Sovereign Credit Ratings, Macroeconomic Variables and their Impact on Stock Market Performance

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Abstract: This study examines the effects of macroeconomic variables on the stock market prices in South Africa for the period of 2010 to 2021. Quarterly data was used applying the Autoregressive Distributed lag Model given the order of integration of the variables. The NARDL model was estimated and to a greater extent, the results were found to be consistent with the standard ARDL model. The results revealed that interest rates have a negative effect, and the unemployment rate was also found to have an inverse relationship with the stock market performance. On the contrary, the results pointed out that economic growth has a positive effect on stock market development in South Africa. While sovereign credit rating was found to have a negative effect. These results imply that the relationship between macroeconomic variables and the stock market needs to be constantly studied and analysed as these variables do have an influence on the stock market performance. And in analysing the effects of macroeconomic variables on the stock market policy makers can be in a better position to enforce economic policies to create a stable environment for the stock market to grow and thrive, thus attracting more investors both locally and internationally. Nevertheless, it is important to note that there are important qualitative events that may have influenced the relationship between the variables; therefore, this validates the limitation of the approach utilised.

Keywords: Macroeconomic variables, Sovereign credit Rating, Stock market, Economic growth, Cumulative Dynamic Multiplier, ARDL.

JEL Classifications: R48, O16, N1, J65, J11, E44, D53, B16.

1. INTRODUCTION AND BACKGROUND

1.1. Introduction

Key macroeconomic indicators are tracked to determine progress within an economy, and among them, how they influence each other (Omar, Ali, Mouneer, & Ket al. 2022). It is important to understand how they relate so that addressing unwanted trends on one should not be at the expense of the other indicator. For example, in search of economic growth as measured by gross domestic product (GDP), should not be at the expense, of say, price stability (measured by inflation), or vice versa. Various sectors of the economy, such as the goods market, the factor market, and the financial system are interlinked, and this is revealed through the indicators - only that not much is known about the extent of the relationship (Chikwira & Mohammed, 2023). Macroeconomic stability is achieved when there is a good understanding of the relationship among macroeconomic indicators; such stability is important to achieve macroeconomic objectives.

According to Jagannathan (2016:15), Loungani et al. (2018), and Upadhyaya (2017:23) the financial industry has been South Africa's most stable growing sector within the economy contributing massively to the economic growth of the country. The stock market contributes 32 percent to the financial sector and 38 percent to the economy (Elliot, Granger, Trehan, Kannan et al., 2019). The stock market accounts for the majority of South Africa's direct foreign investment in the form of equities this implies that a stable stock market fuels direct foreign investment (Kiel & Ross, 2020). It is not fully known to what extent the performance of the stock market influences the rest of the economy and is an area of continued interest for policymakers, academics, and practitioners.

The stock market is central to investors as they can preserve their surplus funds by putting them through the stock market (Muriuki, 2014). The decision to do so depends on many factors such as the overall performance of the economy, and macroeconomic indicators such is inflation, interest rate (Beck et al., 2014), while the decision does affect indicators in the financial system such as prices of stocks (Chikwira &

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Mohammed, 2023). Capital markets have drawn a vast number of buyers because of their advantages and have evolved over the years as technology advances and more people get exposure to the stock markets (Ram et al., 2017:617). Although stock markets generally perform well, they tend to underperform sometimes due to external factors such as changes in macroeconomic variables like interest rates or economic growth and uncertainty such as pandemics (Geske, Richard, Spencer, Cheung et al., 2016:341-351; Omar, Ali, Mouneer, & Ket, 2022).

A well-performing stock market can attract external investors which can cause improvements in infrastructure, transportation, unemployment, and the overall economy (Ram & Spencer, 2018). This raises a great need to ensure a stable stock market by analysing the external factors that disrupt the stock market (Lawala et al., 2018). The continued success of the stock market will enable sustainable economic growth and development (Sharma, 2016:901).

1.2. Background

Post-apartheid South Africa has inherited a long legacy of poverty, inequality, low economic growth, and high unemployment. For years the goal of the government has been to address those socioeconomic issues with the hopes of improving the economic livelihoods of all South Africans, especially the poor black majority (Adjasi, 2019). South Africa has struggled to achieve continuous economic growth and has adopted high-inflation rates over the years (Jian-Zhou & Masih, 2018). This is despite having a sound financial system, which withstood the 2007-09 Global Financial Crisis' shock especially through the sound regulatory framework which is guided by the Basel Accords.

For years, South Africa has made it clear that there is a preference of a stable financial system given the inherent contagious potential; and for this, there has been accusation that the financial system (that includes the stock markets) end up not helping the country to address some of the pressing needs like reducing unemployment or bringing about economic growth. This brings to question what success means for the financial system—the stock market in particular- is it about its own indicators like capitalisation, returns, liquidity etcetera, or it is what the stock market enables within the economy? The stock market can enable access to capital to small and large businesses, which then translates to increased economic activity. How to judge the performance of stock markets may hinge upon what successful performance entails.

Given the current economic outlook, there is a great need to critically assess suitable straits of achieving economic growth to bring about change to the current economic status (Chandra, 2021). Stock markets are known for the ability to help transfer capital from one economic player to the other and assisting in transferring and making risk. Such markets are critical in the aftermath of shocks like Covid-19 to help raise capital and can help address many other problems like inequalities, unemployment, and low growth if well understood.

Nonetheless, it is undeniable that the stock market plays a key role in the economy and its success is essential for the continued inflow of foreign investment which is important for economic growth and development. Studies have shown that macroeconomic variables have a great influence on the stock market performance; this emphasizes the importance of identifying and understanding the macroeconomic factors that drive stock market trends (Rothenberg et al., 2019). Macroeconomic variables are the main signposts or indicators that signal the current trends taking place in the economy (Siklos, 2020:22).

Furthermore, a stable stock market can only be achieved through continuous studying, analysing, and understanding of macroeconomic trends that dictate stock market performance (Kubota, Kalay, & Takehara, 2020:181). This will allow policymakers to implement the correct policies given a certain economic outcome and thus ensuring that the stock market is always stable (Krueger, 2019). The stock market has the potential to bring about sustainable change to an economy that had been suffering for so long with little economic growth (Wang et al., 2021). Therefore, more effort must be put into creating an environment that provides the stock market a platform to excel and reach its maximum potential (Zhang, 2021:35). This paper tries to find the impact of sovereign credit ratings and macroeconomic variables on stock market performance.

2. LITERATURE REVIEW

2.1. Theoretical Literature

The theoretical literature is dominated by a number of hypotheses and models that explain the relationship. There are several theoretical explanations on stock markets and the rest of the economy, starting with how sound stock markets help in the smooth and cost-effective transfer of risk and capital, how stock markets move in sync with business cycles, how investors build investment portfolios, among others. These will be discussed in turn under this section.

2.1.1. Efficient Market Hypothesis (EMH)

This hypothesis which has become popular in financial economics and investment fields was proposed by Fama (1970) who argues that, if anything, the stock market is assumed to contain all publicly available information at any point in time. This is a phenomenon of efficient market; implying that any stock indicator is reflecting what is happening in the economy and is in the public domain - this includes the trend of key macroeconomic variables. If that holds, no single player can take advantage of the market or another player in the process of arbitrage of other mechanisms to enable price differentials or predictable price movements. This means, the stock market indicators (price, liquidity, capitalisation, and so forth), do depend on what is happening within the economy (as reflected in macroeconomic indicators). The other forms of the market include semi-strong and weak form of market where market participants do not have enough information.

2.1.2. Business Cycle Theory

Based on the rational expectations hypothesis, it is argued that the stock market indicators generally mirror economic activities; being low during downturns and high during the

boom phases (Adam & Merkel, 2019). In that way, the indicators cyclically move with the business cycles. Investors can inspect the business cycle and make decisions regarding investment in stock prices accordingly. These interlinkages are the foundations for stock evaluation models like the dividend discount model (DDM) that emphasizes the importance of macroeconomic factors.

The argument has been carried out by Hamilton and Lin (1996) with downtowns being argued to be the ones responsible for fluctuations in the volatility of stock returns. This shows that the stock market indicators react to the state of a business cycle and vindicates the argument that there is a relationship between stock market and macroeconomic indicators. In the same vein, Domian and Louton (1995) found that negative stock returns are quickly followed by sharp increases in unemployment, while more gradual unemployment declines follow positive stock returns, concluding on the asymmetries. Evidence exists of the overreaction of the stock market to macroeconomic factors (Park, 2021) further strengthening the need for this study on the case of South Africa.

2.1.3. The Inflation Illusion Theory

The theory was proposed by Modigliani and Cohn (1979) arguing that stock market investors extend previous growth rates even during periods of fluctuating inflation because they are unable to comprehend how inflation affects nominal dividend growth rates and this indicates that stock prices are undervalued when inflation is high and overpriced when inflation is low. Modigliani and Cohn (1979) note that the true impact of inflation is brought on by the illusion of money, as cited by Eldomiaty, Saeed, Hammam, and Aboul-Soud (2020).

Investors in the stock market experience money illusion because they use nominal discount rates to discount actual cash flows, which results in behavioural issues that lead to inflation-induced valuation mistakes (Eldomiaty et al., 2020). According to the Modigliani-Cohn hypothesis, stock market undervaluation should be eliminated once actual nominal cash flows are disclosed; hence, undervaluation is expected to occur during periods of excessive inflation (Park, 2021). As a result, Modigliani and Cohn (1979) contend that there is a negative link between stock returns and inflation (Gavriilidis & Kgari, 2016). This idea is backed by Fama (1981) given that high inflation indicates low growth and that there is a positive association between predicted economic growth and stock prices, inflation and stock prices ought to have a negative relationship (Grande, Locarno, & Massa, 2014).

2.1.4. Fisher Effect Theory

The Fisher effect is derived from Fisher's (1930) economic theory which expresses the real rate of interest as the difference between the nominal rate of interest and the predicted rate of inflation. The most typical version of this relationship represents predicted nominal rates of return on assets as the sum of projected inflation and expected real return. According to the Fisher effect, expected nominal returns on assets should provide a complete hedge against inflation; if this is the case, a positive relationship between stock returns and inflation is expected, implying that investors are compensated for the loss in purchasing power due to inflation (Gavriilidis & Kgari, 2016).

2.1.5. Portfolio Choice Theory

According to the portfolio choice theory by Mishkin and Falk (2016:432) there is a strong theoretical link between stock market performances and interest rate changes. If banks increase the interest paid to depositors, leaving other factors constant, investors will shift their cash flows from stocks to the banks, because they are receiving a more attractive interest (Koh et al., 2019).

Moreover, the additional interest paid to depositors will drive up lending rates, which will lead to an increase in borrowing costs (Sarantiset et al., 2017). These effects will negatively affect demand for stocks, which in turn negatively affects stock prices (Shleifer & Robert, 2017). Therefore, in theory, there is a negative relationship between the interest rate and stock prices (Alan & Uddim, 2019). Macfarlene et al. (2018) agree with the theory that there is a negative and significant relationship between interest rates and stock prices because as the interest rate decreases, borrowing costs decline and so demand for stocks, all other factors being constant, will increase which should then drive up the price of stocks (Maysami & Macfarlane, 2016:56).

2.1.6. Flow-oriented Model Hypothesis

Dornbusch and Fisher (1980) flow-oriented model hypothesises states that the exchange rate influences global competitiveness and trade balances and thus income and output. With these two variables being positively related to stock prices, theoretically, there should be a negative relationship between the exchange rate and stock prices.

The empirical study conducted by Chiang et al. (2000) discovered a positive relationship between stock returns and the value of the national currency, indicating that an increase in the value of the national currency promotes a greater stock return. Their findings are in line with research by Fang (2002), Phylaktis and Ravazzolo (2005), Wongbangpo and Sharma (2002), and Wu (2000) indicating support for the flow-oriented model of exchange rates.

2.1.7. Sectoral Shift Hypothesis

The sectoral shifts theory, developed by Lilien (1982) and Davis (1987) contends that unemployment is caused in part by resources being shifted from decreasing to increasing areas of the economy (Loungani, Rush, & Tave, 1990). According to economic theory, labour movements from industries with dropping relative salaries to those with rising relative wages actually cause unemployment. The dispersion of unemployment among industries was primarily demonstrated by Cauchie, et al. (2019) as a valuable proxy for explaining changes in the unemployment rate.

2.2. Empirical Literature

According to Johansen (2017), Hansen (2018:311), and McMillian et al. (2016), the link between stock markets and economic activity generally implies that there is a significant relationship between stock market performances and macroeconomic variables. Chancharat, Valadkhani, and Harvie

(2019) studied the correlation between four different macroeconomic variables including gross domestic product (GDP), the consumer price index (CPI), the industrial production index (IPI), and the unemployment (UNEMP), and the stock market of six countries including Germany, Italy, Spain, France, UK, and the US. The studies showed that there is a statistically significant correlation between the macroeconomic variables and stock markets.

The remainder of this review will give pertinent empirical research analysing the nexus between stock market prices and GDP, inflation, interest rate, exchange rate, and unemployment, as this is the study's focus.

2.2.1. The Relationship between the Stock Market and GDP

A vast majority of the empirical literature on African stock markets and specifically the Johannesburg Stock Exchange (JSE) is consistent with the theory that stock prices volatility is positively correlated to GDP, as stated by Adjasi (2014:776), Gay (2015), and Eita and Mangani (2015:94). However, an interesting empirical analysis by Hsing (2012), shows that Botswana's stock market indices are positively related to the GDP of South Africa, suggesting that economic activity in a country influences stock prices in neighbouring countries, due to the deepening of trade between the two countries.

In a study by Fifield, Power, Sinclair, and Nkwantabisa (2021), the authors used annual data from 1996 to 2019 to examine the long- and short-term interrelationships among financial deepening, stock market development, and economic growth for eight African nations. They used the dynamic autoregressive distributed lag bounds test, co-integration test, and granger causality test. They figured out that Nigeria, Algeria, Namibia, Kenya, and Mauritius were co-integrated, whilst the other three nations (Eswatini, South Africa, and Tunisia) were not. The Granger causality test found bi-directional causation between economic growth and stock market development in Algeria, Namibia, and Mauritius, but only unidirectional causality from economic growth to stock market development in the remaining five nations.

2.2.2. The Relationship between the Stock Market and Inflation

Studies conducted by Kaul (1987), Hussain et al. (2012), Omotor (2009), Rapach (2002), and Geetha et al. (2011) reveal that there is a negative correlation between stock prices and inflation. In accordance with this, Jha, Tiwari, and Motwani (2022) performed research on the influence of inflation rates on stock prices utilizing evidence from the Indian market. Their research demonstrates that the inflation rate has a statistically significant negative influence on the price of stocks, and they also discovered that increases in stock prices were much larger when the inflation rate was either stable or reduced yearly, compared to hikes in inflation rate.

Another study conducted by Loannides, Katrakilidis, and Lake (2015) used Greek data from 1985 to 2000 to examine the link between stock market returns and inflation, discovered that the variables have a long-run, bidirectional causal link that is negative in both directions. They also found that, between 1985 and 1992 there were short-run causal effects that ran from returns to inflation, however, between 1992 and 2000, the causal effects ran from inflation to returns. Ibrahim and Agbaje (2013), Grossi and Tamborini (2011), and Arshad et al. (2012) investigated the relationship between earnings from stocks and economic inflation and found that inflation is a critical macroeconomic variable that influences stock returns.

2.2.3. The Relationship between the Stock Market and Interest Rates

This is consistent with research by Taylor and Hashemzadeh et al. (2018), Ahmad (2019:442), and Hosseini (2019) using monthly time series data on the South African Stock Exchange from 2008 to 2018 to study the effect of the volatility of the interest rate on stock prices, by estimating the variables into an EGARCH model. Next, the effect of the volatility of the interest rate was measured using the most recent form of mean-conditional variance of interest as exogenous variables in the conditional variance equation of the stock price (Lai, 2016). The findings suggest that the greater the volatility of interest rates, the more vulnerable stock market prices will be to financial shocks (Ibrahim et al., 2019:73).

Stoica, Nucu, and Diaconasu (2014) performed research on the relationship between interest rates and stock prices utilizing information from Central and Eastern European markets. In the situations of the Czech Republic, Hungary, Poland, and Romania, their findings show that the international interest rate has a discernible influence on the stock market indices. Since Bulgaria, Latvia, and Lithuania do not have monetary policy autonomy, they only find evidence for the inverse link between foreign interest rates and stock index prices.

2.2.4. The Relationship between the Stock Market and Exchange Rates

Empirical studies on Asian markets found a significant and negative relationship between stock prices and foreign exchange rates (Kuwornu et al., 2014). This is especially the case when these markets are compared with stronger currencies of developed economies (Çiftç, 2017). A study by Ajayi, Iqbal, and Khattak (2016) was conducted using an Error Correction Model and monthly stock data from eight advanced economies, among them the US, Canada, France, and Germany from 2007 to 2021. The results of the study show that depreciating currencies have a negative relationship with stock prices both in the short run and the long run (Agbaje, 2019). However, the inflationary effects of currency depreciation could alleviate its effects on stock prices in the short run (Musah et al., 2018:765).

To evaluate the presence of the link between the variables, they used the Granger causality test, VECM, and Johansen co-integration. The findings indicate that the exchange rate and stock prices have a long-term negative correlation, specifically, there is a unidirectional link that runs from the exchange rate to stock prices in the nation.

Hussain, Bilal, and Qureshi (2020) carried out a study examining the correlation between stock prices and currency rates for Pakistan, China, Russia, and Turkey from 2003 to 2017 using the OLS and Quantile regression technique. The ADF test, PP test, and Engle & Granger tests were used in the arti-

cle to determine if the series was stationary over the long run. It has been noted that no country displays a long-term equilibrium between the exchange rate and the price of stocks. Both models demonstrate that the China coefficient is negative, showing a negative correlation between stock prices and exchange rates, which is consistent with the portfolio balance effect being present in China. The coefficients for Pakistan, Turkey, and Russia all have a positive sign, which shows the absence of portfolio balance theory (Kalyanaraman, 2015:875).

2.2.5. The Relationship between the Stock Market and Unemployment

Studies by Maysami and Koh (2016), indicate that the impact of stock market diversion on output and unemployment is significant but small. On the contrary, Kuwornu et al. (2017), Liew (2019:77), and Lawal (2022) find that stock market dispersion leads to unemployment over the shortrun but not over the longrun. More et al. (2017:81) on the other hand, indicate that in the United States the stock market dispersion accounts for a huge portion of both short-term and long- term unemployment even after monitoring aggregate factors, so much so that an increase in stock market dispersion leads to an increase in the unemployment level.

Furthermore, Khan, Javed, and Shahzad (2016:223) using data from the US, China, and Canada found that there is a positive but weak effect from earnings dispersion to unemployment and these results are similar to that obtained by Perveen and Arshad (2017) using data from African countries including Nigeria, Zimbabwe, and Namibia. Even more recent studies by Sivagnanasithi (2016:787), Mukherjee (2017), and Mutuku et al. (2018), found that during periods of recession, the US earnings dispersion is associated with higher unemployment and lower industrial production, but during periods of expansion, dispersion has an insignificant impact on unemployment and production.

The review confirms that there is potential for a relationship between stock markets and macroeconomic indicators. It however points to other factors that may affect the relationship such as the strength of the stock markets versus the banking system. It is therefore imperative to proceed to empirically test the relationship in the case of South Africa as results cannot be easily generalised.

3. METHODOLOGY

3.1. Theoretical Framework and Model Specification

The study is underpinned by the efficient market hypothesis, portfolio choice theory, and the flow-oriented model hypothesis. As discussed earlier, from the flow-oriented mode, the effect is expected to run from the macroeconomic to the stock market. In other words, the stock market responds to events taking place within the macroeconomic environment.

This is also consistent with the portfolio choice theory which suggest that changes in interest rates will have a negative effect on the stock market. In line with the two frameworks presented and discussed, Li and Hu (1998) highlight that the model linking the two variables can be stated as follows:

$$P_t = E\left(\sum_{t=1}^{\infty} \frac{d_{t+\tau}}{1+r_{t+\tau}} \mathrm{I}\Omega_t\right) \quad (3.1)$$

In this case, P_t is the stock price, representing the performance of the stock market. $\Omega_t$denoted the information set at time t. Li and Hu (1998) highlight that $\Omega_t$captures all the previous information announcements. In the event that there is new information available in the market, it will be captured by the difference between Ω_t and Ω_{t-1}. It is also arguing that under the rational expectations, and considering the efficient market hypothesis, changes to stock prices will be from the unanticipated news only. Li and Hu (1998) further highlight that given that announcement surprises are uncorrelated across time, if one combines daily security-price changes and announcement surprises from different days, it is possible to isolate the effects of individual macroeconomic variables on the stock market.

Based on the model discussed as well as the work of Richard and Ocran (2010:663), Mukherjee and Naka (2011), Phiri et al. (2012), Mlambo et al. (2013), and Hoesli (2014:887), the following model was used to analyse the relationship between the variables of interest:

$SM = f(EX, IR, UEPR, GDP, SCR)$ (3.2)

The empirical model to be estimated is as follows:

$SM_t = \alpha + \beta EX_t + \beta IR_t + \beta UEPR_t + \beta GDP_t + \beta SCR_t + \varepsilon_t$ (3.3)

Where SM is the stock market index, EX is the exchange rate (USD/ZAR $1=19.10), IR is the interest rates, UEPR is the unemployment rate, and GDP is gross domestic product.

3.2. Data Sources

This study is quantitative in nature and data for a period of 11 years (2010 to 2021) from South Africa were collected from the South African Reserve Bank (SARB). Sovereign Credit rating indicated as SCR was included in the variables for more robustness. Variables to be used in the study JSE All share Index representing the stock market index, exchange rate (USD/ZAR $1=19.10), interest rates, unemployment, gross domestic product (GDP), and Sovereign Credit rating. The JSE All share Index represents 150 companies listed on the JSE. Also, it is the largest when looking at value and size.

3.3. The Autoregressive Distributed Lag Model Cointegration Test

The study utilised the Autoregressive Distributed Lag Model (ARDL) in the empirical investigation of the relationship between the variables of interest. This approach is also referred to as the bounds cointegration technique which was originally developed by (Pesaran & Pesaran, 1997). Several developments were made to the model by (Shin, 1999; Pesaran et al., 2001). The test was used to analyse the long-term relationship between the stock market and exchange rate, in addition to other macroeconomic variables (Singh et al., 1998).

The data used in the study are integrated into orders 0 and 1, this makes the ARDL model relevant to checking the long-term relationship between the variables. Nkoro and Uko (1998) indicate that this model is free from the problem of endogeneity given that each variable in the model appears as an individual equation. Khan and Khan (1997:427) also highlight that one of the features of the ARDL technique is "its pure identification of the cointegration vectors among the multiple cointegrating vectors. Also, the technique assumes that only a single reduced-form equation relationship exists between the explained and the exogenous variables". The general form of the ARDL model is presented as follows:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + +\beta_k Y_{t-p} + \alpha_0 X_t + \alpha_1 X_{t-1} + \alpha_2 X_{t-2} \ldots + \alpha_q X_{q-1} + \varepsilon_t \quad (3.4)$$

Given that the above model has lags in both the dependent and independent variables. The conventional Error Correction Model (ECM) will be estimated. The equation is given as follows:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta Y_{t-1} + \sum_{j=0}^{q1} \gamma_j \Delta X_{1t-j} + \sum_{k=0}^{q2} \delta_k \Delta X_{2t-k} + \varphi Z_{t-1} + e_t (3.5)$$

The Z indicated in the above equation is the error correction term that connects both the long-run and short-run models. The unrestricted ARDL model of the study is presented as follows:

$$\Delta LnSM_t = \alpha_1 + \alpha_{EX} InEX_{t-1} + \alpha_{IR} InIR_{t-1} + \alpha_{UEPR} InUEPR_{t-1} + \alpha_{GDP} InGDP_{t-1} + \alpha_{SCR} InSCR_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta InSM_{1t-j} + \sum_{j=0}^{q} \alpha_j \Delta InEX_{1t-j} + \sum_{k=0}^{n} \alpha_k \Delta InIR_{1t-k} + \sum_{l=0}^{n} \alpha_l \Delta InUEPR_{1t-l} + \sum_{m=0}^{n} \alpha_m \Delta InGDP_{1t-m} + \sum_{m=0}^{n} \alpha_m \Delta SCR_{1t-m} + \mu_t (3.6)$$

The following null hypothesis that will be evaluated in this case:

$$H_0: \alpha_{EX} = \alpha_{IR} = \alpha_{UEPR} = \alpha_{GDP} = 0$$

The alternative hypothesis of the cointegration is as follows:

$$H_0: \alpha_{EX} \neq \alpha_{IR} \neq \alpha_{UEPR} \neq \alpha_{GDP} \neq 0$$

3.4. F-Statistic

The test involves calculating the F-statistic which is compared against the lower bound and upper bound to determine if there is cointegration (Kutty et al., 2001). If the calculated F-statistic is greater than the upper bound value that will be an indication of the presence of cointegration (Yartey & Komla, 2007). However, if the F-statistic is below the lower bound, that will be an indication that there is no cointegration. Khan and Khan (1999:542) state that if the values fall between the two bounds, lower and upper, the result will be inconclusive. The presence of cointegration will be determined by the significance of the ECM term. The ECM term to be estimated in the model is presented as follows:

$$\Delta lnSM_t = \delta_0 + \sum_{i=1}^{p} \delta_i \Delta InEX + \sum_{k=0}^{q} \delta_3 ln\Delta IR_{t-k} + \sum_{k=0}^{o} \delta_4 \Delta UEPR_{t-l} + \sum_{k=0}^{n} \delta_5 \Delta GDP_{t-m} + \sum_{k=0}^{n} \delta_5 \Delta SCR_{t-m} + \omega ECM_{t-1} + \varepsilon_t (3.7)$$

4. PRESENTATION OF EMPIRICAL RESULTS

4.1. Descriptive Statistics

Table **4.1.** presents and discusses the descriptive statistics of the variables employed in the study.

The descriptive statistics highlight that the mean value of the JSE, utilising stock market capitalisation is 9.44 with a maximum value of 10.54 and a minimum value of 8.48. It is important to note that the country has a well-developed stock market, which compares favourably to those of other developed countries. The exchange rate between the South African rand and the US dollar has a mean of 16, with a maximum value of 23.18 and a minimum value of 7.82. This does suggest that the rand is a volatile currency. Also, in terms of the interest rate, the mean is 10.94, with a maximum value of 21.86 and a minimum value of 5.00. This does speak to the changes to interest rates changes during the covid 19 pandemic when the Reserve Bank pursued policies aimed at stimulating domestic demand. The logged value of real GDP has a mean of 13.58, with a maximum value of 13.88 and a minimum value of 13.25. This shows that there is no significant difference between the mean and maximum value of GDP in South Africa. With respect to sovereign credit rating, the mean value is 7.77, with a maximum value of 13.62 and a minimum value of 6.22. This shows also that there has been a lot in variation of the SCR in South Africa. The country has been downgraded massively in the past 7 years. Lastly, the mean value of the inflation index is 61.34, with a maximum value of 100.00 and a minimum value of 32.00. Well, inflation has been stable in the country but of late it has been out of the 3 to 6% range.

4.2. Lag Length Determination

Having determined the time series properties of the data, the next step involves coming up with the appropriate lag length. This is presented on Fig. (**4.1**).

Fig. (**4.1**) presents the top 20 models and based on the Akaike information criterion, the ARDL (3,1,4,4,2,2,0) was chosen. This was employed in the estimation of the bounds tests, the long-run model as well as the short-run model. The bounds test results and the accompanying cointegration graph are presented in Table **4.2** and Fig. (**4.1**) respectively.

Table 4.1. Descriptive Statistics.

	LSM	EX	IR	UEPR	LGDP	SCR	INFLATION
Mean	9.4405	16.0026	10.9402	21.7232	13.5844	7.7741	61.3487
Median	9.2233	17.2400	11.2500	21.5438	13.5626	8.2769	60.7000
Maximum	10.5498	23.1810	21.8550	27.8000	13.8864	13.6187	100.0000
Minimum	8.4860	7.8250	5.0000	16.5000	13.2556	6.2250	32.0000
Std. Dev.	0.6559	11.1368	4.0462	2.4243	0.1859	0.7517	19.6335
Skewness	0.2828	-0.6705	0.4267	0.5581	0.0500	-0.9210	0.3975
Kurtosis	1.5158	3.3452	2.4798	2.7597	1.6110	2.1744	1.9907
Observations	76	76	76	76	76	76	76

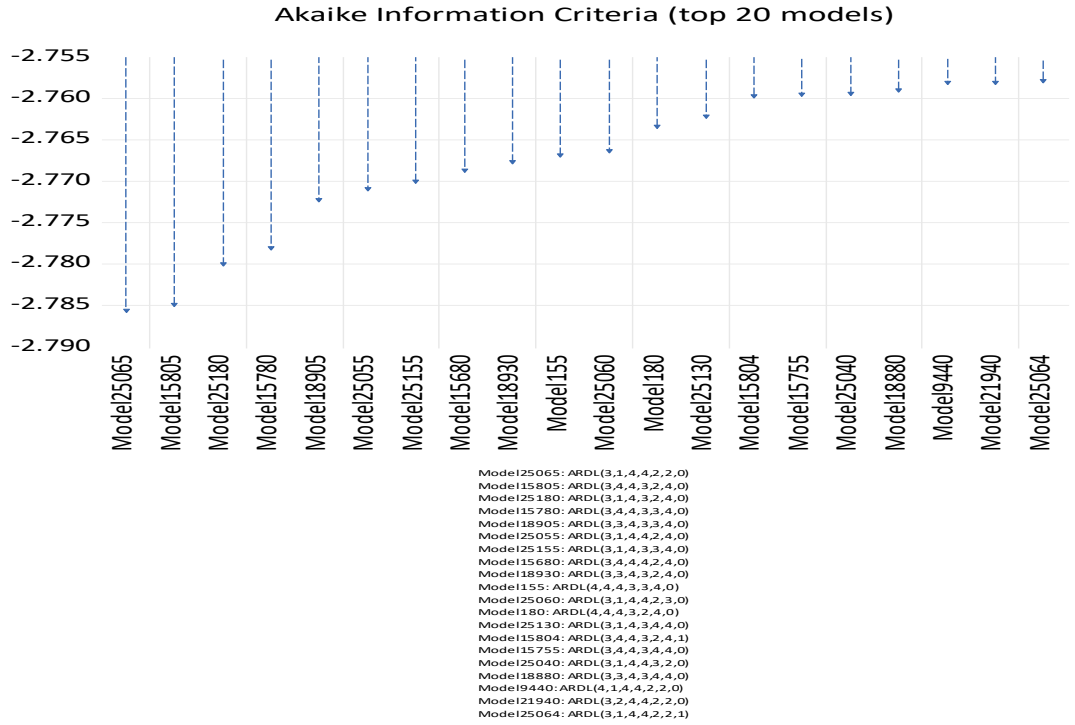

Fig. (4.1). Lag length determination.

Table 4.2. Bounds test results.

Test Statistic					Value	
F-statistic					5.279871***	
	10%		5%		1%	
Sample Size	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
70	2.100	3.121	2.451	3.559	3.180	4.596
75	2.103	3.111	2.449	3.550	3.219	4.526
Asymptotic	1.990	2.940	2.270	3.280	2.880	3.990
* I(0) and I(1) are respectively the stationary and non-stationary bounds.						

*Statistically significant at 10% level
**Statistically significant at 5% level
***Statistically significant at 1% level

Table 4.3. Long run model.

Variable *	Coefficient	Std. Error	t-Statistic	Prob.
EX(-1)	-0.001052	0.001424	-0.739071	0.4625
IR(-1)	-0.015895	0.007633	-2.082332	0.0413
UEPR(-1)	0.008112	0.007565	1.072427	0.2875
LGDP(-1)	2.816347	0.606890	4.640624	0.0000
SCR(-1)	-0.206614	0.071410	-2.893359	0.0052
INFLATION	-0.005494	0.007156	-0.767768	0.4454
C	-26.81437	7.636976	-3.511124	0.0008

*Statistically significant at 10% level
**Statistically significant at 5% level
***Statistically significant at 1% level

The results as presented in table **4.3** shows that the exchange rate has a negative effect on the stock market performance, even the effect is insignificant for the period under study. These results corroborate the findings of Bekhet and Mugableh (2012) who argue that when a country experiences a depreciation of the exchange rate, especially if it is import-dependent, it is likely to result in imports becoming expensive. The results also show that interest rates have a negative effect which is also statistically significant at 5% level. These results are consistent with the findings of Uddin and Alam (2010) as well as Ibrahiml and Musah (2014).

The results also show that unemployment has an inverse relationship with the stock market performance, even though the effect is insignificant. Generally, it is argued that unemployment is one of the important indicators of the state of the economy. Therefore, when unemployment increases, that may be viewed as bad news. Therefore, investors may take it that companies are not hiring enough due to several factors, part of which could be low growth prospects and that makes this an undesirable investment (Rich and Johnson, 2022).

The results also show that economic growth has a positive effect on stock market development in South Africa. A positive GDP is regarded as a strong indicator of a strong economy which is likely to lead a high demand for finance. This will also attract more investors into the domestic stock market. This is supported by studies such as King and Levine (1993) as well as Boyd and Smith (1998). These results are also in line with the demand-pull hypothesis which suggests that it is the demand for finance that leads to the growth of the stock market.

The effect of sovereign credit rating on the stock market is negative and significant. These results are consistent with the findings of Christopher et al (2012) as well as Treepongkaruna (2012). These authors argue that when a country is downgraded, investors view it as a risky investment. They may therefore move their investment to other less risky countries.

Lastly, the results highlight that inflation has a negative effect on stock market development, even though it is insignificant. This again is consistent with the rational expectations hypothesis in which it is argued that investors look at future real activity and make decisions based on that. Given that cointegration was established, the next step involved estimating the error correction model with a view to analyse the short-term relationship between the variables of interest, and these are presented in Table **4.4**.

Table 4.4. Short-run Mode.

Dependent Variable: D(LSM)				
Method: ARDL				
Selected model: ARDL(3,1,4,4,2,2,0)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
COINTEQ*	-0.685860	0.098715	-6.947885	0.0000
D(LSM(-1))	0.456973	0.108076	4.228270	0.0001
D(EX)	0.003356	0.001015	3.306421	0.0017
D(IR)	0.017153	0.006739	2.545393	0.0137
D(UEPR)	0.029176	0.014238	2.049112	0.0451
D(LGDP)	0.425459	0.270493	1.572901	0.1214
D(SCR)	-0.466049	0.310345	-1.501715	0.1388
R-squared	0.729977	Mean dependent var		0.026212
Adjusted R-squared	0.657650	S.D. dependent var		0.084622
S.E. of regression	0.049513	Akaike info criterion		-2.980028
Sum squared resid	0.137287	Schwarz criterion		-2.474102
Log likelihood	123.2810	Hannan-Quinn criter.		-2.778617
F-statistic	10.09267	Durbin-Watson stat		1.760308
Prob(F-statistic)	0.000000			

*Statistically significant at 10% level
**Statistically significant at 5% level
***Statistically significant at 1% level

The results are presented on table **4.4** shows that all the variables employed in the short-run have the correct signs. The

Table 4.5. Bounds test results (nardl model).

Test Statistic					Value	
F-statistic			6.376232			
t-statistic			-5.49071			
	10%		5%		1%	
Sample Size	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F-Statistic						
70	2.519	3.669	2.913	4.168	3.774	5.248
75	2.530	3.648	2.915	4.143	3.768	5.229
Asymptotic	2.380	3.450	2.690	3.830	3.310	4.630
t-Statistic						
Asymptotic	-3.130	-4.530	-3.410	-4.850	-3.960	-4.6353
* I(0) and I(1) are respectively the stationary and non-stationary bounds.						

exchange rate, interest rate, unemployment rate, and GDP do have a positive effect on stock market development in South Africa. The results also show that the ECM term is negative and highly significant, suggesting that in the event of a disequilibrium, the variables adjust to their long-run equilibrium. The rate of adjustment of 69% is very high, which is consistent with the nature of the market.

4.3. Non-Linear Autoregressive Distributed Lag Model

It is importance is to confirm the existence of asymmetric relationship between the variables.

The results as indicated previously in the normal ARDL model show that there is a long-term relationship between the variables of interest. As in Pesaran et al. (2001), the t-bounds statistic was also employed to confirm the existence of cointegration, given that the t-bounds test statistic is -5.49 which is below the I(1) critical value bound its clear confirmation that there are is no cointegration when all variables are I(1).

However, it is argued that even though there is confirmation of cointegration based on the F-Statistic and the t-bounds test, there may be a case of degenerated cointegration. Chung et al (2019) indicate that "Degenerate cases as pointed out by PSS imply non-cointegration. The degenerate cases arise when either the lagged level of the dependent variable or lagged level(s) of the independent variable(s) in the error correction term are found to be insignificant." So, to confirm that this is not the case, a Wald test was estimated, and the results are reported in Table **4.6**.

Given that the p-values of 0.00 for both the F-test and the Chi-squared test, that is an indication that the cointegration which emerges is sensible and not degenerate. Given this, a normalized long run cointegration test was therefore estimated and the results are reported on the following Table.

Table 4.6. Wald test.

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	11.973161	(6, 48)	0.0081
Chi-square	66.83896	6	0.0057
Null Hypothesis: C(2)=0, C(3)=0, C(4)=0, C(5)=0, C(6)=0,			
C(7)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(2)		-0.004991	0.004982
C(3)		-0.001960	0.006141
C(4)		-0.497059	0.425601

C(5)	-0.171750	0.074772
C(6)	-0.015766	0.007493
C(7)	0.000631	0.001410
Restrictions are linear in coefficients.		

Table 4.7. Long run cointegration tests (NARDL).

Variable*	Coefficient	Std. Error	t-Statistic	Prob.
IR(-1)	-0.021126	0.010664	-1.981068	0.0519
UEPR(-1)	0.021198	0.009319	2.274707	0.0484
LGDP	0.882195	0.401013	2.199916	0.0510
SCR(-1)	-0.156648	0.044766	-3.499262	0.0032
INFLATION	-0.013350	0.011561	-1.154738	0.2525
@CUMDP(EX(-1))	-0.003362	0.003038	-1.106629	0.2726
@CUMDN(EX(-1))	-0.009447	0.002986	-3.163096	0.0024
C	15.76751	11.56179	1.363759	0.1774
Note: *Coefficients derived from the CEC regression.				

Table 4.8. The error correction model (NARDL).

Dependent Variable: D(LSM)				
Method: ARDL				
Selected model: ARDL(3,4,4,0,2,0,1)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
COINTEQ*	-0.524168	0.068562	-7.645181	0.0000
D(LSM(-1))	0.300008	0.098526	3.044968	0.0036
D(LSM(-2))	0.305427	0.101299	3.015090	0.0039
D(IR)	-0.021646	0.006651	-3.254412	0.0019
D(IR(-1))	-0.020676	0.007352	-2.812440	0.0068
D(UEPR)	0.035276	0.014039	2.512780	0.0149
D(UEPR(-1))	0.049533	0.017191	2.881304	0.0056
D(UEPR(-2))	0.029232	0.015759	1.854869	0.0690
D(UEPR(-3))	0.025498	0.012003	2.124328	0.0382
D(SCR)	-0.407346	0.299803	-1.358711	0.1798
D(SCR(-1))	-1.138852	0.313760	-3.629686	0.0006
@DCUMDP(EX)	0.001807	0.002052	0.880726	0.3823
@DCUMDN(EX)	0.003559	0.001562	2.277887	0.0266
C	13.10845	1.712647	7.653913	0.0000
@TREND	0.018475	0.002462	7.505250	0.0000
R-squared	0.757773	Mean dependent var		0.026212
Adjusted R-squared	0.687307	S.D. dependent var		0.084622

S.E. of regression	0.047320	Akaike info criterion	-3.060882
Sum squared resid	0.123155	Schwarz criterion	-2.523336
Log likelihood	127.1918	Hannan-Quinn criter.	-2.846883
F-statistic	10.75375	Durbin-Watson stat	1.888637
Prob(F-statistic)	0.000000		
* p-values are incompatible with t-Bounds distribution.			

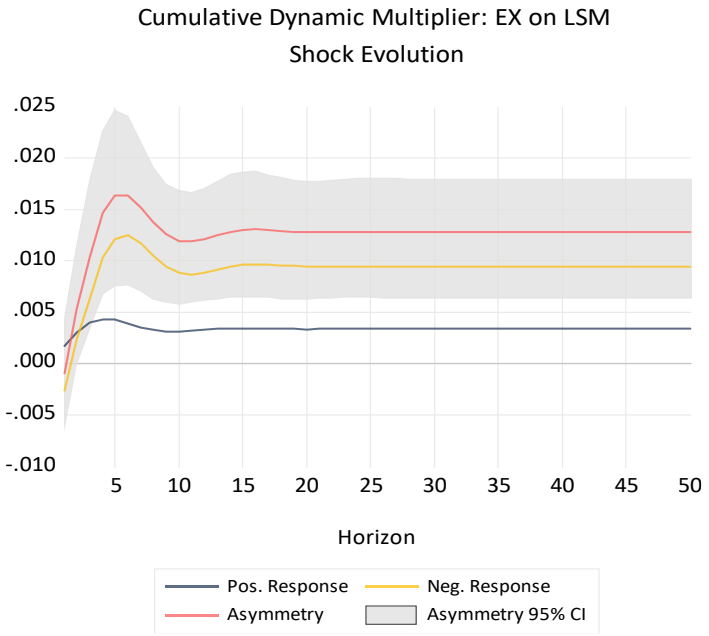

Fig. (4.2). Cumulative dynamic multiplier: EX ON LSM

Table 4.9. Diagnostic Tests.

Test	Ho	Test Statistic	P-Value	Conclusion
Jarque-Bera	Residuals are normally distributed	JB = 0.4707	0.7902	Residuals are normally distributed.
Breusch Godfrey	No autocorrelation in the residuals	nR2(2) = 0.6284	0.7304	No autocorrelation in the residuals.
White	Model is homoscedastic	nR2(2) = 11.1780	0.9721	Model is homoscedastic
Ramsey RESET	Model is correctly specified.	LR(2) = 2.616790	0.1057	Model is correctly specified.

The results as presented in table **4.7** shows that all variables to a greater extent are consistent with the results from the normal ARDL model in terms of the signs. However, in terms of statistical significance, they are all insignificant. However, looking at Table **4.7**, all the variables are significant and carry the correct signs.

Of interest from the study is that for SCR, the effect become significant after the first lag. This therefore suggest that the effect may not be abrupt. However, for all other macroeconomic variables the results suggest that their effect on the stock market is instant which is in line with the efficient market hypothesis. The error correction model is also negative and highly significant suggesting that in the event of a disequilibrium, the market adjusts to its long-run equilibrium with a speed of adjustment of 52%.

4.4. Cumulative Dynamic Multiplier: Exchange Rate on the Stock Market

The last test is on testing the asymmetry responses. Given that the zero line is not located between the lower and upper bands, this is evidence of the asymmetric effects being significant at 5% level.

On average, the results do confirm the existence of a relationship between the stock market and the macroeconomic variables as per the estimations in this section. It has also emerged that all macroeconomic variables do have a significant effect on the stock market in the short run.

Several diagnostic tests were performed to check on the adequacy of the model specified, and the results are reported in Table **4.9**.

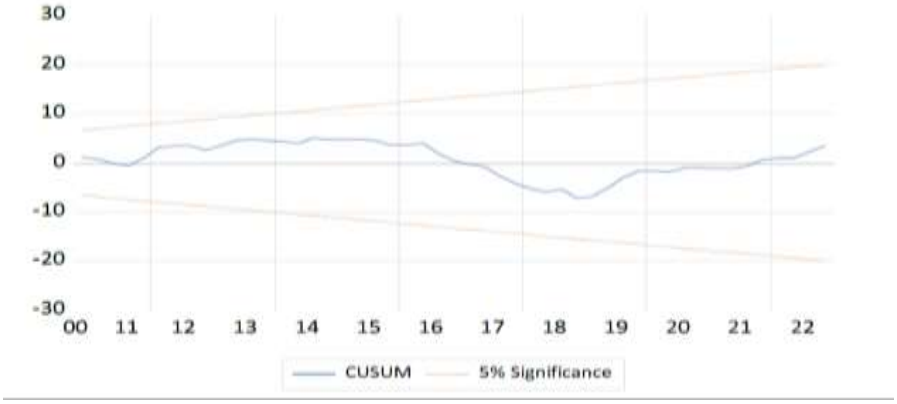

Fig. (4.3). Casum of Squares.

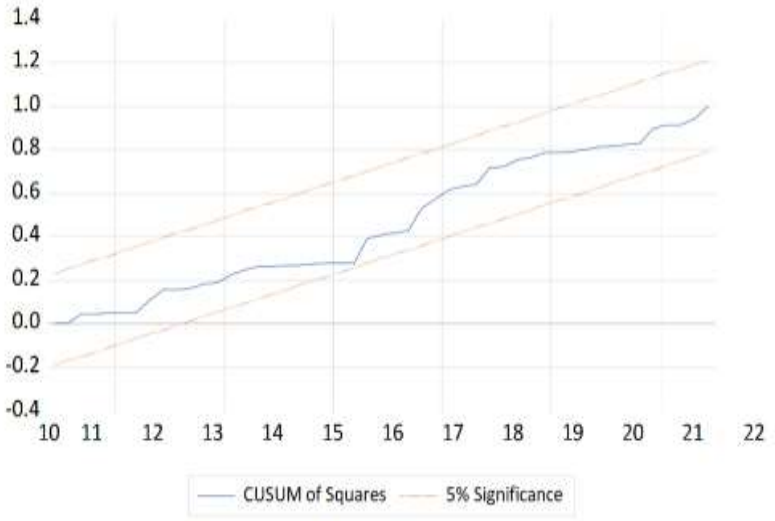

Fig. (4.4). Cusum (NARDL).

As indicated in 4.9, the nonlinear ARDL model does not suffer from non-normality, there is no autocorrelation, no heteroscedasticity and the model is correctly specified. The specification of the model is also confirmed by the CUSUM and CUSM of Squares.

CONCLUSION

The results from the study indicated that the exchange rate has a negative effect on the stock market performance though insignificant in the long run. The results also revealed that interest rates have a negative effect which was found to be statistically significant at a 5% level. The unemployment rate was also found to have an inverse relationship with the stock market performance. On the other hand, the results revealed that economic growth has a positive effect on stock market development in South Africa. Sovereign credit rating was found to have a negative and significant effect on the stock market. Lastly, the results highlight that inflation has a negative effect on stock market development, even though it is insignificant. The results from the analysis do point out that the macroeconomic variables employed in the study do influence the performance of the stock market in South Africa. What was of importance is the effect of the SCR and unemployment, which were both found to be significant and negatively affecting the stock market in South Africa. This was found to be the case both in the long-run and short-run.

Based on the findings from the study, it is important for South African authorities to take into account that innovations in any of the variables employed in the study do have a significant influence on the stock market. One such variable is the interest rate which has been rising in the recent past in a move to control inflation levels, however, that has also affected the stock market.

Another important recommendation is with regards to the link between the stock market and GDP which was found to be bi-directional. This suggests that policies aimed towards developing economic growth are likely to also enhance the growth of the stock market in South Africa. This is critical given the role that the stock market plays in mobilising development finance.

The study sought to analyse the link between the stock market and macroeconomic variables in South Africa, from a quantitative perspective. However, it is important to note that there are qualitative events that are of importance which may have influenced the link between the variables. Given that

the results do conform to the available studies, this therefore validates the approach utilised.

In terms of future analysis, an analysis that considers high frequency data, such as daily data or weekly data would provide more robust results given the nature of the stock market.

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