

UNIVERSITY OF PRETORIA

MASTERS THESIS

**The Impact of Macroeconomic
Variables on Industrial Shares Listed
on the JSE**

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Abstract

Faculty of Economic and Management Sciences

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Master of Financial Management

The Impact of Macroeconomic Variables on Industrial Shares Listed on the JSE

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This study investigates the causal relationships, both long run and short run between the Industrial Index 25 and some macroeconomic variables in South Africa. Quarterly data from all the variables was collected from 1995 Q3 (September) to 2015 Q2 (June). Included in the set of macroeconomic variables used in this study are gross domestic product (GDP), inflation (CPI), prime rates and exchange rates. Statistical techniques applied in order to analyse the relationship between stock returns and macroeconomic variables include Augmented Dickey Fuller (ADF) unit root tests, correlation analysis, Johansen cointegration test, Vector error correction (VECM) and Granger causality tests in a multivariate framework. Results show that inflation significantly increases stock prices, hence investors get some inflationary compensation. Interest rates are shown to have a negative relationship between, suggestive of the substitution between stocks and interest bearing securities when interest rates increase. On the other hand, exchange rates have a positive effect on the INDI25, whilst there is no relationship between INDI 25 and GDP. Two error correction terms were obtained from the VECM. Whilst the first one was insignificant and failed to indicate any long -run relationship, the other term was significant, indicating short term adjustments and the presence of a long run relationship from GDP, CPI, prime rates and exchange rates to INDI 25. Results from Granger causality showed only univariate causality from INDI 25 to prime rates.

Keywords: *Price return, stock price share market index, Industrial 25 Index, Gross Domestic Product, Consumer Price Index, Prime rate, foreign exchange rate, multivariate, time series, ADF, Johansen cointegration, Granger causality.*

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List of Abbreviations

ADF	Augmented Dickey Fuller
ALSI	All Share Index
AMEX	American Stock Exchange
ANOVA	Analysis Of Variance
APT	Abitrage Pricing Theory
AR-GARCH	Augmented Autoregressive General Conditional Heteroscedasticity
ARIMA	Autoregressive Integrated Moving Average
ASE	Amman Stock Exchange
ASX	Australian Stock Exchange
BSE	Bombay Stock Exchange
CAPM	Capital Asset Pricing Model
CPI	Consumer Price Index
DCF	Discounted Cash Flow
ASX	Australian Stock Exchange
DDM	Dividend Discount Model
DJIA	Dow Jones Industrial Index
DJIS-W	Dow Jones Sustainability Industrial Index-World
ECM	Error Correction Model
ECT	Error Correction Term
EGARCH	Eexponential General Conditional Heteroscedasticity
EMH	Efficient Market Hypothesis
EU	European Union
ECM	Error Correction Model
FCFE	Free Cash Flow to Equity
FIML	Full Information Maximum Likelihood
FINI	Financial 15 Index
FTSE	Financial Times Stock Eexchange
GARCH	General Conditional Heteroscedasticity
GDP	Gross Domestic Product
GGM	Gordon Growth Model
GNP	Gross National Product
GSE	Ghana Stock Exchange
ICB	International Classification Benchmark

INDI	Industrial Index
INDI 25	Industrial 25 Index
INET BFA	INET Bureau 25 Of Financial Analysis
IRF	Impluse Response Function
ISE	Instabul Stock Exchange
JCI	Jarkata Composite Index
JSE	Johannesburg Stock Exchange
KPSS	Kwiatkowski Phillips Schmidt Shin
NSE	Nairobi Stock Exchange
NYSE	New York Stock Exchange
NZSE	New Zealand Stock Exchange
PP	Phillip Perron
PPI	Producer Price Index
RESI 10	Resource 10 Index
S & P 500	Standard & Poor 500 Index
SA	South Africa
SARB	South African Reserve Bank
STR	Smooth Transition Regression
UK	United Kingdom
US	United States
USD	United States Dollar
VAR	Vector Auto Regression
VARMA	Vector Autoregressive Moving Average
VD	Variance Decomposition
VECM	Vector Error Correction Model
ZAR	South African Rand

Chapter 1

Introduction

1.1 Introduction

A few key variables are routinely used to describe the state of the macroeconomy that significantly impacts shareholder value (Osamwonyi & Evbayiro-Osagie, 2012). These key variables are revised and released to the public, most importantly shareholders, as new information. Many investors on the Johannesburg Stock Exchange (JSE) consider this information when analysing shareholder returns (Hall & Millard, 2002). It is also these macroeconomic variables that are reflected in the price of a share (Fama, 1990). According to Chandra (2009), 30-35% of changes in shareholder value and returns can be attributed to these macroeconomic variables. It is therefore important to study the link between macroeconomic variables and share markets (Erdem, Arslan, & Sema Erdem, 2005).

Investigating the impact of macroeconomic variables on mean returns was pioneered in the widely cited work of (Chen, Roll, & Ross, 1986). Many of the studies on macroeconomic variables and share returns have focused on the broad stock market and so include data from all sectors. This is proven by the fact that the units of analysis of these studies are often represented by the broad share market index. However, studies in the context of particular sectors have also been conducted (*see* Günsel & Çukur, 2007; Izedonmi & Abdullahi, 2011)

In South Africa, research into the available literature disclosed limited evidence of studies on macroeconomic variables (released macroeconomic data) and shareholder returns in a particular sector (by use of index prices). There are however several studies on the macroeconomy and shareholder returns using the broad All Share Index (ALSI), such as that by (*see* Bonga-Bonga & Makakabule, 2010; Eita, 2012a; Junkin, 2012; MacFarlane, 2011; Mangani, 2009; Moolman & Du Toit, 2005). As the broad Index is not sector-specific, it is composed of companies in various sectors. Whilst analysing the relationship between macroeconomic variables and share returns using the broad index is informative, the overall result does not reveal sector specific information as the inherent result to each index constituent may be different from one another due to specific sector fundamentals. South Africa's industrial shares are

widely held by asset management houses as they are usually viewed as defensive shares which generate real returns even through troughs and recession periods of the business cycle (DeStefano, 2004). According to Chandra (2009) benchmark portfolios play an important role in portfolio construction and evaluation and the Industrial 25 Index (INDI 25) is widely adopted as a benchmark for a number of portfolios in South Africa. In periods of macroeconomic uncertainty the INDI 25 is also adopted for passive investment strategies. Numerous investors on the JSE hold the INDI 25 as a portfolio constituent.

A number of macroeconomic variables affect share prices and returns, namely; inflation, foreign exchange rates, aggregate economic growth, fiscal policy (deficits), short and long-term interest rates, money supply shocks, industrial production, oil prices and unemployment rate, to name a few.

1.2 Problem Statement

The importance of the INDI 25 Index is evident. Despite the significant amount of research over the past three decades examining the link between macroeconomic variables and stock market indices, there is no such evidence of a study examining the relationship between macroeconomic variables and the INDI 25 Index, using the specific macroeconomic variables to be adopted in this study.

1.3 Purpose of Study

The purpose of this study is to address the absence of research by analysing the relationship between macroeconomic variables, namely, aggregate economic output, inflation, interest rates and foreign exchange rate, with the INDI 25 Index. By investigating these relationships, the researcher explores how industrial share returns are affected by these specific macroeconomic variables.

1.4 Research Objectives

The research objectives at the outset were:

- To undertake a detailed investigation into the South African Industrial Sector;
- To undertake a detailed investigation into the linear relationships among macroeconomic variables, and
- To undertake a detailed investigation into the relationships between selected macroeconomic variables and shareholder returns.

1.5 Sampling and Target Population

The target population for this study includes all the companies that were part of the JSE Industrials Sector at the time of writing (June 2015). Sampling involves selecting some of the elements in a population from which to draw conclusions (Blumberg, Cooper, & Schindler, 2011). This section discusses the sampling process. Purposive sampling is a non-probability sample that conforms to certain criteria (Blumberg et al., 2011). The study adopts a purpose non-probability sampling technique as the sample conforms to the criterion of being an industrial share. The final sample is set out in Appendix A. (Blumberg et al., 2011) refer to a sample frame as a list of all population elements from which the sample is drawn. The sampling frame is the INDI 25 of the JSE.

1.6 Description of Inquiry Strategy and Broad Research Design

The empirical research for this study takes the form of a quantitative, explanatory, longitudinal time-series investigation based on secondary data analysis. The emphasis in explanatory research is on studying a problem in order to explain the relationships between variables (Saunders & Thornhill, 2012). This study is quantitative in nature as the data analysis procedure uses numerical data (Saunders & Thornhill, 2012). Numerical data are those whose values are measured numerically as quantities (Blumberg et al., 2011) as is the case with all the data series in this study. Statistical techniques are also adopted in order to achieve the research objectives.

1.7 Importance and Benefits of the Proposed Study

This study seeks to add to the body of academic knowledge by identifying how industrial shares are impacted by macroeconomic variables. The model specified illustrates this impact. In addition, the study endeavours to contribute to the body of knowledge of financial management, and more specifically portfolio management, by identifying the most significant variables that impact industrial shares.

This study can make a great contribution to investors as it assists them to know how their returns are impacted. In addition, the methodology adopted, results obtained and recommendations put forward in this study can be of great use to academics for comparison purposes with previous studies.

1.8 Delimitations and Assumptions

1.8.1 Delimitations

Firstly, the study did not take into account the presence of other economic factors that may have an effect on the price return of the INDI 25. Secondly, this study was undertaken among shares listed in the FTSE/JSE INDI 25 only and so is not inclusive of all listed industrial shares. For purposes of this study, the index price was the proxy for share prices. Using data exclusively from Quarter 3 1995 (September) to Quarter 2 2015 (June) created a long-term time-series bias, as the study did not take a long-term view. As the study focuses on listed companies, inferences are not made about private South African industrial companies, however much of the conclusions may apply to private companies as well.

1.8.2 Assumptions

The movement of the INDI 25 is used as a proxy for the movement in industrial share prices, in order to measure the index price return. For the purposes of this study, Gross Domestic Product (GDP) is used as a proxy for aggregate economic output. Inflation is measured using changes in the Consumer Price Index (CPI). The prime rate is utilised in the study as a measure of interest rates. As a proxy for the foreign exchange rate, the US Dollar/SA Rand (USD/ZAR) exchange rate is used.

1.9 Definition of Key Terms

The key concepts of this study are price return, share market index, INDI 25, gross domestic product (GDP), consumer price index (CPI), prime rate, foreign exchange rate and time-series analysis. The list below briefly defines the concepts, which are discussed further in the literature review.

Price return: (Tsay, 2005) states that holding the asset for one period from an initial date $t - 1$ to an end date t would result in a simple price return:

$$PriceReturn = \frac{P_t - P_0}{P_0} \quad (1.1)$$

Share market index: A share market index is a statistical indicator, benchmark or measure of movements in the general level or direction of share prices (Shilling, 1996). **INDI 25:** This is a market index representing the performance of the top 25 industrial shares on the equity market.

Gross Domestic Product (GDP): Mauch (2010) defines GDP as the money value of all the goods and services produced in the economy.

Consumer Price Index (CPI): CPI is a measure of the change in a households' cost of living (International Monetary Fund, 2009). It is often used as a general measure of inflation (International Monetary Fund, 2009).

Prime rate: This is defined as the average rate of interest charged on loans by commercial banks to private individuals and companies (Trading Economics, 2014).

Foreign exchange rate: Taylor (2006) defines the foreign exchange rate as the ratio of the domestic price level to the foreign price level of goods and services.

Time-series analysis: Time-series data uses a set of numerical values recorded over a number of variables over time at regular intervals (Saunders & Thornhill, 2012). Financial time series is concerned with the practice of asset valuation over a specified time period (Tsay, 2005).

1.10 Structure of Dissertation

This study comprises six chapters which are subdivided as detailed below:

Chapter 1: Introduction This chapter introduces the study and provides a background to the research problem. The problem statement, purpose of the study and research objectives is presented. Thereafter definitions of keywords are provided. Lastly, the delimitations and assumptions of the study are presented.

Chapter 2: Literature Review This chapter discusses the theoretical and empirical literature related to this current study. From an empirical analysis perspective, research findings on the relationship between macroeconomic variables and share returns from both international and South African context are discussed.

Chapter 3: South African Industrial Sector This chapter introduces the industrial sector in South Africa. It also provides an overview of the size and composition of the FTSE/JSE INDI 25, as well as a discussion of its importance to financial markets.

Chapter 4: Research Design and Methods This chapter explicates and motivates the research methodology applied in the study. Furthermore, the chapter discusses the process and tools that were used to analyse the data.

Chapter 5: Results and Discussion of Results This chapter reports and synthesises the findings from the data analysis tests.

Chapter 6: Summary, Conclusion and Recommendations This chapter presents a summary of the study, as well as conclusions and recommendations based on the findings. Furthermore, suggestions for future research are proposed.

Chapter 2

Literature Review

In this chapter, the theoretical link between macroeconomic variables and share returns is analysed. Previous research findings related to the relationship between the selected macroeconomic variables and share returns in an international as well as South African context are also examined.

2.1 Introduction

The relationship between macroeconomic variables and share prices has been studied since 1970 (Malkiel & Fama, 1970). In the research, a range of variables have been examined and researchers have come to different conclusions over different time horizons across different stock markets. Numerous models and methods have been adopted to collect and analyse data. Several researchers have investigated the link between macroeconomic variables as a whole, and share returns. The theoretical and empirical link between the study's selected macroeconomic variables and share returns are broadly examined in this chapter.

2.2 Theoretical Framework

The theoretical link which provides evidence to support the relationship between macroeconomic variables and share returns is based on four models, namely; the Efficient Market Hypothesis (EMH), the Capital Asset Pricing Model (CAPM), the Arbitrage Pricing Theory (APT), and the Discounted Cash Flow Model (DCF).

2.2.1 Efficient Market Hypothesis (EMH)

Developed by Eugene Fama, the EMH holds that prices adjust rapidly to material public information. Malkiel and Fama (1970), states that an efficient market is one in which all the relevant information about the changes in macroeconomic variables are fully reflected in the current share prices and hence, investors would not be able to earn abnormal profits in such markets. In simpler terms, Maysami, Howe, and Rahmat

(2005), state that no investor should be able to employ readily available information in order to predict share price movements quickly enough so as to make a profit through trading shares. Therefore, the EMH implies that policy makers should feel free to conduct national macroeconomic policies and release the information without the fear of influencing share prices.

There are three forms of market efficiency; weak-form market efficiency, semi-strong form market efficiency, and strong-form market efficiency. The weak-form of EMH states that current share prices fully reflect all currently available share market data. Given this, information on past share prices will have no predictive power about the future direction of share prices because price changes will be independent from one period to the next (Maysami et al., 2005). Thus, in a weak-form efficient market, investors cannot achieve positive risk-adjusted returns on average through using technical analysis (Malkiel & Fama, 1970).

The semi-strong form efficiency is similar to what the general EMH states in that, it holds that share prices must contain all relevant information on the macroeconomic variables which are publicly available, and that it has important implications for policy makers and the financial market players (Malkiel & Fama, 1970). Share prices in this form of market efficiency include all past information with regard to macroeconomic variables. Thus, in a semi-strong efficient market, an investor cannot achieve positive risk-adjusted returns on average by using fundamental analysis. If markets are in this category, investors should invest passively in a tradable index that reflects the market index.

The third form is the strong-form market efficiency and it suggests that share prices fully reflect all information relating to macroeconomic variables from both private and public sources (Malkiel & Fama, 1970). The strong-form incorporates all types of information, including past share market information, material public information and material non-public or insider information. Thus, in a strong-form of market efficiency, no group of investors has monopolistic access to information relevant to the macroeconomic variables and so no investor would be able to consistently attain positive abnormal risk-adjusted returns (Malkiel, 2005). Markets can be weak-form efficient without being semi-strong or strong-form efficient. However, if markets are semi-strong form efficient, they must be weak-form efficient, but semi-strong form efficient markets need not be strong-form efficient.

Furthermore, the EMH holds that any individual who invests in the financial market will earn a return equal to that of professional traders and investors. However, there have been numerous occurrences where market prices have not fully reflected available information and professional investors have been able to earn higher returns than those that the rest of the market earns. Early studies by (see Fama & Schwert, 1977; Nelson, 1976) and others have all asserted that macroeconomic variables do

influence share returns by affecting share prices.

Malkiel (2005) identified the internet bubble of the late 1990s as a financial market irregularity where the EMH did not hold. In addition, Moolman and Du Toit (2005) argued that investors are only able to earn higher risk-adjusted returns in the short run as intrinsic values of shares in different sectors may be affected differently by changes in macroeconomic variables.

2.2.2 Capital Asset Pricing Model (CAPM)

The CAPM also provides a theoretical framework of the link between macroeconomic variables and share returns. Developed by (Sharpe, 1964), the CAPM is an equilibrium model that predicts the expected return on a share, given the expected return on the market, the shares beta coefficient, and the risk-free rate. The CAPM investigates the effects risk has on the expected return of an investment, relative to the market portfolio. The CAPM can be stated as follows:

$$E(R_i) = RFR + \beta_i[ER_{mkt} - RFR] \quad (2.1)$$

Where $E(R_i)$ is the expected return of asset i , RFR is the risk-free rate of return, ER_{mkt} is the expected return of the market portfolio and β_i is the Beta of the stock market.

There are several shortcomings of the CAPM and recently there has been much debate over whether the CAPM is the best model to calculate the required return on equity. It is noteworthy that the CAPM only acknowledges one source of risk (macroeconomic variable). In addition, different investors and analysts use different inputs to the CAPM, thus there is no single number that is correct. Consequently the CAPM presents unrealistic assumptions of investor behaviour, a fact that was highlighted by Poon and Taylor (1991).

2.2.3 Arbitrage Pricing Theory (APT)

The APT was developed by (Ross, 1976) as an alternative to the CAPM. APT is one way of linking macroeconomic variables and share market returns, where these returns can be explained by multiple risk factors (Ross, 1976). In financial literature, the APT examines the issue of whether risk associated with a particular macroeconomic variable is reflected in the expected returns of the asset by measuring the risk premiums associated with each of these macroeconomic variables (Srinivasan, 2011). Maysami et al. (2005), state that the APT seeks to measure the risk premiums attached to the various macroeconomic variables that influence share returns, whether they are significant, and also whether they are priced into share market returns. The risk

associated with a share may take one of two forms, namely systematic risk and non-systematic risk (Paavola et al., 2006). Systematic risk is that which is inherent to the overall market which cannot be diversified away. Non-systematic risk is that risk which is unique to each asset and can therefore be diversified away by means of portfolio diversification. In this way the APT captures the non-market influences that cause shares to move together.

Though early theoretical papers on the APT focused on individual share returns, it has recently also been used for an aggregate market framework. Most studies based on the APT theory (linking the state of the macroeconomy to share returns) are characterised by modelling a short run relationship between macroeconomic variables and the share price in terms of the first differences, assuming trend stationarity.

Furthermore, several assumptions hold for the APT. Firstly, investors can lend and borrow at the risk-free rate of interest. Secondly, there are no taxes imposed on the interest borrowed or lent. The third assumption is that the APT assumes the risk that there is no restriction on the short selling of shares. The fourth is that risk unique to individual shares (non-systematic risk) may be diversified away. Lastly, it is assumed that investors are risk averse, implying that they aspire for their portfolios to exhibit a minimum level of risk (Junkin, 2012).

In the APT, no assumptions are made with regard to the distribution of share returns and assumptions on utility theory unlike with the CAPM. Thus, the APT discourses the inadequacies of the CAPM which makes more assumptions that may distort final results (Junkin, 2012). In addition, the APT acknowledges several sources of risk that affect a share's expected return, unlike the CAPM.

The ATP model, as used by Chen et al. (1986), is shown as follows:

$$ER_{it} = \lambda_0 + \lambda_1 b_{i1} \dots \lambda_j b_{ij} + \epsilon_{it} \quad (2.2)$$

Where: ER_{it} is the expected return of asset i at time t , λ_0 is the risk-free rate of return, λ_j is the assets return sensitivity to factor j and ϵ is the error term

Several shortcomings are associated with the APT model. Firstly, it sets no theoretical foundation for the macroeconomic variables that should be included in ascertaining the risk-adjusted return of the shares (Paavola et al., 2006). Secondly, it does not indicate the number of macroeconomic variables that should be included into the model. Lastly, the model may be sensitive to the number of independent variables included in the linear regression equation (Cheng, 1995).

2.2.4 Discounted Cash Flow Models (DCF)

An alternative approach to the three models described above is the DCF model. This model relates the share price to future expected cash flows (Humpe & Macmillan,

2009). The advantage of the DCF model is that it can be used to focus on the long run relationship between the share market and macroeconomic variables (Humpe & Macmillan, 2009). These variables influence expected profit and therefore future expected cash flows (dividends)-a principle factor in share price valuation. Consequently the DCF model presents a solid foundation linking share prices and the macroeconomy.

The equation below shows that the present value of the asset at P_0 is equal to the sum of the expected future cash flows (dividends) discounted to $t = 1$.

$$P_0 = \sum_{t=0}^{\infty} \frac{D_t}{(1 + k_e)^t} \quad (2.3)$$

Where: P_0 is the current value of share, D_t is the dividend at time t and k_e is the required rate of return on common equity

2.2.5 Gordon Growth Model (GGM)

Developed by Gordon (1962), the Gordon Growth Model (GGM), assumes that both the growth rate of dividends and the required return on the share are constant and are never expected to change. The model also assumes that the required rate of return must be greater than the growth rate for the model to work. The current price of an asset is dependent upon the expected dividend of the asset divided by the difference between the required rate of return and the growth rate of the asset (Junkin, 2012). The GGM is shown as follows:

$$P_0 = \frac{D_0(1 + g_c)}{k_e - g_c} = \frac{D_1}{k_e - g_c} \quad (2.4)$$

Where:

$$D_1 = D_0(1 + g_c) \quad (2.5)$$

and P_0 is the current value of share, D_1 is the next period's dividend, k_e required rate of return on common equity and g_c is the constant growth rate of dividends

The GGM makes use of a single constant growth rate of dividends and is suitable for stable and mature, non-cyclical, dividend-paying companies.

2.2.6 The Multi-Stage Gordon Growth Model (MSGGM)

As it is improbable for a company to experience constant dividend growth in the long run due to the cyclical nature of expected profits, the multi-stage GGM was developed to address the shortcomings of the GGM.

The current value of the share is equal to the discounted value of dividends during the initial stage of high growth, plus the discounted value of the terminal price of the asset during the subsequent stable growth stage (Junkin, 2012). The initial GGM above was modified as follows:

$$P_0 = \frac{D_1}{(k_e - g_c)} + \frac{D_1}{(k_e - g_c)^2} + \dots + \frac{D_n}{(k_e - g_c)^n} + \frac{P_n}{(k_e - g_c)^n} \quad (2.6)$$

Where:

$$P_n = \frac{D_{n+1}}{k_e - g_c} \quad (2.7)$$

and P_0 is the current value of share, D_n is the dividend in year n, k_e is the required rate of return on common equity, g_c is the constant growth rate of dividends after year n and P_n is the terminal value of share at the end of year n.

A shortcoming of the multi-stage GGM involves determining the length of time for which there is high growth. (Junkin, 2012) points out that a longer period of high growth would increase the present value of the asset as the lower stable growth stage ensues.

2.2.7 The Three-Stage Gordon Growth Model (TSGGM)

The three-stage GGM is most appropriate for valuing companies with an initial high growth rate, followed by a lower growth rate during a second, transitional period, followed by a constant growth rate in the long run.

$$P_0 = \sum_{t=1}^{t=n_1} \frac{EPS_0 * (1 + g_a)^t * P0_n}{(k_e, gh)^t} + \sum_{t=1}^{t=2n} \frac{D_t}{(k_e, t)^t} + \frac{EPS_{n_2} * (1 + g_n) * P0_n}{(k_e, st - g_n)(1 + r)^n} \quad (2.8)$$

Where:

P_0 = Current value of share

EPS_t = Expected earnings per share in year t

D_t = Dividend in year t

$k_{e,hg}$ = Required rate of return in high growth stage

$k_{e,t}$ = Required rate of return in transition stage

$k_{e,st}$ = Required rate of return in stable growth stage

g_a = Growth rate in high growth stage lasting n_1 periods

g_n = Growth rate in stable stage

$P0_a$ = Dividend pay-out ratio in high growth stage

$P0_n$ = Dividend pay-out ratio in stable growth stage

The three-stage GGM is however empirically more advanced than the general GGM or the multi-stage GGM as a larger number of variables are required. More importantly, the model asserts the channels through which macroeconomic variables may influence share prices.

2.2.8 Free Cash Flow-to-Equity Model (FCFE)

When a firm does not pay dividends, investors' estimates of future dividend payments are highly speculative and cannot be estimated with confidence. Thus, the Free Cash Flow to Equity model (FCFE) is the most suitable as long as growth rates of earnings can be estimated. A company's FCFE represents the potential amount of cash that could be paid out to shareholders (Chandra, 2009). The value of a company is estimated as the present value of cash available to shareholders after the firm meets its necessary capital expenditures and working capital expenditures and it reflects the company's capacity to pay dividends (Chandra, 2009).

2.3 Empirical Literature

Previous research findings related to the relationship of the selected macroeconomic variables and share returns in an international as well as South African context are discussed below.

2.3.1 Aggregate Economic Output and Share Returns

This section discusses previous findings on the link between aggregate economic output and share returns, both on international and South African stock markets.

International Studies

A number of studies have investigated the link between a country's aggregate economic output and its share market returns. Fama (1981) analysed monthly, quarterly and annual data from 1954 to 1980 in his study on the anomalous relationships between share prices and real activity, inflation, and money. He found that there is a strong positive correlation between real common share returns and real economic activity. He suggested that there is a significant relationship, which is consistent with the findings of Chen et al. (1986).

Huang and Kracaw (1984) measured the variability of share market returns to fluctuations in real economic activity and the unemployment rate in the United States

of America (US). Utilising a Granger causality test, they employed GNP as a proxy for real economic activity. The findings of [Huang and Kracaw \(1984\)](#) are unique amongst most studies in that, the results revealed a unidirectional relationship from GNP to share market returns. More specifically, the findings indicated that changes in the log price of real GNP are Granger-caused by the variation in share market returns.

[Fama \(1990\)](#) tested the link between three macroeconomic and equity returns on the New York Stock Exchange to measure sources of total return variation and judge the rationality of share prices in the US. Using a multivariate regression analysis to explain the links under investigation, he found that 43% of the total variation in annual returns on the NYSE could be attributed to real activity. Furthermore, aggregate economic output was found to be responsible for almost half of the total variation in annual returns on the NYSE.

[Chen \(1991\)](#) studied the relation between changes in financial investment opportunities and changes in the US macroeconomy. He focused on the lagged production rate, the default premium, the term premium, yield spreads between low grade and high grade bonds, the yield spread between long-term and short-term government bonds, the short-term interest rate, the market dividend-price ratio, the dividend yield, and economic growth (GDP growth rate). The findings showed that the market excess return is negatively correlated with recent economic growth and positively related with expected future economic growth in the US.

Additionally, [Martinez \(1999\)](#), assessed the usefulness of fundamental and macroeconomic information to the French market by analysing the relationship between weekly share prices and quarterly macroeconomic data from 1993 to 1997. After carrying out a screen test, she tested the relationships under study. The findings showed that a strong relationship between share prices and GDP was evident. In addition, she found that the explanation of share market returns in France is considerably strengthened when GDP is added to the explanatory model.

Utilising a bivariate Vector Auto Regression (VAR) technique and Impulse Response Function (IRF) methodology, [Hassapis and Kalyvitis \(2002\)](#), investigated the link between real share price changes (price returns) and macroeconomic variables, namely CPI, industrial wholesale price index, industrial output price index and industrial goods price index with empirical evidence from the G-7 economies. The results showed that share price changes in the economies under study are strongly positively related to output growth. These findings are consistent with the results of (*see* [Fama, 1990](#); [Nasseh & Strauss, 2000](#)).

[Wongbangpo and Sharma \(2002\)](#) examined the relationship between share returns and five macroeconomic variables in five Asian countries, namely; Malaysia, Indonesia, the Philippines, Singapore and Thailand. They found that in the long run, share price indices in all of the countries were positively related to growth in aggregate

economic output. The study also suggested the presence of a linear relationship between share returns and aggregate economic output.

In their study, [Gan et al. \(2006\)](#), examined the interactions between the New Zealand Stock Exchange (NZSE) Index and a set of seven macroeconomic variables from January 1990 to January 2003 employing a co-integration test. Specifically, they used the Johansen maximum likelihood and Granger-causality tests to investigate the short-run dynamic linkages between the NZSE40 price returns and macroeconomic variables. Their findings revealed that the NZSE40 price returns are consistently determined by the real GDP growth rate.

[Samitas and Kenourgios \(2006\)](#), examined whether current and future domestic and international macroeconomic variables can explain long-run and short-run share returns in four new European countries (Poland, the Czech Republic, Slovakia and Hungary), four old western European countries (the United Kingdom, France, Italy and Germany), and the US as a foreign global influence. Using the Dividend Discount Model (DDM) and the Johansen co-integration and causality tests, they found that new European share markets are not perfectly integrated with foreign financial markets, and that domestic economic activity and the German factor explain share price movements in these countries.

Using the panel estimator methodology, [Apergis et al. \(2011\)](#), analysed the dynamic relationship between excess returns and macroeconomic factors for a group of emerging markets spanning the period 1996 to 2009. The empirical findings indicated that GDP plays a significant role in explaining excess returns. Furthermore, the findings indicate that GDP has a positive relationship with excess returns in the sample of emerging market economies.

[Hsing \(2011a\)](#), examined the effects of GDP, the ratio of government deficit to GDP, M3 money supply, nominal effective real interest rate, USD/ZAR exchange rate, inflation rate, and the US government bond yield on the stock market index in South Africa. He applied an Exponential General Autoregressive Conditional Heteroscedasticity (EGARCH) model to a quarterly time series sample range spanning 1980 Q2 to 2010 Q3. The findings from the EGARCH model shows that with a coefficient significant at a 1% level, the South African stock market index is positively influenced by the rate of real GDP growth.

[Adaramola \(2011\)](#), set out to investigate the impact of macroeconomic indicators on share prices in Nigeria. Quarterly time series data was used on share prices of selected companies and six macroeconomic variables (money supply, interest rate, exchange rate, inflation, oil price and GDP) between January 1985 and April 2009. The findings pointed out that macroeconomic variables have a varying impact on share prices. The empirical findings of the study further indicated that GDP has a significant impact on share prices in Nigeria.

In examining Hungary's share market index price return and selected macroeconomic variables (GDP, M1 and M2 money supply, government debt to GDP ratio, Treasury bill rate, exchange rate, and Euro area government bond yield), [Hsing \(2011b\)](#), applied a General Autoregressive Conditional Heteroscedasticity (GARCH) model to a quarterly time series sample spanning from 2000 Q1 to 2010 Q2. He found that Hungary's share market index price return has a significant and positive relationship with real GDP, which implies that a higher real GDP would increase Hungary's share market index price returns.

Using monthly time series data from January 2000 to June 2012, [Zakaria and Shamsuddin \(2012\)](#), focused on the relationship between stock market price returns and five selected macroeconomic variables (GDP, inflation, exchange rate, interest rates, and money supply) in the Malaysian Stock Exchange. They employed GARCH and VAR Granger causality tests to establish the nature and extent of the various relationships they had under investigation. The findings revealed that GDP volatility is not significantly related to stock market volatility. Furthermore, they concluded that the weak relationship between stock market volatility and macroeconomic volatilities was due to a lack of institutional investors in the market and also that this weak relationship indicated the existence of an information asymmetry problem, among various investors in shares listed on the Malaysian Stock Exchange.

[Hsing et al. \(2012\)](#), focused on only one data point and not a time series in their study. By applying the EGARCH model and based on a quarterly sample during 1998, they studied the policy returns and macroeconomic determinants of the all share market index price returns in Argentina. Their results indicated that the Argentine stock market index price returns are positively associated with real GDP.

[Karunanayake et al. \(2012\)](#), used quarterly data from 1950 to 2010 and a multivariate GARCH model to investigate the interplay between share market returns and GDP growth rates in Anglo-Saxon economies. They found that spill-over's from share market returns towards GDP growth exist in both the US and Australia which is the opposite relationship from most findings, whereas spill-over's from GDP growth to share market returns exist only in the US growth towards its share market. This is consistent with the findings of [Fama \(1990\)](#).

More recently, [Lai et al. \(2013\)](#), analysed the dynamic interactions among macroeconomic variables and the stock markets in three Asian countries, namely; Taiwan, Hong Kong and China, incorporating long-run and short-run movements. They observed that foreign stock markets have a greater impact on the domestic stock market than domestic macroeconomic variables. Furthermore, their results showed that in the long-run, share prices are positively related to growth in output (GDP) in Hong Kong and Taiwan, but negatively in China. This is because factors from other foreign economies influence local financial markets.

Rafique et al. (2014), went a step further by using GDP per capita. They examined the impact of four macroeconomic variables (GDP per capita, gross domestic savings, inflation and the discount rate) on the Karachi Stock Exchange of Pakistan using an Analysis of Variance (ANOVA) model. Their study made use of time series data spanning 20 years from 1991 to 2010. Results from the analysis of the data indicated that GDP per capita has a positive significant impact on the Karachi Stock Exchange ALSI with a coefficient of 142.661.

South African Context

As far as South African literature is concerned, there are limited studies focusing on the relationship between GDP and share returns. By using the Johansen co-integration technique, Jefferis and Okeahalam (2000), examined the relationship between share returns and macroeconomic variables in three Southern African countries, that is, South Africa, Botswana and Zimbabwe. They analysed quarterly time series data for the period beginning 1985 to 1995. The results revealed that share returns in South Africa were driven by GDP.

Olalere (2007), examined the behaviour of the ALSI and market capitalisation on the JSE in response to changes in the following domestic and international macroeconomic fundamentals; CPI, USD/ZAR exchange rate, domestic GDP, yield on South African government bonds, yield on US government bonds and US GDP. The Johansen co-integration and Error Correction Model (ECM) techniques were used to test for long-run relationships. The Johansen co-integration technique established that both domestic macroeconomic factors and foreign GDP influence the long run behaviour of both the South African stock market ALSI and stock market capitalisation. In addition, the findings revealed that the ALSI elicited a positive and significant response from domestic GDP. Referencing Olalere (2007) work, he also found that the stock market index adjusts back to equilibrium faster than the rate that market capitalisation adjusts back.

More recently, MacFarlane (2011), adopted a Johansen co-integration and Granger causality test in examining whether macroeconomic variables explain future market movements on the JSE. He examined quarterly time series data between 1965 and 2010. This makes his study the one that covers the longest time period in South Africa. He found that GDP significantly influenced future FTSE/JSE ALSI returns. The author concluded that GDP should be used as a future predictive tool for South African share market returns.

2.3.2 Inflation and Share Returns

This section discusses previous findings on the link between inflation and share returns, both internationally and on the South African stock market.

International Studies

Several studies have examined the link between inflation and share returns. **Nelson (1976)**, focused on the inflation rate and rates of return for common shares. More specifically, he investigated empirically the relation between returns on common shares and the rate of inflation over the post-World War II period. The evidence presented does not support the Fisher hypothesis which argues that inflation and price returns on common shares move directly with the rate of inflation. Rather they suggest a negative relation between returns and both anticipated and unanticipated changes in the rate of inflation which prevailed during the post-World War II period. Furthermore, post-sample tests for 1973 and the first half of 1974 indicated that past rates of inflation could have been used for a trading strategy that generated higher returns than an investment strategy during that period.

Fama and Schwert (1977), estimated the extent to which various assets were hedges against inflation. They found that the common share returns were negatively related to the expected and unexpected components of inflation from 1953 to 1971 in the US. The findings indicated that whether anticipated or unanticipated, the real rate of inflation had a negative effect on share price returns. Later in the year, **Hong (1977)**, examined the relation between inflation and the market value of individual shares on the NYSE, using theory and a series of econometric tests. He suggested that nominal equity values increase with the price level.

Blume et al. (1977), studied the causal relationship of several determinants of common share prices (the money supply, percentage change in the money supply, inflation and Moody's AAA corporate bond rate) by utilising empirical time series data. They focused on common share prices listed on the NYSE in the US. The empirical results showed that a consistent pattern of causality was found. In addition, the results revealed a strong statistical relationship between inflation and common share prices on the NYSE. This relationship was found to be negative.

In investigating the relationship between stock market returns and rates of inflation, **Firth (1979)**, employed a multivariate regression model of monthly share market returns on the rate of inflation. He used the Wholesale Price Index price returns as a proxy for the rate of change of inflation. Of importance, he found that there was a negative relationship between rates of inflation and share market returns. Consequently, **Feldstein (1980)**, in his study examined the impact of inflation on the ratio of share price (or price per share) to real earnings, the P/E ratio. His results showed that

the equilibrium ratio of share prices to real earnings can fall even if the demand price per share for some individuals is actually increased by inflation. Therefore, while inflation may present an increase in price per share, it may reduce real earnings.

Schwert (1981), studied the adjustment of share prices to information about inflation in the US. Based on daily returns to the S & P 500 Index between 1953 Q1 and 1978 Q1, it was clear that the stock market reacts negatively to the announcement of unexpected inflation in the CPI. However, the magnitude of the reaction was found to be small (**Schwert, 1981**). Furthermore, the results also revealed that the stock market reacts at the time of announcement of the CPI, approximately one month after the price data are collected by the US Bureau of Labour Statistics.

Cohn and Lessard (1981), provided a consistent investigation of the effects of inflation on share prices in Canada, France, Germany, Italy, Japan, Netherlands, the UK and the US for the period 1970 to 1979. Their regression analysis used end-of-quarter share prices to construct the dependent variable. The findings suggested that during the period under study, falling (rising) inflation coincided with a rise (fall) in share prices, implying a negative and significant relationship.

In their widely cited study, **Geske and Roll (1983)**, studied the fiscal and monetary link between share price returns on the NYSE and inflation in the US. Their findings reveal that insignificant changes in inflation figures can cause large and opposite unidirectional percentage changes in share price returns. Therefore, their findings imply that share price returns are highly inelastic to rates of inflation.

Later in the same year **Solnik (1983)**, provided empirical evidence on the relation between share price returns and inflationary expectations, supported by international evidence. More specifically, he focused on nine countries (the US, Japan, UK, Switzerland, France, Germany, Netherlands, Belgium and Canada) for the period 1971 to 1980. The findings revealed that share price movements signal negative revisions in inflationary expectation, consistent with the basic hypothesis of **Geske and Roll (1983)**. In addition, a weak real interest rate effect was found for some of the countries under study.

Gultekin and Gultekin (1983), examined the relation between share market returns and inflation forecasts. He used data from the Livingston survey to test the Fisher Effect in its pure form as a model relating expected share returns to expected inflation. The expectations data from the Livingston survey revealed a positive one-to-one relation between expected share returns and expected inflation. Furthermore, the results showed that the expected real return on shares was not constant over time, but was positively related to expected inflation.

Kaul (1987), empirically hypothesised the relation between share returns and inflation. The findings indicate that in post-World War II US, Canada, the UK and Germany, there was a negative relation between share returns and inflation.

Furthermore, the negative relation was caused by money demand and counter-cyclical money supply effects. Thus, **Kaul (1987)**, concluded that these relations vary over extended periods of time in a systematic manner depending on the influence of money demand and supply factors.

Pearce and Roley (1988), examined the relationship between unanticipated inflation and an individual share's rate of return. They used announced inflation data to examine the effects of unanticipated inflation on the share's rates of return. The empirical results revealed that time-varying firm characteristics related to inflation predominantly determine the effect of unanticipated inflation on a share's rate of return. Furthermore, the debt-equity ratio appears to be particularly important in determining the response of a firm's share price.

Following on a study conducted by **Ibbotson and Sinquefeld (1976)**, **Hamao (1989)**, studied the nature of share price returns, bonds, bills and inflation. However, he focused on the Japanese financial markets between the period 1973 and 1987. The findings indicated that Japanese shares had higher returns than the US returns, on average, for the period under study due to a higher rate of inflation.

Lee (1992), studied the causal relations among share returns, interest rates, real activity and inflation. He used a multivariate VAR technique using data in post-World War II US. The VAR results of his study, with reference to **Lee (1992)**, indicated that share returns explain little variation in inflation, whereas inflation explains a substantial variation in share returns. These findings are consistent with the results presented by **Chopin and Zhong (2001)**.

In his study focused on inflation and asset returns in a monetary economy, **Marshall (1992)**, utilized post-World War II US time series data between 1959 Q1 and 1990 in an equilibrium monetary asset pricing model. The empirical findings showed the presence of negative correlations between real equity returns and inflation in the US. The empirical findings also showed a significant negative correlation between inflation and the ex post real return to nominally riskless bonds. This contradicts the traditional view that equities ought to act as an inflation hedge. More-over, negative correlations existed between expected asset returns and expected inflation. **Marshall (1992)**, also suggested that asset return correlation will be more strongly negative when inflation is generated by fluctuations in real economic activity than when it is generated by monetary fluctuations.

Balduzzi (1995), study examined the link between share returns and the rate of inflation. He employed quarterly time series data on industrial-production growth, monetary-base growth, CPI inflation, three-month Treasury bill rates and returns on the equally-weighted NYSE portfolio for two sub-periods. The first sub-period spanned 1954 to 1976 and the second 1977 to 1990. The findings showed that production growth causes a weak negative correlation between inflation and share

returns on the NYSE.

Lajeri and Dermine (1999), evaluated the impact of unexpected inflation on share returns. Their empirical test of theories that predicted the impact of inflation on share returns of Banks in France made use of quarterly time series data, also for two sub-periods; 1977 to 1987 and 1987 to 1991. They employed the Augmented Dickey-Fuller (ADF) unit root test and the Johansen co-integration for analysis. The results show that during periods of volatile inflation, there was a negative relationship between unexpected inflation and share returns of French Banks.

Groenewold et al. (1997), supported the conclusion of a negative relationship between share returns and inflation. They extended this, identifying that the way it occurs is through a rise in the inflation rate which raises equilibrium real output which then has a negative impact on share returns. Their approach utilised a small empirical macro econometric model. Two years later, Adrangi et al. (1999), investigated the relationship between share returns and the inflation rate with data from two emerging markets, South Korea and Mexico. The Johansen co-integration and Juselius co-integration tests were employed to test the long run equilibrium between the two variables. The results of the study showed that, there exists a negative relationship between the real share returns and unexpected inflation in each of the two economies. This is consistent with the results of Fama (1981).

Khil and Lee (2000), also explored the relationship between real share return and inflation. They focused on the US and ten other countries within the Pacific-rim, using quarterly time series data obtained for the period between January 1970 and December 1997. The results revealed that ten countries showed a significant and negative relation between real share returns and inflation; Malaysia however exhibited a significant and positive correlation.

Rapach (2001), examined the effects of three macroeconomic variables (money supply, inflation and aggregate economic output) on the S & P 500 price returns in the US. He employed a structural VAR methodology on quarterly time series data spanning 1959 Q3 to 1999 Q1. Most importantly, he found that in the long-run, an increase in inflation does not cause a sustained real depreciation of S & P 500 price returns. Chopin and Zhong (2001), examined the relationship between share returns and inflation. They found that there exists a significant and negative correlation between share returns and inflation. This is consistent with the findings of (Chopin & Zhong, 2001) and Altay et al. (2003).

By using simple and non-linear transformation regressions, Boyd et al. (2001), empirically investigated predictable increases in the rate of inflation with the ability of the financial sector to allocate resources effectively in the US. The evidence indicated that there is a significant and economically important negative relationship between inflation and equity market activity, and the relationship is non-linear. Furthermore,

the results suggested that as inflation rises, its marginal impact on stock market development diminishes rapidly. The results also indicated that in high inflation economies, nominal share returns move one-for-one with marginal increases in inflation, and that for economies with inflation in excess of 15%, there is a discrete drop in the performance of share returns in the financial sector.

Boyd et al. (2001), empirically investigated the impact of real macroeconomic variables (CPI, Producer Price Index (PPI) and money supply) on aggregate equity returns. They analysed 17 macro-series data points by estimating a GARCH model and found that share market returns are significantly correlated with inflation.

Fifield et al. (2002) investigated the extent to which global and local macroeconomic factors explain share returns in emerging stock markets. They selected their macroeconomic variables using the principal components analysis technique. Their local variables were GDP, inflation, money supply and interest rates, and their selected global variables were world industrial production and world inflation. Furthermore, a regression model was developed in order to explain the index returns of 13 emerging stock markets from 1987 to 1996. The results revealed that local factors were important only in explaining returns in India and Turkey but that the addition of the local variables to the global variables significantly increased the proportion of variation in returns explained in Greece, Mexico, Portugal and Thailand. In Chile, Hong Kong, Malaysia and the Philippines, neither global (inflation rates) nor local variables (inflation rates) were significant. In the same year and using a GARCH approach, **Patro et al. (2002)**, estimated a two-factor model incorporating inflation and dividend yield for the weekly equity index price returns of sixteen European countries using panel data. The findings of their study also revealed that inflation is positively related to stock market risk.

Al-Khazali (2003), investigated the short- and long-term relationship between share price returns, inflation and output for twenty-one emerging markets. He found a negative relationship between real share price returns and the rate of inflation in the short term, with the exception of that in Malaysia. In the long-run, he found a positive relationship between the expected rate of inflation and share price returns.

Lovatt and Parikh (2000), examined the relationships between real share returns and macroeconomic variables (inflation, GDP growth rate and interest rates) for the UK economy for the period 1980 to 1994. They argued for the use of expectation macroeconomic variables in favour of leading values of industrial production. They went on to investigate the unit root properties of the data which showed that much of the data is characterised by the presence of unit root non-stationarity. Furthermore, an ECM test was carried out, revealing a plausible relationship between real share returns and inflation in the UK. **K. Park and Ratti (2000)**, investigated the relationships between inflation, share returns and monetary policy in the US. They used quarterly

data from 1979 to 1982 and employed a VAR model. They found that monetary policy tightens significantly in response to positive shocks to inflation, and that the combined impact on share price returns is negative and volatile.

Ryan (2006), sought to gain a long span perspective on Irish share returns and inflation. He pointed out that a major issue in finance is the behaviour of share returns over long periods as opposed to short horizons. Ryan (2006) used the most extensive time period researched thus far. He utilised annual time series data spanning over two centuries. The findings of his study indicated that real share price returns are independent of expected inflation over the long-run. Furthermore, his findings showed a positive relationship between ex-post long horizon nominal share returns and inflation, in line with the Fisher hypothesis.

In an attempt to study the effect of macroeconomic variables (interest rate, money supply, inflation and government expenditure), and the behaviour of the Kuwait Stock Exchange, Al Mutairi and Al Omar (2007), used monthly time series data during the period 1995 to 2005. They too, used a VAR technique to explain the long-run and short-run relationships. The findings of the study indicated that the macroeconomic variables have a limited impact on the behaviour of the Kuwait Stock Exchange. Their findings further showed that inflation had the highest effect among the macroeconomic variables, responsible for 11% of the variance in share price returns throughout the period under consideration.

Menike (2010), used multiple regressions to study the relationship between the macroeconomy and share returns in Sri Lanka. She used eight macroeconomic variables and the Colombo Stock Exchange as the variables of study. Significantly she found a significant and negative relationship between inflation and share returns, consistent with various other studies (*see* Fama, 1981; Gallagher & Taylor, 2002; Geske & Roll, 1983; Omran & Pointon, 2001)

Kyereboah-Coleman and Agyire-Tettey (2008), examined how macroeconomic indicators affect the performance of stocks. Using the Ghana Stock Exchange (GSE) as a case study, they analysed quarterly time series data spanning the period 1991 to 2005. To ascertain stationarity, the ADF test for unit roots was employed. Furthermore, the Johansen co-integration and ECM techniques were used to determine both short-run and long-run relationships. The findings revealed that inflation rates have an adverse effect on stock market performance and serve as a major hindrance to business growth in Ghana. In addition, while the rate of inflation was found to have a negative effect on share price returns, it takes time for this to take effect due to the presence of a lag. As a result, Kyereboah-Coleman and Agyire-Tettey (2008), suggested that investors benefit from exchange rate losses as a result of domestic currency depreciation.

Bordo et al. (2009), examined the association between inflation, monetary policy and the US share market conditions during the second half of the 20th Century. They

used quarterly time series data from 1953 to 1999 from a hybrid latent variable VAR to establish the impact of inflation on a latent index of share market conditions in the US. The findings revealed that disinflation shocks promote market booms and inflation shocks contribute to busts. Furthermore, inflation shocks elucidate more of the variation in real share prices.

Hussainey and Khanh Ngoc (2009), examined the impact of two US macroeconomic indicators (the interest rate and industrial production) on Vietnamese share prices. They applied a multivariate regression analysis to monthly time series data spanning January 2001 to April 2008. The effect from individual US indicators was analysed first, after which the simultaneous effects were studied. The findings revealed that US macroeconomic fundamentals, and specifically inflation, significantly affects Vietnamese share prices.

More recently, **(Graham, 1996)**, studied the link between inflation, real share returns and monetary policy in the US. He focused on quarterly time series data over two sub-periods, 1950 to 1976 and 1976 to 1982. The findings showed the presence of an unstable and negative relation between the rate of inflation and real share returns prior to 1976, and a positive relation after 1982; the relation was positive in between these years. In addition, **(Graham, 1996)**, suggested that the instability in the relation was a result of a shift from a counter-cyclical to a pro-cyclical monetary policy in 1976, and consequently reverted back to a counter-cyclical policy in 1982.

In studying whether macroeconomic factors matter for share returns, **Benaković and Posedel (2010)**, observed the sensitivity of a share price return as a function of one or more factors by estimating a multifactor model on the Croatian market. The study included fourteen shares on the Croatian capital market from January 2004 to October 2009 and made use of inflation, industrial production, interest rates, and market index as well as oil price as factors. The results show that inflation had the strongest negative relation, and thus had a negative influence.

Ali (2010), investigated the impact of changes in selected macroeconomic variables on share returns on the Dhaka Stock Exchange. A multivariate regression model was used to estimate the relationship. Based on a regression coefficient, they found that inflation had a negative influence on the Dhaka Stock Exchange ALSI price. Furthermore, a lack of Granger causality between share prices and the selected variables revealed evidence of an informational inefficient market.

Using the ADF unit root test for stationarity, the Johansen co-integration test and the Granger causality tests, **Omotor (2010)**, studied the link between share prices and inflation in Nigeria considering monthly and quarterly time series data for the period 1985 to 2008. He employed the CPI as a proxy for the rate of inflation. The results showed that share market returns provide an effective hedge against inflation in Nigeria. In addition, he suggested that the implication of his findings is that investors

on the Nigerian stock market should view equities as long-term holdings against inflation's erosion of purchasing power.

Distinguishing expected and unexpected inflation in their study, (Geetha, Mohidin, Chandran, & Chong, 2011), sought to find the relationship between inflation and share returns in three countries; Malaysia, the US and China. The data-set spanned the period 1994 to 2004. The findings of the study revealed that there is a long-run relationship between expected and unexpected inflation with share returns in all three countries. The findings further indicated that there is no short-run relationship between inflation and share returns in Malaysia and the US.

Furthermore, Izedonmi and Abdullahi (2011), supported the conclusion that inflation does not have a significant influence on share returns. Their approach was to utilise the APT consisting of the Nigerian Stock Exchange and three macroeconomic variables (inflation, exchange rate and market capitalisation) on a monthly basis. The results are broadly consistent with similar studies carried out by (see Burmeister & McElroy, 1988; Günsel & Çukur, 2007)

More recently, Ahmed and Mustafa (2012), also found a negative relationship between real share returns and inflation in Pakistan. Their analytical model is based on the Full Information Maximum Likelihood (FIML). Their results indicate that when the real output (GDP) growth rate is controlled, the negative relationship between real share returns and inflation disappear. Pramod Kumar and Puja (2012), argued for testing the long run equilibrium relationship for inflation and share returns as most investors hold shares over long holding periods. After analysing quarterly time series data from 1994 Q2 to 2011 Q2 and using the Johansen co-integration and Vector Error Correction Model (VECM) techniques, they found a positive relationship between inflation and share returns, consistent with the results of Al-Khazali (2003).

Stulz (1986), provided an equilibrium model to examine the link between asset pricing and expected inflation. The model he presented assumed that expected real returns on common shares were negatively associated with expected inflation. The findings showed that the expected real rate of return on the common share portfolio falls for a given increase in expected inflation, when the increase in expected inflation is caused by an increase in money growth, rather than by a worsening of the investment opportunity set. Furthermore, Stulz (1986), suggested that the implications of the effect of a change in expected inflation on the cross-sectional distribution of the share returns under study explains the observation that shares' returns that co-vary positively with expected inflation may have lower expected returns. The findings are consistent with the results of (see Fama, 1981; Geske & Roll, 1983)

(Sirucek, 2012), focused his paper on the effect, implication, impact and relationship between selected macroeconomic variables (the rate of inflation, interest rates, money supply, PPI, oil price and unemployment) and the wider US indices

(S & P 500 and Dow Jones Industrial Average (DJIA)). He analysed quarterly time series data between 1999 and 2012. Based on the least-squares results of the linear regression model compiled, the model tracking the DJIA was found to be significant. The findings also revealed a negative correlation between the rate of inflation and share prices of the two indices.

James et al. (1985), simultaneously investigated the causal relations among common share returns and macroeconomic factors (real activity, inflation and money supply changes) using a Vector Autoregressive Moving Average (VARMA) model. The empirical results strongly support a reversed causality model, which suggests that changes in share returns result in changes in money supply growth, which in turn impacts the expected inflation.

Using a unit root test based on the formal ADF test procedure, the Johansen-Juselius VAR based co-integration test, and the ECM technique, **Kimani and Mutuku (2013)**, focused on the inflation dynamics of the overall share market performance in Kenya. They studied the performance of the Nairobi Stock Exchange (NSE) 20 share market index, which consists of the top twenty listed shares on the NSE by market capitalisation, using quarterly time series data for the period December 1998 to June 2010. The Johansen-Juselius VAR based co-integration test indicated a co-integrating relationship, showing that there was a negative relationship between inflation and share market performance in Kenya for the period under study. Furthermore, the ECM estimations revealed that 27% of the departure from equilibrium is cleared on a quarterly basis.

Using the Generalised Dickey-Fuller unit root, Johansen co-integration and VAR tests to determine the long-run relationship between the growth rate of the stock index returns on the Tehran Stock Exchange in Iran and a set of macroeconomic variables (inflation rate, money supply, growth rate and exchange rate), **Esmaeili and Gholami (2013)**, analysed quarterly time series data for the period 2002 to 2011. They found a long-run relationship between inflation and share price returns of the Tehran Stock Exchange ALSI. In addition, the relationship between the share price returns and the ALSI was positive.

Michael (2014), empirically studied the relationship between inflation and share market returns using quarterly time series data from January 1992 to December 2010 on the GSE, an emerging stock market in Africa. He employed the ADF unit root test and ADRL approach to co-integration testing. Furthermore, he tested for Granger causality using the ECM technique. The findings show that there is a negative and statistically significant relationship between inflation and share returns in the short-run, with a negative and statistically significant relationship in the long-run. In addition, the findings also revealed a unidirectional causality from inflation to share returns. The implication of this finding was that inflation influences share market returns

towards long-run equilibrium.

In examining the causal (long-run) relations between the Amman Stock Exchange (ASE) in the Jordanian capital markets and selected macroeconomic variables (exports, foreign reserves, interest rates and inflation), [Maghyreh \(2002\)](#), employed the ADF unit root, Johansen co-integration analysis and ECM over monthly time series data for the period between January 1987 and December 2000 into a multivariate regression model. The results indicate that information regarding inflation is reflected in share prices on the Jordanian capital market. More importantly, there was found to be a negative relation between the rate of inflation and share prices.

[Samadi, Bayani, and Ghalandari \(2012\)](#), set out to determine the relationship between the growth rate of long-term share returns and a set of macroeconomic variables such as inflation, growth rate, liquidity, the exchange rate and oil revenues in Iran. In their study, quarterly time series data for the period 1999 to 2009 was analysed. ADF test results indicated the existence of a co-integration relationship between inflation and growth rates of return on share prices.

[Al-Majali and Al-Assaf \(2014\)](#), linked the long-run and short-run relationship between the share market index and main macroeconomic variables performance in Jordan by investigating whether the ASE performance, measured by the ALSI price, is affected by GDP, CPI, credit to the private sector and interest rates. ADF unit root tests, Johansen co-integration tests, VECM, IRF and Variance Decomposition (VD) tests were employed. The findings indicated that there exists a long-run equilibrium relationship between the ASE and the CPI in Jordan. The findings also indicated that there is a unidirectional long-run relationship between the ASE and the CPI.

South African Context

Studies on the link between inflation and share returns in South Africa reveal conflicting results. [Alagidede and Panagiotidis \(2010\)](#), investigated the relationship between the share price and inflation for selected African stock markets. For South Africa, the finding revealed that the elasticity of the share price with respect to the consumer price is 2.264 and that the share price shows a transitory negative response to the consumer price in the short-run and a positive response in the long-run. Hence, shares are a hedge against inflation in the long-run.

Using a multivariate co-integration approach, [Junkin \(2012\)](#), studied the macroeconomic determinants of stock market behaviour in South Africa. He utilised monthly time series data from 1995 to 2010 by applying the Johansen co-integration, IRF and VD testing methodologies. The results reveal that inflation negatively influences the FTSE/JSE ALSI.

[Eita \(2012b\)](#), examined the relationship between inflation and stock market returns in South Africa. Using a VAR technique, his study reveals that stock market returns

and inflation in South Africa are significantly and positively related, in contrast with the study carried out by Junkin (2012). Furthermore, Eita (2012b), states that the positive association between the two variables suggests that shares are a hedge against inflation in South Africa.

2.3.3 Interest Rates and Share Returns

This section discusses previous findings on the link between interest rates and share returns, both on international and South African stock markets.

International Studies

D. Choi and Jen (1991), examine the relation between the expected returns on common shares and short-term interest rates using a two-factor model, that is, the NYSE and the American Stock Exchange (AMEX) share returns. They showed that these expected returns are systematically related to interest rate risk. The results of the study revealed that expected returns are smaller when the interest rate-risk premium is considered than when it is not. This implies that interest rates are a negative factor for expected returns and that a negative relationship exists here.

The relationship between short-term interest rates and share prices plays an important role in determining common share prices. More recently, Campbell and Hamao (1992), studied long-run capital market integration on share returns in the US and Japan. Specifically, they focused their study on the predictability of monthly excess returns on equity portfolios over the domestic short-term interest rate in the US and Japan between the period 1971 Q1 and 1989 Q3. The findings revealed that the interest rate helps in explaining excess share returns in each country. Furthermore, in the 1980s, the US short-term interest rate helps to explain excess Japanese stock market returns. The findings also showed a common movement in expected excess share returns across the two countries. These results are consistent with the findings of Flannery and James (1984).

(Lyng & Zumwalt, 1980), carried out an empirical case study of the interest sensitivity of commercial Bank share price returns using a multi-index approach. They used a two-index regression model consisting of the traditional equity market, as well as a debt market index. The findings revealed that commercial Bank share price returns in the US (which represent the equity market index) exhibited a considerable amount of interest rate sensitivity. Using a sample of actively traded commercial Banks and share savings and loan associations, Flannery and James (1984), examined the relationship between the interest rate sensitivity of common share returns and maturity composition of the firm's nominal contracts in the US. Significantly, the results showed that common share returns are correlated with interest rate changes.

Furthermore, the co-movement of share returns and interest rate changes is positively related to the size of the maturity of difference between the firm's nominal assets and liabilities.

Sweeney and Warga (1986), studied the pricing of interest rate risk with evidence from the US stock markets, specifically the NYSE. They employed the FIML estimation on twenty-five individual companies using the two factor APT model. In it, they used the group of companies' share price returns as the dependent variable and the yield on long-term government bonds as the independent variable. The findings show that empirically, most of the interest-sensitive shares are located in the utility sector. Furthermore, they showed evidence that the interest rate information was priced into the market values of the shares.

Keim and Stambaugh (1986), analysed the relationship between returns of the Treasury bill rate and long-term bonds of various default risks on share price returns of firms of various sizes in the US in 1983. The results showed that returns of small firm shares and low-grade bonds are more highly correlated in January than in the rest of the year. More importantly, they found that the Treasury bill rate and share prices of all the firms are highly correlated.

In explaining the relations between long-term share prices and the term structure of Treasury bills in post-World War II US between January 1950 and November 1983, **Campbell and Shiller (1987)**, used twenty-year Treasury bonds as a proxy for interest rates. The findings indicated that the state of the term structure of interest rates predicts share returns on the NYSE.

Asprem (1989), investigated the relationship between share indices and macroeconomic variables in ten European countries. The results revealed that the impact of interest rates on share price returns was strongest in Germany, the Netherlands, Switzerland and the UK. Furthermore, there was found to be a high degree of similarity of the effects under study in Germany, the Netherlands and Switzerland. **Asprem (1989)**, also found that share prices for most countries were often related to the historic value of interest rates.

Akella and Greenbaum (1992), sought to relate the cross-sectional variation in the sensitivity of Bank share returns to unexpected changes and innovations in interest rates in the US. Using the APT to develop a regression model with data between 1970 and 1990, they sought to gain an improved understanding of the duration transformation undertaken by Banks and its influence on the innovation sensitivity of their share returns. More importantly, the findings of their study indicated a significant negative relation between increases in the rate of interest and share returns of US banks.

In their study on the dynamic linkage between macroeconomic variables and the Japanese Stock Exchange, **Mukherjee and Naka (1995)**, found the presence of

co-integration and a positive relationship between short-term interest rates and share returns in the Japanese stock market. They employed a VECM model.

Sill (1995), in his study on the links between the US macro economy and asset market returns, found that the excess share returns are positively correlated with interest rates. The study further concluded that additional effects on the excess return from interest rates are observed from the closely correlated covariance of the two variables. In addition, the estimation results indicate that interest rates help to explain the behaviour over time of expected excess share returns.

Mok (1993), used Granger causality tests to examine the causality of daily interest rate, exchange rate and share prices in Hong Kong. He analysed the open and closing share market prices for the period 1986 to 1991 and showed that the Hong Kong Dollar is linked to the United States Dollar. This implies that in order to maintain the link, the interest rate would have to adjust, where if the Hong Kong Dollar appreciates, there would be pressure for the Hong Kong interest rate to fall, causing share prices to rise, and vice-versa. The findings indicated a sporadic unidirectional causality from closing share prices to the interest rate, and weak bi-directional causality between share prices and the exchange rate. Furthermore, results suggested that the Hong Kong share market efficiently incorporated much of the interest rate and exchange rate information in its price changes, both at the daily market open as well as at closing.

As a departure from most studies, **Mansur and Elyasiani (1995)**, investigated the sensitivity of Bank equity returns to the level and volatility of interest rates. The results suggest that the long-term interest rate affects Bank equity returns more adversely than short-term interest rates. Bank equity returns have more exposure to long-term interest rates as opposed to short-term rates.

In re-examining the relationship between interest rate changes and bank share returns, **Broussard, Kim, and Limpaphayom (2003)**, studied two different regulatory regimes in Japan. They indicated that there was strict regulation of the Japanese financial system and significant oversight of Bank activities during the first regime (1975 to 1983), while the latter regime (1984 to 1994) represented a period of financial liberalisation and interest rate deregulation. More importantly, the findings showed that interest rate changes negatively impacted Japanese Bank equity returns in the second regime, however not so during the period of heavy regulation. The findings also revealed that most of the short-term interest rate effects were channelled through volatility proxies, whereas the long-term effects were channelled through yield spread and shape effects.

S. Park (1997), focused on the rationality of negative share price responses to strong macroeconomic activity in the US. He used monthly, quarterly and annual time series data for the period between 1956 and 1995 to examine the effects of the macroeconomic variables on share returns and future cash flows. The findings

indicated that increases in the real rate of interest and employment growth showed the strongest negative effect on share returns in the US. Furthermore, comparing the two macroeconomic variables, it was clear that employment growth was related more negatively with future corporate cash flows. [S. Park \(1997\)](#), concluded that the negative share price responses to interest rates were however rational.

In the UK, [Dinenis and Staikouras \(1998\)](#), examined the impact of interest rate changes on the common share returns of portfolios of financial institutions, that is, Banks, insurance companies, investment trusts and property investment companies. They used a two-index model to test the effect of both current and unanticipated interest rate changes. Furthermore, their study made use of a wide sample of non-financial companies for comparison purposes. The results of the study showed that a significant negative relationship exists in the UK between common share returns and changes in the interest rate. In addition, common share returns and variability of interest rates were related with a significant positive coefficient.

In investigating the causal relations among share returns and macroeconomic variables in a small, open economy, [Gjerde and Sættem \(1999\)](#), sought to draw important results by utilising a multivariate VAR technique on European data, specifically the Norwegian share market. In line with findings on studies conducted in the US and Japanese share markets, the findings showed that real interest rate changes affect share returns in Norway.

[Muradoglu, Taskin, and Bigan \(2000\)](#), sought to investigate the causality relationship between share prices and macroeconomic variables in emerging markets. They followed [Mukherjee and Naka \(1995\)](#), in their selection of the following macroeconomic variables; industrial production, inflation, interest rates and oil prices. The findings of the study indicated a unidirectional relationship with the direction running from interest rates to share returns. Furthermore, they suggested that the interest rates in the emerging markets under study were influential on share prices through their effect on future cash flows and the rate at which they are discounted—a conclusion also drawn by [Chen et al. \(1986\)](#), and [Fama \(1981\)](#).

[Hondroyannis and Papapetrou \(2001\)](#), studied the dynamic interactions among indicators of economic activity (industrial production, interest rate, exchange rate, the performance of the foreign stock market and oil prices) and share returns to examine whether economic activity movements affect the performance of the Greece Stock market. The empirical evidence suggests that interest rate changes explain share price movements and have a significant impact on macroeconomic activity in the short run. Furthermore, the results indicate that foreign stock market price changes only partially explain domestic stock market price movements.

[Maysami et al. \(2005\)](#), investigated the relationship between macroeconomic variables and Singapore share returns using a co-integration test. The study revealed

that short- and long-term interest rates have significant positive and negative relations respectively within the Singapore share market. This is consistent with the findings of [Bulmash and Trivoli \(1991\)](#).

[Al-Sharkas et al. \(2004\)](#), investigated the relationship between macroeconomic factors and share prices on the stock market in Jordan. He utilised an ECM to determine the impact of the selected variables (real economic activity, money supply, inflation and interest rate) on the ASE. The results show that the share returns and macroeconomic variables have a long-run equilibrium relationship. Further, the study revealed that the relationship between interest rates and the share returns on the ASE is negative.

[Gunasekarage, Piseditasalasai, and Power \(2004\)](#), examined the influence of money supply, the Treasury bill rate (as a proxy for interest rates), CPI (as a proxy for inflation) and the exchange rate on the Colombo ALSI price in Sri Lanka. They analysed monthly data for a seventeen-year period (January 1985 to December 2001) employing the ADF unit root test, Johansen co-integration test, a VECM, IRFs and VD tests. The VECM results indicated that the lagged values of the Treasury bill rate have a significant influence on the Colombo ALSI price. Furthermore, the Treasury bill rate demonstrates the strongest influence on the index price returns when compared to other variables.

[Xu \(2007\)](#), studied interest rate uncertainty and share market volatility in Singapore. He suggested that uncertainty of the interest rate plays a more important role in explaining the time varying of volatility than the volatility of the interest rate itself. The results indicate that share market volatility increases with the uncertainty of the interest rate. Furthermore, the relationship between interest uncertainty and share volatility is stronger for small companies than it is for big companies.

[Liu and Shrestha \(2008\)](#), studied the relationship between the Chinese share market indices and a set of macroeconomic variables (money supply, industrial production, inflation, exchange rate and interest rates) using heteroscedastic co-integration analysis to control for time-varying volatility. The findings showed that a co-integrating relationship exists between share prices and the interest rate in the highly speculative Chinese stock market. Furthermore, the findings also showed that stock market performance in China is positively related to that of the macro-economy in the long-run.

[Majid and Yusof \(2009\)](#), employed an auto-regressive distributed lag model approach to co-integration in investigating the long-run relationship between Islamic share prices and macroeconomic variables in Malaysia in the post 1997 financial crisis period. More specifically, they examined how the interest rate, exchange rate, M3 money supply, Treasury bill rate, and Federal fund rate impact price returns on the Kuala Lumpur Stock Index. They found that when the interest rate was raised either

domestically or internationally, Muslim investors would buy more Shari'ah compliant shares, thereby escalating the Islamic share prices.

A study conducted by [Pal and Mittal \(2011\)](#), examined the long-run relationship between the Indian capital markets and key macroeconomic variables using quarterly time series data spanning the period January 1995 to December 2008. They found a positive relationship between the interest rate and the Indian capital markets but revealed that the impact is not significant. The ADF unit root test, the Johansen co-integration and the ECM techniques were applied to establish statistical dynamics.

[Asaolu and Ogunmuyiwa \(2011\)](#), studied the impact of macroeconomic variables on the average share price movement to determine whether changes in macroeconomic variables explain movements in share prices in Nigeria. They employed the ADF test, the Granger causality test, Johansen co-integration and ECM on time series data from 1986 to 2007. The findings revealed that a weak relationship exists between the average share price movements and interest rates in Nigeria.

[Tangjitprom \(2011\)](#), examined the importance of macroeconomic factors to determine the performance of emerging stock markets with evidence from Thailand. Furthermore, she examined the lead-lag relationship of macroeconomic factors and share returns by the VAR model and the Granger causality test using a regression analysis. The results show that macroeconomic variables can explain Thailand stock market returns significantly after adjusting for lags of data availability. The VD technique revealed that the interest rate is the most important macroeconomic variable that explains the variance in share returns.

In Indonesia, [Yogaswari, Nugroho, and Astuti \(2012\)](#), attempted to find evidence on the effect that three macroeconomic variables (inflation, interest rate and exchange rate) have on share price volatility on the Jakarta Composite Index (JCI) in Indonesia. They gathered monthly time series data over the period January 2007 to December 2011. Multiple regression analysis was applied to construct a quantitative model showing the relationship between macroeconomic variables and share prices. The result of their study indicates that a significant relationship existed between interest rates and the JCI share price returns.

[Quadir \(2012\)](#), used an Autoregressive Integrated Moving Average (ARIMA) model on the basis of monthly time series data for the period January 2007 to February 2007 to investigate the effects of the Treasury bill interest rate on share returns on the Dhaka Stock Exchange. He took overall market returns as the dependent variable to be affected by changes in the macroeconomic variables. The findings indicate that, though the ARIMA model found a positive relationship between the Treasury bill interest rate and the share market returns, the coefficients were statistically insignificant.

[Masduzzaman \(2012\)](#), investigated the long-run relationship and short-run dynamics among macroeconomic fundamentals and share returns in Germany and the

UK. He examined each case individually by applying the Johansen co-integration, ECM, VD and IRF analysis, incorporating the CPI, interest rates, exchange rates, money supply and industrial production between February 1999 and January 2011. The Johansen co-integration tests indicated that the UK and German share returns and interest rates are co-integrated. The findings also revealed that there are both short-run and long-run causal relationships between share prices and interest rates, implying short-term adjustments and long-run dynamics.

Sohail and Hussain (2009), explored the nature and extent of the relationship between macroeconomic policies and stock returns in Pakistan. The intent of the study was to investigate the response of share prices to macroeconomic variables (industrial production index, CPI, money supply, three-month Treasury-bill rate and exchange rate) on the three share market indices, that is, Islamabad Stock Exchange 10 Index, Lahore Stock Exchange 25 Index, and the Karachi Stock Exchange Index. They applied a Johansen co-integration technique to explore the long-run relationships. The results showed that Treasury bills were both positively and negatively related to the three stock market indices.

Nkoro and Uko (2013), examined the impact of six domestic macroeconomic variables on Nigeria's share market returns using a GARCH model and annual data from 1985 to 2009. They investigated the impact of inflation, government expenditure, index of manufacturing output, interest rate, oil price and exchange rate. The results revealed that of the six macroeconomic variables studied, interest rates exert a strong, significant influence on share returns.

Muktadir-Al-Mukit (2013), investigated the effects of interest rates on share market performance by using monthly time series data for the economy of Bangladesh over the period 1991 to 2012. He employed a number of econometric techniques including the Johansen co-integration, the ECM, IRF and VDs tests. The findings revealed a significant long-run relationship between the interest rate and share returns. The co-integration results reveal that in the long-run, a 1% increase in the interest rate causes a 13.2% decrease in the Bangladesh stock market. Furthermore, the estimated ECM coefficient indicates that 0.12% in the deviation of share returns is corrected in the short-run, whereas the IRF suggests a negative relationship between the interest rate and the share price returns. The VD indicates that 99.57% of the variation in share market returns may be attributed to its own shock, implying that share market returns are largely independent of other variables in the system **Muktadir-Al-Mukit (2013)**. In addition, the Granger causality results show the presence of a unidirectional causality from interest rates to the market index.

In New Zealand, **Hsieh (2013)**, examined the effects of selected macroeconomic variables on the New Zealand stock market. He applied the ADF test and the EGARCH model to a sample range from January 1994 to December 2010. The findings showed

that New Zealand's stock market index is negatively influenced by the domestic real interest rate, and positively influenced by the world interest rate.

Hassan, Sangmi, et al. (2013), used inflation, exchange rate, industrial production, money supply, gold price and the interest rate as the independent variables and the Bombay Stock Exchange BSE 100 Index as the dependent variable, gathering monthly time series data between April 2008 and June 2012. They applied a multiple regression analysis to specify a model. Their results indicated that a significant relationship exists between the interest rate and share prices in India.

Alam, Uddin, et al. (2009), investigated the role of the real rate of interest and firm characteristics when explaining share returns in the big four South East Asian countries, Malaysia, Indonesia, Singapore and Thailand. He employed a factors model to analyse two time intervals serving as time periods pre and post the Global Financial Crisis of 2007. Period A was from July 2003 to June 2007, whereas period B from July 2007 to June 2011. The findings revealed that the significance of the relationship between the real rate of interest and portfolio share returns was not consistent among the countries for both periods. Alam et al. (2009), further suggested that the findings were highly dependent on the portfolio, country as well as the period.

Abdelbaki (2013), studied how monetary policy through interest rates, affects the stock market in Bahrain. He investigated the relationship between macroeconomic variables and the Bahrain stock market and used the Autoregressive Distributed Lag model. An important finding was that the development of a financial market is closely related to the overall development of the national economy. Expansionary monetary policy raises money supply, decreases interest rates and raises investment in shares and share prices. Furthermore, a similar effect can be brought about by fiscal policy but the effect will go directly through interest rates and investment.

Issahaku, Ustarz, and Domanban (2013), employed monthly time series data between January 1995 and December 2010 to examine the existence of causality between macroeconomic variables and share market returns in Ghana. The VECM was used to establish the long-run and short-run relationships between share market performance and macroeconomic variables. IRFs and forecast error VD techniques were used to assess the stability of the relationships over time. They found that in the short-run, a significant relationship exists between share returns and the interest rate. However, no significant relationship was found to exist in the long-run.

Giri and Joshi (2017), applied unit root tests and the multivariate co-integration test and Granger causality test to the Bombay Stock Exchange (BSE) Sensitivity Index and selected macroeconomic indicators in their empirical analysis of the relationship between share market indices and macroeconomic variables in India. They selected the 91 days Treasury bill rate, foreign institutional investors, reserve money, narrow M1 and broad M3 money supply, gold price, oil price, index of industrial production,

level of foreign exchange reserve and foreign exchange rate as their variables and used monthly data from April 1994 to December 2012. The results revealed that the Treasury bill rate and the share market index are co-integrated. In addition, the Granger causality test showed that there exists a unidirectional causal relationship between the Treasury bill rate and the BSE Sensitivity Index.

Employing the ECM, ADF and co-integration analyses on quarterly time series data, [Kpanie, Vivian, and Sare \(2014\)](#), examined the dynamic connection between the Treasury bill rate (proxy for interest rate), inflation rate, exchange rate and oil prices and the stock market performance in Ghana. The findings of the study showed that interest rates are statistically significant at 1% in explaining their influence on the GSE. The findings of the work also revealed that there is a longrun relationship between the interest rate and the GSE share prices.

South African Context

Limited literature exists concerning the link between interest rates and share returns in South Africa. In their study of the relationship between the JSE ALSI and various macroeconomic factors, namely, GDP, long-term and short-term interest rates, and the gold price, [Moolman and Du Toit \(2005\)](#), found that short-term share price fluctuations are determined by interest rates. They used the Johansen co-integration and ECM techniques to analyse the panel data.

Using monthly time series data from January 1988 to March 2003, [Alam et al. \(2009\)](#), examined the impact of interest rates on share market indices in fifteen Sub-Saharan African countries. Their study sought evidence supporting the existence of market efficiency through both time series and panel regressions. The results showed that in South Africa, a change in the interest rate has a significant and negative relationship with changes in index price returns.

Also [Mangani \(2009\)](#) investigated macroeconomic effects on individual JSE shares on the JSE Securities Exchange using weekly data from 1983 to 2002. A GARCH framework was used to investigate the effects of discount rate changes on individual shares. He found that the discount rate was clearly important in describing the dynamics of mean returns.

[Hancocks \(2011\)](#), studied the extent to which selected macroeconomic variables influenced share prices on the JSE. His study employed the Johansen co-integration and VECM techniques to analyse time series data from July 1996 to December 2008. The VECM results found that both long and short-run interest rates had an influence on share prices. He also found that it is important to examine each sector of the stock market separately to capture the distinguishing effects on each sector.

2.3.4 Foreign Exchange Rate and Share Returns

This section discusses previous findings on the link between the foreign exchange rate and share returns, both on international and South African stock markets.

International Studies

Tursoy, Gonsel, and Rjoub (2008), state that exchange rates play an important role in capital mobility because of the increase in economic globalisation. Therefore, as sales of cash flow of businesses that are directly or indirectly affected by international activities change "in the value", the exchange rate is an important risk factor from some investors' point of view **Tursoy et al. (2008)**.

There have been several studies conducted on the relationship between the foreign exchange rate and share returns. An early study by **(Jorion, 1990)**, investigated the effect of exchange rate changes on US multinational companies. Of importance, the findings present evidence of a negative relationship between local exchange rates and share returns of US multinationals. Furthermore, the co-movement between share returns and the value of the dollar was found to be positively related to the percentage of foreign operations of US multinationals.

J. J. Choi, Elyasiani, and Kopecky (1992), estimated a multi-factor model of Bank share returns, incorporating exchange rate factors. They found that exchange rate innovations were significantly and negatively related to Bank share returns prior to October 1979. Furthermore, they also showed that after that date, the relation became significantly positive. They suggested that the explanation for this result lies with the observation that between 1979 and 1980, the balance sheet of the banking system showed a decline from a positive net position in several major foreign currencies to a negative position that became large in the mid 1980's.

Chamberlain, Howe, and Popper (1997), investigated the exchange rate exposure of US and Japanese banking companies. They used daily data to construct estimates of exchange rate sensitivity on the equity returns of US Banks and compared them to those of Japanese Banks. They found that the share returns of a significant fraction of US companies move with the exchange rate, while few of the Japanese returns appear to be sensitive to exchange rate changes. They attributed the relative strength of their results to the use of daily data. They also attributed the difference between exchange rate sensitivities of Japanese and US banking companies to differences in the structure of ownership, securities and derivatives laws, supervision, the extent of foreign ownership, and in hedging policies.

Kwon and Shin (1999), studied whether macroeconomic variables in South Korea could explain share market returns by using Johansen co-integration and Granger causality tests obtained from a VECM. The findings of their study revealed that the

South Korean stock market reflects macroeconomic variables on share indices. More importantly, the Johansen co-integration test and VECM illustrated that share indices are co-integrated with the exchange rate, which provided direct long-run equilibrium with each share market index under study. In addition, the share market indices were found not to be a leading indicator for macroeconomic variables, contradicting previous findings that the stock market rationally signals changes to macroeconomic variables.

M. H. Ibrahim and Yusoff (2001), analysed dynamic interactions among the exchange rate and equity prices for the Malaysian stock exchange using time series techniques of co-integration and VAR. They found a negative relationship between the exchange rate and the Malaysian financial market. To gauge the strength of the interactions among the variables, they made use of VDs and IRF. Furthermore, they cautioned monetary authorities to be careful in implementing exchange rate policies as they may have adverse repercussions on the Malaysian financial market.

Tsoukalas (2003), examined the relationship between macroeconomic factors and share prices in the emerging Cypriot equity market. He found that the exchange rate and share prices in Cyprus are strongly correlated. Furthermore, he suggested that the findings be viewed against the backdrop that the Cyprus economy depends on tourism, which is a large source of foreign exchange.

In analysing the dynamic links between share prices and four macroeconomic variables for the case of the Kuala Lumpur Stock Index in Malaysia, **M. H. Ibrahim and Aziz (2003)**, used the Johansen co-integration test and VAR techniques through rolling sub-samples to draw statistical dynamics. The study documents a significant long-run and substantial short-run negative association between the exchange rate and share prices. In addition, the study documents that the interactions between the exchange rate and share prices are unstable.

Stavarek et al. (2004), investigated the nature of share prices and exchange rates in the European Union (EU) and the US. He examined the causal relationships among share prices and foreign exchange rates in four old EU member countries (Austria, France, Germany and the UK), four new EU member countries (Czech Republic, Hungary, Poland and Slovakia) and the US. **Stavarek et al. (2004)**, employed monthly time series data from 1970 to 2003 to ascertain the short-run and long-run causalities between the share prices and exchange rates. **Stavarek et al. (2004)**, also endeavoured to answer the question of whether the links between the analysed macroeconomic variables were of similar intensity and direction in old and new EU member countries, and whether the relationships have changed. The results revealed a much stronger causality in countries with developed capital and foreign exchange markets, that is, the old EU member countries and the US. The results also indicated more powerful long-run and short-run causal relations during the 1993 to 2003 period than during

1970 to 1992. Furthermore, the causalities were unidirectional from share prices and exchange rates. In addition, the relations between the share prices and exchange rates were stronger when the real effective exchange rate was used in favour of the nominal effective exchange rate.

While examining if there is a link between the share market and exchange rates that might explain fluctuations in either market, [Dimitrova \(2005\)](#), used a multivariate process that allowed for simultaneous equilibrium in the goods, money, foreign exchange and share markets in the US and the UK between January 1990 and August 2004. She found that an increase in the exchange rate (depreciation) causes a decline in current share prices. In Japan, depreciation of the exchange rate is encouraged to make goods and share prices more attractive for foreign investors and to increase exports and foreign portfolio investments.

[Erdem et al. \(2005\)](#), focused their study on the volatility spill-over's of macroeconomic variables on the Istanbul Stock Exchange (ISE) Index and the INDI. They observed that there is a significant and positive volatility spill-over from the exchange rate to the two ISE indices under investigation. The results obtained were consistent with the findings of (see [Chopin & Zhong, 2001](#); [Fama, 1990](#); [Rapach, 2001](#); [Wongbangpo & Sharma, 2002](#)) who all found a negative relationship between the exchange rates and share returns.

[Erdoğan and Özlale \(2005\)](#), analysed the effects of macroeconomic dynamics on share returns on the Turkish share market, specifically the ISE. Referencing [Erdoğan and Özlale \(2005\)](#), they used a time varying parameter model with GARCH specification which allowed them to observe the varying effects of different macroeconomic variables on share returns between 1994 and 2004. Specifically focusing on the foreign exchange rate, the findings indicated that the financial crisis of 1994 led to a structural break on the impact of exchange rate developments on stock exchange performance, coupled with unsuccessful stabilisation attempts.

[Lael Joseph and Vezos \(2006\)](#) showed that the degree of sensitivity of share returns to interest rates in the UK is not very pronounced, despite their use of daily high frequency time series data to provide greater evidence of exposure sensitivity. The purpose of their study was to investigate the impact of changes in the foreign exchange rate and interest rate on US Banks' share returns. An EGARCH model was employed to account for the ARCH effects in daily returns. To measure sensitivity, the standard OLS estimation method was used. Their findings showed that ARCH effects do impact on measures of sensitivity.

[Hyde \(2007\)](#), studied the response of industry share returns to three types of risk, namely; market risk, exchange rate risk and interest rate risk. He investigated the sensitivity of share returns at the sector level to market, exchange rate and interest rate shocks in the four major European economies of France, Germany, Italy and the UK.

The findings of his study revealed that sector returns in these countries have great exposure to the market. More importantly, the findings also indicated that there exist significant levels of exposure to interest rate risk in France and Germany, however, not so much in Italy and the UK.

Hasan and Nasir (2008), explored the relationship between five macroeconomic variables and equity prices on the Karachi Stock Exchange for the period June 1998 to June 2008 by using an Auto Regressive Distributive Lag bounds testing procedure. They found that the index series were not stationary at level but the first differences of the logarithmic transformations of the series are stationary. The coefficient of the ECM was found to be negative and statistically significant. Results of the bounds testing procedure coefficients revealed that exchange rates have a significant long-run effect on equity prices.

Using the Box-Jenkins ARIMA model, **Gay Jr et al. (2011)**, researched the time series relationship between stock market index prices and the macroeconomic variables of exchange rate and oil price for Brazil, Russia, India and China. There was no significant relationship found between exchange rate and stock market index prices of either country. In addition, the findings also revealed no significant relationship between present and past stock market returns, suggesting the markets of Brazil, Russia, India and China exhibit the weak-form of market efficiency.

Kandir (2008), investigated the role of macroeconomic factors in explaining Turkish share returns. He employed a regression model to test the relationship between share price returns of all non-financial companies listed on the ISE and seven macroeconomic variables, namely; growth rate of industrial production index, change in CPI, the growth rate of international crude oil prices, returns on the MSCI world equity index, exchange rates, interest rates, and money supply for the period July 1997 to June 2005. The empirical findings showed that the exchange rate significantly affects the price returns.

According to **Sariannidis et al. (2010)**, who used a GARCH model employing monthly log prices from December 1993 to October 2007 to examine the relationship between the Dow Jones Sustainability Index-World (DJSI-World) returns to ten-year bond returns and the Yen/USD exchange rate, the total return of the DJSI-World is affected by the Yen/USD exchange rate. The results also showed that the relationship of the Yen/USD exchange rate and the DJSI-World returns is a negative relationship with a one month delay.

Muhammad, Hussain, Ali, and Jalil (2009), empirically explored the correlation among the macroeconomic variables and share prices of the Karachi Stock Exchange in Pakistan. They considered quarterly data for the foreign exchange rate, foreign exchange reserve, industrial production index and broad money M2 supply from the period June 1986 to June 2008. The results show that after reforms in 1991, the

influence of the external factors (foreign exchange rate and foreign exchange reserve) significantly affected share prices, while the internal variables insignificantly affected the share prices in Pakistan.

A study was conducted by [Rahman and Uddin \(2009\)](#), on the interaction between share prices and exchange rates in Bangladesh, India and Pakistan, using the Johansen co-integration and Granger causality tests with data spanning January 2003 to June 2008. The co-integration test results showed that exchange rates do not influence share prices and vice-versa. The study also showed that there is no linear relationship between share prices and exchange rates.

In examining the impact of several macroeconomic variables on the Dow Jones Sustainability Index and Dow Jones Wilshire 5000, [Sariannidis et al. \(2010\)](#), showed that changes in the Yen/USD exchange rate negatively affects the share returns of the US stock market. The authors used a GARCH model with monthly data for the period beginning January 2000 to January 2008. Furthermore, the study concluded that the Yen/USD exchange rate can be classified as a destabilising factor for the sustainability index.

[L. Wang and XU \(2010\)](#), showed that the exchange rate has an increasingly big impact on China's stock index, especially after the reform of the Renminbi (RMB)/USD exchange rate. They established a multi-linear regression model by combining the share index and the exchange rate, interest rate and CPI. They found that the RMB/USD exchange rate changes in the same direction as the Shanghai Composite Index, therefore, when the exchange rate changes, the Shanghai Composite Index changes in the same direction. More specifically, when the exchange rate rose by one unit, the Shanghai Composite Index rose 1.384 percentage points.

[Kutty \(2010\)](#), examined the relationship between share prices and exchange rates in the Mexican share markets. He employed the ADF unit root test and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test for stationarity, the Johansen co-integration test, as well as the ECM technique and Granger causality test using a VAR model to establish long-run relationships. The findings of the Granger causality test revealed that share prices lead exchange rates in the short-run but that there exists no long-run relationship between share prices and exchange rates in Mexico. This contradicts many studies which have found a long-run relationship between the two variables. Furthermore, [Kutty \(2010\)](#), suggested that policy makers of the Mexican economy should be cautious in implementing stock market regulations as they have short-term implications on exchange rates.

[G. Wang and Lim \(2010\)](#), examined the impact of macroeconomic variables on sector share returns in Australia. The study made use of monthly index prices of the Australian Stock Exchange (ASX) and eight time series macroeconomic factors (the ASX P/E ratio, the relationship between the Australian, New Zealand and US

Dollars, the ASX bond index, the dividend yield of the ASX200 Index, ASX200 market capitalisation, the interbank interest rate, the Treasury bill yield and the unemployment rate). Data from March 2000 to December 2007 was included. The results showed that the exchange rate is an important determinant of ASX sector returns.

Batori, Tsoukalas, and Miranda (2010), employed co-integration analysis, VECM and VAR modelling, as well as the Granger causality test to determine the effect of exchange rates on the share market indexes for a group of EU countries using daily time series data from 1999 to 2009. The countries included were the Czech Republic, Hungary, Poland, Denmark, Romania, Sweden and the UK. The findings revealed that for the Czech Republic, Hungary and Poland, the Granger causality tests suggested that exchange rates influence changes in the share market and vice-versa, implying bidirectional causality. For Denmark they found that exchange rates cause changes in the share index prices only. Furthermore, the exchange rate was found not to impact changes in the share index prices of Romania and Sweden. However, for the UK, they found that the exchange rate and index price do not influence each other. They found that foreign portfolio investment is the transmitting mechanism for the influence of the exchange rate on the stock markets.

Srinivasan (2011), studied the relationship between selected macroeconomic variables and the share market return. He found there to be a significant short run relationship between the exchange rate and US share market index price. The study revealed that the exchange rate can explain short-run movements in the US share market index price and vice-versa.

Wickremasinghe (2011), focused his study on the Sri Lankan Stock Exchange and the macroeconomy. His study addressed several methodological weaknesses in relation to unit root and co-integration tests which prior studies in the area of the study overlooked. He found a causal relationship between the share market and exchange rate. This implied that the share prices on the Sri Lankan share market were able to explain the forecast variance of the USD exchange rate.

Sayilgan, Süslü, et al. (2011), analysed the impact of macroeconomic factors on share returns in Turkey and emerging market economies using panel data. The study focused on quarterly data of exchange rates, GDP, inflation rates and the S & P 500 share market index prices for the period 1996 to 2006. The empirical results reveal that share returns in all economies under study are affected by exchange rates in a statistically significant manner.

Zia and Rahman (2011), analysed the dynamic relationship between the exchange rate and share market index in Pakistan using monthly time series data from January 1995 to January 2010. This constitutes 181 data points. In addition, they employed the ADF unit root test and the Engle-Granger co-integration test to establish the short-run

and long-run relationships between the exchange rate and the Karachi Stock Exchange 100 Index. Contradicting most studies, the findings indicated no causal relationship. The authors attributed this result to the unstable political environment in Pakistan.

Hussin et al. (2012), used monthly data from April 1999 to October 2007 in observing the relationship between the Kuala Lumpur Syariah Index and five macroeconomic variables; industrial production, CPI, M3 aggregate money supply, Islamic inter-bank rate and the exchange rate. They applied an estimation of VAR to the research model developed and found that Islamic stock prices are co-integrated with the exchange rate of the Malaysian Ringgit/USD.

Zhu (2012), studied the impact of macroeconomic factors on returns in the energy sector in the Shanghai stock exchange using data for the period beginning January 2005 to December 2011 without missing any monthly observations. Companies were selected from the Shanghai Stock Exchange as samples to present the energy industry. The findings revealed that the exchange rate has effects on the share price returns of the energy sector in the Shanghai Stock Market.

Following on from a study by Muhammad et al. (2009), Hussain, Aamir, Rasool, Fayyaz, and Mumtaz (2012), studied the impact of macroeconomic variables on share prices in Pakistan. The study focused on the short-run and long-run causal relationship between the variables and the Karachi Stock Exchange. The exchange rate, foreign exchange reserves, interest rates, imports and the money supply were used as independent variables, whereas the Karachi ALSI was the dependent variable. Their study made use of four tests: ADF unit root test, Johansen co-integration test, VECM and Granger causality test. The findings revealed the presence of a long-run association between the exchange rate and share prices. Furthermore, they found that the exchange rate showed a positive and significant relationship with share prices. In addition, only the first Error Correction Term (ECT) was significant and indicated short-term adjustments towards equilibrium.

Kuwornu (2012), employed monthly data from January 1992 to December 2008 to investigate the effect of four macroeconomic variables; CPI (as proxy for inflation), crude oil price, exchange rate and 91-day Treasury bill rate (as proxy for interest rates) on the Ghanaian share market returns using the Johansen multivariate co-integration procedure. He found that there is co-integration between the exchange rate and share returns in Ghana, indicating the presence of a long run equilibrium relationship. Furthermore, the results reveal that the residual value of 0.785548 of the ECM indicates that 79% of the deviations in share returns are corrected in the short-run.

Hassan and Al refai(2012), regressed four macroeconomic variables on share returns indirectly by measuring the effects of the variables on the Jordan share market index. The conclusion drawn from this study was that there was a negative correlation

between the foreign exchange rate and share prices. This conclusion complements what was found by Kim (2003).

Later in the same year, Nirmalasari and Soekamo (2012), focused on several macroeconomic factors that may affect the return of share indices in Indonesia, and more specifically on how big the influence of these factors on the movement of share prices was. They used the JCI as a sample index from January 2001 to December 2009 and a GARCH model to calculate the collected data. They found that there was a significant correlation between the exchange rate and share returns in Indonesia in the period. In addition, the growth of the exchange rate could explain JCI returns of 12 percent.

Hsing (2013), tested the relationship between the share market and macroeconomic factors in Japan. A significant finding of the study was that there was strong evidence that the Japanese share market index is positively related with the nominal effective exchange rate. Further, it was found that an initial appreciation of the Japanese Yen would cause the share market index to rise whereas a further appreciation of the Japanese Yen beyond a certain critical value would reduce the Japanese share market index. The study revealed a non-linear relationship.

By using a regression analysis, S. Singh, Tripathi, and Parashar (2013), examined the primary macroeconomic factors (exchange rate and wholesale price index) responsible for affecting share price returns on the National Stock Exchange in India. Furthermore, their paper investigated the relative influence of the factors affecting the National Stock Exchange by categorising them. The results of the study suggested that the values of the exchange rate significantly affect the performance of the Nifty Index.

To examine the effect of macroeconomic variables on the share price movement in the Indian Stock Market, Hassan et al. (2013), used six variables of the macroeconomy (inflation, exchange rate, industrial production, money supply, the gold price and interest rates) as independent variables and the Nifty and BSE 100 prices as the dependent variables. Monthly time series were gathered from April 2008 to June 2012. The results of their study indicated that share returns of the Nifty and BSE 100 are negatively impacted by exchange rates.

The study by Kalyanaraman and Tuwajri (2014), was conducted using the S& P 500 as a proxy for global share prices and the local Saudi ALSI. The work examined if there exists a long-run relationship between five macroeconomic variables (CPI, industrial output, money supply, exchange rate and oil prices) and the index share prices. Time series analysis was used on monthly data from January 1994 to June 2013. Application of the Johansen co-integration tests found the existence of a long-run relationship among the chosen variables.

Using a Johansen multivariate co-integration approach and VECM, M. Ibrahim and

Musah (2014), found that exchange rates do not only explain a significant proportion of the variance error of stock returns in Ghana, but that their effects persist over a long period. Their study relied on more recent data, spanning September 2000 to September 2010. Furthermore, their Granger causality test could not establish causality from any direction between macroeconomic variables and stock market returns on the Accra Stock Exchange.

South African Context

The relationship between share prices and the foreign exchange rate has also been studied in South Africa. In their study on modelling stock returns in the South African Stock Exchange, Bonga-Bonga and Makakabule (2010), found that there is a significant relationship between exchange rates and share returns. They used a non-linear Smooth Transition Regression (STR) model to account for the smooth asymmetric response of stock returns from economic variables.

Employing an Augmented Autoregressive General Autoregressive Conditional Heterodestacity (AR-GARCH) model, Chinzara et al. (2010), examined the relationship between industrial production, CPI, broad M3 money supply, the exchange rate, oil price and gold price, and the stock market. The study further examined whether financial crises influence the relationship between macroeconomic volatility and stock market volatility. The results revealed that there are positive volatility spill-over's from the exchange rate to the stock market.

Mlambo, Maredza, and Sibanda (2013), used a GARCH model to assess the effects of exchange rate volatility on the JSE. They employed monthly South African data for the period June 2000 to December 2010. Their findings confirmed a very weak relationship between currency volatility and the stock market. Furthermore, they concluded that the weak relationship between currency volatility and the stock market suggests that the JSE can be marketed as a safe market for foreign investors, however, investors and portfolio managers still need to monitor the developments between these two variables.

Using a co-integration and VECM test, Muzindutsi and Sekhampu (2013), examined the relationship between socially responsible investment and macroeconomic stability in South Africa and found that the inflation rate was not significant in predicting short-run changes in the Social Responsible Investment Index. The study further concluded that the exchange rate is significant in explaining the behaviour of the index in the long-run.

2.4 Conclusion

The literature on the link between macroeconomic variables and share returns is abundant. Most of it focused on the relationship between macroeconomic variables and the broad share market index, composed of different economic sectors. The present study focuses on industrial shares to understand unique relationships between this economic sector and the selected macroeconomic variables.

The international empirical evidence on the relationship between GDP and share returns revealed that there is a positive relationship. South African studies have also found that there is not only a positive relationship between GDP and share returns, but that this positive relationship is significant. Moreover, the relationship between inflation and various stock indexes on developed stock markets were generally found to have a negative relationship. However, a South African study by [Junkin \(2012\)](#), found a negative relationship between inflation and the ALSI in the short-run, but a positive relationship in the long-run. Using a VAR research technique and in contrast to the results of (*see* [Eita, 2012a](#); [Junkin, 2012](#)), revealed that stock market returns and inflation in South Africa are significantly and positively related. Furthermore, he stated that the positive association between the two variables suggests that shares are a hedge against inflation in South Africa.

Most international studies in the US and Asia revealed that stock prices and returns can be explained by interest rates. Conflicting results were found across different markets as well as by time horizons. Several studies found a positive relationship between share prices and short-term interest rates, with a negative relationship between share prices and long-term interest rates. Other studies found a negative relationship in the short-term and a positive relationship in the long-term. Notably, the majority of the studies adopted a multi-index approach using the APT. In investigating the relationship between exchange rates and the share markets in Europe, [Batori et al. \(2010\)](#), found that for the Czech Republic, Hungary and Poland, the Granger causality tests suggested that exchange rates influence changes in the share market and vice-versa, whereas for Denmark they found that exchange rates cause changes in the share index prices only. In the UK, they found that the exchange rate and index price do not influence each other. Studies conducted in South Africa produced conflicting results. [Bonga-Bonga and Makakabule \(2010\)](#), used a non-linear STR model and found a significant relationship between exchange rates and the aggregate stock market, whereas [Mlambo et al. \(2013\)](#), adopted a GARCH model and found a very weak relationship between currency volatility and the South African stock market for the period June 2000 to December 2010.

Chapter 3

South African Industrial Sector

3.1 Introduction

In this chapter, the industrial sector in South Africa is introduced. A background to the FTSE/JSE INDI 25 is also provided and particulars concerning its size, composition and importance to financial markets are discussed.

3.2 Overview of the Industrial Sector

The industrial sector has arguably been the best performing sector of the South African equity market in recent years (Brown, 2012:1). Industrial goods and services contain companies involved in the manufacturing industries and companies' servicing these companies (JSE, 2004:3). Companies in the industrial sector include engineering, aerospace and defence, containers and packaging companies, electrical equipment manufacturers and as well as transport support services (JSE, 2004:3).

According to the International Classification Benchmark (ICB), the industrial sector in South Africa may firstly be classified into two industrial economic groups; basic industries and general industries. The first economic group consists of four industrial sectors; chemicals, construction and building materials, forestry and paper, and steel and other materials. The second economic group is that of general industries. It consists of four industrial sectors, namely aerospace and defence, diversified industrials, electronic and electrical equipment, and engineering and machinery. (JSE, 2004:4).

3.3 Overview of the FTSE/JSE Industrial 25 Index

In this section, the size and composition of the INDI 25 is noted and its importance to the financial markets is outlined.

3.3.1 Size and Composition

The FTSE/JSE INDI 25 was formed in June 2002. The index is composed of the 25 largest industrial shares by market capitalisation. A list of these shares as at April 2014 is presented in Appendix A. The INDI 25 can be traded by financial market players with the ICB index code J211 (JSE, 2004:3). The index is composed of relatively large liquid companies, representing a significant portion of the JSE market capitalisation (Brown, 2012:1).

The companies in question are mostly consumer-oriented with significant offshore earnings. As of August 2012, five companies (SABMiller, British American Tobacco PLC (BAT), Naspers, MTN Group and Compagnie Financiere Richemont AG) accounted for over 61% of the index weightings. During the same period, over 80% of the index was accounted for by consumer-oriented shares (Brown, 2012:2).

Table 3.1 indicates the characteristics of the INDI 25 based on market capitalisation.

TABLE 3.1: AFTSE/JSE: Industrial 25 Index Characteristics

Attribute	Value
Number of Constituents	25
Ticker	INDI
Largest Company	British American Tobacco (BAT)
Index Price As at 10 March 2017	65823
Index Price 52 Week High	74851
Index Price 52 Week Low	61214

Source: Researcher's Own Construction

3.3.2 Importance to Financial Markets

The INDI 25 rose by 88% for the period January 2012 to December 2013 (Hedley, 2014:1) and it outperformed the other large-cap share indices in different sectors. The Resource 10 Index (RESI 10) is composed of the 10 largest resource shares by market capitalisation and is unchanged over the same period, while the Financial 15 Index (FINI 15), which is composed of the 15 largest financial shares, was up 52% (Hedley, 2014:1). The Top 40 index had risen by 44% over the same period.

As the INDI 25 is exclusively composed of industrial shares, it does not contain mining, basic resource nor financial shares. This implies relatively low volatility in the INDI 25 (Hedley, 2014:1). Mining, basic resource and financial shares make up 63% of the weightings in the Top 40 (Brown, 2012:2).

Brown (2012:2), states that industrials are only given a weighting of 3% compared to the more stable INDI. Another important feature of the INDI 25 is that 70% of the companies earn the bulk of their revenue outside of South Africa, imparting high

rand-hedge qualities for institutional and individual investors in the index (Brown, 2012:2; Hedley, 2014:2).

The bullish performance of the large-cap industrial shares on the JSE over the past has led them to be expensive. If large-cap industrial shares on the JSE were a standalone market, it would be the most expensive market in the world (Hedley, 2014:2). This has created opportunities elsewhere on the JSE, but has also made the JSE expensive compared to other markets (Hedley, 2014:2).

3.4 Change in Macroeconomic Variables

For the period under study, the flow of the macroeconomic variables selected for this study is reviewed. The line graphs below illustrate the trend of the relationship between each macroeconomic variable and the INDI 25.

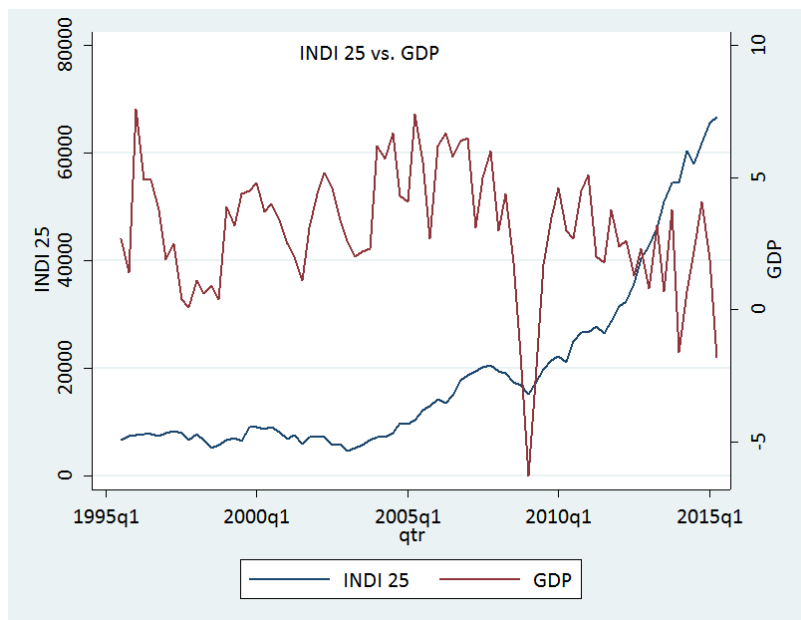


FIGURE 3.1: INDI 25 and GDP (1995-2015)

The results depicted in Figure 3.1 above show that beginning in Q1 2003, the INDI 25 price and the GDP growth rate were both increasing, with the GDP growth growing at a faster rate than the INDI 25 up to Q4 1995. The results also show that during the global financial crisis of 2008/2009, both the INDI 25 and the GDP growth rate significantly reduced from Q2 2008, with the recovery commencing in Q1 2009. The GDP growth rate increased from -6.3% Q on Q in Q1 2009 to 4.6% in Q1 2010, but thereafter remained relatively flat with short-term quarterly fluctuations up to Q2 2015. However, the INDI 25 price has consistently grown, from a weighted average price of 15502 in Q1 2009 to 67367.45 in Q4 2014. Thus, the GDP growth rate and the INDI 25 prices have had a significant relationship in the period post the financial crisis.

The graph in Figure 3.2 below shows that from Q3 2003 to the global financial crisis of 2008, the INDI 25 price and the rate of inflation, as measured by the CPI, were increasing at the same rate with the INDI 25 price rising from 5610.27 to 18791.91, and the rate of inflation rising from 5.1% to 11.3%. This indicates a positive relationship. As the crisis drew to an end, both the INDI 25 and the inflation rate significantly reduced from Q4 2008 to Q1 2009, further implying a positive relationship. Since the financial crisis, the rate of inflation has not explained price movements in the INDI 25 as it has displayed a sharp upward trend until Q2 2015, whereas the rate of inflation has fluctuated every two quarters up to Q2 2015.

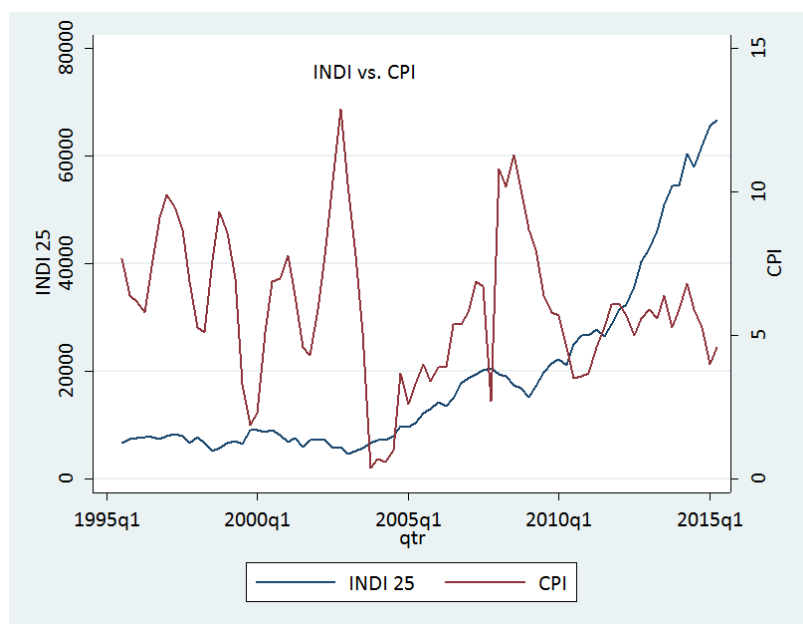


FIGURE 3.2: INDI 25 and Inflation (1995-2010)

The graph in Figure 3.3 shows that the INDI 25 price steadily increased up to the global financial crisis of 2008/2009, whereas the prime interest rate was consistently lowered by the SARB from 17% in Q2 2003 to 11% in Q1 2005. This was consequently followed by consistent rate hikes leading into the financial crisis. From the global financial crisis of 2008/2009 to Q2 2015, the prime interest rate was relatively flat up from 10.5% in Q3 2009 to 9.25% Q2 2015, whereas the INDI 25 experienced consistent capital appreciation from a price of 15502.98 in Q1 2009 to 67367.45 at the end of Q2 2015. Therefore, despite the positive correlation between the prime rate and the INDI 25 from 2005 leading into the financial crisis, the two variables have had a negative relationship, moving in opposite directions.

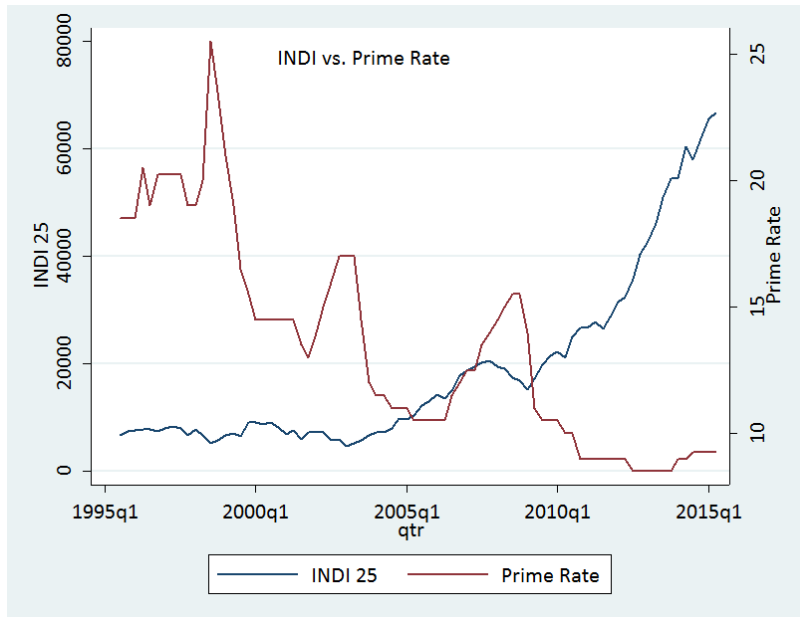


FIGURE 3.3: INDI 25 and Prime Rates (1995-2010)

The trend in Figure 3.4 shows that both the USD/ZAR exchange rate and the INDI 25 have relatively increased over the period under study, despite a decline in the USD/ZAR exchange rate from Q1 2003 to Q1 2004, and a decline in the INDI 25 from Q1 2008 to Q1 2009. The observation of both variables moving in the same direction is testament to the fact that a significant proportion of the earnings of constituents of the INDI 25 are obtained from outside South Africa, thereby being resistant to exchange rate (Rand) shocks.

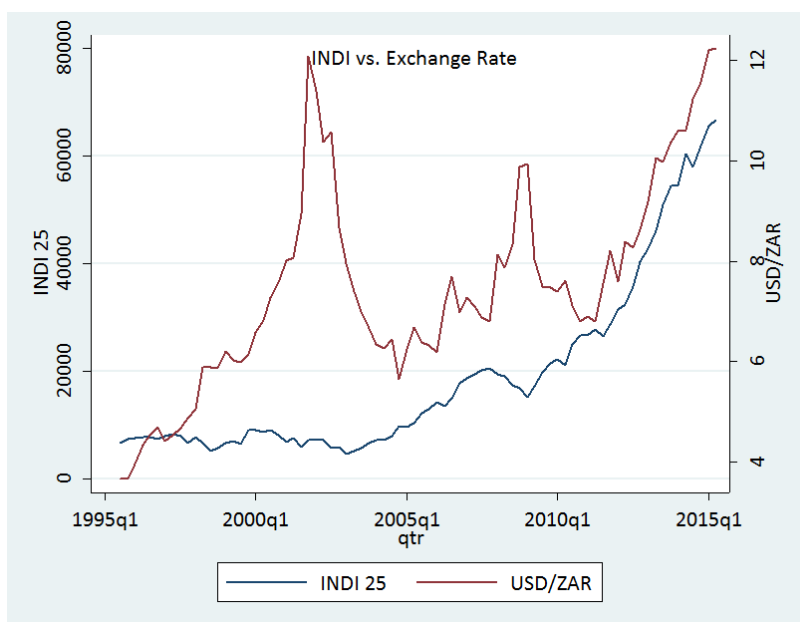


FIGURE 3.4: INDI 25 and Exchange Rates

3.5 Conclusion

The industrials sector is comprised of some of the largest companies in South Africa. It is mainly composed of multinational consumer-oriented companies.

The FTSE/JSE INDI is important to the financial markets as it presents minimal economic cyclicality to investors considering that highly cyclical stocks such as resource and financial stocks are excluded from the index. Most companies comprising the INDI obtain a significant portion of their earnings outside South Africa and this presents a rand-hedge to investors.

In recent times, the INDI 25 has outperformed all major sector indices as well as the aggregate market index. This out-performance has however led the index and the JSE at large to be expensive.

Chapter 4

Data and Methodology

4.1 Data Description

The current study takes the form of a longitudinal study as it consists of data collected over an extended period (Blumberg et al., 2011). The data points have several observations and do not simply represent a snapshot of one point in time. The period of study is from September (Q3) 1995 to June (Q2) 2015. Secondary data analysis occurs when further analyses of data that has already been collected for some other purpose is carried out (Saunders & Thornhill, 2012).

4.2 Data Collection

This section describes the sources and collection methods used to obtain the secondary data. The secondary numeric data used to capture the dependent variable, INDI25 was collected from INET Bureau of Financial Analysis (INET BFA), a service supplying real-time and historical financial information. The data collected from INET BFA consists of quarterly closing values of the INDI 25 from the third quarter of 1995 (September) to the second quarter of 2015 (June). Quarterly figures for the macroeconomic variables (GDP, CPI, prime rate and USD/ZAR exchange rate) for the same period were also collected. Inflation data was obtained from the South African Reserve Bank (SARB), whilst GDP and the exchange rate data was sourced from Stats SA.

4.3 Description of Variables

4.3.1 Dependent Variable

As the study focuses on industrial shares, the movements of the INDI 25 price index is the proxy for share returns in the study, hence it serves as the dependent variable. The index values based on the price return were downloaded from from the INET Bureau

of Financial Analysis (INET BFA). The INDI 25 comprises the top 25 industrial shares on the JSE by market capitalisation

Measurement of Share Returns

Share index returns may be calculated using a price index or return index. Price indexes use the prices of constituent shares in the return calculation. A rate of return that is calculated using a price index is referred to as a price return (Chandra, 2009), which is represented by the percentage change in the price of the index. The second form of index return, a return index, incorporates both prices and interim cash flows from the constituent shares in the return calculation. A rate of return that is calculated based on a return index is called a total return (Chandra, 2009). If the constituent shares in an index produce interim cash flows such as dividends or interest payments, the total return of the index will be greater than its price return.

Indices concern movements of share prices which contain all publicly available information. To calculate index returns in this study, only INDI 25 prices were used. Interim dividends were not added to the return calculations. This implies that price returns were measured. Kyereboah-Coleman and Agyire-Tettey (2008) state that any dividend expectations would be priced into the individual constituent share prices of the companies which make up the index. Thus, the impact of dividends on the share price of the index is already accounted for and so it is appropriate to exclude dividends from the return calculation in this study.

4.3.2 Independent Variables

Gross Domestic Product (GDP): Theory suggests that corporate cash flows are related to a measure of aggregate economic output such as GDP and money supply. Though GNP is traditionally taken as an overall indicator of a nation's health; corporate profit does not follow this. GDP is a more correlated measure to aggregate activity, and may therefore be used as a proxy for macroeconomic conditions. In this study, GDP is employed as it is more closely related to economic activity within a country. It has been found to be a useful tool in a variety of studies, (see Chen et al., 1986; Fama, 1981; Wongbangpo & Sharma, 2002)

Prime Rates: Authors have frequently included both a 10 year bond yield and a 3 month Treasury bill rate. Neither is used in this study. Instead, the prime interest rate is used as it is the rate at which companies on the JSE source loans (i.e. commercial bank lending rates), and therefore it has the greatest effect on anticipated and unanticipated share returns. The relationship between interest rates and stock prices has been hypothesised to be negative. When interests increase, this presents

itself as an opportunity cost of holding money and thus there tends to be a substitution between stocks and interest bearing securities which causes a decline in stock prices.

Inflation: Changes in CPI are used to capture inflation. The CPI is the most commonly used measure of inflation (see [Balduzzi, 1995](#); [Omotor, 2010](#)). High rates of inflation have been hypothesised as negatively related to equity prices for a number of reasons. First, high inflation forces resources out of investment into consumption leading to a fall in the demand for market instruments. Secondly, inflation tends to be translated into nominal interests rates and monetary authorities react to inflationary pressures. High inflation often leads to an increase in the discount rate ([Ray, 2012](#)).

Exchange Rate: The USD/ZAR is utilised due to the fact that most materials and components used by South African industrial companies are denominated in USdollar. Changes in the exchange rate affect the import demand, competitiveness and profitability of companies via changes in cost of production as well as changes in expected cash flow. We expect a negative relationship between stock prices and the foreign exchange rate. Under the assumption that South African is import dominated, if the SA Rand depreciates against the US dollar, then imports become more expensive. In the case that the demand for these import is inelastic, then overall imports will increase lowering available cash flows in the domestic market available for investments and other economic activities.

4.4 Data Analysis

Data analysis involves reducing the accumulated data to a manageable size, developing summaries, looking for patterns, and applying statistical techniques ([Blumberg et al., 2011](#)). The data consisted of five variables observed at equally spaced points in time I=i.e quarterly. Hence, they constitute time series data. To undertake an analysis of the relationship between the selected macroeconomic variables and the performance of the INDI 25, a modified version of [Chen et al. \(1986\)](#) multivariate regression model is adopted in the form;

$$INDI25 = f(GDP, CPI, PrimeRate, ExchangeRate) + \epsilon_t \quad (4.1)$$

We perform a natural log transformation of our model in order to reduce multicollinearity and to make our equation linear, which gives;

$$\log INDI25_t = \alpha_0 + \alpha_1 \log GDP_t + \alpha_2 \log CPI_t + \alpha_3 \log PR_t + \alpha_4 \log EXR_t + \epsilon_{it} \quad (4.2)$$

Where:

$\log INDI_t$ = log of INDI 25 Share Market Index

α = Coefficient of the variable

GDP = log of Gross Domestic Product

CPI = log of Consumer Price Index

PR = log of Prime Rate

EXR = log of USD/ZAR Exchange Rate

ϵ_t = Error term

Since all the variables in equation 4.2 are in log form, their coefficients could be interpreted as their long-run elasticities. Therefore α_1 which is the coefficient of $\ln GDP$ is the elasticity of INDI25 with respect to GDP. In particular, it measures the degree of responsiveness of INDI25 to changes in the level of GDP ceteris paribus

From the above theoretical and empirical literature, we hypothesize the following signs for our coefficients;

$$\alpha_1 > 0; \alpha_2 < 0; \alpha_3 < 0; \alpha_4 < 0$$

We proceed to test for normality, correlation, causality and cointegration tests.

4.4.1 Normality Test

As a starting point, all the data series are tested for normality to know the nature of data distribution. The Jarque-Bera (JB) test is the most commonly used normality test and hence this study will also adopt that test. The JB test uses the sum of the skewness and kurtosis statistics based on the skewness and coefficients. The JB statistic is specified as follows:

$$JB = \left[\left(\frac{S^2}{6/n} \right) + \left(\frac{(K - 3)^2}{24/n} \right) \right] \quad (4.3)$$

Where n = sample size, S = Skewness coefficient, and K = Kurtosis coefficient. The JB test statistic follows the chi-squares distribution with two degrees of freedom. Under the null hypothesis of normality, $S = 0$ and $K = 3$ and the expected value of the statistic is 2. The denominators on the RHS of equation 4.2 are the variances of skewness and Kurtosis, respectively.

4.4.2 Correlation Test

In order to test for the direction and strength of the relationship between INDI25 and the macroeconomic variables under consideration, we employ correlation analysis. The correlation coefficient shows the extent to which the dependent variable is linearly associated with the independent variables. The correlation coefficient r is calculated

as:

$$r = (n \sum xy - (\sum x)(\sum y)) / \sqrt{n(\sum x^2) - (\sum x)^2} \sqrt{n(\sum y^2) - (\sum y)^2} \quad (4.4)$$

The closer to 1 the correlation coefficient r is, the greater the linear association between the variables. However, in the presence of heteroskedacity, the correlation coefficients may be biased upwards, reinforcing an otherwise not true linear relationship. Also it is important to note that correlation only measures the degree of linear association between two variables but not necessarily provide any indication on the long run dynamic relationships. This we explore using the Johansen Cointegration approach.

4.4.3 Stationarity Tests

In order to ascertain cointegration, it is necessary that the series are integrated of the same order and to do so we can test for the existence of unit root in the data series to determine stationarity and/or nonstationarity of the data. A non-stationary process generates the problem of spurious regression between unrelated variables such that in some cases the regressions will produce a high R^2 even though there is no meaningful relation between variables. There are many available tests for verifying the presence of a unit root, however, this study employs the use of the Augmented Dickey-Fuller (ADF) test because of its popularity and wide application. Augmented Dickey -Fuller (ADF) is an extension of Dickey -Fuller test. The ADF specification is:

$$\Delta y_t = \alpha_0 + \delta y_{t-1} + \sum_{i=1}^{\rho} \beta_i \Delta y_{t-i} + \epsilon_t \quad (4.5)$$

Where:

Δ is the first difference operator

y_t = the time series to be tested

α_0 = is the intercept

β_1 = coefficient of interest in analysing the unit root

ρ = is the lag order of the autoregressive process and $\delta = \rho - 1$

ϵ_t = is the white noise error term

The main idea behind the ADF test is to include enough lagged terms so that the error term is serially uncorrelated. The null and alternative hypotheses are specified as:

$H_0 : \rho = 1$ [Unit root i.e Variable is not stationary]

$H_1 : \rho = 0$ [No Unit root i.e Variable is stationary]

If the coefficient is significantly different from one (less than one) then the hypothesis that y contains a unit root is rejected. Rejection of the null hypothesis denotes stationarity in the series. If we do not reject the null hypothesis, we conclude we have a unit root. Before running ADF test, we plot time series plots of the variables to check if there is a trend.

4.4.4 Optimal Lag Length

After testing for stationarity, we determine appropriate lag length p . The optimum lag length for variables is found by the vector autoregression (VAR) lag order selection method. There are six criteria: the log likelihood value ($\log L$); the sequential modified likelihood ratio (LR) test statistic; the final prediction error (F and E); the Akaike information criteria (AIC); the Schwarz information criterion (SC); and the Hannan-Quin information criterion (HQ) for choosing the optimal lag length. Apart from the LR statistic, all the others are minimizing functions of lag length. In this study we use the AIC:

$$AIC = 2k - 2\ln(L) \quad (4.6)$$

Where L is the maximum value of the likelihood function and k is the number of estimated parameters in the model.

4.4.5 Cointegration and Long run Relationship

After establishing the unit root or stationarity of our series, we invoke the [Johansen \(1988, 1991\)](#) cointegration test and the VECM which captures both the long-run dynamics as well as the short-run error correction model (ECM). If a group of variables are individually integrated of the same order and there is at least one linear combination of these variables that is stationary, then the variables are said to be cointegrated. The cointegrated variables will never move far apart, and will be attracted to their long-run relationship. Testing for cointegration implies testing for the existence of such a long-run relationship between economic variables.

Even though we can test for cointegration using other methods such as the Engle-Granger method (also known as two-step estimation procedure) and the Phillips-Ouliaris methods, in this study we apply the Johansen Procedure due to the multivariate nature of the regression model estimated. Johansen's procedure builds cointegrated variables directly on maximum likelihood estimation instead of relying on OLS

estimation. This procedure relies heavily on the relationship between the rank of a matrix and its characteristic roots. The Johansen approach is based on estimation by likelihood methods by specifying a Vector Autoregressive Regression (VAR) equation of the form:

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{\rho-1} \Gamma_i \Delta X_{t-i} + \epsilon_t \quad (4.7)$$

Where;

$$\Pi = \sum_{i=1}^{\rho} A_i - I \quad (4.8)$$

and

$$\Gamma_i = - \sum_{j=i+1}^{\rho} A_j \quad (4.9)$$

Where Δ is the first difference lag operator, X_t is a $(p \times x)$ random vector of time series with $I(1)$, Γ is the $(p \times p)$ matrices of parameters and r is the number of cointegrating relations or vectors (i.e cointegrating rank) and i determines the number of lags specified in the dynamic VAR relationship.

In order to assert cointegration, the Johansen approach estimates the Π matrix and tests if we can reject the restrictions implied by the reduced rank of Π . Focus of the Π matrix is hinged upon the suggestion by Johansen (1988) that information on the nature of the long run relationships in the variables is contained in this matrix. In the event that matrix Π has full rank (i.e $r=p$), then all the elements in X_t are stationary $I(0)$.

Johansen (1995) derives an maximum likelihood estimator for the parameters and proposes two different likelihood ratio tests for the inference on r , namely;

1. The trace test (LR_{trace})
2. The maximum eigenvalue test (LR_{max})

The trace statistic tests for the null hypothesis of no cointegration ($H_0 : r = 0$) against the alternative of cointegration ($H_1 : r > 0$) and is specified as;

$$LR_{trace} = -T \sum_{i=r+1}^K \ln(1 - \hat{\lambda}_i) \quad (4.10)$$

Where the λ_i is the estimated values of the characteristic roots obtained from the Π matrix, T is the number of usable observations and r is the number of cointegrating

vectors. For any given value of r , larger values of the trace statistic are evidence against the null hypothesis that there are r or fewer cointegrating equations in the VECM.

The maximum eigenvalue test examines the number of cointegrating vectors and it conducts tests on each eigenvalue separately. It tests the null hypothesis that the number of cointegrating vectors is equal to r against the alternative of $r-1$ cointegrating vectors. The maximum eigenvalue statistic is specified as;

$$LR_{max} = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (4.11)$$

If the variables in X_t are not cointegrated, then the rank Π is equal to zero and all the characteristic roots are equal to zero. In the case that $\ln(1) = 0$, then each of the expressions in $\ln(\lambda_i)$ will be equal to zero in that case.

The choice of testing for cointegration using the Johansen procedure instead of other methods such as the Engle-Granger and the Phillips-Ouliaris methods is that the Johansen procedure is a vector cointegration test method, hence it can estimate more than one cointegration relationship, if the data set contains two or more time series as is the case in this study.

4.4.6 Fitting the VECMs

$$\begin{aligned} LlnINDI_t = & \{ \alpha_0 + \sum_{i=1}^n \Phi LlnINDI_{t-1} \\ & + \sum_{i=1}^n \delta LlnGDP_{t-1} + \sum_{i=1}^n \varphi LlnCPI_{t-1} \\ & + \sum_{i=1}^n \Omega LlnPrimerates_{t-1} \\ & + \sum_{i=1}^n \lambda LlnExchangerate_{t-1} + \epsilon_t \} \end{aligned} \quad (4.12)$$

$$\begin{aligned} \Delta lnINDI25_t = & \{ \alpha_0 + \sum_{i=1}^n \Phi \Delta LlnINDI25_{t-1} \\ & + \sum_{i=1}^n \delta \Delta LlnGDP_{t-1} + \sum_{i=1}^n \varphi \Delta LlnCPI_{t-1} \\ & + \sum_{i=1}^n \Omega \Delta LlnPrimerates_{t-1} \\ & + \sum_{i=1}^n \lambda \Delta LlnExchangerate_{t-1} + \sigma ECT_{t-1} + \epsilon_t \} \end{aligned} \quad (4.13)$$

Where σ is the coefficient of the error correction term ECT_{t-1} which is obtained from the cointegrating vector and measures the feedback effect or the speed of adjustment to long-run equilibrium resulting from a shock to the stock market, ϵ_t is the error term while the other variables still maintain their usual definitions. The study proceeds to examine the causal relations of the variables using Granger causality test.

4.4.7 Granger Causality Test

We also perform the Granger-causality tests in order to determine if one time series helps in forecasting the other. A variable X is said to Granger-cause a variable Y if, given the past values of Y, past values of X are useful for predicting Y. The pre-condition for applying a Granger causality test is to ascertain the stationarity of the variables. This study employs the [Toda and Yamamoto \(1995\)](#) Granger causality under the VAR framework to capture the degree and direction of causality between the variables. The Granger causality tests requires that we create bivariate VAR models for the data in levels with a lag length $p+m$, where p is the number of lags found in the previous AIC analysis, and m is the maximum order of integration of the variables in the process.

$$Y_t = a_0 + \sum_{i=1}^{p+m} a_i Y_{t-i} + \sum_{i=1}^{p+m} b_i X_{t-i} + \mu_t \quad (4.14)$$

$$X_t = c_0 + \sum_{i=1}^{p+m} c_i X_{t-i} + \sum_{i=1}^{p+m} d_i Y_{t-i} + v_t \quad (4.15)$$

We then test for Granger causality using the Wald test for linear restriction only for the first p lagged values. We test the null hypothesis that X does not Granger-cause Y:

$$H_0 : \sum_{i=1}^p b_i = 0; H_1 : \sum_{i=1}^p b_i \neq 0 \quad (4.16)$$

And Y does not Granger-cause X:

$$H_0 : \sum_{i=1}^p d_i = 0; H_1 : \sum_{i=1}^p d_i \neq 0 \quad (4.17)$$

We reject each H_0 if the computed F statistic is greater than the critical value at a reasonable significance level otherwise we do not reject H_0 . Rejecting the H_0

in equation 4.16 implies that the selected macroeconomic variable Granger causes INDI25 and that past values of former significantly predict stock prices.

Similarly, rejecting H_0 in equation 4.17 also implies that INDI25 Granger causes the selected macroeconomic variable as such past values of the index could be used to predict the macroeconomic variable in question.

Chapter 5

Empirical Results

This chapter reports on the results from the tests discussed in the previous chapter

5.1 Descriptive Summary

Shown in Figure 5.1 are the levels and first differences time series plots for all the 5 variables used in this study. Apparent is that series INDI25, prime rate and the exchange rate depict trends in their levels, whilst series CPI and GDP depict stationarity in their levels. All series however appear stationary in their first differences. To assert this, we however test for unit roots.

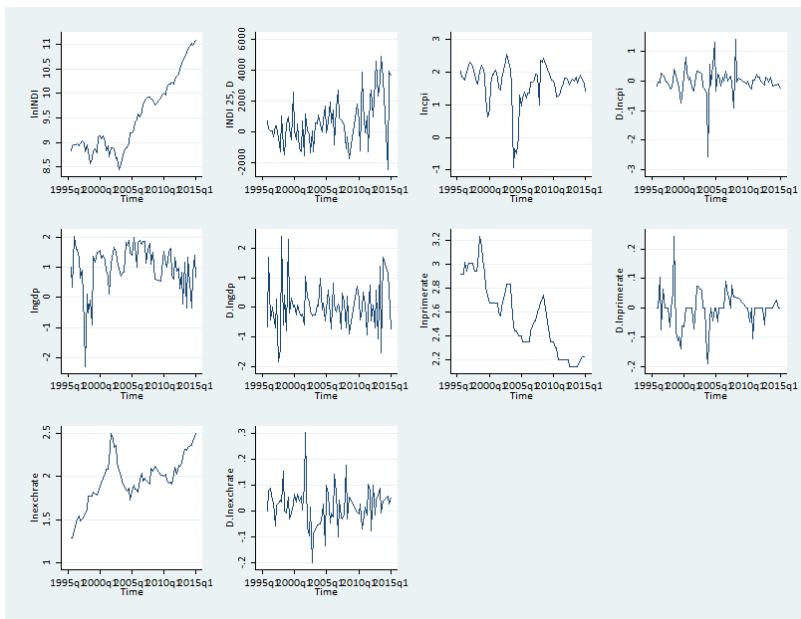


FIGURE 5.1: Level and 1st Differences Trends in Data Series

Table 1 below shows the descriptive summary of the data.

TABLE 5.1: Descriptive Statistics

Variable	Mean	Median	Std. Dev.	Min.	Max.	N
Industrial Index 25 25	17909.462	9762.30	15539.089	4619.480	65630.609	75
Inflation	5.865	5.80	2.55	0.4	12.9	75
Gross Domestic Product	3.424	3.20	1.844	0.1	7.600	75
Prime Rate	13.637	13.00	4.258	8.5	25.5	75
Exchange Rate	7.303	7.10	1.978	3.65	12.2	75

Except for the INDI25 series, all the variables analysed show means and the median values not far away from each other. Though this may indicate some form of symmetry in the series, it does not necessarily imply normality, hence we need to test for normality.

5.2 Normality Tests Results

Figure 5.2 below shows the normality plots for the 5 variables. Except for the exchange rate, all the variables do not appear normally distributed. The Jarque-Bera (Skewness-Kurtosis) normality tests are applied in order to ascertain this and the results are presented below.

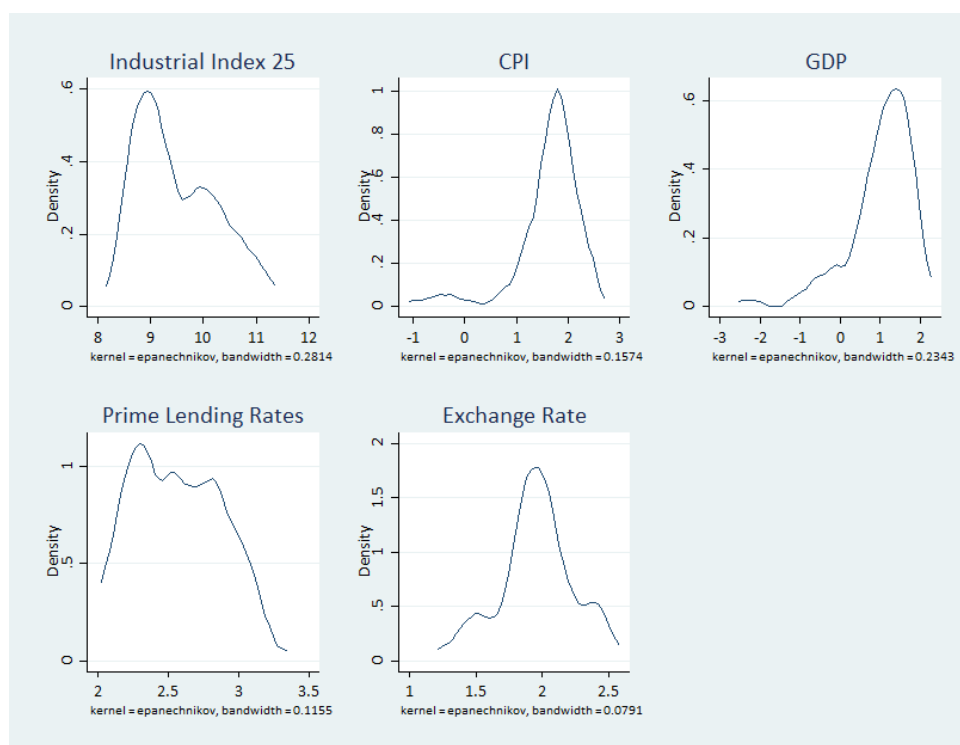


FIGURE 5.2: Normality Plots

Table 5.2 below reports the Jarque-Bera(S-K) normality test results for all the variables.

TABLE 5.2: Normality Test Results: Jarque-Bera (Skewness-Kurtosis) Results

Variable	N	Pr(Skewness)	Pr(Kurtosis)	Adj χ^2	Prob > χ^2	Decision
Industrial Index25	75	0.0268	0.057	8.61	0.0135	Reject H_0
Inflation	75	0.00000	0.0001	32.55	0.0000	Reject H_0
GDP	75	0.0000	0.0006	25	0.0000	Reject H_0
Prime Rate	75	0.3965	0.0001	13.17	0.0014	Reject H_0
Exchange Rate	75	0.3911	0.7169	0.89	0.6411	Accept H_0

Results from table 5.2 support the findings suggested in figure 5.2 above. Except for the exchange rate series, we fail to accept the null hypothesis at all critical levels that the time series are normally distributed and hence conclude that the INDI25, CPI, GDP and the prime rates series are not normally distributed.

5.3 Correlation Test Results

We also test for any linear relationship between the dependent and each of the explanatory variables. The scatter plots below give a graphical analysis, particularly in terms of the direction of these relationships

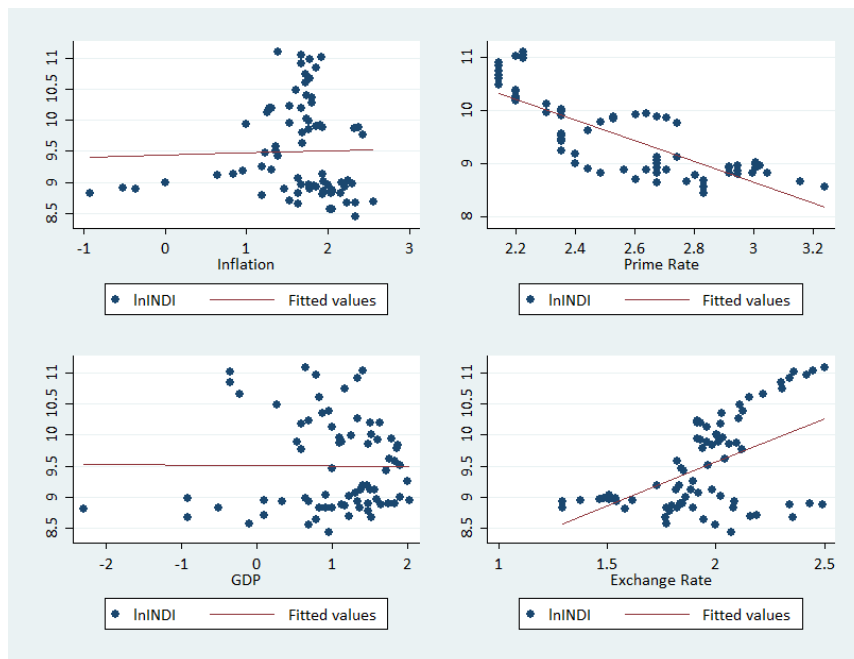


FIGURE 5.3: Correlation Plots

The nature of relationship between industrial index 25 and inflation and INDI25 and GDP does not show much linearity compared to those of the INDI25 and prime rates, which is negative and that of INDI25 and exchange rate that is positive. However,

the graphical analysis does not necessarily show the strength of this relationship, hence we test for by conducting correlation tests. The results of these tests are given in table 5.3 below;

TABLE 5.3: Cross-correlation table

	Industrial Index25	Inflation	GDP	Prime Rate	Exchange Rate
Industrial Index25	1				
Inflation	0.0298	1			
GDP	-0.00807	-0.284*	1		
Prime Rate	-0.800***	0.337**	-0.199	1	
Exchange Rate	0.522***	0.0458	0.0510	-0.587***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

As already indicated from the graphical analysis, the INDI25 has a weak, insignificant positive relationship with inflation, and a weak, insignificant negative relationship with GDP. However, the relationship between INDI25 and prime rates is negative and significant at the 1% level. INDI25 and exchange rate have a significant positive relationship.

5.4 Unit Root Test Results

One of the prerequisites for testing for cointegration is that the series be stationary at the same levels. Therefore, as a next step, we perform the unit root test. For these tests, we use the AIC lag selection criterion for each of the variables. Figure 5.4 above

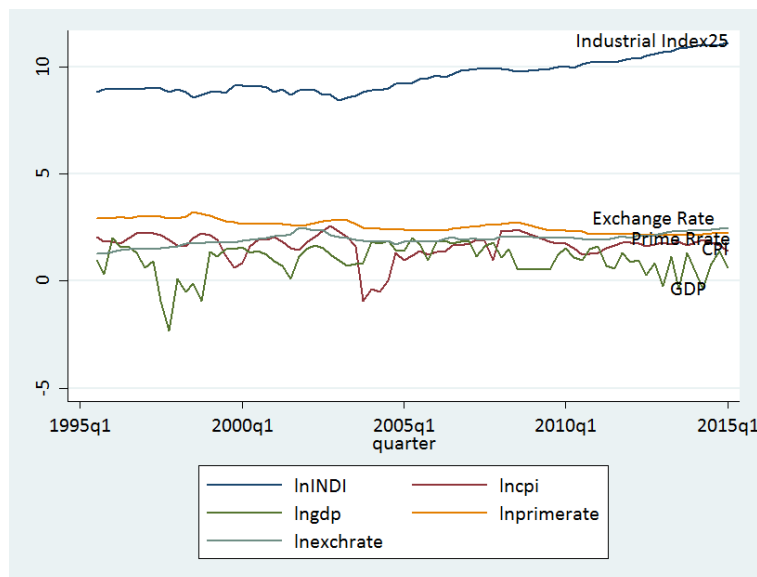


FIGURE 5.4: Time Series Plots

shows the time series plots for all the 5 variables. Apparent is the increasing trend in the INDI25 variable compared to the other 4 variables. Reported below are the ADF univariate unit root tests.

TABLE 5.4: Augmented Dickey Fuller Results: LEVELS

Variable	Levels	1% C Value	5% C Value	10% C Value	Lag AIC	P-value
Industrial Index25	-1.670	-4.088	-3.472	-3.163	1	0.7639
Inflation	-2.819	-4.095	-3.475	3.165	4	0.0629
GDP	-2.832	-4.115	-3.484	-3.170	2	0.1853
Prime Rate	-3.363	-4.091	-3.473	-3.164	2	0.0565
Exchange Rate	-2.439	-4.088	-3.472	-3.163	1	0.3592

TABLE 5.5: Augmented Dickey Fuller Results: 1st DIFFERENCES

Variable	1st Diff	1% C Value	5% C Value	10% C Value	Lag AIC	P-value
Industrial Index25	-9.036	-3.541	-2.908	-2.589	0	0.0000
Inflation	-5.809	-3.546	-2.911	-2.590	0	0.0000
GDP	-6.000	-3.562	-2.920	-2.595	1	0.0000
Prime Rate	-5.020	-3.542	-2.908	-2.589	1	0.0002
Exchange Rate	-7.736	-3.541	-2.908	-2.589	0	0.0000

From the results presented in table 5.4, we fail to reject the null hypothesis of a unit root in all the series in their levels at all common significance levels - hence we conclude that all series have a unit root in their levels. However, after differencing, shown in table 5.5, we can overwhelmingly reject the null hypothesis of a unit root at all common significance levels for all series. We can therefore conclude that all the variables are I(1).

5.5 Optimal Lag Selection

The appropriate lags is selected according to the Aikake Information Criteria (AIC) for the whole model. The results are reported in table 5.6 below.

TABLE 5.6: Lag Selection-Order Criteria

Lag	LL	LR	df	P-value	FPE	AIC	HQIC	SBIC
0	-163.135				0.000057	4.4246	4.48588	4.57793
1	192.331	710.93	25	0.000	9.6e+09*	-4.27187*	-3.90419*	-3.35185*
2	214.698	44.733*	25	0.009	1.0e+08	-4.20257	-3.52847	-2.51585
3	226.342	23.29	25	0.561	1.5e+08	-3.85112	-2.87062	-1.39771
4	243.492	34.298	25	0.102	1.9e+08	-3.64452	-2.35761	-0.424423

Endogenous: INDI25 CPI GDP Exchange rate Prime rate. * Indicates lag order selected by the criterion.

Where LR= sequential modified LR test statistic

FPE = Final prediction error

AIC = Akaike information criterion

SBIC = Schwarz information criterion

HQIC = Hannan-Quinnin formation criterion

5.6 Cointegration Test Results

After asserting that all variables are stationary at the same level, i.e I(1), we test for cointegration. Presented below are the test results. As with the unit root analysis, we also use the AIC lag selection criterion to determine the number of lags.

TABLE 5.7: Multivariate Johansen Cointegration Test

Null Hypothesis	Eigenvalue	J_{trace}	5% C Value	J_{max}	5% C Value
$r = 0$		106.7224	68.52	64.9711	33.46
$r \leq 1$	0.56063	41.7153*1*5	47.21	22.7688	27.07
$r \leq 2$	0.25040	18.9825	29.68	13.1002	20.97
$r \leq 3$	0.15281	5.8823	15.41	5.8361	14.07
$r \leq 4$	0.07121	0.0462	3.76	0.0462	3.76
$r \leq 5$	0.00058				

* Reject null hypothesis at 5% level

From table 5.7 above, we can reject the null hypothesis that the variables are not cointegrated. Both test statistics indicate at most 2 cointegrating relationships thus showing the existence of a long-run relationship between the macroeconomic variables (GDP, CPI, Prime rates, Exchange rates) and the stock price, INDI25 on the JSE. Presented below is the normalised cointegration equation of interest:

TABLE 5.8: Normalised Cointegrating Equation for JSE

INDI25	GDP	CPI	Prime rates	Exchange rates	Constant
1	0	-1.73374*	1.537777*	-0.5497924*	-9.530306*
SE	-	0.3612839	0.9077561	0.9337257	
t-value		-4.80	1.69	-0.59	

* shows the value of coefficients

This normalised equation can be written as:

$$INDI25 = \beta_0 + \beta_1 CPI - \beta_2 Primerates + \beta_3 Exchangerates \quad (5.1)$$

When we put the values of the coefficients in the equation above, we can rewrite equation 5.1 as;

$$INDI25 = 9.53 + 1.73CPI - 1.54Primerates + 0.55Exchangerates \quad (5.2)$$

We found a positive and significant relationship between inflation (CPI) and the INDI25. During inflationary periods, price increases can be easily passed on

to consumers and this can enhance company profits. According to Hussain et al. (2012), this profit increase can have a positive impact on company balance sheets and stock prices. Moreover, because most companies tend to keep inventory, hence price increases result in inventory profits hence stock prices increase. This result provides support for the Fisher hypothesis that there is a one - to - one relationship between stock returns and inflations. In this case, investors get some compensation for inflationary pressures (Adam & Tweneboah, 2008). This finding is consistent with the findings of (see Firth, 1979; Hussain et al., 2012; M. H. Ibrahim & Yusoff, 2001). However, this result is inconsistent with the findings of (see Al-Sharkas et al., 2004; Fama & Schwert, 1977; Humpe & Macmillan, 2009; Nelson, 1976).

According to the normalised equation above, there is a negative relationship between interest rates and stock price. This result is as expected. When interests increase, this presents itself as an opportunity cost of holding money and thus there tends to be a substitution between stocks and interest bearing securities which causes a decline in stock prices. This result is consistent with the findings of (see Adam & Tweneboah, 2008; Al-Sharkas et al., 2004; Chen et al., 1986; D. Choi & Jen, 1991; Gjerde & Sættem, 1999; Humpe & Macmillan, 2009). However, this finding is contrary to the findings of (see Maysami et al., 2005; Mukherjee & Naka, 1995; Sohail & Hussain, 2009).

Stock price (INDI25) and exchange rate have a positive though insignificant relationship. This is contrary to expectations. However, this result is not surprising given that the extent of the impact of exchange rates on stock prices and other economic activities depends on the dominance of imports and exports sectors. Moreover, this result might be due to some strengthening of the South African Rand against the USdollar hence lowering import costs and improving the international competitiveness of local producers Maysami et al. (2005). This result is consistent with the findings of (see Maysami et al., 2005; Mukherjee & Naka, 1995; Sohail & Hussain, 2009) . However, this result is inconsistent with the findings of (see Adam & Tweneboah, 2008; M. H. Ibrahim & Yusoff, 2001; Kwon & Shin, 1999). who found a negative relationship between exchange rates and stock prices.

We fail to find any relationship between GDP and stock price (INDI25). This result is consistent with conventional wisdom that equity market returns are not linked to GDP growth. Our result offer some support for the "DMS Growth Puzzle" (Dimson, 2005), who found no evidence of a stable positive relationship between GDP growth and equity returns. A number of factors can explain this finding. From one angle, one can argue that given that the world today as become so integrated, then it is the growth in global markets that might matter more than local markets such that whilst economic activity in the local matters, in a highly globalised economy, this might be outweighed by economic activity in the rest of the world which still impact of share

prices in the local market. Secondly, we can also argue that it is possible that expected economic growth may be built into the prices and thus reduce future realized returns, hence we fail to observe any impact from growth to stock prices (Barra, 2010).

5.7 Vector Error Correction Model (VECM)

Having confirmed the presence of long-run equilibrium, we can now analyse the short run dynamics. We observe 2 co-integrating equations;

TABLE 5.9: VECM Cointegrating Equations

Error Correction	D.lnINDI	D.lnGDP	D.lnCPI	D.lnPrime rates	D. lnExchange rates
VECM1(-1)	0.09	-0.24	0.19	0.02	0.02
	0.64	-3.56	3.40	2.83	2.47
VECM2(-2)	-0.35	-0.73	0.04	0.06	0.04
	-1.63	-6.92	0.48	4.78	2.59

* shows the value of coefficients. () shows t-values

The coefficients in the VECM1(-1) and VECM2(-2) show the speed of adjustment towards the equilibrium path. According to table 5.9, the first error correction term (VECM1) is positive and less than 1 indicating absence of a short run relationship. However, the second error correction term (VECM2) is negative and less than 1 and significant at the 10% level. Therefore, VECM2 shows that the adjustment in INDI25 is due to the second error correction term. According to VECM2, the INDI25 is adjusted 3.5%. This shows that it takes "7 quarters" - $(0.25/0.035108)$ to eliminate the disequilibrium and achieve long run equilibrium path.

5.8 Granger Causality Tests Results

In order to investigate the causal relationship between macroeconomic variables and stock price, Granger Causality tests were carried out. Reported below are results. We analyse causality at the 1, 5 and 10% level of significance. If the calculated p-value is greater than 10%, we can reject the null hypothesis that variable X causes variable Y and conclude that X does not affect or cause the other variable.

TABLE 5.10: Granger causality Wald Tests

Variables	Alternative Hypothesis	P-value	Decision
GDP	$GDP \Rightarrow INDI25$	0.252	\neq Independent
	$INDI25 \Leftarrow GDP$	0.786	
CPI	$CPI \Rightarrow INDI25$	0.512	\neq Independent
	$INDI25 \Leftarrow CPI$	0.868	
Prime rates	$Prime\ rates \Rightarrow INDI25$	0.407	\uparrow Uni-directional
	$Prime\ rates \Leftarrow INDI25$	0.006*	
Exchange rate	$Exchange\ rate \Rightarrow INDI25$	0.164	\neq Independent
	$Exchange\ rate \Leftarrow INDI25$	0.351	

*, ** (***) denote significance at 1%, 5% (10%) level.

From table 5.10 above, we do not find evidence of Granger causality in 3 of the 4 models specified since we fail to reject the null hypothesis. However, we found evidence of univariate Granger causality from INDI25 to prime rates at the 1% significance level. Some of these results are consistent with the findings of (see Gan et al., 2006; R. J. Singh, Haacker, Lee, & Le Goff, 2010).

Chapter 6

Summary, Conclusion and Recommendations

In this chapter, the link between macroeconomic variables and share returns, as well as the econometric results are summarised. Recommendations from the study are also discussed.

6.1 Summary and Conclusion

The FTSE/JSE INDI is important to the financial markets as it provides minimal economic cyclical to investors compared to highly cyclical stocks such as resource and financial stocks. Additionally, in recent times, the index has outperformed all other major indices listed on the JSE. This dissertation analyses the impact of macroeconomic variables on industrial shares listed on the JSE using the INDI 25 as a proxy for industrial shares. This was achieved by using monthly data from Q3 1995 to Q2 2015.

The theories advanced earlier in the study, namely EMH, CAPM and the APT all suggest a relationship between the macroeconomy and share returns. Consequently, the macroeconomic variables used for the study were selected based on the APT which acknowledges several sources of risk that affect the expected return of a share. However, this literature sets no theoretical foundation for the macroeconomic variables that should be included in ascertaining risk-adjusted share returns. Additionally, the APT model does not indicate the number of macroeconomic variables that should be included in the model.

The study made use of the unit root test to examine the series for stationarity. The Johansen co-integration method was used to analyse the long run relationships between the macroeconomic variables and the INDI 25 of the JSE. The VECM was used to reconcile the short run behaviour of economic variables with the long run behaviour. It is concluded that the macroeconomic variables have a long run impact on share returns and more specifically on the INDI 25. The results of the study are congruent with other South African as well as international studies which have revealed that share returns are influenced by macroeconomic variables. We found a positive and significant relationship between inflation and stock price, indicating and

inflation premium to investors. As expected, we also found a negative relationship between interest rates and stock prices, suggestive of the substitution between stocks and interest bearing securities when interest rates increase which causes a decline in stock prices. The relationship between exchange rates and stock prices is shown to be positive, contrary to our expectations but not necessarily an anomaly within the literature since the impact of the exchange rate on the stock prices and other economic activity depends on whether the economy is import intensive or export intensive.

6.2 Recommendations

In this section, recommendations of the study are presented. These recommendations are suggested for policy makers, investors and for further research.

6.2.1 Policy Makers

The results of the study evoke important policy implications. As the study reveals that an increase in the exchange rate has a positive impact on the INDI 25, it is recommended that the SARB puts in place appropriate policy measures to ensure the stability of the exchange rate. This may be done through the implementation of prudent monetary policy measures to maintain positive investor sentiment and confidence.

Additionally, as the results of the study showed interest rates to be significant in explaining the returns of industrial share returns listed on the JSE, it is imperative that SARB constantly re-evaluates the rationality of the prevailing Repo Rate. The Reserve Bank may also utilise other monetary policy tools at its disposal, such as Open Market Purchases, to maintain suitable interest rates.

6.2.2 Investors

As the results of the study revealed a positive relationship between inflation and the INDI25, it is recommended that investors closely follow the CPI in order to appreciate its influence on their returns.

In addition, the findings of this study also reveal a positive relationship between the USD/ZAR exchange rate and the INDI25. It is therefore imperative and recommended that foreign investors monitor the exchange rate as a falling exchange rate has been shown to have a positive impact on the INDI25. Moreover, the exchange rate should be considered at valuation to hedge against currency risk and diversify investments.

6.2.3 Further Research

The results of this study are not consistent with some of the results of previous studies due to differences in the macroeconomic variables used. Further research may identify other variables that were not utilised in this study that are significant and have an impact on the INDI25. Variables such as fiscal balance, oil price, gold price, money supply, foreign exchange reserves and foreign direct investment may be included in future studies. The specific focus of this study is on the INDI25 and further research may investigate the impact of the selected macroeconomic variables on other stock market indices of the JSE.

As the bulk of previous studies utilise a domestic bilateral exchange rate to measure exchange rate impacts on the share market, a further recommendation would be to incorporate the real effective exchange rate to help validate the stronger linkage between changes in the exchange rate and movements of the INDI25. -

Appendix A

Appendices

TABLE A.1: Sample Data

Year	Quarter	INDI 25	GDP	CPI	Prime Rates	Exchange Rates
1995	q3	6805.14	2.7	7.7	18.5	3.65
1995	q4	7501.92	1.4	6.4	18.5	3.65
1996	q1	7678.17	7.6	6.2	18.5	3.96
1996	q2	7752.32	4.9	5.8	20.5	4.33
1996	q3	7833.27	4.9	7.4	19	4.52
1996	q4	7539.08	3.8	9.1	20.25	4.68
1997	q1	7937.4	1.9	9.9	20.25	4.42
1997	q2	8344.33	2.5	9.5	20.25	4.52
1997	q3	7986.09	0.4	8.7	20.25	4.67
1997	q4	6703.71	0.1	0.89	19	4.87
1998	q1	7751.18	1.1	5.3	19	5.04
1998	q2	6796.3	0.6	5.1	20	5.89
1998	q3	5283.33	0.9	7.6	25.5	5.89
1998	q4	5805.4	0.4	9.3	23.5	5.86
1999	q1	6785.05	3.9	8.6	21.0	6.2
1999	q2	7052.78	3.2	7.0	19.0	6.03
1999	q3	6529.49	4.4	3.3	16.5	5.98
1999	q4	9096.45	4.5	1.9	15.5	6.15
2000	q1	9169.29	4.8	2.3	14.5	6.58
2000	q2	8676.48	3.7	5.1	14.5	6.82
2000	q3	9173.94	4.0	6.9	14.5	7.28
2000	q4	8167.90	3.4	7.0	14.5	7.57
2001	q1	6851.42	2.5	7.8	14.5	8.02
2001	q2	7568.78	2.0	6.4	14.5	8.07
2001	q3	6012.80	1.1	4.6	13.5	8.94
2001	q4	7199.40	3.1	4.3	13.0	12.09
2002	q1	7287.70	4.4	5.9	14.0	11.4
2002	q2	7178.15	5.2	7.8	15.0	10.38
2002	q3	5825.34	4.6	10.4	16.0	10.57
2002	q4	5910.45	3.4	12.9	17.0	8.66
2003	q1	4619.48	2.6	10.3	17.0	7.95
2003	q2	5204.60	2.0	7.8	17.0	7.39
2003	q3	5696.26	2.2	5.1	14.5	7.0
2003	q4	6783.80	2.3	0.4	12.0	6.65
2004	q1	7302.85	6.2	0.7	11.5	6.34
2004	q2	7332.22	5.7	0.6	11.5	6.27
2004	q3	8088.21	6.7	1.0	11.0	6.44
2004	q4	9802.64	4.3	3.7	11.0	5.64
2005	q1	9762.30	4.1	2.6	11.0	6.24
2005	q2	10383.33	7.4	3.3	10.5	6.67
2005	q3	12342.54	5.6	4.0	4.0	6.37
2005	q4	13939.35	2.7	3.4	3.4	6.32
2006	q1	14353.23	6.2	3.9	10.5	6.19
2006	q2	13544.34	6.7	3.9	10.5	7.14
2006	q3	15079.02	5.8	5.4	11.5	7.7
2006	q4	17825.64	6.4	5.4	12.0	6.97
2007	q1	18754.18	6.5	5.8	12.5	7.27
2007	q2	19521.76	3.1	6.9	12.5	7.1
2007	q3	20204.63	5.0	6.7	13.5	6.88
2007	q4	20565.98	6.0	2.7	14.0	6.79
2008	q1	19440.37	3.0	10.8	14.5	8.12
2008	q2	19126.50	4.4	10.2	15.0	7.88
2008	q3	17393.16	1.8	11.3	15.5	8.32
2008	q4	16926.94	-1.7	10.1	15.5	9.89

Year	Quarter	INDI 25	GDP	CPI	Prime Rates	Exchange Rates
2009	q1	15195.66	-6.3	8.7	14.0	9.94
2009	q2	17229.51	-2.7	8.0	11.0	8.03
2009	q3	19798.57	1.7	6.4	10.5	7.49
2009	q4	21617.21	3.5	5.8	10.5	7.47
2010	q1	22329.99	4.6	5.7	10.5	7.4
2010	q2	21109.88	3.0	4.6	10.0	7.62
2010	q3	25010.11	2.7	3.5	10.0	7.11
2010	q4	26792.62	4.5	3.6	9	6.8
2011	q1	26716.02	5.1	3.7	9	6.9
2011	q2	27749.4	2.0	4.6	9	6.79
2011	q3	26477.67	1.8	5.3	9	7.55
2011	q4	28759.64	3.8	6.1	9	8.2
2012	q1	31474.03	2.4	6.1	9	7.6
2012	q2	32415.27	2.6	5	9	8.39
2012	q3	35794.74	1.3	5.7	8.5	8.27
2012	q4	40402.79	2.3	5.6	8.5	8.63
2013	q1	42761.53	0.8	5.9	8.5	9.18
2013	q2	46077.87	3.2	5.6	8.5	10.05
2013	q3	51008.73	0.7	6.4	8.5	9.98
2013	q4	54481.85	3.8	5.3	8.5	10.38
2014	q1	54571.34	-1.6	5.9	9	10.6
2014	q2	60511.38	0.7	6.8	9	10.61
2014	q3	58031.73	2.2	5.9	9.25	11.24
2014	q4	61988.54	4.1	5.3	9.25	11.57
2015	q1	65630.61	1.9	4	9.25	12.2
2015	q2	66752.83	-1.8	4.6	9.25	12.24

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