UNIVERSITY OF KWAZULU-NATAL

A quantitative study on the impact of microeconomic and macroeconomic variables on the JSE stock prices

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ABSTRACT

Given the JSE's relevance in providing liquidity in the South African economy, it is crucial to understand the factors that impact the value of the All-Share Index (ALSI) of the JSE. In this study, the simultaneous impact of macro and microeconomic variables on the ALSI was analysed. Macroeconomic variables comprised the gold price, interest rate, exchange rate, gross domestic product, inflation and money supply. Microeconomic variables comprised the PE ratio, DPS, BVS, ROA and ROE. Similar research in South Africa has focused on the impact of macroeconomic variables on the ALSI. However, there is minimal research on the impact of microeconomic variables on the ALSI or the combined impact of macro and microeconomic variables on the ALSI. An understanding of the explanatory power that these economic variables have on the ALSI will help policymakers to make the right decisions at a macroeconomic level and investors to make decisions when buying shares. For this study, annual data was used from 1997 to 2016. The dependent variable was the JSE all-share index, and the independent variables were the macro and microeconomic variables. The PCA, VECM and best subset models were applied. Multicollinearity existed within the independent variables, hence the PCA model was applied to deal with the multicollinearity. After the VECM was applied, there was a presence of non-stationarity; thus, the VECM was not a suitable model. Consequently, the best subset model was applied. In the outcome of the best subset model, there was a presence of heteroscedasticity; however, the EWMA model could not remedy the heteroscedasticity. The outcome of the best subset model variables that had a significant influence on the ALSI were dividends per share and money supply with an adjusted R^2 of 0.9788. In other words, macro and microeconomic variables do impact the ALSI. The impact of both macro and microeconomic variables on the ALSI is also supported by the fact that when the PCA model was applied, the first factor accounted for 52% of the variation of the ALSI and included the following variables: money supply, interest rate, gross domestic product, gold price, book value per share and dividends per share. The limitations of the study were the number of observations that could be attained, as only 20 observations were used. If financial results were made public on a monthly or weekly basis by listed companies, it would have allowed for a greater number of observations. With more observations, explorations of other models such as the ARCH/GARCH model can be carried out.

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ACRONYMS

ADF	: Augmented Dickey-Fuller Test
ALSI	: All-Share Index
APT	: Arbitrage Pricing Theory
ARDL	: Autoregressive Distributed Lag
ATP	: Arbitrage Pricing Theory
BVS	: Book Value/Share
CAPM	: Capital Asset Pricing Model
DA	: Debt to Total Assets
DCC	: Dynamic Conditional Correlation
DPS	: Dividends/Per Share
DY	: Dividends Yield
EPS	: Earnings/Per Share
FDI	: Foreign Direct Investments
FTSE	: Financial Time Stock Exchange
GARCH	: Generalised Autoregressive Conditional Heteroscedasticity
GDP	: Gross Domestic Product
ITNLSUR	: Iterated Non-Linear Seemingly Unrelated Regression
JSE	: Johannesburg Stock Exchange
M1	: Money Supply One
OLS	: Ordinary Least Square
PE	: Price Earnings
POLS	: Pooled Ordinary Least Squares Regression

ROA : Return on Assets

ROE : Return on Equity

UAE : United Arab Emirates

UK : United Kingdom

US : United States

VAR : Vector Autoregression

VECM : Vector Error Correction Model

CHAPTER 1: INTRODUCTION

1.1. Introduction

Capital markets play a pivotal role in the growth of an economy by fast-tracking economic growth as they provide savings mechanisms. As a result, funds can be raised and channelled in areas where there are profitable opportunities (Ali, 2011; Bosiu, Nhundu, Paelo, Thosago & Vilakazi, 2017). Capital markets also allow emerging companies to raise money at a lower cost and to decrease the dependency on banks, thus reducing the risk of a credit crunch (Yartey & Adjasi, 2007). With the availability of funds, investments capable of reducing unemployment, poverty reduction and accelerating economic growth become possible (Musa & Ibrahim, 2010). Given the weak economic growth in South Africa, characterised by a high unemployment rate and income distribution remaining uneven (Roux, 2020), it becomes crucial to understand the variables that impact the value or growth of the Johannesburg Stock Exchange (JSE).

There is an extensive body of research in developed and developing countries that confirm macro and microeconomic influence on the All-Share Index (ALSI) price (Shubiri, 2010; Pradhan & Dahal, 2016; Ramadan, 2016; Ali, 2011a; Francis, 2017; Jamaludin, 2017). In South Africa, there is strong evidence that macroeconomic variables do impact the ALSI (Barr, 1990; Bernadine, 1993; Van Rensburg, 1996; Van Rensburg, 1998; Hsing, 2011; Ndako, 2013; Ho, 2017). Macroeconomic variables include inflation, exchange rate, interest, gold price, money supply and Gross Domestic Product (GDP). Microeconomic variables also influence the variation in the South African ALSI. Many studies have investigated the impact of the microeconomic variable, dividends per share, on the ALSI (Bhana, 1998; Auret & Sinclaire, 2006; Mlonzi, Kruger & Nthoesane, 2011; Erasmus, 2012; Swart & Hoffman, 2013; Banda, 2017). Microeconomic variables in this study are accounting ratios such as price–earnings ratio, dividends per share (DPS), return on assets (ROA), return on equity (ROE) and book value per share (BVS). The extensive literature on this type of study signifies the importance of stock price movements for economies or the significance of the JSE.

1.2. Background of the JSE

South Africa's stock exchange, which is the Johannesburg Stock Exchange (JSE), was established in 1887. It is the second oldest stock exchange in Africa following Egypt (Paul, Japheth & Linus, 2019). The JSE was established to provide finance to new mines. In turn, this stimulated the growth of mines (Yartey, 2008). The compositions of the firms listed on the JSE are no longer mining firms only. There has been substantial growth in the JSE, and by 2015 there were more than 395 listed firms at a value of 756.8 billion USD (Deer & Koy, 2019). By July 2019, the JSE was valued at approximately 1 trillion USD (JSE Trading Statistics, 2019). The JSE is the largest stock exchange in Africa with a 90% combined market capitalisation of the entire continent and ranks number 19 in the world by market capitalisation (Deer & Koy, 2019; Paul et al., 2019). Over the past few years there has been a steady drop in firms registered on the JSE, however, the market capitalisation of the JSE has been increasing.

From the abovementioned, the South African stock exchange plays a pivotal role in the South African and African economy by providing liquidity for firms or as a mechanism to raise funds. Furthermore, the South African stock exchange is also a savings mechanism and is essential for economic growth. Therefore, it is crucial to understand the factors that impact the JSE all-share index (ALSI) market capitalisation. Such information will allow portfolio managers to make investment decisions, which will help portfolio managers to choose stocks optimally to maximise profits. The stock market is also one of the leading indicators of economic activity in a country, making it essential to understand which variables impact the JSE within the South African context. Some of the factors that impact the value of the JSE can be split into microeconomic and macroeconomic factors, where the former are variables concerned with factors that impact individual units such as the return on investment of a firm and the latter are variables that impact the country's economy as a whole; for example, any change in the fiscal policy.

1.3. Problem statement

The South African stock exchange plays a pivotal role in providing access to liquidity and channelling funds into profitable projects and hence spurs economic growth. A

broader understanding of factors that influence the variation of the South African ALSI value becomes essential. This can be achieved by understanding the explanatory power of both macroeconomic and microeconomic variables on the South African ALSI, which has not been studied in South Africa.

South African research has focused more on macroeconomic impacts than microeconomic impacts on the JSE all-share index. However, international studies offer a more balanced analysis. Impacts of both macroeconomic and microeconomic variables on stock values have been studied concurrently in other countries (Mukherjee & Naka, 1995; Al-Tamimi, Alwan & Abdel Rahman, 2011; Ali, 2011a; Ali 2014; Chittedi, 2015; Pradhan, 2016). It then raises the question: how would both macroeconomic and microeconomic variables impact the JSE all-share index?

Another gap to highlight is that in South African studies there was a focus on analysing the impact of DPS on the ALSI as opposed to also analysing other microeconomic variables and their impact on the ALSI (Bhana, 1998; Auret & Sinclaire, 2006; Mlonzi et al., 2011; Erasmus, 2012). This indicates a limited exploration of the microeconomic impact on the JSE all-share index given that there is extensive research that explores a broader range of microeconomic variables (Alia, 2011; Ali, 2014; Al-Tamimi et al., 2011; Srinivasan, 2012; Chittedi, 2015; Sharif, Purohit & Pillai, 2015; Pradhan, 2016).

In summary, there are two gaps identified that provide impetus to conduct this research. Firstly, to research the simultaneous impact of macroeconomic and microeconomic variables on the JSE all-share index. Secondly, to have an eclectic group of microeconomic variables when assessing the impact of microeconomic variables on the JSE all-share index instead of just limiting it to DPS. Understanding the explanatory power of a combination of macroeconomics and microeconomics on the South African ALSI would be useful for investors and the government in decision-making.

1.4. Purpose statement

The purpose of the quantitative study is to test the theory of whether both macro and microeconomic factors explain the variation in the value of the Johannesburg ALSI. A factor analysis, VECM and best subset regression model will be used on annual observations between 1997 and 2016 in South Africa. There are prima facie cases that support research on the impact of both macroeconomic and microeconomic variables on the ALSI in South Africa given the available literature (Mukherjee & Naka, 1995; Al-Tamimi, Alwan & Abdel Rahman, 2011; Ali, 2011a; Ali, 2014; Chittedi, 2015; Pradhan, 2016).

1.5. Significance of the study

Understanding whether both macroeconomic and microeconomic variables influence the ALSI will help potential investors make decisions when purchasing stock listed on the JSE. Those who are already invested with the listed firms and policymakers will understand which economic variables attract not just local investments but also Foreign Direct Investment (FDI) into the South African stock exchange. Increased investments will create employment opportunities and help to reduce income inequality in South Africa. Lastly, the fact that this research will incorporate the simultaneous impact of macroeconomic and microeconomic variables on the ALSI will also contribute to the literature on this subject. South African studies have not conducted research on the simultaneous impact of these economic variables on the ALSI.

1.6. Research Objectives

The key research objectives are as follows:

- To determine whether a combination of macroeconomics and microeconomic variables significantly influences the South African ALSI.
- To determine the magnitude of the relationship amongst the group of microeconomic and macroeconomic data.
- To determine whether dividends per share is not the only microeconomic variable with an influence on the ALSI. Therefore, the following microeconomic variables also formed part of the study, i.e. book value per share, price–earnings ratio, return on equity and return on assets.

- To determine if the VECM is an appropriate model to test the impact of macroeconomic and microeconomic effects on the South African ALSI.

1.7. Hypothesis

H1: Combined macroeconomic and microeconomic variables will have a significant impact on the South African ALSI.
H0: Combined macroeconomic and microeconomic variables will not have a significant impact on the South African ALSI.

H1: The VECM is an appropriate model to test the impact of both micro and macroeconomic effects on the South African ALSI.

H0: The VECM is not an appropriate model to test the impact of both micro and macroeconomic effects on the South African ALSI.

H1: There is correlation between macro and microeconomic variables.
H0: There is no correlation between macro and microeconomic variables.

1.8. Theoretical Framework

This study used three models dictated by the challenges encountered when conducting this research. The PCA, VECM and best subset model were applied.

1.8.1. Principal Component Analysis (PCA)

The PCA model reduces the number of variables by simplifying the model even further and helps in reducing multicollinearity (Jolliffe, 1986). There are 11 independent variables and, due to the existence of multicollinearity, the principal component model is applied. Abekha (2005) used the same approach to solve the problem of multicollinearity in Ghana in the process of analysing the impact of macroeconomic variables on stock prices. Mingione (2011) conducted a very similar study to the current study and used the PCA model. The study was conducted by Mingione (2011) to forecast the financial stability indices in Jamaica by aggregating economic variables and international indicators quarterly between 1996 and 2011. Zahedi and Rounaghi (2015), having drawn observations from 20 accounting ratios, reduced the model significantly to one independent variable using the first factor, which has a 95% influence on stock prices. The results from Zahedi and Rounaghi (2015) confirmed

that the PCA model could assess whether the microeconomic factors have a significant impact on stock prices.

In the PCA analysis, the factor which accounts for the highest variation is normally chosen. Joliffe (1982) highlights this point by further outlining that it is not necessarily true that the low variation factor has no significance. There is ample literature that supports this finding (Bair, Hastie & Tibshirani, 2006; Wang, 2012). The first factor was selected in this study as it accounted for most of the variation. Following this, the vector error correction model was applied after eliminating multicollinearity using the PCA model.

1.8.2. Vector Error Correction

The Vector Error Correction Model (VECM) was first used by Sargarn (1964) and was then made popular by Engle and Granger (1987). The Engle and Granger (1987) two-step error correction model can be utilised in multiple settings with multiple variables.

Financial data is characterised by volatility clustering, which is when the asset prices have wide swings for an extended period (Gujarati, 2012). Therefore, models such as the Vector Auto Regression (VAR), Generalised Autoregressive Conditional Heteroskedasticity (GARCH) and VECM were better-suited models when analysing financial data as these models are suited to deal with the volatility of financial data. Secondly, with the VAR, there is a risk of incorrect lag length in the model (Braun & Mittnik, 1993; Gujarati, 2012).

Mukherjee and Naka (1995) compared the VECM against the VAR model and found that the VECM is far superior. This was done by testing both models' forecasting accuracy through measuring it by the root mean square error where, if the root mean square is closer to zero, it represents more accurate results. The VECM results were more accurate by 15.75% when compared to the VAR results. Furthermore, inequality coefficients were smaller with the VECM. The VAR model cannot be used to investigate long-term relationships, and there is an inability to forecast short-term relationships in the presence of co-integration (Mukherjee & Naka, 1995; Coovadia, 2014).

The VECM has therefore been chosen due to its superiority. It has also been one of the favoured models for South African research when looking at the impact of macroeconomic variables on the JSE all-share index (MacFarlane, 2011; Hsing, 2011). In another developing nation, Dimmua (2015) used the VECM to test the influence of microeconomic variables on the Ghanaian stock prices. In a well-developed nation, Prazak (2018) also used VECM and CAPM to study the combined influence of macroeconomic and microeconomic variables on Czech Republic's stock prices.

The studies mentioned above prove that the VECM applies to this type of study and it was therefore used. There was, however the presence of non-stationary data in the model and the best subset model was applied.

1.8.3. Best subset model (Miller, 2002)

The best subset model selects the best model from all possible subsets from the independent variables considered (Miller, 2002; Zhang, 2016). Elliot, Gargano and Timmerman (2013) applied subset regression to analyse United States (US) stock returns when influenced by macroeconomic and microeconomic variables. The subset model was compared to other models such as ridge regression, bagging, and Lasso or Bayesian Model Averaging and was found to perform better. At a later stage, Elliot, Gargano and Timmerman (2016) found that the best subset model was a better predictor than the dynamic factor approach or univariate regression.

Given the high number (11) of variables considered in this study, the best subset model is used. This model is applied to single out the group of variables with the best explanatory power and, at the same time, eliminate multicollinearity.

1.9. Brief Literature Review

The literature on the macroeconomic and microeconomic factors and their impact on the ALSI dates back to the 1960s. There is overwhelming evidence that these variables impact a country's ALSI (King, 1966; Mukherjee & Naka, 1995; Barr, 1990; Chittedi, 2015; Chung & Ariff, 2016; Prashan, 2016; Jamaludin, 2017). Van Rensburg (1996; 1998; 2003) conducted considerable research on the impact of economic variables on the JSE all-share price and used models such as the Non-Linear

Seemingly Unrelated Regression (ITNLSUR), factor analysis, Arbitrage Pricing Theory (ATP) and Capital Asset Pricing Model (CAPM). Van Rensburg (1996; 1998; 2003) found inflation, money supply, interest and price–earnings ratio to have a significant impact on the ALSI, while Reese (1993) also used a factor analysis and ATP model and found the macroeconomic variable, gold price, to have a significant influence on the ALSI.

Barr (1990) pioneered the use of factor analysis in South Africa when assessing the influence of macroeconomic variables on the ALSI. In Barr's (1990) study, gold had a significant direct impact on the industrial share index and, in turn, had a positive impact on the capitalisation of the ALSI. The CAPM model, founded by Treynor (1961) and Sharpe (1964), has been used frequently due to its simplicity. However, the CAPM has been criticised due to its unrealistic assumptions. The specification of a single factor impacting security returns does not do justice to representing the variety of influences affecting security returns (Roll, 1977).

Due to the high volatility of financial data, more advanced models were used including the Generalised Autoregressive Conditional Heteroscedastic (GARCH), Vector Error Correction Model (VECM) and Vector Autoregressive (VAR) model in the assessment of macroeconomic variables on the ALSI. Macroeconomic variables such as inflation, interest rate, GDP, exchange rate and money supply have been found to have a long-term impact on the ALSI when the VECM was applied (Moolman & Du Toit, 2005; Muzindutsi, 2011; MacFarlane, 2011; Hancocks, 2011; Coovadia, 2014; Banda, 2017).

Dividends per share have been the most popular microeconomic variable that has been analysed with regard to its relationship with the South African ALSI. Bhana (1998) used the cross and the adjusted return model and found dividends per share to have a positive correlation with the ALSI. Similarly, in later studies conducted by Mlonzi et al. (2011) and Erasmus (2012), dividends per share also had a significant positive correlation on the ALSI. There is an increase in perceived value on listed entities that pay higher dividends, increasing the demand and price of shares. It also becomes crucial to understand whether the economic variable impacts on South Africa's trading partners and other developing countries.

Empirical findings confirm that macroeconomic and microeconomic variables are correlated with the ALSI with other developing and developed countries. The VECM was applied in the three developing countries of Sri Lanka, Pakistan and Bangladesh. Nishat (2004) and Kibria, Yasir, Kamran, Arshad, Perveen and Sajeed (2014) found that exchange rate, inflation and GDP had a significant influence on the ALSI in Sri Lanka and Pakistan, respectively. In Pakistan, Francis (2017) also found inflation to have a significant influence on the ALSI. Ali (2014) used the multivariate regression, Johansen Test for co-integration and the VECM. Dividends per share, money supply, GDP and exchange rate had a significant influence on the Dhaka Stock Exchange (Bangladesh). What stands out in studies conducted outside South Africa is that in these studies, an analysis was conducted on the impact of both macro and microeconomic variables on the ALSI simultaneously (Shubiri, 2010; Ali, 2011a; Al-Tamimi, Alwan & Rahman, 2011; Ali, 2014; Bhargava, 2014; Pradhan & Dahal, 2016). With both macroeconomic and microeconomic variables having explanatory power, conducting a study and understanding the influence of both these classes of economic variables on the South African ALSI would be of interest.

1.10. Organisation of the study

This paper will be structured as follows: the first chapter seeks to single out the reasons and objectives for conducting the study. In the second chapter, literature will be reviewed and gaps from the past studies will be identified. The third chapter will outline and justify the methodologies used to conduct the study. In the fourth chapter, the empirical findings will be presented and discussed. Finally, in the fifth chapter, the conclusion and recommendations will be made, including highlighting the limitations of the study.

1.11. Summary

The purpose and significance of the study are outlined in this chapter. A group of macroeconomic and microeconomic variables will be tested for their influence on the ALSI. Models such as the PCA, VECM and best subset model will be used to ascertain whether macroeconomic and microeconomic variables influence the ALSI. In South Africa, studies have either looked at the influence of macroeconomic variables on the

ALSI or microeconomic variables on the ALSI rather than the combined influence of these groups of economic variables. The findings in this study will augment the literature and assist investors and policymakers in making decisions.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

The first chapter introduced and highlighted the purpose of the study, the latter of which is informed by reviewing the literature. There are several research studies that have analysed the influence of macro and microeconomic factors on stock prices in developing and developed countries. The review of the literature will serve to analyse the findings from historical studies.

This chapter will follow the following order: firstly, critical terms in this study will be explained. Secondly, literature will be reviewed on South African studies to gain perspective of the economic factors impacting the JSE all-share index. Thirdly, it is vital to understand how other developing nations compare and contrast findings in South Africa. Lastly, literature will be reviewed on the influence of macro and microeconomic variables on stock returns in developed countries. Reviewing literature on both developed and developing countries allows an all-rounded understanding of the importance of economic variables on the value of a country's all-share index.

2.2. Defining Key Variables

The section intends to define the variables analysed and the key concepts thereof, which will include both the independent variables and dependent variable.

2.2.1. Macroeconomics

“Macroeconomics can be defined as the part of the economy that is concerned with examining the economy as a whole or its primary subdivisions or aggregates such as the government, repo rate, households and business sectors” (Van Rensburg, McConnell & Brue, 2015: Page 7). In this context, macroeconomic variables such as inflation, money supply, interest rates and exchange rate, to name a few, affect the economy as a whole. All these variables are assumed to affect the JSE stock values.

2.2.2. Microeconomics

“Microeconomics is part of economics that is concerned with individual units such as a person, a household, a firm, or an industry. It looks at decision-making by individual

customers, workers, households, and businesses" (Van Rensburg, McConnell & Brue, 2015: page 7). In this study, microeconomic variables such as P/E ratio, gearing and debt/equity ratios, to name a few, are individual company variables that will be tested to find out if they have an impact on a firm's stock price.

2.2.3. Stock price (dependent variable)

A stock price is defined as the share price of a company that can be sold in the stock market (Gujarati, 2012). In this study, a group of stock prices known as the South African ALSI is the dependent variable. The ALSI comprises the top 150 publicly listed firms on the JSE and the ALSI measures the value of those 150 firms.

2.2.4. Exchange Rate

The exchange rate can be described as the value of one country's currency over another (Van Ransberg et al., 2015). The rand/dollar exchange rate will be used in this study, as the dollar is the most frequently used currency in the world. There is depreciation (weakening) in exchange rate when a country's currency value decreases in relation to a foreign country. Using the rand/dollar as an example, it will cost more rands to buy a single dollar in such a case. The appreciation of a foreign exchange rate increases the currency value of the local currency in relation to the foreign currency. In other words, one can buy more dollars with a single rand.

2.2.5. Interest Rate

The interest rate can be defined as the amount the borrower pays for the use of an asset, which is commonly a financial asset (Van Ransberg et al., 2015). In this study, interest is the prime interest rate controlled by the South African Reserve Bank through the repo rate adjustment. An adjustment of the interest rate takes place to either encourage or discourage spending in the economy, depending on whether the economy requires growth or needs to reduce growth. For example, by lowering interest rates it reduces the cost of money, increases borrowing of funds, increases expenditure and stimulates growth. Growth stimulation can however have an inflationary effect.

2.2.6. Gross Domestic Product (GDP)

GDP is the value of the annual total of products and services manufactured in a given country (Van Rensburg et al, 2015). GDP is used to measure the economic growth of a country in monetary terms. In this study, per capita will be used to account for the variation of the population over the period of study in South Africa.

2.2.7. Gold Price

South Africa is amongst the most significant gold exporting countries and is a natural resource-dependent economy (Roux, 2020). Therefore, the gold price is crucial to the South African economy, mainly due to the fact that mining firms contribute significantly to the value of the ALSI. South Africa is not a price setter; instead, gold is exported at the current world price. Gold prices are highly volatile since the demand can shift quickly as some use it as a hedge against inflation (Van Rensburg et al., 2015). However, there are limitations to producing gold as gold mining is costly, causing an inelastic supply.

2.2.8. Inflation

Inflation is the general increase in prices in an economy, which reduces the buying power of each rand that is spent (Van Rensburg et al., 2015). The Consumer Price Index (CPI) is used to calculated inflation. The CPI has a group of sample products and services calculated at current prices to ascertain value. Weights are applied to specific products, which is determined through percentage spending of disposable income by households on certain products. CPI value can be calculated month on month. A consistently high percentage increase in CPI is what is known as inflation. The monetary policy can be used to control inflation.

2.2.9. Money Supply

Money supply is influenced by the decrease or increase in the interest rate (Van Ransberg et al., 2015). An increase in the interest rate increases the cost of money and reduces the funds injected into the economy. Furthermore, an increased interest rate increases the returns on an investment deposit, thus reducing the money flowing

in an economy. A reduction in interest rate will have a contrary effect on the money supply.

2.2.10. Price–Earnings (PE) ratio

The PE ratio is the value of a stock relative to the earnings on a stock (Firer, Ross, Westerfield & Jordan, 2012). Mathematically, it is obtained by dividing the share price by the earnings per share. A high PE ratio could imply that the stock is overvalued, because it means an investor is willing to pay a premium amount for a rand of earnings.

2.2.11. Dividends Per/Share (DPS)

The DPS is the dividends paid for every ordinary share issued in a year divided by the number of issued shares in a given year (Firer et al., 2012; Van Ransberg et al., 2015). Dividends paid out to shareholders will increase the DPS and may attract investors. Reduced dividends per share may also attract investors, as it could mean that investors are clawing back profits to invest in the business and pay high dividends in the future. Therefore, dividends per share cannot be looked at in isolation when buying shares. Instead, a full understanding of a company's strategy is also essential.

2.2.12. Return on Assets (ROA)

ROA measures the profitability of an investment by a company (Firer et al., 2012; Van Ransberg et al., 2015). In other words, these are profits after tax made on assets or resources employed by a company. ROA can measure the efficiency of a firm or the quality of investment decisions made by a firm. The higher the ROA, the more attractive a share becomes to investors.

2.2.13. Return on Equity (ROE)

Return on equity is the net profit after tax divided by company's equity investment in a year (Firer et al., 2012; Van Ransberg et al., 2015). ROE can also be considered as a return on net assets, since shareholder's equity is the company's assets minus its debt. Whether a company achieves a good or bad ROE depends on the ROE achieved by other firms in that industry, and potential investors will use this approach to analyse the ROE of a listed firm.

2.2.14. Book Value per Share (BVS)

BVS is the minimum equity value on a company's balance sheet after adjustment for cash inflows and outflows; outflow adjustment being dividends and stock buy-backs, inflow being retained earnings (Ross et al., 2012). It is often concluded that a company has a high historic performance if the book value per share is high (Srinivasin, 2012).

2.3. Empirical Review of Literature

The review of literature will be conducted on the impact of macroeconomics and microeconomics on the ALSI. Firstly, literature will be reviewed on South African studies, followed by developed and developing countries.

2.3.1. Macroeconomic and microeconomic impacts on the ALSI in South Africa

It is important to firstly understand the impacts of macro and microeconomic factors on the ALSI in South Africa as the foundation for this study. The findings on the studies analysed are summarised in Table 2.1. Therefore, when reading about the findings refer to Table 2.1.

Table 2.1: Summary of South African historic study findings

Author	GoldP	Interest	Exch_R	GDP	Inflation	M1	P/E ratio	Div_S	ROA	ROE	BVS
Barr 1990	+	+									
Reese (1993)	+/-		#(-)	#(+)	#(-)						
Van Rensburg(1996)	#	+			-	+					
Van Rensburg(1998)		#	#								
Moolman and Du Toit (2005)		-	+	+							
Mangani (2009)	+	-									
Muzindutsi (2011)			-								
Alam & Uddin (2009)		-									
Hancocks (2011)		+	-		-	+					
Gupta and Modise (2013)		+									
Coovadia (2014)		#(+)	#	+	+	-					
Hsing (2011)		-	-	+	-	+					
Ndako (2013)			(#)+/-								
Ho (2017)		-		+	_						
Mac Farlane (2011)		#(-)	#(-)	-	#(+)	#(+)					
Bhana (1998)								+			
Erasmus (2012)								+			
Mlonzi et al(2011)								+			
Auret & Sinclaire(2006)							-	+			
Banda 2017		-	+		+						
Van Rensburg & Robertson (2003)							-				
Swart & Hoffman (2013)								+			

(#) insignificant, (-) negative and (+) positive

Adapted from the authors reviewed in this section or authors from the above table (Barr, 1990; Rees, 1993; etc.)

In an early study conducted by Barr (1990), monthly data was used from 1979 to 1987 and data was modelled using factor analyses and a covariance bi-plot. Two factors were calculated, namely factors 1 and 2 representing the industrial and the financial-orientated index, respectively. Gold and metal prices had a strong influence on the industrial index, and this was attributed to the economic activity being driven by positive gold and metal prices through the effect this has on the mining sector, as this

sector has strong linkages with other sectors. The mining sector represents 33% of market capitalisation on the JSE (Brands South Africa, 2012), and in 2015 the mining sector's contribution to the South African GDP was 8% (Leeuw & Mtegha, 2018). Therefore, the mining industry remains a relevant sector in the South African economy.

Similar to Barr's (1990) study, Reese (1993) used factor analysis to create factors and then regressed those factors and incorporated them in Arbitrage Pricing Theory (APT) from 1980 to 1989 monthly. However, Reese's (1993) study compared the ATP model to the Seemingly Unrelated Regression (SUR) model. The combination of these factors was tested against the mining and industrial index. The mining index was positively impacted by the gold price factor and the growth rate risk factor. The gold price factor was the better-suited factor in explaining the mining index's variation, which is expected given that gold prices would have a direct effect on the mining index. The industrial index was impacted by a higher number of factors than the mining index, which is understandable given that the mining sector is more of a specialised sector in relation to the industrial sector. The industrial index was influenced by factors made up of the risk of the gold price and residual market risk, foreign exchange/residual market risk, inflation risk/residual market risk, gold price risk/residual market risk and, lastly, the default premium risk. The impact or correlation of these factors on the industrial index varied depending on the type of company. Further findings by Reese (1993) were that the SUR model was not superior to the APT model in finding the right factors that affect the indices. However, the weakness of Reese's (1993) study was that the residual market risk was significantly different to zero; hence, more work had to be done in finding more factors.

Three years later, Van Rensburg (1996) conducted a study for the same period as Reese (1993), i.e. 1980 to 1989, even though the study was conducted in a later period. A similar approach was also used, which was the factor analysis. The only difference was that Van Rensburg (1996) used the Iterated Non-Linear Seemingly Unrelated Regression (ITNLSUR) methodology of McElroy and Burmeister, whereas Reese (1993) used the Linear SUR. Furthermore, van Rensburg (1996) conducted a study on the impact that the factors would have on the ALSI and specific indices, while Reese (1993) analysed the impact that the factors would have on specific JSE indices

only. Van Rensburg (1996) found that inflation had a negative relationship, and that the term structure of the interest rate was positively related to the JSE all-share index, which is consistent with Reese's (1993) findings. The foreign markets represented by the Dow Jones had a positive and statistically significant influence on the JSE all share indexes. The gold price relationship with the JSE all share indexes was insignificant, which was unexpected for South Africa. The insignificance of the gold price cannot be caused by mining shares being under-represented in the sample; in fact, mining shares had higher capitalisation. However, the gold price still had an insignificant impact on the ALSI. These findings are contrary to expectations, given the mining industry's significant contribution to the South African economy, as mentioned above.

Van Rensburg (1996) subsequently undertook a more precise analysis of the effects of the gold price on the listed shares by analysing the impact that that gold price has on the mining index. The gold price did not have a significant positive relationship with mining shares according to this analysis, which conforms to Reese's (1993) study for the same period. The gold price had no significant relationship with industrial shares and financial shares. The influence of the gold price on the mining shares can be expected based on economic theory, i.e. if the price of gold increases, the supply of the gold will also increase, thus increasing profitability and production for mining firms.

Barr (1990) and Van Rensburg's (1996) studies, as mentioned earlier, used data for a similar period and it was interesting to see that in both their studies, foreign share markets impacted the JSE all-share index. This could be attributed to the fact that South Africa is a substantial exporter of minerals thus exposing it to foreign markets. However, the methodology employed by Van Rensburg (1996) resulted in a greater number of macroeconomic variables explaining the variation on the JSE all-share index, suggesting that the ITNLSUR model is better suited than the SUR model.

At a later stage, Van Rensburg (1998) did a study on macroeconomic forces that impacted the JSE from 1965 to 1995. Van Rensburg used the Arbitrage Pricing Theory (ATP) model and the ITNLSUR model. The research findings indicated that the industrial shares had a high sensitivity towards the Dow Jones and short-term interest, while gold shares were relatively more sensitive to the gold price. The ATP model was also found to be better suited for this kind of study compared to the Capital Asset

Pricing Model (CAPM). The ATP model is a more superior model to the CAPM model because it suggests that returns are linearly related to several common or systematic factors (Ross, 1978) due to its simplicity. The ATP model has less restrictive assumptions as it is based on no-arbitrage conditions. The CAPM has been the most widely-used pricing model established by the authors Treynor (1961) and Sharpe (1964). However, CAPM is criticised for its unrealistic assumptions such as the establishment of a mean-variance efficient portfolio. The specification of a single factor impacting security returns does not do justice to representing the variety of influences affecting security returns. Van Rensburg and Robertson (2003) then used the CAPM model to assess the impact of microeconomic variables on the JSE all-share index from 1990 to 2000 using monthly data. It was found that the PE ratio had an adverse relationship with the JSE all-share index.

At a later stage, Moolman and du Toit (2005) used the Error Correction Model (ECM) and analysed the impact that macroeconomic variables have on the ALSI using quarterly data. The results were as follows: the exchange rate had a positive co-efficient, negative short-run interest, positive GDP, negative discount rate (long term) and positive foreign stock values. Mangani (2009) also had similar findings to Moolman and du Toit (2005) regarding the impact that the interest rate had on the ALSI, i.e. interest rate had a negative influence on the ALSI. Mangani (2009) found the increase of gold value to impact resource stock values positively and that it had a negative effect on non-mining stock, which shows that investors will trade off non-mining shares for mining shares when the gold price increases. However, the models used by Moolman and du Toit (2005) and Mangani (2009) were different. Mangani (2009) used the Generalised Autoregressive Conditional Heteroscedasticity (GARCH) model and weekly data from 16 December 1983 to 25 May 2007, while Moolman and du Toit (2005) used the error correction model as well as quarterly data from 1978 to the end of 2000. It is important to note that weekly data improves the accuracy of results because it increases the number of observations in a study; however, improving the accuracy of data is limited by the number of observations. For a similar period, i.e. 1998 to 2003, Alam and Uddin (2009) used panel regression and monthly data and found the interest rate to have a significant negative influence on the ALSI in South Africa and other countries, i.e. Bangladesh, Colombia and Italy.

Muzindutsi (2011) used monthly data from 1978 to 2008 and the error correction model and found an inverse long-run relationship between the real exchange rate and the ALSI; however, in the short-run, there was no influence on stock values. Interestingly, it was noted that the exchange rate's influence on the JSE grew stronger when the exchange shifted from a fixed exchange rate to a floating exchange rate.

Similarly to Muzindutsi (2011), Hancocks (2011) also found that the exchange rate had an inverse relationship with the ALSI. Furthermore, a study on the effects of other macroeconomic variables was conducted and narrowed down to the economy's different sectors. Inflation had a notable and negative influence on the ALSI. The long-run interest rate, short-run interest rate and money supply had a significant and positive influence on the ALSI. Hancocks (2011) used the VECM and used data in the period between 1996 and 2008. Hancocks' (2011) study had the following limitations: there were different measures of exchange rates, and using a nominal rand/dollar exchange rate could have yielded much more accurate findings and possibly offered a useful understanding on the correlation between the rate of exchange and stock values, especially in the retail sector.

Gupta and Modise (2013) studied the in-sample and out-sample predictability of stock returns using a predictive linear regression model for the period 1990:01 to 1996:12 for an out-sample, and a period of 1997:1 to 2010:6 for an in-sample. The data that was used was monthly. Research findings suggested that macroeconomic and financial variables did not contain sufficient data in predicting South African share prices. The macroeconomic variables that were considered included interest, crude oil prices, employment, money supply, inflation, industrial production and oil production. However, only interest rate variables influenced the South African ALSI, and this was positive.

Coovadia (2014) used the same methodology as Hancocks (2011), i.e. the VECM. This study was conducted between the periods of 1994 to 2012 using quarterly data. Contrary to Hancocks' findings, Coovadia (2014) established that GDP had a significant and positive relationship with the ALSI. Inflation also had a direct impact on the ALSI. There was however a significant negative relationship with the money supply. The JSE all-share index long-run sensitivity to exchange rates and the interest

rate was insignificant in Coovadia's study. The R-Square of the model was low for Coovadia's study, indicating that more variables should have been considered in explaining the ALSI. Perhaps the inclusion of microeconomic variables would have improved the strength of the model. The results suggest that a non-linear model will be better suited.

More current studies include the work done by Hsing (2011), who used the GARCH model. It was concluded that real GDP, money supply and the US stock market index positively correlated with the ALSI. The US's deficit in terms of GDP, real interest rate, nominal effect of exchange rate, US bond yield and inflation rate negatively affected the JSE. MacFarlane (2011) found conflicting and mixed results when compared to Hsing (2011), and this could be partly attributed to the use of a different approach, i.e. co-integration analyses, Granger Causality test, innovation accounting and the VECM for investigating the long-term influence of macroeconomic variables on the ALSI in the period between July 1965 and July 2010 quarterly. MacFarlane (2011) found that GDP had a surprisingly inverse relationship with the ALSI. The rand/dollar exchange rate and interest rate had a negative but insignificant correlation with the ALSI. Inflation and money supply had a positive but insignificant influence on the ALSI. Based on the number of insignificant variables, MacFarlane (2011) concluded that the model used should have perhaps included precious metals as part of the variables since the South African economy has a historical dependency on precious metals. Furthermore, the S&P 500 or the Morgan Stanley Capital International (MSCI) world index has a strong influence on the ALSI. MacFarlane (2011) critiques the study in that the data used lacked frequency, as quarterly data was used due to lack of monthly data.

Muzindutsu (2011) conducted a similar study in a similar period to MacFarlane (2011) using different models/approaches. The Granger-Causality test, Engle-Granger co-integration and descriptive statistics were used as methodologies. The correlation of the exchange rate with the JSE all-share index was stronger between periods of free-floating and dual exchange rates, while it was less significant during the joint exchange rate period. The difference in results could be attributed to South Africa's political climate and financial sanctions imposed during the joint exchange rate period. An inverse long-term relationship existed between the JSE all-share index and real

exchange rate, while no relationship existed in the short-run. Bidirectional casual linkage was found between the two variables in South Africa.

Ndako (2013) later reviewed the period between January 2000 and December 2009 using weekly data and found no co-integration with the real exchange rate and the stock market in South Africa and various other Sub-Saharan countries using a bivariate Vector Auto Regression (VAR) model. The Dynamic Conditional Correlation (DCC) model showed that only the Ghanaian exchange rate had a positive influence on the ALSI, while Nigeria and South Africa had both positive and negative relationships. Kenya and Mauritius reflected a negative relationship.

Ho (2017b) explored the impacts of macroeconomic factors on equity market development in South Africa in periods between 1975 and 2015 through annual observations. The Autoregressive Distributed Lag (ARDL) bound testing model was applied. The banking sector growth and growth in the economy had a direct long-run influence on the growth of the stock market. In the short run, GDP had a direct relationship with equity market growth, while the current period of trade openness, real interest rate and inflation rate had an inverse relationship with equity market growth. GDP is one of the measures used to measure the performance of the economy; therefore, it is rational for GDP to have a positive correlation with equity market growth. It would be expected that an increase in trade openness would stimulate the economy as it would improve access to markets. As a result, GDP would grow and the equities market would also grow accordingly. However, this is a rather peculiar finding, and it is worth researching the impacts of trade openness on equity growth. Interest rate increases raise the cost of borrowing money for firms and make investments much more attractive than investing in equities markets, which explains the negative correlation with equity market growth. The negative correlation between inflation and equity growth is expected given that inflation increases the general costs of goods, including factors of production, which would reduce the margins of listed firms and result in negative economic growth.

Banda (2017) conducted research on the impacts of inflation, exchange rate and interest on the ALSI using the VECM. The period was from 1995 to 2015 and quarterly data was used. Interest was found to have a direct relationship with the ALSI, reflecting

the substitution relationship between interest and stock prices. Inflation had a direct relationship with the ALSI, which are the same findings as Coovadia's (2014). There is a possibility that the monetary policy application to control inflation has had positive spin-offs on the economy or businesses, thus the positive relationship between inflation rate and ALSI. The exchange rate was found to have a positive relationship with the ALSI, which could be attributed to the fact that South Africa is a net importer of merchandise with a negative trade balance of R47.3 billion in 2018 (Roux, 2020). Therefore, a positive change or appreciation of the rand increases the ALSI because it makes imported inputs for listed firms cheaper.

The majority of the studies investigating the impact of microeconomic variables on the ALSI in South Africa were limited to the impact of dividends payouts on the JSE all-share index. Dividends payouts had a direct influence on the South African all-share index (Bhana, 1998; Auret & Sinclaire, 2006; Mlonzi, et al., 2011; Erasmus, 2012; Swart & Hoffman, 2013). Auret and Sinclaire (2006) is one of the few studies that took it a step further by analysing the impact of the PE ratio and book value on the ALSI, and found the PE ratio to have a negative impact on the ALSI and the BV to have a direct relationship with the ALSI.

Table 2.1 summarised the findings of the several studies done on the impact of macro and microeconomic factors on the ALSI in South Africa. The literature spans back from the early 90s to more current studies. The majority of the South African studies focused on the impact of macroeconomic factors on the ALSI, while only four studies focused on the influence of microeconomic variables on the South African ALSI. There was no single study that simultaneously analysed the influence of macroeconomic and microeconomic factors on the South African ALSI.

South African studies have not broadly explored the impacts of microeconomic variables on the ALSI. Most of the studies have been limited to just the effects of dividends payouts per share on the ALSI. Furthermore, there have been no studies that explored the combined impact of both macro and microeconomic variables on the ALSI in a single study. The VECM (Johansen Co-Integration model) and the GARCH model seemed to be the favoured models historically. These models are relatively

advanced models when dealing with financial data, as financial data is characterised by high volatility.

2.3.2 Developing Countries

Table 2.2 reflects the impact of macro and microeconomic factors on the ALSI in developing countries. The developing countries include Pakistan, Sri Lanka, Bangladesh, Brazil, Russia, China, Jordan, Kenya, Ghana and Nepal.

Table 2.2: Summary of developing countries' historic study findings

Author	Gold_P	Interest	Exch_R	GDP	Inflation	M1	P/E ratio	Div_S	ROA	ROE	BVS
Nishat (2004)					-						
Nijam et al (2015)		+	+	+	-						
Francis (2017)		+	+		-	-					
Ali (2011a)					-		+				
Ali (2011b)							+	#			
Ali (2014)		#	-	-	#	-	#	+			
Chittedi (2015)	-	-			-	+					
Ramadan (2016)		-		+	-	+					
Ouma (2014)		#	-		+	+					
Pradhan & Dahal (2016)				+	+	+	+	+	+		+
Kibria et al (2014)			+	+	+	+					
Shubiri 2010		#		+	-		+	+			
Dimmua (2015)								+		#	

(#) insignificant, (-) negative, (+) positive

Adapted from the authors reviewed in this section or authors from the above table (Nishat, 2004; Ali, 2011a etc.)

Using the Vector Correction Model, Nishat, Shaheen and Hijazi (2004) identified that the production output index in Pakistan had the most significant positive correlation with Pakistan's stock values. Inflation had the most significant negative influence on

Pakistan's ALSI. A later study by Kibria et al. (2014) investigated the impact of GDP per head, inflation, GDP savings, money supply and exchange rate on the Pakistan KSE 100 Index using annual data. The Granger Causality test and regression analysis were applied when analysing annual observations over 23 years from 1991 to 2013. The study outcome was as follows: GDP savings, inflation, exchange rate, money supply and GDP per capita had a significant positive impact on the KSE 100 index.

The direct effect of inflation on the Pakistan ALSI was in contrast to Nishat et al's (2014) earlier findings in Pakistan. Inflation in accordance to economic theory will have an inverse relationship with the ALSI as increased inflation tends to result in an increase in interest, which then reduces the share price. Kibria et al's (2004) study used a less advanced model, i.e. regression model, while Nishat et al. (2014) used the VECM, which is the better-suited model given the high volatility in financial data. The different models used could be the reason why there were different outcomes between these studies. Nonetheless, Kibria et al. (2014) found that the macroeconomic variables analysed caused 73% of the variation in the Pakistan ALSI over the three terms.

In Sri Lanka, Nijam, Ismail and Misthafa (2015) used the ordinary least square technique to calculate a regression model's parameters. The linear, Linear-log, log-log and log-linear model were tested to find an appropriate model. The study was done in the quest to determine whether macroeconomic variables, namely GDP, wholesale price index (inflation), exchange rate, interest rate and the balance of payments over the period from 1980 to 2011 could explain the changes in the ALSI. The serial correlation was tested using the Durbin–Watson Statistic for the log-log model; this model had the highest R^2 at 82%. The study's outcome revealed that GDP, exchange rate and interest rate had a significant positive influence on the ALSI in Sri Lanka. A markedly negative relationship with inflation was observed similar to that seen in a study conducted by Nishat and Shaheen in Pakistan (2004). The balance of payments' impact on the ALSI was insignificant.

A similar study to Nijam et al. (2015) was conducted by Francis and Ganeshamoorthy (2017) on the impact of macroeconomic variables on the Sri Lanka stock exchange (Colombo) between 1986 and 2014. The Augmented Dickey-Fuller (ADF) unit root

test, Johansen Co-integration test, VECM and Granger Causality test were used in this study. The interest rate and exchange rate had a significant positive correlation with the ALSI, while inflation had a significant negative correlation with the ALSI. Although there were inconclusive results in Nijam et al's (2015) findings on money supply, Francis and Ganeshamoorthy (2017) used monthly data and found that money supply had a markedly negative association with the ALSI in Sri Lanka contrary to economic theory and expectations. Furthermore, Francis and Ganeshamoorthy's (2017) findings were that interest rate and the exchange rate had a positive correlation with the ALSI, contrary to economic theory. Perhaps the unexpected results are caused by the fact that Sri Lanka was at war from 1983 to 2009. Should the war be included as a proxy, it would be interesting to determine the degree to which results would change. Lastly, inflation had a negative impact on the ALSI in Sri Lanka. It can therefore be concluded with certainty that inflation has a negative effect on the Colombo ALSI, as Nijam et al. (2015**)** had the same findings for a similar period.

Ali (2011a) analysed the impact of macro and microeconomic factors on developing equity markets in the Bangladesh stock exchange (Dhaka) using a multivariate regression model Ordinary Least Square (OLS) from 2002 to 2009 and the data was collected monthly. Amongst the OLS models explored, a log model was eventually chosen. Independent macroeconomic factors were inflation, production output index and foreign payments. Independent microeconomic variables were the market price/earnings (PE) ratio and average growth in market capitalisation. The five variables were statistically significant at a 5% confidence interval. The significant negative relationship between the production output indexes with the ALSI in Bangladesh is in contrast to Nishat and Shaheen's (2004) findings in Sri Lanka. The industrial sector contributes 33% to GDP. When the industrial sector becomes attractive for investors, investors may perhaps direct their investment towards the industrial shares and other alternative investments in the equities markets to diversify their portfolio. The diversion of investments away from equities likely far outweighed the increase in the ALSI due to increased investments in industrial shares. Variables that had a significant negative relationship with the ALSI were inflation and foreign remittance. The market PE ratio and the monthly average growth in market capitalisation had a direct positive correlation with stock returns.

Ali (2011b) undertook another study in a similar period i.e. January 2000 to December 2010, and used monthly data. The study conducted assessed the impact of microeconomic variables on the Dhaka (Pakistan) ALSI using the Johansen and Julius test and T-Y Granger causality models. The price–earnings ratio had a positive influence on the ALSI, consistent with the result found when the OLS model was used.

For an extended period of study (1986–2010), Ali (2014) used the VECM and found DPS to have a positive relationship with the ALSI, while money supply, GDP and exchange rate had a significant negative relationship with the ALSI of the Dhaka Stock Exchange. The money supply sign was consistent with the findings by Ali (2011a). However, there was no consistency with signs for the impact of the exchange rate on the ALSI when comparing studies done by Ali (2014) and Ali (2011b). This could be a result of a change from being a net exporter to being a net importer of production inputs, thus the change from a positive exchange rate effect on the ALSI to a negative one.

Shuburi (2010) also analysed the impact of three macroeconomic and three microeconomic variables on the Amman (Jordan) banks' stock prices using the multivariate analysis. Annual observations were used of 14 banks listed on the Amman stock exchange between 2005 and 2008. PE ratio and DPS were both significant and had a positive impact on the banks' stock prices. Net asset value was found to have an insignificant impact on stock prices. For the macroeconomic variables, GDP had a positive and significant impact on the stock prices, while inflation had a negative and significant impact on the stock prices.

Ramadan (2016) used 77 Jordanian industrial firms listed on the Jordanian stock exchange to determine the effect of macroeconomic variables on equity prices between 2000 and 2014. An unbalanced pooled cross-sectional time-series multiple least squares regression model was used. Interest and inflation presented a significant and negative correlation with the stock values of the industrial firms, while money supply and GDP had a significantly positive correlation with stock values.

Chittedi (2015) used the Granger causality test to examine the macroeconomic variables and stock values in Brazil, India, Russia and China (BRIC) countries

between April 1994 and July 2010. In India, foreign institutional investments had a positive impact as did the money supply, while inflation and gold price were both negative in the long run. In Brazil, only interest had a negative impact on the Brazilian ALSI at a 10% level of significance. China was found to have no variables with a significant influence in the ALSI. In Russia, the production output index had a positive correlation with the Russian ALSI. However, due to data constraints, essential variables such as inflation, gold price and foreign institutional investments had to be omitted.

Ouma and Muriu (2014) used three techniques in determining whether macroeconomic factors influenced the Nairobi stock exchange in Kenya, i.e. Ordinary Least Squares, APT and CAPM. Monthly data was used between 2003 and 2013. It was found that money supply and inflation affected the stock market values in Kenya positively, while the exchange rate affected stock prices negatively. The positive impact of inflation on the ALSI is a rather interesting result; perhaps the positive impact of inflation on the ALSI is because of the equities market being used as a hedge against inflation. The interest rate had no impact on the stock prices. This study lacked variables such as government spending, GDP and money supply. Having these results could have improved the strength of the model, especially the variable government spending, as the Kenyan government has some ownership in the firms that are part of the Nairobi Stock Exchange. Furthermore, using a VECM could have yielded more robust and consistent results with the more advanced model.

Pradhan and Dahal (2016) studied the effects of microeconomic and macroeconomic factors on share prices on the Nepalese commercial banks throughout 2002/03 to 2013/2014 using a pooled cross-sectional annual data analysis. ROA, DPS, inflation, money supply, PE ratio and BVS had a significant relationship on the Nepalese banks' share prices.

Dimmua (2015) used the VECM to test the impact of microeconomic variables on the Ghanaian stock prices. Yearly data was used from December 1997 to December 2013. The dividend yield was the only variable that had a significant influence on the Ghanaian stock prices. Challenges experienced in this study included the ability to

acquire quarterly data due to dealing with listed firms, hence the data had to be annual, while another challenge was the short period of analysis.

The VECM was the most commonly used model in the rest of developing countries. The positive effect of GDP and PE ratios on the ALSI was consistent throughout the developing countries analysed. Inflation had varying effects on different countries. In Kenya, Nepal and Pakistan, for example, inflation had a positive impact on the ALSI, implying that the stock values could be utilised as an inflation-protection mechanism. Increased inflation results in a decline in real income, causing investors to sell their shares to increase their buying power, thus increasing stock value.

On the contrary, Sri Lanka, Bangladesh, the BRIC countries and Amman stock values were negatively influenced by inflation, implying the effect of squeezed margins for business due to increased inflation costs, therefore decreasing the profitability of firms and thus the value of the ALSI. The PE ratio had a positive impact on all the developing countries analysed. Only one paper touched on BVS, which had a direct effect on the ALSI index in India. Interest rate, DPS and exchange rate had a mixed effect on the ALSI.

2.3.3. Developed Countries

This section will review literature on the effect of macro and microeconomic factors on the ALSI of different developed countries. Table 2.3 below provides a list of all the developed nations and the relationship that the economic variables have with the ALSI. The developed countries are Taiwan, Japan, Malaysia, Turkey, Bahrain, the Unites States (US), Canada, United Kingdom (UK), United Arab Emirates (UAE), Singapore, Malaysia and Indonesia.

Table 2.3: Summary of developed countries' historic study findings

Author	GoldP	Interest	Exch_R	GDP	Inflation	M1	P/E ratio	Div_S	ROA	ROE	BVS
Dogan & Yalcin (2007)				+/-							
Sharif, Purohit & Pillai (2015)							+	+		+	+
Bhargava (2014)		-			+		+	+			
Kabir & Beusichem (2014)		#	#								
Chung & Ariff (2016)						+					
Al-Tamimi et al (2011)		#(-)		#	-	+	+				
Mukherjee & Naka (1995)		#(-)	+		-	+					
Ho (2017)				+	-						
Jamaludin (2017)			+		-	#(+)					
Prazak (2018)				+	-				+	+	

(#) insignificant, (-) negative, (+) positive

Adapted from the authors reviewed in this section or authors from the above table (Mukherjee and Naka, 1995; Ho, 2017, etc.)

A slightly dated study by Mukherjee and Naka (1995) tested the influence of Japan's macroeconomic factors on stock values using the VECM. The monthly data evaluated were from the period of January 1971 to 1990. There was a co-integration relationship that existed between the independent variables and the dependent variable. Production output index and money supply had a converse relationship with the Taiwanese ALSI. These findings suggest that the industrial sector has a pivotal role in the economy. Inflation, on the other hand, had an inverse relationship with the Taiwanese stock values, as inflation reduces company profits. There were mixed results with the interest rates, whereby long-term interest rates had an inverse relationship with the ALSI while there was a direct relationship with call money rates.

Lastly, the exchange rate had a direct relationship with the Taiwanese stock exchange price.

Jamaludin, Ismail and Manaf (2017) studied three Asian countries, i.e. Singapore, Malaysia and Indonesia, where a comparison was made on how macroeconomic variables impact the Islamic shares and conventional shares. Macroeconomic factors such as inflation, money supply and exchange rate were Panel Regressed to understand the impact that these variables had on the ALSI. Monthly data was used between the periods of January 2005 to December 2015. The Panel Least Square Regression technique was used in which inflation had a more significant effect on the Islamic shares and non-Islamic shares than the other variables. Inflation had an inverse relationship with the ALSI. The money supply was positive but insignificant, and the exchange rate had a direct and significant influence on the Asian country's ALSI value for both Islamic and non-Islamic shares. The effect of these variables on Sri Lanka, Pakistan and Bangladesh's ALSI was the same as these three Asian countries. The magnitude of the influence of the macroeconomic factors on the Islamic shares was more significant due to the conservative nature of the Islamic economy. Jamludin et al's (2017) study had a few limitations, such as only a few variables being used for the study. A more advanced model could have been used, and considerations of time lags would possibly have been beneficial.

Ho (2017a) also analysed the impact of macroeconomic determinants in the Malaysian stock development between the period of 1981 and 2015 using annual data. These macroeconomic determinants were economic performance, banking development, foreign direct investment (FDR), inflation rate and trade openness. The ARDL bound testing procedure was used to ascertain if a correlation existed between the dependent and independent variables. GDP and the ratio of trade to GDP had a significant direct long-term effect on the value of stock prices, while banking sector growth had an inverse long-term relationship with the growth of the stock market. In the short run, previous periods of banking development, along with current and prior periods of the relation of trade to GDP had a positive impact on stock market growth. Inflation negatively influenced equities market growth, which conforms to Jamaludin et al's (2017) findings in Malaysia.

Dogan and Yalcin (2007) researched the impact that the exchange rate had on the ALSI in Turkey between January 1997 and November 2003. The VAR model was used to test the relationship. Different results were found in this period as a result of the amendment in the exchange rate regime. Between January 1997 and November 1999, the exchange rate had a positive impact with the majority of the share prices. Between the periods of January 2000 and November 2003, the exchange rate had a statistically significant negative relationship with most of the share prices. There was a change to a crawling peg exchange rate regime in Turkey in the later periods of the study, thus the change in results.

Sharif et al. (2015) analysed the microeconomic variables that impact the share price of 48 companies on the Bahrain Stock Market over an annual period between 2006 and 2010. Pooled Ordinary Leases Squared (POLS) regression, fixed effects and random effects methods were utilised to carry out the research. The 48 companies represented 80% of the companies' component of the Bahrain stock exchange; therefore, inferences from results can be used to represent the entire stock exchange. The independent microeconomic variables were ROE, BVS, EPS, DPS, PE, debt to total assets and firm size (Log MCAP). The dependent variable was the share prices of the chosen listed companies. The independent economic factors explained the variation in the ALSI, given the adjusted R^2 of 80%. However, one of the study's shortcomings was the exclusion of macroeconomic variables, which could have resulted in a higher adjusted R^2. The outcome revealed that variables ROE, DPS, BVS, PE and Log MCAP had a significant positive correlation with share price. A significant negative relationship was found between the dividends yield and all-share price, implying that investors prefer funds to be clawed back into the business, therefore enabling the business's growth. Leverage had an insignificant inverse relationship with the share price, implying that debt does not determine share price. It could be that investors do not view debt as a deciding factor as increased debt could mean two things: either the firm has increased debt to grow the business, or the firm has increased debt to rescue itself from a downturn of the business. Therefore, debt levels (leverage) and a combination of other factors will influence the ALSI.

Bhargava (2014) used the autoregressive model to determine the effect of macro and microeconomic variables on the value of 3000 US firms' stock prices. Quarterly data

was used in the period between the years 2000 and 2007. The comprehensive dynamic and static model, total assets, dividends per share, earnings per share and inflation had a direct relationship with the 3000 US firms. Long-term debt, the unemployment rate in manufacturing and interest rate had an inverse relationship with the 3000 US firms' stock value.

A similar study by Kabir and Beusichem (2014) evaluated the impacts of macroeconomic variables, i.e. interest rate, crude oil, exchange rate and gold price on stock returns on 10 US industries. Monthly data was used between January 1997 and September 2014 and the OLS model was applied. The impact of macroeconomic factors on share price varied depending on the industry. Crude oil prices negatively influenced consumer goods, consumer services, financials and the healthcare industry share prices, as an increase in crude oil prices subsequently increased the costs of these industries. However, crude oil had a positive effect on the share prices of the oil and gas sector as profits increase with a rise in oil prices. The interest rate and exchange rate had an insignificant impact on the ALSI; this could be attributed to the control measures of these variables such as trading instruments in the interest rate.

Chung and Ariff (2016) applied a system of equations to test the effects of money supply on the G4 countries (Canada, Japan, UK and the US) using quarterly data from January 1960 to April 2013. The Dynamic OLS method was used, and the results' robustness was then enhanced by the use of the Bootstrapping method. The money supply had a markedly positive impact on the four economies' share prices as improved liquidity increased spending.

Al-Tamimi et al. (2011) carried out a regression analysis to study the influence of microeconomic and macroeconomic factors on the UAE stock values of 17 companies based on available data. The data used was from 1990 to 2005. Oil price and dividends per share were eventually omitted as explanatory variables due to problems of multicollinearity. Earnings per share had a significant positive influence on UAE share prices. The money supply had a direct correlation with the UAE all-share index. GDP was statistically insignificant with the UAE all-share index, while inflation and interest rate had negative coefficients. Inflation was significant and negative at the 1% level of significance, and the interest rate was insignificant.

In the US, UAE and Japan, the interest rate had an insignificant relationship with the ALSI. However, in the US, Bhargava (2014) found that the interest rate negatively affected the country's ALSI between 2000 and 2007. It is expected that the exchange rate has an inverse relationship with the ALSI because, as exports decrease with a strong exchange rate, sales and profits of listed companies reduce and, consequently, so does the value of the ALSI. However, the positive coefficient in the exchange rate for Turkey, the US and Japan implies that these countries are significant importers of inputs or goods, making it cheaper to import with a relatively stronger currency. In turn, it increases the margins and profitability hence positively affecting the ALSI.

GDP had a statistically insignificant impact on the ALSI in Canada, the US, Japan, UK and UAE but the sign was positive. Other economic variables besides GDP possibly had a stronger influence on the ALSI such as money supply, dividends/share, and political and social factors. The impact of inflation on the ALSI was negative in the UAE and Japan. Mukherjee and Naka (1995) found money supply to have a positive impact on the ALSI in Japan and Chung and Arrif (2016) also found the money supply to have a direct relationship with the ALSI. However, Al-Tamimi et al. (2011) found money supply to be insignificant including in other nations such as the UAE, Canada, US and UK. This implies that these countries have a higher propensity to save with increased money supply when compared to Japan. PE ratio seems to have a positive influence on the ALSI value in developed countries. Other microeconomic factors such as DPS, ROE and BVS had a positive impact on the Baharian ALSI.

In the Czech Republic, Pazak (2018) used the CAPM, Johansen Test and the VECM to assess whether macro and microeconomic factors impact the country's ALSI. The data used was quarterly from 2006 to 2016. GDP, ROE and ROA had a positive and significant effect on the ALSI while inflation had a negative impact on the ALSI. The two microeconomic variables had a stronger effect on the Czech Republic's ALSI than the macroeconomic variables.

Seven studies were analysed to understand the impact of macroeconomic and microeconomic variables in developed countries. Only two studies showed the simultaneous effect of macroeconomic and microeconomic variables in the selected

countries' ALSI. The rest of the studies looked either at microeconomic or macroeconomic variables and their impact on the ALSI separately.

2.4. Discussion of macroeconomic and microeconomic variable relationship with the ALSI

This chapter focused on the models used to analyse the macroeconomic and microeconomic variables' impact on stock values in different countries. These models ranged from the OLS model to the more advanced GARCH and VECM.

The literature supports the notion that macroeconomic and microeconomic variables have a strong relationship with a country's ALSI. Non-South African studies analysed the impact of macroeconomic and microeconomic variables on the ALSI and the simultaneous effect of these variables on the ALSI. For example, Bhargava (2014) used comprehensive dynamic models to assess the impact of macroeconomic and microeconomic factors in the US to deal with non-stationarity of financial data. Dynamic economic models comprise, for example, the Vector Autoregression (VAR), Error Correction Model (ECM) and Autoregressive Integrated Moving Average (ARIMA) (Gonzalez, 1985; Maria-Carme, 2006).

South African studies have not analysed the simultaneous effect of macroeconomic and microeconomic variables, unlike in some other countries reviewed in the literature used for this study. Furthermore, South African studies focused on the effect of the dividends per share when analysing the impact of microeconomic variables on the ALSI. However, there is a broader range of microeconomic variables such as P/E ratio, BVS, ROE and ROA. This then brings about the question of how well can macroeconomic and microeconomic variables explain the variation of the ALSI in South Africa simultaneously. Furthermore, it begs the question of whether including more microeconomic variables in the model would better explain the variation in the ALSI.

The impact of macroeconomic and microeconomic variables generally showed a consistent impact on the ALSI in different studies or countries. However, a few studies did differ from the collective findings and this was attributed to the different models used and the number of observations employed.

Table 2.4 reflects the type of impact that economic variables have on the ALSI based on the findings in previous studies. These variables either had a direct, inverse or no impact on the ALSI. It is essential to highlight the expected relationship that the economic variables will have with the ALSI to compare findings in this study with findings conducted in previous research.

Table 2.4: Expected sign in relation to the ALSI variables expected sign

Variables	**Expected sign**
Exchange Rate	(-)
Interest Rate	(-)
Gross Domestic Produce	(+)
Gold Price	(+)
Inflation	(-)
Money Supply	(+)
Price Earnings Ratio	(+)
Dividends per Share	(+)
Return on Asset (ROA)	(+)
Return on Equity	(+)
Book Value per Share	(+)

2.4.1. Exchange Rate

The expected relationship between the exchange rate and the ALSI is negative, as the weakening of the exchange rate makes it cheaper to purchase South African equities, thus increasing the value of South African equities (Muzindutsi, 2011). The share price of exporting firms will increase as it will make their products cheaper and result in higher exports, consequently increasing the firms' profits and the value of the share price of the exporting companies. Several studies found the exchange rate to have a negative impact on the ALSI, and it can be assumed that a majority of the listed firms in those countries produce exported goods (Muzindutsi, 2011; Hancocks, 2011; Hsing, 2011; Ouma, 2014). The exchange rates' positive relationship with the ALSI was found

in non-South African studies (Mukherjee & Naka, 1995; Kibria et al., 2014; Nijam et al., 2015; Francis, 2017; Jamaludin, 2017). These are countries that are likely not very export based. In South Africa, only Muzindutsi (2011) found the exchange rate to impact the JSE all-share index positively. The majority of the studies found the contrary, and this is expected given that South Africa has a significant amount of firms that produce exported goods, such as the mining firms and vehicle-producing firms listed on the JSE all-share index.

2.4.2. Interest Rate

Given the findings with the reviewed literature, the interest rate is expected to have an inverse relationship with stock values (Mukherjee & Naka, 1995; Moolman & du Toit, 2009; Alam & Uddin, 2009; Hsing, 2011; Bhargava, 2014; Ramadan, 2016; Ho, 2017a). A higher interest rate would result in a higher discount factor, decreasing the value of shares. Secondly, with a higher interest rate, it becomes more attractive to invest funds in high-yielding investment accounts than in the equities market. Lastly, increased interest rates increase the cost of borrowing, thus reducing profitability for large corporations, which then reduces the value of equity shares (Firer et al., 2012).

2.4.3. GDP

A positive relationship is expected between GDP and ALSI as these were the research findings when the literature was reviewed (Reese, 1993; Moolman & du Toit, 2005; Coovadia, 2014; Hsing, 2011; Kibria et al., 2014; Nijam et al., 2015; Ramadan, 2016; Pradhan & Dahal, 2016; Ho, 2017a). Higher GDP means increased production with listed firms, and this is likely to result in increased profitability and, in turn, to increase the value of listed firms on a country's ALSI.

2.4.4. Gold Price

As South Africa is a significant exporter of gold, an increase in gold price is expected to increase cash inflows and hence the profitability of gold-producing listed firms (Reese, 1993; Mangani, 2009). This would in turn have a positive impact on the ALSI since the ALSI comprises a significant amount of mining stocks (Roux, 2020).

2.4.5. Inflation

Inflation is expected to have an inverse relationship with stock values (Reese, 1993; Mukherjee & Naka, 1995; Van Rensburg, 1996; Nishat & Shaheen, 2004; Hsing, 2011; Ali, 2011; Al-Tamimi et al., 2011; Nijam et al., 2015; Ramadan, 2016; Francis & Ganeshamoorthy, 2017; Jamaludin et al., 2017; Ho, 2017a, 2017b). This happens in two ways. Firstly, inflation is likely to compel an increase in interest rate (monetary policy), which decreases stock values. Secondly, inflation increases the cost of inputs, reducing profitability and free cash flow, resulting in a reduction in the share price.

2.4.6. Money Supply

According to literature, the money supply has had a positive impact on the ALSI in South Africa (Van Rensburg, 1996; Hancocks, 2011; Hsing, 2011). In other developing economies such as Jordan, Kenya and Pakistan, money supply was found to positively influence the ALSI value (Kibria et al., 2014; Ouma & Muriu, 2014; Ramadan, 2016). Based on the historic findings, the expected effect of money supply on stock values is a positive effect.

2.4.7. Price–Earnings (PE) Ratio

The increase in price–earnings ratio is expected to increase the demand for equities as the value of the stock prices increases. The price–earnings ratio was found to impact stock values in developed and developing countries positively (Al-Tamimi et al., 2011; Ali, 2011; Bhargava, 2014; Sharif et al., 2015; Pradhan & Dahal, 2016). However, Auret and Sinclaire (2006) found the price–earnings ratio to have a negative impact on the ALSI. There are no other studies in South Africa that analysed the impact of PE ratio on the ALSI. Had there been, it would have helped to compare the study's findings with Auret and Sinclaire's (2006) findings.

2.4.8. Dividends per Share (DPS)

After the review of literature, increased dividends per share is expected to have a positive relationship with the ALSI (Bhana, 1998; Auret & Sinclaire, 2006; Mehndiratta & Gupta, 2010, Mlonzi et al., 2011; Erasmus, 2012; Swart & Hoffman, 2013; Bhargava, 2014; Sharif et al., 2015; Pradhan & Dahal, 2016). Increased dividends pay-outs make the shares much more attractive to investors. The increased demand increases the share price.

2.4.9. Return on Assets (ROA)

An increase in ROA will increase the value of the ALSI following economic theory (Pradhan & Dahal, 2016; Prazak, 2018). If a company's interim or annual performance reflects an increased return on assets invested, it increases the demand for the assets and, therefore, the share price.

2.4.10. Return on Equity (ROE)

The expected relationship between return on equity and share price is positive as an increasing return on equity increases the demand for shares, therefore increasing the price of shares (Sharif et al., 2015).

2.4.11. Book Value per Share (BVS)

The expected relationship between book value and share price is positive (Srinivasan, 2012; Sharif et al., 2015). Increased book value translates into the share price increasing as it attracts investors and increases the demand for a share.

2.5. Conclusion

Literature on the impact of macroeconomic and microeconomic variables is extensive. In developed and developing countries, macroeconomic and microeconomic variables influence the ALSI. The reviewed literature has helped point out that research on the impact of microeconomic variables in South Africa was limited to dividends per share. Furthermore, there has been no study in South Africa that analysed the combined impact of microeconomic and macroeconomic effects on the South African ALSI. Models such as the CAPM, APT, OLS, ARCH/GARCH, VECM and PCA are some of the models used in studies when analysing the impact of macroeconomic variables and microeconomic variables.

CHAPTER 3: RESEARCH METHODOLOGY

3.1. Introduction

The reviewed literature interrogated the research findings of studies that investigated the correlation of macroeconomic and microeconomic variables with the all-share index (ASLI). A significant number of studies used the Ordinary Least Square (OLS) methodology for conducting the studies (Ali, 2011; Kabir & Beusichem, 2014; Nijam et al., 2015; Chung & Ariff, 2016). Other studies made use of the more advanced models such as the Generalised Autoregressive Conditional Heteroscedasticity (GARCH), Granger Causality and Vector Autoregression (VAR) models (Moolman & du Toit, 2005; Mangani, 2009; Hancocks, 2011; Chittedi, 2015; Francis & Ganeshamoorthy, 2017).

The purpose of this chapter is to explain the research approach, data collection, the description of the variables considered in the study and, lastly, the advantages and disadvantages of the various models that were reviewed in literature.

3.2. Research Paradigm

This study uses a positivist approach. A positivist approach is defined as having a scientific approach and working with observations and applying pre-determined research designs and objective measures to yield facts or outcomes that are unbiased and unambiguous (Saunders, Lewis & Thornhill, 2016; Sekaran & Bougie, 2016). Economic observations are being used to test a cause-and-effect sequence, i.e. the impact of macroeconomic and microeconomic variables impacting the JSE all-share index.

3.3. Research design

In this study, time-series data is used to investigate the long-term relationship between 11 macro and microeconomic variables on the JSE all-share index. Various methodologies have been used historically, which have their advantages and disadvantages when analysing financial data. However, the PCA, VECM and best subset model were the chosen models to carry out the study. The use of some of these models was also guided by the challenges experienced when conducting the study. The following challenges were experienced: multicollinearity, which led to the use of

the PCA and then the VECM; however, stationarity existed in the data, which subsequently led to the use of the best subset model.

3.4. Study site

This study is based on the South African stock exchange and the South African economy. The South African stock exchange is called the Johannesburg Stock Exchange (JSE), and the ALSI value is a measure of the JSE performance. The influence of South African macro and microeconomic variables on the JSE all-share index will be assessed.

3.5. Data sources and data collection

Secondary data can be described as data that has been collected for a different objective but can be used for additional analyses in another area or subject (Saunders et al., 2016; Johnston, 2017). In this study, secondary annual time series data was used and data was collected from 1997 to 2016.

The independent variables are made up of 11 macroeconomic and microeconomic variables. The South African ALSI represents the dependent variable. The data for this study was sourced from the McGregor Bureau for Financial Analysis (BFA), Statistics South Africa and the JSE Monthly data would have been preferred as it would have increased the number of observations and consequently improved the reliability of the results. However, most of the microeconomic data is published annually since most listed firms publish their financial results annually. As a result of this, microeconomic data is annual, and for consistency, macroeconomic data and the JSE all-share index (dependant variable) had to be annual.

Instead of using microeconomic data of all the firms listed on the JSE all-share index, microeconomic data of the top 40 listed companies (Top 40 Index) was used. Microeconomic data was obtained from the JSE. The listed companies in the Top 40 Index represent more than 80% of the value of the ALSI. Therefore, the microeconomic data of the companies in the Top 40 Index is a good representation of all firms listed on the JSE all-share index.

3.6. Data Analysis.

Data analysis is when data is processed using methodologies and statistical tools to process it such that it is converted into meaningful information (Saunders et al., 2016). Quantitative data analysis was conducted in this study, and the methodologies used were the Principal Component Analysis (PCA), Vector Error Correction Model (VECM) and the best subset model, which will be discussed in detail in the sections to follow.

3.6.1. Principal Component Analysis (PCA)

PCA is a technique used in statistics that linearly converts a set of variables (X1, X2, X3…) to a set of variables that is smaller in size (Hardle & Simar, 2007; Gujarati, 2012). This technique is used to eliminate highly correlated variables and simplify the models with a risk of losing the strength of interpreting the data. The linear combination of the new set of variables is called factors.

The first principal component accounts for the most variability of the dependent variable. The following principal components account for the data variability at a decreasing scale.

Eigenvalues, also called characteristic roots, measure the variance in all variables in a given factor. If a factor has a low eigenvalue, then its contribution to the variance in data is minimal. A factor's eigenvalue can be calculated as the total of the squared factor loadings for all variables.

3.6.2. Vector Error Correction Model (VECM)

The Johansen (1990) VECM affords more efficient estimators as it is a maximum-likelihood estimation model. If two variables Y and X are stationary, they are said to be co-integrated and the VECM can then explain the correlation between the two variables. A co-integration relationship means that in the long run, the two variables form an equilibrium relationship. The VECM was developed by Johansen (1991) to examine the long-run relationship. This procedure requires the use of data that is non-stationary with a unit root if at least the residuals are stationary. Therefore, it is imperative to test for stationarity. For co-integration to exist between non-stationary variables, at least two variables have to be integrated into order one (Gugurati, 2012).

To test for stationarity, the Augmented Dicky Fuller (ADF) test and the Phillip-Peron (PP) unit root test can be used (Dickey & Fuller, 1981; Phillip & Peron, 1988).

The VECM (Johansen, 1991)

$$\Delta Y_t = \sum_{j-1}^{k-1} r_j \Delta Y_{t-j} + \alpha\beta' Y_{t-k} + \mu + \epsilon_t$$

Δ = First difference symbol
Yt = p x1 vector integrated of order 1
μ = px1 constant vector demonstrating a direct trend in a system k
k = Lag
ϵt =
p x1 Gaussian white noise residual vector
rj = P x P matrix expressing short-run changes amongst variables across p equations at the j_{th} lag
α = p x r pace of change
β = p x r co-integration vectors

The VECM is predicted by regressing change in Yt with the lagged difference of change in Yt and change in Yt-k and determining the rank of π=αβ'. Eigenvectors in β' are predicted from the canonical correlations of the set residuals from the regression equations. To establish the rank π, which gives the order of co-integration (r), the eigenvalues π,λi must be calculated. The order of co-integration is tested by using the λtrace and λmax test statistics.

Co-integration relationships can be established by using the λtrace tests. The λmax test is used to test a specific alternative hypothesis. Models, where π has full rank, imply that Yt is stationary and not I(1) assumed under the VECM. These models will be rejected as there will be no error-correction.

Once the order of co-integration has been determined, it is then necessary to identify and then evaluate the pertinent co-integration vector and speed of adjustment coefficients. Where π does not have full rank, and multiple co-integration vectors are present, the first eigenvalue will be chosen.

Challenges were experienced with the VECM in its application, which will be explained in the next section, and the best subset model was also applied. The best subset model will be explained in the next section along with how it can be applied.

3.6.3. Best subset model (Miller, 2002)

A subset model is used to choose a subset from a greater number of variables. It could be necessary to do this as it may be a cumbersome exercise to measure the Y variable using H variables. However, it is hoped that the subset can be predicted with sufficient accuracy from other variables. A more popular situation is where the X-influencing factors measured at a point in time are used to estimate Y. A subset model introduces an omission bias, and the best subset model is generally used when there is a high correlation amongst variables or a high number of predictor variables. Subset modelling works well in reducing complexity by reducing the variables to a subset of variables. This is the case in this study where many predictor variables correlate, and since there was stationarity in the data, the best subset model will be used.

Assuming that the forecasted factor, Y is linearly related with c forecasted factor, H1, H2, ... , Hc; that is

$$Y = \beta 0 + \sum_{i=1}^{k} \beta i Hi + € \quad (1.1)$$

where the nil average residuals are separately tested from an identical distribution with limited variance σ2. The coefficients β0, β1,..., βc are commonly unidentified, so an estimation using the least squares can be done.

The least-squares predictors of the regression coefficients can be expressed as q's, as reflected in matrix of

$$q = (H' H)^{-1} H'\_y,$$

where

$$q' = (q0, q1, ..., qc),$$

H is an n × (c + 1) matrix in which row i has a 1 and then by the values of factors H1, H2, ..., Hc for the i-th observation, and y is a vector of length n containing the observed values of the variable to be ascertained.

To predict Y for a given vector $h\_ = (1, h1, ..., hc)$ of the predictor factors or variables, the following is used

$$\hat{Y} = h'q$$
$$= q0 + q1h1 + ... + qkhc.$$

Then, from a standard least-squares theory (see e.g. Seber (1977) page 364), we have that $var(h'q) = \sigma 2h\_(H'H)-1\ h$.

If the Cholesky factorisation is created of H'H, i.e. we find a (c +1)×(c +1) upper-triangular matrix R such that

$$(H'H)-1 = R-1\ R-T,$$

where the superscript $^{-T}$ expresses the inverse of the transpose, then it follows that $var(h'q) = \sigma 2h'(h'R-1)(h'R-1)$ (1.2)

Now h' R−1 is a vector of extent (c +1) so that the variance of the predicted value of Y is the sum of the squares of its elements. This is an appropriate way of computing the variance of Ŷ, although Cholesky factorisation is suggested. Alternatively, a comparable triangular factorisation has to be obtained directly from the H-matrix without the intermediary step of forming the 'sum of squares and products' matrix H'H. Now, considering estimate Y with only the initial p of the H-variables where p < c. Write

$$H = (HA, HQ),$$

where H_A contains the first (p + 1) columns of *H,* and H_B contains the remaining (c − p) columns. If we then form the Cholesky factorisation

$$H'AHA = R'ARA,$$

then R_A contains the first (p + 1) rows and columns of *R*, and the opposite $R^{-1}{}_A$ is also identical with the same rows and columns of R^{-1}. The Cholesky factorisation of *H'H* is present and unmatched except for signs provided that *H'H* is a positive-definite matrix.

Then, if h_A consists of the first (p + 1) elements of h and q_A is the corresponding vector of least-squares regression coefficients for the model with only p variables, we have similarly to (1.2) that

$$\text{var}(h'_A\, qA) = \sigma 2(h'AR\text{-}1A)(h'AR{-}1A\,)' \quad (1.3)$$

To determine the best fit model, R^2, adjusted R^2 and Mallows C_p are used. R^2 and adjusted R^2 measure the coefficient of multiple determinations and are used to determine the ability to estimate the criterion variable based upon the set of predictor variables. Mallow's C_p is a measure of bias or estimation error (Mallows, 1973).

Adapted from: Hocking, 1972.

3.6.4. Transformation of variables

The following factors will be tested: gold price, interest rate, exchange rate, GDP per capita, inflation, money supply, PE ratio, DPS, BVS, ROA and ROE. Table 3.1 reflects these variables and their abbreviated format for modelling purposes.

Table 3.1: Transformed variables and their definition

Transformation	Definition
AllShareIndex	JSE all-share-price
GoldPrice	gold price
Interest	interest rate
ExchangeRate	exchange rate
GDPCapita	Gross Domestic Product per Capita
Inflation	Inflation
MoneySupply	Money Supply
PEratio	price-earnings ratio
DivShare	Dividends/per Share
BookValS	Book value/per share
ReturnAs~t	Return on Assets
ReturnonEq~y	Return on Equity

3.7. Reliability and validity

Reliability can be described as having an approach consistent with and informed by research design techniques used in similar studies (Saunders et al., 2016). Validity refers to correctness of the research design techniques for a particular study and the accuracy of the analysis of the results (Saunders et al., 2016). The methodologies or the research design used in this study were informed by methodologies used in previous studies. Furthermore, due to financial data being highly volatile, models that can deal with volatile data were chosen. Therefore, the research design can be relied upon. A greater number of observations would have been preferred; however, the number of observations was limited due to most listed companies publishing annual data only. Each specific microeconomic data variable from the listed firms was calculated into an average for each particular year. For example, to calculate the annual ROE observation in 1998, the ROE of all listed firms were used to calculate the average ROE in 1998, and the average ROE represented the annual ROE for 1998. Macroeconomic variables' data were made available from Statistics SA.

3.8. Ethical consideration

Ethical clearance was obtained from the Humanities and Social Sciences Research Ethics Committee of the University of KwaZulu-Natal. Publicly-available data was used, so ethical clearance was not required from the listed companies.

3.9. Summary

Times series annual data was collected from three different sources. A total of 20 annual observations were used. The dependant variable is the annual values of the ALSI and the independent values made of 11 economic variables, split into two categories i.e. microeconomic and macroeconomic variables. The PCA, VECM and best subset model were adopted, given their applicability in this study. There were, however limitations in terms of the number of observations obtained due to monthly microeconomic data not being available. In the chapter to follow, the results will be presented, which will give details on the approach used and how the models presented in this chapter were applied.

CHAPTER 4: PRESENTATION OF FINDINGS AND DISCUSSION

4.1. Introduction

Some challenges were faced, which brought about the use of different models. A correlation matrix was conducted, and the outcome showed that the independent variables are highly correlated with one another. In addition, the outcome of the VIF shows the presence of multicollinearity. The principal component analysis was then used to deal with multicollinearity. The VECM was applied, and lastly, a best subset model was employed. This chapter will begin with the overview of the ALSI over the years, followed by presentation of the results and then the discussion of the results.

4.2. Overview of the growth of the All-Share Index

As reflected in Figure 4.1 below, there has been a growth in the value of the ALSI from 2007 to 2016.

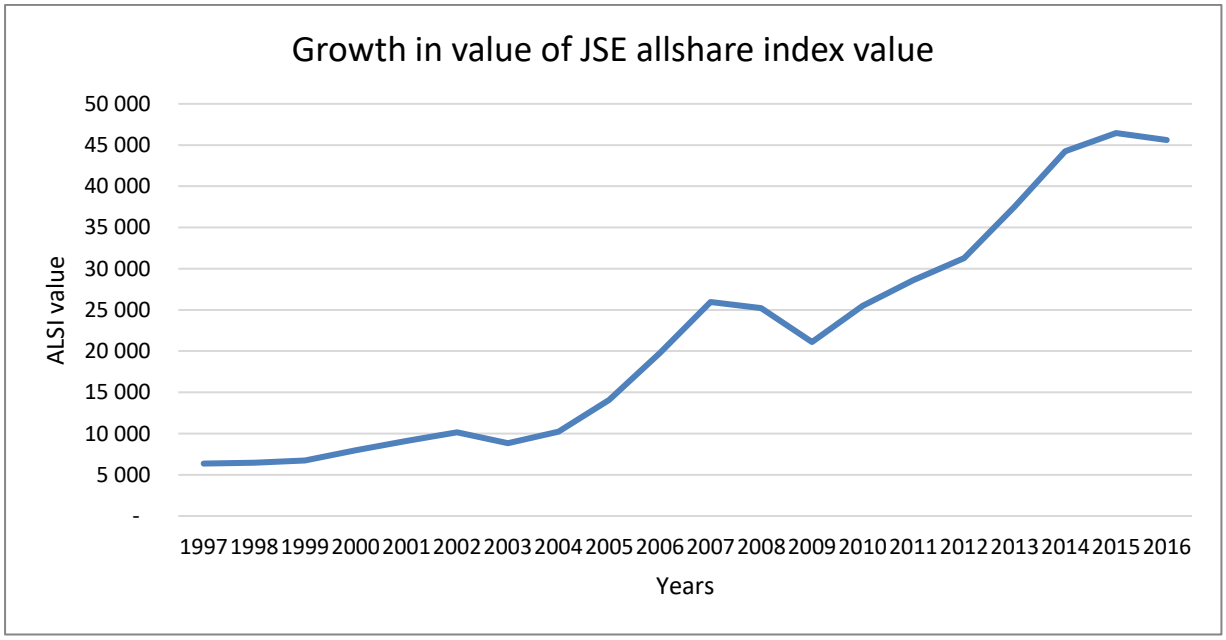

Figure 4.1: All-Share Index value between 2007 and 2016

Adapted from the JSE

The ALSI has been on an increasing growth trend between 1997 and 2016. There was steady growth in the value of the ALSI from 1997 and 2003, and this could have been related to inflationary pressure and thus a rise in interest rates (Laubscher, 2014). From 2004 to 2007, there was an accelerated growth in the value of the ALSI as a reduced price of imports in South Africa lowered inflation and allowed for reduced

interest rates, which stimulated the growth of the ALSI until 2007 (IB Inc., 2018). In 2008, South Africa had a contraction in growth impacted by the world's major economies going through a financial crisis. There was also an increase in commodity prices during this period (e.g. oil prices). From 2010 there was a recovery in the South African economy, and as a result, the South African ALSI started on a growth trajectory and grew till 2015.

4.3. Correlation matrix

In attempting to apply the VECM, there was significant evidence that multicollinearity existed in the data. Referring to Appendix 1, only return on equity, inflation, interest and PE ratio had a VIF below 1. The balance was all above 5, indicating multicollinearity. The correlation matrix presented in Table 4.1 shows a strong relationship between some of the independent variables.

Table 4.1: Correlation matrix

	AllShare Index	*Inflation*	*Money Supply*	*Exchange Rate*	*Interest*	*GDP Capita*	*Gold Price*	*Book ValS*	*DivShare*	*Peratio*	*Return As~t*	*Returnon Eq~y*
AllShareIndex	1.0											
Inflation	(0.0)	1.0										
MoneySupply	1.0	(0.1)	1.0									
ExchangeRate	0.8	0.1	0.8	1.0								
Interest	(0.7)	0.5	(0.8)	(0.5)	1.0							
GDPCapita	1.0	(0.1)	1.0	0.7	(0.8)	1.0						
GoldPrice	0.8	(0.0)	0.8	0.4	(0.6)	0.8	1.0					
BookValS	0.8	0.2	0.8	0.6	(0.4)	0.8	0.7	1.0				
DivShare	0.9	0.0	0.9	0.7	(0.7)	0.9	0.8	0.9	1.0			
Peratio	(0.3)	(0.3)	(0.3)	(0.0)	0.1	(0.4)	(0.5)	(0.4)	(0.3)	1.0		
ReturnAs~t	0.5	(0.1)	0.4	(0.1)	(0.6)	0.5	0.5	0.3	0.5	(0.4)	1.0	
ReturnonEq~y	(0.1)	(0.1)	(0.1)	(0.2)	(0.3)	(0.0)	(0.2)	(0.2)	(0.1)	(0.1)	0.5	1.0

A strong relationship between two variables is depicted when the correlation coefficient is closest to 1. Money supply seems to be highly correlated with most of the variables, though there are various other independent variables that had a significant correlation with each other. These include exchange rate with GDP/capita, exchange rate with dividends per share, interest rate with GDP/capita, interest rate with dividends per share, gold price with GDP/capita, dividends/share with GDP/capita, and book value per share with gold price.

Such correlation between variables results in multicollinearity and this leads to spurious results, hence this problem has to be remedied. One of the ways to remedy this problem is by using the principal component analysis.

4.4. Principal Component Analyses (PCA)

As a result of multicollinearity, the PCA model was applied to eliminate this problem. Abekah (2005) used the same approach when analysing the fundamental microeconomic variables that impact stock returns in Ghana. Kumar (2013) used the PCA model when analysing the impact of 12 macroeconomic variables on the Indian stock exchange. Table 4.2 reflects the results of the PCA.

The first factor accounted for 52.83% of the total variance in the ALSI. Money supply and GDP/capita had the strongest positive association with the first factor. Gold price, BVS and DPS also had a positive sign which conforms to expectations. Interest had a negative factor loading, and this was expected. The inverse relationship between interest and ALSI is due to investors directing investments towards stock purchases on the ALSI, as reduced interest reduces the return on investments. The first factor can possibly be regarded as a macroeconomic factor since it consists of mainly macroeconomic variables.

The second factor accounted for 16.59%. However, the variables associated with the ALSI were not in line with expectations. With the second factor, it was interesting to see that ROA and ROE had negative signs, whilst the exchange rate and interest had positive signs. The balance of the nine factors combined only influence the variation on the ALSI by 30.2%, which is the expected outcome when a principal analysis is done; therefore, making the signs of the coefficient on the first and second factor of greater importance to a study (Van Rensburg, 1998).

The first factor was the chosen factor for this study. This was selected not only by virtue of this factor accounting for the most variation in the ALSI, but also due to a considerable number of variables from the 2nd to the 11th factor having signs that do not conform to expectations in the South African context. The variables in the first factor were money supply, interest, GDP per capita, gold price, book values and dividends per share. The relationship of the variables in the first factor with the ALSI

conformed to economic theory. The balance of the factors account for a less significant variation on the ALSI and the signs were contrary to expectations.

Table 4.2: Principal component analysis

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7	Comp8	Comp9	Comp10	Comp11
Inflation		0.3958	0.5659	0.424		-0.4164					
Money Supply	0.4028							0.5334			-0.6767
Exchange rate		0.3148		0.4266	-0.381					0.6032	
Interest	-0.3252	0.3506						0.449	0.4164	0.4518	
GDP Capita	0.4075							0.4899			0.7159
Gold Price	0.3552			-0.4359			0.7348				
Book ValS	0.3432				0.4174	0.5988			-0.5195		
Div Share	0.392						-0.368	-0.434	0.6397		
PE ratio			-0.6261		0.6322						
Returnon As~t		-0.486			0.3516	-0.3948				0.4627	
Returnon Eq~y		-0.5612		0.6126		0.4177					

4.5. Vector Error Correction Model (VECM)

After identifying the group of variables that best explain the variation in the ALSI, the co-integration was calculated using the Johansen Test of co-integration, reflected in Table 4.3. The suitable number of the co-integration vectors, having lagged the data once, is three because the trace statistics corresponding to the third rank (46.2645) are less than that of the fifth critical value (47.21). Again, the maximum statistic outlines the same deductions as the trace statistic.

Table 4.3: Johansen tests for co-integration

VECrank: AllShareIndex, Money Supply, Interest, GDPCapita, GoldPrice, BookValS DivShare, trend (constant) Lags (1) max

Johansen Tests for Co-integration					
Trend Constant Number of obs = 19					
Sample: 1997 - 2016 Lags = 1					
Maximum Rank	Parms	LL	Eigenvalue	Max Statistics	5% Critical Value
0	7	-998.78		87.91	45.28
1	20	-954.83	0.99	76.97	39.37
2	31	-899.7	0.98	33.26	33.46
3	40	-887.22	0.93	24.97	27.07
4	47	-882.24	0.73	9.96	20.97
5	52	-878.42	0.4	7.66	14.07
6	55	-878.42	0.33	3.68	3.76
7	56	-876.57	0.18		

The VECM outlines the co-integration equation coefficients as reflected in Table 4.4. The coefficients of the first, second and third co-integration equations were statistically significant at a 95% confidence interval: ce1 = 0.2534097, p = 0.013; ce2 = -0.0119057, p = 0.041; ce3 = -726.2498, p = 0.004. The calculation of the VECM is the next step after finding the co-integration coefficients.

Table 4.4: VECM co-integration coefficients

Vector error-correction model						
Sample: 1998 - 2016						
No. of obs = 19						
AIC = 84.94514						
Log Likelihood = -773.9789		HQIC = 85.22276				
Det (Sigma_m1) = 9.72e+27		SBIC = 86.58549				

Equation	Parms	RMSE	R-sq	chi-2	P>chi2
D_AllShareIndex	4	2385.2	0.6392	24.8	0.0001
D_MoneySupply	4	31534.3	0.9028	129.95	0
D_Interest	4	1.34933	0.6334	24.19	0.0001
D_GoldPrice	4	273.501	0.3023	6.07	0.1943
D_BookValS	4	423.095	0.9094	140.5	0
D_DivShare	4	37.7282	0.6265	23.49	0.0001

	Coef.	Std. Err.	Z	p>|z|	(95% Conf. Interval)	
D_AllShareIndex						
Ce1-L1	0.25341	0.101474	2.5	0.013	0.054525	0.452295
Ce2-L21	-0.01191	0.005836	-2.04	0.041	-0.23343	-0.00047
Ce3-L1	-726.25	252.2022	-2.88	0.004	-1220.56	-231.943
_cons	13.64565	1351.999	0.01	0.992	-2636.22	2663.514

As reflected on Table 4.5, the independent attributes which were statistically significant to the ALSI within the co-integration vectors/coefficients were gold price, BVS and DPS for ce1. The gold price was -246.5312, p=0.00, meaning an increase in gold price

would significantly lower the value of the ALSI. The negative impact of an increase in gold price is contrary to expectations. Book value per share had a coefficient of 24.62, p=0.055. A 1% increase in book value results in a 24% increase in the value of the ALSI. The book value coefficient was significant at the 95% confidence interval. The positive sign of the book value per share coefficient conformed to economic theory. The dividend per share was 997.0372, and the p=0.00 value indicated that the coefficient was statistically significant at the 95% confidence interval. The dividend per share coefficient positive sign means that a percentage increase in the dividends per share results in a 997% increase in the value of the ALSI. The stability of the model was checked, and the Johansen Normalisation test and the Eigenvalue stability test were used to test the stability of the model. These tests are reflected in Table 4.5 and Table 4.6.

In Table 4.5, the VECM stability output shows that the system is somehow stable. Three of the roots are one, and three-unit moduli were therefore imposed. In Table 4.6, the eigenvalue stability condition and the root companion matrix plot show the presence of non-stationary in the co-integrating equations, since the moduli of the first three eigenvalues are not less than unity.

Table 4.5: Johansen Normalisation Restrictions imposed

Beta	Coef.	Std. Err.	z	P>|z|	(95% Conf. Interval)	
_ce1						
AllShareIndex	1					
MoneySupply	0	(omitted)				
Interest	0	(omitted)				
GoldPrice	-246.531	42.2362	-5.84	0.00	-329.313	-163.75
BookValS	24.62608	12.8272	1.92	0.055	-0.51477	49.76694
DivShare	997.0372	217.4322	4.59	0.00	570.878	1423.196
_cons	9842					
_ce2						
AllShareIndex	0	(omitted)				
MoneySupply	1					
Interest	-1.46E-11					
GoldPrice	-2019.091	355.4346	-5.68	0.000	-2715.53	-1322.45
BookValS	-1.26317	107.9461	-0.01	0.991	-212.834	210.3073
DivShare	9400.88	1829.78	5.14	0.000	5814.578	12987.18
_cons	53263.84					
_ce3						
AllShareIndex	2.17E-19					
MoneySupply	0	(omitted)				
Interest	1					
GoldPrice	-0.057	0.009644	-5.91	0.000	-0.0759	-0.38094
BookValS	-0.00854	0.002929	2.91	0.004	0.002797	0.142787
DivShare	0.211722	0.049649	4.26	0.000	0.114412	0.309033
_cons	-17.4858					

Table 4.6: Eigenvalue Stability condition

Eigenvalue		Modulus
1		1
1		1
1		1
0.5274558	+ 0.4868887i	0.717823
0.5274558	-0.4868887i	0.717823
0.05556898		0.055569

The VECM specification imposes three-unit moduli

To acquire an improved view of an appropriate model, we use the co-integration model and predict it. Figure 4.2. reflects stationarity in the 2000s. However, the co-integrating equation is not a stationary series; therefore, an alternative model would explain the variation better. It must be noted that the co-integration models were all significant, but the respective differences between the attributes were insignificant, hence the nature of Figure 4.2 concerning time.

Figure 4.2: Depicting stationarity

4.6. Best subset regression

In light of the stationarity in the data, the best subset regression model was used, and results are reflected in Table 4.7. Money supply, exchange rate, and gold price and dividend per share gave the lowest Mallows Cp.

The best subset regression model in Table 4.7 was significant with F (4, 15) = 219.92, p=0.00 < 0.05, meaning that the combination of the independent variables could significantly predict the share index. The adjusted R^2 of 0.9788 depicts that 97.88% of the share index's total variability is explained by money supply, exchange rate, gold price and dividend shares.

Only two attributes were found significant, that is, money supply, 0.27455, t=6.59, p= 0.00 <0.05 and dividend per shares, 32.08, t=3.29, p=0.005 <0.05. Neither exchange rate nor the gold price significantly affects the ALSI as the coefficients were statistically insignificant at the 95% confidence interval. Nonetheless, the exchange rate had a negative coefficient with the ALSI, which is the expected sign (Reese, 1993; Muzindutsi, 2011; Hsing, 2011; Ndako, 2013; MacFarlane, 2011). The gold price co-efficient was negative, while the expected sign was positive. However, it was statistically insignificant.

Looking at the regression diagnostics, the model had a Durbin–Watson value of 1.727, depicting positive autocorrelation in the residuals. The Breusch–Pagan test $\chi 2$=6.37 bolsters this conclusion, p=0.011 < 0.05, which means that the null hypothesis of constant variance in the residuals can be rejected. Ali (2011a) also used this test when analysing macroeconomic and microeconomic variables to test for heteroskedasticity. In other words, there is heteroscedasticity found in the model.

In Table 4.7, the presence of heteroskedasticity means that the estimators are no longer Best Linear Unbiased Estimators (BLUE) because the coefficients are no longer efficient; therefore, the regression predictions will be inefficient.

Table 4.7: Best subset model equation, Durbin–Watson d-statistics, Breusch–Pagan

Source	**SS**	**df**	**MS**		no. of obs=20	
Model	3.60E+09	4	8.99E+08		F(4,15) =219	
Residual	61326417	15	4088428		Prob > F = 0.0	
Total	3.66E+09	19	1.93E+08		R-Square =0.9832	
					Adjusted R2= 0.9788	
AllShareIn~x	**Coef.**	**Std.Err.**	**t**	**P>|t|**	**(95% Conf.Interval)**	
MoneySupply	0.27455	0.004165	6.59	0	0.018578	0.03633
Exchangerate	-400.92	390.6612	-1.03	0.321	-1233.6	431.7548
GoldPrice	-2.07527	1.994406	-1.04	0.315	-6.32624	2.175708
DivShare	32.08352	9.757559	3.29	0.005	11.28578	52.88127
_cons	-499.762	2488.898	-0.2	0.844	-5804.72	4805.199

Durbin-Watson d Statistic(5,20) = 1.72
Breusch-Pegan/Cook Weisberg test for heteroskedasticity
H0 : Constant variance
Variables: fitted values of ALSI
chi2(1) = 6.37
Prob> chi2 = 0.0116

4.7. Exponentially Weighted Average (EWMA) model

Polakow and Flint (2015) used the Exponentially Weighted Average Model (EWMA) in the presence of heteroscedasticity. Figure 4.3 shows the results of the EWMA model. It turned out that the model does not model the ALSI well at a calculated coefficient of 0.4, and had a high square mean error of 6104.5.

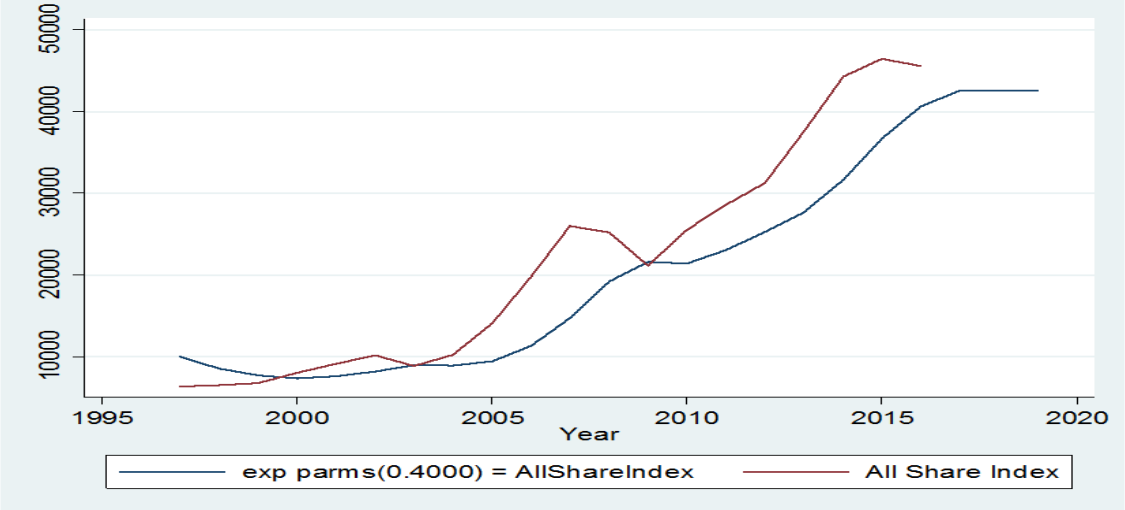

Figure 4.3: Exponential coefficient of the all-share index at 0.4

Further analysis was conducted using the EWMA model. When looking at Figure 4.4, the exponential coefficient was increased to 0.9, and even though the mean square was reduced drastically it was still very high at 3744.8. Therefore, it can be concluded that the EWMA cannot be modelled.

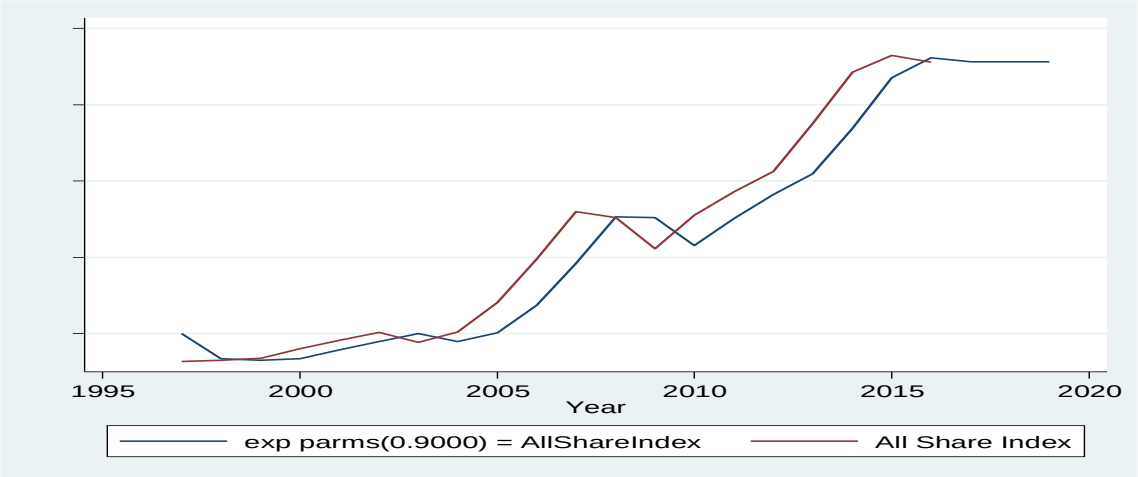

Figure 4.4: Exponential coefficient of the all-share index at 0.9

4.8. Discussion of results

The findings of the study will be discussed in the following sections and compared to findings in other studies. The correlation matrix, PCA, VECM, best subset regression model and EWMA model will be discussed.

4.8.1. Correlation matrix

A correlation analysis was done using the correlation matrix. It was found that there were independent variables that were correlated with one another, resulting in multicollinearity. For example, dividend per share and book value per share had a correlation of 0.9, meaning that increased dividends pay-out per share increases the book value of a listed firm. Increased dividends per share increases the demand for shares, thus increasing the book value of a stock.

In addition, macroeconomic variables were correlated with one another and with microeconomic variables. This can be illustrated by the fact that money supply had a correlation of 1 with GDP/capita, -0.8 with the interest rate, 0.8 with the exchange rate, 0.8 with the gold price, 0.9 with DPS and 0.8 with BVS. It is not surprising that money supply is highly correlated with so many economic variables as the injection of money into the economy increases expenditure. The increase in expenditure can spark a series of economic events in an economy such as increasing production, thus GDP growth.

Furthermore, an increase in expenditure could result in inflationary increases, thus reducing the repo rate and increasing exports, consequently strengthening the exchange rate. As already mentioned in this chapter, exchange rate and the interest rate were also as highly correlated with numerous other variables, i.e. macroeconomic and microeconomic variables. There is however a high correlation amongst the independent variables, and this can be problematic in a model.

High correlation as per the above can result in unreliable and spurious results if the VECM is applied. This problem is termed multicollinearity. Ali (2011a) had the same challenge when analysing the influence of macro and microeconomic variables on the Dakha Stock Exchange. The PCA model was applied to remedy this problem by

determining the group of economic factors with the highest contribution in the variation of the ALSI.

4.8.2. Principal component analysis

Abekah (2005) and Mingione (2011) also used the PCA model to remedy the multicollinearity challenge for both macroeconomic and microeconomic variables. Mingioni (2011) found that the PCA model improved accuracy when predicting the out-sample period and forecasting a single aggregate index using a combination of macroeconomic and microeconomic variables. After the PCA application, it resulted in only six variables being part of the first factor. The first factor accounted for 52% of the variation of the ALSI. These variables were money supply, interest, GDP per capita, gold price, book values and dividends per share. The variables that were found to account for 52% of the first factor are likely to best represent the macroeconomic and microeconomic variables and their impact on the ALSI. The first factor has the strongest influence on the dependent variables (Van Rensburg, 1998).

To illustrate the above point, DPS and BVS were the only microeconomic variables which formed part of the first factor. Finding DPS as part of the first factor in this study is aligned to Dimmua (2015) and Pradhan et al's (2016) findings, as DPS had the strongest explanatory power of the ALSI when compared to other microeconomic variables. This may be the reason why most South African studies use DPS to analyse the influence of microeconomic data on the ALSI (Bhana, 1998; Auret & Sinclair, 2006; Mlonzi et al., 2011; Erasmus, 2012; Swart & Hoffman, 2013). On the contrary, other microeconomic variables have been found to significantly impact the ALSI in other studies outside of South Africa (Al-Tamimi et al., 2011; Bhargava, 2014; Sharif et al., 2015).

The literature on BVS is not extensive. South African studies focus more on macroeconomic impacts on the ALSI as opposed to microeconomic variables. Auret and Sinclair (2006) found BVS to have a significant direct effect on the ALSI. Investors will assess the balance sheet of publicly listed firms when deciding to purchase shares. A high book value increases the demand for a stock, therefore, increasing the share price.

Among the microeconomic variables, only PE ratio, ROA and ROE formed part of the second factor. The second factor accounted for 16% of the variation of the ALSI. The ROE and ROA on the second factor did not conform to economic theory. Pradhan and Dahal (2016) found ROA to have a direct impact on the ALSI, while Sharif et al. (2015) found ROE to have a positive effect on the ALSI. Investors look at the ROE and ROA of a firm when making investment decisions. If there is growth in these accounting ratios, it increases the demand for shares and consequently increasing the value of a stock. Since ROE and ROA are part of a factor that forms only 16% of the variation of the ALSI, this suggest that investors are less concerned about these accounting ratios and more concerned about DPS.

Research conducted in previous studies has had balanced findings regarding the positive, negative and insignificant influence of interest rate on the ALSI. The negative sign of the interest rate coefficient conforms to economic theory and has been found to have a significant impact on the South African ALSI (Moolman & Du Toit, 2005; Alam & Uddin, 2009; Mangani, 2009; Hancocks, 2011; Hsing, 2011; Muzindutsi, 2011; Gupta & Modise, 2013; Coovadia, 2014). The positive impact of interest on the South African ALSI in previous studies can be attributed to South Africa experiencing recession between 1994 and 2012, i.e. 1997–1999 and 2007–2009 (Coovadia, 2014; Roux, 2020). However, the current study extends beyond these recession periods, hence the negative correlation with the ALSI reflected on the first factor.

It was somewhat anticipated for the exchange to not be part of the first factor because, for similar studies conducted in South Africa, the exchange rate was found to have an insignificant impact on the ALSI for a considerable number of studies (Bernadine, 1993; Van Rensburg, 1998; MacFarlane, 2011; Ndako, 2013). In a research study done by Ndako (2013), it was concluded that the exchange rate had no significant impact on the South African ALSI due to the use of weekly data by attracting a lot of noise in the data. MacFarlane (2011) also came to a similar conclusion to Ndako (2013), i.e. the lack of significance in most variables using quarterly data instead of monthly data. Furthermore, MacFarlane (2011) theorised that exchange rate movements do not reflect the true impacts of economic changes in South Africa due to manipulations of the exchange rate, and that the exchange rate has a stronger relationship with other factors such as the monetary policy (MacDonald & Ricci, 2004)

and commodity prices (Aron, Elbadawi & Khan, 2000). Furthermore, the fact that the exchange rate was highly correlated with numerous other independent variables is perhaps the reason why the exchange rate was not part of the first factor.

Although the exchange rate was not part of the first factor, it was part of the second factor with a 0.3 coefficient. It is important to point out that the sign of the exchange rate was positive. South Africa is a net importer of merchandise with a negative trade balance (Roux, 2020). Therefore, a positive change or appreciation of the rand results in an increase in the ALSI because it makes imported inputs for listed firms cheaper. However, historical studies showed a negative impact on the exchange rate with the ALSI (Muzindutsi, 2011; Hancocks, 2011; Hsing, 2011). A much more recent study shows the exchange rate to have a positive impact on the ALSI (Banda, 2017). In other developing countries, exchange rate was found to have a positive effect on the ALSI. These were the findings in Kenya (Nikjam et al., 2015), Sri Lanka (Francis, 2017) and Pakistan (Kibria et al., 2014). In developed nations, the exchange rate has a positive relationship with the Japanese ALSI (Mukherjee & Naka, 1995). Jamaludin (2017) also found the exchange rate to positively impact the ALSI of Singapore, Malaysia and Indonesia.

The inclusion of money supply in the first factor suggests that money supply significantly influences the variation on the ALSI in South Africa (Van Rensburg, 1996; Hancocks, 2011; Hsing, 2011). The strong positive influence of money supply on the ALSI is not unique to South Africa and also occurred in research studies conducted in other developing countries and developed countries (Ali, 2011a; Kibria et al., 2014, Chittedi, 2015; Ouma, 2014; Ramadan, 2016; Pradhan & Dahal, 2016; Ho, 2017; Jamaludin, 2017). Injection of money into an economy increases aggregate demand, stimulating growth in the economy as well as the firms involved in production to meet aggregate demand, thus increasing the stock prices of listed firms.

South Africa is a mineral- and resource-abundant country and is one of the world's leading producers and exporters of gold. In 2004 South Africa accounted for 14% of world production (Yager, 2004). The mining sector is second in the ranking by market capitalisation of the top 50 JSE listed firms following the consumer goods sector. However, if SAB Miller and British American Tobacco are removed, which make up

35% of the top 50 listed firms by market capitalisation, the mining sector becomes the first ranked by market capitalisation of 25%. Therefore, it is consistent with economic theory that gold forms part of the first factor and has a strong positive relationship with the ALSI. Numerous studies conducted in South Africa found gold price to significantly impact the ALSI (Barr, 1990; Van Rensburg, 1996; Mangani, 2009).

The growth of GDP is one of the useful tools for measuring the financial health of an economy. Extensive literature confirms that it has a significant and positive influence on the South African ALSI (Moolman & Du Toit, 2005; Hsing, 2011; Coovadia, 2014; Ho, 2017). The strong correlation of GDP on the ALSI index value has also had a positive impact on other developing countries. Therefore, the GDP impact on the South African ALSI is consistent with theory (Shubiri, 2010; Ali, 2011a; Kibria et al., 2014; Ouma, 2014; Nijam et al., 2015; Chittedi, 2015; Pradhan & Dahal, 2016; Ramadan, 2016; Francis, 2017).

Inflation was not part of the first factor but part of the second factor on the PCA outcome. Inflation was found to negatively impact the South African ALSI (Van Rensburg, 1996; Hancocks, 2011; Hsing, 2011; Ho, 2017). Furthermore, in other developing countries there is extensive research that found inflation to have a negative relationship with the ALSI. There is a possibility that strict controls of inflation have positive spin-offs on the listed firms; therefore, there is a positive correlation with inflation and the ALSI. It has been argued that shares can serve as a hedge against inflation and thus positively impact stock prices (Zaremba, Umar & Mikutowsk, 2019; Al-Nassar & Bhatti, 2019). Inflation's positive relationship with the ALSI was found in a study conducted by Coovadia (2014). A positive relationship with the ALSI was also found in other developing countries (Kibria et al., 2014; Ouma, 2014; Pradhan & Dahal, 2016).

4.8.3. VECM

After finding the group of variables that have a significant influence on the ALSI when eliminating multicollinearity, the VECM was applied. Only dividends per share and gold price were significant when the VECM was applied. The first, second and third co-integration were statistically significant at the 95% confidence interval. However, the co-integration equation was non-stationary even though all the co-integration models

were significant. As a result of non-stationarity, no inferences were drawn on the results of the VECM.

4.8.4. Best subset regression model

Due to stationarity in the application of the VECM, the best subset model was applied. Wallet, Marchette, Solka and Wegman (1997) used the best subset model because of the large number of highly correlated independent variables. In applying the best subset model, it was found that money supply, exchange rate, gold price and dividend per share gave the lowest Mallows Cp, which was the best representative group of variables influencing the ALSI. The adjusted R^2 of 0.9788 reflected that these variables contributed to 97.88% of the variation in the ALSI, which is a good fit. It was interesting to see that money supply, gold price and dividends per share were of significance in both the PCA model and the best subset model, which emphasises the importance of these variables on the ALSI. However, money supply and dividends per share were the only variables found to be significant. The positive influence of money supply with the ALSI conforms to theory (Mukherjee & Naka, 1995; Van Rensburg, 1996; Ouma & Muriu 2014; Kibria et al., 2014; Hancocks, 2011; Hsing, 2011; Ramadan, 2016). In other words, growth in money supply results in increased demand for equity shares, increasing the share price. The complimentary relationship between DVS and the ALSI also conforms to theory and findings in South African studies (Bhana, 1998; Auret & Sinclair, 2006; Mlonzi et al., 2011; Erasmus, 2012; Swart & Hoffman, 2013). Increased dividends per share in one of the top 40 companies in the JSE would increase the value of the ALSI as the demand for share prices would rise.

The exchange rate and gold price did not affect the ALSI as the coefficients were statistically insignificant at the 95% confidence interval. This is surprising because, in historical studies, gold was found to influence the JSE all-share index significantly. There was heteroscedasticity present in the model as it was found that the variance was not constant when using the Breusch–Pagan test and the Durbin–Watson test. However, even the coefficients are un-biased, hence inferences cannot be drawn on these coefficients because the estimates are no longer efficient. The estimated variance and covariance are biased, resulting in the t-test and f-test being invalid in the presence of heteroscedasticity (Guermat & Hadri, 1999; Gujarati, 2012).

4.8.5. Using alternative models

Polakow and Flint (2015) used the EWMA model to try and deal with heteroscedasticity. However, due to the high exponential coefficient and a high square mean error, the EWMA model has proven not to be useful in remedying heteroscedasticity. It can be concluded that the coefficients are not biased, but these coefficients cannot be relied on as heteroscedasticity could not be remedied.

The ARCH/GARH model is not the best model to use due to the independent variables having only a sample of 20 years or 20 observations. The ARCH/GARCH model requires at least 250 observations for the model to be significantly negatively biased and for the conditional volatility to explain the squared returns (Hwang & Valls Pereira, 2006; Yaziz, Zakaria & Ahmad, 2017). There were limitations in obtaining data with 250 observations.

4.9. Summary of results

The PCA was used to eliminate multicollinearity. Afterwards, the VECM was applied. However, there was the presence of non-stationarity, or the model had no stability. In the application of the VECM, gold price was found to have a significant inverse effect on the ALSI, and the dividends per share had a significant positive impact on the ALSI. To deal with the problem of non-stationarity, the best subset model regression was then applied. The outcomes of the best subset regression were money supply, while dividends per share had a significant positive impact on the ALSI at an adjusted R^2 of 0.978. Heteroscedasticity was found when doing the Durbin–Watson Statistics and Breusch–Pagan test. The EWMA was applied to deal with heteroscedasticity; however, the results had a high mean square, so this problem could not be eliminated. The chapter to follow will focus on the inferences of the results.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

The main aim of this paper was to analyse the influence of macroeconomic and microeconomic variables on the ALSI in South Africa from 1997 to 2016. More precisely, this study aimed to add to the body of literature the combined influence of macro and microeconomic variables on the ALSI, since no South African research has analysed the combined impact of these variables. There is, however extensive literature that analysed the combined effects of macroeconomic and microeconomic variables in other countries. Financial data was obtained from resources such as the JSE, BFA and Statistics SA. Annual data was used because accounting ratios of publicly listed firms are mostly produced annually. Therefore, for consistency, data for both macroeconomic and microeconomic variables was annual. The PCA, VECM, best subset and EWMA models were applied to establish if there is a combined impact of these economic variables. This chapter also includes the challenges, implications, limitations of the study, and recommendations for future studies.

5.2. Conclusion

Two groups of independent variables were used, i.e. macroeconomic variables and microeconomic variables. There was a high correlation within a single group of variables and between the two groups of variables. Due to the high correlation, multicollinearity existed. However, the selected variables were relevant for the research conducted as literature does support the inclusion of these variables in such a study.

The combinations of both macroeconomic and microeconomic variables explain the variation in the ALSI. Primarily, money supply and the DPS were found to be the two significant variables when the best subset model was applied. The adjusted R^2 of more than 80% showed that these variables influenced the variation in the ALSI significantly. It is interesting that the significant variables comprised only two variables among eleven independent variables selected for the study. The impact of both macro and microeconomic variables on the ALSI is also supported by the fact that when the PCA model was applied, the first factor accounted for 52% of the variation of the ALSI and included the variables money supply, interest rate, GDP, gold price, BVS and DVS.

Amongst the microeconomic variables, only DPS had a significant impact on the ALSI; and amongst macroeconomic variables, only money supply was found to be significant. Since dividends per share was the only significant microeconomic variable and had a strong correlation with other microeconomic variables, it suggests that dividends per share best represent the rest of the selected microeconomic variables in the study. These findings or deductions are in line with the previous studies in South Africa, which have only analysed the effect of dividends per share on the ALSI.

The VECM was not the appropriate model as the financial data was non-stationary. Due to the number of variables considered, it was impractical to convert the financial data into a stationary form. The best subset model therefore had to be applied. However, heteroscedasticity was found, which rendered the results inefficient. The EWMA model was considered, but the model could not be applied due to the high exponential co-efficiency. The model that could have been used to deal with heteroscedasticity problems would have been the ARCH/GARCH model.

The research questions were answered, and the findings have implications for future studies, investors and policymakers. The implications of this research will be discussed in the section to follow.

5.3. Implications of the research

Various shortcomings were experienced when conducting the study, such as multicollinearity, non-stationarity and heteroscedasticity. Therefore, the final results of money supply and dividends per share were deemed as non-biased but inefficient as heteroscedasticity could not be remedied. Nonetheless, money supply and DPS had a positive impact on the ALSI. In other words, if the government engages in an expansionary monitory policy by increasing money supply, the value of the ALSI will increase. The government should seriously consider the impact of changes in the monetary policies on the South African ALSI. For instance, negative changes in the value of the ALSI will negatively affect pension funds, which in turn will cause pensioners to rely heavily on state resources in the future. The increase in dividends pay-out also increases the value of the firms listed on the JSE. This makes dividends pay-out an important accounting ratio when analysing financial results of listed

companies. Increased dividends pay-out is a sign of a profitable firm, which then attracts investors who generally want a high return on their investment. This means that firms that intend selling their shares to another firm can strategically increase their value by increasing their dividends pay-out to increase the firms' share value.

Macroeconomic and microeconomic variables contributed to over 80% of the variation of the ALSI. It is imperative that in future studies the effects of both macro and microeconomic factors are considered when assessing factors that impact the ALSI. The findings in this study suggest that microeconomic variables can be represented by the dividends per share in South Africa, whilst most macroeconomic variables can be represented by money supply except for inflation. One should bear in mind that DPS is a measure of profitability, as with the other accounting ratios considered in this study. Money supply has a high correlation with all of the macroeconomic variables. It is plausible that increased money supply can increase investment and growth, thus impacting most of the macroeconomic variables in an economy. Given the high adjusted R^2 calculated, perhaps the money supply well represents the macroeconomic factors included in this study. The high correlation that money supply has with other macroeconomic variables corroborates this statement. Future studies should perhaps reduce the number of macroeconomics and microeconomic variables considered in a single study to avoid problems such as multicollinearity. However, based on the study findings, it can be deduced that money supply and DPS should be the two most important variables to include in future studies.

The VECM and best subset models were not the most appropriate models as there were challenges of non-stationarity of data and heteroscedasticity. Future research should use the ARCH/GARCH model with increased observations to suit the application of the ARCH/GARCH model.

Despite the challenges encountered in this study, based on the high adjusted R^2 of the model results, the importance of including macroeconomic and microeconomic variables is clear when analysing economic variables that impact the JSE all-share index.

5.4. Limitations to the study

Due to the majority of microeconomic data or financial ratios being available yearly most of the time, only yearly observations could be used for the study. Monthly observations would have allowed for a higher frequency of data. For a study carried out over 20 years, if monthly data were available, this study would have had 240 observations. Had this been the case, this would have increased the predictive ability when modelling. It would have also allowed usage of models with better predictive power such as the ARCH/GARCH model. The ARCH/GARCH model requires at least 250 observations, yet the JSE has only been in existence for 130 years (Cheung & Lai, 1993). Furthermore, due to time constraints, conducting the study for more than 20 years was impractical.

There were also challenges of multicollinearity; therefore, the PCA model was applied to remedy this problem. However, the data was non-stationary when using the VECM, hence the best subset model had to be applied. Money supply, exchange rate, gold price and dividend per share proved to affect the ALSI when using the best subset model. However, money supply and dividends per share only had a statistically significant effect on the ALSI. The heteroscedastic nature of the results renders the coefficients inefficient, perhaps due to misspecification. Misspecifications could be caused by the omitted variables in the process of dealing with multicollinearity. Regardless, the two main research questions based on the results were answered as follows: there is indeed a strong correlation amongst the group of microeconomic and macroeconomic data, thus causing multicollinearity. Even though the heteroscedasticity is of concern, it can be concluded that some of the macroeconomic and microeconomic factors do influence the ALSI.

5.5. Recommendations for future studies and for solving the research problems

It is recommended that similar studies in future should use microeconomic variables from 1887, which is the year the JSE was established, even though economic trading conditions and the composition of listed firms on the JSE have changed substantially from this time. The next study should have more than 20 annual observations when assessing the influence of both macroeconomic and microeconomic factors on the South African ALSI. Once the increased data frequency is found for microeconomic data (company financial ratios), the ARCH/GARCH model can be explored for a similar

study. However, this will be in the distant future since at least 240 observations are required, and to date, the JSE is only 130 years old.

The only significant microeconomic variable is DPS. Therefore, it is safe to conclude that dividends per share can represent microeconomic variables for future studies, especially when taking into account the literature regarding some researchers who have argued that a company's accounting ratios all represent profitability. Therefore, it would be plausible that a single microeconomic variable, which is accounting ratios in this study, represents the changes in a firm's financial performance. Money supply was the only significant variable amongst the macroeconomic variables. This raises the question of whether money supply alone can represent the macroeconomic variables in a country. An argument for money supply to only represent macroeconomic data can be supported by the fact that most macroeconomic data was highly correlated with the money supply in this study. A counter-argument would be that in previous South African studies that have included the relevant macroeconomic variables, most of the variables were found to be significant. Therefore, the impacts of macroeconomic variables on the ALSI must not be limited to just the money supply.

5.6. Summary

There were various challenges experienced in this study, including multicollinearity, non-stationarity and heteroscedasticity. Despite the challenges, the three main objectives of the study were achieved. More precisely, the main research question has been answered, namely: macroeconomic and microeconomic variables do indeed influence the variation in the ALSI.

The PCA model was applied first to deal with multicollinearity. The VECM was then applied to find out whether there is a long-term relationship between macro and microeconomic variables; however, there was non-stationarity in the data. The best subset model was then applied, and heteroscedasticity was present. However, money supply and dividends per share were the ratios found to be significant.

Although the heteroscedasticity is of concern, the main research objectives were met, i.e.:

i) It can be concluded that some of the macroeconomic and microeconomic factors combined do influence the ALSI.
ii) There is indeed strong correlation amongst the group of microeconomic and macroeconomic data, thus causing multicollinearity.
iii) Non-stationary was present in the data; therefore, the VECM could not be applied.

Furthermore, the hypotheses tested had the following outcomes: Firstly, the null hypothesis that macroeconomic and microeconomic variables do not have an impact on the ALSI is rejected. Secondly, the null hypothesis of the VECM not being a suitable model for this study cannot be rejected. Lastly, the null hypothesis of no correlation between macro and microeconomic variables cannot be rejected.

Based on the outcome of the study, a gap was noted which warrants an extension of the current study. The recommended model to extend this study would be the ARCH/GARCH model, provided that there are at least 250 observations available to allow the application of such a model. Since the JSE was established in 1887, it means the annual accounting ratio data of listed firms will be less than 250 years, which suggests that biannual or monthly data will have to be used. To gather monthly data, a researcher will have to consult each firm listed on the JSE for the study since most firms only publish financials annually. This exercise will prove to be impractical as it will involve consultation with over 100 firms. The lesson here for publicly listed firms in South Africa is that it would be in their best interest to ensure that monthly financial information is available to the public. Producing accounting ratios or microeconomic information monthly will allow researchers to conduct robust research and add value to listed firms and, at the same time, contribute to the literature on this subject.

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APPENDIX

Appendix 1: Regressions Statistics with Variance Inflation Factor Calculation

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.998292
R Square	0.996587
Adjusted R Square	0.995639
Standard Error	885.379
Observations	47

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	8240403435	824040343.5	1051.211	2.85027E-41
Residual	36	28220252.43	783895.9008		
Total	46	8268623687			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*	*VIF*	*STD error*
Intercept	1468.426	4280.570038	0.343044612	0.73356	-7212.971868	10149.82	-7212.97	10149.82		
BookValS	-0.11627	0.197988339	-0.58725979	0.560695	-0.517809551	0.285268	-0.51781	0.285268	14.95	2521.674
DivShare	46.45903	4.794687671	9.68968875	1.43E-11	36.73495396	56.18311	36.73495	56.18311	38.04	166.1311
Peratio	18.2299	15.95541031	1.142552761	0.260766	-14.1291736	50.58897	-14.1292	50.58897	3.07	14.1815
ReturnAs~t	167.4382	99.35803756	1.685200523	0.100601	-34.06922161	368.9457	-34.0692	368.9457	6.65	3.351802
ReturnEq~y	29.78494	28.18820775	1.056645249	0.297713	-27.38339885	86.95327	-27.3834	86.95327	2.83	7.710247
Inflation	71.24411	57.4292078	1.240555329	0.222794	-45.22772122	187.7159	-45.2277	187.7159	3.47	4.1904
MoneySupply	0.013755	0.00271326	5.069429806	1.21E-05	0.008251936	0.019257	0.008252	0.019257	82.60	432598.2
ExchangeRate	-92.2776	157.7100377	-0.58510904	0.562124	-412.1283482	227.5732	-412.128	227.5732	20.23	3.683457
GDPCapita	-0.04003	0.09362963	-0.42753211	0.671538	-0.229919362	0.14986	-0.22992	0.14986	8.93	4122.56
Interest	13.25354	45.87125569	0.288929072	0.774293	-79.77767849	106.2848	-79.7777	106.2848	2.36	4.327131

VIF >= 5 shows multicollinearity and VIF less than 5 is an indication of the lack of multicollinearity.

Appendix 2: Description Statistics

Column1	AllShareIndex	BookValS	DivShare	Peratio	ReturnAs~t	ReturnEq~y	Inflation	MoneySupply	ExchangeRate	GDPCapita	Interest
Mean	10166.24222	1798.371	109.1839	9.291934	3.282192134	7.19737589	9.369541	319280.383	4.498125532	48152.6383	13.92021
Standard Error	1955.639357	367.824	24.23271	2.068584	0.48891051	1.12465512	0.611233	63100.93117	0.537287481	601.3372443	0.631177
Median	3930.767542	705.0642	34.15152	3.134848	2.833939394	4.3930303	8.938547	76398	3.2667	47126	13.16667
Mode	#N/A	0	0	0	0	0	#N/A	#N/A	0.8696	#N/A	12.5
Standard Deviatior	13407.18795	2521.674	166.1311	14.1815	3.35180159	7.71024707	4.1904	432598.1891	3.683457393	4122.560446	4.327131
Sample Variance	179752688.9	6358842	27599.53	201.1148	11.2345739	59.4479098	17.55946	1.87141E+11	13.56785836	16995504.63	18.72406
Kurtosis	1.317310944	0.920465	2.032726	6.04538	-0.879052307	-0.8496448	-0.96109	1.217825453	-0.084104688	-0.50746678	-1.06276
Skewness	1.534437425	1.45143	1.747015	2.254063	0.612083237	0.68711763	0.259033	1.467854874	0.82200895	0.781179708	0.41792
Range	46301.18333	8470.951	575.7752	70.94545	10.14757576	25.1066667	17.26954	1604398	14.0293	14083	14.375
Minimum	157.4833333	0	0	-2.44091	0	0	1.385382	2513	0.6795	42386	7.958333
Maximum	46458.66667	8470.951	575.7752	68.50455	10.14757576	25.1066667	18.65492	1606911	14.7088	56469	22.33333
Sum	477813.3842	84523.42	5131.643	436.7209	154.2630303	338.276667	440.3684	15006178	211.4119	2263174	654.25
Count	47	47	47	47	47	47	47	47	47	47	47

Appendix 3: Raw Data

years	all share index	money supply	exchange rate	Interest rate	GDP/Capita	Gold Price/ounce Rands	Book Val / Share ©	Dividend / Share ©
2016	45 599	1 606 911	14.7088	10.46	73 369	1 247	8 229.13	443.18
2015	46 459	1 428 508	12.7507	9.42	64 788	1 152	6 874.48	417.96
2014	44 266	1 241 272	10.8444	9.13	63 055	1 251	6 480.00	443.85
2013	37 539	1 132 039	9.6502	8.50	59 888	1 394	5 975.72	418.42
2012	31 273	1 035 142	8.2099	8.75	55 982	1 676	5 225.90	379.59
2011	28 599	947 269	7.2531	9.00	53 868	1 574	4 804.23	328.23
2010	25 491	862 876	7.3222	9.83	49 906	1 238	3 917.59	181.86
2009	21 113	806 345	8.4372	11.71	46 170	985	3 363.16	187.71
2008	25 209	753 655	8.2517	15.13	43 897	877	4 194.13	273.95
2007	25 968	738 317	7.0544	13.17	39 387	705	3 566.22	233.83
2006	19 788	605 679	6.7672	11.17	34 653	614	3 383.63	253.85
2005	14 084	503 053	6.3618	10.63	31 335	449	1 969.41	173.77
2004	10 220	421 494	6.4499	11.29	28 591	411	1 742.72	150.11
2003	8 846	387 788	7.5647	14.96	26 026	368	2 432.22	89.32
2002	10 141	358 251	10.5165	15.75	24 462	289	2 385.68	143.03
2001	9 089	315 556	8.6031	13.77	21 417	271	2 236.56	151.59
2000	7 989	274 355	6.9353	14.50	19 741	277	1 455.36	137.08
1999	6 755	269 316	6.1131	18.00	17 651	985	1 703.65	89.12
1998	6 481	222 984	5.5316	21.79	16 475	280	2 096.07	140.39
1997	6 363	182 365	4.6073	20.00	15 634	705	6 685.00	177.78

Appendix 4: Best Subset Model Results

Best subsets Regression: All Share Index versus Inflation, Money Supply, exchange rate, interest, GDP/capita, gold price, book value/share, Dividends/share, return on equity, return on assets.

Response is All Share Index

Vars	R-Sq	R-Sq (adj)	R-Sq (pred)	Mallows Cp	S	Inflation	Money Supply	Exchange rate	Interest	GDP/Capita	Gold Price	Book Val / S	Div/Share	PE ratio	Return on Asset	Return on Equity
1	96.9	96.8	95.7	2.8	2492.2		X									
1	94.9	94.6	93.7	15.5	3227.3					X						
2	98.2	98.0	97.1	-2.8	1981.9		X						X			
2	97.1	96.8	95.8	3.5	2477.8	X	X									
3	98.2	97.9	97.0	-1.1	2015.4	X	X						X			
3	98.2	97.9	96.6	-1.0	2025.3		X				X		X			
4	98.3	97.9	96.4	0.3	2022.0		X	X			X		X			
4	98.3	97.8	96.5	0.5	2045.2	X	X					X	X			
5	98.4	97.9	96.4	1.7	2028.2	X	X	X			X		X			
5	98.4	97.8	96.4	2.1	2072.8	X	X	X				X	X			
6	98.5	97.8	96.0	3.4	2077.5	X	X	X			X	X	X			
6	98.5	97.8	95.7	3.4	2079.5	X	X	X	X	X			X			
7	98.6	97.8	95.7	4.6	2067.7	X	X	X	X		X		X		X	
7	98.5	97.7	95.4	5.0	2110.6	X	X	X	X	X		X	X			
8	98.6	97.6	95.3	6.4	2130.3	X	X	X	X	X	X		X		X	
8	98.6	97.6	94.8	6.4	2133.9	X	X	X	X		X	X	X		X	
9	98.7	97.5	94.9	8.1	2198.1	X	X	X	X	X	X	X	X		X	
9	98.7	97.5	94.8	8.2	2209.2	X	X	X	X	X	X		X		X	X
10	98.7	97.2	94.2	10.0	2301.7	X	X	X	X	X	X	X	X		X	X
10	98.7	97.2	94.1	10.1	2314.5	X	X	X	X	X	X	X	X	X	X	
11	98.7	96.9	93.3	12.0	2440.2	X	X	X	X	X	X	X	X	X	X	X

Appendix 5: Topic title approval/Ethical clearance

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

21 December 2020

Mr Zenda Mduduzi (206509868)
Graduate School of Business & Leadership
Westville Campus

Dear Mr Mduduzi,

Protocol reference number: HSS/0182/018M
New Project Title: A quantitative study on the impact of microeconomic and macroeconomic variables on the JSE stock prices

Approval Notification – Amendment Application

This letter serves to notify you that your application and request for an amendment received on 21 December 2020 has now been approved as follows:

- Change in title

Any alterations to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form; Title of the Project, Location of the Study must be reviewed and approved through an amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

All research conducted during the COVID-19 period must adhere to the national and UKZN guidelines.

Best wishes for the successful completion of your research protocol.

Yours faithfully

[redacted]

.....
Professor Dipane Hlalele (Chair)

/dd

cc Supervisor: Dr Pfano Mashau
Cc Academic Leader Research: Professor Muhammad Hoque
Cc School Administrator: Ms Zarina Bullyraj

Appendix 6: Turnitin

MBA 25.07.2020

ORIGINALITY REPORT

10%	3%	3%	9%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

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2	www.wordsandwhiskey.org Internet Source	1%
3	Submitted to University of KwaZulu-Natal Student Paper	1%
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