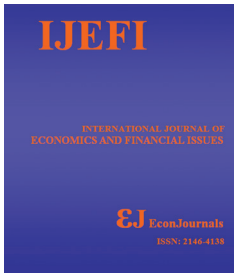

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An Econometric Analysis of Inflation, Exchange Rate, and Interest Rate on Stock Market Performance in South Africa

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ABSTRACT

The stock market is crucial for resource production, distribution, and mobilization because it provides listed firms with long-term funding. Despite the extensive research on the relationship between inflation and exchange rates, the influence of interest rates on stock market performance has received limited investigation. The goal of this study is to address this gap by examining extensive South African data spanning from the first quarter of 2010 to the fourth quarter of 2022. The study constructs a sample space of 48 quarters, utilizing the JSE All Share Price Index as a substitute for measuring stock market performance. Furthermore, it incorporates additional macroeconomic data from reputable sources like the Federal Reserve Bank of St. Louis and the South African Reserve Bank. We employ the auto-regressive distributed lag (ARDL) model to examine the relationship between the stock prices of the Johannesburg Stock Exchange (JSE) and various variables, including inflation, interest rates, and exchange rates. The unit root test results indicate that the exchange rate integrates at order zero (I(0)), while the share price index, inflation, and interest rate integrate at order one (I(1)). The model explains roughly 96.5% of the variability in the dependent variable. According to the findings, short-term interest rates have a significant and negative impact on the Johannesburg stock market's performance. However, the study does not demonstrate the significant effects of exchange rates and inflation. Furthermore, the Granger causality test has proven that the independent factors have no ongoing impact on the dependent variable. Without establishing the generalizability of the findings outside these boundaries, the study limits its conclusions to South Africa and the studied period. Different methods, as the quantile autoregressive distributed lag (QARDL) or the non-linear autoregressive distributed lag (NARDL) methodology, could be used in future studies to look into these relationships. These studies could also look at other factors that affect stock market performance. These insights may help policymakers adopt the most effective monetary or fiscal policies and support investors in making well-informed decisions to diversify their portfolios and minimize risks.

Keywords: Inflation, Interest Rate, Prices, Stock Market
JEL Classifications: B22; B23; B26; E37

1. INTRODUCTION

A vital financial institution for investors, business owners, and the government is the stock market. By providing listed companies with long-term finance, it supports the creation, distribution, and mobilization of resources. It promotes saving and investing, aids in economic expansion, and offers a platform for trading financial assets. The market's performance fluctuates with macroeconomic and economic fundamentals, enabling businesses to raise funds and accomplish their objectives. The JSE All Share index, which includes over 350 listed companies, covers approximately 99% of the market capitalization. The trade value fell by 7.3% between 2008 and 2013, which can be attributed to the 2008 global financial crisis (ASEA yearbook 2012; 2013). In March 2020, the Johannesburg stock exchange fell by 9.72% due to covid-19 (Kamoet 2022). When stock markets fall consumers has fear of loss of wealth and purchasing power as the value of investment contrast leading to less spending and lower GDP. Furthermore, Stock Market reacted negatively to the "surprise news" over a 21-day event period after announcing COVID-19 in South Africa.

The pandemic outbreak news instilled fear in investors, causing them to react irrationally and make decisions based on fear and panic. Investors' herd-like behaviour resulted in negative stock market reactions.

Nonetheless, the South African Reserve Bank had recently reduced interest rates in order to stimulate investment, however as of January 2022, the South African Reserve Bank lifted its benchmark repo rate to 4.25% (SARB, 2022). This had an impact on the cost of doing business, and the consequences e reflected in stock prices. The main Consumer Price Index projection has been dramatically raised to 5.8% in January 2022, up from 5.5% in December 2021 (StatsSA 2022). Furthermore, high inflation rates result in lower stock returns. However, in South Africa, there is still a significant lack of knowledge regarding the exact impact of interest rates on the volatility of stock returns and share prices. The absence of clarity poses an important obstacle for policymakers and financial experts. The difficulty of predicting the stock market's response to interest rate adjustments hinders the formulation of effective investment strategies and economic policies. The objective of this study is to resolve this obstacle by finding the factors that affect the volatility of stock returns and the prices of shares, with a particular focus on interest rates. This research attempts to assist financial analysts in making more accurate strategic decisions regarding asset allocation by examining the primary factors that influence stock market performance, specifically inflation, interest rates, and currency rates. It is essential to understand the relationship between these variables and stock market performance in order to optimize economic policies and investment strategies.

1.1. Theoretical Framework

1.1.1. Theory of arbitrage pricing

The theory of arbitrage pricing serves as the foundation for this investigation. The "arbitrage pricing theory," a general theory of asset pricing, has gained popularity. Specifically, by economist Stephen Ross, this theory was created in 1976 as an alternative to the capital market pricing fashion model (CAPM). In this multi-factor model, every investor accepts that the market is stochastic. Capital asset returns are consistent with factor structure. According to Ross (1976), if equilibrium prices are present and there are no arbitrage opportunities over a static portfolio of assets, the expected returns on an asset are roughly linearly related to factor loadings or beta. A financial asset's expected returns can be predicted as a linear function of multiple macroeconomic factors or hypothetical market indexes, with the sensitivity of each element to change being represented by a factor-specific beta coefficient. After being discounted at the implied return of the model, the asset price must coincide with the projected end-of-period price. This rate of return is used to calculate the precise asset price. If the price begins to diverge, arbitrage should bring it back to the mean.

1.1.2. Inflation illusion hypothesis

According to Modigliani and Cohn (1979), the inflation illusion impacts stock market investors but not bond market investors. They contended that these investors fundamentally undervalued stocks in the 1970s due to two critical errors in reasoning: (1) they used nominal interest rates to discount real cash flows; and (2) they failed to account for the capital gain that accrues to equity holders of companies with fixed rate debt liabilities. A study by Modigliani and Cohn (1979) titled the Inflation, Rational Valuation, and the Market discussed this issue. Although the nominal interest rate has increased, the authors contend that it is necessary to calculate the current value of adjusted profits using exactly the same real rate that was in place prior to inflation. Even in times of fluctuating inflation, stock market investors frequently utilize historical nominal growth rates to modify stable expectations for future nominal dividends. But because they don't change the nominal growth rate to correspond with the nominal discount rate, the dividend-price ratio fluctuates with the nominal bond yield. This implies that while inflation is high, stock prices are low, and they could rise when inflation is low. The relationship between the dividend yield and the long-term nominal interest rate and inflation reflects the interaction between rational and irrational investors.

1.1.3. The proxy hypothesis

To explain the inverse relationship between stock prices and inflation, Fama (1965) developed a proxy theory. The inverse relationship exemplifies how inflation undermines real economic output. The levels of US stock prices throughout the decades of strong inflation in the 1970s indicate how poorly shares perform in industrialized nations when inflation is high. Furthermore, Fama (1981) finds a poor link between current high inflation rates and projected rates of real economic growth. He claims that the hypothesis of the negative stock return inflation link is erroneous since inflation and real activity have a negative correlation. In contrast, forecasts for actual economic activity growth and stock return rates are connected. As inflation increases, investors anticipate slower and more erratic economic growth, which calls for a higher risk premium. The "proxy effect" is the term used by Fama and French (1992) to describe the finding that there is a negative correlation between stock returns and inflation. They defined the proxy effect as how future business profits and stock prices are adversely affected by a decline in economic activity. When there is no inflationary impact on real economic activity, the proxy effect, according to Fama, completely vanishes.

Traditional theory used variable interest rates to compare savings and investments. The main factor driving saves and investment, according to economists, is not interest rates. Government taxes, prices, and regulations all have an impact on investment. British economist Keynes thought that the "animal spirits" of entrepreneurs had an impact on investment. Interest rates are crucial for investing and saving, but they do not contain all the information. The interest rate that lenders must take when issuing credit is the real interest rate, which accounts for inflation.

1.1.3.1. Theoretical basis for exchange rates on stock market performance and interest rates on stock market performance

Exchange rates significantly influence the stock market's performance from a variety of perspectives. The Purchasing Power Parity (PPP) theory suggests that exchange rates should eventually correspond with the prices of identical products and services in various countries (Krugman et al., 2015). Absolute purchasing power parity (PPP) occurs when exchange rates equalize the price levels between two countries. On the other hand, relative PPP occurs when changes in exchange rates balance variations in

inflation rates (Dornbusch, 1987). Changes in exchange rates have a direct impact on the competitiveness of a nation's exports and imports. Levich (1985) suggests that a depreciation of the domestic currency can be advantageous for export-oriented businesses as it lowers the price of their goods in international markets. However, it can also result in increased production costs for enterprises that depend on imports, since the price of imported items rises. The impact varies according to the level of dependence that businesses have on both exports and imports (Copeland, 2008).

Exchange rates closely influence the dynamics of inflation and interest rates. A currency that is increasing in value can effectively regulate inflation, which leads to a decrease in interest rates. Consequently, this can enhance the stock market's performance by decreasing borrowing costs and encouraging consumer expenditure and investment (Taylor, 1995). On the other hand, inflation may escalate when a currency experiences a decrease in value. This can lead to high interest rates, which can have a negative effect on stock markets by increasing the cost of financing and decreasing corporate profits (Froot and Thaler, 1990). Exchange rate fluctuations also impact the movement of foreign investments. Currencies that maintain or appreciate in value attract foreign investors seeking to diversify their investment portfolios and generate capital gains. However, a declining currency may discourage foreign investors due to the potential losses from exchange rate fluctuations (Dornbusch, 1980). Changes in exchange rates have a direct impact on the earnings of multinational corporations that denominate their sales and expenses in separate currencies. This, in particular, influences the stock prices of these organizations (Adler and Dumas, 1984). Market sentiment and speculation can cause equities to overvalue or undervalue as a result of short-term exchange rate fluctuations. In general, purchasing power parity (PPP) remains consistent over time, helping to stabilize the impact of fluctuations in currency exchange rates on stock markets (Rogoff, 1996).

Central banks determine interest rates, which have a substantial impact on the performance of the stock market (Cecchetti and Schoenholtz, 2017). They impact the interest rates for both businesses and individuals, influencing borrowing expenses. Decreasing interest rates have the potential to reduce capital expenses, which could increase corporate profits and stock prices by encouraging investment and spending (Ekimova et al., 2017). When interest rates go up, borrowing expenses also increase, leading to limitations on business investments and consumer expenditures. As a result, corporate profits and stock values decrease (Tobin, 1969). Businesses use the discount rate to evaluate their future cash flows, which impacts interest rates. Reduced interest rates have a positive impact on stock prices because they increase the present value of future cash flow. On the other hand, Modigliani and Miller (1958) highlighted that an increase in interest rates reduces value. Interest rates also affect how appealing other investments, like bonds, are. Stocks are more appealing when interest rates are low, while high rates may result in investors turning towards bonds, leading to a decrease in stock prices (Brunnermeier and Pedersen, 2009). Economic conditions frequently require adjustments to interest rates. Lower rates encourage economic growth during downturns, which can lead to higher stock prices, whereas higher rates can potentially signify slower growth and negatively impact stock prices by calming down an overheating economy (Romer and Romer, 2004). Furthermore, the reduction of interest rates can boost the positive impact of appreciating currencies on stock prices (Goodhart, 1989).

2. LITERATURE REVIEW

2.1. Inflation on Stock Market Performance

Between January 1992 and December 2010, Michael (2014) investigated the relationship between inflation and stock market returns on the Ghana Stock Exchange. The analysis discovered a short-term, statistically significant negative link between inflation and stock market returns. This negative association, on the other hand, improves dramatically over time. Because there is a negative short-term association between inflation and stock market returns, stock market value is expected to rise as inflation rises. Mousa et al. (2012) explored the relationship between stock prices and inflation. According to the study's findings, 30% of the companies studied had a marginally favorable link between stock price movements and inflation, whereas 70% of the companies studied have a negative correlation with inflation. In their 2013 study, Haruna, Yazidu, and Paul examined Ghana's macroeconomic factors and stock market performance. From January 1995 to December 2010, monthly time series data were used for the analysis. The study looked at the long- and short-term correlations between stock performance and macroeconomic conditions using the Vector Error Correction Model (VECM). The study found, among other things, that stock returns and inflation have a significant long-term and short-term link. Kuwornu and Victor (2011), using the consumer price index and stock market returns as proxies for Ghana's inflation rate from 1992 to 2008, came to similar conclusions.

In five Southeast Asian nations, including Malaysia, Wongbampo and Sharma (2002) examined the correlation between stock market prices and macroeconomic factors including inflation. The study found that the relationship between stock prices and inflation was negative in each of the five Southeast Asian countries it examined. While Geetha et al. (2011) looked into how inflation affected the stock markets in China, Malaysia, and the United States. The researchers used monthly time series data from January 2000 to November 2009 as secondary data. The analysis revealed no short-term association for Malaysia or the US, but one for China, between predicted or unexpected inflation and stock gains. In 2012, Daferighe and Charlie It was investigated how the performance of the Nigerian stock market was impacted by inflation using time series data covering 20 years, from 1991 to 2010. To ascertain how inflation affects various stock market performance criteria, regression data analysis was employed. It was discovered that while there is a negative correlation between inflation and stock market performance measures, there is a positive correlation between inflation and the turnover ratio. Research was done on the impact that inflation rate has on stock returns in the Nigeria stock market by Uwubanmwen and Eghosa (2015). The study also aimed to determine whether stock returns on the Nigerian stock market were affected by the rate of inflation and whether stock returns could be precisely predicted using stock prices. The

findings indicated that inflation has a negligible but weak effect on stock return.

Eldomiaty et al. (2019), who conducted their research more recently, looked into how inflation and interest rates affected stock values. Stock prices and inflation rates have an inverse relationship, according to an examination of quarterly data using the tests for Granger causality, linearity, normalcy, Johansen cointegration, cointegration regression, and vector error correction model. When Chakravarty and Mitra (2013) employed alternative vector auto regression (VAR) to examine monthly data on the wholesale pricing index, they came to the same conclusions. In India, they discovered an inverse relationship between inflation and stock prices. Saleem et al. (2013) reached the same finding through the use of the Granger causality test, showing a consistent inverse correlation between inflation and stock prices.

2.2. Exchange Rate on Stock Market Performance

In order to assess the relationship between the exchange rate and stock prices of 12 emerging market nations from May 1994 to April 2010, Cakan and Ejara (2013) employed linear and non-linear Granger causality tests. They discovered that as a nation's local currency depreciates, exporting goods becomes much more economical. This can increase demand and sales abroad, which can raise stock values. Using data spanning the years 2000 to 2013, Barnor (2014) investigated how macroeconomic conditions affected stock returns. In contrast, interest rates and the total quantity of money in circulation had a negative impact on stock returns while favorably affecting share prices and the exchange rate, respectively, according to his research. Inflation had no discernible impact on stock returns.

Younas et al. (2013) examined how exchange rates impact the Pakistani stock market and found an inverse relationship between stock prices and exchange rates. This study demonstrated that, in addition to having an effect on international organizations' returns, the exchange rate also has an effect on those of domestic firms. Multinational firms see a significant shift in the value of their foreign operations due to exchange rates, which may reduce profitability and have a negative effect on the stock price. While domestic businesses that rely significantly on imports would experience a downturn in stock values as a result of their currency's devaluation, which raises the cost of their inputs and reduces their profitability.

Using the daily closing index from October 2007 to March 2009, Agrawal et al. (2010) evaluated the correlation between Nifty returns and the Indian rupee-US dollar exchange rate. The returns on the Nifty index and the exchange rate were negatively correlated over the study period. In order to determine the degree of correlation between the two variables in the Indian stock market, Najaf & Najaf (2016) also applied the Granger causality test. The goal of the study was to determine whether or not a company's profitability is significantly impacted by the value of an exchange rate. The findings demonstrated that changes in exchange rates have a detrimental influence on stock values. Jamil and Ullah (2013) used the Co-integration Technique and the Vector Error Correction Model (VECM) to examine how foreign exchange rates impacted Pakistani stock prices. They discovered that exchange rates and stock market returns had a short- and long-term link using monthly data from 1998 to 2009. While the long-term association is not substantial, the short-term period was discovered to have a positive but significant relationship. Moreover, during this period, Pakistan's exchange rate policies, which included interventions by the central bank to stabilize the currency, could have resulted in short-term volatility that influenced stock prices. In the long term, such interventions may have been successful in stabilizing the currency, thereby reducing its influence on stock market performance.

Aurangzeb (2012) reached the same conclusion after examining the variables influencing the performance of the stock markets in South Asian nations using monthly data for Pakistan, India, and Sri Lanka from 1997 to 2010. For the analysis, a descriptive statistical method was used in the study. The findings showed that exchange rates considerably enhance stock market performance in the three South Asian markets. Adarmola (2012) used quarterly data for the years 1985-2009 to use Johansen's Cointegration Technique and error correcting procedures to her investigation on the relationship between exchange rate volatility and stock market activity in Nigeria. Exchange rates significantly impact Nigerian stock market performance in the short term, but have a negative long-term relationship, indicating a significant impact on the market as per the results.

2.3. Interest Rate on Stock Market Performance

The link between stock prices and interest rates has gotten a lot of attention in the literature, though with various degrees of success. Using the VECM model and annual time series data for the years 1985-2008, Onasanya and Ayoola (2012) discovered that the stock market return is not significantly influenced by stock market macroeconomic variables. Interest rates were explicitly found to be unimportant and inversely linked with stock market performance in Nigeria.

The variable is not significant for the Ghanaian stock market, according to Owusu-Nantwi and Kuwornu's (2011) study of the correlation between interest rates and stock market returns. The results might have been influenced by the limitations of the specific period and data set employed. The relationship between interest rate, as determined by the rate on the 91-Treasury bill, and stock market return was discovered to be negative when the authors used monthly data from 1992 to 2008. The study's conclusions, however, agreed with several other studies it was reviewing. Uddin and Alam examine both the linear relationship between changes in interest rates and share prices in their 2007 study. They found that Interest Rate and Share Price always have a significant negative relationship, as does the relationship between changes in Interest Rate and Share Price changes.

The impact of macroeconomic indicators on the CNX bankex return in the Indian stock market was studied by Subburayan and Srinivasan in 2014. They discovered that interest rates significantly boost bank stock returns. Additionally, they discovered that there is no connection between the interest rate and the CNX Bankex. In contrast, Mutuku and Ng'eny (2015) investigated the dynamic

relationship between Kenyan stock prices and macroeconomic variables. In addition, they applied a vector error correction model. The stock price and the rate on Treasury bills were found to be positively correlated. Khrawish et al. (2010) looked at the interest rate and market capitalization rate for Jordan's Amman Stock Exchange. Both factors have a bearing on the nation's economy. The results of the study contradicted the notion that interest rates and market capitalization rates are negatively connected by demonstrating a strong positive association. Waqar and Khan (2017) conducted an empirical analysis of the association between macroeconomic indicators and the stock market using annual series data from 1991 to 2017. The preferred long run ARDL model demonstrates that while inflation and exchange rates have a positive impact on the stock market, with inflation being highly significant and exchange rates being insignificant, respectively, interest rates have a negative impact on the stock market and its estimate coefficient is statistically highly significant.

Ndlovu et al. (2018) used quarterly stock price data for the Johannesburg Stock Exchange in South Africa from the years 1981Q1 to 2016Q4 to analyze the correlations between the macroeconomic variables inflation, money supply growth, interest rates, and the USD ZAR exchange rate. They discovered that while inflation, money supply, and interest rates all have positive connections with these variables over time, the exchange rate has a negative link with share price over time. In contrast, Khumalo (2013) examined the relationship between inflation and stock prices in South Africa from 1980 to 2010. The findings indicate that inflation has a considerable and detrimental effect on South African stock values. However, Alagidede and Panagiotidis (2010) found evidence of a long-term, favourably correlated relationship between inflation and stock prices. Eita (2012), which used the vector auto regression (VAR) method and found a significant and positive association between South Africa's stock market returns and inflation, provided support for this. Additionally, according to Eita (2012), there is a positive link between the two variables, demonstrating that South African shares serve as a hedge against inflation.

Banda et al. (2019) looked into the relationships between macroeconomic factors (total economic production, inflation, interest rates, and exchange rates) and industrial shares in emerging economies. The Industrial Index (INDI 25) on the Johannesburg Stock Exchange (JSE) was examined using data from 1995 to 2017. The results show a significant positive relationship between inflation and stock prices. It was discovered that there was a bad correlation between interest rates and stock prices, though. Industrial shares were influenced favorably by exchange rates during that time. The relationship between stock returns and interest rates in South Africa from 1995 to 2019 was examined by Godfrey (2020) using OLS and GARCH, and he found a substantial positive association between the two. Additionally, a negative and strong correlation between exchange rates and stock market price returns was found by the results. The study also found a strong and positive correlation between interest rates and stock return volatility.

Milambo et al. (2013) employed the GARCH model to investigate the relationship between exchange rate volatility and the South African stock market. Fluctuations in foreign project funding value significantly impact the South African stock market. While currency and stock market volatility are not strongly linked, macroeconomic factors like mining output, interest rates, money supply, and US interest rates significantly influence the financial system.

3. DATA AND METHODS

3.1. Data Source

This study looks into the relationships between the JSE All Share Index, which represents South Africa's stock market, and interest rates, exchange rates, as well as inflation. The analysis utilizes quarterly data from 2010 to 2022, comprising 48 observations. This dataset incorporates significant economic events like the post-2008 financial crisis recovery and the impacts of COVID-19. The selected time period is intended to comprehensively assess the effects of these macroeconomic factors on the stock market. The study employed the ARDL model, which is specifically appropriate for assessing time series data that includes variables with potentially varying levels of integration. This enables the estimation of both short and long term links between the variables. Furthermore, Granger causality tests are employed to determine the causal relationship's direction, thereby revealing potential signs that anticipate the effect. The EViews software offers the essential tools for performing reliable econometric analysis. The discoveries will provide valuable perspectives for investors and policymakers in the South African economy.

3.2. Description of Variables

3.2.1. Inflation

Inflation is described as the rate of general price growth (Bleaney and Fielding. 2002). Inflation may also be caused by cost-push inflation or demand-pull inflation, according to Sloman and Kevin (2007). Inflation is measured in term of GDP deflator.

3.2.2. Interest rates

In an economy, there are many different types of interest rates, such as short-term and long-term interest rates (Ali, 2014). For this study, we are using the long-term interest rate. Investors may experience issues with any change in the interest rate. If the nominal interest rate is lower than the inflation rate, there is a negative real interest rate (Gagnon and Ihrig, 2004).

3.2.3. Exchange rate

Exchange rate is the rate at which one currency can be converted into another currency (Ahmad et al. 2010). A rapid change in exchange rate can affect the profitability and returns of the business.

3.3. Data Analysis

3.3.1. Model specification [ARDL]

An autoregressive distributed lag (ARDL) model is an ordinary least square (OLS) based model which is applicable for both non-stationary time series as well as for times series with mixed order of integration. The level of significance is selected at 5%. For this investigation, the ARDL methodology was used. The method employs the ordinary least squares (OLS) method for cointegration

of variables and is suitable for simultaneously generating short-run and long-run elasticities for a small sample size (Duasa, 2007). The order of the variables' integration is flexible with ARDL. The operation of this model is explained in the following.

$$smp_t = \beta_0 + \beta_1 infl_t + \beta_2\, int_t + \beta_3\, exch_t + \varepsilon$$

Smp = stock market performance determined by share index price
Infl = Inflation, determined by consumer price index
Int = Interest Rates, determined by prime overdraft
Exch = Exchange rate, Rand against US Dollar
β_0 = Constant variable
ε = All the variables or error terms that have an impact on the dependent variable but were excluded from the model because they were either unknown or difficult to measure

The dependent variable is the stock market price index. Independent variable exchange rate that is measured by the government through the South African reserve bank. The rate is set against the US dollar because the US Dollar is the most traded transaction across the country that is denominated in dollars due to its stable value. The interest rate that will be used in this study is prime overdraft. Inflation is another explanatory variable that will be used in this study, and it is measured by the consumer price index.

To ascertain the connection between South Africa's stock market performance and inflation, exchange rate, and interest rate, we conducted several econometric tests. Among the diagnostic tests performed were the Augmented Dickey Fuller (ADF)-based unit root test, heteroscedasticity, multicollinearity, and normality test.

3.3.2. Unit root test

When generating relevant findings for time series analysis, stationary data is essential since it improves the reliability and accuracy of the established models. If the time series data are in fact non-stationary, regression parameters cannot be used, or if they are, the results may not be accurate. For research purposes, data that is more stable is preferable because it reduces the possibility of inaccurate regression. One of the most widely used techniques for determining whether the data are stationary is the unit root test. This paper uses ADF instead of the various unit root tests that can be used to determine whether the data is stationary (Chauque and Rayappan, 2018)

3.3.3. Granger causality test

To establish a link between two variables and determine if one time series data is significant in predicting each other, The test's objective is to determine whether historical data from one variable can be used to predict future changes in a different variable. Granger Causality Test can be used to determine how changes in stock prices and economic conditions interact, Granger (1969). The short-term connection between the dependent and independent variables is assessed using the Granger causality test. Unidirectional and bidirectional causality between variables are the test's two results.

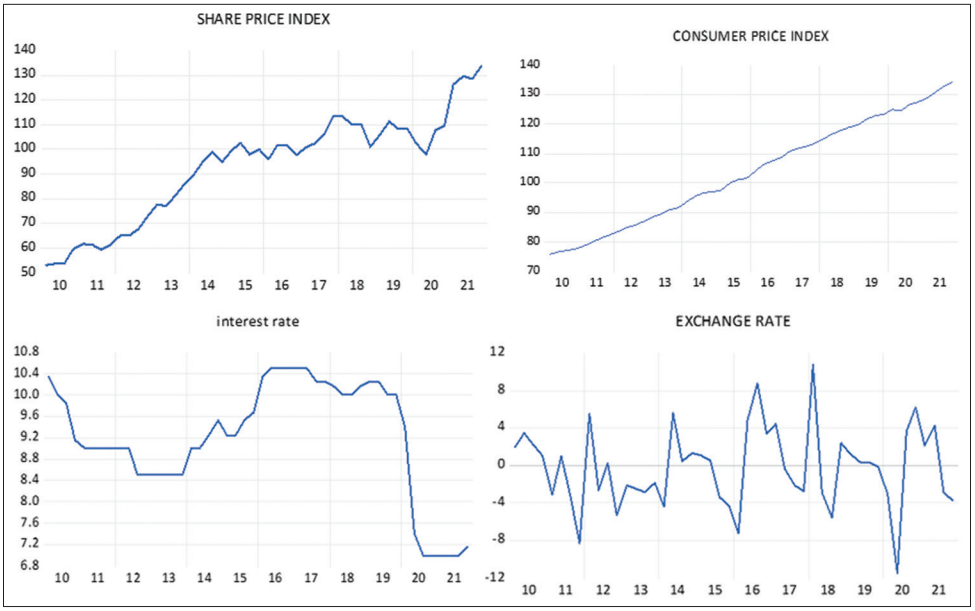
4. FINDINGS AND DISCUSSION

4.1. Descriptive Analysis

Descriptive statistics were used to condense the data and provide insights into the data's pattern and trend. In the study, descriptive statistics techniques such as range, sum, mean and standard deviations, and skewness were used. Table 1 below demonstrates that the share price index has a positive mean value of 92.928, a maximum value of 133.49, and a minimum value of 53.141.

Results shown above demonstrates that the performance of the share price index is typically in the positive range. Furthermore, the variable has a normal distribution. The average exchange rate is −0.197, with minimum and maximum values of −11.523

Figure 1: Informal unit root



Source: author's own computation

and 10.796 respectively. This in a way suggests that for the study period, the rand dollar exchange rate fluctuates between these two values. Additionally, the variable has a normal distribution. The maximum values of the inflation and interest rate means are positive at 103.65 and 9.206, respectively. Furthermore, the variables have a normal distribution.

Figure 1 indicates fluctuations above and below the mean, indicating that both the mean and variance have remained consistent over time for Share price index, Inflation, Interest rate and Exchange rate. The use of non-stationary data in analysis could produce misleading or inaccurate results.

Table 2 below outlines the empirical findings of the unit root test that was used to establish the order of integration for time series data.

Table 1: Descriptive analysis

Statistic	Share price index	Inflation	Interest rate	Exchange rate
Mean	92.92867	103.6467	9.206458	−0.196571
Median	99.22089	102.7343	9.250000	0.303764
Maximum	133.4909	134.3085	10.50000	10.79575
Minimum	53.14110	75.84112	7.000000	−11.52335
Std Deviation	21.77111	17.88975	1.093078	4.326731
Skewness	−0.352711	0.025376	−0.780619	0.035520
Kurtosis	2.203262	1.715411	2.644741	3.284079
Jarque-Bera	2.264822	3.305489	5.127347	0.171496
Probability	0.322255	0.119152	0.077021	0.917826
sum	4460.576	4975.042	441.9100	−9.435419
Observations	48	48	48	48

Source: author's own computation

Std. DevQ=StandardQDeviationQ

Table 2: QUnitQRootQTest

Variable	Level		1st difference	
Model specification	T-statistic	p-value	t-statistic	p-value
Share price index				
Intercept	−0.662311	0.8461	−6.605648	0.0000
Trend and intercept	−1.974134	0.5999	−6.528985	0.0000
None	2.382787	0.9952	−5.841581	0.0000
Consumer price index				
Intercept	1.105026	0.9970	−6.785396	0.0000
Trend and intercept	−3.350691	0.0707	−6.874741	0.0000
None	14.34793	1.0000	0.125118	0.7169
Exchange rate				
Intercept	0.3108	0.4737	−9.970776	0.0000
Trend and intercept	0.3157	0.4734	−9.856735	0.0000
None	2.3118	0.4563	−10.07412	0.0000
Interest rate				
Intercept	−1.399405	0.5745	−4.507103	0.007
Trend and intercept	−1.469140	0.8259	−4.50880	0.0040
None	−0.810633	0.3594	−4.491.53	0.0000

Source: author's own computation

At level and first difference, the Augmented Dicky Fuller (ADF) Test has been used. Additionally, the findings indicate exchange rate, interest rate, consumer price index, share price index, are all stationary at the first difference. The next step is to estimate the VAR lag length criteria in order to select the ideal lag length after verifying the order of integration.

4.2. Lag Length Criterion

Table 3 shows the optimal lag results. To determine the optimal lag, we use the Akaike information (AIC) criterion. In comparison to the Hannan-Quinn information criterion (HQ) and the SBC, the AIC produces reliable and effective results (Schwarz information criterion). According to the findings in Table 2, there are three optimal lags for quarterly data series in this study.

4.3. ARDL Bound Test

The presence of a long-run relationship between inflation, exchange rate and exchange rate and the share price index in is tested by employing the ARDL bounds testing approach. Table 4 presents results of the cointegration for bound test. The Akaike information criterion (AIC) is employed to determine the optimal lag length for the model. The null hypothesis of no co-integration is not rejected because the calculated f-statistic of (3.046764) is lower than the significance level. This indicates that there is no long run relationship between the variables. Because there is no long run relationship the short run relationship is estimated using ARDL.

4.3.1. Granger causality

To determine the causal relationship between the independent variables and the share price index, the Granger causality test is used. According to Ali (2014), if variables have a causal relationship, they can be used to forecast changes in each other. The granger causality test results are shown in Table 5. This test's hypotheses would be:

Null hypothesis: A does not cause granger to B.

Alternative hypothesis: A does granger cause B.

As a result, if the P-value is less than the 5% level of significance, the null hypothesis of no causality is rejected, and we accept the alternative hypothesis. Furthermore, based on the data in Table 5, the hypothesis of no causality between variables is accepted.

4.4. ARDL short run

Table 6 displays the short-term association between the dependent variable and the independent variables. The dependent variable (market performance)'s variance could be accounted for by all the factors with a model's R square of 0.965119, or approximately

Table 3: QLagQLengthQCriteriaQ

Lags	LogL	LR	FPE	AIC	SBC	HQ
0	−529.1840	NA	39.40207	24.23564	24.39783	24.29579
1	−288.7929	426.1479	14.70922	14.03604	14.84703* 15.79077	14.33680*
2	−279.2816	15.13149	20.14360	14.33098	16.03522	14.87234
3	−254.3859	35.08030* 9.231169	14.12216* 22.86807	13.92663* 14.31201	17.06940	14.70860
4	−246.8642					15.33458

Source: author's own computation

*denotes the lag order chosen by the criterion

96.5% of the variance. Additionally, the model has the best fit with an adjusted R-square of 0.958520. The probability of 0.000 indicates the significance of the entire model. Through the Akaike Info criterion (AIC), model lags are chosen. The model is serial correlation-free according to the model's Durbin-Watson value of 2.061346.

The short-run result implies that there is no relationship, and the short-run relationship is as follows: Share price index and short-term interest rates exhibit a substantial inverse relationship (r = −1.435, t-stats = −2.355, P = 0.02390.05). Although there is a positive short-run association between the exchange rate and the share price index (= 0.281, t-stats = 1.936, P = 0.0605>0.05), it is not statistically significant. Despite being positive at (=1.766, t-stats = 1.544, P = 0.1313>0.05), the influence of the consumer price index on the share price index is not statistically significant. The implication is that interest rates, currency rates, and inflation rates have an impact on how well the stock market performs. However, interest rates exhibit a considerable significance in this case. The results of studies by Mousa et al. (2012), Owusu-Nantwi and Kumowi (2011), and Banda et al. (2019) support this.

For the Share price index itself, the lagged period positively influences the current period. Based on Wald test Share price index lag 1 can influence itself. Interest rate is negatively related to share price index in the short run, and it is significant (P = 0.0239 < 0.005). The exchange rate is positively related to share price index in the short run, but it is not significant (P = 0.0605>0.05). The consumer price index at level and lag 2 has a positive influence on the share price index but in the current period, it is not significant. And the consumer price index at lag 1 and 3 has a negative influence on the share price index in the short run and its influence is significant.

Table 4: ARDL Bound testing for cointegration

Test statistics	Value	Optimal lag length	Significance	I (0)	I (1)
F-statistics	3.046764	(1.0.0.3)	10%	2.72	3.77
K	3		5%	3.23	4.35
			2.5%	3.69	4.89
			1%	4.29	5.610

Source: Author's own computation

4.4.1. Post-tests/diagnostic tests

Serial Correlation: This is a measure of how similar a particular time series is to a lag version of itself over time intervals. The absence of autocorrelation in the model is the null hypothesis for autocorrelation. The model contains autocorrelation, according to the alternative autocorrelation hypothesis. To determine whether there is serial correlation in the residual, the Breusch-Godfrey test is performed. Its usage in this context is primarily justified by its ability to produce strong results and take into account higher order serial correlation (Ogujiuba and Mngometulu, 2022).

Table 7 shows that the Durbin Watson stat of the model is between 1.5 and 2.0 implying that there is no serial correlation.

4.4.1.1. Heteroskedasticity

This is a breach of the linear regression modelling assumptions, and it may compromise the reliability of the economic study. The absence of heteroscedasticity in the model is the null hypothesis for this phenomenon. The alternative theory is that the model contains heteroscedasticity.

The results of the White Test for Heteroskedasticity are presented in Table 8. The residuals are homoscedastic, and the F-statistics value of 0.717936 with 52% probability clearly shows that the data is not heteroskedastic.

4.4.2. Normality test

The likelihood that a random variable underlying a data collection is regularly distributed is computed using normality tests, which are used to determine if a data set is well-modelled by a normal distribution. The assumption of normalcy is that residuals are distributed normally. The normalcy test is illustrated graphically in Figure 2. At the Jarque-Bera value of 1.1778599, which is larger than 5% level of confidence, the probability value is approximately 41%, which is high. The Jarque-Bera test for the current analysis demonstrates that the residuals are regularly distributed.

4.4.2.1. Multicollinearity

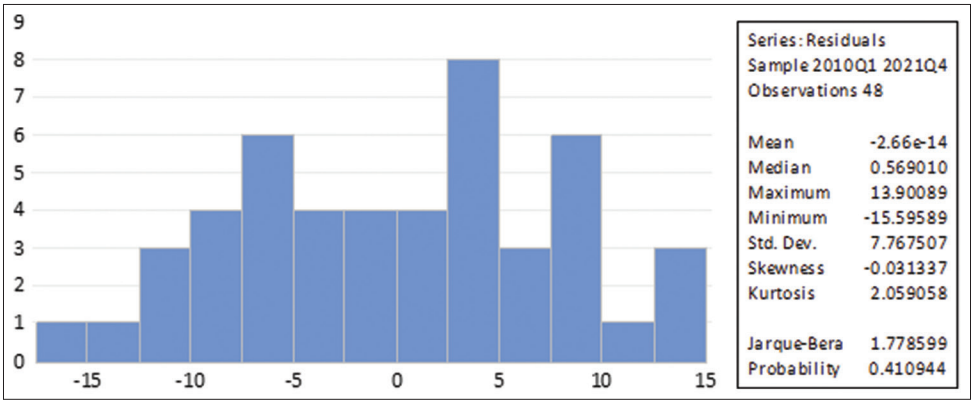
According to Daoud (2017) multicollinearity is a statistical phenomenon in which there is strong correlation between two or more predictor variables in a multiple regression model. They are referred to as orthogonal if there is no linear link between the predictor variables. The presence of high intercorrelations between two or more independent variables in a multiple regression

Table 5: Granger causality

NullQhypothesisQ	Obs.	F-statistics	Prob.	Conclusion
INTERESTQRATEQdoesQnotQGrangerQSHAREQPRICEQINDEX	45	2.6742	0.0609	No Causality
SHAREQPRICEQINDEXQdoesQnotQGrangerQINTERESTQRATEQ		0.7181	0.5474	No causality
EXCHANGEQRATEQdoesQnotQGrangerQSHAREQPRICEQINDEX		1.5612	0.2147	No causality
SHAREQPRICEQINDEXQdoesQnotQGrangerQEXCHANGEQRATE		1.6602	0.1918	No causality
CONSUMERQPRICEQINDEXQdoesQnotQGrangerQSHAREQPRICEQINDEXQ	45	2.0628	0.1214	No causality
SHAREQPRICEQINDEXQdoesQnotQGrangerQCONSUMERQPRICEQINDEXQ		1.8773	0.1499	No causality
EXCHANGEQRATEQdoesQnotQGrangerQINTERESTQRATEQ		0.3204	0.8106	No causality
INTERESTQRATEQdoesQnotQGrangerQEXCHANGEQRATEQ		0.7585	0.5243	No causality
CONSUMERQPRICEQINDEXQdoesQnotQGrangerQINTERESTQRATEQ	45	1.3145	0.2838	No causality
INTERESTQRATEQdoesQnotQGrangerQCONSUMERQPRICEQINDEX		2.6545	0.0623	No causality
CONSUMERQPRICEQINDEXQdoesQnotQGrangerQEXCHANGEQRATE		0.4572	0.7138	No causality
EXCHANGEQRATEQdoesQnotQGrangerQCONSUMERQPRICEQINDEXQ		0.1166	0.9498	No causality

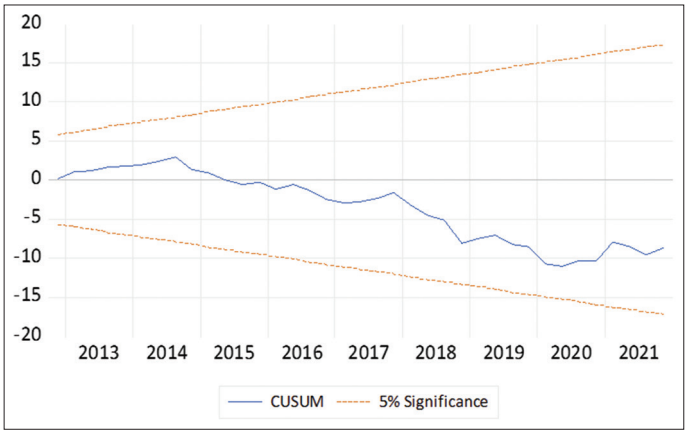
Source: Author's own computation

Figure 2: Normality Test



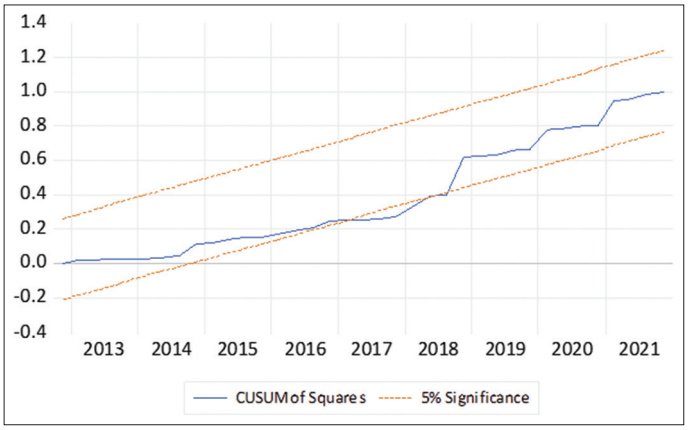
Source: author's own computation

Figure 3: Cusum test



Source: author's own computation

Figure 4: Cusum of square test



Source: author's own computation

model. Asteriou (2021) asserts that when there is imperfect multicollinearity between two or more explanatory variables, we can not only derive OLS estimates but also the best linear unbiased estimators (BLUE). The null hypothesis of multicollinearity is that is no multicollinearity in the model The alternative hypothesis is that there is multicollinearity in the model.

Table 9 shows the results of multicollinearity using the Variance Inflation Factor (VIF). The results show that there is no severe multicollinearity because the values of the Centered VIF are < 10.

Table 6: ARDL results

Variable	Coefficient	t-statistics	P-values
Share price index (−1)	0.883427	9.545267	0.0000
Interest rate	−1.435065	−2.354921	0.0239
Exchange rate	0.280982	1.936649	0.0605
Consumer price index	1.766438	1.543608	0.1312
Consumer price index (−1)	−3.242852	−2.244868	0.0308
Consumer price index (−2)	3.119137	2.114687	0.0413
Consumer price index (−3)	−1.552863	−1.390231	0.1728
C	14.40186	1.730323	0.0919
R-squared		0.965119	
Adjusted R-square		0.958520	
Durbin Watson		2.061346	
Prob.		0.0000	

Source: author's own computation

Table 7: Serial correlation

F-statistic	Durbin Watson statistic
34.8670	1.6751

Source: Author's EViews computation

Table 8: Heteroskedasticity

F-statistic=0.717936	Prob.F (3.44)=0.5466
R-square=2.239962	Prob. Chi-square=0.5241

Source: author's own computation

Table 9: Multicollinearity

Variable	Centered VIF values	Conclusion
InterestQrateQ	1.079107	No multicollinearity
ExchangeQrateQQ	1.036916	
ConsumerQpriceQindexQ	1.055130	
ConstantQ	NA	

Source: authors own computation

4.4.3. Stability test

H0: Parameters are not constant overtime
H1: Parameters are constant over time.

Figure 3 and 4 shows that the Cusum test lines lie within the 5% significance but the cusum of squares lines does not lie between the % significance level which indicates that the model is not stable. By accepting the null hypothesis of parameters are not constant overtime.

The effect of inflation, exchange rate, and interest rate on stock market performance in South Africa during the first quarter of 2010 to the last quarter of 2021 was examined using time series data. The study used Augmented Dicky Fuller to test for stationarity. Results showed that all the variables are stationary at 1st difference. The lag length used to select the lag that was most appropriate lag based on the lag length criterion. According to the co-integration test results from the bound test to determine the long run relationship between inflation, exchange rate, interest rate, and stock market it was established that here is no long run.

This study investigated the complex link between inflation, exchange rates, interest rates, and stock market performance in South Africa from the first quarter of 2010 to the fourth quarter of 2021. The use of reliable econometric techniques provides an in-depth understanding of the influence of various macroeconomic variables on the JSE All Share Price Index. The ARDL bounds testing method showed an important result: there is no long-term link between inflation, exchange rates, interest rates, and the stock market index. This suggests that although short-term changes in these factors can influence stock prices, these impacts fade away over long periods of time. The research conducted by Antonakakis et al. (2016) and Ahmed et al. (2015) supports this conclusion, indicating a positive relationship between inflation and the stock market index within a specific timeframe. Stocks are negatively impacted by higher inflation since it results in an overall decline in consumer expenditure during inflationary periods.

Additionally, unexpected findings from the Granger causality tests showed that there was no causal relationship among inflation, exchange rates, interest rates, or the share price index. This means that fluctuations in these macroeconomic indicators do not consistently predict fluctuations in South Africa's stock market performance. This discovery questions traditional beliefs and highlights the intricate nature of financial markets, showing how sentiment, investor actions, and external events can have significant impacts in addition to economic basics. In the temporary period, the research found a notable inverse correlation between interest rates and the share price index. This indicates that increased interest rates have a dampening effect on stock market returns, possibly because it leads to higher borrowing expenses and diminishes reasons to invest. However, the short-term relationship between exchange rates and the share price index was not statistically significant, indicating minimal immediate influence on stock market performance. Morley (2009), Richards et al. (2007) and Umoru and Asekome (2013) all conduct research that supports this finding, suggesting that a positive exchange rate will boost actual stock prices in the near future.

5. CONCLUSION

The study's goal was to determine the impact of inflation, interest rates, and exchange rates on stock market performance at the Johannesburg stock exchange over an 11-year period, from 2010 to 2021. The study found that these economic factors had a temporary impact on the stock market without any lasting consequences. Surprisingly, short-term interest rates have a significant negative effect on stock values. The study's conclusions are specific to South Africa and only apply to the period under investigation. Further research using various approaches may be required to confirm these findings in different contexts. Moreover, the study only examined past data and did not investigate the potential impact of significant events, such as the global financial crisis or pandemics, on the correlation between these factors. Additionally, there is potential for future investigation to go further into the remaining 3.5% of stock market movements that are unaccounted for by the economic factors analyzed in this paper. These could potentially cover non-economic factors.

According to the study's results, it is recommended for investors to diversify their portfolios in order to reduce the risks linked to short-term changes in the economy. Policymakers ought to aim for consistent inflation and exchange rates to create a suitable atmosphere for the stock market. This study highlights an essential fact that the complexity of the South African stock market. However, depending solely on economic variables is not enough to make accurate forecasts. Investor sentiment, larger market trends, and external influences are all crucial factors. Despite the complex dynamics of the situation, investors should take into consideration these wider aspects while making investing decisions. Similarly, officials should closely observe market mindset, geopolitical developments, and global economic trends in order to comprehend potential effects on stock prices. Future research should investigate non-economic elements such as laws, technical improvements, and globalization to get a more thorough knowledge of the Johannesburg Stock Exchange. By recognizing the limitations of this study and including a more comprehensive viewpoint, these results offer significant perspectives for investors and policymakers navigating the complexities of the South African stock market.

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