An Empirical Investigation into the Determinants of Stock Market Behaviour in South Africa

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DECLARATION

I **Durodola Oludamola Olalere** do hereby declare that except for references specifically indicated in the text and such help as I have acknowledged, this thesis is wholly my own work and has not been submitted at any other University or Technikon for any degree purposes.

Signed by _____ on this 27th day of June 2006

Abstract

The argument with regards to whether macro-economic fundamentals determine stock market behaviour is very important because of the roles it plays in an economy. Such roles include: pooling and trading of risks, mobilization of savings, provision of liquidity and allocation of capital. However, the stock market will only perform such roles effectively if the macro-economic environment is conducive. This study examined the behaviour of the All Share Index (ALSI) and market capitalization on the Johannesburg Stock Exchange in response to changes in the domestic and international macro-economic fundamentals such as the consumer price index, rand-dollar real exchange rates, domestic GDP, yield on South African government bonds, yield on United States government bonds and United States GDP.

The study used cointegration and error correction techniques proposed by Johansen and Juselius (1990) to test for long run relationship. Two separate models were estimated and results obtained show that the two proxies for the stock market behaviour (All share Index and market capitalization) are true endogenous variables, but react differently to economic fundamentals. The consumer price index has a significant negative impact on the JSE share price index while market capitalization is determined predominantly by the yield on South African government bonds. The exchange rate seems to have had little or no influence on the share price index, but becomes negative and significant in the case of market capitalization. The yield on United States government bonds also produced a strong influence on both the share price index and market capitalization. While it has a negative significant impact on share prices, it produced a positive significant impact on market capitalization.

In order to ascertain whether the South African interest rate or the United States interest rate is more important in explaining the share price and market capitalization, each of the variables were estimated in the model separately, the result obtained reveals that the United States interest rate is more important than the domestic interest rate in explaining the share price and market capitalization on the JSE. This implies that investors need to observe the USA interest rate before investing in South African equities.

A comparison of the responses of share price index and market capitalization to impulses from the macro-economic variables tested reveals that both proxies elicit a positive response from aggregate output. The share price index responds more significantly to impulses from output growth than the market capitalization, meaning that, as aggregate production increases, the share price index tends to respond positively and quickly. The exchange rate produced mixed result from the two proxies, while it produced a positive response from the market capitalization; an initial positive response was noted in the share price index that immediately turned negative. Another glaring contrast was identified in the response of both proxies to impulses from the United States interest rate. The share price index responded positively while the market capitalization produced a negative response. This finding reveals that the two proxies actually respond differently to macro-economic variables.

The variance decomposition of both stock prices and market capitalization reveals that the yield on United States government bonds has a more significant absorption potential than the South African government bonds. However, the absorption process is slower in the case of the market capitalization. The exchange rate has a greater impact on the market capitalization than stock prices. The overall assessment shows that share prices respond faster than market capitalization to macro-economic fundamentals. The study also shows that the increased openness of the South African economy by way of relaxation of the exchange control on capital account transaction has allowed the USA market to play a crucial role in equity prices in South Africa.

Three main policy recommendations results from the study. Firstly, if inflation is well monitored, then the local equity market is bound to perform strongly resulting in strong shares earning growth. Secondly, the exchange rate should be made to be less volatile so that long term investment plans across borders can be further enhanced. Thirdly, financial analyst and investors in South Africa need to analyse macro-economic developments in the United States before investing in equities in South Africa.

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LIST OF ACRONYMS

ADF	Augmented Dickey Fuller
AIC	Akaike Information Criterion
ALSI	All Share Index
ALTx	Alternative Exchange
BEE	Black Economic Empowerment
CD-ROM	Compact Disc Read Only Memory
CSDP	Central Securities Depository Participants
DF	Dickey Fuller
DIR	Domestic Interest Rate
FIBV	Federation International Bourses de Valeurs
FIFA	Federation of International Football
FTSE/ALSI	.Financial Times Stock Exchange/ All Share Index
FPE	Final Prediction Error
FSB	Financial Service Board
GARCH	Generalised Auto-regressive Conditional Heteroscedasticity
GDP	Gross Domestic Product
GDP_d	Gross Domestic Product Domestic
GDP_f	Gross Domestic Product Foreign
HOTS	Heard On Streets
HQ	Hannan Quin
INF	Inflation
JB	Jacque Bera
JETS	JSE Equities Trading System
JSE	Johannesburg Stock Exchange
KPSS	Kwiatkowski Phillip Schmidt and Shin
LCPI	Log of Consumer Price Index
LM	Lagrange Muliplier
LR	Likelihood Ratio
LRDIR	Log of Real Domestic Interest Rate
LRER	Log of Real Exchange Rate
LRGDP	Log of Real Gross Domestic Product
LRSMI	Log of Real Stock Market Index

LSE	London Stock Exchange
NASDAQ	National Association of Securities Dealers Automated Quotation
NP	NG and Perron
NSE	Nigerian Stock Exchange
NYSE	New York Stock Exchange
OLS	Ordinary Least Square
OMAM	Old Mutual Asset Managers
PP	Phillip Perron
QMLE	Quasi-Maximum Likelihood Estimation
SACF	Sample Auto-Correlation Function
SADC	Southern African Development Community
SARB	South African Reserve Bank
SC	Schwarz Criterion
SECA	Stock Exchange Control Act
SENS	Stock Exchange News Service
SETS	Stock Exchange Trading System
SME	Small to Medium Scale Enterprises
S&P 500	Standard and Poor Stock Index
SRI	Socially Responsible Investment Index
STRATE	Share Transaction Totally Electronic
UDI	Unilateral Declaration of Independence
VAR	Vector Auto-regressive Model
VECM	Vector Error Correction Modelling
WFE	World Federation of Exchanges

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DEDICATION

This work is dedicated to my parents for their unrelenting support financially, morally and spiritually during my study period. I also wish to dedicate this work to my brother and sisters who have been an inspiration to me. And finally to my love Sandra. May God bless you all.

CHAPTER 1

INTRODUCTION

1.1 Introduction

The past two decades have witnessed significant crashes of stock market indices in both developed and emerging markets. The most widely publicised instance was the 1987 Wall Street crash in the United States where the Dow Jones industrial average fell by 22.6%, the largest one-day decline in recorded stock market history. This significant crash was not confined to the United States only, but spread to other developed systems. By the end of October 1987, stock markets in Australia had fallen by 41.8%, Canada by 22.5%, Hong Kong by 45.8% and the United Kingdom by 26.4 % (Wikipedia 2005).

These collapses generated a lot of research on the extent to which stock market indices really reflect economic fundamentals. The 1987 Wall Street crash is described in George *et, al.* (1989:171) as "the most dramatic single event in world financial history". These phenomenal events in financial markets around the globe generated a lot of debate amongst researchers about the causes of stock market crashes, the role of the stock market in an economy, the unique features of the stock market and how the stock market relates to the business cycle. These issues are considered crucial because of their implications for the roles of stock markets in the broader economic development perspective.

The stock market is defined by Faure (2003:5) as the institutional framework through which the corporate sector issues new share capital and where ownership of shares already issued changes hands. The new issue of share capital takes place in the primary market arm of the stock market, while ownership of shares already issued occurs in the secondary market.

The stock market and its derivatives allow financial market participants to invest and trade at the retail level. The other markets such as bond market and money market, as well as their derivatives are generally of a wholesale nature in which only the substantially high net worth individuals can invest and trade (Faure 2003: 6). The capital market, which

comprises the stock market and the bond market, deal in instruments of a different nature. The bond market trades in bonds and it represents debt funding to investors, while the stock market instruments, which are stocks, represent equity or ownership to investors.

Pilbeam (1998:171) categorised players or participants in the stock market into three broad groups, namely: investors, brokers and market makers. Investors are the people and institutional organisations who buy and sell stock, either on their own behalf, or on behalf of other investors. Brokers are agents who undertake trading on behalf of their clients, and attempt to execute trades on their clients' behalf at the best possible price. In addition, brokers may also offer investment advice and sell research services. Market makers provide bid-ask quotes for shares on a continual basis. If they are unable to find counterparties for a buy /sell order, they have to be prepared to take an open position in the stock market themselves or conduct an offsetting trade with another market maker (Pilbeam 1998:171).

1.2 Why the stock market is so important

The stock market performs many functions that justify its relevance in the growth process of an economy. Though these functions are not sufficient in themselves because they require an enabling economic environment for them to have full positive impact on economic growth, they are very vital for investment and productivity. These functions are as follows:

1.2.1 Pooling and trading of risks

Without the activities of the stock market, investors facing *liquidity shocks* are forced to withdraw funds invested in long-term investment projects and such withdrawals could hamper economic growth. Stock markets manage this situation by giving lenders immediate access to their funds through the secondary market, while simultaneously offering borrowers a long-term supply of capital. Eventually, at the aggregate level, the liquidity risk that individual investors face is diversified (Fourie *et al* 1992:124).

In addition, investors also want to diversify *productivity risks* associated with individual investment projects. Without the operations of the stock market, they would have to restrict

their investment wholly to a particular investment project, which implies high risk in the event of the failure of the project. The stock market functions in this area by allowing investors to hold a small share in a large number of firms. By so doing, diversification of risks is attained and this invariably spurs economic growth (Pilbeam 1998:171).

1.2.2 Mobilization of savings and adequate corporate control

The Harrod-Domar growth model proposes *savings* as a very important tool for economic growth. In support of this view the stock market establishes a market place where investors feel comfortable to relinquish control of their savings. By exchanging their savings for shares in companies that are listed, investors are entitled to appoint directors who will be responsible for the smooth running of the company. Shareholders are entitled to a return on their investment contingent upon performance in terms of profit by the management. It therefore, enables them to keep a firm grip on the management who have to perform or be replaced (Pilbeam 1998:180).

1.2.3 Provision of liquidity and allocation of capital

According to Levine and Zervous (1996:44), the stock market affects economic activities through the creation of liquidity. Many profitable investments require long-term commitment of capital, but investors are often reluctant to relinquish control of their savings for long periods. Liquid stock markets make investment less risky and more attractive because they allow savers to acquire equity and to sell it quickly and cheaply if they need access to their savings or want to alter their portfolios. A liquid market thus improves the allocation of capital by allowing investors to switch from one firm to the other and, in the process reallocate capital from less viable firms to more viable ones.

The stock market also facilitates the flow of funds from the surplus economic units to deficit economic units. Without a sound stock market, much of the savings of the ultimate lenders would not be available to borrowers who will put the funds into viable investments. In other words, the stock market provides the necessary conditions for effective channelisation of free funds into viable investments.

1.2.4 Overcoming the problem of information asymmetry

Investors often find themselves in a dilemma as to which firm will be the most profitable to invest in. The cost of acquiring such information from all firms listed could be enormous. One of the most outstanding functions of the stock market is the provision of informational support. The stock market is not only superior in terms of quality and quantity of information, but also in the rapidity with which the information is disseminated to market participants, particularly investors. The information provided enables surplus funds to be diverted into viable investments thereby fostering economic growth (Pilbeam 1998:177).

1.3 Research Problem

Based on the importance of the stock market in an economy as earlier stated, it is pertinent to assess the determinants of stock market behaviour, most especially for an emerging economy like that of South Africa. Recent government policies such as Black Economic Empowerment (BEE[1]) and the Small to Medium Scale Enterprises (SMEs) require a well functioning stock market to thrive. From the early 1990s, the South African stock market exhibited irregular behaviour. This is evident from annual time series data of its market capitalization, total number of shares traded and its turnover velocity, spanning the period 1990-2005. The market capitalization[2] at the end of 1990 stood at US$136 868.7 million. It increased to US$148 675 million in 1992 and reached its peak of US$277 108.8 million in 1995; it declined to US$84 343.5 million in 2002 before increasing to US$ 168 263.1 million and US$ 249, 310.0 million in 2003 and 2004 respectively, while at Dec 2005 it stood at US$565,408 million (JSE 2006).

The turnover velocity [3] was observed to be on an upward trend. For example, the number of deals recorded in 1998 was 655 200, moved to 4, 136 737 in 2001, in 2004 was 4, 021 000 and 5 000, 000 in 2005 December. Also, the number of companies listed for trading was 796 in 1990, but this figure dropped considerably to 624 in 1994, increased to 669 in

[1] BEE is a program launched by the South African government to redress the inequalities of apartheid by giving previously disadvantaged groups an opportunity to be stakeholders in the South African economic terrain. (Wikipedia 2005)
[2] This measures the total number of shares traded multiplied by their values.
[3] This measures the number of deals per annum

1997, before declining to 389 and 373 in 2004 and 2005 respectively (JSE 2006 and WFE 2006).

Against the background of the fluctuations observed in the South African stock market, especially with regard to market capitalization and the number of companies listed, it is appropriate to estimate and examine empirically the determinants of stock market behaviour. This could assist in ascertaining what conditions might guarantee stability and consistency in the behaviour of the stock market.

Studies based on developed and a few developing countries have identified macroeconomic and institutional factors determining stock market behaviour. Garcia and Lui (1999) and Don and Stuart (2004), for example, identified macroeconomic factors such as real income, inflation, money supply, savings rate, stock market liquidity and foreign stock market. Garcia and Lui (1999) found evidence that savings rate and real income exert positive and significant effects on the stock market and are, therefore, the most important factors influencing stock market behaviour.

On the contrary, Don and Stuart (2004) argue that the most important factors are stock market liquidity and foreign stock markets. Pagano (1993) suggests that regulatory and institutional factors are the most important factors influencing the functioning of the stock market. For example, mandatory disclosure of reliable information about firms may enhance investors' participation in the stock market. Therefore, the argument as to which factors are the most important in determining stock market behaviour remains inconclusive.

In South Africa, Coetzee (2002), using quarterly data covering the period 1991-2001, found evidence that a statistically significant negative relationship exists between monetary variables such as inflation, short-term interest rates, the rand-dollar exchange rate and stock prices both in the short run and in the long run. The results of this study are contradicted by Moolman (2004), who used quarterly data spanning the period 1993-2003, and found evidence that the long run determinant of stock market behaviour is the discounted future dividend, whereas the short run fluctuations are caused by the short term interest rates, the rand-dollar exchange rate and the S&P 500 index.

Jefferis and Okeahalam (2000), in an earlier study spanning the period 1985-1995, examined the impact of domestic and foreign macro-economic variables on stock prices in three Southern African stock markets namely: South Africa, Zimbabwe and Botswana. In the case of South Africa, real exchange rate, real GDP and domestic long-term interest rate were identified to have significant impact on stock prices in the long-run, while changes in real domestic long-term interest rate, the USA interest rate, real exchange rate and domestic GDP were identified to be significant in the short-run.

Owing to the different results identified in these South African studies, it is clear that the issue of the long run determinants of stock market behaviour in South Africa remain unsettled. A number of limitations were also identified in the studies, for example: Jefferis and Okeahalam (2000) used only one proxy to depict stock market behaviour and only examined macro-economic fundamentals up to 1995. This may be a constraint because other proxies could be used to portray stock market behaviour and may indeed respond differently to economic fundamentals, and also, since 1995, a lot of changes have taken place within the macro-economic terrain in South Africa that need to be incorporated into stock market modelling.

Coetzee (2002) examined only the impact of monetary conditions on stock market behaviour, without considering other important macro-economic variables from the real sector. Moolman (2004) used the JSE/actuarial All Share Index spanning the period 1993-2001 and FTSE/JSE African index series 2002-2003 to depict stock market behaviour. It could be deduced that the FTSE/JSE African index series that replaced the JSE Actuarial All share index came into existence in January 2002 and only covers top performing shares by market capitalization in each sector, while small firms with low market capitalization and illiquidity problems are not included (FTSE/JSE 2006). Therefore Moolman's (2004) study might not fully represent the general behaviour of the South African stock market.

Against this background, this study will re-visit these issues by probing into what economic factors actually determine stock market behaviour in the long run. In the process, two major innovations that distinguish it and make it more robust than earlier studies in this area will be introduced. Firstly, the study will estimate two models, each exploring the determinants of stock market behaviour. The proxies depicting stock market behaviour will be the traditional FTSE/JSE African index series and the market capitalization, following

Garcia *et al.* (1999). The aim will be to determine whether the two proxies react differently to impulses in economic fundamentals. Secondly, the study will make use of more recent developments in time series econometrics, which were not used in previous studies, such as the impulse response and variance decomposition analysis to examine the responses of the stock market to impulses from macro-economic fundamentals.

1.4 Objectives of the study

The broad objective is to examine the behaviour of the stock market in South Africa with particular reference to domestic and international macroeconomic variables. This objective is explored through the following sub-objectives:

- To examine the historical development of stock market indicators;
- To determine the impact of the selected monetary and macroeconomic variables on the stock market in the long run;
- To determine the time interval for the stock market to revert back to long-run equilibrium following disequilibrium in the short-run; and
- To determine how the stock market responds to shock(s) due to each of the variables and which of them has the greatest impact on the stock market.

1.5 Organization of the study

The layout of this study is as follows: chapter two provides a review of the literature, both theoretical and empirical, on the relationship between stock market prices/returns and macroeconomic fundamentals in developed, as well as emerging economies, including South Africa. Historical development of the JSE and its institutional determinants are examined in chapter three. Chapter four provides a framework for the analysis, which includes a description of the econometric techniques to be used, model specification, a priori expectations, data definitions and sources. Chapter five provides the empirical analyses, results and their interpretations. Chapter six concludes by summarizing the main empirical findings, and policy implications. It also discusses the limitations of the study and areas for further research.

Chapter 2

Theoretical Foundation and Empirical Determinants of Stock Price Valuation

2.1 Introduction

In this chapter, an analysis of the theoretical foundation and empirical literature underpinning this study is undertaken. The chapter starts with a discussion of the present value model according to Smith (1925). This is followed by Gordon growth models. The second part of the chapter examines empirical literature on the macro-economic determinants of stock prices. Comparison will also be made on how macro-economic variables affect stock prices in developed, developing and emerging economies.

Under the empirical literature, other factors apart from macro-economic determinants of stock prices are also briefly discussed. For example, information is considered an important determinant of stock prices through the operation of the efficient market hypothesis (Moolman 2004:48). The efficient market hypothesis tests the efficiency of the stock market by evaluating the speed of response of stock prices to historical and current publicly available information, as well as to privately available information (Moolman 2004:49). However, it is pertinent to state that the efficient market hypothesis will not be examined for the purposes of this study, but that the emphasis will be on the macro-economic factors as determinants of stock price behaviour.

2.2 The Present Value Model

In financial literature, issues pertaining to share valuation in the equity market are based on the present value model. There are two known versions of the present value model: Smith's (1925) and Gordon's (1962) versions (Moolman 2004:51). These different versions have led to studies interpreting the empirical results of the model differently. This study starts with the version by Smith (1925) and later compares and contrasts it with the Gordon (1962) version. The standard theory of the present value model of share valuation

according to Smith (1925) postulates that the equilibrium price of a share at a point in time is equal to the discounted present value of the expected future cash (dividend) flows from that share. The model suggests that any factor that affects or changes the expected future profits of firms will affect their dividend payment, and consequently affect the share valuation (Jefferis and Okeahalam 2000:24). The present value model, as first presented by Smith (1925) is:

$$P_{i,t} = \sum_{n=1}^{\infty} \frac{E(D_{i,t+n})}{(1+k_i)^n} \quad \text{……..1}$$

Where P_i is the current share price, $D_{i,\,t+n}$ is the future dividend payment to be discounted to the present and finally $(1+k)^n$ is the discounting factor and K the discount rate. The current share price can be solved from equation 1 by setting t =0

$$P_{i,0} = \sum_{n=1}^{\infty} \frac{E(D_{i,n})}{(1+k_i)^n} \quad \text{……2}$$

Equation 2 reveals that the value of a stock is derived by discounting the expected future dividend receipts of the stock to the present. From this equation, the expected capital gain from the sale of stock is also incorporated, since its magnitude is also determined by the present value of the expected future dividend payment. Furthermore, the dividends have to be appropriately discounted, to yield the formula for equity prices:

$$P_e = \frac{D_1}{(1+R_1)} + \frac{D_2}{(1+R_2)^2} + \frac{D_3}{(1+R_3)^3} + \text{.....} + \frac{D_n}{(1+R_n)^n} + \frac{P_{en}}{(1+R_n)^n} \text{.....3}$$

where : P_e is the price of the share today and D_1, D_2, D_3 ……D_n are the expected dividend payments in year 1, 2, 3……n; P_e n is the price of the share in year n ; and R_1, R_2, R_3……R_n are the rates at which future payments are discounted. It is assumed that dividend payments are fixed, that is $D_1=D_2=D_3$……D_n and also that the rate at which dividends are discounted is fixed, that is $R_1=R_2=R_3$=……R_n.

Then equation 3 simplifies to

$$P_e = \sum_{t=1}^{n} \frac{D}{(1+R)^t} + \frac{E(P_{en})}{(1+R)^n} \quad \text{……4}$$

Where $E(P_e)$ is the expected price of the share in year n. This equation says that the value of equity is the discounted value of all the dividend payments due plus the discounted expected value of the share in year n.

2.3 The Gordon Growth Model

A major problem with the present value model, as proposed by Smith (1925), represented by equation 4, is that it assumes that the dividend payments *D* are fixed, especially in the long run. It is more reasonable to assume that dividend payments are likely to change. This assumption is now commonly used, following a model suggested by Gordon (1962), which is a variant of the present value model. The Gordon constant growth model argues that, over time, dividends will grow at a certain consistent growth rate of g percent per annum. This implies that the dividends in equation 4 can be modelled as:

Dividend in previous year = D_0.....5

Dividend year 1 = $D_1 = D_0(1+g)$.....6

Dividend year 2 = $D_2 = D_0(1+g)^2$.....7

Dividend year 3 = $D_3 = D_0(1+g)^3$.....8

Dividend year n = $D_n = D_0(1+g)^n$.....9

Substituting these values into equation 3 yields:

$$P_e = \frac{D_0(1+g)}{(1+R)} + \frac{D_0(1+g)^2}{(1+R)^2} + \frac{D_0(1+g)^3}{(1+R)^3} + ... + \frac{D_0(1+g)^n}{(1+R)^n} + \frac{Pe_n}{(1+R)^n} \quad \text{.....10}$$

Having modelled dividends, the problem of how to estimate the price Pe_n, still remains, but this is the present value in year n of all dividends from the year n to infinity. This means that equation 10 can be changed to:

$$P_e = \frac{D_0(1+g)}{(1+R)} + \frac{D_0(1+g)^2}{(1+R)^2} + \frac{D_0(1+g)^3}{(1+R)^3} + \ldots\ldots\ldots + \frac{D_0(1+g)^n}{(1+R)^n} + \frac{D_0(1+g)^{n+1}}{(1+R)^{n+1}} \ldots\ldots 11$$

Using the fact that an infinite geometric progression simplifies in the following manner:

$$ab + ab^2 + \ldots\ldots ab^n + \ldots\ldots = \frac{a}{1-b} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 12$$

Then equation 11 simplifies to:

$$P_e = \frac{D_0(1+g)}{R-g} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 13$$

Or equivalently:

$$P_e = \frac{D_1}{R-g} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 14$$

Equations 13 and 14 are known as the Gordon growth model for the pricing of equities. For it to make economic sense, it is required that R is greater than g; this avoids the possibility of a negative or infinite share price. The model shows that there are three factors that are crucial to the price of equities:

- The dividend payment made by the firm, (D_o) or the forthcoming dividend (D_1). This will be a function of the current profitability level and the dividend policy of the firm. Furthermore, the profitability of the firm depends on the macro-economic environment in which the firm operates (Moolman 2004: 48).
- The expected growth rate of dividends made by the firm, (g). One factor that is crucial here is the rate of economic growth in the economy; the higher the economic growth rate, the higher the dividend growth rate. Another important factor will be the sector of the economy in which the firm operates. It may be in a low growth or high growth sector of the economy. Other factors that are likely to be relevant include government economic policy, especially with regard to

taxation. Firm-specific factors would include the type of product and managerial competence (Pilbeam 1998:179).

- The rate of return required by the market (R). A rise in the rate of discount will imply a larger discounting of future dividends for the share and a lower share price. The required rate of discount will be dependent on how risky the firm is deemed to be by market participants and the rate of return that can be obtained from alternative risk-free investments, such as government bonds (Pilbeam 1998:180).

In the special case where the rate of growth of dividends is assumed to be zero, that is g = 0, then the Gordon model reduces to:

$$P_e = \frac{D}{R} \quad \text{.....15}$$

This means that shares that have a zero growth rate should be priced according to the dividend as a ratio of the rate of discount (Gordon 1962).

2.3.1 The Multi-Staged Gordon Growth Model

2.3.1.1 Two-Staged Growth Model

The assumption of constant dividend growth, as proposed by Gordon, seems somehow distant from reality, in the sense that the level of profitability of firms, especially in the long run, is uncertain and as a result, firms may not be able to sustain a consistent dividend growth policy for long. Owing to this assertion, Gordon came up with the two-staged model, which explains the dividend growth trend both in the short run and in the long run. The two-staged model, as suggested by Gordon, rests on the notion that, at the initial stage or in the short run, a firm's pay-out in the form of dividend experiences a high growth rate over time. However, this high dividend growth rate is short-lived and is followed by a drop to a lower, more stable dividend growth rate in the long run. Therefore the model is based upon two stages of growth, an extraordinary growth phase that lasts for n years, and a lower stable phase that lasts for ever (Damodaran 2002: 22-30). The model follows thus:

$$P_0 = \sum_{t=1}^{t=n} \frac{DPS_t}{(1+r)^t} + \frac{P_n}{(1+r)^n} \quad \text{……16}$$

Where

$$P_n = \frac{DPS_{n+1}}{r_n - g_n} \quad \text{……..17}$$

P_0 = Price of share in year 0

DPS_t = Expected dividend per share in year t

P_n = Terminal value, which is the price of share at end of year n

r = Required rate of return in high growth stage

g = Dividend growth rate in high growth stage

r_n = Required rate of return in stable growth phase after year n

g_n = Dividend growth rate in stable growth phase after year n

However, the two-stage growth model is not without its own limitations. For example, it is somewhat cumbersome to estimate the duration of the high growth phase and why it suddenly dropped to a lower level in the second phase (Goodspeed 2004:44). These limitations gave birth to Gordon's third model on share pricing, which is known as the Three-stage growth model.

2.3.1.2 The three-stage growth model

The three-stage growth model, according to Gordon, identifies three phases of dividend growth, the high growth phase, the declining or transition growth phase and the infinitely stable growth phase. The price of shares is therefore determined by the present value of expected dividends during the high growth phase, the declining growth phase and the terminal value at the beginning of the final stable-growth phase (Goodspeed 2004:45).

$$P_0 = \sum_{t=1}^{t=n1} \frac{EPS_0(1+g_a)^t \times PO_a}{(1+r)^t} + \sum_{t=n1+1}^{t=n2} \frac{DPS_t}{(1+r)^t} + \frac{EPS_{n2}(1+g_n)\times PO_n}{(r_n - g_n)(1+r)^n} \quad \text{……..18}$$

High growth phase Transition Stable growth phase

Where EPS_t = earnings per share in year t

DPS_t = dividend per share in year t

g_a = growth rate in high growth stage that lasts n1 period

g_n = growth rate in stable growth stage

PO_a = payout ratio in high growth stage

PO_n = payout ratio in stable growth stage

r = rate of return in high growth stage

r_n = rate of return in stable growth stage.

In as much as the Gordon growth model tries to align with reality, it is obvious that it does not truly reflect the actual determinants of the dividend payout of firms that invariably affect the pricing of shares. A critical evaluation of this model reveals that the model lacks the necessary flexibility that can make it adapt dividend policies to the level of profitability of firms, which in turn is influenced by the prevailing macro-economic condition in which firms operate. For example, the two-stage growth model proposes a high dividend growth rate in the initial stage; if, at this stage, the business cycle is in a trough and economic activities seem sluggish, the aggregate production and the level of profitability of the firm reduces. Against this background, it is absolutely impossible for firms to maintain a high dividend growth rate and that could render the model null and void.

On the contrary, instead of the rigid set of assumptions underpinning the Gordon growth model as regards a firm's dividend policy, a flexible approach of dividend payment that adjusts in line with the level of profitability of the firm, in accordance with the prevailing macroeconomic conditions in the economy, would be more appropriate in determining the price of shares. From the foregoing discussion, it can be deduced that prevailing macro-economic conditions play an important role in determining the level of profitability of a firm, which also influences the dividend policy and finally the pricing of shares.

2.4 Conclusion

In conclusion, the theoretical foundation explaining the behaviour of stock prices rests on the present value theory of security valuation. According to this theory, stock prices are a

function of all the expected future dividends discounted at the discount rate. In empirical studies, dividends are usually replaced by proxies that measure the state of the business cycle or the performance of the aggregate economy. The assumption of a fixed dividend payment by the present value theory was found to be unrealistic; rather, the Gordon growth model proposes the constant growth model, the two-stage growth model and the three-stage growth model. However, a critical evaluation of these models reveals that the models lack flexibility, which can make them adapt dividend policies to the level of profitability of firms, which in turn is influenced by the prevailing macro-economic conditions in which firms operate.

2.5 Empirical studies on Developed Economies

A wide array of studies has been conducted in developed countries on the impact of macro-economic fundamentals on share prices. Fama and Schwert (1977) and Fama (1981) tested the hypothesis that a negative relationship exists between inflation and stock returns on the NYSE[4]. Estimating a bivariate model, they argued that the negative relationship between stock returns and inflation is as a result of the negative relationship between inflation and real economic activities, such as capital expenditure, the average real rate of return on capital and output. They found evidence to suggest that a higher level of inflation retards the growth rate process of economic activities in the real sector. The retardation of economic activities reduces the level of profitability of firms and finally the stock returns on the NYSE.

Chen *et al.* (1986) explored the factors that determine the movement of asset prices in the United States. Likely variables investigated according to the present value model were inflation, long-term government bonds, real per-capita consumption and oil prices. Using a simple regression model, the variables were found to be significant, except for real per capita consumption and oil prices. Furthermore, George *et al.* (1989) investigated the causes of the daily movements in the stock prices of some selected stock markets in countries like the United States, Japan, Great Britain and Germany. The variables tested were exchange rate, interest rate, gold and oil prices. The results obtained were unimpressive as the coefficients and the (t) statistics of the variables tested were found to

[4] NYSE is the New York Stock Exchange

be predominantly negative and insignificant respectively in explaining stock price movements. However, a change in the demand for stock was found to be the dominant factor influencing stock price movements.

All the studies reviewed so far have attributed stock price movement wholly to economic fundamentals. Aiyagari (1988), in a study carried out in the United States, argued that even though shocks from macro-economic fundamentals have a tendency to influence stock prices, unpredictable behaviour of the "animal spirit" within investors can also cause stock prices to move and such movements might have no link whatsoever to economic fundamentals. He further reiterated that there have been instances in the past when asset prices in the United States exhibited wild fluctuations and great sensitivity to virtually unrelated events, for example the great depression in 1929[5].

Looking at other probable causes of stock price movement, apart from macro-economic fundamentals, Pu Liu *et al.* (1990) examined whether information about security recommendations provided by the Heard on the Street (HOTS) column of the Wall Street Journal impacts on stock prices. They argued that investors consult the HOTS column of the Wall Street Journal before taking buy or sell decisions that invariably affect the prices of stock. By using the OLS estimation procedure, their findings show that the daily publication of the HOTS column has a significant impact on stock prices on Wall Street.

Kothari and Shanken (1991) examined the present value model by observing how dividend growth affects stock returns. Their study is clearly different from other studies in that it focuses on dividend growth instead of macro-economic factors as determinants of stock prices. They carried out a cross sectional analysis of returns on twenty portfolios and time series analyses of shares on the NYSE over a total of 59 years spanning the period 1927 to 1985. The outcome of the regression analysis reveals that the model estimated, which has expectation of future dividend as its explanatory variable, accounts for 72 percent of annual share price variation. The cross sectional experiment of 20 portfolios formed on the basis of return performance in a given year shows that 90 percent of the variation in portfolio returns can be explained by expected future dividend.

[5] Franco Modigliani a foremost member of the Keynesian school of thought ridiculed the neoclassical economists by saying that the only sensible explanation for the great depression of 1929 on the basis of neoclassical theories is to attribute it to "a severe attack of contagious laziness" (Modigliani 1977:6).

Edman *et al.* (2005) attribute stock returns behaviour to the outcome of soccer matches while studying stock market reaction to the results of international football competitions such as the FIFA World Cup. They argued that soccer has been suggested by psychological literature as an event that impacts on moods. For soccer loving nations like Germany, Italy, Brazil, France and Nigeria, fans have been known to express mood swings such as laughter and tears, bliss and pain. In view of the psychological effect of soccer on fans, the study focussed on the linkage between moods and stock returns.

Their null hypothesis was that the stock market is unaffected by the outcomes of football matches. By using the OLS and GARCH techniques, they found empirical evidence linking stock market behaviour to football losses. They rejected the null hypothesis that stock market behaviour is not affected by outcomes of football matches. An inverse relationship was established between stock prices and football match results. However, the transmission pathway by means of which mood swings affect stock prices could not be determined with certainty. The explanation put forward to support the finding was that football match losses affect the mood of the people and they consequently lower productivity or reduce revenue, which eventually impacts on stock prices.

McQueen and Roley (1993) found that stock prices respond to macro-economic news about the state of the economy for the United States and Finland, respectively. They argued that, when investors hear the news that economic activities will rise above general expectation during a recession, then there are indications that a boom is approaching and this positively impacts on stock prices.

Kaul (1990) extended the work of Fama and Schwert (1977) by analysing the impact of changes in monetary regimes on the relations between real stock returns and expected inflation in four developed countries that have experienced distinct monetary regimes namely: United States, Canada, United Kingdom and Germany. The study was based on the proxy hypothesis by Fama (1981), which stipulates that expected inflation is negatively correlated with stock prices via the positive relations between real activities and stock price performance. His findings show an immense support for the validity of the proxy hypothesis.

Fama and French (1989) investigated the impact of business conditions on stocks on the NYSE. By using a multiple regression estimation technique, they identified that business conditions do have an impact on stock returns. When business conditions are at their lowest ebb, income is definitely low and expected returns on stocks must be high to encourage the transition from consumption spending to investment. Also, when business conditions are good, the market for stocks must clear at a lower level of return, so they concluded that dividend yield can be used to forecast stock returns.

Jensen *et al.* (1996) re-examined the study by Fama and French (1989) by testing whether only business conditions could be responsible for variations in stock returns or whether monetary conditions were involved. They focused on the effect of changing monetary conditions on security returns in the presence of varying business conditions. They found evidence to suggest that monetary stringencies impact significantly on stock returns only during an expansive period while they become insignificant during a restrictive period.

One common finding that can be extracted from these studies, especially Fama and Schwert (1977), Fama (1981), George *et al.* (1989), Kothari and Shanken (1991), Chen *et al.* (1986), Fama and French (1989), Jensen *et al.* (1996), Kaul (1990) and Edman *et al.* (2005) is that real economic fundamentals do influence stock prices, with particular reference to inflation, monetary and business conditions. The only different evidence was in the case of Aiyagari (1988) and Pu Liu *et al.* (1990).

Aiyagari (1988), for example, linked stock price movement to the unpredictable behaviour of “animal spirit” within investors. His finding could be considered as inconclusive against the fact that the public makes investment decisions based on their perception of the future economic fundamental outlook. Also, Pu Liu *et al.* (1990) attribute stock price movement on Wall Street to published information by financial analysts in the Wall Street Journal. A more critical evaluation of their findings reveals that financial analysts based their security recommendations on careful assessment of the economic environment in which firms operate.

The conclusion from both papers is that economic fundamentals have a role to play in stock price behaviour. It is important to note that the regression analysis in most of the studies could be spurious as they do not take into account the time series properties of data. For

example, most of the models were estimated using ordinary least squares (OLS) technique, without testing the time series properties of the data or examining whether long-run co-integrating relationships were present.

A more recent econometric approach was employed by Leigh (1997) in a study carried out to examine stock market efficiency on the Singapore stock exchange. He argued that if the stock market is weakly and semi-strongly efficient, then current stock prices must incorporate both past prices and current macro-economic variables prevalent in Singapore. Using a Johansen-Juselius (1990) multivariate VAR co-integration approach, he found that the Singapore stock market is indeed weakly and semi-strongly efficient and that real stock returns do cointegrate with broader macro-economic variables, such as output, consumption, the domestic interest rate, the real exchange rate, broad money, stock market wealth and the capital stock, all expressed in real terms.

The finding of a weak and semi-strong efficiency was also detected in the case of the United States stock market. Yuhn (1996) developed an alternative approach to testing for stock price volatility, using a co-integration test for the present value model of stock prices. The study examined the possibility of either a linear or non-linear co-integration in the present value model of stock prices. Two types of co-integration were tested for the United States stock market, involving monthly data from 1959:1 to 1992:6. The first test proposes that, if the present value model is valid, then a linear association of the variables in the present value model, such as dividend and stock prices, must be stationary. The second test proposes that, if the present value model is valid, then a non-linear association of the variables, such as the real price of stocks, real dividend discount factors and real interest rates, must be stationary.

The test reveals no support for linear cointegration between stock prices and dividends, but there was overwhelming support for non-linear cointegration, which shows that the deflection of the United States stock prices from their long run equilibrium trend is merely temporary. There was evidence also to agree that current stock prices reflect all available information about market fundamentals.

The findings by Yuhn (1996) of no linear co-integration between stock prices and dividends was re-examined by Han (1996) when he tested two versions of the present value

model using the Canonical Co-integration Regression and Johansen Maximum Likelihood methods. The deterministic and stochastic components of stock prices and dividends of the Standard and Poor stock index[6] were examined and evidence shows that neither levels nor logarithmic levels of stock prices and dividends were co-integrated. The finding was consistent for both methods used and conforms to the argument underpinning the present value model that macro-economic fundamentals, rather than dividends, impact on stock prices.

A study carried out on the Madrid Stock exchange in Spain by Ansotegui and Esteban (2002) confirms that macroeconomic fundamentals do impact on stock prices, most especially in the long run. Using the Johansen procedure for co-integration, the study proxied dividend with industrial production, inflation and interest rate and tested whether they have a common co-movement with the stock index on the Madrid stock exchange. It was found that one co-integrating vector does exist. However, the interrelations among the variables were unidentifiable and this serves as a limitation on the interpretation of the variables. Both interest rate and inflation carried negative signs, as expected, while real activities proxied by industrial production were positive. One important discovery from the study was that the null hypothesis of weakly exogenous was accepted for the other variables in the model, except for inflation. This shows that the cointegrating vector has a direct impact on the determinants of inflation.

Hondroyiannis and Papapetrou (2001) attempted a comprehensive investigation of the interrelations between stock prices, oil prices, foreign stock market and domestic macro-economic indicators such as industrial index, interest rates and exchange rate. The empirical study used monthly data for the period 1984:1 to 1999:9 for the Greece stock market. By utilizing a multivariate vector autoregressive model according to Johansen (1988) and Johansen-Juselius (1990), they found no evidence to support the claim of a long run relationship between stock prices and the selected macro-economic variables over the period under examination.

However, in the short run, the selected macro-economic variables do affect the performance of the stock market. Their findings also show that the Greece stock market is

[6] This is the composite stock price index (S & P 500) for the US stock market.

only partially influenced by the macro-economic variables, while a substantial proportion of the variation in the stock market remains unexplained. Oil prices affect the stock prices indirectly through the industrial production index. The result of the Impulse response analysis shows that all the variables are important in explaining stock price movement. The empirical result in summary suggests that the Greek stock market does not signal changes in overall macro-economic activities.

Lee (1992) investigated by using a multivariate VAR approach, the causal relations and dynamic interactions among stock returns, interest rates, real activity and inflation in the post-war USA. The sample period for the study is from January 1947 to December 1987. The stock return refers to stock prices on the NYSE; the interest rate is the treasury bills rate, while inflation was computed from the consumer price index. Real activity is proxied by the industrial production index. The results show that the stock market rationally signals changes in real activities and that a positive significant relationship exists between stock returns and real activities. A negative impact was established between inflation and stock prices. The causality test proves that stock returns help explain a substantial fraction of the variance in real activities. Stock returns explain little variation in inflation, however interest rates explain a substantial fraction of the variation in inflation.

A new dimension was introduced to studies modelling the stock market by Fang (2002) when he examined the impact of the exchange rate on stock prices in five Asian countries, namely Thailand, Hong Kong, Singapore, South Korea and Taiwan, over the period of the Asian crisis. The exchange rate as an explanatory variable was meant to capture the effect of capital inflows from other countries on stock prices in the five Asian countries examined. The study was expedient considering the wave of globalization pervading the world economy within the time frame of the study, i.e. 1997-1999.

The study emphasised the magnitude of volatility experienced by stock prices in relation to currency depreciation in the countries examined. In order to capture the volatility, the GARCH[7] model was used. The results obtained show that foreign currency depreciation decreases the mean stock returns and also fuels stock price volatility. The study therefore recommended that foreign investors wanting to invest in the Asian countries concerned

[7] GARCH is Generalised autoregressive conditional heteroscedasticity.

should analyse the stability of the country's exchange rate before investing, so as to forestall the risk of capital loss. It is also important to state that the study only covered the crisis period and the results might be different for normal periods.

In the line of volatility studies, Flannery and Protopapadakis (2002) examined the impact of real macro-economic variables on aggregate equity returns in the US market. They estimated a GARCH model of daily equity returns where returns realised and their conditional volatility depends on 17 macro series announcements. They found evidence to suggest that stock market returns are significantly negatively correlated with inflation and money growth.

Lastly, Torben *et al.* (2004) focus on the reaction of stock prices in the USA, Germany and Britain, amongst other prices in the overall financial market, to news about macro-economic fundamentals. By applying the Gaussian quasi-maximum likelihood estimation (QMLE) technique to the multivariate structural GARCH model they found that, in the case of stock prices, good news when the economy was expanding is bad news for stock prices, whereas bad news during a recession is good news for stock prices.

In contrast to most studies that applied time series data to stock market modelling, Drehman and Manning (2004) identified the fundamental determinants of stock returns on the UK stock exchange using panel data. Their study focussed specifically on time variation in market responses to fundamental factors by allowing coefficients to vary both over the business cycle and with the type of monetary regime. The panel estimation methodology used in the study employed a dataset of monthly returns for individual constituents of the UK's FTSE all share index (556 firms, excluding banks and investment trusts) covering the period January 1980-October 2003.

The results obtained from the panel regression show that expected GDP growth, which serves as a proxy for business cycle, has a positive significant impact on stock prices. The Treasury bill rate reflects concurrent changes in the real risk free rate. Such changes impacted negatively on future dividend and hence upon stock prices. Inflation, which is among the variables tested, impacted negatively on stock prices. The exchange rate elicits a negative response from the stock market index. In the case of oil prices, the expected negative sign against stock prices was identified. The conclusion from the study was that

economic fundamentals are consistently important for all industries in all time periods. However, investors in the UK show more response to key macro-economic developments such as GDP growth and inflation and are less responsive to interest rate changes.

Having identified various macro-economic variables impacting on stock prices from earlier studies, it is also pertinent to examine whether reverse causality also exists between stock prices and macro-economic variables. Bullard and Schaling (2002) attempted to find answers to this question when they carried out a study to ascertain whether monetary authorities should ignore stock market behaviour when formulating monetary policies. Their study emanated from the argument that movement in stock prices provides information on the state of the economy and such movement needs to be considered when the reserve bank wants to formulate its monetary policy. The result of the study disproved the assertion that the inclusion of equity price behaviour in the monetary authority policy's reaction function is irrelevant.

Evidence from Turkey presented a clearer view of the direction of causality between stock prices and macro-economic variables. Karamustafa and Kucukkale (2002) carried out a study to ascertain the direction of causality between stock price indices of the Istanbul stock exchange and macro-economic variables such as US Dollar exchange rate, trade balance, industrial production index and money supply. They used the Engel Granger causality test and the Johansen-Juselius co-integration test. The objective of the tests was to identify whether a long run relationship exists between stock prices and the selected variables and, most importantly, to determine with clarity where the direction of causality is coming from.

From the Johansen-Juselius co-integration test results, two co-integration vectors were identified, stock price was found to be positively related to industrial production index, money supply and the US Dollar exchange rate and negatively related to trade balance. The Granger causality test showed that macro-economic variables do not have a causality effect on stock prices on the Istanbul stock exchange, but rather, that stock prices spur money supply, US Dollar exchange rate, trade balance and industrial production index.

The finding of the study by Gjerde and Saetter (1999) for Norway was contrary to that of Karamustafa and Kucukkale (2002) with regard to the direction of causality between

macro-economic variables and stock returns. By estimating a VAR model and correlation coefficient analysis, they used a broader set of variables that included domestic financial variables (stock prices, interest rate and inflation), real sector variables (industrial production and consumption), as well as international factors that were considered important to the Norwegian economy (Norwegian currency/US Dollar exchange rate, oil prices). Their study observed monthly data spanning the period 1974-1994.

The result of the correlation coefficient analysis reveals a negative relationship between the Norwegian stock market, interest rate and inflation, while positively related to oil price changes. The causality test shows that the domestic real activity has a substantial influence on real stock returns while the opposite causality does not occur. The VAR model estimated shows that stock returns respond negatively to interest rate, while stock returns explain little variation in inflation. The dependence of the Norway's economy on oil is reflected in the stock market, which responds significantly to oil price changes. The stock returns respond slowly, but positively, to changes in industrial production. The argument put forward was that a high interest rate may have more impact on industrial production and finally stock prices.

Evidence from the United States, United Kingdom, Japan and Canada in a study by Jones and Kaul (1996) on the relationship between stock prices and oil prices during the post war period refutes the finding of a positive relationship between oil prices and stock prices in Norway by Gjerde and Saetter (1999). Jones and Kaul (1996) conducted a detailed investigation on the effect of oil price shocks on stock prices in the USA, Canada, Japan and the UK during the post-war period. Their focus was to ascertain whether the stock market rationally evaluates the impact of oil price shocks on the economy. Arguments emanating from their investigation indicate that stock prices in the USA rationally reflect the impact of news on current and future cash flows.

They estimated a standard cash flow/dividend valuation model and regression analysis using quarterly data spanning the period 1947-1991 for the USA, 1960-1991 for Canada, 1970-1991 for Japan and 1962-1991 for the UK. Their findings suggest that oil price hikes in the post-war period have had a significant and detrimental effect on the stock market of each country. However, due to varying levels of dependence on oil, the extent of the detrimental effect differs across the countries. For Japan, the negative impact of oil price

shocks was more severe than for other countries under observation. Japan was followed by Canada, while the USA and UK, though negative too, were not as severely affected as Japan and Canada.

In an attempt to determine whether stock market returns correlate with future economic activities, Hui Guo (2002) argued that, if a positive shock is applied to expected future dividend growth, then there will be higher future GDP growth as well. However, dividend shocks are considered as weak predictors of future economic activities. By using the simple OLS, he showed that dividend shocks explained only 2 per cent of variation in GDP growth. He found that stock price movement is not significantly sensitive to dividend news and therefore dividends have little explanatory power over the GDP.

In conclusion, a summary of the studies reviewed so far revealed that macro-economic factors do influence stock prices. The approaches of the studies differ with regard to the methodology used, objectives of the study and their findings. While some of the studies identify news about macro-economic fundamentals as a major driver of stock prices, for example McQueen and Roley (1993), other studies, such as Leigh (1997) and Ansotegui and Esteban (2002), identify macro-economic fundamentals as determinants of stock prices. Some of the studies placed more emphasis on ascertaining long run co-movement between stock prices and economic fundamentals, for example Yuhn (1996) and Han (1996). Lastly, the rest of the studies such as Fang (2002), Flannery and Protopapadakis (2002) and Torben *et al*. (2004), examined the volatile nature of stock prices and their determinants.

2.6 Empirical Studies on Developing and Emerging Economies including South Africa

The literature reviewed in the previous section was based on developed economies. This section focuses on the review of studies carried out on developing and emerging market economies. It is widely known that developed economies have a highly sophisticated economic and financial system that they have been able to put in place over the years through sound fiscal and monetary discipline. This has enabled them achieve important macro-economic objectives, such as moderate economic growth, a low unemployment rate and price stability (Gugliemo *et al.* 2004:33-35).

On the other hand, it is believed that developing economies, mainly in African countries and emerging economies that comprise a few African countries and some Asian and Latin American counterparts do not have the level of economic system sophistication attained by developed economies (Gugliemo *et al.* 2004:33-35). Against the wide disparity between developed and developing economies, results obtained from the developed country systems might not be the same as those of developing countries. This section will review literature on the impact of macro-economic fundamentals on stock market behaviour in developing and emerging economies and discuss how their findings differ from those for developed economies.

In support of the view that there exists a wide disparity between developed and emerging market economies, Sandeep and Asani (1998) empirically investigated the behaviour of stock prices in eight developed economies (Switzerland, Canada, France, Germany, Italy, Japan, UK and USA) and ten emerging economies (Indonesia, South Korea, Malaysia, Philippines, Taiwan, Thailand, Argentina, Chile, Brazil and Mexico) to stock market crashes from 1970 to 1997. They identified major regimes of stock market declines or crashes in the developed and emerging economies and found evidence to suggest that the stock markets of developed and emerging economies react differently to stock market crashes.

Their results show that each of the developed stock market crashes was less intense than the previous one with regard to the rate of price decline and the duration of the crisis

period. In the case of emerging economies, the stock prices were found to drop more quickly and steeply and it took longer for the economy to recover. This indicates how vulnerable stock markets in developing countries are to price shocks. Therefore, studies modelling stock markets in developed economies and their macro-economic impact might not be used to explain stock market behaviour in emerging and developing markets.

Garcia and Lui (1999), having the same focus as Sandeep and Asani (1998) with regard to a parallel investigation of developed and emerging stock markets, but with a slight difference of approach in terms of "proxy used" to represent the stock market, investigated the determinants of stock market development. Stock market development was proxied by market capitalization instead of the stock market index, as is popularly used in most studies. By using regression and pooled data from 1980 to 1995 in thirteen emerging economies (Argentina, Brazil, Chile, Colombia, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, Taiwan and Venezuela) and two industrialized economies (Japan and the United States), they found that real income level, savings rate, financial intermediary development and stock market liquidity are significant determinants of market capitalization in all the countries. However, the savings rate, financial intermediary development and stock market liquidity have a more positive impact on stock market development for the industrialized countries.

Chung and Shin (1999) used cointegration and the Granger causality test from a vector error correction model to determine if current economic activities in Korea can explain stock market returns. The variables used are monthly data for the period January 1980-December 1992. The variables are trade balance, foreign exchange rate, industrial production and money supply. The co-integration test indicates that the variables in the model are cointegrated with the stock price index even though there was no bi-variate co-integration in the pair-wise estimation. The vector error correction model demonstrates the causal relationship between the variables and stock returns. Their finding also proves that the Korean stock market is more sensitive to foreign exchange rate, trade balance, money supply and the production index.

Amongst the emerging markets, clear-cut differences were identified. The East Asian countries possessed a more developed stock market than the Latin American countries as a

result of sustained economic growth, a higher savings rate, a more liquid stock market and a more developed banking sector.

In South Africa, Van Rensburg (1995) modelled a linear relationship between stock returns on the JSE and macro-economic variables such as unexpected changes in the term structure of interest rates, unexpected changes in inflation expectations and unexpected changes in the gold price. Using the OLS regression technique, all the variables were significant in explaining stock returns on the JSE.

Oyama (1997) closely examined the general relationship between stock prices and macro-economic variables in Zimbabwe for the period 1991-1996. The study was based on the dividend discount model, error correction model and the multi-factor return generating model. The error correction model revealed that stock price behaviour towards the latter end of the period examined was due to domestic macro-economic factors, such as the growth rate of money and the Treasury bills rate. However, a sudden jump in stock prices in the period 1993-94 was linked to the shift in the risk premium, which seems to have been caused by foreign investors.

The finding by Oyama (1997) that domestic macro-economic factors play an influential role in stock market behaviour in the case of Zimbabwe was confirmed by Jefferis and Okeahalam (2000) in a study carried out on South Africa, Zimbabwe and Botswana in the period 1985 to 1995. By using a co-integration approach according to Johansen, they obtained long-term co-movement between stock prices and some economic fundamentals, such as real exchange rate, real GDP and real domestic interest rate for the Zimbabwean stock market. Foreign interest rate was insignificant because the Zimbabwean economy was predominantly closed to foreign influence, particularly during the years of Unilateral Declaration of Independence (UDI), whereas the South African stock market exhibited the closest relationship with the variables tested. The real stock market index possesses a positive relationship with real GDP, as well as the real exchange rate, while it establishes a negative relationship with real long-term interest rates. The impact of the real exchange rate was due to the openness of the South African economy in trade terms. However, the foreign interest rate was insignificant owing to relatively tight exchange controls on capital account transaction, which are now being gradually relaxed.

Coetzee (2002) took a monetary approach to determinants of stock market behaviour in South Africa. Instead of testing macro-economic fundamentals, as carried out by Jefferis and Okeahalam (2000), he examined the impact of monetary conditions on stock prices for the South African stock market over the period 1991-2001. His aim was to detect the long run co-movement between monetary variables and stock returns through the use of cointegration according to the Johansen procedure. The outcome of the study reveals that there exists a long-run co-movement between monetary factors and stock prices, and, during expansive monetary conditions, the stock return performs better while a restrictive period adversely affects stock prices. A negative relationship was found to exist between monetary variables, such as inflation, short-term interest rates, the rand-dollar exchange rate and stock prices, both in the short run and in the long run.

Van Rensburg (1998) separated the gold index and the industrial index from the general all share index (ALSI) on the JSE and explored what factors could be responsible for their behaviour. In the case of the gold index, the rand-dollar exchange rates and the gold price were identified, while the industrial index was found to be influenced by the short term interest rate and the Dow Jones industrial index.

Moolman (2004) estimated a structural econometric model of the South African stock market, using the cointegration and error correction modelling proposed by Johansen (1990). The model exposed the macro-economic variables that influence the stock market, as well as the magnitude of their impacts. The results obtained reveal that the long run level of the South African stock market is determined according to the expected present value model. Therefore, the long run level of share prices is determined by discounted future dividends. In addition, the short run fluctuations are caused by the short term interest rate, the rand-dollar exchange rates, the S&P 500 index, the gold price, the forward-looking expectations of investors and a risk premium.

All the studies within the Southern African region, such as Van Rensburg (1995), Coetzee (2002), Moolman (2004), Jefferis and Okeahalam (2000) and Oyama (1997), that have estimated stock market models used the share price as the endogenous variable representing stock market behaviour. This implies that their findings might be narrowed down to stock price behaviour. This is because some other proxies can be used to depict stock market behaviour such as the market capitalization as used be Garcia *et al.* (1999).

Studies reviewed so far have concentrated on the Southern African region, the Latin American and East Asian countries. However, Nwokoma (2004) looked at the form of the relationship that might exist between the Nigerian stock market and some selected macro-economic variables, such as the industrial production index, the consumer price index, a narrowly defined money supply (M1) and the short term deposit rate of commercial banks. He investigated whether stock prices on the Nigerian Stock Exchange (NSE) are co-integrated with the selected economic variables. By using a co-integration technique according to the Johansen procedure and an impulse response analysis of a Vector Autoregressive model (VAR),he suggests that only the level of the interest rate and industrial production index are co-integrated with stock prices on the NSE. The results of the Impulse response analysis show that stock prices on the NSE respond more to its past prices than other macro-variables tested.

Evidence from the Egyptian stock exchange indicates that monetary conditions did not have a significant impact on stock prices prior to January 1998. Meanwhile, post-December 1997 provided new proof that monetary policies do influence stock prices. These were the findings of Sourial (2001) in the paper that identified the influence of monetary policy on stock prices in the Egyptian stock market. The study was carried out using the Bayesian VAR model, which consists of four explanatory variables (credit to the private sector, discount rate, inflation rate, narrow and broad money (M1, M2)). The estimation results revealed that a reduction in credit to the private sector implies a tight monetary condition that has a tendency to depress stock prices. The same impact was found for the M1 and M2 respectively. However, the discount rate failed to explain any movement in stock prices. Lastly, inflation was found to have a negative impact on stock prices.

A very important point to note is that most studies modelling the determinants of stock prices in emerging markets, including South Africa, include variables capturing foreign influence on domestic stock prices, specifically from developed countries. This reveals that most emerging markets are being influenced by developed markets factors. Variables such as the S&P 500 index, US interest rates, US GDP, the Dow Jones industrial average, the rand-dollar exchange rates, unexpected returns on the NYSE etc. were found to have significant influence on the South African stock market across various studies, such as Van Rensburg (1995 and 1998), Jefferis and Okeahalam (2000) and Moolman (2004).

A further review of two major items of literature modelling stock price determinants in South Africa reveals different findings. Jefferis and Okeahalam (2000), for example, identified domestic long term interest rate as a short run determinant of stock market behaviour, while Moolman (2004) identified the domestic short term interest rate. With regard to long run determinants of stock prices, Jefferis and Okeahalam (2000) identified real exchange rate and real GDP, while Moolman (2004) identified discounted future dividends. Therefore, it is clear that the issue of long-run determinants of stock market behaviour in South Africa remains inconclusive.

2.7 CONCLUSION

This chapter has shown the various macro-economic factors that could impact on the behaviour of the stock market. It has also provided a theoretical background that will serve as a guide for the estimation stage of this study. The theoretical foundation explaining the behaviour of stock prices rests on the present value theory of security valuation. According to this theory, stock prices are a function of all the expected future dividends discounted at the discount rate. The chapter has further provided insight into the different techniques of estimation and their likely outcomes. Looking at the techniques used, the studies reviewed can be broadly categorised into two. The first section of the studies used the ordinary least square method of estimation, which does not take into account the time series properties of the data used.

The rest of the studies incorporated more recent techniques in econometrics by using the multivariate co-integration tests suggested by Johansen and Juselius (1990). Examples of such studies include Leigh (1997), Yuhn (1996), Ansotegui and Esteban (2002), Fang (2002), Flannery and Protopapadakis (2002), Torben *et al.* (2004), Moolman (2004), Oyama (1997), Jefferis and Okeahalam (2000), Coetzee (2002), Nwokoma (2004) and Sourial (2001).

These studies identified long run co-movement between the stock market index of the various countries concerned and macro-variables such as output (GDP), consumption, domestic long term interest rate, real exchange rate, broad money, capital stock, inflation, industrial production, gold prices, savings rate, real income level, and treasury bills rate.

The identification of these factors will serve as a guide for the estimation stage of the study in that reference will be made to the findings of earlier studies reviewed in later chapters. Table A1 in the Appendix provides a summary of all the important studies reviewed. The next chapter examines the Johannesburg Stock Exchange as the institution representing the South African stock market and its performance indicators.

Chapter 3

THE JSE Securities Exchange and its Performance Indicators

3.1 Introduction

The literature reviewed in the previous chapter indicates that economic fundamentals affect the behaviour of share prices. This chapter introduces the institutional approach to the study of the determinants of share price behaviour. This is carried out by evaluating the performance of the Johannesburg Stock Exchange (JSE), which is the institution that is saddled with the responsibility of performing the role of the stock market for the South African economy.

Pagano (1993) points out that institutional factors have significant influence on stock price performance. This implies that the organisational structure, legal framework and trading procedure have an influential role in the behaviour of share prices. This chapter will discuss all these factors in greater detail. The discussion will be carried out by looking at the historical development of the JSE over the years, its administrative structure, legal framework, functions, trading procedure, membership and STRATE[8] in relation to the performance of the JSE. Stock market indicators regarding the performance and growth of the JSE are also examined.

3.2 Historical development of the JSE

The JSE has a history dating as far back as 1838, and during this period it has performed and continues to perform a crucial role in the commercial and economic development of Southern Africa by providing a market where entrepreneurs and established businesses in search of capital can link up with investors in search of investment opportunities. Contrary to widely held belief, the Johannesburg Stock Exchange was not the first, nor the only, exchange established in South Africa. The first known stock trading took place in Cape Town in 1838 and subsequent transaction was by public auction. Meanwhile, the discovery of diamonds in Kimberley in 1871 motivated the establishment of another stock exchange.

[8] STRATE is an acronym for Share Transactions Totally Electronic.

In its case, a committee was formed to lay down the rules of conduct in business dealings since earlier dealings had been regulated by common law. Kimberley remained the financial centre of South Africa until the discovery of gold on the Witwatersrand.

In the year 1884 two exchanges were established in Mpumalanga (formerly known as Barberton), following the discovery of gold in the Eastern Transvaal (Fourie *et al.* 1992:138). The two exchanges started trading activities with some 30 stockbrokers. In 1890, both ceased operation due to irregularities with regard to the regulatory framework guiding the conduct of participants. The discovery and the subsequent establishment of mining and financial companies, meant investors needed an exchange facility through which shares could be traded. The Witwatersrand Club and Exchange Company Limited was formed in February 1886 and was later succeeded by the foundation of the Johannesburg Stock Exchange in November 1887, barely 14 months after the discovery of the Witwatersrand goldfield by Benjamin Woolan (Fourie *et al* 1992:138, JSE 2005).

Apart from the exchanges mentioned earlier, others were established at Klerksdorp, Pietermaritzburg, Durban and Cape Town for short periods. Since South Africa had relatively few large commercial companies at that time, the only shares of interest were those in the mining industry. In 1931, the Pietermaritzburg exchange was closed down, leaving the Johannesburg Stock Exchange as the only stock exchange in operation since 1887, its year of inception.

The JSE developed rapidly after its formation and became the driving force behind the development of the Witwatersrand goldfields. It was soon an essential part of the city's financial and commercial life. In 1933, a new stock exchange was formed in Johannesburg, which subsequently became known as the Union Exchange. This stock market remained operational until 1958 when it was closed down by the Treasury due to the huge administrative cost incurred in running it (JSE 2005).

The government being anxious that shareholders of companies quoted on the Union Exchange would be deprived of a market in which to trade decided to absorb them into the Johannesburg Stock Exchange. Because of the more stringent listing requirements of the JSE, the shares quoted were divided into two sections, namely a primary and a secondary section. Most of those shares originally quoted on the Union Exchange were listed in the

secondary section. This division was discontinued in January 1979 due to the need to drop shares of non-performing firms who couldn't sustain the listing requirements of the secondary section of the exchange.

As the South African economy grew, more industrial companies obtained listings. The growth of the JSE can be confirmed by comparing the 151 companies (mining, financial and industrial) listed in 1932 with the 721 companies listed in 1992 and the 389 listed in 2004 (Fourie *et al* 1992:139). This rapid growth is further evidenced by the fact that the JSE has had to be re-organised five times within 90 years. The JSE was admitted into the membership of the Federation International Bourses de Valeurs (FIBV)[9] in 1963, and in 1985 an independent businessman was appointed as the JSE Chief Executive Officer. In 1993, the JSE obtained full membership of the African Stock Exchanges Association. On the 8th November 1995, the requirement that all stockbrokers be South African citizens was abolished (JSE 2005).

The South African Institute of Stockbrokers was established to coordinate the examination, admission and discipline of stockbrokers. The option of corporate membership with limited liability, subject to the appropriate capital requirements, was introduced. Trading was permitted for members only. Also, ownership of members by non-stockbrokers was passed into law subject to the passing of a fit and proper test. This enables inter-alia, banks to operate stockbroking businesses (JSE 2005).

On 15th May 1996, the bond market emerged as a separate independent trading entity from the JSE to become the Bond Exchange of South Africa (BESA) and was licensed under the Financial Market Control Act as a financial service provider. The open outcry trading platform of the JSE was abolished on 7th June 1996 and was immediately replaced by an order driven centralized automated trading system, which is known as the JSE equities trading system (JETS). Recognising the importance of adequate and timely information, a real time news service for the dissemination of company announcements and price/time sensitive information called Stock Exchange News Service (SENS) was inaugurated on the 18th August 1997. Also, an internet-based facility called the emerging enterprise was created to establish contacts between seekers and providers of capital for small and medium

[9] This is the world federation of exchanges established in 1930 to foster cooperation amongst stock exchanges of the world.

scale businesses (JSE 2005). In order to put all traders on the same platform with regard to information concerning shares and to avoid a situation whereby some market participants make profit from insider information, an Insider Trading Act was enacted based on the recommendations of the King Task Group and a few members of the JSE. In November 1999, paper share certificate issuance to shareholders was cancelled and replaced by an electronic clearing and settlement system known as STRATE (share transactions totally electronic) (JSE 2005).

3.3 Legal Framework of the JSE

The JSE is governed externally by the Stock Exchange Control Act (SECA) and internally by its own rules and regulations. It was introduced in 1947 and has subsequently been amended several times. The Control Act, which is enforced by the Financial Services Board (FSB), lays down the capital and certain other requirements for membership, the type of books that must be kept by a stockbroker, provisions in respect of minimum cover, the time allowed for the payment of share purchases and for the delivery of shares, and the conditions under which short sales may be executed (JSE 2005).

The Act also requires that broking firms submit annual audited balance sheets to the FSB and that a representative of the FSB may attend any meeting of the JSE committee. The Act stipulates the requirements for the formation of a stock exchange. The JSE internal rules, which are extensive, are primarily intended to regulate the manner in which trading is to be conducted, the obligations of members to one another and to their clients, the operations of the Clearing House and the disciplines that members have to adhere to strictly (JSE 2005).

Furthermore, the rules deal with issues relating to the protection of the investing general public, and any changes have to be approved in writing by the FSB. The JSE regulations, govern areas such as the domestic operations of the exchange which may be introduced or amended more rapidly than the rules. Presently, the JSE securities exchange aspires to align its operations with international best practice. This alignment relates to regulations guiding the exchange, clearing and settlement system etc. The president of the JSE[10] commented

[10] The president of the JSE is Russell M Loubser who is also a member of the Board of Directors of the World Federation of Exchanges, previously Executive Director of the Financial Market Department at Rand Merchant Bank Ltd (JSE2005).

that this drive will position the JSE as a reputable institution amongst the world financial markets, which will also improve foreign investors' confidence in the South African equities market (JSE 2005).

3.4 The Organizational Structure of the JSE

The JSE executive committee, which consists of 12 ordinary members who are elected annually by a secret ballot, directs the exchange. They elect a chairman, vice-chairman and various sub-committees as the need arises. The sub-committees are a very vital tool for managing the stock exchange. Each sub-committee has a permanent chairman, vice-chairman and a number of permanent members. A president who is a permanent employee of the JSE, together with two appointed members from the financial industry, also serves on the committee. The president is responsible for carrying out the policy decisions of the committee. The major policy decisions taken by the sub-committees are general purpose finance, listings, public relations and gilts. All policy decisions taken by the main committee are put into operation by the Stock Exchange Administration (see Fourie *et al*1992:140).

3.5 Trading and Settlement on the JSE

During the mid-90s, there was a need to bring about transformation on the JSE in view of the wave of globalization and technological advancement pervading the world financial markets. The pressure to reduce costs and develop a more efficient and transparent trading, clearing and settlement system was increasing with closer integration of world financial markets. In order to keep pace with global trends with regard to information technology being practised in developed countries in Europe and America, the open outcry trading floor was abolished on the 7th of June 1996 and replaced by an order driven centralized automated trading system called JSE equities trading system (JETS) (JSE 2005).

Dual trading and negotiated brokerage were also introduced. On 13th May 2002, the JETS system gave way to the JSE SETS (Stock Exchange Trading System), a trading system implemented in association with the London Stock Exchange (LSE). The new system was expected to increase transparency and liquidity of trading on the JSE, as well as dual listing

on both the JSE and the LSE. The STRATE (Share Transaction Totally Electronic) system, which came into operation in November 1999, takes care of electronic handling of clearing and settlement on the JSE. STRATE limited is the Central Securities Depository for the South African equities market and deals only with Central Securities Depository Participants (CSDP) who are the transfer secretaries at banks approved by the Financial Services Board. Under this system, script (share certificates) is "dematerialized" i.e. ownership of shares is evidenced by computer-generated statements sent from CSDPs to share holders on a monthly basis (JSE 2005). The ultimate aim is to eliminate the dependence on paper in the form of share certificates and transfer documents.

According to the President of the JSE, STRATE has led to a new era of clearing and settlements that will not only boost the JSE's competitiveness in the international financial markets, but also improve South Africa's standing in terms of settlements and operational risks. STRATE was initiated when the old clearing and settlement system in a paper based office environment could no longer cope with the increased number of daily transactions on the JSE. This assertion came after the successful implementation of the JET system contributed to a massive leap in turnover in the year following its implementation (JSE 2005).

3.6 Analysis of Market Performance of the JSE

The strategic focus of the JSE securities exchange is to run a world-class exchange, which operates at low cost, but is highly efficient, offering a wide range of financial products to a broader and demanding investor community (JSE 2004 Financial Report). It aims to remain the market of choice for local and international investors looking to gain exposure to South Africa and in future the broader African continent. In line with this focus, the Chairman of the JSE, Humphrey Borkum, commented in the JSE annual report for 2004 that:

"The concerted effort by the JSE to cut costs, combined with the thriving equities market, has resulted in a good financial performance for the JSE for the year under review. This translates to a growth in the net asset value of the exchange from R386 million in Dec 2003 to R464 million in Dec 2004" (Culled from the JSE (2005)

In view of the performance of the JSE as a corporate entity, it is appropriate to examine some selected market indicators that reflect the growth of the market and its economic performance.

3.6.1 Market Capitalization

The market capitalization of a stock exchange is the total number of issued shares of domestic and foreign companies, including their several classes, multiplied by their respective current prices at a given point in time. It encompasses shares of domestic companies such as ordinary and preferred shares, while excluding investment funds, rights, warrants, convertible instruments, options, futures and companies whose only business goal is to hold shares of other listed companies (WFE 2005).

The size of the market capitalization can be categorized into six classes: mega market capitalization (US$200 Billion and above), big/large market capitalization (US$10-$200 billion), mid-market capitalization (US$2-$10 Billion), small-market capitalization (US$300milliom-US$2Billion), micro-market capitalization (US$50million-US$300million), and nano-market capitalization (under US$50 million) (Investopedia 2005). The JSE falls into the category of the mid market capitalization, according to the market capitalization of Dec 2004, which was US$ 442 520 million (JSE 2005).

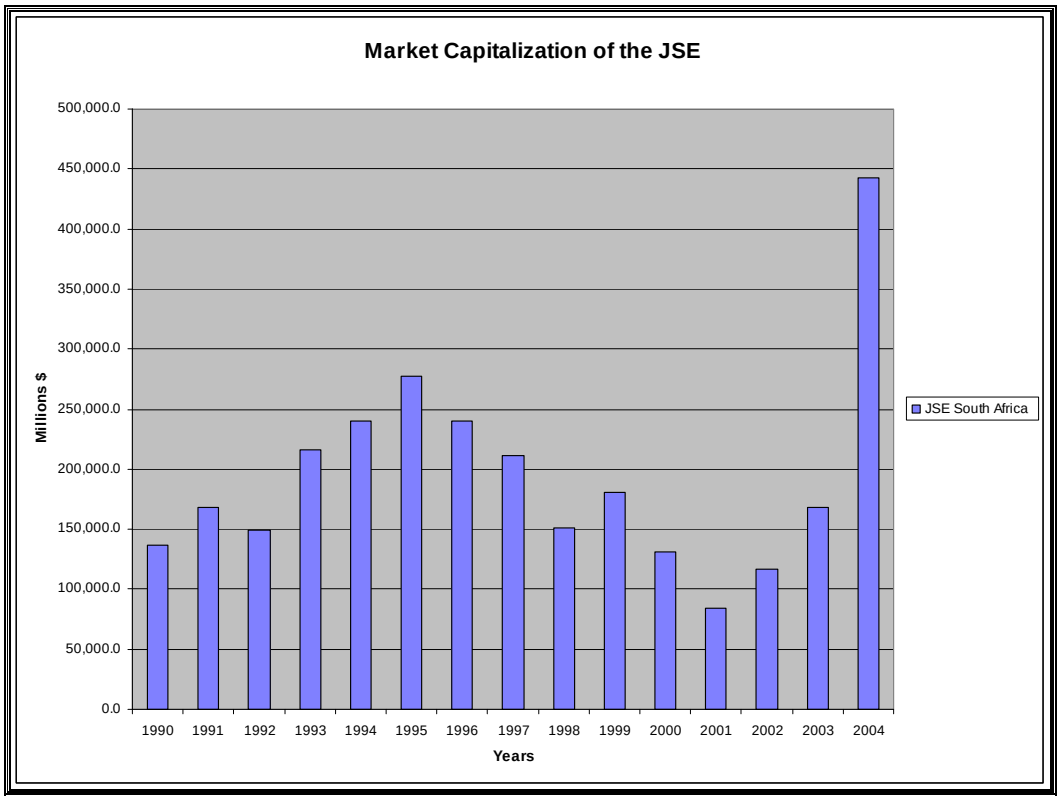
Market capitalization is determined by two factors, namely: the number of shares issued and the share price or value. Technical analysis[11]maintains that the market value of shares is determined mainly by the interaction of demand and supply, which in turn is determined by numerous rational and irrational factors. Prices do not respond only to changes in fundamental value, but also to peoples' fallacy and behaviour.

However, fundamental analysis stipulates that macro-economic conditions in an economy determine the profitability of firms, which invariably affects share prices, and the need to source funds through the stock market. Proponents of the business cycle and the stock market believe that in periods of boom, productivity expands and firms raise additional

[11] Technical analysis is an approach to investment management based on the belief that historical market statistics especially price and volume exhibits irregularities such that future trends in stock movement can be deduced from historical data. See Cambell et al (1979).

capital through the stock market so as to boost production, while in periods of recession, the number of shares issued declines (Moolman (2004)). Figure 1 below illustrates the growth trend of the market capitalization of the JSE from 1990-2004.

Figure 1



Source: Computed using data from the JSE security exchange financial statistics data (1990-2004)

From the 90s the market capitalization growth experienced peaks and troughs in certain periods. It peaked in 1995 and from then fell consistently to slightly below US$100,000 million in 2001 before rising to US$442 525.5 million in 2004. The first peak recorded in 1995 could be as a result of new economic reforms heralding the birth of a new political dispensation in South Africa in the previous year. The remarkable growth recorded in 2004 could be attributed to a number of factors, one of which is the inclusion of high calibre companies, for example Peermont, Lewis Stores and Spar, listing on the JSE (JSE 2005).

Another factor could be the growth in Altx, the JSE's parallel market for small and medium-sized companies, which was launched in 2003, with 10 listings to date and a market capitalization value greater than the combined market capitalization of the Venture

Capital market[12] and the Development Capital market[13]. Other factors that could be responsible are: the securing of the first foreign inward dual listing in terms of the new dispensation and the launch of the Socially Responsible Investment Index (SRI).

3.6.2 Market Turn-over and Turn-over velocity

Market turnover measures the number of trades representing all transactions in equity shares, while the market turnover "in value" measures or captures the total number of shares traded, multiplied by their respective matching prices (WFE 2005). There are three main categories of trades according to the facility used to execute the trading operations, namely: trades effected through the Electronic Order Book, negotiated deals and other trading activities (WFE 2005). Trades carried out through the Electronic Order Book represent the transfer of ownership effected automatically through the exchange's electronic order book, where authorised intermediaries place the orders generally matched on a price/time basis.

The negotiated deals represent the transfer of ownership effected through a bilateral negotiation and involving at least one exchange member as intermediary, i.e. trades between two intermediaries or between an intermediary and a customer. These trades can be executed in a number of ways, including special trading platforms, telephone or other structures, and are reported by the intermediary to the exchange's authority. They can be executed and/or reported on systems operated by the exchange (WFE 2005).

The other trading activities include certain trade-related operations that cannot be reported in the other two categories of trading. Examples include stock movements from clearing centres to facilitate the completion of the trading process or repurchase agreements. In the case of the JSE, total share turnover is composed of electronic order book and negotiated deals only, excluding other trading activity. The turn-over velocity is the ratio between the turn-over of domestic shares and their market capitalization. The value obtained, is annualized by multiplying the monthly moving average by 12. It is calculated by deriving for each month the annualized ratio between the domestic market capitalizations,

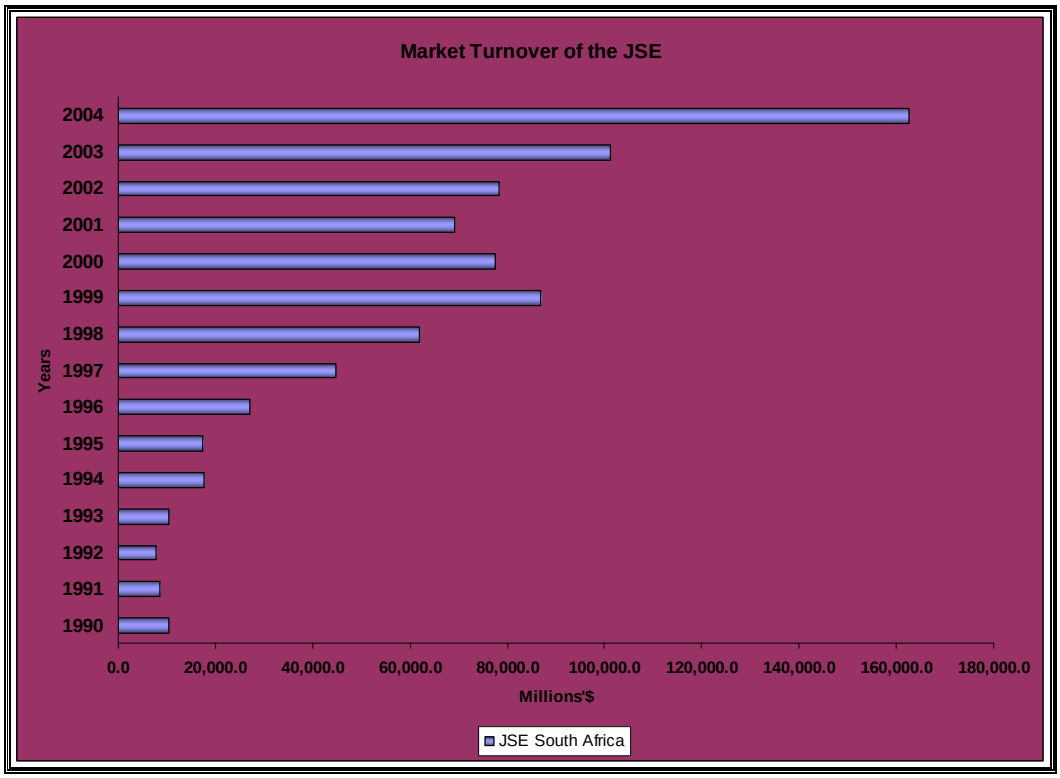
[12] The venture capital market is a market created to assist companies specializing in venture capital projects. The listing requirements are not as demanding as the main board (JSE 2005).
[13] The Development Capital Market is a market created to assist developing small to medium scale firms in raising capital for expansion (JSE 2005).

multiplied by 12. Then the percentage ratio obtained is added together using a moving average methodology divided by 12 (WFE 2005).

Over the years, share trading in emerging markets has improved from less than 3 percent of the $1.6 trillion world total in 1985 to around 8.7 percent of the $22.8 trillion shares traded on all the world stock markets in 1998 (Aggarwal 2000: 56). In South Africa, there has been a tremendous growth in the turn-over velocity of shares traded on the JSE. This could be as a result of the substitution of the open outcry trading floor for screen based JET system or the opening of membership and the deregulation of brokerage charged by members which encouraged an influx of new members.

For example, the number of transactions daily in 1995 ranged between 2 700 and 3 000. By 1998, the average turnover rate had jumped to 14 680 a day with a peak of about 30, 000 transactions. By the end of 1998, facilities to provide clearing services to handle peaks of 60,000 were available (JSE 2005). Figure 2 below illustrates the growth trend of the market turn-over of the JSE from 1990-2004.

Figure 2



Source: Computed using data from the JSE security exchange financial statistics compilation (1990-2004)

Figure 2 shows the steady increase each year in the value of shares traded (in dollar terms) on the JSE securities exchange. The market turnover growth has been on the increase throughout the period under observation, 1990-2004. This growth could be attributable to factors such as the demise of the open outcry system of trading in June 1996, which was replaced by an order-driven centralized automated trading system, and also the opening up of the securities market to new members. Other factors could be the dematerialization of the script issue through the automated clearing system known as STRATE (Share transactions totally electronic). In view of the aforementioned factors, trading could be carried out faster and more conveniently, thereby accommodating huge volumes of transactions involving shares.

3.6.3 Number of Companies Listed

This refers to companies whose shares have been admitted to the JSE Securities exchange official list, and are authorised to raise funds through the sale of shares. The listed companies could be foreign or domestic. A company is considered foreign when it is incorporated in a country other than where the exchange is located. Listed companies stand to benefit from listing in that it will enable them raise cheaper "equity capital," rather than relying on "debt financing" when sourcing funds to expand their operations. Also a listing will improve the credibility of the company when obtaining other forms of finance, such as bank loans (JSE 2005).

A listing will also enhance the status of the company, and the providers of the finance will be assured by the fact that its financial information and actions will be subject to the JSE and public scrutiny. In summary, the benefit of a company being listed is to improve its dealings with banks, suppliers, distributors and customers who could have a positive effect on the company's overall performance (WFE 2005).

However, companies desiring to be listed must be ready to incur certain costs, for example, in addition to the cost of listing the company will have to pay an annual listing fee to maintain its listing (JSE 2005). Upon listing, the company is bound to comply with the listing requirements of the JSE. Complying with these requirements can be expensive in terms of cost and management time. In addition, listed companies can be sanctioned by the JSE if they breach the listings requirements.

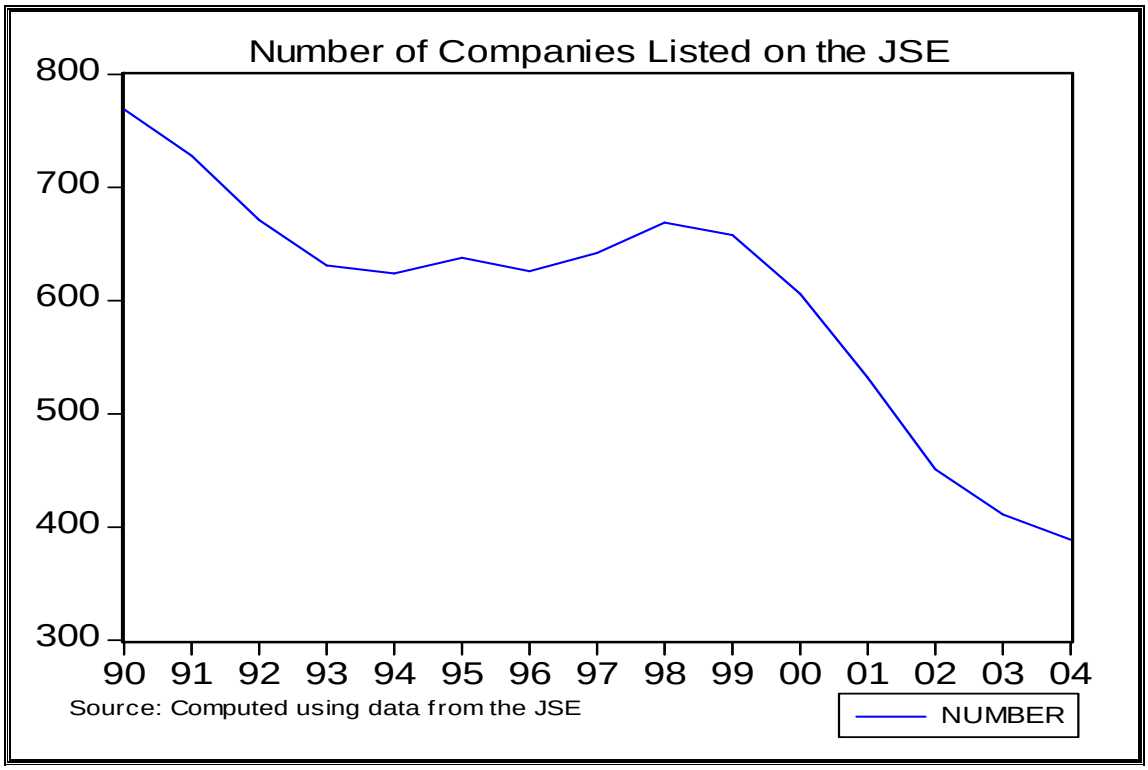
3.6.3.1 Methods of Obtaining a Listing

There are three broad methods of obtaining a listing. The first one is an introduction, where a company acquires a wide spread of public share holding. When the company is desirous of raising funds through the capital market, existing shareholders of the company are invited to take up the shares. This implies that existing shareholders are introduced to new shares and not the general public. This method is not expensive to undertake and also requires few formalities.

The second method is known as private placing. According to this method, firms wanting to raise capital through share issue privately negotiate with high net worth individuals or established high profile corporations to take up its shares. This is normally carried out via merchant banks or sponsors. The general public is also not invited. The last method is known as public offer, which can be further sub-divided into two; offer for sale and offer subscription. In the latter case, firms invite the general public to subscribe to their newly issued shares and the proceeds go to the firm making the public invitation. This method usually comes with a prospectus that is sent to all outlets for easy access by the general public. The public has a period in which applications and payment are to be made. Based on the outcome of the application, the company decides on the mode of allocation. In the former case, existing shareholders invite the general public to subscribe to their shares and the proceeds go to the shareholders and not the issuing firms (JSE 2005).

Figure 3 below illustrates the number of companies listed on the JSE within the period 1990-2004.

Figure 3



The above graph shows that the number of companies listed on the exchange has been decreasing over the years under review. For instance, it fell by 7.9 per cent in the period between 1999 and 2000 and by 12.2 per cent between 2000 and 2001 respectively. It only fell by a mere 2 per cent between 2003 and 2004. This behaviour could be linked to a number of factors, such as the condition of the market in which these companies operate and the state of the company. If the market is static or declining, it will probably have a negative effect on the company, also if the company is not in a sound financial position with good prospects and does not have the system in place to comply with the JSE's financial disclosure requirements, it could end up delisting. In 1996, there was an influx of foreign interest in the JSE securities exchange, which could be attributed to an improvement in the regulatory standards and compliance of the exchange.

The entry of international players was as a result of the opening of the South African market to foreign investors, who were growing in importance in emerging market portfolios. The perceived business opportunity as a result of the privatization of public

organizations was also an important pull factor. By the end of 1999, the strength of these pull factors had weakened and in the light of a global bear market and the Asian crisis coupled with the need to re-assess global investment of resources, some of the international players withdrew their investment in South Africa (Hawkins 2004:9).

3.7 Conclusion

The South African stock market has the potential to stimulate economic growth and improve living standards. Although it operates in a complex and ever-changing political, social, legal, regulatory and institutional environment, given that the macro-economic environment is favourable, it can contribute immensely to the growth of the economy. The fact still remains that the JSE as an institution, plays a very vital role in attracting investors both domestically and internationally to trade. According to Pagano (1993), institutional performance could either enhance or hinder the stock market from performing its role in the economy. A well-managed stock market could contribute positively to the overall performance of the market.

This chapter has examined the JSE as an institution and its contribution to the economy. It is also important to determine the macro-economic conditions in which the JSE has been operating and see how they have impacted on the behaviour of the stock market over time. The next chapter will attempt to develop the empirical framework and the econometric technique that will be used in this regard.

Chapter 4

Methodology and Framework for the Analysis

4.1 Introduction

The previous chapter examined the development of the JSE and importance of institutional factors responsible for running the stock market in South Africa. The JSE is ranked as the best performing market in Africa in terms of volume of trading or turnover, market capitalization and technological innovation with regards to electronic trading systems (Jefferis and Okeahalam 2000:27).

This chapter examines how macro-economic fundamentals impact on the stock market indicators in South Africa using econometric techniques. The focus will be to provide the framework for the analysis. This includes a description of the econometric techniques used in the determination of the macro-economic factors influencing stock market indices, both in the short run and in the long run. It also describes the model for the analysis, as well as variable definitions and *a priori* expectations.

In chapter two it was established that the price of a stock is determined by the expected future cash flows, namely its dividend, which is discounted to the present, using a constant or time varying discount rate. According to the model any macro-economic factor that affects or changes the expected future profits (and hence dividends) or the discount rate, will affect the share price (Jefferis and Okeahalam 2000:24).

In order to determine the impact of the monetary and macro-economic variables such as inflation, exchange rate, economic growth and interest rate on stock prices, and to ascertain whether or not their relationship possesses long run movement, a multivariate cointegration test and vector error correction model proposed by Johansen (1988) and Johansen and Juselius (1990) is used. To observe how the stock market responds to shocks and the time interval it takes for it to revert back to equilibrium following shock(s) an impulse response analysis is used. Lastly, to derive the actual proportion of the response of the stock market to shocks from the monetary and macro variables, variance decomposition analysis is employed.

The first section of this chapter focuses on model specification and variable definition, including the *a priori* expectations, while the second section examines the procedure of the multivariate cointegration test and vector error correction model, impulse response analysis and variance decomposition analysis respectively.

4.2 Model specification and variable description

The specified models examine the impact of domestic and international monetary and macro-economic variables on stock market indices and market capitalization (which serve as proxies for stock market behaviour) for South Africa. This approach is not an attempt to derive an innovative model, but rather, revisit the model by Jefferis and Okeahalam (2000) with some slight modification in terms of variables included, proxies depicting stock market behaviour and the empirical techniques used.

The choice of variables is guided by factors that might influence share valuations either through expected future dividends or the discount rate in line with the present value model. This study attempts to contribute to the body of knowledge in this area by empirically estimating two separate proxies for the stock market behaviour. The two models will have the same explanatory variables, but the endogenous variable for each model will be different. In order to assess the determinants of stock market behaviour, this study estimates the following structural models:

$$LRSMI = \beta_0 + \beta_1 LRGDPUS + \beta_2 LRER + \beta_3 LRDIRSA + \beta_4 LCPI + \beta_5 LRGDPSA + \beta_6 LRDIRUS + \in_t \quad ..4.1A$$

and

$$LMCAP = \beta_0 + \beta_1 LRGDPUS + \beta_2 LRER + \beta_3 LRDIRSA + \beta_4 LCPI + \beta_5 LRGDPSA + \beta_6 LRDIRUS + \in_t \quad .4.1B$$

where the dependent variables LRSMI and LMCAP are the log of the real all share price index and the log of market capitalization, respectively. LRGDPUS is the log of real Gross Domestic Product for the United States of America; LRER is the log of real exchange rate; LRDIRSA is the log of the real domestic interest rate, which is the yield on government

bonds for South Africa; LRDIRUS is the log of the real domestic interest rate, which is also the yield on the United States government bond, LRGDPSA is the log of real Gross Domestic Product for South Africa and LCPI is the log of consumer price index.

The following section will briefly discuss the macro-economic variables as they relate to stock market indices and market capitalization. In doing this, the present value model theory, which serves as the economic theory underpinning the study, is taken into consideration. The standard model of the present value model of share valuation postulates that the equilibrium price of a share at time *t* is a function of the discounted value of the expected future cash (dividend) flows from that share. According to the model any macro-economic condition that affects or changes the expected future profits, or the discount rate, will therefore affect the share price (Jefferis and Okeahalam 2000:24).

4.2.1 Stock Market Index

Stock market indices are carefully computed as weighted averages of the stock prices of all firms in all the market sectors. The stock market index serves as an indicator of the performance of the entire market. The stock market price index that represents all the firms on the JSE is known as the FTSE/JSE African All share Index series[14]. This comprises the FTSE/JSE Africa TOP 40, which is the top forty companies ranked by market capitalization, the FTSE/JSE Africa INDI 25, which is the top twenty-five companies belonging to the basic industrial or general industrial economic group, also ranked by market capitalization; the FTSE/JSE Africa FINI 15, which is the top 15 companies belonging to the financial economic group, also ranked by market capitalization; the FTSE/JSE Africa FINDI 30, which is the top thirty companies belonging to both the financial and basic industrial group ranked by market capitalization and, finally, the FTSE/JSE Africa GLDX, which is all companies belonging to both the FTSE/JSE Africa All share index and the gold mining sub-sector (FTSE/JSE 2006).

The FTSE/ALSI is published on a daily basis to reflect how the market performs at the end of each trading day. From the above highlighted constituents of the FTSE/JSE African All share index series, it is clear that only very important shares in each sector are taken into

[14] FTSE/JSE is the Financial Times Stock Exchange/Johannesburg Stock Exchange

account in the computation of the index while very scarcely traded shares with small market capitalization are left out. This could also imply that the FTSE/JSE African All Share Index series does not actually represent the overall performance of all the shares traded on the exchange. In order to capture the overall performance of the stock market, this study also examines the market capitalization of all the shares traded on the exchange as another proxy for stock market behaviour.

4.2.2 Market Capitalization.

The use of market capitalization as a proxy for stock market behaviour is the major contribution of this study. This is due to the limitations of the stock market index, which does not fully represent the general performance of the stock market in South Africa. Garcia *et al.* (1999:37) argued that market capitalization is a better proxy to capture the general development of the stock market and that it is less arbitrary than the All Share Index. For the purpose of this study, market capitalization is measured as the total market value of all traded shares on the stock exchange as share of GDP.

4.2.3 Output (Gross Domestic Product for South Africa and United States of America)

It is hypothesized that domestic aggregate level of production (GDP) in monetary terms is positively related to share prices in the stock market. Based on the present value model, firms are more profitable during periods of high economic growth and therefore pay a higher dividend which makes shares attractive and constitutes a demand pressure on shares by investors, invariably leading to rising share prices. Also, if the economy is expanding, economic agents have enough money to spend on consumption and investment according to Keynes's motive for holding money. This will cause firms to raise funds through the primary market so as to expand their production base in order to meet rising commodity demand.

Studies like Fama and French (1989) have examined the business cycle with respect to peaks and troughs and have noted that when the economy is at the peak and businesses are making profits, share prices tend to rise. Therefore, most speculators in the financial market tend to exercise the "buy cheap sell high strategy". This is done by not buying during a boom period but buying during a recession or trough. This also means that demand

pressure during a recession could exert a positive influence on share prices while restraining behaviour could depress share prices during a boom. This argument could elicit an inverse relationship between share prices and domestic aggregate level of production.

In the case of foreign GDP impacting on the domestic share price, *a priori* expectations might not be ascertained with certainty. Jefferis and Okeahalam (2000:35) assert that it could produce mixed results. They argued that a positive relationship could be established if export from South Africa to the United States is important. This means that if the United States economy is booming, South African's exports could become attractive to Americans, which improves the profitability of South African firms. The high profit could lead to high dividend payments to share holders and exert a positive influence on share prices in South Africa.

On the other hand, it could also elicit a negative relationship in that an economic boom in the United States could boost the US firms' profitability and share prices, which could lead to capital outflow from South Africa and therefore depress domestic share price. This argument was also supported by Dwyer and Hafer (1990) who found a negative relationship between United States real GDP and stock prices for Canada, Japan and Germany respectively.

4.2.4 Exchange rate

Exchange rate was included in the model to capture the effect of exchange rate fluctuations on stock market indices. Exchange rate risk is the uncertainty involved when investing in a foreign economy using foreign currency (Reilly 1989:16). Globalization and deregulation have made it possible for foreign investors to easily access the South African equity market. Such that when foreign speculators invest in the South African economy, profit from their equity investment has to be converted to their domestic currency to ascertain the true return for the investor. This means that investors have to take into account the risk that the exchange rate between their domestic currency and the foreign currency in which the investment is made might fluctuate. Examining the *a priori* expectation, it is observed that depreciation boosts the profitability of domestic producers of tradable exports and imports substitutes relative to foreign competitors. Therefore, an appreciation of the foreign currency or the depreciation of the domestic currency which represents a rise in the

absolute value of the domestic currency, will lead to an increase in a firm's export and performance, which will lead to an increase in their stock prices. As a result, the exchange rate should have a positive influence on their profits and hence on their stock prices (Moolman 2004:40). According to Dreheman and Manning (2004) for industrial firms that make use of foreign raw materials for production, if the domestic currency appreciates or drops in absolute value it means imported raw materials become less expensive and also affect the profitability of firms positively. Thus there is a negative relationship between exchange rate and share price.

4.2.5 Consumer Price Index

The consumer price index (CPI) is a measure of the overall price level of goods and services bought by the average household at a point in time. The actual inflation rate is computed from the consumer price index as the rate of change of the consumer price index relative to a base year. The CPI for the purpose of this study is meant to capture the influence of general price level dynamics in the real market on tradings in the stock market and a firm's profitability. The hypothesized negative relationship between inflation and stock prices in economic theory stems from the inverse interaction between real activities and inflation. Fama and Schwert (1977) and Fama (1981) argue that an increase in the rate of inflation retards the economic growth process. The slow pace of economic growth results from a massive drop in the level of savings by economic agents. They argued further that if economic agents know that by saving funds, the purchasing power would be eroded due to a high inflation growth rate, then they would withdraw funds and investment would be hindered. Therefore, the retardation of economic activities would reduce the level of profitability of firms, which would finally depress stock prices.

4.2.6 Interest rate (Yield on Government Bond for South Africa and United States)

The present value model postulates that the price of stocks is determined by discounting a series of expected future income streams from a security to the present using a time varying discounted rate. In most empirical studies, the discount rate is usually replaced by the long term interest rate. The domestic long term rate in this case implies the rate that investors will have to earn to substitute government bonds for equity investment. Theory suggests an inverse relationship between interest rates and stock prices. A higher real interest rate is

expected to discourage investors from putting money into stocks through a substitution effect that arises due to the sudden attractiveness of interest-bearing instruments such as government bonds. Apart from the yield on government bonds, a higher interest rate, such as the repo rate, could also reduce the present value of future expected profit of firms influencing a firm's performance and consequently depressing the stock price.

Jefferis and Okeahalam (2000:35) argued that the influence of foreign interest rates on domestic stock prices depends on the level of integration of an economy into the international capital market. If an economy is fully integrated with minimal exchange controls on their capital account, then it is most likely that foreign interest rates would be very relevant, but if not, then the domestic rate will be more relevant.

Depending on whether investors perceive bond investment as a complement to or substitute for equity investment could also determine the *a priori* expectation. If government bonds are regarded as a substitute form of investment then in theory a negative relationship holds, but if it is regarded as a complementary form of investment in a portfolio of securities then a positive relationship could hold. The positive relationship could be linked to the Markowitz theory of portfolio investment where investors are risk averse. This implies that such an investor will endeavour to diversify risk by putting funds into different investments with varying risk levels. The Table 1 below gives a summary of information about all the variables in the model.

Table 1: Summary of important Information of all the Series in the Model.

Variable	*Computation*	*Coverage Period*	*Data Source*	*Frequency*	*A priori Result*	*Earlier Studies*
LRSMI	Log $\frac{stockmarketindex}{consumerpriceindex}\times 100$	1990-2004	IMF International Financial Statistics (IFS)CD ROM	Quarterly		Moolman 2004, Jefferis and Okeahalam 2000, Coetzee 2002.
LMCA	Log $\frac{MarketCapitalization}{GDP}\times 100$	Same as above	Same as above	Same as above		Garcia *et al*, 1999
LRGDPSA	$\text{Log}\left(\frac{GDPSA}{CPISA}\times 100\right)$	Same as above	Same as above	Same as above	positive or negative	Moolman 2004, Jefferis and Okeahalam 2000.
LRGDPUS	$\text{Log}\left(\frac{GDPUS}{CPIUS}\times 100\right)$	Same as above	Same as above	Same as above	positive or negative	Jefferis and Okeahalam 2000.
LRER	$\text{Log}\left(E\frac{CPI_d}{CPI_f}\right)$	Same as above	Same as above	Same as above	positive or negative	Jefferis and Okeahalam 2000, Jiming and Kelvin 2003

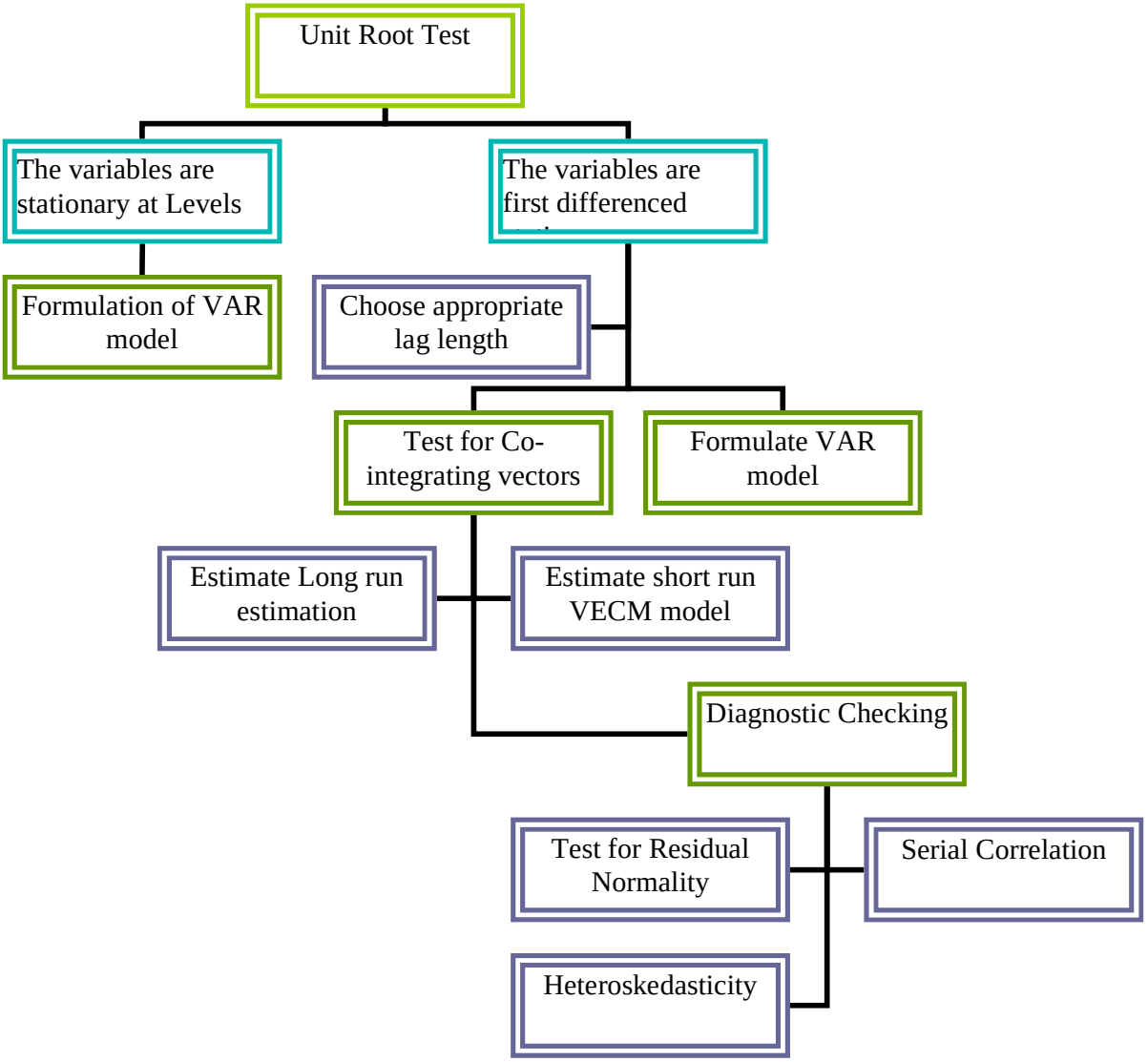
LCPI	$\text{Log}(CPI)$	Same as above	Same as above	Same as above	negative	Jefferis and Okeahalam 2000, Moolman 2004.
LRDIRSA	$\text{Log}\left[\frac{100 + DIRSA}{100 + INFLATION}\right]$	Same as above	Same as above	Same as above	negative	Jefferis and Okeahalam 2000
LRDIRUS	$\text{Log}\left[\frac{100 + DIRUS}{100 + INFLATION}\right]$	Same as above	Same as above	Same as above	positive or negative	Jefferis and Okeahalam 2000

4.3 Cointegration and Vector Error Correction

This study employs co-integration and vector error correction, using the Johansen (1988) approach that was further developed in Johansen and Jesulius (1990), to test the existence of a long run relationship between stock returns and macro-economic factors. If stock returns are influenced by macro-economic fundamentals in the long run, then the movement between these variables will be bound together. In other words, the variables will be co-integrated. The estimation procedure is shown using the flowchart below, while a detailed description follows:

Figure 4

Johansen Co-integration Procedure



4.3.1 Testing for Unit Root

The innovative work on testing for unit root in time series was introduced by Dickey and Fuller (Fuller 1976, Dickey and Fuller 1979). The main aim of the test was to observe the null hypothesis that $\phi = 1$ in

$$\Delta Y_t = \phi Y_{t-1} + U_t \quad \text{.....16}$$

Against the one-sided alternative $\phi \angle 1$. Thus the hypotheses to be tested are

Ho: Series contain a unit root versus

H_1: Series does not contain a unit root

From the above hypothesis, if a series contains a unit root, it is said to be non-stationary, and if it does not have a unit root it is stationary. According to Gujarati (2003:797), a series is weakly stationary if its mean and variance do not vary systematically over time. Such a time series is known as a second order stationary process or, in a wider sense, a stochastic process. However, a time series is strictly stationary if all the moments of its probability distribution and not just the first two (mean and variance) are invariant (Gujarati 2003:797-798). Also Brook (2002) defined a stationary series as a time series with a constant mean, constant variance and constant auto covariance for each given lag (Brook 2002:367).

Non-stationarity of a series has always been regarded as a problem in econometric analysis (Charemza and Deadman 1992:124). The use of non-stationary data can cause spurious regression and also the non-stationarity or otherwise of a series can significantly impact on its behaviour and properties, especially with response to shocks[15]. If a time series is non-stationary, its behaviour can be studied only for the time period under consideration. Each set of time series data will therefore be for a particular episode. As a consequence, it is not possible to generalize from non-stationary data to other time periods. Therefore it could be problematic to undertake hypothesis tests about the regression parameters if the data are non-stationary (Brooks 2002:367-368).

[15] The word "Shock" is usually used to represent unexpected change in a variable or the value of the error term during a particular period (Brooks 2002:367).

Before any sensible regression analysis can be performed, it is essential to identify the order of integration of each variable. In general a series is said to be integrated of order *d*, denoted I (d), if it has to be differenced *d* times to become stationary. Thus, stationary time series that do not require any differencing are said to be level stationary or integrated of order zero I (0). Therefore, unit root tests are designed to test the order of integration of a variable (Brooks 2002:375).

In testing for unit root, the Dickey- Fuller (DF), Augmented Dickey Fuller (ADF), GLS detrended Dickey Fuller (DFGLS), Kwiatkowski, Phillips, Schmidt and Shin (KPSS), Ng and Perron (NP) and the Phillip Perron (PP) are widely known methods in empirical studies. Of all these methods, the Phillip Perron (PP), the Dickey Fuller (DF) and the Augmented Dickey Fuller method (ADF) are commonly used.

4.3.2 Formulation and Estimation of appropriate VAR model

Sims (1980) advanced the vector autoregressive models (VARs) in econometric studies as a natural generalization of univariate autoregressive models (Brooks 2002:330). A VAR is a systems regression model that possesses the characteristics of a univariate time series model, as well as a simultaneous structural equation model. This is because it has more than one dependent variable, which means that any of the variables within the model can be expressed as a dependent variable and also the dependent variables can be explained by their own past values plus their error terms (Brooks 2002:330). According to Maddala and Kim (1998), the maximum likelihood method is applied by Johansen to the VAR model, assuming that the errors are white noise. The general infinite VAR representation is:

$$\Delta X_T = \Pi X_{T-1} + \sum_{t=1}^{\infty} B_I \Delta X_{t-i} + pz_t + E_t \quad \text{..... ....} \quad 17$$

X_T represents the vector of I (1) variables, ΔX_t are all I (0) and $\Pi = 0$ if cointegration does not exist, while Z_t is a vector of deterministic variables. In order to estimate the system, it is required that we fit a finite auto-regression of order k:

$$\Delta X_T = \Pi X_{T-1} + \sum_{t=1}^{K} B_I \Delta X_{t-i} + pz_t + E_{kt} \quad \text{.....} \quad 18$$

If ΔX_t.....ΔX_{t-k+1} are all *I* (0) and X_t is *I* (1), for the equation to be consistent, Π_i should not be of full rank. Let its full rank be n and its reduced rank be r, if the ranks of r and n are equal, then the variables in X_t are *I* (0), while if the rank of Π_i is zero, then there are no long run co-movements (Harris 1995:79). In most cases Π_i has reduced rank; that is, $r \leq (n-1)$. Then we have:

$$\Pi_i = \alpha\beta \text{.....19}$$

Where α is an n*r matrix and β is an r*n matrix. βX_{t-1} is the r cointegrated variables, β depicts the matrix of coefficients of the cointegrating relations and α is the matrix of error correction terms or the short run impact. The first stage in the estimation of equation 18 involves the determination of the optimal or appropriate lag length. The determination of the appropriate lag length is crucial because of the influence it has on the number of co-integrating vectors identified in the VAR model (Seddighi *et al.*2000:309).

The information criterion method has been popularly used in literature to determine appropriate lag length for the VAR. The information criteria include the sequential modified likelihood ratio (LR), the Final Prediction Error (FPE), Akaike Information Criterion (AIC), the Schwarz Information Criterion (SC) and the Hannan-Quin Information Criterion (HQ). These criteria may produce conflicting VAR orders. The final choice is based on the criteria that agree with the theory underpinning the study and all the *a priori* expectations that are linked with the theory concerned (Seddighi *et al*, 2000:309).

4.3.3 Identify the number of Co-integrating Vectors

The number of co-integrating vectors explains the number of different forms of long run relationships in the model estimated. This could be determined using the two popularly used likelihood ratio (LR) test statistics, as provided in Johansen (1988): the trace statistics (λ_{trace}) and the maximum Eigen values ($\lambda_{\max}$) with their test statistics given respectively as follows:

$$\lambda_{trace}\ (r) = -T \sum_{i=r+1}^{g} \ln\left(1-\lambda_i^{"}\right) \text{.....20}$$

And

$$\lambda_{\max}\ (r, r+1) = -T \ln\left(1-\lambda_{r+1}^{"}\right) \text{.....21}$$

Where r is regarded as the number of cointegrating vectors under the null hypothesis and $\lambda_i^{"}$ is the estimated value for the ith-ordered eigen-value from the Π matrix. The larger the ith- ordered eigen-value ($\lambda_i^{"}$), the larger and negative will be $\ln\left(1-\lambda_i^{"}\right)$ and, hence, the larger will be the test statistics figure. Each of the eigen-values is linked to a different cointegration vector, which are termed eigenvectors. A statistically significant non-zero eigen-value implies a significant cointegrating vector (Wang 2003:20 and Brooks 2002:405).

The null hypothesis of the Trace test states that the number of cointegrating vectors is less than or equal to r, against an alternative hypothesis that there are more than r. The null hypothesis of maximum eigen-value is that the number of cointegrating vectors is r against an alternative of r+1. The critical values for the two statistics are provided by Johansen and Juselius (1990:183) and they are available in most econometrics software. The decision rule stipulates that if the test statistic is greater than the critical value from the Johansen tables,one should reject the null hypothesis that there are r cointegrating vectors in favour of the alternative that there are r+1 for λ_{trace} or more than r for $\lambda_{\max}$ (Brook 2002:405).

4.3.4 Long-run estimation (cointegration regression) and short-run VECM model

After identifying the number of co-integrating vectors in the model, the long run and short run parameters estimation follows. The long run estimation is carried out by normalizing the variable of interest in the VAR model estimated. The long run cointegration regression examines whether the variables within the VAR model possess long run co-movement. Brooks (2002:388) asserts that if a linear combination of variables within a model is stationary and also bound together by some relationship in the long run this implies that they are cointegrated.

The vector error correction model is a representation where the long run equilibrium is embedded in an equation that captures short run variation and dynamics. Modelling the short run dynamics will provide information concerning how adjustments are taking place among the various variables, to restore long run equilibrium in response to short term disturbances. According to Johansen and Juselius (1990), a true error correction takes place within the model when the error correction coefficient is negative and statistically significant.

4.3.5 Diagnostic Tests

In order to test the hypothesis of cointegration, the normality assumption must be fulfilled. This is because the normal distribution of the series in a model is used to construct confidence intervals and to perform tests of hypotheses for parameters in a co-integration regression model. The consequence of non-normality could be that the F and t tests of the coefficient might not be valid. The multivariate extension of the Jarque-Bera (JB) residual normality test can be used to test the null hypothesis that the residuals are normally distributed.

Islam and Ahmed (1999:105) argued that deviation from normality may not render the cointegration test result invalid. They stated that such deviations were also observed by Johansen and Juselius in two of their papers (1990 and 1992) and concluded that the more crucial issue in cointegration analysis is whether the residuals are uncorrelated and homoskedastic.

When error terms or residuals of co-integrating regression equations are correlated with each other, these errors are said to be serially correlated. By being serially correlated, the co-variance between the error terms over time for a time series data will not be equal to zero. In other words, if the co-variance of the error term is equal to zero, then the error terms are uncorrelated. Co-integrating regression equations with correlated error terms will tend to produce coefficient estimates that are inefficient, thereby causing wrong inferences to be made with regard to whether an exogenous variable is or is not important in explaining the endogenous variable concerned. The null hypothesis of no serial correlation in the error term can be tested using the Lagrange Multiplier (LM) test (Brooks 2002:155-157, Gujarati 2003:443).

One of the stochastic properties of the models in cointegration analysis is that the variance of the error term be constant. This could be referred to as the assumption of homoskedasticity in the classical model. If the error term does not have a constant variance, it is said to be heteroskedastic (Brooks 2002:150-151. If estimation and inferences are carried out in a model that has an error term that is heteroskedastic, then the formulae representing the coefficient of the standard error become unreliable. As a consequence, any inference made from the result obtained would be misleading. In Eviews software, the null hypothesis of no heteroskedasticity can be tested using the Whites heteroskedasticity test.

4.4 Impulse response and variance decomposition analysis

An impulse response traces out the responsiveness of a one time shock to one of the innovations on current and future values of the endogenous variables through the dynamic lag structure of the VAR (Wang 2003:64-65). Conceptually, we can think of an impulse response function as the outcome of a conceptual experiment where a set of behavioural responses of variables are observed in turn as impulses are applied to each one separately. Traditionally, impulse response is designed to provide answers to the question: "What impact does a shock of size (s) hitting the system at time (t) has on the state of the system at time t+n, given that no other shocks hit the system" (Brooks 2002:342-343).

The variance decomposition analysis is an alternative, but closely related, approach to impulse response analysis with regard to VAR system dynamics. It shows the proportion of the movements in the dependent variables that are due to their own shocks plus shocks to the other variables. A shock to a particular variable will obviously directly impact on that variable and it will also filter into all other variables in the system through the dynamic structure of the VAR (Brooks 2002:343).

In most studies, it is common to observe that own series shocks explain most of the forecast error variance of the series in a VAR. In a nutshell, impulse responses and variance decompositions offer very similar information. However, both analyses have been found to be extremely difficult to interpret accurately (Runkle 1987:25). Runkle (1987:25) argues that in order to achieve accurate interpretation of both analyses, confidence bands should be constructed around the impulse responses and variance decompositions analyses.

4.5 Conclusion

This chapter has focused on laying the analytical framework for the empirical analysis in the next chapter. The model specified for estimation is adapted from Jefferis and Okeahalam (2000). The uniqueness of the model is demonstrated by its ability to combine both domestic and international economic factors as exogenous variables in the model. The chapter also highlights the possible limitations inherent in the FTSE/JSE African index series with regard to its inability to capture or represent the overall performance of all trading activities in the South African stock market. In view of this, the market capitalization is introduced to run as a parallel model with the FTSE/JSE African index series. The latter part of the chapter explains the econometric technique to be used in estimation, which is the Johansen and Juselius (1990) co-integration technique. The next chapter will focus on the actual estimation using E-views 5.0 version. It will also present and analyse the findings.

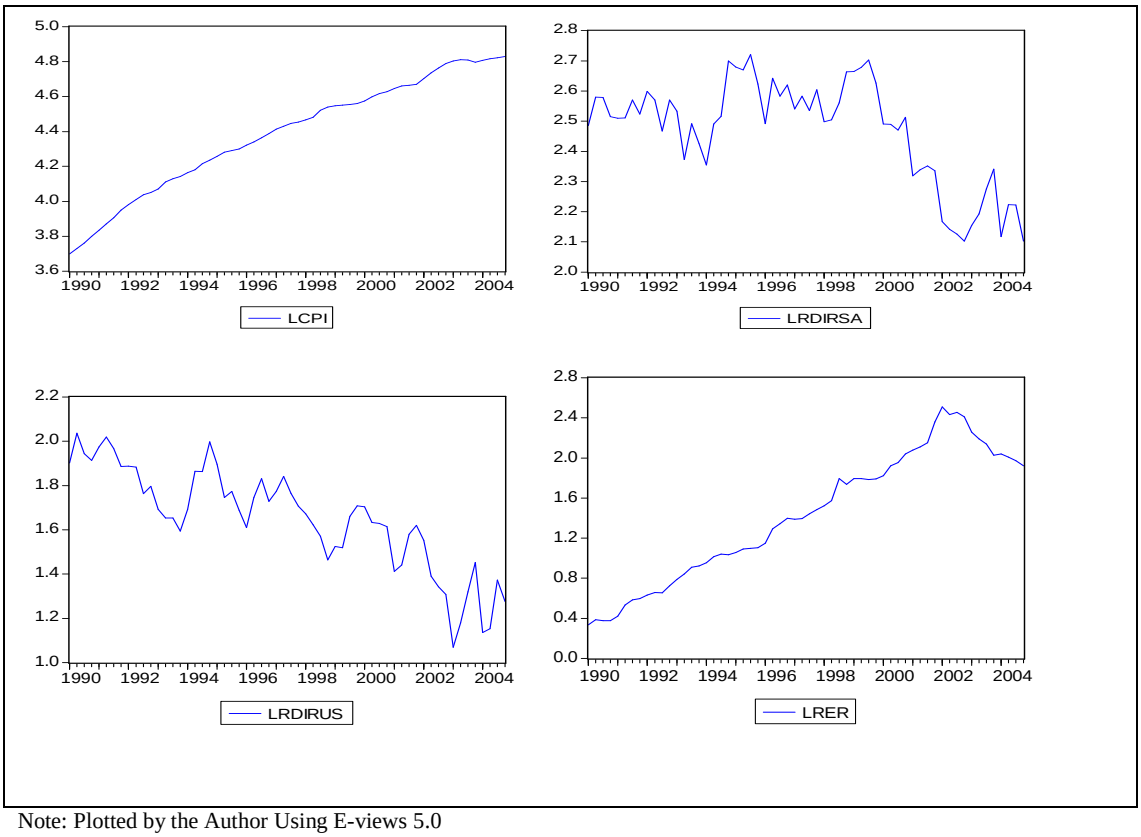
CHAPTER 5

Empirical Estimation and Results Analysis

5.1 Preliminary Investigation/Analysis

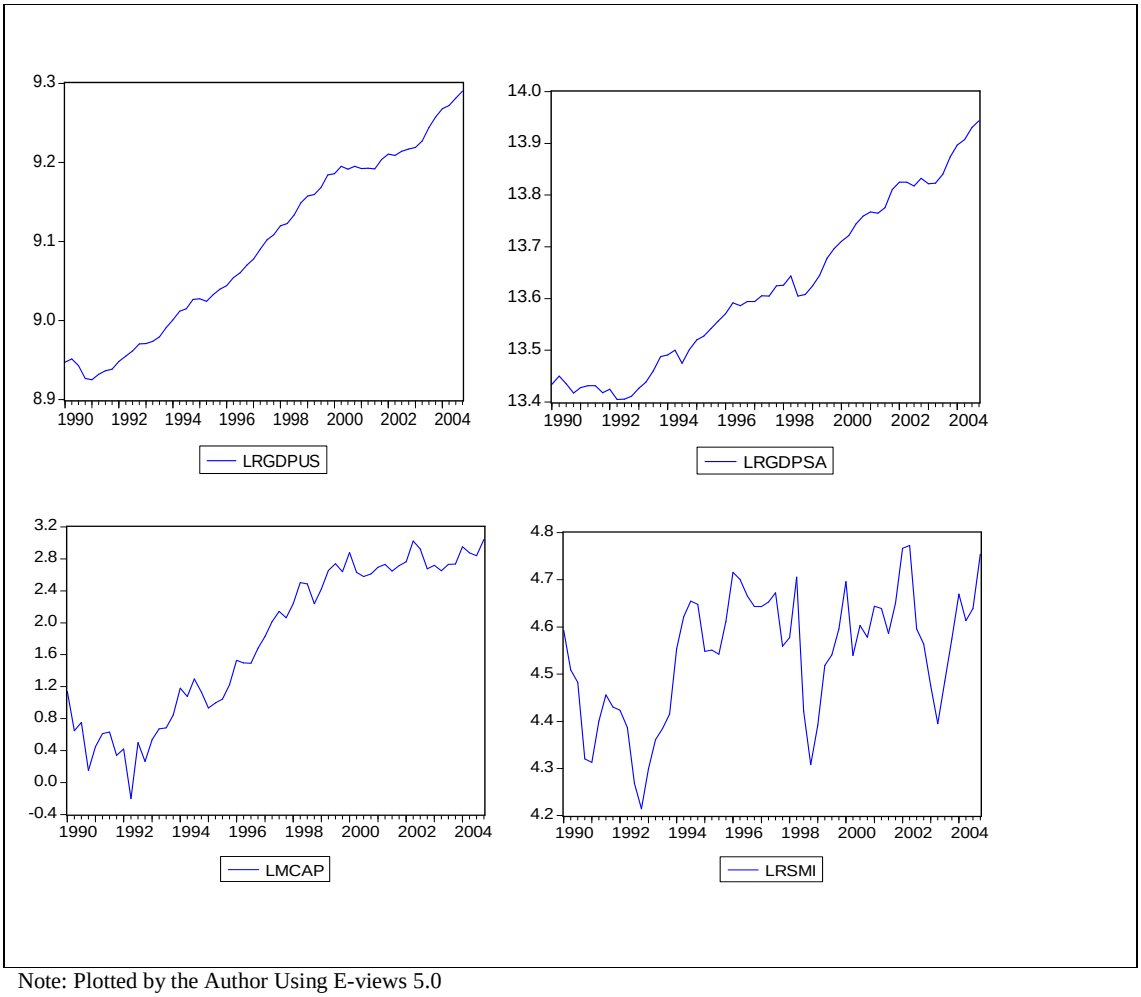
This chapter starts with a preliminary investigation of the series in the model. According to Hans (1996:268), a visual plot of the data is usually the first step in the analysis of any time series data. Before carrying out a formal test to check series for stationarity, it is advisable to plot the time series under study. This gives an initial impression about the likely nature of the series. Plotting the series against time can reveal the existence of structural breaks, outliers or data error during data capturing. As part of the preliminary investigation, correlation analysis of the series is also examined. The pair-wise correlation matrix will reveal the strength of association between the series in the model. This investigation will assist us in detecting the possibility of multicollinearity among the variables in the model. Figures 5 and 6 below reveal the plot of the series against time.

Figure 5: Graphical Plot of Time series data 1



Note: Plotted by the Author Using E-views 5.0

Figure 6: Graphical Plot of Time series data 2



Note: Plotted by the Author Using E-views 5.0

Considering the plots of LRGDPUS, LRGDPSA, LCPI and LRER at levels against time for the period 1990:1 to 2004:4; it is observed that there was a consistent upward sloping trend or drift. A similar plot against time for LMCAP also reveals a consistent upward sloping trend without any structural breaks or outliers, except LRSMI, which reveals major slumps in 1992, 1998 and 2003. A plot of the LRDIRUS and LRDIRSA reveals a negatively sloping trend or drift. The above plotted series reveal that they are not stationary time series because, visually, the mean and variance of the individual series do not seem to be time invariant.

Table 2 Pairwise Correlation Matrix (Model 1)

	LRSMI	LRGDPSA	LRGDPUS	LRER	LRDIRUS	LRDIRSA	LCPI
LRSMI	1.0000	0.548104	0.503830	0.494639	-0.213817	-0.260953	0.495923
LRGDPSA	0.548104	1.0000	0.978728	0.932538	-0.840150	-0.684028	0.943206
LRGDPUS	0.503830	0.978728	1.0000	0.956574	-0.836543	-0.583142	0.972489
LRER	0.494639	0.932538	0.956574	1.0000	-0.808595	-0.577050	0.969599
LRDIRUS	-0.213817	-0.840150	-0.836543	-0.808595	1.000	0.737633	-0.844827
LRDIRSA	-0.260953	-0.684028	-0.583142	-0.577050	0.737633	1.0000	-0.549967
LCPI	0.495923	0.943206	0.972489	0.969599	-0.844827	-0.549967	1.0000

Table 3 Pair-wise Correlation Matrix (Model 2)

	LCPI	LMCAP	LRDIRSA	LRDIRUS	LRER	LRGDPSA	LRGDPUS
LCPI	1.000000	0.928519	-0.549967	-0.844827	0.969599	0.943206	0.972489
LMCAP	0.928519	1.000000	-0.510967	-0.760892	0.942464	0.929436	0.963112
LRDIRSA	-0.549967	-0.510967	1.000000	0.737633	-0.577050	-0.684028	-0.583142
LRDIRUS	-0.844827	-0.760892	0.737633	1.000000	-0.808595	-0.840150	-0.836543
LRER	0.969599	0.942464	-0.577050	-0.808595	1.000000	0.932538	0.956574
LRGDPSA	0.943206	0.929436	-0.684028	-0.840150	0.932538	1.000000	0.978728
LRGDPUS	0.972489	0.963112	-0.583142	-0.836543	0.956574	0.978728	1.000000

From the pair-wise correlation matrix results reported in Tables 2 and 3 above, the LRGDPUS is highly positively correlated with LRGDPSA, LCPI and LRER. Its inclusion can produce perverse results due to multicollinearity[16]. In table 3 LCPI and LRGDPUS are also highly positively correlated with LRGDPSA, LMCAP, LCPI and LRER. The correlation analysis was computed to determine what variables should be included in the regression analysis that would avoid the problem of multicollinearity among the regressors. According to Gujarati (2003:345), the problem with multicollinearity, especially in time series data, may be that the regressors included in the model share a common trend over time; this implies that they rise and fall in unison. This is quite evident from the visual plot of LRGDPUS and LRGDPSA in Figure 6.

5.2 Sample correlogram

Sample autocorrelation function (SACF) at lag k denoted as P_k is defined as the ratio of the sample covariance (at lag k) to the sample variance (Brooks 2000:232). The sample correlogram is a plot of the sample autocorrelation function against k. Plotting and examining the sample auto-correlogram is another useful way of examining the properties

[16] The term multicollinearity refers to the existence of a perfect or near perfect linear relationship among some or all explanatory variables of a regression model (Gujarati 2003:342).

of a series. If a particular series is stationary, the autocorrelation coefficients at various lags should hover around zero or decline very quickly. In the case of a non-stationary time series, the autocorrelation coefficient starts at a very high value and declines very slowly towards zero as the lag length increases. The correlogram of LRSMI, LRER, LCPI, LRGDPSA, LRDIRSA, LRDIRUS, LMCAP and LRGDPUS at levels reveals that the autocorrelation coefficient starts at a very high value, i.e. very close to one, and tapers off slowly towards zero as the lag length increases, showing that all the time series are non-stationary at levels. However, their auto-correlogram reveal that they are stationary after first differencing.

5.3 Unit Root Tests Results

More formal methods of testing for stationarity include the Dickey Fuller (DF) and the Phillip Peron (PP), among others. These tests provide a more objective test for stationarity. The original Dickey Fuller test is weak as it lacks the ability to correct for autocorrelation of the error term, and because of this, the Augmented Dickey Fuller test (ADF) is used. Table 2 below reports the unit root tests results using the ADF and PP tests.

Table 4: Unit Root (with Trend and Intercept)

Augmented Dickey Fuller			Phillip Peron		Order of Integration
Variables	Levels	1st difference	Levels	1st difference	I(1)
LCPI	-2.174896	-4.855897***	-2.031434	-4.825305***	I(1)
LRDIRSA	-2.445168	-9.646599***	-2.330052	-9.698390***	I(1)
LRER	0.709203	-5.659015***	-0.029135	-5.723848***	I(1)
LRGDPSA	-2.431037	-7.041580***	-2.433844	-7.026007***	I(1)
LRSMI	-3.116363	-6.607163***	-3.116363	-6.711572***	I(1)
LRGDPUS	-3.136032	-5.298554***	-3.150487	-5.298554***	I(1)
LRDIRUS	-3.690720	-7.385146***	-3.690720	-9.255356***	I(1)
LMCAP	-3.621097	-11.00502***	-3.634455	-11.32062***	I(1)

Notes: ***, **, and * denote the rejection of the null hypothesis of unit root at the 1%, 5% and 10% level of significance respectively. The lag order for the series was determined by the Schwarz information criterion.

The series were tested for stationarity around a trend and an intercept. The results show that all the variables were non-stationary at levels and after first differencing became stationary, i.e. they are all I(1) series at 1% level of significance according to both ADF and PP tests.

5.4 Formulation and Estimation of Appropriate VAR model

Given the nature of the unit root test results, this study examines two models with specific focus on the determinants of LRSMI and LMCAP as proxies for stock market behaviour within a VAR framework. The following empirical VAR models were formulated and estimated:

(LRSMI, LRER, LCPI, LRGDPSA, LRGDPUS, LRDIRSA, LRDIRUS) ……..24

(LMCAP, LRER, LCPI, LRGDPSA, LRGDPUS, LRDIRSA, LRDIRUS) …….25

Since both the ADF and PP tests overwhelmingly indicate that the series are first differenced stationary, the VAR model formulated above is specified as a vector error correction model (VECM) of the form:

$$\Delta Y_t = \Pi Y_{t-k} + \Gamma_1 \Delta Y_{t-1} + \Gamma_2 \Delta Y_{t-2} + ... + \Gamma_{k-1} \Delta Y_{t-(k-1)} + U_t \text{.....26}$$

$$\text{Where } \Pi = \left(\sum_{j=1}^{k} \beta_i \right) I_g \; and \longrightarrow \Gamma_i = \left(\sum_{j=1}^{i} \beta_j \right) - I_g .$$

The choice of the most appropriate lag length is very crucial at this level, particularly when using the Johansen procedure. This is because the VAR order chosen can significantly affect the conclusion reached about the number of cointegrating equations identified and the parameter estimates (Seddighi 2002:309). In the literature, the AIC, SC and the LR are more often used in the determination of the appropriate lag length (Seddighi *et al.* 2000:309, Aziakpono and Obasa 2004:328 and Brooks 2004:427).

In addition, Seddighi *et al.* (2000:309) argue that in a situation where information criteria give conflicting VAR orders, the order that complies with economic theory and all the *a priori* knowledge that is associated with the theory should be used. The lag length selected by AIC LR and SC are reported in Tables 5 and 6 below. AIC and LR chose 2 lags while

the SC chose 1 lag length. In the second model, LR AIC and SC selected lag length 2, 5 and 1 respectively. For both models the most appropriate lag length is 1. Our choice of the appropriate lag length is guided by the *a priori* knowledge associated with the economic theory underpinning the present value model.

Table 5: Lag Length Selection Model (1)

VAR Lag Order Selection Criteria						
Endogenous variables: LRSMI LRER LRGDPSA LRGDPUS LRDIRSA LRDIRUS LCPI						
Exogenous variables: C						
Sample: 1990Q1 2004Q4						
Included observations: 56						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	441.3281	NA	4.33e-16	-15.51172	-15.25855	-15.41356
1	916.4485	814.4922	1.08e-22	-30.73030	-28.70495*	-29.94508*
2	978.2099	90.43628*	7.40e-23*	-31.18607*	-27.38853	-29.71377
3	1023.888	55.46608	1.04e-22	-31.06742	-25.49770	-28.90805
4	1075.955	50.20725	1.48e-22	-31.17695	-23.83505	-28.33051
* 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						

Table 6: Lag Length Selection Model (2)

VAR Lag Order Selection Criteria						
Endogenous variables: LMCAP LRER LCPI LRGDPSA LRGDPUS LRDIRSA LRDIRUS						
Exogenous variables: C						
Sample: 1990Q1 2004Q4						
Included observations: 55						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	385.0584	NA	2.52e-15	-13.74758	-13.49210	-13.64878
1	839.4649	776.6219	1.01e-21	-28.48963	-26.44580*	-27.69927*
2	892.9524	77.80012*	9.37e-22*	-28.65282	-24.82063	-27.17088
3	939.9627	56.41234	1.27e-21	-28.58046	-22.95993	-26.40696
4	1007.958	64.28610	1.05e-21	-29.27119	-21.86230	-26.40611
5	1084.039	52.56534	1.04e-21	-30.25597*	-21.05873	-26.69932
* 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						

5.5 Identifying the Number of Cointegrating Vectors

The next stage after the identification of the appropriate lag length is to determine the number of co-integrating vectors in the model. In a case where there are two variables in an equation, there can be at most only one linear combination of the two variables, i.e. at most one cointegrating relationship. However, where there are multiple variables, i.e. greater than two, there may be more than one cointegrating relationship. The Johansen approach allows determination of more than one cointegrating relationship in a VAR framework (Brooks 2002:393).

When identifying the number of co-integrating relations in a VECM, the choice of assumptions underlying the Data Generating Process (DGP) of the series involved in the model is very crucial (Aziakpono 2004:331). E-views reports five possible deterministic assumptions underlying the DGP of all series[17]. Table 7 below reports the number of co-integrating vectors identified by trace and maximum eigen-value under the five deterministic assumptions for models 1 and 2.

Table 7: Number of Cointegrating Vectors

Model	Test statistics at 5 per-cent	None No Intercept No Trend	None Intercept No Trend	Linear Intercept No Trend	Linear Intercept Trend	Quadratic Intercept Trend
Model 1	Trace	4	3	1	1	0
	Max-Eig	1	0	0	0	0
Model 2	Trace	1	1	0	0	0
	Max-Eig	1	1	0	0	0

Critical values based on Mackinnon-Haug-Michelis (1999). Number of co-integrating relations by both models

From Table 7 model (1) the third and fourth assumptions identified the same number of co-integrating vectors for both trace and maximum eigen-value statistics. The trace statistics test results indicate the presence of only one cointegrating relationship, while the maximum

[17] See E-views manual for a list of the five deterministic assumptions and instructions on when to use them.

eigen-value identified no co-integrating vector. Luintel and Khan (1999:392) have shown that trace statistics are more robust than maximum-eigen statistics in testing for the number of cointegration vectors. Following this argument, the analysis is based on the result of the trace statistics. For model (2), the second assumption seems to give a meaningful result of one co-integrating vector by both trace and maximum eigen-value. The finding is also very similar to earlier studies such as Jefferis and Okeahalam (2000) and Moolman (2004).

A similar conclusion was obtained for the maximum eigen-value where the null hypothesis of $r = 0$ (i.e. no cointegration) is rejected in favour of the alternative hypothesis $r = 1$. On the other hand, the null hypotheses of $r \leq 1, r \leq 2$ and $r \leq 3$ cannot be rejected in favour of the alternative hypotheses of $r = 2, r = 3$ and $r = 4$ respectively, which invariably indicate the presence of one cointegrating vector.

5.6: Error Correction Modelling

After identifying the number of cointegrating vectors, the next step is to estimate the long run regression by normalising on the variable of interest. Vector error correction modelling will be used in this regard. The Vector error correction model according to Johansen and Juselius (1990) is a representation where the long run equilibrium is embedded in an equation that captures short run variation and dynamics.

Modelling the short run dynamics will provide information concerning how adjustments are taking place among the various variables, to restore long run equilibrium in response to short term disturbances in the determinants of the real stock market index. Table 8 below reports the long run equation and the error correction terms for both models (1 & 2), as well as their residual diagnostic result.

Table 8: Estimates of the long run relation, the speed of adjustment and residual test

Variable	Model 1(LRSMI)	Model 2 (LMCAP)
C	63.79706	18.98201 [0.74499]
Trend	0.078456 [7.37217]	
LRSMI	1.000000	
LMCAP		1.0000
LCPI	-2.643276 [-8.24902]	
LRDIRSA	0.005364 [0.05234]	-3.152877 [-4.39673]
LRDIRUS	-0.425037 [-4.05252]	3.181158 [3.69312]
LRER	0.054350 [0.84568]	-0.881482 [-2.11946]
LRGDPSA	-4.296998 [-7.94826]	-1.263243 [-0.68135]
LRGDPUS		
Speed of Adjustment	-0.670853 [-3.94217]	-0.239562 [-3.26795]
Residual Diagnostic tests		
Normality Test (Jarque-Bera) χ^2 (probability values in bracket)	$\chi^2(12) = 18.65764$ (0.0971)	$\chi^2(10) = 17.18814$ (0.0703)
Serial Correlation Test	LM Stat = 38.68261 (0.3494)	LM Stat = 27.08 (0.3516)
White Heteroskedasticity Test	χ^2 (294) = 308.0820	χ^2 (330) = 317.5308

By normalising on LRSMI in model 1 and excluding the LRGDPUS, the single cointegrating vector in normalised form gave the long run relationship which is given by:

LRSMI = 63.79706 -2.643276 **LCPI** + 0.005364 **LRDIRSA** - 0.425037

s.e.	(0.32044)	(0.10249)	(0.10488)
t	[-8.24902]	[0.05234]	[-4.05252]

LRDIRUS+ 0.054350**LRER**- 4.296998**LRGDPSA**……..28

s.e.	(0.06427)	(0.54062)
t	[0.84568]	[-7.37217]

From the pair-wise correlation matrix reported earlier on, the LRGDPUS was excluded from the model because of its high level of correlation with LRGDPSA, LCPI and LRER. Its inclusion produced perverse results that could be due to multi-collinearity. The coefficient of LCPI turns out to be negative and statistically significant in explaining the stock market index in the long run which complies with *a priori* expectations. The LRDIRSA was not significant and it also gave a positive coefficient. However, the yield on United States government bond (LRDIRUS) turns out to be negative and highly significant, as expected.

To determine whether multicollinearity was responsible for the results obtained especially for LRDIRUS and LRDIRSA, two separate models were estimated each including either of both variables. The results, which are reported in Appendix A4 and A5, show that both LRDIRUS and LRDIRSA produced negative coefficients and are significant when estimated separately in the model. However, the LRDIRUS presents a more significant effect on LRSMI than the LRDIRSA. These results portray a very interesting argument as to the main drivers of the stock market in South Africa. The result shows that the United States financial market, which is represented by the yield on US government bonds, has greater influence on the equity market in South Africa than the domestic bond market. This could be due to the increased openness of the South African market to foreign investors and the increasingly dominant effect of the US financial market on the South Africa financial market.

The real exchange rate shows a positive relationship, but it turns out to be insignificant in explaining the all share index, particularly in the long run. This result did not come as a

surprise owing to the fact that the exchange rate has been fairly stable over time and therefore poses no serious threat to either domestic or foreign investors.

Lastly, the domestic GDP produced a negative coefficient, establishing an inverse relationship with the all share index. This result contradicts the *a priori* expectation and findings of other studies in this area. It is important to note that multi-collinearity might have influenced the signs. A possible explanation according to Goodspeed (2004:20) is that investors, particularly in the South African equity market, do not invest based on present economic conditions, but rather, base their investment decisions on forecasted future economic conditions.

This argument is based on the fact that current economic conditions have already been incorporated into the current share price. If the economy is booming and growing moderately, it will not automatically culminate in an increase in share price, so investors will try to forecast the long run behaviour of the economy and invest according to their investigation results. If the economy is expected to enter a recession in the future, it might affect share prices negatively now, even though the economy is booming presently.

The second argument is closely tied to the first one; it is based on the behavioural mechanisms and psychology of investors with regard to speculation. Faure (2004:107) argued that speculation which is the art of buying at a lower price with the intention of selling at a higher price with profit as the motive is influenced by psychological factors that enable individuals to act and react according to their perception of market conditions. If an investor perceives that an economy is tending towards recession in the future s/he expects share prices will fall considerably in the future, so in order to make profit, the investor will refrain from investing now and wait until the time when prices fall so as to buy cheaply. This means that when the economy is expanding or booming, investors perceive share prices to be high and they will prefer to wait until there is a recession and when prices fall they will buy. Therefore, share prices could rise during a recession and fall during a boom period.

Lastly Faure (2004: 62) explains that certain sectors on the JSE are known to out-perform the market when the economy is in recession. Here, emphasis is on the primary market with regard to firms raising funds for expansion. The sectors that were identified are the food

sector, insurance, liquor and the drugs or pharmaceutical sectors. The implication is that during recession or low GDP growth, these companies will have to raise funds through the stock market, which invariably positively enhance the price of shares.

The result of the impulse response analysis complies with *a priori* expectations with regard to the positive interaction between GDP and share price index. In as much as there could be an explanation for the negative interaction obtained between GDP and stock prices in the long run regression, it seems more logical to base our findings on the impulse response analysis results.

For the second model, after normalising on LMCAP and excluding the LCPI and LGDPUS, the single cointegrating vector in normalised form gave the following long run relationship:

LMCAP = 18.98201 -0.881482 **LRER** + 3.181158 **LRDIRUS** – 3.152877

s.e.	(25.4794)	(0.41590)	(0.86137)	(0.71710)
t	[0.74499]	[-2.11946]	[3.69312]	[-4.39673]

LRDIRSA- 4.296998**LRGDPSA**……..28

s.e.	(1.85403)
t	[-0.68135]

The LRGDPUS and LCPI were excluded from the model because they are highly correlated with LRGDPSA and LRER and their inclusion produced perverse results, possibly due to multicollinearity. The real exchange rate was negative and statistically significant in explaining the LMCAP, particularly in the long run. However, the yield on United States government bonds (LRDIRUS) turns out to be positive and highly significant. While the yield on South African bonds reveals a negative statistically significant relationship with the LMCAP. Based on this result, the LRDIRUS and LRDIRSA were estimated separately in the model, each including either of both variables.

The results which are reported in Appendix A6 and A7 show that both LRDIRUS and LRDIRSA produced positive coefficients and are significant when estimated separately in the model. However, the LRDIRUS presents a more significant effect on LMCAP than the

LRDIRSA. This result confirms the findings from the LRSMI model, which suggest a dominating effect of the United States financial market on the South African market. Lastly, the domestic GDP produced a negative co-efficient establishing an inverse, but insignificant relationship with the Log of market capitalization. The result of the domestic GDP being negative though tallying with the LRSMI model, is rather surprising because of its contradiction of *a priori* expectations and findings of studies in this area, such as Jefferis and Okeahalam (2000) and Moolman (2004). The arguments that apply to the LRSMI model could also be used to explain the LMCAP model.

5.7 Diagnostic Tests of the Stochastic Properties of the Model

To check for the stochastic properties of the two models, three diagnostic tests were carried out: the Serial Correlation (LM) test, the Normality test, and the White Heteroscedasticity test. The results for the two models are reported in Table 8 above. The null hypothesis of no serial correlation could not be rejected, because the P-value obtained is high. However, the heteroscedasticity test shows that the residuals are homoscedastic, while the normality test reveals that the residuals were not normally distributed. As shown in Table 8, the joint Jacque-Bera test statistic of 18.65764> X_2 = 11.070 at 5 percent level of significance for model 1 and the joint Jacque-Bera test statistic of 17.18814> X_2 = 11.070 at 5 percent level of significance for model 2, therefore the residuals of both models are not normally distributed. However, Islam and Ahmed (1999) have argued that the absence of normal distribution of the residuals may not pose a serious threat to cointegration test results.

5.8 Error Correction Model

The vector error correction model for the LRSMI reveals that the coefficient of the estimated equilibrium error correction is negative (-0.670853) and statistically significant (-3.94217). The speed of adjustment of LRSMI to long run equilibrium due to short run disturbances is 67 percent for every quarter. The speed of adjustment shows that the LRSMI is really endogenous and reacts promptly to short run disturbances.

Also, the estimated vector error correction model for the LMCAP model reveals that the coefficient of the estimated equilibrium error correction is negative (-0.239562) and

statistically significant (-3.26795). The speed of adjustment of LMCAP to long run equilibrium due to short run disturbances is 24 percent for every quarter. The speed of adjustment shows that the LMCAP is also endogenous and reacts more slowly to short run disturbances than the LRSMI. A comparison of LRSMI and LMCAP reveals that LRSMI adjust faster to long run equilibrium owing to short run disturbances than the LMCAP.

5.9 Tests for Weak Exogeneity

A weakly exogenous variable refers to a variable that is independent of the contemporaneous and future errors in the equation concerned. Testing for weak exogeneity is important, particularly in a VAR model, because it shows by way of the Likelihood Ratio test (LR test) whether a variable should be regarded as endogenous or exogenous (Brooks 2002:310). Table 9 below reports the weak exogeneity test results for both models 1 and 2.

Table 9: Weak exogeneity test results Models 1 and 2

Model 1			
Variables	***Chi-square***	***P-Value***	***Decision rule***
D(LRSMI)	4.970237	0.025787	Not weakly exogenous
D(LCPI)	0.013887	0.906192	Weakly exogenous
D(LRDIRSA)	1.694467	0.193013	Weakly exogenous
D(LRDIRUS)	1.657826	0.197897	Weakly exogenous
D(LRER)	0.001304	0.971190	Weakly exogenous
D(LRGDPSA)	0.004081	0.949066	Weakly exogenous
Model 2			
D(LMCAP)	6.123731	0.013338	Not weakly exogenous
D(LRER)	0.091086	0.762801	Weakly exogenous
D(LRDIRSA)	0.014090	0.905511	Weakly exogenous
D(LRGDPSA)	3.857097	0.049536	Not weakly exogenous

The result shows that the null hypothesis of weakly exogenous was accepted in all the variables except D (LRSMI), D (LMCAP) and D (LRGDPSA) for both models. However, D (LMCAP) is more endogenous than D (LRGDPSA). This indicates that both variables are the only true endogenous variables in the models. E-views reports the graphical display of the long run co-movement of the variables within the model. The cointegrating graph in Figure 7 below revolves around the mean and is therefore stationary, further revealing that there is a true cointegration in the two models. According to Brooks (2002:388), a linear combination of variables in a model will be stationary, if they are cointegrated. For this study, the plot of the cointegrating vector identified in the two models and reported in

Figures 7 and 8 below appears stationary, which further proves that true cointegration actually exists. However, the cointegrating vector of the first model seems to be more stationary than the second model.

Figure 7 Cointegrating Graph Model 1

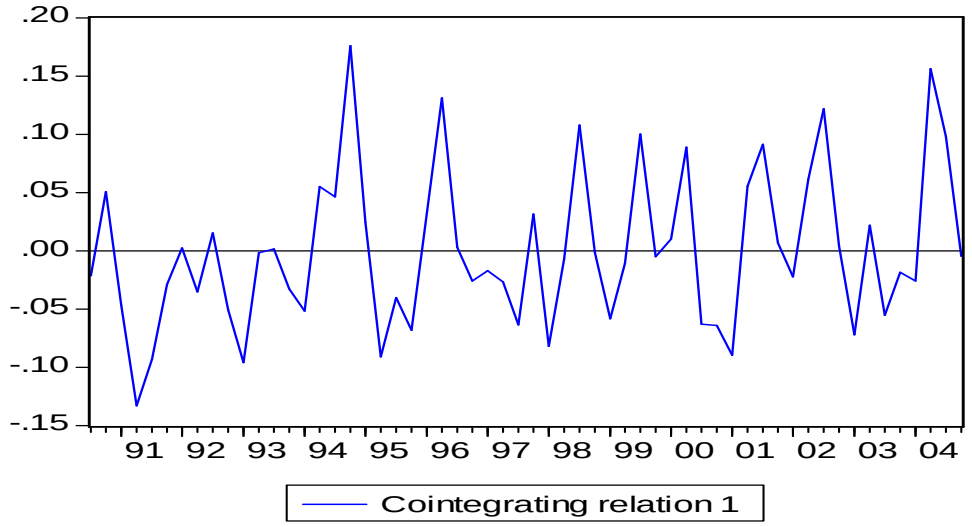
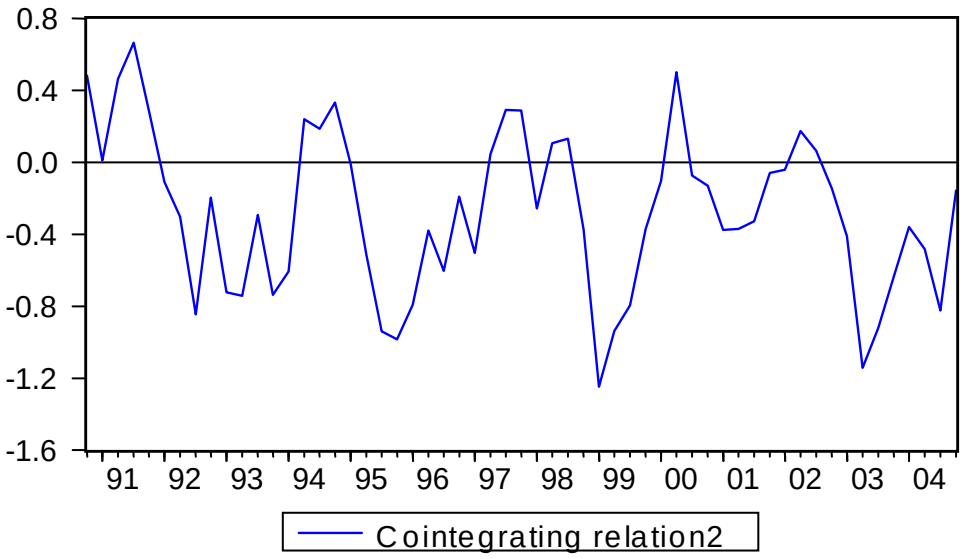


Figure 8 Cointegrating Graph Model 2



5.10 Impulse Response Analysis

An impulse response traces the effect of one standard deviation shock to one of the innovations on current and future values of the endogenous variables (Ansotegui and Esteban 2002:851). Econometric studies that have investigated long run co-movement between variables in a VAR framework often state that the Impulse response analysis possesses the ability to present a clearer view of the inter-relations among variables in the short run than the error correction modelling in a VAR framework (Ansotegui and Esteban 2002:850).

Figure 9 below illustrates the dynamic response of the real stock market index to various unitary shocks to each variable from the model up to a time period of 10. For the purpose of this study emphasis will be to report the response of LRSMI to shocks from each of the other variables within the system.

Figure 9 Model (1) Impulse Response Analysis

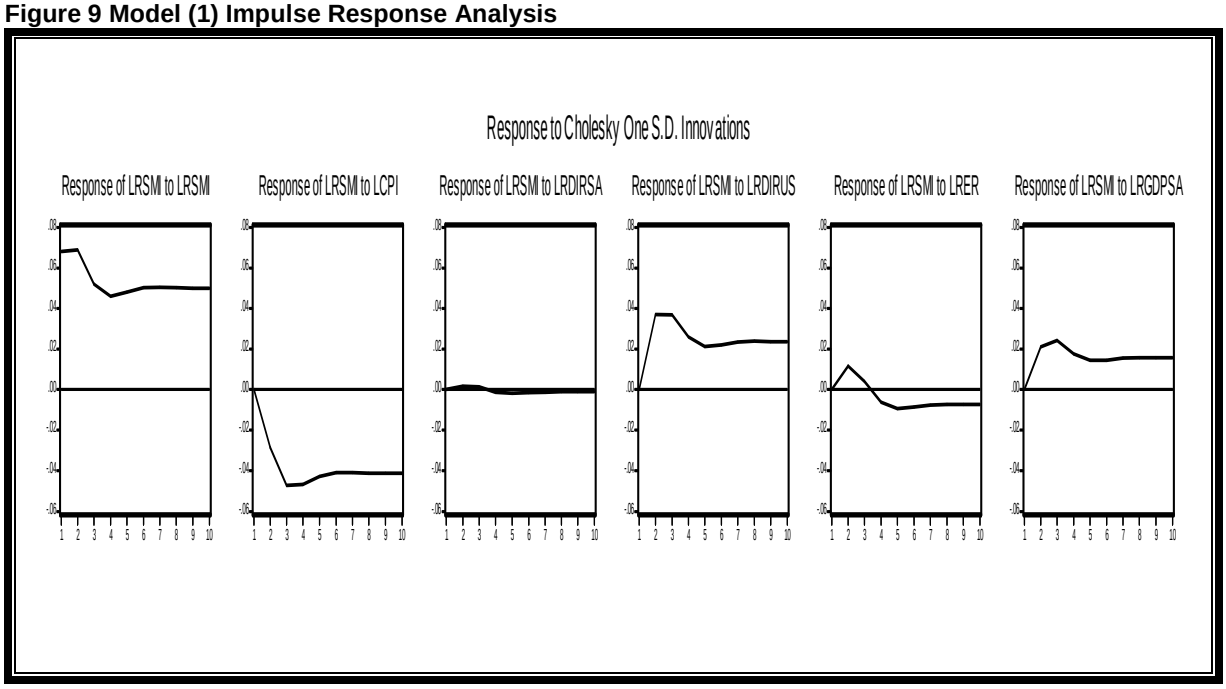
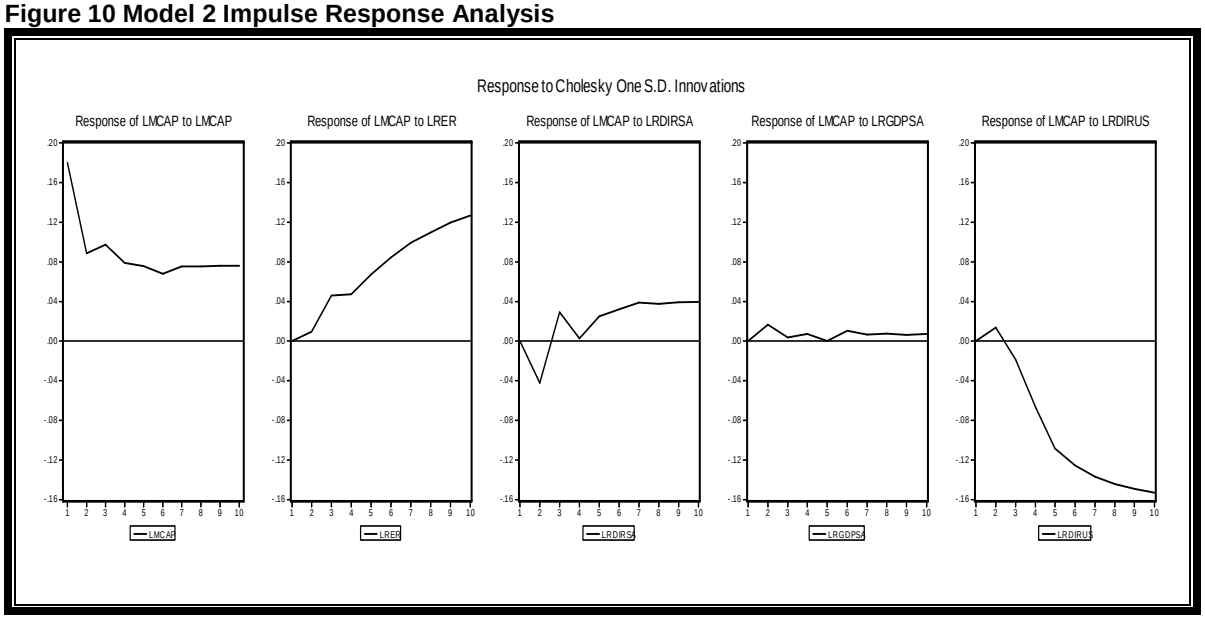


Figure 10 Model 2 Impulse Response Analysis



Following shocks from the LRSMI an unexpected increase in the LRSMI led to a permanent positive increase in itself, later shifting to a lower level, but remaining positive. The quick response of stock prices to own shocks indicates that the market is information efficient. The LCPI is the next most important variable affecting the LRSMI, but negatively. The shock in LCPI produces a sharp decline, which gets worse between the third and fourth periods, but later recovers slightly before stabilizing. The response remains perpetually negative, though not as much as at the outset. This shows that as the inflation rate increases, stock prices remain depressed.

The LRDIRSA has little or no noticeable effect on LRSMI. The graph reveals that the response remains neutral all through the duration and is neither negative nor positive. The LRDISUS, which is the yield on United States government bonds, has greater impact on LRSMI and it is positive. This is evident from the positive sharp response of LRSMI to a shock to LRDIRUS, which later subsided to a lower level before stabilizing. Shock to the exchange rate produced an initial mild positive response before turning negative in the fourth period. A shock to LRGDPSA produced a positive sharp response in LRSMI and later stabilized at a lower level.

For the second model, a shock to LMCAP by itself responded sharply and positively, but dropped almost instantaneously to a lower level before stabilizing. A shock to LRER elicits a positive persistent upward-sloping behaviour from the LMCAP. The response of the

LMCAP to a shock from the LRDIRSA is negative at the initial stage and as time progresses turns positive, but mildly so. The LMCAP's response to shocks coming from the LRGDPSA is neutral at first with a later insignificant positive response. Lastly the LRDIRUS stimulates a sharp significant negative response from the LMCAP, further confirming the dominant impact of the United States financial market on the South African market.

A comparison of the responses of share price index and market capitalization to impulses from the macro-economic variables tested reveals that both proxies elicit a positive response from aggregate output. The share price index responds more significantly to impulses from output growth than the market capitalization, meaning that, as aggregate production increases, the share price index tends to respond positively and quickly. The exchange rate produced mixed results from the two proxies, while it produced a positive response from the market capitalization; an initial positive response was noted in the share price index that immediately turned negative. Another glaring contrast was identified in the response of both proxies to impulses from the United States domestic interest rate. The share price index responded positively while the market capitalization produced a negative response. This finding reveals that the two proxies actually respond differently to macro-economic variables.

5.11 Variance Decomposition Analysis

The variance decomposition method of examining VAR system dynamics is slightly different from the Impulse response analysis. It tends to give the proportions of the movements in the dependent variable coming from own shocks versus shocks to other variables (Brooks 2002:342). In the case of the generalised variance decomposition analysis, emphasis was on the variance decomposition of the stock market index (LRSMI). From Table 10 model 1 below, the first period innovations to the LRSMI was wholly affected or absorbed by itself, i.e. 100 per cent. In the second period, it reduces to 77 per cent while the LRDIRUS accounted for 11 percent, LCPI 7 percent and LRDIRUS 11 percent. It is also very interesting to note that the South African interest rate shows little or no response to the LRSMI. As the period progresses, the LCPI increased more than every other variable with respect to innovations to the stock market index with its peak of 28 percent in the 10^{th} period. This shows that inflation has a greater role in determining share

prices on the JSE than all the other variables in the model, followed closely by the United States domestic interest rate.

Table 10 Model 1 Variance Decompostion

Variance Decomposition of LRSMI:							
Period	S.E.	LRSMI	LCPI	LRDIRSA	LRDIRUS	LRER	LRGDPSA
1	0.068176	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.110344	77.19454	6.674359	0.019289	11.31676	1.117448	3.677601
3	0.138048	63.54982	15.94398	0.020537	14.29021	0.796871	5.398586
4	0.156172	58.32513	21.40346	0.022027	13.96731	0.790314	5.491769
5	0.171118	56.44678	24.07775	0.029420	13.19572	0.968246	5.282090
6	0.185079	55.60052	25.48557	0.032323	12.70659	1.044904	5.130086
7	0.198347	54.90716	26.47754	0.032004	12.46073	1.053598	5.068964
8	0.210803	54.28134	27.27983	0.031234	12.31207	1.050574	5.044948
9	0.222499	53.77362	27.92686	0.030631	12.19057	1.050379	5.027940
10	0.233575	53.37753	28.44094	0.030160	12.08741	1.051117	5.012844

Table 11 Model 2 Variance Decompostion

Variance Decomposition of LMCAP:						
Period	S.E.	LMCAP	LRER	LRDIRSA	LRGDPSA	LRDIRUS
1	0.180096	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.206454	94.51461	0.205220	4.184208	0.650461	0.445501
3	0.235359	89.78570	3.952815	4.771209	0.525899	0.964380
4	0.261414	81.85616	6.490646	3.878997	0.502375	7.271822
5	0.301534	67.79575	9.846396	3.613710	0.377603	18.36654
6	0.345726	55.42928	13.43066	3.619328	0.381771	27.13896
7	0.394074	46.31469	16.68550	3.758720	0.320077	32.92101
8	0.441849	39.74931	19.42009	3.703732	0.283216	36.84365
9	0.489051	34.87622	21.82855	3.659103	0.247371	39.38876
10	0.534777	31.19142	23.85501	3.597666	0.225807	41.13010

From Table 11 model 2 above, it can be seen that the first period innovation to LMCAP was wholly affected or absorbed by itself, i.e. 100 per cent. In the second period it reduced to 94 percent, while the LRDIRSA accounted for 4 percent, LRDIRUS 0.4 percent and LRGDPSA 0.7 percent. As the period progresses particularly from the fourth period, the LRDIRUS increased in relevance more than every other variable with respect to innovations to stock market index with its peak of 41 percent in the tenth period. This further confirms that the United States interest rates has a greater role in determining share prices on the JSE than all other variables in the model, followed closely by the exchange rate.

A comparative analysis of the variance decomposition of both proxies (LRSMI and LMCAP) reveals that the yield on United States government bonds has a more significant absorption potential than the South African government bonds. However, the absorption process is slower in the case of the LMCAP. The exchange rate has a greater impact on the LMCAP than the LRSMI. The overall assessment shows that the share price index responds faster than market capitalization to macro-economic fundamentals.

5.12 CONCLUSION

In this chapter, six macro-economic determinants of stock market behaviour, namely Gross domestic product for South Africa (LRGDPSA), Gross domestic product for the United States (LRGDPUS), Rand/Dollar real exchange rate (LRER), Consumer price index (LCPI), Yield on South African government bonds (LRDIRSA) and Yield on United States government bonds (LRDIRUS) were explored using the cointegration test by Johansen and Juselius (1990). Two proxies were used: the All share index (LRSMI) and Market capitalization (LMCAP) to depict the stock market behaviour. Two separate models were estimated and results obtained show that both proxies are true endogenous variables, but react differently to economic fundamentals.

In the first model, the long run regression shows that general price levels have the most important impact on the All share index, further confirming the proxy hypothesis by Fama (1981). Investors are very sensitive to inflationary effects. This finding does make sense because the real buying power of capital gains from investing in equities is very crucial when taking investment decisions. The next most significant variable is the aggregate level of production in the economy. The coefficient of LRGDPSA, though significant, gave a negative response with share prices. This is very surprising because of its contradiction to theory that stipulates a positive relationship. The impulse response analysis gave the result that conforms to theory by establishing a positive relationship between share price index and aggregate level of production (LRGDPSA).

The exchange rate also turns out to be insignificant and positive, which is similar to findings by Jefferis and Okeahalam (2000). The most interesting finding is the significant influence that the USA financial market had on the South Africa's financial market. The LRDIRUS has a more significant impact on share prices on the JSE than the yield on South

African government bonds. This implies that investors observe the USA interest rate before investing in South African equities.

In the second model, the yield on South African government bonds has the most significant impact on the market capitalization on the JSE than its USA counterpart. While the USA interest rate posted a positive relationship, the South African interest rate established a negative impact. The reverse was obtained in the case of stock prices for the first model. The exchange rate surprisingly became significant in the second model and it also elicits an inverse interaction with the market capitalization. However, the level of production in the economy was insignificant and negative. The results of the impulse response and variance decomposition analysis further support the argument that the USA financial market is an important determinant of share price behaviour on the JSE.

CHAPTER 6

Summary of Major Findings and Policy Recommendations

6.1 Summary of the Major Findings

This section attempts to summarise and make conclusions from the results of the study. The objectives and findings of the study are revisited. This is carried out by aligning each objective stated in chapter one with the findings in chapter five. This is followed by a discussion of the economic importance of the study, and recommendations for future policy formulation. It concludes by briefly highlighting the limitations of the study and areas for further research.

The study set out to empirically examine the behaviour of the South African stock market, with particular reference to domestic and international monetary and macro-economic variables. The first sub-objective examined the historical development of the stock market indicators for the JSE. Three market indicators were examined for the period 1990 and 2004 and they include; the market capitalization, market turn-over or turn-over velocity and the number of companies listed.

Market capitalization refers to the product of the total volume of shares issued by both domestic and foreign firms and their current price. Between 1990 and 2004, market capitalization on the JSE recorded peak periods in 1995 and 2004 and troughs in some other periods. The 1995 peak record can be attributed to economic reforms that brought about increased openness of the South African economy to foreign investors. The economic reforms were as a result of the new political dispensation that unfolded in 1994.

The 2004 peak period could be associated with the creation of a parallel market for small and medium-sized companies, which was launched in 2003. It is believed that market capitalization will continue to grow in the future as the South African economy expands, and more firms endeavour to raise funds for expansion through the stock market.

The market turn-over measures the frequency with which shares change hands in the secondary market of the JSE. The market turn-over on the JSE showed a steady increase each year between 1990 and 2004 with a larger rate of increase towards 2004. This growth

could be primarily linked to the demise of the open outcry system of trading in June of 1996, which was replaced by an order driven centralized automated trading system. In addition, the dematerialization of the script issue through the automated clearing system known as STRATE on the JSE might also be responsible. Both factors have led to a tremendous increase in shares trading on the JSE. It is most likely that the ongoing trend will extend into the future.

The number of companies listed on the JSE meant that the shares of these companies have been admitted into the JSE security exchange official list and such companies have been authorised to raise funds through the sale of shares. The number of companies on the official list of the JSE exchange has dwindled over the period under review (1990-2004). This could be associated with a number of factors, such as the Asian crisis that led to capital flight from emerging markets including South Africa. The cost of listing might also have been too high for some firms listed or intending to list.

The second sub-objective was to determine the impact of each of the selected monetary and macro-economic variables on stock prices and to investigate whether long run co-movement exists between them. Two models were specified and empirically estimated following the present value model. The cointegration and vector error correction technique as proposed by Johansen (1988) and Johansen and Juselius (1990) were used to capture long run co-movement. Two proxies were used to capture the stock market behaviour, namely; the all share index (ALSI) and market capitalization.

The results show that the consumer price index has a significant negative impact on the JSE share price index while market capitalization is determined predominantly by the yield on South African government bonds. The exchange rate seems to have had little or no influence on the share price index, but becomes negative and significant in the case of market capitalization. The yield on United States government bonds also produced a strong influence on both the share price index and market capitalization. While it has a negative significant impact on share prices, it produced a positive significant impact on market capitalization.

In order to ascertain whether the South African interest rate or the United States interest rate is more important in explaining the share price and market capitalization, each of the

variables were estimated in the model separately, the results obtained reveal that the United States interest rate is more important than the domestic interest rate in explaining the share price and market capitalization on the JSE. This implies that investors observe the USA interest rate before investing in South African equities. Jefferis and Okeahalam (2000:47) found the United States government bonds not to be significant and concluded that during the period of their study, which is 1985-1995, the South African monetary authority had tight exchange control on their capital account transactions. This has been gradually relaxed since then, which implies that the increased relaxation of the exchange control on capital account transactions has really allowed the USA market to play a crucial role in equity prices in South Africa.

The inverse relationship obtained for the interaction between aggregate level of production and the two stock market proxies (share price index and market capitalization) is contrary to theoretical expectation and empirical studies. However, the impulse response analysis seems to give a more plausible result and therefore forms the basis for conclusion. The impulse response analysis establishes a positive relationship between GDP and share price index and market capitalization. The GDP has a more significant effect on share prices than market capitalization.

The third sub-objective of the study attempted to determine the time interval required for the stock market to revert back to long run equilibrium following short run disequilibrium. The Johansen and Juselius (1992) procedure captures the short run disequilibrium via error correction modelling. The findings show that the two stock market proxies have different speeds of adjustment to long run equilibrium. The share price index adjusts faster to short run equilibrium than market capitalization. This explains why financial analysts, economists and investors prefer to watch the share price index on the JSE because of its sensitive nature to information about macro-economic conditions in the economy.

The fourth sub-objective focussed on the determination of how the stock market responds to shock(s) to each of the variables and which of the variables has the greatest impact on the JSE stock market. In order to achieve this sub-objective, the Impulse response analysis and the Variance decomposition analysis were used. Some econometric studies that have investigated long-run co-movement between variables in a VAR framework have often stated that the Impulse response analysis possesses the ability to present a clearer view of

the inter-relations among variables in the short-run than the error correction modelling in a VAR framework (Ansotegui and Esteban 2002:851).

The result of the impulse response analysis shows that aggregate production elicits a positive response from the share price index and the market capitalization. However, the response from the share price was more significant than the market capitalization. The consumer price index impacts negatively on the share price index, which was also the case in the long run regression noted earlier. The United States interest rate elicits a negative and significant response from the market capitalization, but a positive response from the share price index.

The exchange rate established a positive significant influence on market capitalization, especially in the long run, but produces a negative response from the share price index. From the variance decomposition analysis, an innovation in the first period to share price index and the market capitalization was wholly absorbed by itself. In the second period, stock prices decompose faster than the market capitalization due to shocks from macro-economic variables. As the period progresses, the consumer price index and the United States interest rate account for a greater percentage of innovations hitting the stock price index and the market capitalization respectively. This observation further confirms the dominant influence of the United States financial market on the South African market, as reflected by the market capitalization.

6.2 Economic Importance of the Study and Policy Recommendation

Chapter one discussed the important roles of the stock market in an economy. It is, however, important to state that the stock market requires an enabling macro-economic terrain before it can perform its role effectively. This study has examined how macro-economic factors affect the stock market and what conditions might positively enhance stock market performance.

A very important finding from this study is that inflation has a negative and significant influence on share prices, especially in the long run. Recent global events with respect to the volatile nature of energy prices have raised concern as to its transmission effect on

aggregate prices, especially for South Africa. However, recent economic indicators show that core inflation has remained moderate, falling below the upper boundary of the inflation target range set by the SARB[18]. The inflation rate as at May 2006 stood at 4.5 percent, which is still within the 3-6 per-cent target range. Against this background, a further monetary tightening policy might not be necessary. Based on the findings of this study, if inflation is well monitored then the local equity market is bound to perform strongly resulting in strong shares earning growth. With low inflation, the stock market will be able to channel savings into shares of companies without investors loosing the purchasing power of their savings.

Since April 2003, foreign investors have contributed to an approximately 175 percent increase in share prices on the JSE (OMAM 2006). It follows that if foreign investors withdraw their funds from South African equities, the stock market could fall more than 10 percent in a month (OMAM 2006). However, recent financial indicators reveal that foreign investors are not ready to give up their investments in South African equities. As at February 2006, they have invested almost R25 billion this year while last year a total of R52 billion was invested in the South African equities market either through public offer or private placements (OMAM 2006).

One factor that is a crucial determinant of foreign capital inflow is the exchange rate. This study identified a positive long-run relationship between the rand-dollar bilateral real exchange rate and stock market indices for the first model and negative/inverse relationship for the second model. It was observed that, whenever the dollar appreciates against the rand, the stock market indices will go up. This means that when the dollar appreciates against the rand, foreign investors increase their investment in South African equities.

In addition, from the real sector perspective, if the dollar appreciates against the rand, South African exports increase and this leads to increased profitability for firms and consequently enhances their share prices. Therefore, it is recommended that the exchange rate should be made less volatile, meaning that it should be reasonably stable, so that long-term investment plans across borders can be further enhanced.

[18] SARB is the South African Reserve Bank.

Also looking at the dominant influence of the United States financial market on the South African financial market, it is imperative that financial analysts and advisors in South Africa carry out an extensive analysis of macro-economic developments in the United States in relation to equity performances in South Africa. If the United States Federal Reserve Bank increases interest rates so as to curb inflation, this could imply a capital outflow from South Africa provided that the South African interest rate remains stable.

6.3 Limitations of the study and areas for further research

The analysis in this thesis will not be complete without providing the limitations inherent in the study. First and foremost, the study was limited by the data frequency employed. In order to capture the real effect of macro-economic fundamentals on stock market behaviour, it would have been better to use monthly data for the period 1990-2004. This would have increased the level of precision of the parameter estimates obtained for the long run regression. However, the absence of monthly data for some of the variables, for example GDP constrained the study to use quarterly data. Also, the VAR model estimated in the study did not capture all the variables that could possibly impact on stock prices on the JSE. Variables such as the London FTSE, S&P 500 and NASDAQ which represent developed stock market indices were not included in the study. Some variables were also excluded from the model estimated due to the problem of multicollinearity encountered in the study.

Future research could extend this study by comparing the results obtained for South Africa with any other emerging markets and find out if the same macro-economic factors influence stock markets across all emerging markets. The FTSE/JSE African Index series can also be decomposed into its constituents and each tested against macro-economic variables so that comparison can be drawn on how different sectors within the JSE react to macro-economic conditions. In conclusion, while these limitations should serve as a caution to readers in interpreting the results of this study, they, do not diminish its usefulness. It is hoped that future studies will be wary of the aforementioned limitations.

APPENDIX A1

TABLE 1: Summary of important studies reviewed on Determinants of Stock Prices

Author and Year	Sample Period	Country of Focus	Determinants/Variables			Method of Analysis	Findings
			Dependent	Explanatory	Explanatory		
Fama and Schwert (1977)	----------	USA	Stock prices	Inflation rate	----------	Ordinary least square	Negative relationship between stock prices and inflation
Fama (1981)		USA	Stock prices	Inflation rate	----------	Ordinary least square	Negative relationship between stock prices and inflation
Chen et al (1986)		USA	Stock prices	Inflation, long-term government bond,	Real per-capital consumption and oil prices	Simple regression model	All variables are significant except real per-capital consumption and oil prices
George et al (1989)		USA, Japan and Germany.	Stock prices	Exchange rate and interest rate,	Gold and oil prices	Ordinary least square	All variables are insignificant
Aiyagari (1988)		USA	Stock prices	Human tastes and		Trend analysis	Stock prices

Author and Year	Sample Period	Country of Focus	Determinants/Variables			Method of Analysis	Findings
				preferences			behaviour can also be explained by unpredictated human behaviour.
Pu Lui *et al* 1990		USA	Stock prices	Wall Street Journal		OLS Estimation	Periodic publication of the journal has a significant effect on share prices.
Kothari and Shanken (1991).	1927-1985	USA	Stock prices	Future dividend expectation		Regression analysis	Future dividend expected account for 72 per-cent of annual share price variation.
Edman *et al* (2005)		Germany, Italy, Brazil, France and Nigeria.	Stock prices	Football match result		OLS and GARCH	That football match result affect mood of investors which eventually affect stock prices.
McQueen and Roley (1993)		USA and Finland	Stock prices	News about macro-economic condition of the economy		Trend Analysis	Macro-economic news of a boom impact positively on share prices
Kaul (1990)		USA, Canada, UK and Germany.	Stock prices	Inflation and Changes in monetary regime		Correlation Coefficient Analysis.	Negative correlation between inflation and stock prices.

Author and Year	Sample Period	Country of Focus	Determinants/Variables			Method of Analysis	Findings
Fama and French (1989).		USA	Stock prices	Business conditions and dividend yield		Multiple regression estimation	Dividend yield can be used to forecast stock returns.
Jensen *et al* (1996)		USA	Stock prices	Monetary stringencies and business conditions		Covariance and Correlation Coefficient analysis.	Monetary stringencies impact on stock prices only during expansive periods.
Leigh (1997)		Singapore	Stock prices	GDP, domestic interest rate, real exchange rate, proad money and capital stock.		Johansen and Juselius (1990) multivariate VAR co-integration	One co-integrating vector and the market is weakly and semi strongly efficient.
Yuhn (1996)	1959:1 to 1992:6	USA	Stock prices	Real dividend and real interest rate.	Dividend on S&P 500.	Johansen (1988), Johansen & Juselius (1990)	Overwhelming support for non linear co-integration between variables and stock prices
Han (1996)		USA	Stock prices	Inflation rate, interest rate and industrial production.		Canonical Co-integration Regression and Johansen Maximum Likelihood Method.	No co-integration between stock prices and dividends.

Author and Year	Sample Period	Country of Focus	Determinants/Variables			Method of Analysis	Findings
Ansotegui and Esteban (2002)		Spain	Stock prices	Oil prices, foreign stock market, industrial production index, interest rate and exchange rate.		Johansen (1988), Johansen & Juselius (1990)	One co-integrating vector found, interest rate and inflation are negatively related while industrial production is positively related.
Hondroyiannis and Papapetrou (2001).	1984:1-1999:9	Greece	Stock prices	Trade balance, foreign exchange rate, industrial production and money supply.		Johansen (1988), Johansen & Juselius (1990)	No co-integration found while variables only affect stock prices partially in the short-run. Oil prices affect stock prices through industrial production index.
Chung and Shin (1999)	January 1980-December 1992	Korea	Stock prices	Treasury bills, inflation and industrial production index.		Johansen(1988), Johansen & Juselius (1990) and Granger Causality	One co-integrating vector found causality runs from variables to stock prices.
Bong Soo Lee (1992)	Jan 1947-Dec 1987	USA	Stock prices	Exchange rate Inflation and money growth		Johansen(1988), Johansen & Juselius (1990)	Negative relationship found between inflation and stock prices, positive relationship between industrial production and stock prices. Causality test shows that causality

Author and Year	Sample Period	Country of Focus	Determinants/Variables			Method of Analysis	Findings
Fang (2002)	1997-1999	Thailand, Hong Kong, Singapore, South Korea and Taiwan.	Stock Prices	News about macro-economic determinants		GARCH Model	runs from stock prices to real activities. Foreign currency depreciation decreases mean stock returns and fuels stock price volatility.
Flannery and Protopapadakis (2002)		USA	Stock prices	GDP, Treasury bills, inflation, exchange rate and oil prices.		GARCH Model	Stock prices are negatively correlated with inflation and money growth.
Torben *et, al.* (2004)		USA, Germany and Britain.	Stock prices	US-dollar exchange rate, trade balance, industrial production and money supply.		Quasi-maximum Likelihood estimation technique to GARCH	Good news when economy is expanding is bad news for stock prices
Drehman and Manning (2004).	January 1980-October 2003.	UK	Stock prices			Panel regression analysis.	GDP is significant and positively related while inflation, exchange rate and treasury bills impact negatively on stock prices.
Karamustafa and Kucukkale (2002).		Turkey	Stock prices			Engel-granger and Johansen-Juselius co-integration test	Two co-integrating relationship found. Causality runs from stock prices to

Author and Year	Sample Period	Country of Focus	Determinants/Variables			Method of Analysis	Findings
							variables in the model.
Gjerde and Saetter (1999).	1974-1994	Norway	Stock prices	Interest rate, inflation, industrial production index, consumption, exchange rate and oil prices.		VAR model and correlation coefficient analysis	Negative relationship between Interest rate, inflation and stock prices, while positive relationship between stock prices and oil prices, industrial production and consumption.
Jones and Kaul (1996)	USA(1947-1991) Uk (1962-1991) Canada (1960-1991) and Japan (1970-1991)			Oil prices		Regression analysis	Oil price hikes had a significant negative impact on all countries focussed in the study.
Hui Guo (2002)		USA, UK Japan and Canada.	Stock prices			OLS	Future dividend growth is insignificant in explaining stock prices.
		USA					
Garcia *et al* (1999)		Argentina, Chile, Brazil, Columbia, Indonesia,	Market Capitalization			Regression Analysis	All variables are significant but east Asian countries have more developed market.

Author and Year	Sample Period	Country of Focus	Determinants/Variables			Method of Analysis	Findings
		Korea, Philipines, Malaysia, Taiwan, Venezuela and Peru.		Future dividend growth.			
Jefferis and Okeahalam (2000)	1985-1995	South Africa, Zimbabwe and Botswana.	Stock prices			Johansen(1988), Johansen & Juselius (1990)	One co-integrating vector found. Domestic GDP, real exchange rate established a significant positive relationship while CPI, domestic interest rate and foreign interest rate has a negative relationship. All variables are significant except foreign interest rate
Coetzee (2002)	1991-2001	South Africa	Stock prices			Johansen(1988), Johansen & Juselius (1990)	Long-run relationship found between monetary variables and stock prices. All variables established negative relationship with

Author and Year	Sample Period	Country of Focus	Determinants/Variables			Method of Analysis	Findings
Moolman (2004)		South Africa	Stock prices	Real income, savings rate, financial intermediary development and stock market liquidity.		Johansen(1988), Johansen & Juselius (1990)	stock prices. One co-integrating vector was found while exchange rate, S&P 500 index, gold price, risk premium all have significant short-run impact. .

Author and Year	Sample Period	Country of Focus	Determinants/Variables			Method of Analysis	Findings
				Real exchange rate, real GDP, domestic interest rate, USA interest rate, USA GDP, inflation(CPI)			.

Author and Year	Sample Period	Country of Focus	Determinants/Variables			Method of Analysis	Findings
				Monetary variables such as broad money and inflation, short-term interest rate, rand-dollar exchange rate.			

Author and Year	Sample Period	Country of Focus	Determinants/Variables			Method of Analysis	Findings
				Discounted future dividend, short-term interest rate, rand-dollar exchange rate, S&P 500 index gold price and risk premium			

Appendix A2

Stock Market index series and selected macro-economic variables

year	LRSMI	LCPI	LRER	LRGDPSA		LRDIRSA	LRGDP US	LRDIRUS	LMCAP
1990 Q1	4.59272	3.699077	0.3342	13.43386		2.485005	8.94748103	1.901525	1.141737
1990Q2	4.509308	3.730021	0.385627	13.44997		2.579248	8.95143305	2.035726	0.650224
1990Q3	4.482639	3.761433	0.377108	13.43496		2.578626	8.94328186	1.94341	0.752038
1990Q4	4.320689	3.800197	0.376334	13.41723		2.515066	8.92707922	1.913529	0.151655
1991Q1	4.312937	3.834061	0.421559	13.42753		2.50924	8.9255497	1.973481	0.448595
1991Q2	4.400253	3.870784	0.534125	13.4312		2.510368	8.93243888	2.018841	0.611917
1991Q3	4.456002	3.906407	0.583108	13.43134		2.569821	8.93648027	1.96749	0.633923
1991Q4	4.430064	3.949704	0.597672	13.41785		2.523744	8.93887391	1.886167	0.341921
1992Q1	4.423744	3.981176	0.632823	13.42447		2.598442	8.94821574	1.88703	0.421322
1992Q2	4.386952	4.010782	0.657917	13.4049		2.569948	8.95523352	1.882947	-0.20132
1992Q3	4.268557	4.038656	0.652981	13.40538		2.46754	8.96165022	1.763296	0.502589
1992Q4	4.214803	4.052133	0.725737	13.41118		2.570562	8.9707239	1.796934	0.265218
1993Q1	4.299472	4.071076	0.788864	13.42665		2.532714	8.97123069	1.692029	0.534195
1993Q2	4.361339	4.111693	0.843997	13.43795		2.373477	8.97411001	1.652467	0.671
1993Q3	4.3846	4.128585	0.911848	13.4601		2.492087	8.97958496	1.653631	0.683848
1993Q4	4.41561	4.142341	0.921691	13.48756		2.426122	8.99135238	1.593329	0.84318
1994Q1	4.553459	4.163404	0.953992	13.49066		2.355303	9.00115575	1.692322	1.182565
1994Q2	4.621394	4.180828	1.016099	13.50002		2.490088	9.01199469	1.863479	1.076086
1994Q3	4.654831	4.215972	1.039651	13.47469		2.516334	9.01511595	1.863071	1.295442
1994Q4	4.647796	4.235844	1.035213	13.50125		2.699542	9.02671071	1.996869	1.134346
1995Q1	4.54812	4.258304	1.057975	13.51953		2.679554	9.02767176	1.896565	0.931176
1995Q2	4.550957	4.282068	1.092293	13.52734		2.670358	9.02419207	1.745662	0.996399
1995Q3	4.542119	4.290322	1.099001	13.54239		2.720713	9.03268517	1.773271	1.046726
1995Q4	4.61234	4.29946	1.103306	13.55645		2.623368	9.03994295	1.687436	1.226732
1996Q1	4.715948	4.321347	1.148502	13.57044		2.492141	9.04431897	1.609823	1.529526
1996Q2	4.700611	4.341074	1.292252	13.59138		2.641747	9.05428469	1.745929	1.497866
1996Q3	4.665435	4.363863	1.346115	13.58628		2.582866	9.0603645	1.831132	1.493921
1996Q4	4.642887	4.38689	1.399381	13.59402		2.619625	9.07019374	1.72789	1.681824
1997Q1	4.643211	4.413162	1.390522	13.59379		2.539866	9.0775549	1.772641	1.830766
1997Q2	4.652718	4.430698	1.395164	13.60543		2.583314	9.09026513	1.840659	2.0143
1997Q3	4.672137	4.446526	1.444349	13.60441		2.534853	9.10210874	1.765121	2.140501
1997Q4	4.55921	4.453533	1.483385	13.62475		2.604676	9.10875266	1.707264	2.060972
1998Q1	4.577334	4.466598	1.522478	13.62559		2.498561	9.11963243	1.67211	2.238107
1998Q2	4.705308	4.48074	1.574801	13.64376		2.504357	9.12258621	1.622985	2.504939
1998Q3	4.42091	4.521027	1.79447	13.60455		2.560247	9.13376497	1.570395	2.487522
1998Q4	4.308522	4.540418	1.738632	13.60791		2.663889	9.14881348	1.463771	2.235511
1999Q1	4.391591	4.547859	1.794439	13.62461		2.663971	9.15745458	1.524191	2.423364
1999Q2	4.518092	4.551031	1.794475	13.64506		2.678436	9.15955952	1.518877	2.654778
1999Q3	4.54094	4.553877	1.786218	13.67736		2.702366	9.1684431	1.659821	2.739837
1999Q4	4.595603	4.559859	1.790947	13.69628		2.626117	9.18416154	1.708778	2.638336
2000Q1	4.696285	4.575432	1.8241	13.71075		2.490762	9.18586409	1.704312	2.878482
2000Q2	4.539263	4.599152	1.922393	13.72154		2.489867	9.19516514	1.632364	2.629517
2000Q3	4.603094	4.61779	1.953344	13.74417		2.47053	9.19126788	1.628821	2.579436
2000Q4	4.578113	4.627616	2.039951	13.75912		2.513052	9.19504641	1.613997	2.610662
2001Q1	4.644107	4.646984	2.079679	13.76742		2.318891	9.19239136	1.411027	2.695453
2001Q2	4.639188	4.661267	2.109997	13.76491		2.339055	9.1926188	1.44014	2.732081
2001Q3	4.586428	4.664382	2.152076	13.77539		2.352137	9.1919706	1.579784	2.647756

2001Q4	4.650351	4.66974	2.358961	13.81062		2.336288	9.203742	1.619572	2.716038
2002Q1	4.766709	4.702297	2.509515	13.82488		2.166849	9.21056298	1.551929	2.762083
2002Q2	4.773068	4.735672	2.434713	13.82503		2.141967	9.20876871	1.390258	3.022848
2002Q3	4.59608	4.76337	2.456198	13.81742		2.126027	9.21409001	1.342627	2.923528
2002Q4	4.564095	4.789739	2.411048	13.83263		2.102668	9.21698114	1.307077	2.676254
2003Q1	4.475438	4.803775	2.258855	13.82149		2.15484	9.21877371	1.069009	2.720119
2003Q2	4.394589	4.810638	2.191262	13.82295		2.192916	9.22694652	1.179581	2.652659
2003Q3	4.485153	4.809253	2.138923	13.84014		2.275052	9.24422513	1.319746	2.729835
2003Q4	4.574499	4.797195	2.029073	13.87394		2.340712	9.25735213	1.451928	2.733566
2004Q1	4.669423	4.808193	2.03994	13.89624		2.117955	9.26783103	1.136277	2.951448
2004Q2	4.613466	4.817374	2.008026	13.90748		2.223285	9.271681	1.152807	2.875661
2004Q3	4.639203	4.821974	1.973662	13.93058		2.222349	9.28113708	1.372335	2.840047
2004Q4	4.7542	4.828394	1.921086	13.94346		2.102417	9.29006634	1.275274	3.043783

Appendix A3

Number of Companies listed on the JSE, Market Capitalization and Market Turn-Over.

Years	Number of Companies Listed	Market Capitalization Millions($)	MarketTurn-over Millions($)
1990	769	136,868.70	10,468.90
1991	728	167,958	8,702.80
1992	671	148675	7,753.60
1993	631	215,882.80	10,363.20
1994	624	240,028	17,630.90
1995	638	277,108.80	17,425.40
1996	626	239,578.80	26,997.50
1997	642	211,598.70	44,696.40
1998	669	150,670	61,836.90
1999	658	180,462.90	86,838.10
2000	606	131,321	77,446.10
2001	532	84,343.50	69,278.40
2002	451	116,544.40	78,391.80
2003	411	168,263.10	101,126.90
2004	389	448,000.12	160,000.89

Appendix A4 Long-run regression and error correction model 1 without LRDIRUS

Vector Error Correction Estimates					
Date: 05/29/06 Time: 20:39					
Sample (adjusted): 1990Q3 2004Q4					
Included observations: 58 after adjustments					
Standard errors in ( ) & t-statistics in [ ]					
Cointegration Restrictions:					
B(1,1)=1					
Convergence achieved after 1 iterations.					
Restrictions identify all cointegrating vectors					
Restrictions are not binding (LR test not available)					
Cointegrating Eq:	CointEq1				
LRSMI(-1)	1.000000				
LRGDPSA(-1)	-6.291293				
	(0.70604)				
	[-8.91063]				
LCPI(-1)	-2.937145				
	(0.45451)				
	[-6.46220]				
LRER(-1)	-0.033271				
	(0.09051)				
	[-0.36759]				
LRDIRSA(-1)	-0.255653				
	(0.10950)				
	[-2.33479]				
@TREND(90Q1)	0.109273				
	(0.01414)				
	[7.72986]				
C	91.37652				
Error Correction:	D(LRSMI)	D(LRGDPSA)	D(LCPI)	D(LRER)	D(LRDIRSA)
CointEq1	-0.509865	0.036467	-0.013712	0.048896	0.320211
	(0.14906)	(0.02737)	(0.01800)	(0.12799)	(0.14749)
	[-3.42051]	[1.33250]	[-0.76196]	[0.38202]	[2.17106]

Appendix A5 Long-run regression and error correction model 1 without LRDIRSA

Vector Error Correction Estimates					
Date: 05/29/06 Time: 20:45					
Sample (adjusted): 1990Q3 2004Q4					
Included observations: 58 after adjustments					
Standard errors in ( ) & t-statistics in [ ]					
Cointegration Restrictions:					
B(1,1)=1					
Convergence achieved after 1 iterations.					
Restrictions identify all cointegrating vectors					
Restrictions are not binding (LR test not available)					
Cointegrating Eq:	CointEq1				
LRSMI(-1)	1.000000				
LRGDPSA(-1)	-4.405107				
	(0.49517)				
	[-8.89621]				
LCPI(-1)	-2.740473				
	(0.30944)				
	[-8.85633]				
LRER(-1)	0.089488				
	(0.06121)				
	[1.46189]				
LRDIRUS(-1)	-0.378749				
	(0.07530)				
	[-5.03002]				
@TREND(90Q1)	0.079516				
	(0.01018)				
	[7.80969]				
C	65.54972				
Error Correction:	D(LRSMI)	D(LRGDPSA)	D(LCPI)	D(LRER)	D(LRDIRUS)
CointEq1	-0.731415	-0.003203	0.012065	0.109688	0.510836
	(0.18371)	(0.03713)	(0.02388)	(0.16730)	(0.26965)
	[-3.98128]	[-0.08625]	[0.50525]	[0.65562]	[1.89443]

Appendix A6 Long-run regression and error correction model 2 without LRDIRSA

Vector Error Correction Estimates				
Date: 05/30/06 Time: 12:37				
Sample (adjusted): 1990Q4 2004Q4				
Included observations: 57 after adjustments				
Standard errors in ( ) & t-statistics in [ ]				
Cointegration Restrictions:				
B(1,1)=1				
Convergence achieved after 1 iterations.				
Restrictions identify all cointegrating vectors				
Restrictions are not binding (LR test not available)				
Cointegrating Eq:	CointEq1			
LMCAP(-1)	1.000000			
LRER(-1)	-0.690688			
	(1.77471)			
	[-0.38918]			
LRDIRUS(-1)	10.87997			
	(3.28902)			
	[3.30796]			
LRGDPSA(-1)	7.336101			
	(7.68616)			
	[0.95446]			
C	-117.8275			
	(104.247)			
	[-1.13027]			
Error Correction:	D(LMCAP)	D(LRER)	D(LRDIRUS)	D(LRGDPSA)
CointEq1	-0.030832	0.017360	-0.014280	0.000202
	(0.02251)	(0.00633)	(0.01046)	(0.00175)
	[-1.36978]	[2.74237]	[-1.36479]	[0.11540]

Appendix A7 Long-run regression and error correction model 2 without LRDIRUS

Vector Error Correction Estimates				
Date: 05/30/06 Time: 12:45				
Sample (adjusted): 1990Q4 2004Q4				
Included observations: 57 after adjustments				
Standard errors in ( ) & t-statistics in [ ]				
Cointegration Restrictions:				
B(1,1)=1				
Convergence achieved after 1 iterations.				
Restrictions identify all cointegrating vectors				
Restrictions are not binding (LR test not available)				
Cointegrating Eq:	CointEq1			
LMCAP(-1)	1.000000			
LRER(-1)	174.2221			
	(304.836)			
	[0.57153]			
LRDIRSA(-1)	709.3969			
	(482.432)			
	[1.47046]			
LRGDPSA(-1)	-303.6121			
	(1414.89)			
	[-0.21458]			
C	2430.702			
	(19389.0)			
	[0.12536]			
Error Correction:	D(LMCAP)	D(LRER)	D(LRDIRSA)	D(LRGDPSA)
CointEq1	5.99E-05	6.92E-05	5.67E-05	3.17E-05
	(0.00012)	(3.6E-05)	(4.5E-05)	(8.8E-06)
	[0.49094]	[1.92202]	[1.25369]	[3.61271]

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