Gordon Institute of Business Science
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The impact of selected macroeconomic variables on sectors of the JSE

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ABSTRACT

Various studies have examined the relationships between macroeconomic variables and equity returns using large volumes of data from various time periods. Many studies used an overall stock market index as a proxy for measuring the returns of an entire stock market. Using an overall stock market index has the consequence that the performance of different sectors of an economy cannot be considered separately.

The aim of this study was to assess whether relationships exist between four preselected macroeconomic variables and three sectors of JSE. The Prime lending rate, CPI, the rand-dollar exchange rate and GDP were cross-correlated at different time lags with the Top 40, Resource 10, Industrial 25 and the Financial 15 FTSE/JSE indices.

Quarterly data for four macroeconomic variables and the four indexes was collected from Bloomberg for the 10-year period 2005 to 2014 and tests of cross-correlation were performed at different time lags between each macroeconomic factor and each index.

The results showed that the GDP was positively correlated with the Industrial 25 and Financial 15 indexes. Movements of the Prime lending rate were negatively correlated with the Top 40, Resource 10, and Financial 15. Inflation was negatively correlated with the Top 40 and Resource 10 indexes and the rand-dollar exchange rate was negatively correlated with the Top 40, Industrial 25 and Financial 15 indexes.

Keywords: FTSE/JSE indices, macroeconomic variables, equity returns.

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CHAPTER 1: RESEARCH PROBLEM

1.1. Introduction

Stock markets have an important function in an economy as they allow capital to be raised by corporates and from an investor's point of view, domestic and foreign capital to be invested and divested relatively easily from different economic sectors. Numerous studies have searched for relationships between macroeconomic variables and equities performance. Many of the previous studies suggested that equity prices respond to changes in macroeconomic factors, such as levels of economic activity, foreign exchange rates, interest rates, budget deficit levels, inflation, and employment rates. In theory, these variables should be some of the drivers of corporate profits, which in turn should influence the price of equities. Thus it is expected that some relationships between macroeconomic variables and equity prices should exist.

When the many different outcomes of previous studies are reviewed, it is supposed that where such connections do exist, it is possible that these are not necessarily consistent across time periods, across all markets or across all the industries within a single market.

Many previous studies have searched for evidence of relationships between macroeconomic factors and the performance of the Johannesburg Stock Exchange (JSE) and various other equity markets. They attempted to ascertain whether current and future equity market returns are a function of macroeconomic variables. While the results of past studies are valuable, it is also important to consider whether macroeconomic factors influence individual sectors of an economy. If macroeconomic variables do provide predictive information regarding future equity returns, it would be important take those variables into account when making policy, operational and investment decisions. This information would be helpful to governments, industry bodies, investors and business. Any identified relationships could be used widely, as part of institutional and individual investment planning, as well as to direct government policy and corporate strategy.

To ascertain whether relationships do exist between macroeconomic variables and individual sectors of the South Africa economy, this study considered the movements of four macroeconomic variables: the level of economic activity, inflation, interest rates and the rand-dollar exchange rate on three sectors of the JSE; namely the Resource Index, the Industrial Index and the Financial Index. Data for the Top 40 Index was also included to compare how each individual sector performed in relation to the JSE as a whole.

1.2. Research Problem

A multitude of studies have investigated whether relationships exist between macroeconomic factors and equity returns. These studies used data from various financial markets, with many studies using an overall equity market index as a proxy for the performance of an entire market. The consequence of using an overall share index is that it aggregates the performance of companies operating in different economic sectors into the performance of a single index.

When Afordofe (2011) analysed the relationships between the JSE Resource Index and macroeconomic variables, he proposed that unique relationships may exist between macroeconomic variables and different sectors of the JSE. He continued by stating that it would be necessary to compare the returns of individual economic sectors with movements of macroeconomic variables in order to determine whether any specific relationships exist between those macroeconomic variables and a specific sector. Afordofe (2011) tested the returns of the JSE Resource Index against the movements of four macroeconomic factors. He suggested that financial and industrial sectors could also be used as dependent variables in future studies to consider whether economic sectors have any unique relationships with macroeconomic factors.

This study examined the effects of movements of 4 macroeconomic factors on equity returns of three JSE indices:

1. FTSE/JSE Top 40 Index (JSE code J200).
2. FTSE/JSE Resources 10 Index, (JSE code J202).
3. FTSE/JSE Industrial 25 Index, (JSE code J210).

4. FTSE/JSE Financial 15 Index, (JSE code J211).

There is no universally accepted theory that guides how market returns are connected to macroeconomic variables. According to Chen, Roll and Ross (1986), macroeconomic variables should be elected for a study based on their expected influence on shareholder cash flows or on the rate of return used as inputs of valuation models.

According to Gordon's (1959) model, the price of a share is equivalent to the discounted sum of expected future dividends. However, Miller and Modigliani (1961) argued that the underlying driver of a company's value is its earnings, with dividends merely being cash payments to shareholders out of accumulated profits.

Any macroeconomic indicators that are in some way expected to be able to influence future dividends, or the discount rate used in equity valuations, in theory should affect the equity pricing. This research study did not attempt to provide an exhaustive list of macroeconomic factors that determine equity prices. The following were selected for testing as this study hypothesised that each of these four indicators has the potential to have a material influence on the price of JSE-listed shares:

1. Inflation (Consumer Price Index)
2. Interest rates (Prime lending rate)
3. Aggregate Economic Activity (Gross Domestic Product)
4. rand-dollar exchange rate (rand-dollar)

1.3. Research Motivation

The question of whether macroeconomic variables explain equity price movements has occupied business minds and academia for decades. A large body of research exists concerning investigations searching for relationships between macroeconomic variables and share pricing using various methods of statistical analysis.

Fama (1981) and many others that have followed on his efforts, including Nasseh and Strauss (2000), have found evidence that economic factors do influence equity prices.

Van Rensburg (1995, 1997, 1999) and Jefferis and Okeahalam (2000) analysed the JSE during the 1980s and 1990s in light of data for macroeconomic indicators.

As technology advances and information continues to be liberalised, there is a possibility that the Fama-efficiency of markets improves. This could lead to quicker market responses to movements of macroeconomic factors. An understanding of the impacts of macroeconomic factors on sectors of the JSE may be of use to investors who aim to develop profit maximising investment strategies. It would be relevant to academics and economists who wish to achieve a more thorough understanding of how macroeconomic variables and sock market returns may be related, if at all. A better understanding of how macroeconomic factors influence different sectors of the JSE could be used by corporates to develop strategies, risk management and capital planning purposes. Connecting movements in equity prices to macroeconomic variables could also be used to inform government policy and budget allocation decisions.

Porter (1998) commented that the competitiveness and profitability of companies is directly affected by the industry in which they operate. In order to investigate whether correlations exists between macroeconomic factors and macroeconomic sectors, it is necessary to isolate and measure the performance of each sector individually.

This study aimed to investigate whether any relationships exist between macroeconomic factors and the performance of the JSE as a whole, and also at a sector level. It was motivated by a attempt of increasing the understanding of whether individual sectors of the JSE have unique connections with macroeconomic variables. The results of the research should broaden the existing literature on this subject. Indirectly it should also contribute to a better understanding of emerging market dynamics.

The JSE sectors to be tested were based on their individual contribution to the economy.

1.4. Research Objectives

The aim of this investigation was to determine whether the four selected macroeconomic indicators influence the equity returns of four JSE indexes. The research objectives were set as follows:

1. To determine whether any relationships exist between Gross Domestic Product and the Average Market Return (AMR) of the Top 40, Resource 10, Industrial 25 or Financial 15 indexes.

2. To determine whether any relationships exist between Consumer Price Index and the Average Market Return of the Top 40, Resource 10, Industrial 25 and Financial 15 indexes.

3. To determine whether any relationships exist between the Prime lending rate and the Average Market Return of the Top 40, Resource 10, Industrial 25 and Financial 15 indexes.

4. To determine whether any relationships exist between the rand-dollar (ZAR/USD) exchange rate and the Average Market Return of the Top 40, Resource 10, Industrial 25 and Financial 15 indexes.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

It has often been argued that equity prices are determined in part by macroeconomic variables. This implies that macroeconomic variables influence investor decisions and this in turn motivates researchers to investigate the existence of relationships between equity prices and macroeconomic variables.

Much literature supports the idea that economic variables influence equity returns Chen, Roll & Ross, (1986). In studies conducted to investigate the connections between macroeconomic variables and equity market returns, the following factors have been considered in the past: inflation, interest rates, exchange rates, productivity, unemployment, money supply, government bond rates and oil prices, to name only a few. The aim of this study was to determine whether any relationships exist between four selected macroeconomic variables and four selected indices during the 10 year period from 1 January 2005 to 31 December 2014.

According to the Gordon's model (1959), a share's price is the sum of the discounted expected future dividends. Miller and Modigliani (1961) argued that the driver of a firm's value is its profits, not dividends. Regardless of which concept is subscribed to, it follows that the factors that actually influence share prices are those that impact expected cash flows from an investment and the rate used to present value those future cash flows. Many previous studies preselected the macroeconomic variables for investigation based on this simple logic.

Ross (1976) linked equity market returns to a number of macroeconomic factors. Fama and Schwert (1977) examined the relationship between the United States equity market and macroeconomic factors and confirmed a direct link between macroeconomic movements and equity market volatility. Another study by Fama (1981) found a strong direct relationship between equity market returns and capital expenditure, industrial production, the Gross National Product, money supply, lagged inflation and the interest rates. Numerous other studies have presented evidence of significant relationships

between equity market returns and macroeconomic variables (Geske & Roll, 1983; Black, Fraser & MacDonald, 1997).

Using data from the United States, Chen (1983) concluded that equity prices do respond to economic events and news, with some types of events having a larger effect on equity prices than others Chen, Roll and Ross (1986). Poon and Taylor (1991) analysed the effect of a similar selection of macroeconomic variables to those of Chen et al. (1986) but using data from the London Stock Exchange equities markets. Poon and Taylor found that the relationships between the variables and share prices in the United Kingdom were different to those described by Chen et al. (1986). In a more recent study, Gunsel and Cukur (2007) examined the effects of the interest rates, exchanges rate and inflation on equity market returns in the United Kingdom, finding that macroeconomic factors play a significant role on market returns. But those results revealed differences among industries, suggesting that the effect of each macroeconomic factor depends on the industry.

Chen (1991) found that economic variables (lagged production growth rate, the short-term interest rate) are indicators of current and future economic growth. These findings confirm those of Chen et al.'s (1986) study that suggested that economic variables can be used to achieve excess market returns by forecasting movements of macroeconomic factors.

Mukherjee and Naka (1995) tested the relationship between the Tokyo Stock Exchange and exchange rates, money supply, inflation and bond rates using a Vector Error Correlation Method. Their results indicated that all the tested variables had a relationship with the stock exchange in the long-term.

Kussel (1999) stated that economic indicators do not have a significant effect on the industrial index of the Johannesburg Stock Exchange. The performance of Industrial index is based on events that occur in developed world markets. In contrast, Moolman and Du Toit (2005) demonstrated that the performance of the JSE is determined in part by economic factors.

The Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT) were developed in attempts to explain equity price movements. Both models are based on the

Efficient Market Hypothesis (EMH) of Fama (1965) which states that a share price fully reflects all available information at a point in time.

The Present Value Model (PVM) of Humpe and Macmillan (2009) relates share prices to future expected cash flows. Macroeconomic variables that can influence expected future cash flows or the rate at which those cash flows are discounted, could influence the price of a share. Humpe and Macmillan, (2009) stated that the PVM model has an advantage over the APT model in that it can be used to focus on the long-term relationship between the equity market and macroeconomic variables.

2.2. Macroeconomic Factors

2.2.1. Levels of economic activity and equity returns

The most commonly used measure of economic activity in South Africa is the Gross Domestic Product. GDP measures the total value of all goods and services produced by a country in a given period. Increased GDP should have a positive impact on the total returns of a market, due to overall increased corporate revenues and profits. If viewed in isolation, a strongly positive GDP growth outlook should encourage corporates to invest capacity and should motivate investors to invest in equities in an attempt to maximise investment returns, based on revenue growth prospects of listed companies.

Some investors believe that equity markets move in the same direction as the levels of economic activity in an economy. Whether such a relationship exists or not, if a sentiment is considered to be true by a large number of investors, then that sentiment in itself could drive the amount of capital invested in, and performance of a market.

Much of the existing literature concludes that there is a positive relationship between economic output and equity market returns (Fama, 1990; Cheung & Ng, 1998). Hassapis and Kalyvitis (2002) and Tsouma (2009) also found evidence of a positive long-term relationship between share returns and real economic activity when analysing data from the United States. Jefferis and Okeahalam (2000) confirmed a positive relationship between JSE and GDP movements when they analysed data for the period 1985 to 1995.

Hsing (2011) also found that the ASLI returns were positively influenced by the growth of real GDP.

2.2.2. Interest rates and equity returns

Interest is generally considered to be the cost of debt, being the price paid for the use of capital for a period of time. For a borrower, an interest rate is the cost of borrowing capital. From a lender's point of view, the interest rate is the fee charged for lending capital. The impacts of the interest rate on sectors of a stock exchange provide implications for monitory policy, corporate risk policies, financial instrument valuation and government policy.

Unlike CPI or GDP, the Prime lending rate is set at will, and as such the South African Reserve Bank is able to use the Repo rate to regulate inflation and to a lesser extent the rate of economic growth. The Monetary Policy Committee of the SARB was established when the SARB adopted its inflation-targeting framework. The SARB sets the Repo rate according to its inflation-targeting policy. Thus the Repo rate is somewhat dictated by levels of inflation, leaving the SARB little leeway to adjust the Repo rate beyond the parameters of their inflationary-targeting policy. At a global level, the world watches the United States' monetary policy makers very closely, with markets being moved by unexpected news from the Federal Reserve.

The relationship between share prices and interest rates has received considerable attention in literature. Interest rates are often perceived to have a strongly negative relationship with economic activity, which supports Fama's (1981) findings. This concept is based on the view that a decrease in interest rates will result in higher future profits, due to lower borrowing cost for corporates, and thus higher equity prices.

Lower interest rates encourage the transfer of investment capital from the money market into equity markets, resulting in an increased demand for shares and consequently,

increased share prices. However, if interest rates decline at a time when there is reduced demand for firms' products, sales could decline and the net effect on share prices becomes difficult to predict. Depending on the combined effect of lower borrowing costs and reduced sales, future profits could decrease causing share prices to decline.

Lower interest rates do not necessarily result in greater future profits, unless the total costs decline. The possibility of an increase in other input costs, such as electricity or labour in a manufacturing operation, is real and in such a case, total costs may increase. Therefore, while lower interest rates may lower borrowing costs, profits may still decrease due to decreased market demand or increased input costs.

Many previous studies found that higher interest rates affected both economic activity and equity returns negatively (Fama & Schwert, 1977; Geske & Roll, 1983; Chen et al., 1986; Chen, 1991; DeFina, 1991).

Jefferis and Okeahalam (2000) investigated the data from the stock exchanges of South Africa, Botswana and Zimbabwe. They found that higher interest rates resulted in lower JSE returns.

Spyrou (2001), in a study of the relationship between inflation and share returns of Greece, found that inflation and share returns are negatively related, but only up to 1995 after which the relationship became insignificant. This is an example of how relationships may vary over time.

Al-Sharkas (2004) and Adam and Tweneboah (2008) indicated that the relationship between share prices and interest rates for Jordan and Ghana is negative.

Maysami, lee and Hamzah (2004) revealed that short-term interest rates have a significant positive relationship with Singapore's equity market. According to Abugri (2008), the response of share returns to interest rate is negative in Brazil, Argentina, and Chile, but no significant conclusion could be made for Mexico.

Ologunde, Elumilade and Asaolu (2007) examined the relationship between equity market levels and the interest rates using regression analysis. Their results showed that the interest rate has a positive influence on the JSE.

Alam (2009) investigated the relationship between share returns and interest rates using data from fifteen developed and developing countries, including South Africa. For most equity markets it was found that interest rates had an inverse relationship to equity returns.

2.2.3. Inflation and equity returns

Inflation is the rate of depreciation of the real value of money according to Cukierman, Miller and Neyapti (2002). Financial theory suggests that inflation and share prices should be negatively related. Most previous studies have found evidence to support this theory (Fama & Schwert, 1977; Geske & Roll, 1983; Chen et al., 1986; Chen, 1991; DeFina, 1991).

The economic theory put forward by Fisher (1930) describes the relationship between inflation and both real and nominal interest rates. He suggested that the real interest rate equals the nominal interest rate minus the expected inflation rate. The term "nominal interest rate" refers to the actual interest rate, being the rate at which a fixed amount of currency owed to a lender increases over time. The term "real interest rate" refers to the amount by which the purchasing power of a fixed amount of currency grows over time. The real interest rate is the nominal interest rate adjusted for the effect of inflation on the purchasing power of the loaned currency. The relationship between the nominal and real rate is given by the Fisher equation, which states that the real interest rate is equivalent to the nominal interest rate minus the expected inflation rate.

According to Bordo and Wheelock (1998), a regime of consistent low and stable inflation tends to promote financial market stability. Inflation is used to guide policy decisions on money supply and interest rates, which indirectly affects an economy in a number of ways. The South African Reserve Bank's inflation target is set at a range of between 3% and 6% for the year-on-year increase of the Consumer Price inflation (CPIX). CPIX is defined as Consumer Price Inflation excluding interest rates on mortgage bonds by Gupta, Kabundi and Modise (2009). The CPI is an index of inflation that is calculated by measuring the price of a fixed basket of consumer goods at different points in time . This widely used measure of inflation for South Africa has been selected for this study as the

proxy for inflation.

Boyd, Levine and Smith (2001) found a predominantly negative relationship between inflation and equity returns in data covering over 35 years and 65 countries, including South Africa. In contrast, Paul and Mallik (2003) found that inflation had an insignificant effect on equity prices of the Australian financial sector. However they did find that interest rates and GDP affected equity returns.

Adam and Tweneboah (2008) found a positive relationship between inflation and share returns in Ghana. They suggested that investors used equities as hedges against inflation. Omotor (2010) found evidence of a positive relationship between equity returns when testing data from the Nigerian stock exchange. Tripathi & Kumar (2015) found the same results in a short-term study of the Brazilian economy.

However a positive relationship between inflation and share prices is quite possible. Increases in inflation directly impact share prices positively through changes in the consumer price levels, which could drive revenues upwards. While nominal interest rates may increase with inflation, expected cash flows may increase as well. Thus, the anticipated negative borrow-cost effect of increased interest rates and the positive effects of increased expected cash flows counter each other.

Engle (2004) established a strong predictive link of inflation on equity market returns. Maysami et al. (2004) for Singapore, and Adam and Tweneboah (2008) for Ghana, reported a significant positive relationship between inflation (CPI) and share returns. These results provide a contrast to research that had found a significant negative relationship between share returns and expected inflation.

More recently, Douglason (2012) studied the relationship between inflation and equity market returns in Nigeria. Using monthly and quarterly data from 1985 to 2009 and regression testing for the Fisher effect, his findings suggested that equity market returns have a negative relationship with inflation movements and may provide an effective hedge against inflation. The mixed results of existing literature may suggest that relationships between share returns and inflation may be inconsistent over time and that there may be differences amongst markets .

2.2.4. Exchange rates and equity returns

The interaction between equity and currency markets has resulted in much debate among researchers for decades. This is because of the important role that both the equity and currency markets play in enabling economic activities. There is no theoretical consensus or agreement that actual relationships exist between share prices and exchange rates.

Exchange rate is the price of one currency in terms of another. An exchange rate thus has two components, the domestic currency and a foreign currency. In this study, the exchange rate is said to fall when the South African rand weakens against United States dollar, and the exchange rate rises when the rand strengthens against the dollar.

Abdalla and Murinde (1997) investigated the correlation between exchange rates and share prices for India, Korea, Pakistan and the Philippines. Their results showed a positive correlation between exchange rates and equity prices in India, Korea and Pakistan but not in their data from the Philippines.

Ajayi and Mougoue (1996) studied the relationship in eight developed economies and their results showed that currency depreciation had a negative effect on equity prices. Kim (2003) and Maysami (2004) each concurred with Ajayi and Mougoue's findings.

Adjasi and Biekpe (2006) investigated the relationship between exchange rate movements and equity market returns in seven African countries using co-integration analysis. Their findings suggested that in the short-term, exchange rate depreciation leads to decreases in equity market returns in most of the countries analysed.

A study by Gay (2008) of the economies of Brazil, Russia, India and China found a positive relationship between exchange rates and the equities for Brazil, India and China, but none for Russia.

Abugri (2008) revealed that the responses of Brazilian and Mexican share returns to an exchange rate shock are negative and significant, while neither Argentina's nor Chile's share returns responded significantly to exchange rates.

Yaya and Shittu (2010) examined the predictive power of inflation and exchange rate on South African share volatility. Their results affirmed that previous exchange rates and inflation rates have significant effects on JSE movements.

El-Nader and Alraimony (2012) found a negative relationship between exchange rates and equities in the Amman equities market. They further proposed that the relationship between exchange rates and equity market returns depends on whether the economy is export dominant or import dominant. They proposed that for an export-dominant country a weakening exchange rate has a positive influence on share returns and for an import-dominant country, a strengthening exchange rate improves share returns.

2.3. The South African Economy: 2005 to 2014

For this research study, it was important to consider the performance of the entire economy of South Africa as it forms the context from which the data for the study originates. The JSE is Africa's largest stock exchange by market capitalisation and it is commonly classified as an emerging market. Using Fama's measures, the JSE has been assessed to be semi-strong form efficient by Retief, Afflect-Graves and Hamman (1986). Gilbertson (1976) found strong-form efficiency. Thompson and Ward (1995) showed that there are some share price dependencies but these are too small to be profitably exploited and therefore their study concluded that the JSE is "operationally efficient", meaning that a small group of investors are able to outperform the market.

2.4. Sectors of the South African Economy

South Africa has abundantly proven ore bodies of various natural resources and the country has a well-developed financial, legal, and infrastructural base. However, some infrastructural deficiencies, unemployment and inequality continue to be a challenge, both socially and economically.

2.4.1. Industrials

The South African economy has been developed for more than a century and was founded on the country's mineral resources, but today this sector now contributes less to the economy than it did in past decade. Furthermore, due to its high market capitalisation, the performance of the resource sector has a substantial impact on the performance of the All Share Index (ALSI). The industrial sector has the potential to support economic development, through increased exports, skills development and job creation. It is one of the focus areas of the National Development Plan.

In the financial sector the banking and non-banking financial intermediaries are at the institutional level. These financial institutions provide a range of commercial and retail banking services while also offering insurance and investment products, as well as other innovative non-financial retail sales offerings. The South African banking system is well regulated, and is comprised of the South African Reserve Bank (SARB) as well as a few large banks and various investment institutions. Many foreign banks and investment institutions have operations in South Africa. The market level of the financial sector includes the JSE, the bond market, the money market and the foreign exchange market. Throughout history, manufacturing has been a crucial part of the development of many economies. Industrialisation policies driving increased local beneficiation can grow economies. The South African manufacturing sector's contribution to GDP has fallen from 24% in the early 1980s to 13% in 2014. Various factors have contributed to this deindustrialisation. However, the manufacturing sector remains important given its connections to mining and infrastructure.

2.4.2. Resources

The resources sector of the JSE is comprised of companies operating in mining, and they represent more than a quarter of the market capitalisation of the JSE. This sector is the foundation on which the South African economy developed and it is a large employer. Despite the recent decline of the South African mining sector, it remains an

attractive industry with the potential for further development (Government Communication and Information Systems, 2015).

2.4.3. Financials

In the financial sector there is the institutional level which comprises the banking and non-banking financial intermediaries. The financial institutions provide a range of commercial and retail banking services while also offering insurance and investment products and other innovative retail sales offerings. The South African banking system is effectively regulated, comprising of a South African Reserve Bank as well as a few other large banks and investment institutions. Many foreign banks and investment institutions have operations in South Africa. The market level of the financial sector includes the JSE, the bond market, the money market and the foreign exchange market. This sector is likely to continue as an important contributor to the South African economy.

2.5. JSE Indices

2.5.1. FTSE/JSE Top 40 Index (J200)

This index was established in 2002 and comprises of the 40 largest companies on the JSE, when measured by market capitalisation (JSE: 2015). At 30 June 2014 the 6,06 trillion rand (JSE: 2015) total market capitalisation of the J200 represented approximately 83% of total the 7,27trillion rand market capitalisation of the ALSI.

2.5.2. FTSE/JSE Resource 10 Index (J210)

From June 2002 to March 2011, the FTSE/JSE Resources 20 index was comprised of the 20 largest ALSI (J203) companies that were classified as Resources, when ranked by market capitalisation. In March 2011, the Resources 20 index was superseded by the Resources 10 index, which is comprised of the 10 largest ALSI resource companies (JSE: 2015). For the purposes of this study, the Resource 10 was selected as a proxy for the performance of South African companies that operate in the resource sector.

2.5.3. FTSE/JSE Industrial 25 Index (J211)

The FTSE/JSE Industrial 25 is a market capitalisation weighted index that consists of the largest 25 members of the basic industrial or general industrial economic groups by market capitalisation (JSE: 2015). For this study, the Industrial 25 was selected as a proxy for the performance of the general industrial sector of the South African economy. It should be noted that the constituents of this index include companies that primarily have manufacturing operations, as well as other companies that have primary operations that are not traditionally defined as manufacturing, for example, telecommunications and healthcare.

2.5.4. FTSE/JSE Financial 15 Index (J212)

This index is comprised of the largest 15 ALSI companies that are classified as Financials, when ranked by market capitalisation (JSE: 2015). For this study the Financial 15 was selected as a proxy for the performance of the financial sector companies in South Africa.

2.6. Summary

The South African economy has faced many challenges during the 10 years ended at 31 December 2014. Most significantly, during this period the 2008/9 global financial crisis caused the drop in all sectors of the JSE.

Other external factors such as volatile resource prices have also added further uncertainty to business. Volatile exchange rates and a weaker rand have made planning and budgeting difficult.

Internal factors such as the labour market have put pressure on employers and have increased operating costs and decreased production efficiencies. Coupled with infrastructural deficiencies, such as inconsistent electricity supply, growth has been hindered. Furthermore policy uncertainty regarding black economic empowerment, minimum wages, labour reforms, land reforms, mining rights and beneficiation have each discouraged some capital investment.

The following definitions are tabled as they are used frequently in various sources of information regarding this topic.

Table 1: Definitions

Description	Definition
Top 40	The quarterly closing prices of FTSE/JSE Top 40 Index
Resource 10	The quarterly closing prices of FTSE/JSE Resource 10 Index
Industrial 25	The quarterly closing prices of FTSE/JSE Industrial 25 Index
Financial 15	The quarterly closing prices of FTSE/JSE Financial 15 Index
GDP	The quarterly values for the Gross Domestic Product for South Africa
Prime	The base interest rate charged by commercial banks
CPI	The quarterly values for the Consumer Price index for South Africa
USD	United States Dollar currency
ZAR	South African Rand currency
rand-dollar	Quarter-end exchange rate for the US/ZAR
Selected indexes	The Top 40, Resource 10, Industrial 25, Financial 15 FTSE/JSE indexes

CHAPTER 3: RESEARCH HYPOTHESES

The following hypotheses were set to test whether the four selected macroeconomic variables have any impact on each of the Top 40, Resource 10, Industrial 25 and Financial 15 JSE indices.

Where the results of cross-correlation tests revealed a significant relationship at the 5% significance level, the null hypothesis was rejected and the alternative hypothesis was accepted.

3.1. Hypothesis 1

The first research objective was set to determine whether any correlations exist between Gross Domestic Product (GDP) and the Average Market Return (AMR) of each of the four JSE indices.

The null and alternate hypotheses for each of the four JSE indices being tested against GDP are as follows:

The null hypothesis: There is no correlation between GDP and the AMR of the JSE index being tested.

The alternative hypothesis: There is a correlation between GDP and the AMR of the JSE index being tested.

Thus: $H1o: r = 0$

$H1_A: r <> 0$

3.2. Hypothesis 2

The second research objective was set to determine whether any correlations exist between the Prime lending rate and the AMR of each of the four JSE Indices.

The null and alternate hypotheses for each of the four JSE indices being tested against the Prime lending rate are as follows:

The null hypothesis: There is no correlation between the Prime lending rate and the AMR of the JSE index being tested.

The alternative hypothesis: There is a correlation between the Prime lending rate and the AMR of the JSE index being tested.

Thus: H2o: r = 0

$H2_A$: r <> 0

3.3. Hypothesis 3

The third research objective was set to determine whether any correlations exist between Consumer Price Index (CPI) and the AMR of each of the four JSE Indices.

The null and alternate hypotheses for each of the four JSE Indices being tested against the Prime lending rate are as follows:

The null hypothesis: There is no correlation between Consumer Price Inflation and the AMR of the JSE index being tested.

The alternative hypothesis: There is a correlation between Consumer Price Inflation and the AMR of the JSE index being tested.

Thus: H3o: r = 0

$H3_A$: r <> 0

3.4. Hypothesis 4

The fourth research objective was set to determine whether any correlations exist between the rand-dollar exchange rate and the AMR of each of the four JSE Indices.

The null and alternate hypotheses for each of the four JSE Indices being tested against the rand-dollar exchange rate are as follows:

The null hypothesis: There is no correlation between the rand-dollar exchange rate and the AMR of the JSE index being tested.

The alternative hypothesis associated with this objective: There is a correlation between the rand-dollar exchange rate and the AMR of the JSE index being tested.

Thus: H4o: r = 0

$H4_A$: r <> 0

CHAPTER 4: RESEARCH METHODOLOGY

4.1. Overview

The FTSE/JSE All Share index (ALSI) is one of the Headline Indices of the FTSE/JSE Africa index series. The Top 40, Resource 10, Industrial 25, Financial 15 indices are constructed from the base universe of the ALSI.

This research study adopted a time-series research design to determine whether each of the Top 40, Resource 10, Industrial 25 and Financial 15 indices are correlated with any of the four macroeconomic variables selected for study. The Top 40, Resource 10, Industrial 25 and Financial 15 indices are all dependent variables which were tested against the four independent variables: GDP, Prime, CPI and the rand-dollar exchange rate.

For some of the macroeconomic factors selected for this research study, data is only published quarterly. As such a quarterly sampling period was used. The research study used quarterly data on the selected macroeconomic variables which was tested against quarterly closing prices of the four indices. The end date of 31 December 2014 was chosen as it was the most recent full calendar year of data that could be analysed. The period that was selected for this study is also of interest due to the high levels of uncertainty in international financial markets during 2008 and 2009.

Data for each index and economic indicator was collected for the 10 year period from 1 January 2005 to 31 December 2014. Tests of correlation were then performed to identify relationships between each index and each macroeconomic factor.

The Average Market Return (AMR) is defined as the change in the closing price of an index between two points in time, which were calendar quarters in this study.

$$AMR = \frac{\text{Opening Share Price in period i (Pi)}}{\text{Opening Share Price in period i -1 (Pi-1)}} - 1$$

Dividends paid by individual companies were not taken into account in the calculation of the AMR. Index movements represented only the sum of the share prices of the

individual listed companies that constitute each index. Any dividend expectations were assumed to be priced-in to the individual share prices of the companies that are the constituents of the four indices. An index's value represents a sum of the AMR values of all the index constituents, being the collective return of the companies of the index. As such, the impact of any dividends, being both dividends already declared and future expected dividends, were already accounted for in each index. Hence, it was considered appropriate to exclude all dividends in the calculation of the AMR.

At 30 June 2015 the Top 40 represented 83% (JSE: 2015) of the total market capitalisation of the JSE and thus it was selected as a proxy for the entire JSE equities market. The Resource 10 Index was used a proxy for the movement of all JSE Resources shares prices. The Industrial 25 Index was selected as a proxy for the movement of all prices of shares classified as Industrials by the JSE. The Financial 15 Index was used as a proxy for the JSE defined financial sector shares.

GDP was used as a proxy for aggregate economic activity. South African GDP is reported on a quarterly basis by Statistics South Africa. Growth is commonly calculated by comparing the GDP from one quarter with the GDP of the equivalent quarter from the previous year. GDP is often also reported in real terms in order to make comparisons between the GDP of different periods more meaningful. Real GDP is the nominal GDP as reported, but adjusted for inflation. Inflation is commonly measured using the Consumer Price index (CPI). The South African economy CPI is reported on a monthly basis by Statistics South Africa.

Two measures of interest rates that are widely used in the South African economy are the Repo rate and the Prime lending rate. The Repo rate is the rate at which the SARB lends money to commercial banks. The Prime lending rate usually includes a premium of 3.5% above the Repo rate to allow commercial banks to earn a margin when lending to their customers. Depending on their risk assessment, commercial banks charge an interest rate structured around the Prime lending rate, with higher risk borrowers paying a premium on the Prime lending rate. The Prime lending rate was selected for this study as it is the rate which determines the cost of most of the borrowings by many companies that have South African operations.

For the exchange rate, the rand-dollar was selected for this study. Many commodity prices which are the inputs and the outputs from operations are denominated in United States dollar, and hence the rand reported revenues earned, particularly by resource companies, are directly affected by changes in the rand-dollar exchange rate.

4.2. Research Design

The research methodology used was a quantitative, descriptive approach to test for any relationships that may exist between the four macroeconomic indicators and the AMR of each of the four selected JSE Indices.

The publicly available data for the macroeconomic factors and the four JSE Indices was collected from the Bloomberg database for the period from 1 January 2005 to 31 December 2014. Statistical tests of correlation were then performed between each macroeconomic factor and each index.

The results demonstrated that for each macroeconomic factor this is either a positive, negative or no statistically significant correlation with the AMR of each index. This investigation was a simple attempt to determine whether correlations exist between the four selected macroeconomic factors and the four indices. This study did not attempt to provide an exhaustive list of macroeconomic factors that determine equity prices. No attempt was made to establish causality between the macroeconomic factors and the performance of any index, as this was considered to be beyond the scope of this research.

The research phases were as follows:

1. For the period 1 January 2005 to 31 December 2014 the quarterly closing values of the Top 40, Resource 10, Industrial 25 and Financial 15 were obtained from Bloomberg.

2. For the period 1 January 2005 to 31 December 2014 the quarterly Figures for the South African Prime lending rate, the rand-dollar exhange rate, and the South African CPI and GDP were obtained from Bloomberg.

3. A statistical analysis was performed to determine the nature and extent of any correlations that may exist in the data sets being CPI, the Prime lending rate, GDP and rand-dollar exchange rate and each of the Top 40, Resource 10, Industrial 25 and Financial 15 JSE indices.

4.3. Unit of Analysis

The unit of analysis for this investigation was the Top 40, Resource 10, Industrial 25 and Financial 15 Index values.

4.4. Population

The population for this study included all companies that were listed on the ALSI during the period from 1 January 2005 to 31 December 2014. This study was only concerned with the index values. Therefore the effects of inclusions of constituents or exclusions from the indices were not considered in this study.

4.5. Sampling

Purposive sampling was used for this study.

The sampling frame was all companies included in Top 40, Resource 10, Industrial 25 and Financial 15 indices during the period from 1 January 2005 to 31 December 2014.

The sample size was the number of companies that were included in Top 40, Resource 10, Industrial 25 and Financial 15 indices during the period 1 January 2005 to 31 December 2014.

4.6. Data Collection

The closing quarterly values for 2005 to 2014 were downloaded from the Bloomberg database for the Top 40, Resource 10, Industrial 25 and Financial 15 indices. Bloomberg

is an information service that supplies real-time and historical financial information to subscribers. For each quarter of 2005 to 2014 the values for GDP and CPI were downloaded from Bloomberg along with the quarter's closing Prime lending rate and rand-dollar exchange rate. A study of a much longer time period was impossible as the ASLI index was only established during 2002.

4.7. Data Analysis

The relationship between equity market prices and macroeconomic variables has been widely investigated. Some authors preselected macroeconomic variables in the search to detect a relationship with equity market prices in various countries.

Various methods of statistical analysis have been used to assess whether relationships exist between equity returns and economic indicators. The Arbitrage Pricing Theory was employed by Tursoy, Gunsel and Rjoub (2008); Nishat and Shaheen (2004) as well as Adam and Tweneboah (2008). A vector error correction model was used by Engle and Granger (1987) and Kwon and Shin (1999). Co-integration analyses have been included by Dritsaki and Adamopoulos (2005), Chaudhuri and Smiles (2004), Alam (2009) and Afordofe (2011). Granger (1969) causality tests have been considered by Lee (1992) and Dritsaki (2012).

The data for this research study consisted of eight variables observed at equally spaced points in time. The data analysis procedure described below applies to all the hypotheses tested. If there are statistically significant autocorrelations at the 5% confidence interval, then the null hypothesis can be rejected and the conclusion can be made that the series is not random.

The data for all the variables was exported from Bloomberg and tabulated in Microsoft Excel 2007. For each index and each macroeconomic factor a chart was prepared using Bloomberg's graphing function. This was done to observe how each variable moved during the 10 years under review.

No attempt was made to establish causality between the macroeconomic variables and resources share price performance as the relationships are complex and governed by a multiplicity of factors that extend well beyond the scope of this research. For the purposes of this study, it would have been sufficient to establish that there was indeed a correlation between the said variables.

Granger (1969) proposed that causality can be tested by measuring the ability to predict the future values of one time series by using the values of another related time series. The Granger test is used to determine whether a time series is useful in forecasting the values of another time series.

Two statistical tests can be used to assess randomness in a time series: a runs test and a test for autocorrelation. In the runs test, a base value is selected, as a run is defined as a series of observations that remain on one side of that base value. Autocorrelation is a version of correlation test used to measure whether the values of a time series are related to their own past values. In this research study autocorrelations were used to test for randomness in all the time series. Albright (2009) stated that time series data can contain four components: a trend component, a seasonal component, a cyclic component and a random component.

The data was imported from Excel into R Statistical Analysis Software which was used to test for autocorrelations as an indicator of randomness in each time series. Autocorrelation is also known as lagged correlation. It describes the relationship between observations of the same variable over different periods of time, known as lags. The calculation of autocorrelation is similar to the calculation of correlation between two time series, but when calculating autocorrelation, the same time series is used firstly as the original time series and again as a second, lagged, time series. In a test for autocorrelation, the null hypothesis is that the time series is a random series, with the alternative hypothesis being that the time series is not a random series. If there are statistically significant autocorrelations at the 5% confidence interval, then the null hypothesis is rejected, with the conclusion that the series is not random. Albright (2009) stated that it is common practice to consider no more lags than 25% of the number of observations, in this case being 10 lags as there are 40 data points in the each time

series sample. Furthermore, Albright (2009) stated that the first few lags are generally the most significant. If there is any relationship between successive observations, it is likely to be between closer observations. Hence autocorrelations at large lags may be considered to be random, and as such can be ignored, unless there is a recognisable reason for the autocorrelation at the large lag.

Autocorrelations can be removed from a time series by differencing the time series. The first difference series is the change in the time series from one period compared to the next period. The second difference is calculated by comparing the change in the time series from one period to the result for two periods later, and so on. The random walk model states that while a time series itself may not be random and that autocorrelation might be present, its differences, being the changes from one period to the next, are random (Albright et al. 2009). This is typical for time series data such as share prices or macroeconomic variables.

In order to eliminate autocorrelation within the time series, new differenced time series were produced. This procedure was performed in R for all four macroeconomic variables and all four JSE indices. The test for autocorrelations and the subsequent differencing of the eight time series was in accordance with procedures followed in existing literature (Chaudhuri & Smiles, 2004; Alam, 2009; Afordofe, 2011). Cross-correlation testing was preferred to regression for the purposes of this study, as the cross-correlations allow relationships at different time lags to be identified. In the context of this study, the ability to identify relationships at different time lags is important as it is expected that changes in some macroeconomic variables may only manifest as changes to the AMR of some of the JSE indices, some time after a movement of the value of the macroeconomic variable has occurred.

The differenced time series were then tested for randomness to ensure that all the autocorrelations had been removed. Once it had been confirmed that all eight differenced time series were random, then the differenced time series were tested further to identify any cross-correlations between each of the four macroeconomic variables and each of the four indices. Cross-correlation explains the relationship between two different time series over periods of time and measures the strength and a positive

or negative direction of the relationship, in this case between each macroeconomic variable and the each index.

An index is a portfolio of shares that represents the performance of a segment of a financial market. The purpose of an index is to summarise the performance of the market into one number (Wurgler, 2010). There are many indices that can be used as proxies for the performance of sectors of the JSE. Each index consists of a publicly available set of rules published on the FTSE website. (JSE: 2015).

4.8. Limitations

The following items have been identified as limitations to this research study:

1. Only large-capitlisation JSE listed companies were included in this study. Differences between large listed and unlisted companies, which may be due to many reasons such as differences in management structures, governance, source and costs of funding and size and type of operations, could be reasons for these findings not being applicable to smaller JSE listed or unlisted South African entities as well.

2. This study only considered the quarterly data from the past 10 years. As this time period under review is relatively short, the results from the study may not be adequate to identify any true relationships between the macroeconomic factors and the indices being tested.

3. As JSE indices that were used in this study were only established in 2002, and because this study considers only 10 years of data, it is possible that the true relationships between the macroeconomic variables and the indices may have been obscured by the international markets' 2008/9 financial crisis which may have led to extreme, anomalous or completely unexpected results from this study.

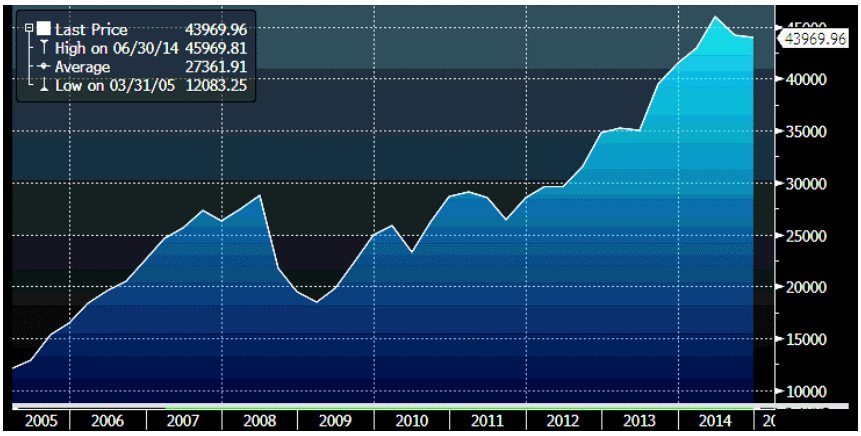
4. This research did not take into account any of the other operational, market or economic factors that may affect the AMR of the Top 40, Resource 10, Industrial 25 and Financial 15.

CHAPTER 5: RESULTS

5.1. Overview

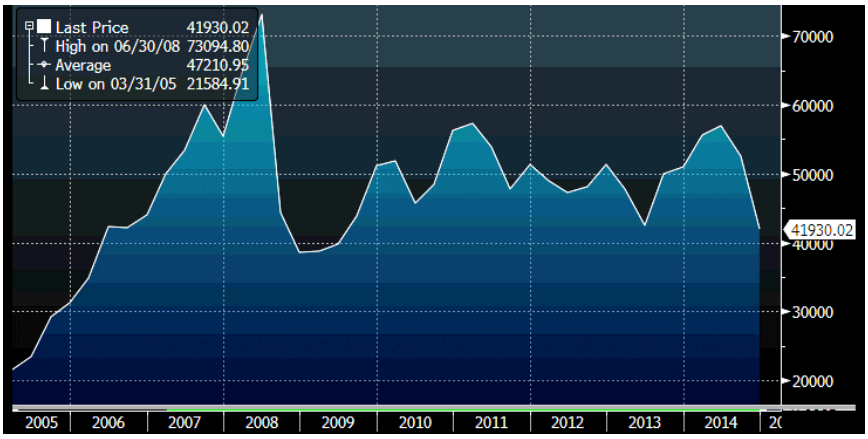
The quarterly closing values for the selected macroeconomic variables and the JSE indices were obtained for the period from 1 January 2005 to 31 December 2014. This data was plotted in Bloomberg as time-series charts Figures 1 to 8.

Figure 1: Plot of the FTSE/JSE Top 40 index



Source: Bloomberg

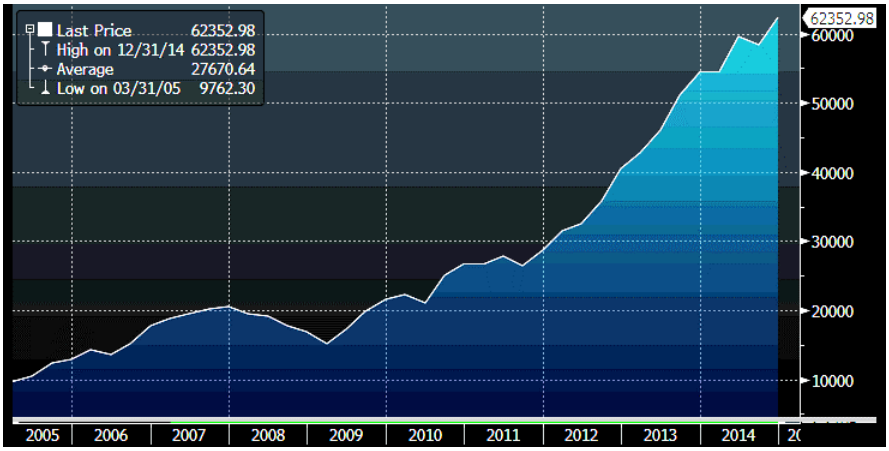
Figure 2: Plot of the FTSE/JSE Resource 10 Index



Source: Bloomberg

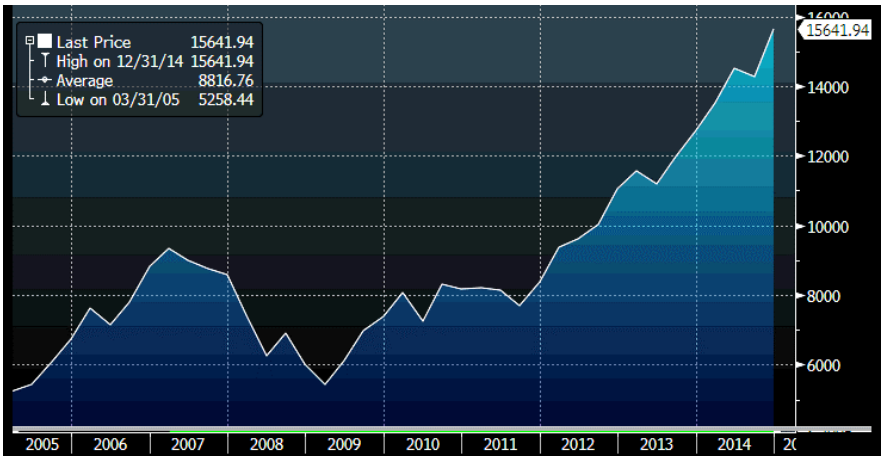
A level of similarity is evident when reviewing the two charts above, which plot the quarterly closing prices of the Top 40 and the Resource 10. This similarity could be partly attributed to the fact that all the constituents of the Resource 10 are included in the Top 40 while the market capitalisation of the Resource 10 is approximately 80% of the market capitalisation of the Top 40. This is discussed in sections 6.2 to 6.5 when the Top 40 and the Resource 10 are individually cross-correlated with each of the four macroeconomic factors in Figures 25, 26, 29, 30, 33, 34, 37 and 38.

Figure 3: Plot of the FTSE/JSE Industrial 25 index



Source: Bloomberg

Figure 4: Plot of the FTSE/JSE Financial 15 index



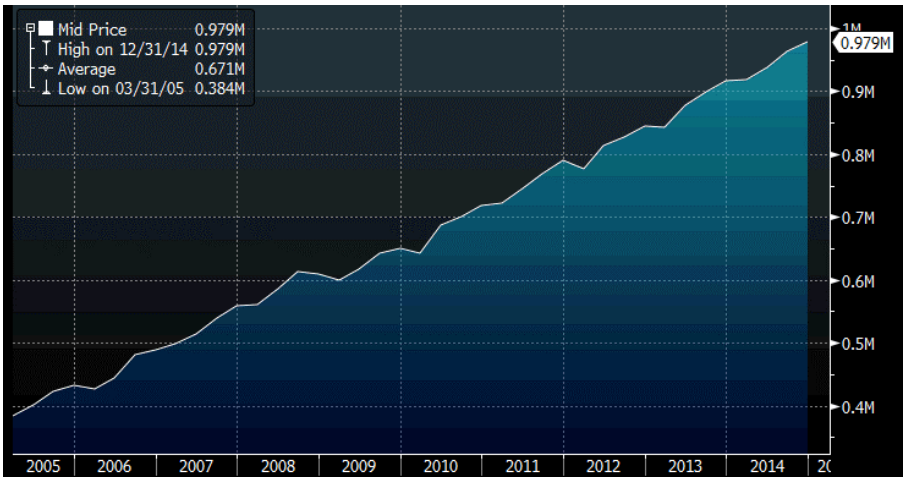
Source: Bloomberg

During the plotted 10-year period the Top 40, Industrial 25 and Financial 15 show clear upward trends.

Commodity prices were volatile during this 10 year period, which impacted the Resource 10 as shown in Figure 2. Essentially, this does not show as strong an upward trend as the other three indices.

Notable declines occurred in the levels of all four indices during 2008 and 2009 due to the international credit crisis, in which South Africa suffered a substantial decline in the value of equities. The ALSI index decreased 43.5% (JSE:2015) during May 2008 and November 2008.

Figure 5: Plot of GDP

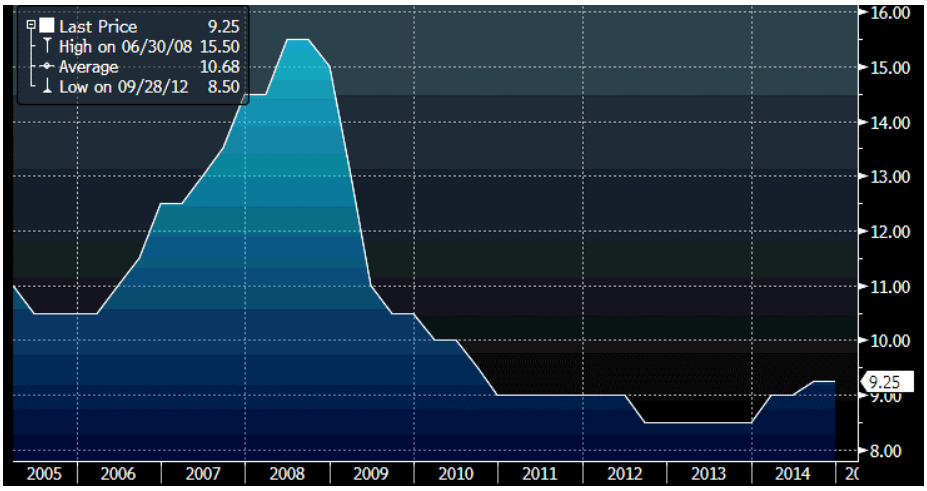


Source: Bloomberg

In Figure 5 an upward trend is evident, with this time series plot showing less volatility during the time of the 2008-2009 economic shock, than some of the other macroeconomic variables.

Figure 6 is chart showing the Prime lending rate from 2005 to 2014.

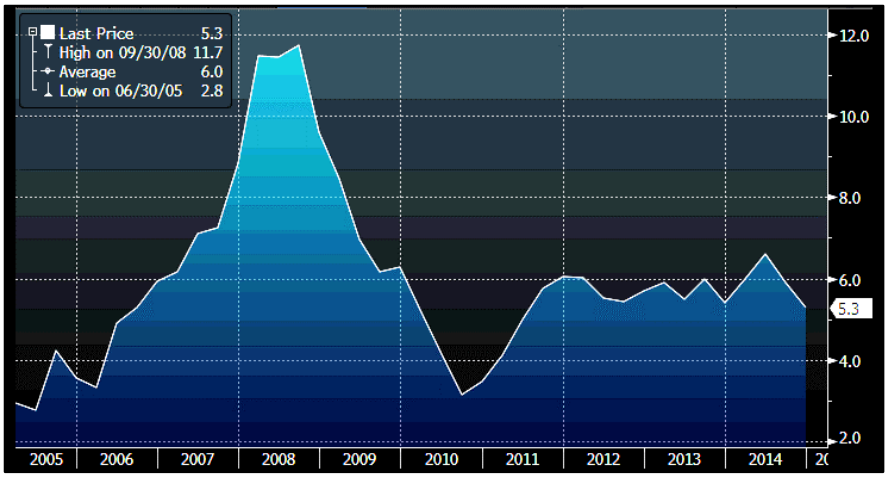
Figure 6: Plot of the Prime lending rate



Source: Bloomberg

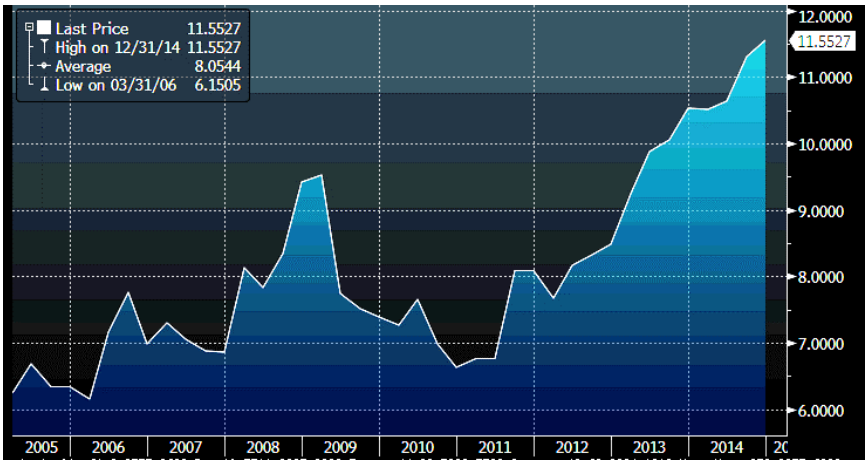
In response to the threat of slowing economic growth during the 2008/9 global financial crisis, the Monetary Policy Committee aggressively lowered the Repo rate as is seen in Figure 6.

Figure 7: Plot of CPI



Source: Bloomberg

Figure 8: Plot of the rand-dollar exchange rate



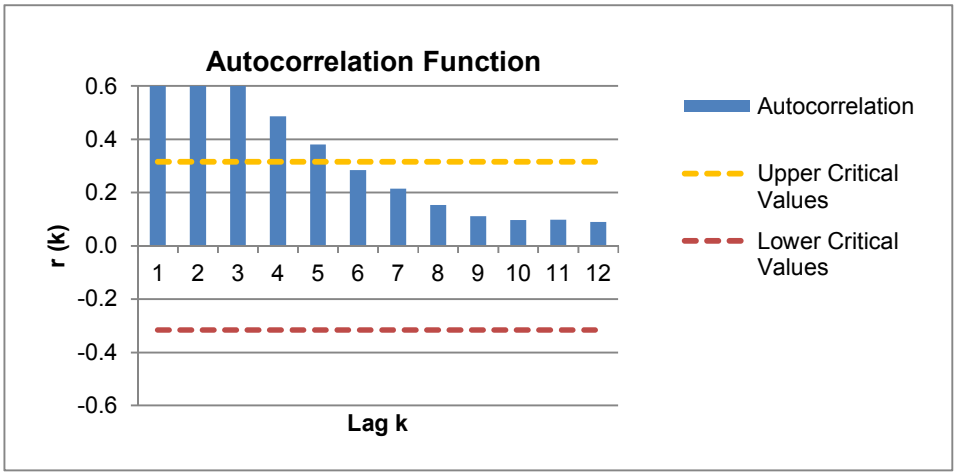
Source: Bloomberg

From visual inspection Figure 8 shows a clear upward trend as the rand-dollar exchange rate weakened from a low of 6.16 to a high of 11.55 during the 10 years under review.

5.2. JSE Indices: Time series transformations

As set out in the research design presented in Section 4.7, the four indices were each tested for randomness using an autocorrelation test. The results of those tests appear in Figures 9, 11, 13 and 15. The transformed indices appear in Figures 10, 12, 14, and 16.

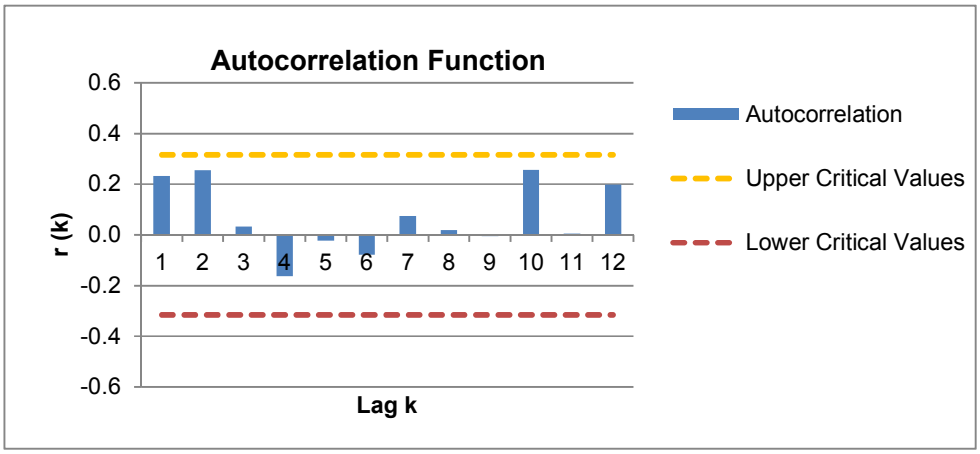
Figure 9: Top 40 time series autocorrelation



Source: Author's research

The autocorrelation in Figure 9 above indicates statistically significant positive autocorrelation at lags of periods one to five. A differenced time series (Figure 10) was calculated to eliminate the autocorrelations.

Figure 10: Top 40 transformed time series autocorrelation

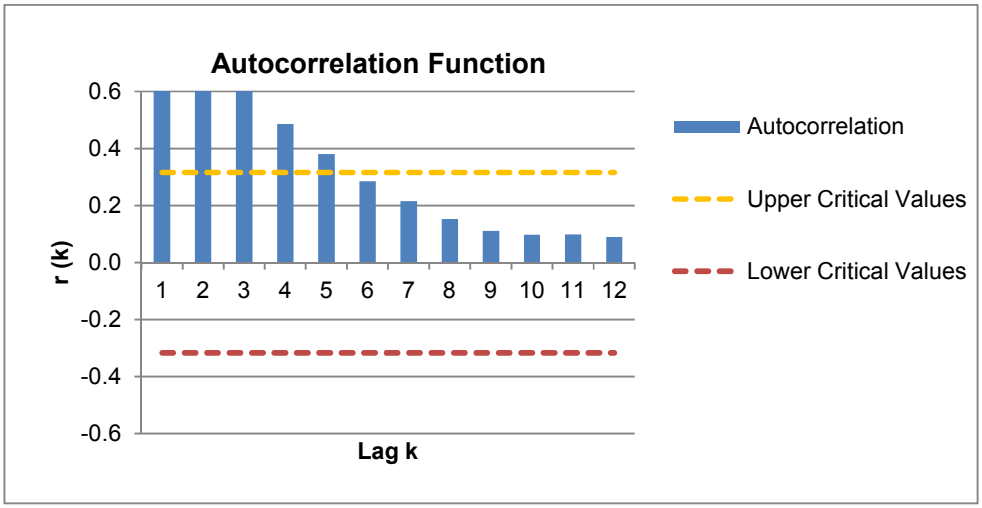


Source: Author's research

The above correlogram of the differenced time series shows that all the autocorrelations have been removed. This transformed time series is cross-

correlated with each of the four macroeconomic variables in Figures 25, 29, 33 and 37.

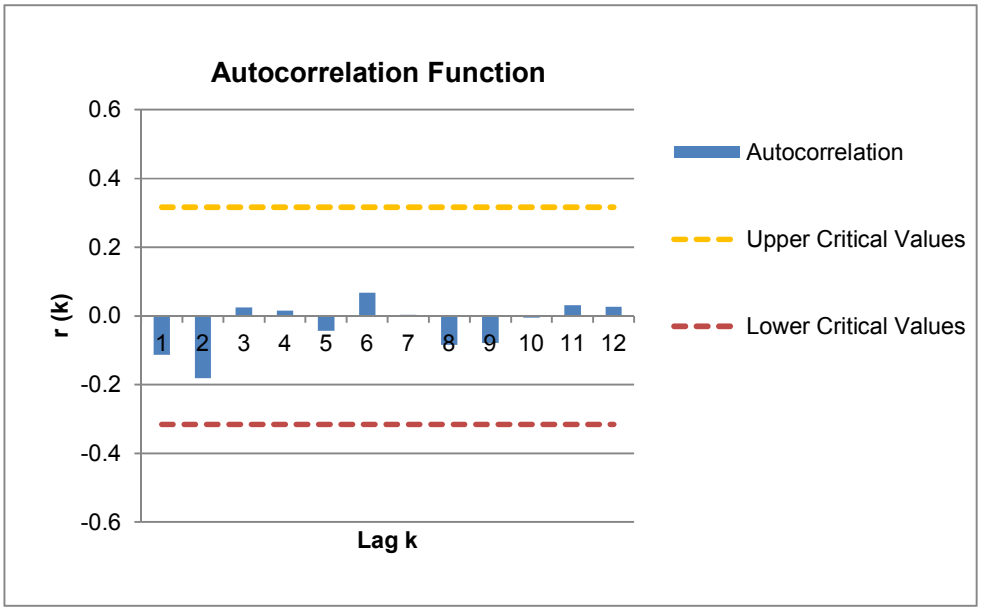
Figure 11: Resource 10 time series autocorrelation



Source: Author's research

The autocorrelation in the Figure above indicates statistically significant positive autocorrelation at lags of periods 1, 2, 3, 4 and 5. A differenced time series (Figure 10) was calculated to eliminate the autocorrelations.

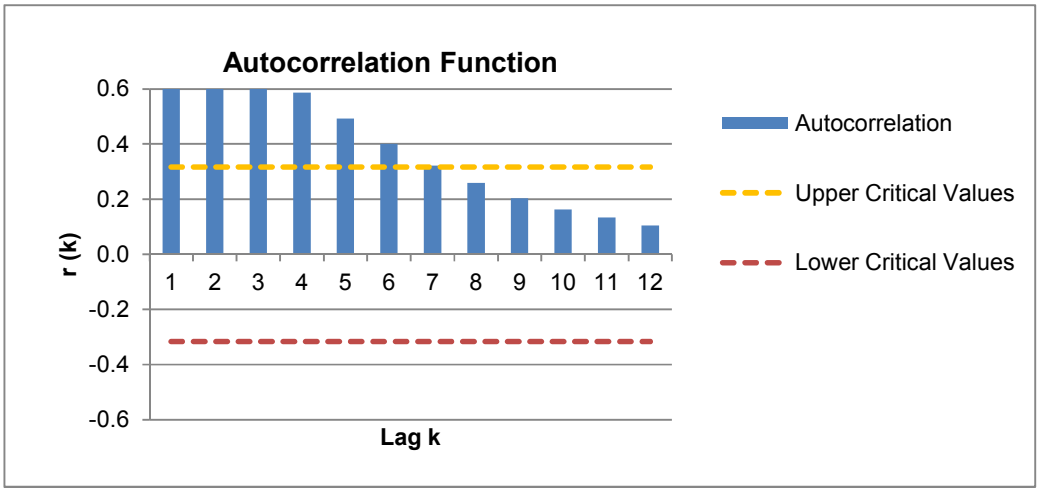
Figure 12: Resource 10 transformed time series autocorrelation



Source: Author's research

Figure 12, a correlogram of the differenced time series, shows that all the autocorrelations have been removed. This transformed time series is cross-correlated with each of the macroeconomic variables in Figures 26, 30, 34 and 38.

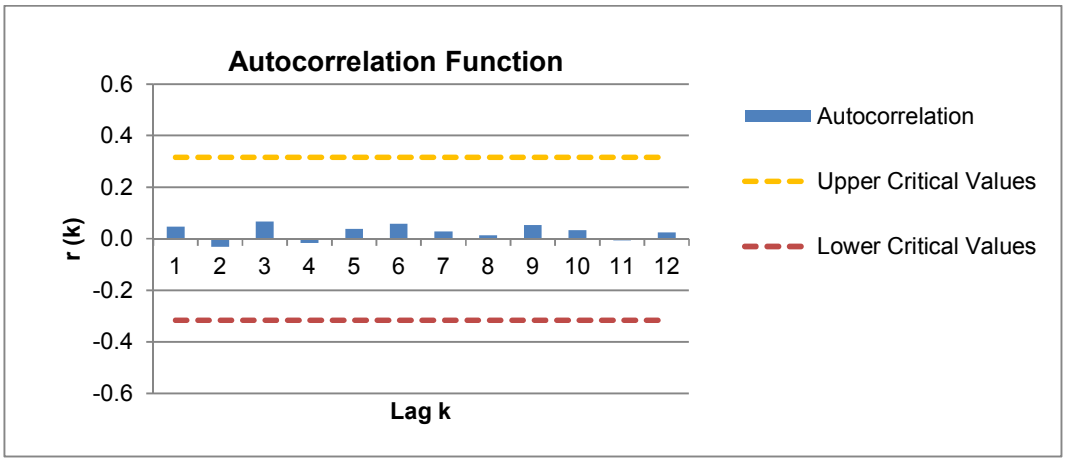
Figure 13: Industrial 25 time series autocorrelation



Source: Author's research

The autocorrelation in the Figure above indicates statistically significant positive autocorrelation at lags of periods 1 to 7. A differenced time series (Figure 14) was calculated to eliminate the autocorrelations

Figure 14: Industrial 25 transformed time series autocorrelation

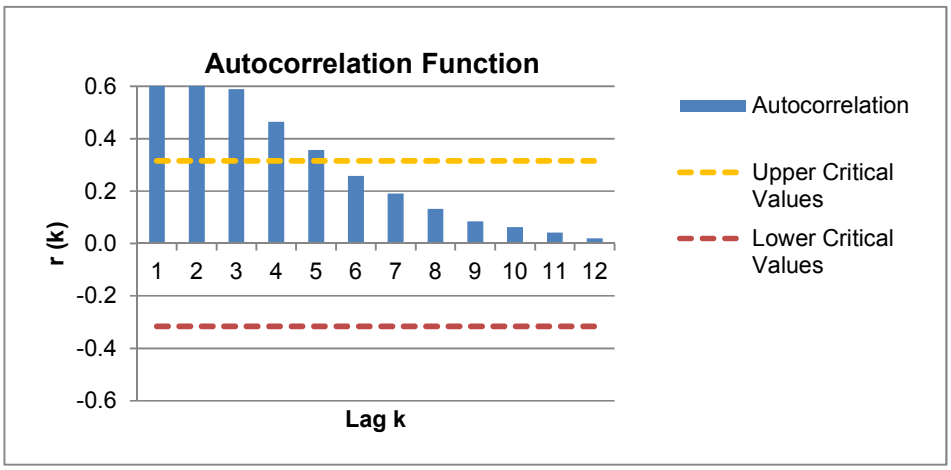


Source: Author's research

Figure 14, a correlogram of the differenced time series, shows that all the autocorrelations have been removed. This transformed time series is cross-

correlated with each of the four macroeconomic variables in Figures 27, 31, 35 and 39.

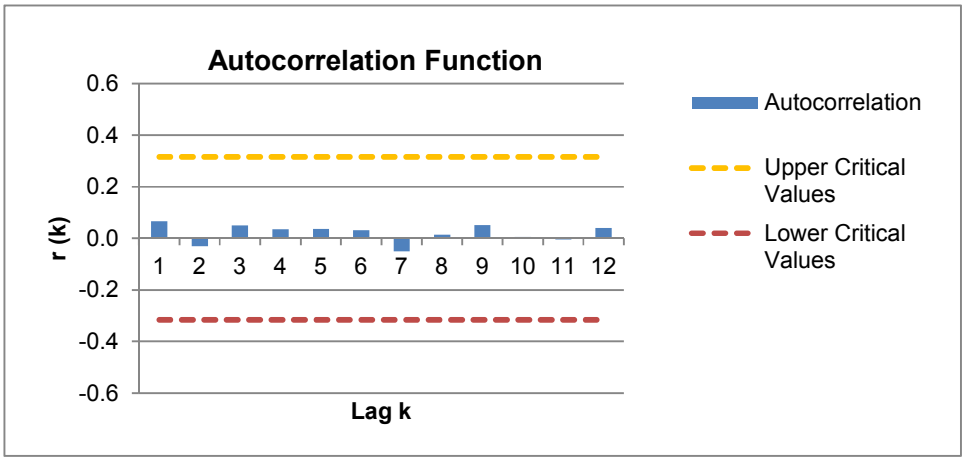
Figure 15: Financial 15 time series autocorrelation



Source: Author's research

The autocorrelation in the Figure 15 above indicates statistically significant positive autocorrelation at lags of periods 1 and 2. A differenced time series (Figure 16) was calculated to eliminate the autocorrelations.

Figure 16: Financial 15 Transformed time series autocorrelation



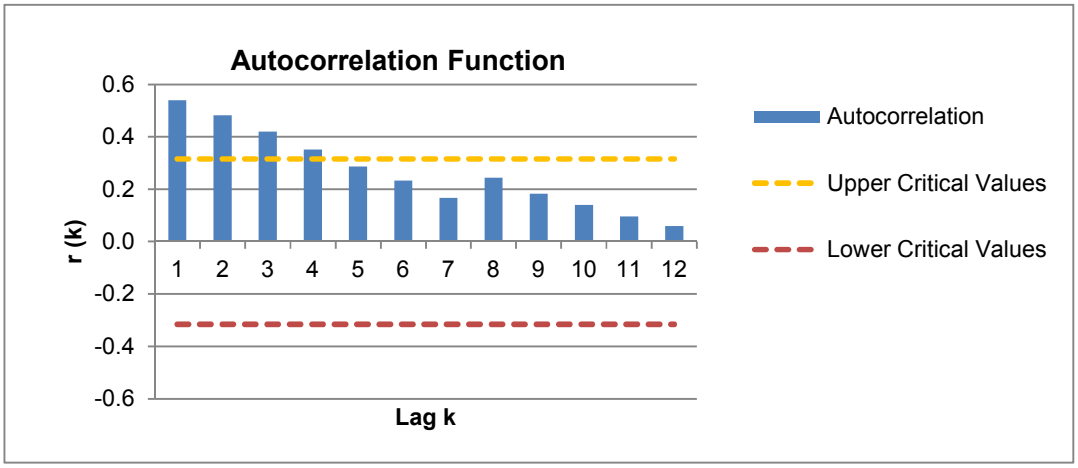
Source: Author's research

The above correlogram of the differenced time series shows that all the autocorrelations have been removed. This transformed time series is cross-correlated with each of the four macroeconomic variables in Figures 28, 32, 36 and 40.

5.3. Macroeconomic Variables: Time series transformations

In accordance with the research design as set out in Section 4.7, the time series for the four economic variables were each tested for randomness using an autocorrelation test. The results of which appear in Figures 17, 19, 21 and 23. The transformed differenced time series for the four economic variables appear in Figures 18, 20, 22 and 24.

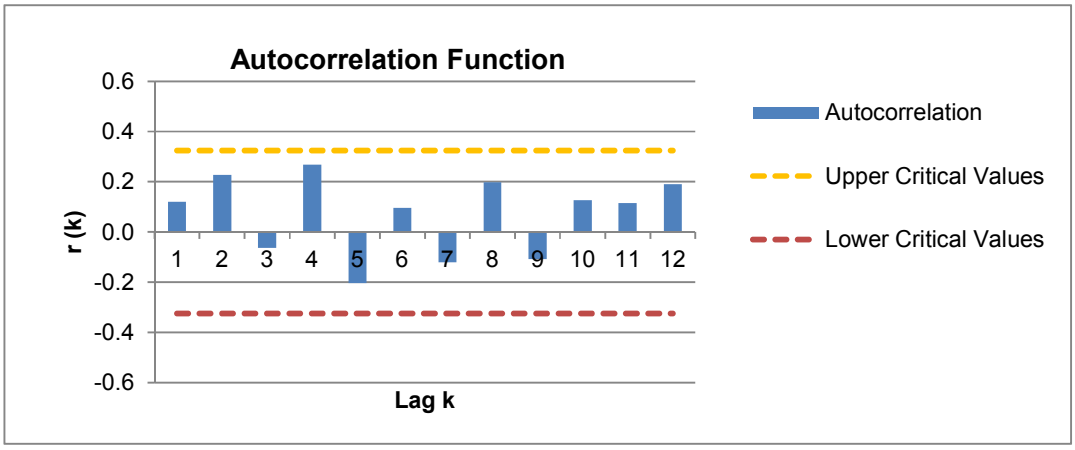
Figure 17: GDP time series autocorrelation



Source: Author's research

The autocorrelation in the Figure above indicates statistically significant positive autocorrelation at lags of periods 1, 2, 3 and 4. A differenced time series (Figure 18) was calculated to eliminate the autocorrelations.

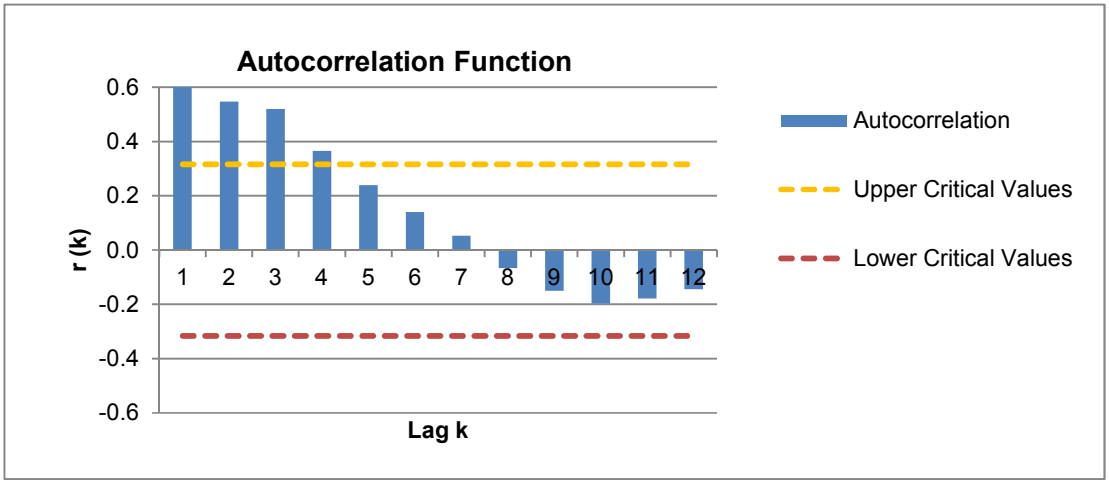
Figure 18: GDP transformed time series autocorrelation



Source: Author's research

The above correlogram of the differenced time series shows that all the autocorrelations have been removed. This transformed time series is cross-correlated with each of the four macroeconomic variables in Figures 25, 26, 27 and 28.

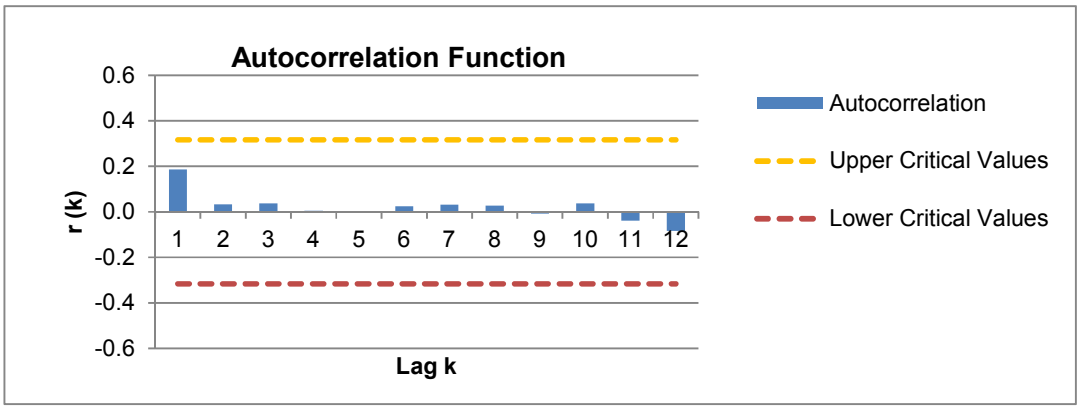
Figure 19: Prime lending rate time series autocorrelation



Source: Author's research

The autocorrelation in the Figure above indicates statistically significant positive autocorrelation at lags of periods 1, 2, 3 and 4. A differenced time series (Figure 20) was calculated to eliminate the autocorrelations.

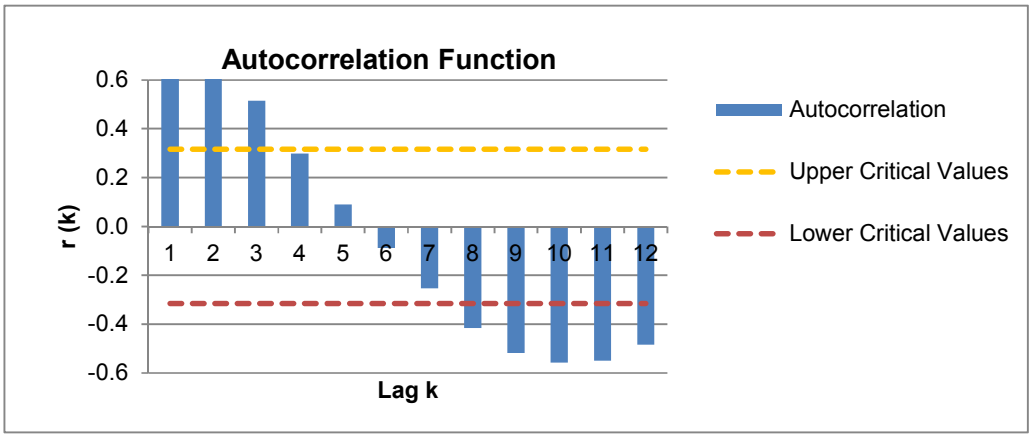
Figure 20: Prime lending rate transformed time series autocorrelation



Source: Author's research

The above correlogram of the differenced time series shows that all the autocorrelations have been removed. This transformed time series is cross-correlated with each of the four macroeconomic variables in Figures 29, 30, 31 and 32.

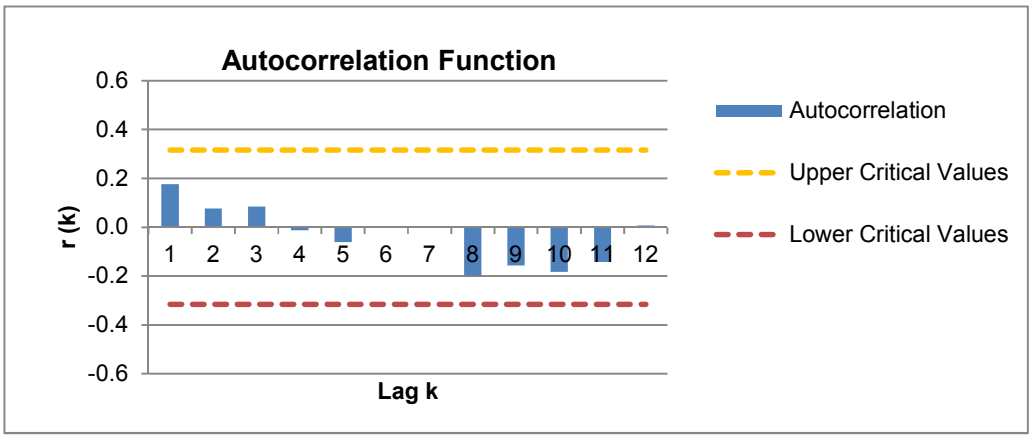
Figure 21: CPI time series autocorrelation



Source: Author's research

The autocorrelation in the Figure 21 above indicates statistically significant positive autocorrelation at lags of periods 1, 2, 3 and negative autocorrelations at lags from 8 to 12. A differenced time series (Figure 22) was calculated to eliminate the autocorrelations.

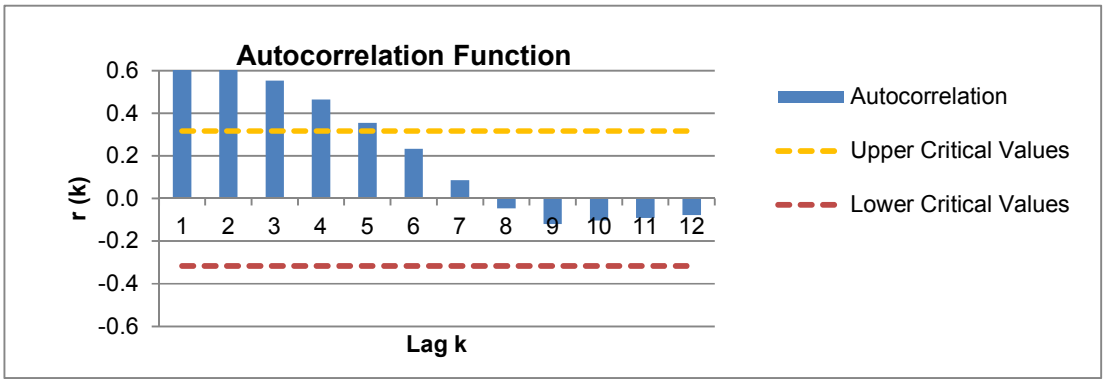
Figure 22: CPI transformed time series autocorrelation



Source: Author's research

The above correlogram of the differenced time series shows that all the autocorrelations have been removed. This transformed time series is cross-correlated with each of the macroeconomic variables in Figures 33, 34, 35 and 36.

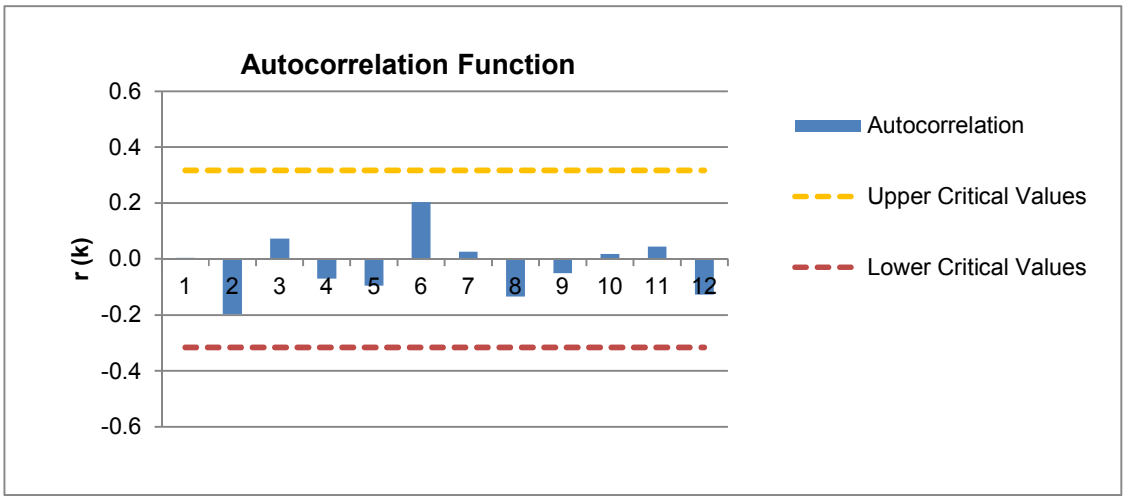
Figure 23: Rand-dollar exchange rate time series autocorrelation



Source: Author's research

The autocorrelation in Figure 23 above indicates statistically significant positive autocorrelation at lags of periods 1, 2, 3, 4 and 5. A differenced time series (Figure 24) was calculated to eliminate the autocorrelations.

Figure 24: Rand-dollar exchange rate transformed time series autocorrelation



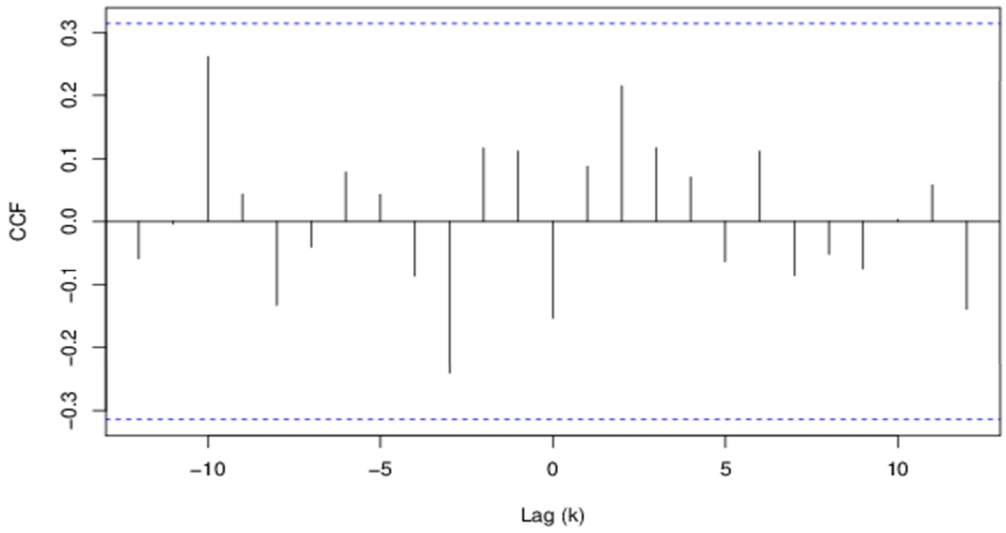
Source: Author's research

The above correlogram of the differenced time series shows that all the autocorrelations have been removed. This transformed time series is cross-correlated with each of the four macroeconomic variables in Figures 37, 38, 39 and 40.

5.4. Hypothesis 1

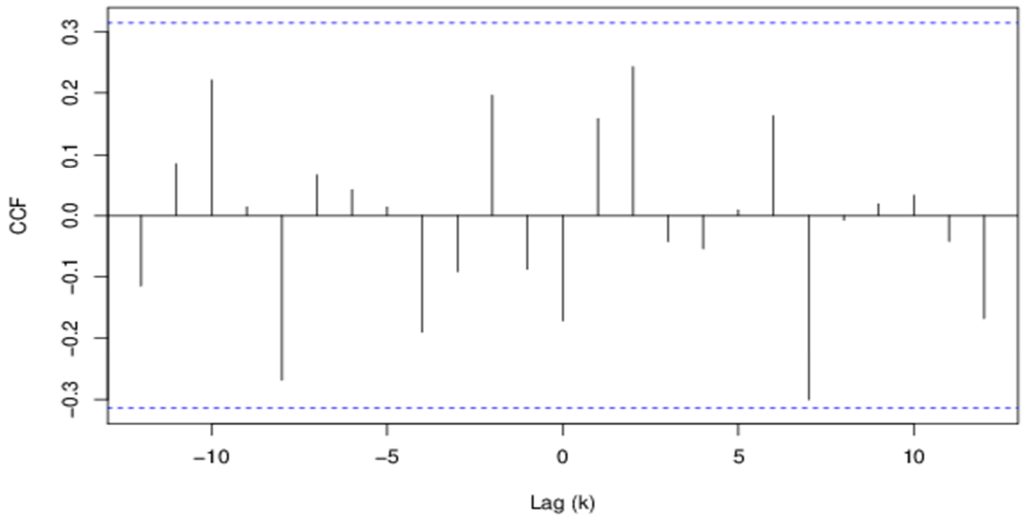
The null hypothesis stated that there is no correlation between GDP and the AMR of any one of the four selected JSE indices. The alternative hypothesis stated that there is a correlation between GDP and AMR of any one of the four selected indices.

Figure 25: GDP cross-correlations with Top 40



Source: Author's research

Figure 26: GDP and Resource 10 cross-correlation



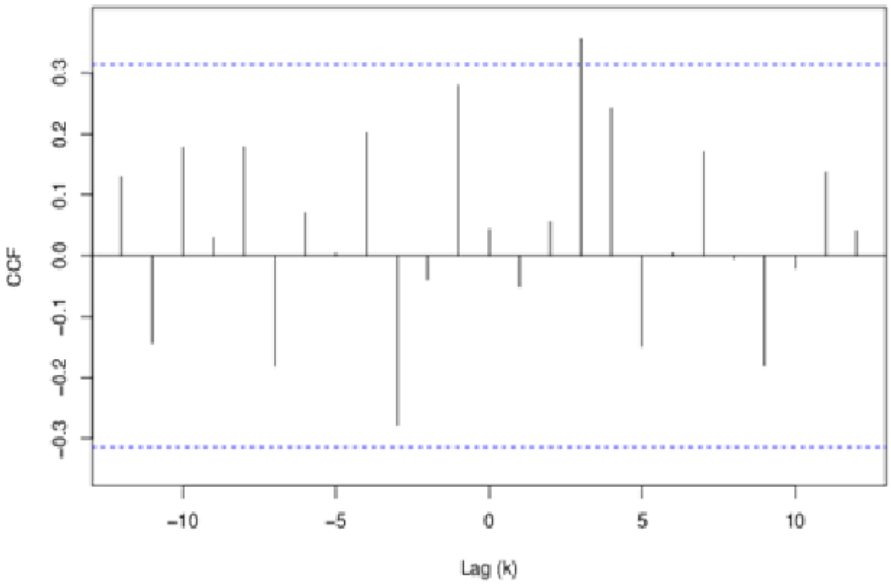
Source: Author's research

The correlograms above show the cross-correlations of GDP and the Top 40 Index (Figure 25) and the cross-correlation of GDP and the Resource 10 Index (Figure 26)

for the period from 1 January 2005 to 31 December 2014. The results of the cross-correlations revealed no significant relationships.

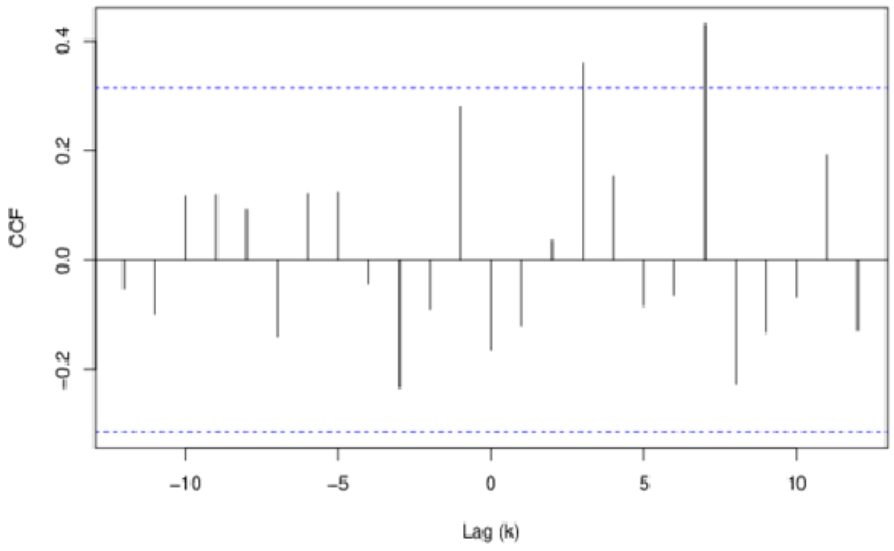
The null hypothesis, that there was no correlation between GDP and the Top 40 Index could not be rejected and the null hypothesis, that there was no correlation between GDP and the Resource 10 Index was also not rejected.

Figure 27: GDP and Industrial 25 cross-correlation



Source: Author's research

Figure 28: GDP and Financial 15 cross-correlation



Source: Author's research

The two cross correlograms above display the cross-correlation of GDP with the

Industrial 25 Index (Figure 27) and the cross-correlation of GDP with the Financial 15 Index (Figure 28) for the period from 1 January 2005 to 31 December 2014. Each plot indicates the cross-correlation between two variables at different lags, which are each a calendar quarter. The positive lag indicates the correlation when the Industrial 25 (Figure 27) or the Financial 15 (Figure 28) lagged GDP by one period through to 12 periods. The negative lag indicates the correlation when GDP lagged the Industrial 25 or the Financial 15 Index by 1 period through to 12 periods.

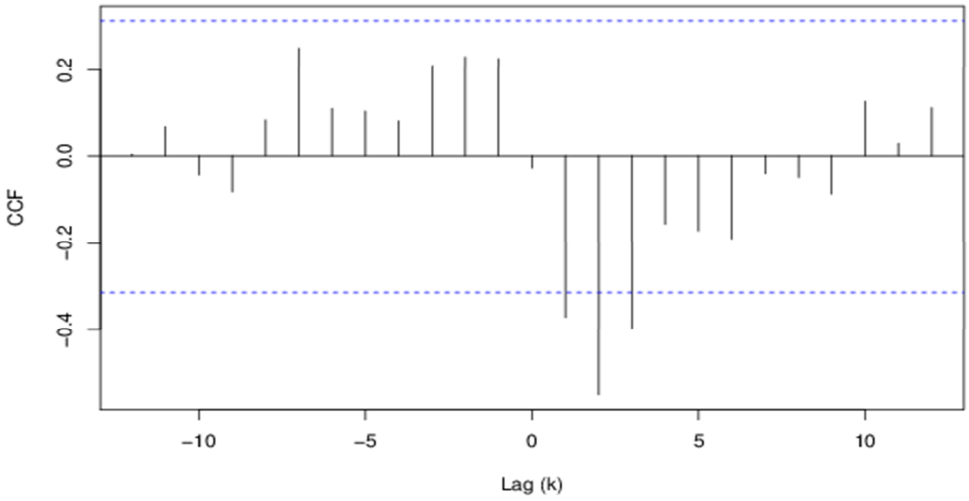
The results of the cross-correlation test revealed a positive relationship between GDP and the Industrial 25 Index at a lag of three quarters (Figure 27). That is, at the 5% significance level, there was a statistically significant positive relationship between GDP movement and movement in the Industrial 25 Index three quarters later. Thus the null hypothesis was rejected and the alternative hypothesis was accepted, that GDP and the Industrial 25 are correlated.

Figure 28 revealed a significant positive relationship between GDP and the Industrial 25 at lags of 3 and 7 quarters. At the 5% significance level, there was a statistically significant positive relationship between GDP movement and movement in the Financial 15 Index that occurred three and seven quarters later. Based on this, the null hypothesis was rejected and the alternative hypothesis accepted, and it was concluded there was a correlation between GDP and the Resource 10 index.

5.5. Hypothesis 2

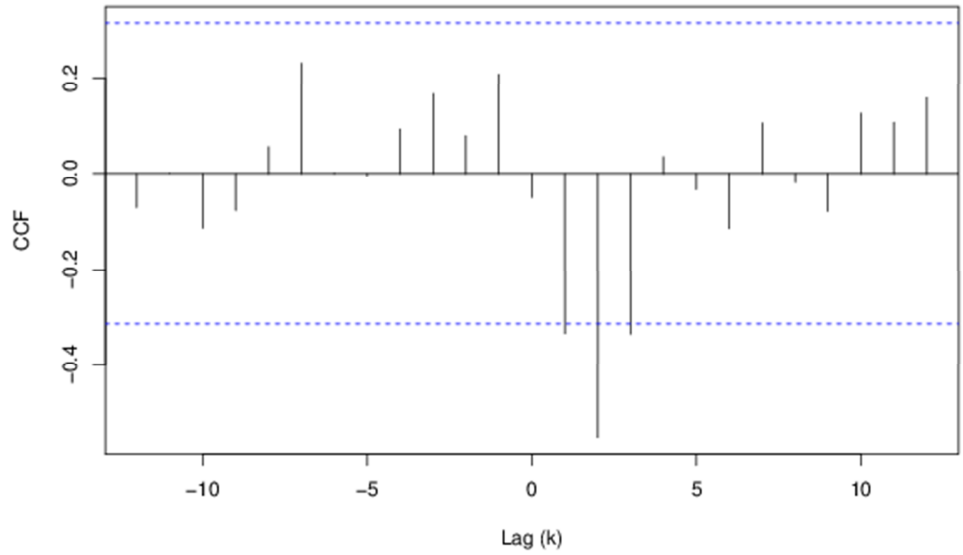
The null hypothesis stated that there is no correlation between Prime lending rate and the AMR of any one of the four selected JSE indices. The alternative hypothesis stated that there is a correlation between the Prime lending rate and the AMR of any of the 4 selected JSE indices.

Figure 29: Prime lending rate and Top 40 cross-correlation



Source: Author's research

Figure 30: Prime lending rate and Resource 10 cross-correlation



Source: Author's research

The cross correlogram in Figure 29 displays the cross-correlations of the Prime lending rate and the Top 40 Index for the period from 1 January 2005 to 31 December 2014. The correlogram in Figure 30 displays the cross-correlations of the Prime lending rate and the Resource 10 Index for the same period. Both plots indicate the cross-correlation between the two variables at different lags.

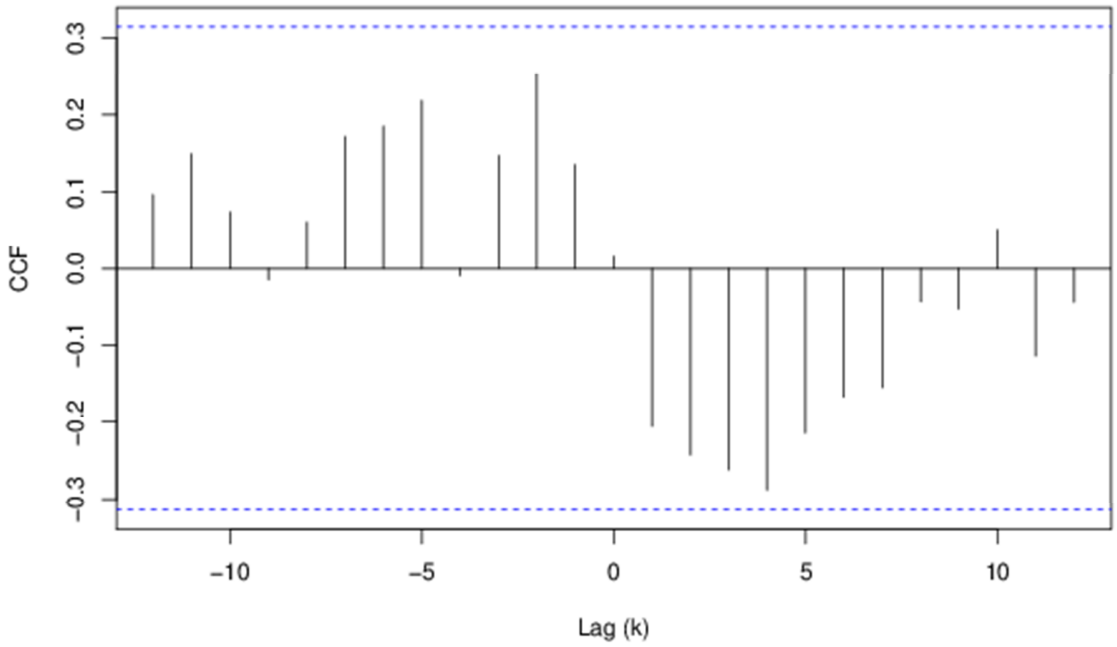
In Figure 29 the positive lag indicates the correlations when the Top 40 Index lagged the Prime lending rate by one period through to 12 periods. The negative lag indicates the cross-correlations when the Prime lending rate lagged the Top 40 index. In Figure 30 the positive lag indicates the cross-correlations when the Resource 10 Index lagged the Prime lending rate and the negative lag indicates the cross-correlations when the Prime lending rate lagged the Resource 10 index.

The results of Figure 29 revealed a significant positive relationship between the Prime lending rate and the Resource 10 Index at lags of one, two and three periods. At the 5% significance level, there was a statistically significant positive relationship between the movement of the Prime lending rate and movement in the Top 40 Index that occurred one, two and three quarters later. Based on this, the null hypothesis

was rejected and the alternative hypothesis accepted, concluding that there was a correlation between Prime lending rate and the Top 40 index.

Figure 30 revealed results similar to Figure 29, showing that there was a significant negative correlation between the Prime lending rate and the Resource 10 Index at positive lags of one, two and three periods. That is, at the 5% significance level, there was a statistically significant negative relationship between Prime lending rate movements and movements in the Top 40 Index one, two and three quarters later. Based on this, the null hypothesis was rejected and the alternative hypothesis was accepted, with the conclusion that Prime lending rate and the Resource 10 Index are correlated.

Figure 31: Prime lending rate and Industrial 25 cross-correlation

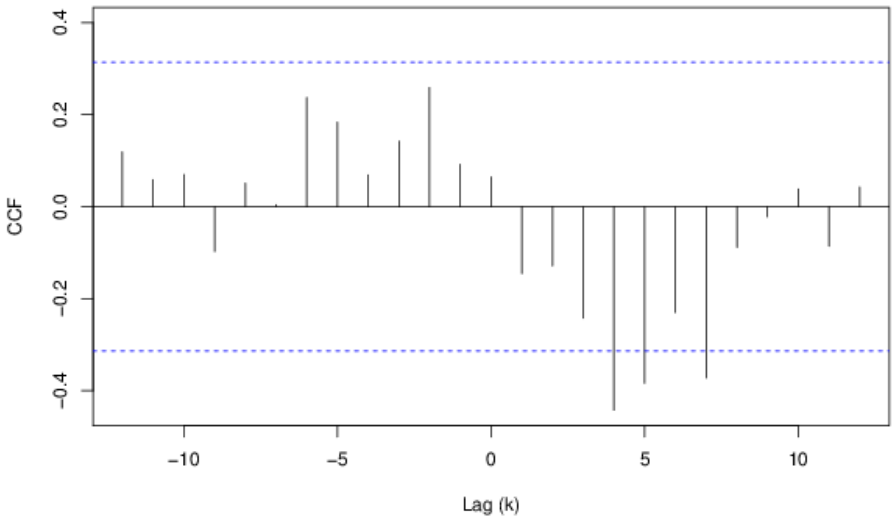


Source: Author's research

The cross-correlation plot above displays the cross-correlation of the Prime lending rate and the Industrial 25 Index during the period from 1 January 2005 to 31 December 2014. The results revealed no significant positive or negative

relationships between Prime lending rate and the Industrial 25 index. The null hypothesis, that there is no correlation between movements of the Prime lending rate and AMR of the Industrial 25 index, was accepted.

Figure 32: Prime lending rate and Financial 15 cross-correlation



Source: Author's research

The correlogram displays the cross-correlation of the Prime lending rate with the Financial 15 Index for the period 1 January 2005 to 31 December 2014. The plot indicates the cross-correlations between the two variables at different lags, with each period interval being a calendar quarter. The positive lag indicated the cross-correlations when the Financial 15 Index lagged the Prime lending rate and negative lag indicated the cross-correlations when the Prime lending rate lagged the Resource 10 index.

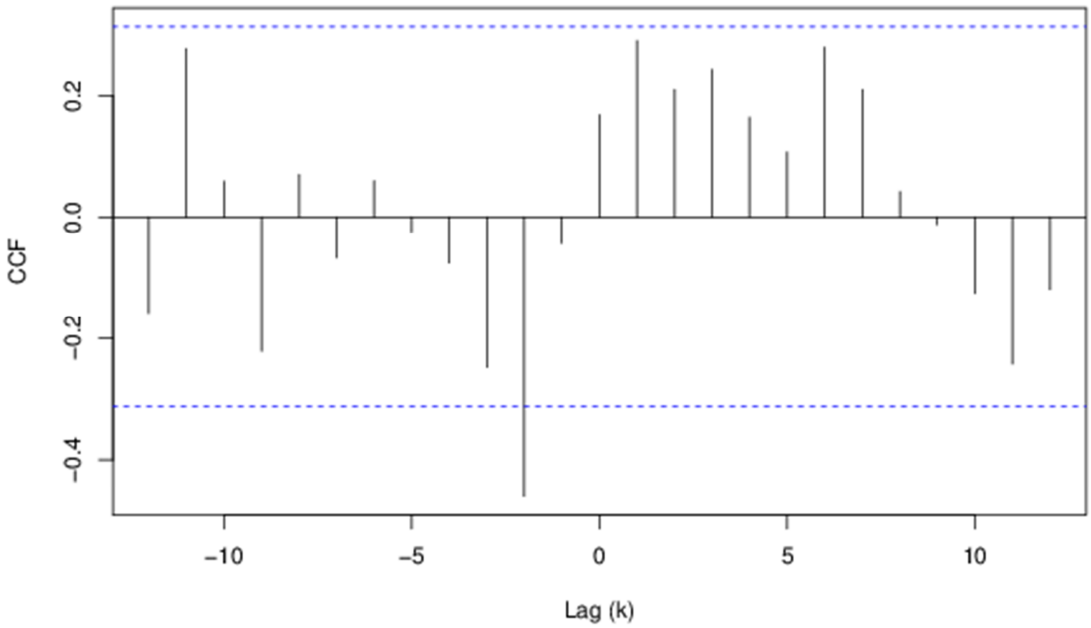
The cross-correlation test above revealed a significant negative relationship between the Prime lending rate and the Financial 15 Index at a lags of four, five and seven periods. Based on this, the null hypothesis was rejected and the alternate hypothesis was accepted, that there is a correlation between the Prime lending rate and the

Financial 15 index.

5.6. Hypothesis 3

The null hypothesis stated that there is no correlation between CPI and the AMR of any one of the four selected JSE indices. The alternative hypothesis stated that there is a correlation between CPI and the AMR of any one of the four selected JSE indices.

Figure 33: CPI and Top 40 Index cross-correlation

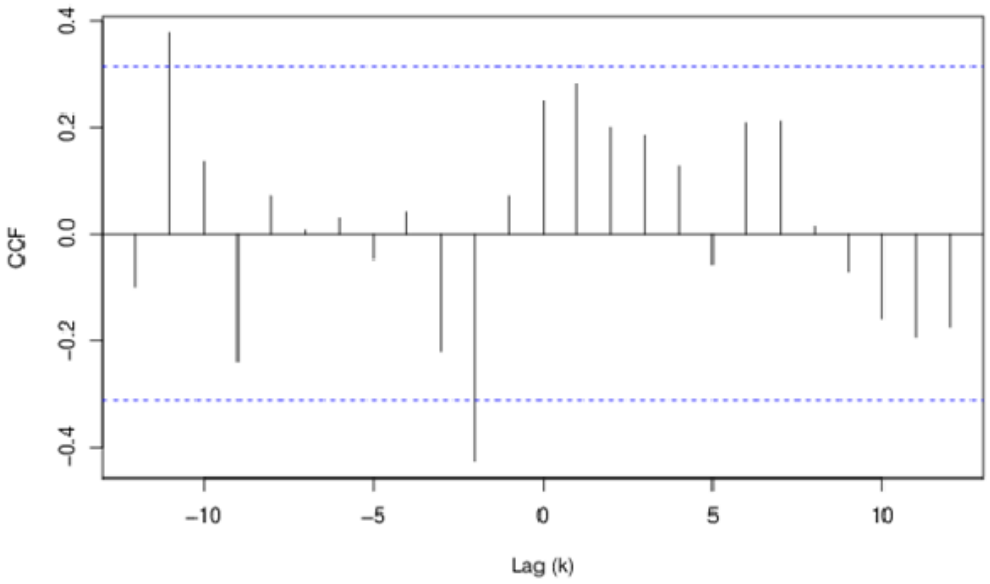


Source: Author's research

The correlogram above displays the cross-correlation of CPI with the Top 40 Index for the period from 1 January 2005 to 31 December 2014. The plot shows the cross-correlation between the two variables at different lags. The positive lag indicates the correlations when the Top 40 Index lagged CPI by one period through to 12 periods, with each period representing one calendar quarter. The negative lag indicates the correlation when CPI lagged the Top 40 index.

The correlogram in Figure 33 shows a significant negative relationship between CPI and the Top 40 Index when the CPI lagged the Top 40 by two quarters. At the 5% significance level, there was a statistically significant relationship between CPI movements and movements in the Top 40 Resource 10 Index two quarters earlier. Based on this, the null hypothesis was rejected and the alternate hypothesis was accepted, with the conclusion that GDP and the Resource 10 Index are negatively correlated.

Figure 34: CPI and Resource 10 cross-correlation



Source: Author's research

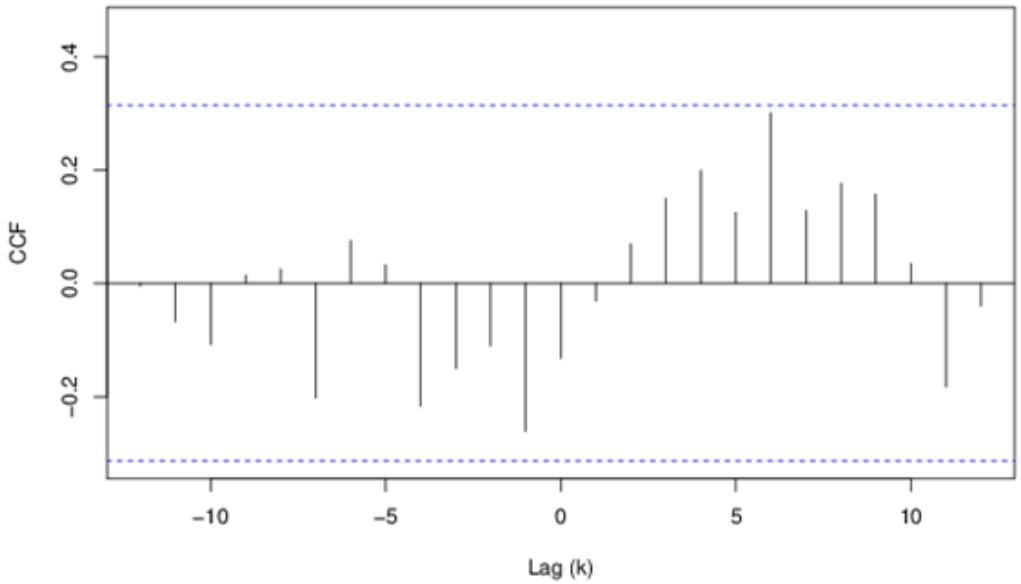
The correlogram in Figure 34 displays the cross-correlation of CPI with the Resource 10 Index for the period 1 January 2005 to 31 December 2014. The plot indicated the cross-correlation between the two variables at different lags. The negative lag indicated the correlation when the Top 40 Index lagged CPI by one period through to 12 periods, with each period being a calendar quarter. The positive lag indicates the correlation when CPI lagged the Top 40 Index by 1 period through to 12 periods.

This correlogram identifies a significant negative relationship between CPI and the Top 40 Index when CPI lagged the Top 40 by two quarters. At the 5% significance level, there was a statistically significant negative relationship between CPI movements and movements in the Resource 10 Index two quarters earlier. Based on this, the null hypothesis was rejected and the alternative hypothesis, that there is a correlation between GDP and the Resource 10 Index, was accepted.

Lastly, when the CPI lagged the Top 40 index by 11 quarters, there was a significant positive relationship observed between the two variables. In view of the conclusions of Albright (2009), this statistically significant correlation is classified as being

random and it was ignored, as there is no specific known reason why this correlation occurred.

Figure 35: CPI and Industrial 25 cross-correlation

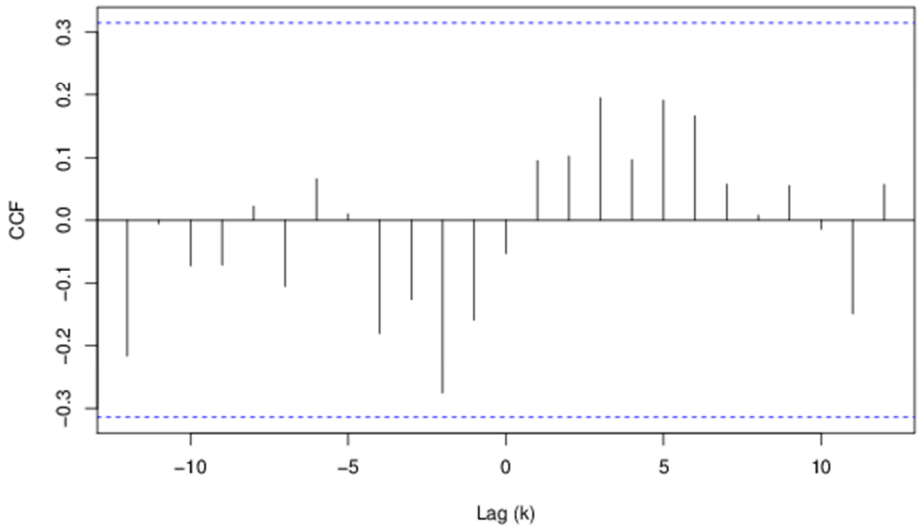


Source: Author's research

The correlogram above displays the cross-correlation of CPI with the Industrial 25 Index for the period 1 January 2005 to 31 December 2014. The plot indicates the cross-correlation between the two variables at different lags. The negative lag indicated the correlation when the Industrial 25 Index lagged CPI by one period through to 12 periods, each period being a quarter. The positive lag indicates the correlation when CPI lagged the Industrial 25 Index by one period through to 12 periods. The results of the cross-correlations revealed no significant relationships.

The null hypothesis, that there was no correlation between CPI and the Industrial 25 Index, could not be rejected and it is concluded that that there is no correlation evident between CPI and the Industrial 25 index.

Figure 36: CPI cross-correlations with Financial 15



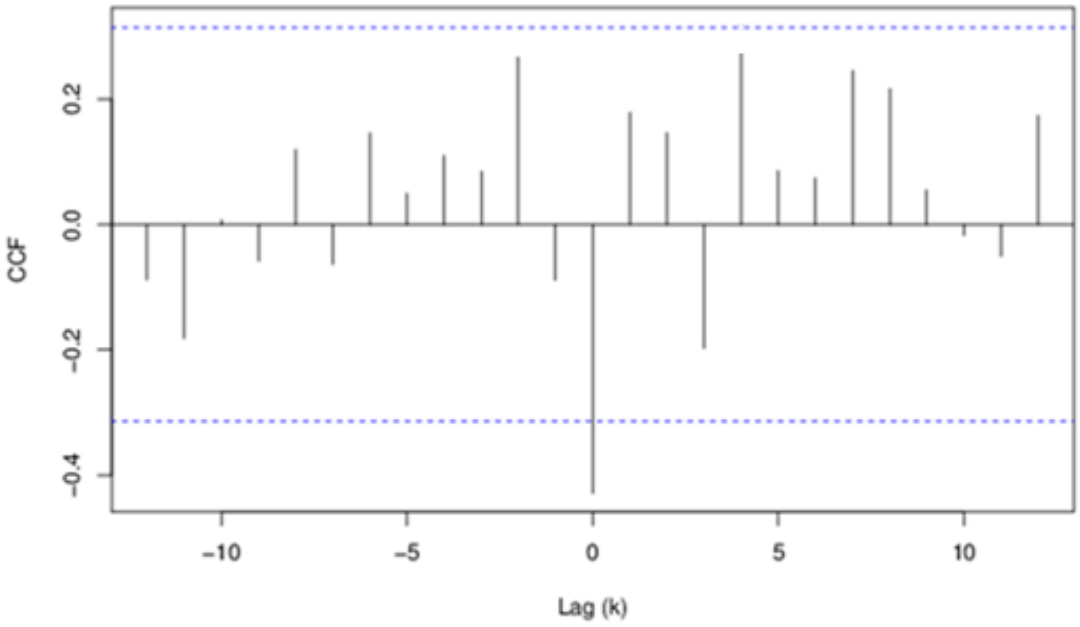
Source: Author's research

The cross-correlation above displays the cross-correlation of CPI with the Financial 15 Index for the period from 1 January 2005 to 31 December 2014. The results of the cross-correlations revealed no statistically significant positive or negative relationships between CPI and the Financial 15 index. That is, at the 5% significance level, there was no statistically significant relationship between CPI movements and movements in the Financial 15 index. Based on this, the null hypothesis was accepted; that CPI and the Financial 15 indices are not correlated.

5.7. Hypothesis 4

The null hypothesis states that there is no correlation between the rand-dollar exchange rate and the AMR of the each of the four selected JSE indices. The alternative hypothesis states that there is a correlation between the rand-dollar exchange rate and the AMR of the each of the four selected JSE indices.

Figure 37: Rand-dollar exchange rate cross-correlations with Top 40

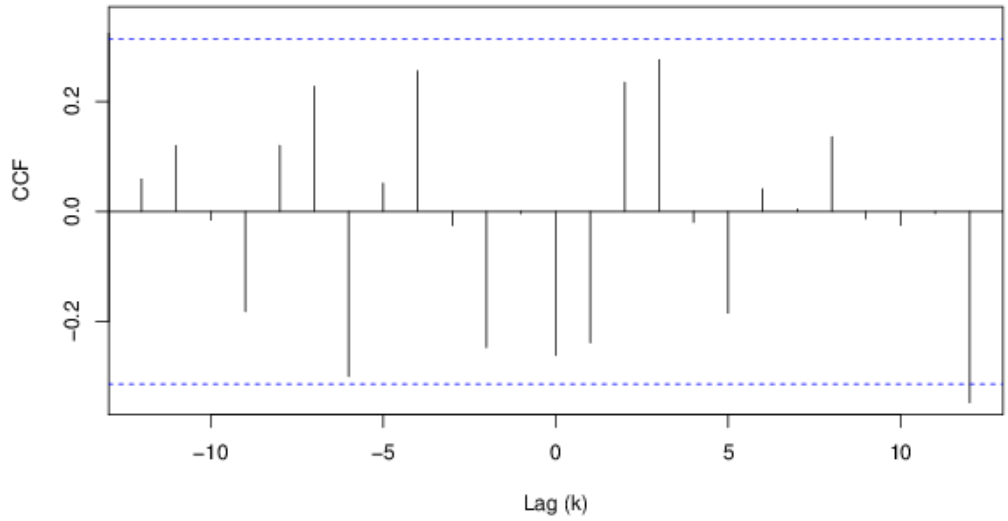


Source: Author's research

This correlogram displays the cross-correlation of the rand-dollar exchange rate and the Top 40 Resource 10 Index for the period from 1 January 2005 to 31 December 2014. The plot indicates the cross-correlation between the two variables at different lags, with each lag being a calendar quarter. The positive lags indicate the correlations when the Top 40 lagged GDP by one period through to 12 periods. The negative lags indicate the correlations when GDP lagged the Resource 10 Index by one period through to 12 periods.

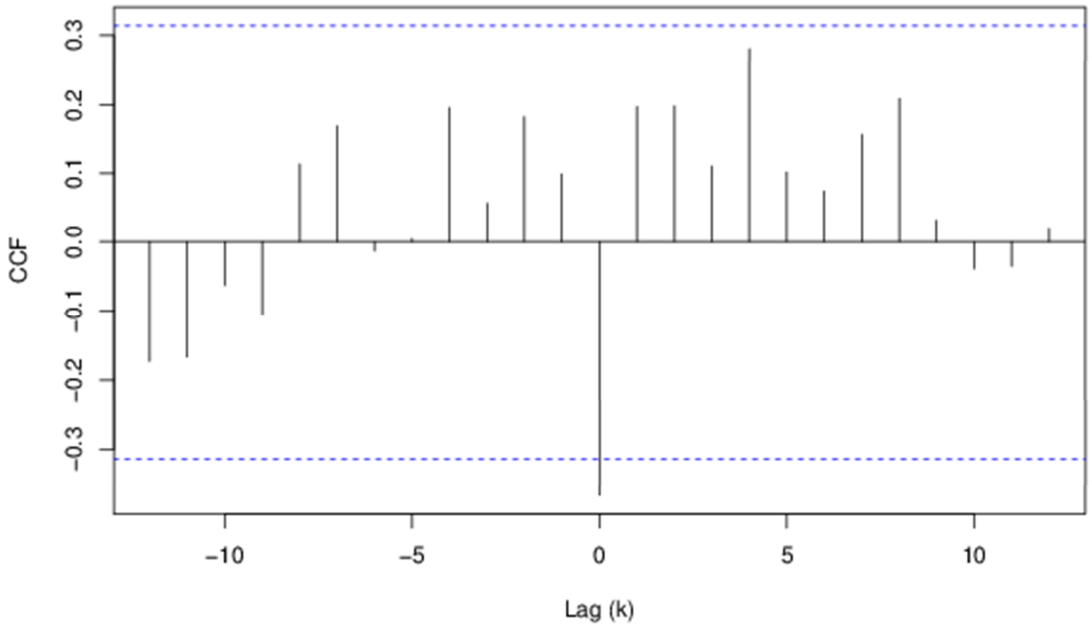
The results of the test revealed a significant, inverse, relationship between rand-dollar rate and the Industrial 25 index. The correlogram shows that there is an inverse correlation. This indicates that the Index increases when the rand weakens against the dollar and the Index decreases when the rand strengthens. Based on this, the null hypothesis was rejected and the alternative hypothesis accepted, concluding that the rand-dollar exchange rate and the Industrial 25 Index are correlated.

Figure 38: Rand-dollar exchange rate cross-correlations with Resource 10



Source: Author's research

Figure 39: Rand-dollar exchange rate and Industrial 25 cross-correlation

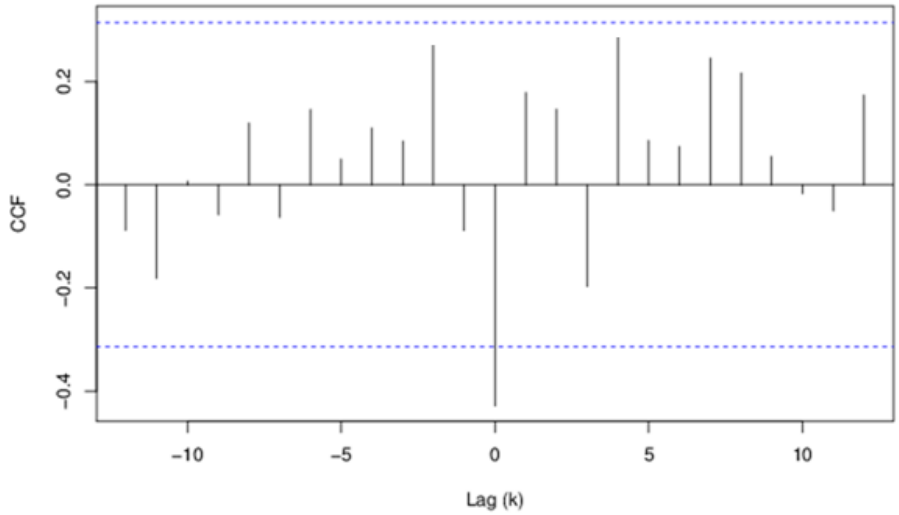


Source: Author's research

The correlogram above displays the cross-correlation of rand-dollar with the Industrial 25 for the period from 1 January 2005 to 31 December 2014. The plot indicates the cross-correlation between the two variables at different lags. The negative lag indicates the correlation when the Industrial 25 Index lagged the rand-dollar rate by one period through to 12 periods, with each period being a calendar quarter. The positive lag indicates the correlation when the rand-dollar rate lagged the Industrial 25 Index by one period through to 12 periods.

The results of the test revealed a significant, inverse, relationship between the exchange and the Industrial 25 index. The correlogram shows that there is an inverse correlation. This indicates that the Index increases when the rand weakens against the dollar and the Index decreases when the rand strengthens. Based on this, the null hypothesis was rejected and the alternative hypothesis accepted, concluding that the rand-dollar rate and the Industrial 25 Index are correlated.

Figure 40: Rand-dollar exchange rate and Financial 15 cross-correlation



Source: Author's research

The correlogram in Figure 40 above shows the cross-correlation of rand-dollar and the Financial 15 Index for the period from 1 January 2005 to 31 December 2014. The plot indicates cross-correlation between the two variables at different lags. The negative lag indicates the correlation when the Financial 15 Index lagged rand-dollar by one period through to 12 periods, with each period being a calendar quarter. The positive lag indicates the correlation when rand-dollar lagged the Financial 15 index.

Similarly to the findings of the rand-dollar against the Industrial 25 cross-correlation test in Figure 39, the results of Figure 40 reveal a significant, inverse relationship between rand-dollar and the Financial 15 index. This indicates that the Index increases when the rand weakens against the dollar and the Index decreases when the rand strengthens. Based on this, the null hypothesis was rejected and the alternative hypothesis accepted, concluding that GDP and the Financial 15 Index are directly correlated.

CHAPTER 6: DISCUSSION OF RESULTS

6.1. Overview

In this chapter the research findings are summarised and compared with conclusions of previous studies that considered data from different periods from various financial markets. Reasons are proposed where the results of this study are obviously similar or clearly different to the findings of previous studies. The format of this chapter follows the sequence of the research hypotheses.

The many studies that have searched for associations between equity returns and macroeconomic factors have reached mixed conclusions. Despite the extensive literature covering numerous JSE related topics, it seems that few studies have tested for these relationships using data from different sectors using the same period of study.

The results of this study are comparable with the findings of Jefferis and Okeahalam (2000), who analysed the relationship between several economic factors and the JSE using cointegration techniques. Examining ALSI data for 1985 to 1995 they found that share prices are positively related to the exchange rate and the GDP and negatively related to the Prime lending rate.

Table 2: Summary of results

In this table the first Figure shown is the cross correlation R-value. The Figure in parenthesis is the corresponding lag period in which the R-value occurred.

	GDP	Prime	CPI	USD/ZAR
Top 40 Index	NSSC	-0.5 (2)	-0.4 (-2)	-0.4 (0)
Resources 10 Index	NSSC	-0.5 (2)	-0.4 (-2)	NSSC
Industrial 25 Index	0.3 (3)	NSSC	NSSC	-0.3 (0)
Financial 15 Index	0.3 (3)	-0.4 (4)	NSSC	-0.4 (0)

Table 2 sets out the Cross-correlation R-value and the (lag) at which it occurred. A positive lag indicates that the meaningful cross-correlation was measured when the index

movement occurred a in period after the change in the macroeconomic variable. A negative lag indicates that the meaningful cross-correlation was measured when the index movement occurred in a period before the change in the macroeconomic variable. A zero lag indicates that the significant movement of the macroeconomic variable occurred at the same time as the movement of the index. A positive R-value represents a positive relationship between the two variables that were tested. A negative R-value represents an inverse relationship between the two variables that were tested. “NSSC” is the abbreviation used to name tests where no statistically significant cross-correlation, and hence no meaningful relationship between two variables, was identified.

6.2. Hypothesis 1

The finding for this hypothesis was that there was a statistically significant positive relationship between movements of GDP and both the Industrial 25 and Financial 15 Indexes. Based on these results, the null hypothesis was rejected and the alternative hypothesis of a non-zero correlation between GDP and the Industrial 25 and Financial 15 indices was accepted. This is consistent with the work of Jefferis and Okeahalam (2000) and Hsing (2011).

It was surprising that no relationship was found between GDP and the Top 40 Index and also that no relationship was found between GDP and the Resources 10 Index. It was not surprising to find that a similar result was obtained for the Top 40 Index and Resources 10 Index. The reason for this is, is that due to its high market capitalisation of the Resources 10 Index Index, it should show a similar behaviors the Top 40.

When considering the work of Jefferis and Okeahalam (2000) and Hsing (2011) the results of this study are surprising. They concluded that GDP had a positive relationship with JSE returns during the period up until 2009. These finding suggest that a change may have occurred between the relationship of GDP and the JSE as a whole.

6.3. Hypothesis 2

Despite the fact that Modigliani and Cohn (1979) considered interest rates to be one of the more significant determinants of the share prices, when looking at other more recent research it cannot be said that changes in interest rates will always significantly affect equity markets. The finding for this hypothesis was that there was a statistically significant positive relationship between movements of the Prime lending rate and all three of the Top 40, the Resource 10 and the Financial 15 indexes. Based on these results, the null hypothesis was rejected and the alternative hypothesis of a non-zero correlation between GDP and the Industrial 25 and Financial 15 indices was accepted. It was expected that a similar result would be obtained for the Top 40 Index and Resources 10 Index, due to the large market capitalisation of the Resources 10 Index, relative to the Top 40.

These results are in agreement with Jefferis and Okeahalam (2000)'s findings from their analysis of JSE data from 1985 to 1995. They concluded that higher interest rates resulted in lower JSE returns, and both Alam (2009) and Eita (2012) concurred. The implication that interest rates exert a negative impact on equity returns is consistent with the interest rate theory, which suggests that a higher interest rates drive investors to save funds and thus capital may be moved out of equity markets.

It was thus surprising that no relationship was found between the Prime lending rate and the returns of the Industrial 25 Index. The Industrial 25 Index findings suggest that the constituents of the Index may be protected from movements of the Prime rate. It may be that this sector's sources of debt funding are affected less by changes in the Prime rate, or that this sector has a very strong ability to hedge against changes in the Prime rate. The question of why the Industrial 25 Index appears to be less prone to movements of the prime rate than other sectors could be considered by in further depth future by studies.

6.4. Hypothesis 3

The results of the cross-correlations between the CPI index and the four indices showed that inflation was negatively correlated with the Top 40 and the Resource 10 indices. At the 5% confidence interval none of the other cross-correlation tests proved to be statistically significant. Due to its high market capitalisation, the results are as expected as the performance of the resource sector has a substantial impact on the performance of the Top 40 Index. These results are consistent with the findings of previous study on JSE data by Firer and Mcleod (1999). Boyd, Levine and Smith (2001) found a predominantly negative relationship between inflation and equity returns in data covering over 35 years and 65 countries, including South Africa. The results are contrary to those of Eita (2012) who more recently identified a positive relationship between JSE returns and inflation.

Exiting literature often attributes findings on this topic to one of two schools of thought. Fisher's (1930) hypothesis states that the expected rate of return on an asset should comprise the real return plus a compensation for the effect of expected inflation. To explain a negative relationship between share prices and inflation, Tripathi and Kumar (2015) hypothesized the drivers of such a relationship to be:

1. An increase in inflation increases the discount rate used in share valuation models. This leads to lower equity prices and thus lower returns.

2. An increase in inflation negatively affects corporate cash flows by increased input costs and the cost of debt. This could also cause a decrease in equity prices and returns due to poorer corporate performances.

3. High inflation often attracts contractionary monetary and fiscal policies which reduce money supply, increase interest rates and has the effect of reducing aggregate economic activity. This would also have an adverse effect on GDP growth, corporate performances and on share returns.

This explanation by Tripathi and Kumar (2015) could explain some of the drivers of inflation being negatively correlated with the Top 40 and the Resource 10 indices.

It was surprising that no statically significant correlation between CPI and the Industrial 25 Index was found and that CPI and the Financial 15 indices were not meaningfully correlated. This is consistent with the work of Paul and Mallik (2003) who found that inflation had an insignificant effect on equity prices of the Australian financial sector.

6.5. Hypothesis 4

The finding for this hypothesis was that, at the 5% significance level, the rand-dollar exchange rate was negatively correlated with the Top 40, Industrial 25 and Financial 15 indices. As the rand weakens against the dollar, the Index prices increase.

Previous literature confirms the existence of links between exchange rates and equity prices, with some authors finding a positive relationship (Kanas, 2000; Nieh & Lee, 2001; Gay, 2008) and others finding a negative relationship (Mougoue, 1996; Kim, 2003).

No result was established between the performance of the Resource 10 and the rand-dollar exchange rate, which was surprising, as Afordofe (2011) found a positive linkage. In the South African context the appreciation of the rand usually results in a relative increase in the price of South African export products in the world market, and this is significant to a resource-based economy. This may decrease the demand for South African exports and it reduces cash inflows to the country. Conversely, the depreciation of the rand makes local exported goods cheaper for foreign markets, leading to an increase in domestic exports, and larger capital inflows.

As commodities are priced in dollars, many South African companies earn revenue in dollars, which is translated to rand for JSE reporting purposes. If the rand depreciates against the dollar, then rand profits increase, leading to increased equity valuations. Conversely, if the rand strengthens against the dollar then rand reported profit decreases, which leads to lower equity valuations. It would therefore also make sense that there is a negative relation between the rand-dollar exchange rate and sectors of the JSE.

In the Top 40, Resource 10, Industrial 25 and Financial 15, there are some constituents of each that have primary listings on foreign stock exchanges. If taking a short term view, what may be relevant is the impact that exchange rate movements have on the JSE share prices of companies with a secondary listing. For a company like British American Tobacco PLC, it could be that the main driver of the JSE share price is the prevailing British Pound price of the primary-listed London Stock Exchange of the share, but converted to rand. In this example, the exchange rate could have a significant influence on the JSE share price of British American Tobacco PLC and which could improve if the rand weakens against the Great Britain Pound. Thus the performance of an index could be affected directly by the constituents of which JSE share prices are determined in part by exchange rate movements. This a factor that has the potential to influence the outcomes of Hypothesis 4.

It is essential for investors to consider the predictive impacts of monetary policy as a tool in predicting the equity market conditions and more specifically for adjusting their investments. An understanding of exchange rate changes on equity market returns might be important to government and policy makers in formulating strategic policies that can be proactive in hedging the economy from external exchange rate shocks.

CONCLUSIONS

7.1 Concluding Remarks

This research study attempted to add to this topic, and thereby to assist future studies with investigations regarding relationships between macroeconomic variables and equity returns. The results are pertinent to today's context in which the JSE shows volatile equity returns.

This study examined the relationships between four macroeconomic variables from the South African economy and the investment returns of four JSE indices. GDP, CPI, Prime lending rate, as well as the rand-dollar exchange rate were each cross-correlated with the Top 40, Resource 10, Industrial 25 and Financial 15 indices during the 10 year period ending on 31 December 2014. For this study, the ability to identify relationships at different time lags was considered to be is important as was expected that changes in some macroeconomic variables may only manifest as changes to the AMR of some of the JSE indices, some time after a movement of the value of the macroeconomic variable has occurred.

The flowing conclusions were made:

1. GDP was found to be positively correlated with the Industrial 25 and Financial 15 indices.

2. The Prime lending rate was negatively correlated with the Top 40, the Resource 10 and the Financial 15 indices.

3. Inflation was negatively correlated with the Top 40 and the Resource 10 indices.

4. The rand-dollar exchange rate negatively correlated with the Top 40, Industrial 25 and Financial 15 indices.

No attempt was made to establish causality between the macroeconomic variables and share price performance as these relationships are complex and governed by many variables that were beyond the scope of this research. For the purposes of this research

study, it was considered sufficient to establish whether a correlation exited between the variables tested.

Limitations to this research study included the fact that the indices that were tested were only established in 2002. This study considers only 10 years of data, and as a result it is possible that the true relationships between the macroeconomic variables and the indices may have been obscured by the international markets' 2008/9 shock crisis which may have led to extreme or unexpected results from this study. This study only considered the quarterly JSE data from the past 10 years. As this time period of review was relatively short, the results from the study may not have revealed the true longer term relationships between the macroeconomic factors and the indices were tested.

Only large-capitalisation JSE-listed companies were included in this study. Differences between large listed and unlisted companies, which may be due to many reasons, could be reasons for these findings not being applicable to smaller JSE listed or unlisted South African entities as well. The research did not take into account any of the other operational, market or economic factors that may affect the AMR of the four indices.

The mixed results are aligned to some of the existing literature. However, for some of the cross-correlation tests performed, no further relationships were identified, which was somewhat surprising. Some of the existing studies of the JSE as well as data from other developed and developing markets, found relationships where this study found none. This could in part be due to fact that it is impossible to generalise these relationships across markets, or across sectors within the classified markets, due to the many conditions that create the unique environments in which each equity market functions. Markets have differing regulations, types of investors and sector biases, economic variables, openness, levels of liquidity and efficiency, size, that each may cause markets to behave differently to one another. The timing of studies is also relevant.

Another possible reason for the variations in findings is that the macroeconomic variables do not move in isolation. For example, GDP might decrease, suggesting negative future effect on equities, while at the same time the rand-dollar exchange rate may strengthen, suggesting possible improved returns. Any investment decision would require judgment by an investor to assess the potential impact of both such movements

and then to decide which would have the most dominant impact.

It is in the government's interest for the JSE to function efficiently and to perform well so that investors might earn positive returns and new capital is attracted to the economy. The JSE has a potentially important role to play in attracting capital to and allocating capital within the economy and it could be used as a tool to promote increased growth and it might even improve the country's overall levels of saving. For this to occur, an environment should be created where interest rates are not excessively high and the rand is not too weak. Policy makers should actively guide monetary policy to positively influence the JSE. The SARB must continue its active inflation management. Lastly policy should be pursued in an attempt to improve investor confidence throughout the South African economy to increase JSE investor confidence. The authorities also need to continuously monitor the developments in world financial markets as these affect the South African equity market performance. These requirements create a complex equilibrium for authorities to aim for, as policy changes may have unintended consequences. Exchange rates can be influenced by good capital account management, but the decision to maintain a weak rand to aid the JSE remains another complex issue.

The results of this study suggest that an opportunity exists for investors to profit from the inefficiencies of equity market, where relationships exist between moments of macroeconomic factors and JSE indexes. Contrary to the idea behind the EMH' efficient market theory it is recommended that investors attempt to predict the equity market sectors returns. This study suggests that there may be a possibility that investors can outperform a market by trading equities of the indices where relationships have been found for indices as new information regarding specific macroeconomic variables becomes available.

A capitalist view is that the aim of a company is to maximise its returns to shareholders on a sustainable basis. From this view, this study suggests that a strategic focus area for corporates should be on increasing capacity that leads to increased output and revenues in the long-term. However corporates cannot individually control macroeconomic variables. Business decisions should be made that consider these macroeconomic factors. For example, capacity planning should be done while being cognisant of business

cycles, such as the current GDP outlook and exchange rate forecasts or the projections for the costs of funding if assessing capital investment programmes. The knowledge of correlations between share returns and each of the macroeconomic indicators could be used as part of corporate risk management.

An important concept that falls outside of the scope of this study, is the extent to which the performance of the JSE is affected by foreign economies, for example those related to trade with South Africa. As the South African economy is relatively small in the global context, these factors are likely to be significant, with many researchers continuing to investigate this question.

7.2 Suggestions for Further Research

The following recommendations may assist with directing future investigation of this general topic:

Studies should be conducted over a longer time period than 10 years. Furthermore, periods should be considered for study without large external financial shocks, to obtain findings on whether relationships exist in the longer term between macroeconomic variables and the returns from different sectors in the economy. However the effect of external shocks could be considered in isolation, for example the 2008-2009 global financial crisis, which could be investigated to determine the effect of such an events have on these correlations.

Unexpected findings from this study that could be analysed in more depth by subsequent studies include:

1. No significant relationship being found between GDP and the Resources 10 Index.
2. The Industrial 25 Index may be less prone to movements of the Prime rate than other sectors.
3. Reasons for the Resource 10 Index to have no statically significant relationship

with the rand-dollar exchange rate.

As continuing advances in technology liberalise information, there is the possibility that the efficiency of markets do improve, which may lead to a market responding quicker to macroeconomic changes than this study has shown. Thus the data from markets can be retested periodically to analyse whether changes in any relationships do occur over time.

In this study, the relationship between the macroeconomic variables and the returns of individual market sectors was examined using tests of correlation. It may be preferable to perform similar investigations using more complex statistical methods that could also detect the variations of any relationships over time.

It may be worthwhile testing data covering individual sectors from other emerging markets. The results from such studies may provide useful information concerning particular sectors of various markets. It is proposed that in studies similar to this one, the data sets should include other macroeconomic variables, such as the trade balances, gold and oil prices, and bond prices, amongst many others.

Further studies could aim to ascertain to what level individual JSE sectors are integrated with foreign economies. Ideas for testing include the GDP or exchange rates of major trade partner countries, or interest rates such as the JIBAR, Libor, Euribor of international markets where capital is raised to fund South African operations.

Aside from quantitative variables, the effects of qualitative variables (such as political events, changes in legislation and economic agreements) could be reviewed for their effect on sectors of the JSE.

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