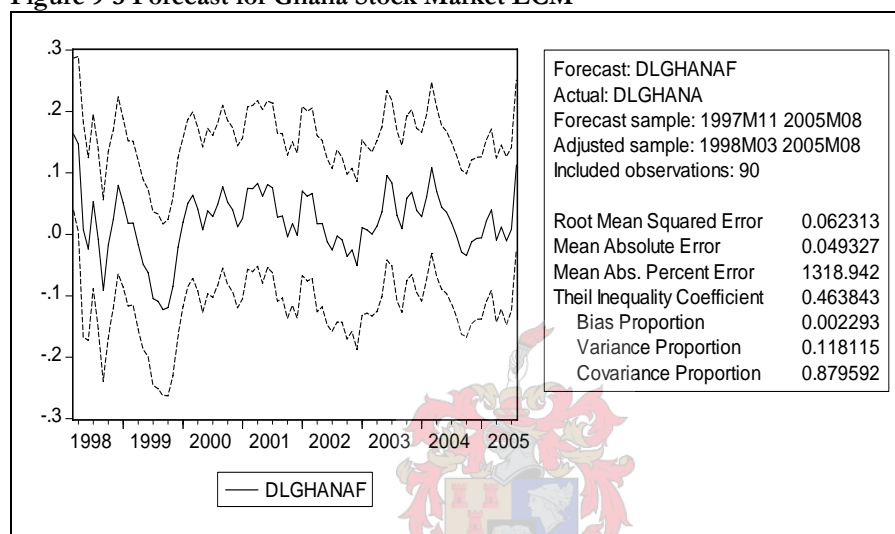
DLGHANAF=dynamic forecast of log difference of Ghana stock market index (Ghana Stock Exchange All Share Index)

Dynamic forecast estimates (Figure 9.3) of the stock returns in Ghana, with bias and variance proportions of 0.002 and 0.118 respectively, also show fairly good forecasting. Clearly the forecast variation is not far from the variation of the actual stock returns in Ghana. In addition, the Mean Absolute Error of 0.049 is also fairly robust.

9.4 Conclusion

The empirical findings from this chapter are three-fold. First, there are unique long-run relationships underlying selected African stock markets. Second, the long-run relations hinge on two markets: a larger relatively more active market (South African stock market) and a smaller and inactive market (Ghana stock market). Third, there are dynamic short-run responses and feedbacks from other African stock markets affecting the South African and Ghanaian stock market in the short run. Equilibrium correction is

faster in the South African model as compared to the Ghanaian model. Disturbances from the short-run disequilibrium on the Ghana stock market returns error correction do not influence the short-run dynamics on the South African stock market. However, short-run disequilibrium in the South African market significantly influences stock market returns On the Ghana stock market in the short run. Thus the South African stock market appears to have a dominating influence on the younger and relatively inactive Ghanaian market. Overall the evidence points to the fact that there is long-run interdependence between some African stock markets as well as dynamic causality running both ways from larger to smaller markets. It is also important to add that the causal links emerging from the analysis is indicative of some underlying stochastic and structural trends amongst the selected African stock markets. Hence the causality may not necessarily be due to integration or dual listing amongst the markets, but due to common underlying stochastic properties.
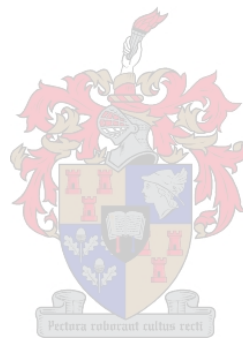
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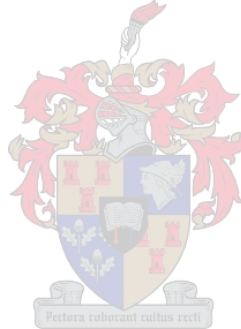
Appendix

Table 9-9General Short-Run Model South Africa

Dependent Variable: $\Delta lsafrica$

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\Delta lsafrica_{t-1}$	0.363	0.145	2.508	0.015
$\Delta lsafrica_{t-2}$	0.302	0.143	2.113	0.039
$\Delta lsafrica_{t-3}$	0.417	0.123	3.394	0.001
$\Delta lsafrica_{t-4}$	-0.084	0.108	-0.778	0.440
$\Delta legypt$	0.342	0.102	3.362	0.002
$\Delta legypt_{t-1}$	-0.052	0.123	-0.422	0.675
$\Delta legypt_{t-2}$	-0.228	0.104	-2.193	0.033
$\Delta legypt_{t-3}$	-0.096	0.108	-0.886	0.380
$\Delta legypt_{t-4}$	-0.128	0.096	-1.330	0.189
$\Delta \lg hana$	-0.157	0.128	-1.227	0.225
$\Delta \lg hana_{t-1}$	-0.028	0.103	-0.268	0.790
$\Delta \lg hana_{t-2}$	-0.293	0.122	-2.397	0.020
$\Delta \lg hana_{t-3}$	0.235	0.128	1.830	0.073
$\Delta \lg hana_{t-4}$	-0.318	0.152	-2.094	0.041
$\Delta lmaur$	0.029	0.245	0.119	0.906
$\Delta lmaur_{t-1}$	0.386	0.332	1.163	0.250
$\Delta lmaur_{t-2}$	0.133	0.254	0.523	0.603
$\Delta lmaur_{t-3}$	0.336	0.243	1.385	0.172
$\Delta lmaur_{t-4}$	0.369	0.253	1.458	0.151
$\Delta \ln gr$	0.170	0.109	1.559	0.125
$\Delta \ln gr_{t-1}$	0.210	0.154	1.366	0.178
$\Delta \ln gr_{t-2}$	-0.045	0.186	-0.242	0.810
$\Delta \ln gr_{t-3}$	-0.092	0.149	-0.615	0.541
$\Delta \ln gr_{t-4}$	-0.146	0.166	-0.880	0.383
$\Delta lken$	-0.633	0.142	-4.467	0.000
$\Delta lken_{t-1}$	0.085	0.156	0.543	0.589
$\Delta lken_{t-2}$	0.067	0.167	0.400	0.691
$\Delta lken_{t-3}$	0.093	0.146	0.636	0.527
$\Delta lken_{t-4}$	0.191	0.138	1.382	0.173
$\Delta ltunisia$	-0.171	0.103	-1.660	0.103

$\Delta ltunisia_{t-1}$	0.069	0.117	0.589	0.558
$\Delta ltunisia_{t-2}$	-0.179	0.132	-1.358	0.180
$\Delta ltunisia_{t-3}$	0.007	0.136	0.053	0.958
$\Delta ltunisia_{t-4}$	-0.246	0.115	-2.140	0.037
$ect1_{t-1}$	-0.704	0.156	-4.513	0.000
$ect2_{t-1}$	0.135	0.102	1.319	0.193
Constant	0.011	0.008	1.339	0.186

R-squared	0.645	Akaike info criterion	-2.652
Adjusted R-squared	0.399	Schwarz criterion	-1.617
S.E. of regression	0.055	F-statistic	2.626 [0.001]
Breusch-Godfrey Serial Correlation LM	1.102[0.376]	White Heteroskedasticity	0.642[0.896]
ARCH	1.290[0.272]	Normality	1.272[0.531]

Table 9-10 General Short-Run Model Ghana

Dependent Variable: $\Delta \ln gr$

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\Delta \ln gr_{t-1}$	0.396	0.260	1.525	0.133
$\Delta \ln gr_{t-2}$	-0.087	0.127	-0.688	0.494
$\Delta \ln gr_{t-3}$	0.198	0.112	1.772	0.082
$\Delta legypt$	0.101	0.135	0.744	0.460
$\Delta legypt_{t-1}$	0.144	0.092	1.571	0.122
$\Delta legypt_{t-2}$	-0.060	0.091	-0.656	0.515
$\Delta legypt_{t-3}$	-0.011	0.091	-0.120	0.905
$\Delta lsafrica$	-0.119	0.130	-0.915	0.364
$\Delta lsafrica_{t-1}$	0.122	0.120	1.020	0.312
$\Delta lsafrica_{t-2}$	0.138	0.122	1.140	0.259
$\Delta lsafrica_{t-3}$	0.223	0.106	2.099	0.040
$\Delta lmaur$	0.533	0.238	2.238	0.029
$\Delta lmaur_{t-1}$	-0.012	0.238	-0.051	0.960
$\Delta lmaur_{t-2}$	-0.198	0.207	-0.958	0.342
$\Delta lmaur_{t-3}$	-0.204	0.215	-0.950	0.346
$\Delta \ln gr$	-0.004	0.151	-0.029	0.977
$\Delta \ln gr_{t-1}$	0.206	0.165	1.254	0.215

$\Delta \ln gr_{t-2}$	0.269	0.155	1.732	0.089
$\Delta \ln gr_{t-3}$	-0.219	0.192	-1.139	0.260
$\Delta lken$	-0.234	0.193	-1.216	0.229
$\Delta lken_{t-1}$	-0.210	0.129	-1.625	0.110
$\Delta lken_{t-2}$	-0.062	0.137	-0.450	0.654
$\Delta lken_{t-3}$	0.344	0.124	2.773	0.008
$\Delta ltunisia$	-0.062	0.081	-0.770	0.444
$\Delta ltunisia_{t-1}$	-0.044	0.106	-0.416	0.679
$\Delta ltunisia_{t-2}$	0.049	0.100	0.484	0.630
$\Delta ltunisia_{t-3}$	0.015	0.115	0.127	0.899
$ect1_{t-1}$	-0.274	0.199	-1.375	0.174
$ect2_{t-1}$	-0.202	0.092	-2.201	0.032
Constant	0.000	0.008	0.004	0.997

R-squared	0.566	Akaike info criterion	-2.614
Adjusted R-squared	0.342	Schwarz criterion	-1.747
S.E. of regression	0.057	F-statistic	2.522 [0.001]***
Breusch-Godfrey Serial Correlation LM	3.472 [0.014]**	White Heteroskedasticity	3.674 [0.000]***
ARCH	1.453 [0.224]	Normality	83.441 [0.000]***

CHAPTER TEN

CONCLUSION AND RECOMMENDATIONS

10.1 Conclusion

This thesis investigated the links between stock market development and key economic growth variables in fourteen African countries. The essence was to find out whether there were dynamic interlinkages between stock market activities and economic growth indicators. Specifically the thesis sought to test whether stock market activity contributed to investment and economic growth. It also tested whether stock market returns had dynamic interrelationship with macroeconomic variables like, interest rates, inflation and exchange rates. The thesis also examined the relationship between stock market development and banking sector development. Finally it also tested whether there were dynamic long-run causal links between the selected African stock markets. The analyses of the various interrelationships were done using dynamic panel data modelling and cointegration and error correction modelling econometric approaches. In this regard eight essays were designed to test the various relationships outlined above. Specific conclusions were arrived at based on each hypothesis tested in each essays. General conclusions are therefore drawn from the individual conclusions.

On the whole the evidence thus far points to the fact that stock markets play a significant role in economic growth of the selected African countries. This significant role is only evident in an improvement in the total value of shares traded. This signals the importance of liquidity and active trading to economic growth. Stock markets only play a significant positive role in the growth of African countries that can be classified as upper-middle income. Here both market capitalization to GDP and value of shares traded significantly influence growth. Stock markets are also more significant in countries with moderately capitalized markets in Africa.

Stock markets returns also positively and significantly influence investment growth. This implies that robust stock market performance adds to capital formation for investment. More importantly, the results imply that despite the size, trading and liquidity constraints faced by most African stock markets, their impact on investment mobilization is significant. Stock markets in Africa are also potential sources of investment growth.

Apart from the traditional channels of sourcing for investment, African economies can tap investment finance from their young and fledgling stock markets.

The empirical evidence also shows that different economic environments within different countries could result in different responses of stock market returns to economic growth variables, and vice versa. In the case of stock market returns and exchange rate dynamics, for instance, Tunisia alone exhibits a stable long-run relationship between stock market prices and exchange rates, with an exchange rate depreciation leading to increases in stock market prices in Tunisia. In the short run, however, exchange rate depreciations reduce stock market returns. Even though there is no long-run stable relationship between stock market prices and exchange rates for Egypt, Ghana, Kenya, Mauritius, Nigeria and South Africa, there are substantial short-run interactions between exchange rate movements and stock market returns. However, shocks induced by either stock market returns or exchange rate changes seem to be more protracted in Ghana (11 months), Kenya (10 months), Mauritius (8 months) and Nigeria (10 months) than in South Africa (4 months) and Egypt (5 months).

With respect to stock markets and inflation, there is a long-run relationship between stock market prices and inflation for three countries: Egypt, Mauritius and South Africa. The long-run relationship between inflation and stock market prices is negative for these three countries, but only significant statistically for Mauritius and South Africa. Both long-run and short-run dynamics show that inflation impacts negatively on stock markets' development in Egypt, Mauritius and South Africa. This implies that stock markets in these countries are unable to hedge effectively against inflation. There is no long-run relationship between inflation and stock prices for Ghana, Kenya, Nigeria and Tunisia.

A similar trend to that noted in the evidence of the different responses of stock market returns to economic growth variables, and vice versa, is also noticed with respect to stock market returns and interest rate movement. The existence of a long-run relationship between interest rate and stock market prices is significant only for Kenya and South Africa. For Kenya there is a rather puzzling positive relationship between stock market prices and interest rates, implying that stock market prices increase with increases in the interest rates. Higher interest rates appear to send signals to the stock

market in Kenya of higher government domestic borrowing and associated inflationary pressures. Therefore, the stock market prices may be edging up in response to higher interest rates to hedge against the inflationary impacts.

In South Africa, on the other hand, there is a negative long-run relationship between stock market prices and interest rates. Thus increases in interest rates have adverse impacts on stock market activity, resulting in the diversion of funds away from the market. Overall, the results reveal that, even though there are some similarities in the relationship between interest rates and stock market returns in the selected African countries, there are also inherent differences in the dynamics between interest rates and stock market returns across the different countries studied. Thus shocks to either interest rates or stock market returns tend to take a longer time to filter through the system for Egypt, Ghana, Nigeria and Tunisia. However, the existence of a long-run relationship between interest rates and stock market prices exists only for 2 out of the 7 countries. Furthermore, whilst stock market returns appear to lead interest rate changes in Kenya, the reverse occurs in South Africa.

Further investigations were also conducted into the relationship between stock markets development and financial/banking sector development in Africa. At the country level there is a positive correlation between liquid liabilities to GDP ratio and stock market indicators in Kenya, Kenya, Morocco, Mauritius and Namibia. Developments in the stock market complement developments in the banking sector in Cote d'Ivoire, Kenya, Morocco, Mauritius, Namibia, South Africa and Zimbabwe. There is, however, evidence of some form of substitution between stock market development and the financial system in Egypt. Cote d'Ivoire, South Africa, Mauritius, Tunisia and Morocco stand out as having the most developed stock markets and financial intermediation system.

It is also revealed that there are unique long-run relationships underlying African stock markets. The long-run relations hinge on two markets: a larger relatively more active market (South African stock market) and a smaller and inactive market (Ghana stock market). In addition, there are dynamic short-run responses and feedbacks from other African stock markets affecting the South African and Ghanaian stock market in the short run. Equilibrium correction is faster in the South African model compared to the

Ghanaian model. Thus there are common underlying stochastic trends amongst the selected African stock markets, leading to dynamic short and long-run causal links.

Thus far the emerging evidence points to the fact that stock markets indeed play a causal role in investment formation and economic growth in Africa. Movements in key macroeconomic variables such as inflation, exchange rate and interest rates also influence stock market returns. At the same time, these macroeconomic variables are also influenced by stock market returns. Most importantly, even though there's some similarity in the level of development of most African countries, the economic conditions and environments differ, hence resulting in different dynamic responses between stock markets and economic variables.

Finally, Nigeria and Egypt emerge in addition to South Africa, Mauritius and Morocco as the most developed stock markets. Ghana, Namibia and Swaziland are the least developed stock markets. The performance of the BRVM in Cote d'Ivoire also gives credence to the benefits to be reaped from regional stock markets. The existence of poor institutional developments, especially manual processes, longer settlement cycles and lack of central depositaries, is an obstacle to the development of a number of markets, notably Algeria, Zimbabwe, Ghana, Malawi and Namibia. Transactions costs also appear to be very high in Ghana, Kenya and Egypt.

10.2 Recommendations
These results suggest some policy recommendations. The selected African economies need to ensure that stock markets, are further developed so that they become incorporated into the economic system. It is clear that the level of integration of African stock markets into the economies is still weak. The trading activities on the selected African stock markets need to be enhanced via education and the promotion of the need to raise capital through stock markets. Efficiency and productivity effects of the stock market on economic growth are robust when markets are liquid and active. In the pursuit of these market development policies, there must be consolidation and indeed an improvement on current growth and investment patterns in African economies to infuse higher demand for capital market activities, which in turn augment economic growth.

Despite the size, trading and liquidity constraints faced by most African stock markets, their impact on investment mobilization is significant. Stock markets in Africa are also potential sources of investment growth. Apart from the traditional channels of sourcing for investment, African economies can tap investment finance from their young and fledgling stock markets. Thus to boost investment growth in Africa, it is important that African countries pay particular attention to developing their stock markets.

The listing of small and medium-scale enterprises (SMEs) should be vigorously encouraged. Africa's enterprise base is comprised mostly of these SMEs; however, it is disappointing to find that there are few such firms listed on the stock exchanges. A special two-tier listing case could be considered, where tier one consists of the existing traditionally listed firms and tier two is a listing of financially sound SMEs. Thus the overall market performance in each stock market should reflect the tier-one and tier-two listings. Such a system would further integrate African economies and businesses into the stock markets, resulting in resource mobilization benefits to listed SMEs and overall higher development of African stock markets. Though remotely related, the existence of complementarity between the banking sector as well as overall financial intermediation and stock market development also shows that rapid promotion of stock market activity need not undermine banking sector development or overall financial sector development. However, given the evidence in the case of Egypt, care must be exercised in engaging in such policies in Egypt.

Macroeconomic policies, especially on inflation, interest and exchange rate, should be formed and implemented in line with stock market activity. For instance, some countries' interest rate and exchange rate shocks affect stock market activity in a protracted manner. Thus stock market activity is dampened for long periods with exchange rate misalignments in Ghana (11 months), Kenya (10 months), Mauritius (8 months) and Nigeria (10 months). A similar protracted impact trend is noticed for the effect of interest rate shocks on stock market returns in Egypt, Ghana, Nigeria and Tunisia. These revelations imply that central banks in these countries must be cautious in developing and implementing exchange rate and interest rate policies. These policies, if not handled well, could end up derailing the various stock markets in these countries.

With regards to inflation policies, it is important to note that inflation management is also good for stock market activity. This is especially so for Egypt, Mauritius and South Africa where, in the long run, stock markets are unable to hedge effectively against inflation. Hence inflation management should also be benchmarked against stock market price movement to prevent the dampening of firm activity on stock markets. Indeed such policies are also apt for countries such as Ghana, Kenya, Nigeria and Tunisia, where the interaction between inflation and stock market returns occurs only in the short run.

Policies to strengthen the infrastructural and institutional base of selected African stock markets must also be pursued vigorously. Institutional development in Nigeria, Mauritius, South Africa, Morocco and Mauritius contribute to the high stock market development rankings of these countries. In contrast, institutional development was very low in Algeria, Zimbabwe, Ghana, Malawi and Namibia. This was mainly due to manual processes, longer settlement cycles and lack of central depositaries. Resources must be channelled to provide for faster settlements cycles, more trading days and the use of comparative technology rather than the typical manual systems. Such changes on the stock markets would induce faster, cost-effective and efficient transactions and market activity.

Finally, the performance of the BRVM in Cote d'Ivoire could be indicative of the merits to be reaped from forming regional stock markets in Africa. Regional stock markets could also be the way to reduce or share the costs involved in infrastructural and institutional developments of African stock markets. In addition, regional stock markets would also open up associated countries more rapidly to each other, hence resulting in enhanced economic activity amongst the group of countries. In such instances, the effect of stock market development on economic growth should be greatly enhanced. Furthermore, this could result in a more concerted and regional effort at macroeconomic policy management, given the influences between stock market returns and macroeconomic variables.

Indeed, there is support for regionalism in stock markets, when viewed from the evidence on the dynamic causal relationships between selected African stock markets. Overall the evidence points to the fact that there is long-run interdependence between

African stock markets as well as dynamic causality running both ways from larger to smaller markets. Hence African stock markets have common structural endowments, result in their co-moving together. Such endowments, co-movements and dynamic causal links should enhance the formation of regional stock markets.

A limitation of this study has been the short time-series on stock market indicator variables. As African stock markets continue to grow with time, longer time-series would encourage more detailed empirical country case studies on links between stock markets and economic growth. In addition, future work would also examine the response of listed firms by sector to changes in macroeconomic economic indicators.