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ASYMMETRIC IMPACT OF INTEREST RATES ON STOCK MARKET RETURNS: EMPIRICAL EVIDENCE FROM SOUTH AFRICA

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Abstract:

This study explores the relationship between interest rates and stock market returns in South Africa from 2000Q1 to 2023Q3, utilizing the non-linear autoregressive distributed lag (NARDL) model. It incorporates variables such as stock price volatility, market capitalization, exchange rate risk, and inflation to control for potential confounding factors. The findings indicate a significant asymmetric impact of interest rates on stock market returns in South Africa. Specifically, a negative change in interest rates has a more pronounced effect on stock market returns than a positive change. This asymmetry underscores the sensitivity of the South African stock market to shifts in monetary policy. The study reveals a strong long-term relationship between negative stock price volatility and stock market returns, but not in the short run. Positive market capitalization has a smaller impact on stock market returns, while lagged negative market capitalization exerts a stronger effect. Exchange rate risk significantly influences returns in the long run, while negative inflation shocks have a more pronounced short-term impact. This finding has important implications for investors and policymakers seeking to understand the relationship between interest rates and stock market performance in South Africa. Therefore, investors and policymakers should closely monitor changes in monetary policy to anticipate potential impacts on the stock market.

Key words: *Interest rates, Stock market returns, NARDL*

1. Introduction

Emerging economies, such as South Africa, have faced significant fluctuations in interest rates and stock returns in recent years. These changes have heightened interest in understanding the relationship between interest rates and stock returns within the country. The stock market has gained importance over time, becoming a central focus of the financial sector due to its crucial role in mobilizing capital and resources into productive sectors (AL-Naif, 2017). Through investing in the stock market, individuals can gain financial gain and participate in the growth and success of companies. In addition, the stock market reflects investors' and businesses' confidence and performance as a barometer of economic health. Consequently, fluctuations in the stock market can have ripple effects across various sectors of the economy, making it essential for policymakers

and analysts to closely monitor its movements. According to World Bank data (2023), South African stock market returns have been performing poorly in recent years, raising concerns about the country's overall economic stability and growth prospects. The COVID-19 pandemic recently led to substantial capital outflows from South African stocks, driven by increased uncertainty and market volatility. This has resulted in diminished investor confidence and a lack of stability in the South African market, placing significant pressure on the economy.

South Africa has experienced a significant decline in its macroeconomic fundamentals since gaining independence. Ali (2014) asserts that higher interest rates make the stock market less efficient. This is because when investors can earn greater returns from bonds and Treasury bills, they are less likely to invest in stocks. Therefore, interest rates and stock market performance are negatively correlated. Additionally, interest rate fluctuations affect corporations' capital costs, which impact their expected cash flows and stock prices (Jammazi et al., 2017). Further, interest rate fluctuations may cause investment portfolios to be rebalanced, which can affect stock prices.

Numerous studies have explored the relationship between interest rates and stock returns, with some suggesting a symmetric impact (see Vaz et al., 2008). However, other research has indicated a weak or nonexistent relationship. For instance, Muthukumaran and Somasundaram (2014) found no short-run causality between interest rates and stock returns, concluding that interest rates do not affect stock returns in India. Similarly, Khan et al. (2012) reported a weak connection between stock performance and interest rates in Kenya. Conversely, some studies have identified an inverse effect. For example, Komba et al. (2024) utilized autoregressive distributed lag (ARDL) analysis and discovered an inverse relationship between interest rates and stock returns in the financial sector. Kganyago and Gumbo (2015) applied an OLS regression model, revealing a significant and substantial inverse relationship between money market interest rates and stock market performance. In South Africa, Mapfumo (2022) employed the Vector Auto Regression (VAR) model and found a negative correlation between interest rates and the equity market. On the other hand, Msindo (2015) also used the VAR model and concluded that the selected variables did not significantly influence the FTSE/JSE All Share Index returns. Most of these studies assumed a linear relationship between interest rates and stock market performance. Therefore, we argue that a more comprehensive analysis that incorporates non-linear relationships and other macroeconomic factors is necessary to fully understand the dynamics between interest rates and stock market performance in South Africa. Exploring non-linear relationships, such as those identified by NARDL, could provide a more accurate and nuanced understanding of this relationship. Considering both the positive and negative effects of interest rate changes, as well as the influence of other macroeconomic factors like inflation and exchange rate, will enhance our understanding of how these variables interact in South Africa. To better understand the complex impact of interest rates on stock market performance, researchers should conduct a more comprehensive analysis that goes beyond simple linear regressions. As a result of this holistic approach, investors and policymakers will be able to make more informed decisions.

Our study aims to address the gaps left by previous research by using the NARDL approach to explore the potential non-linear relationship between interest rates and stock market returns in South Africa. By incorporating lagged variables and examining potential asymmetries, we provide a more accurate depiction of how interest rates affect stock market returns in the country. The results indicate that interest rates have an asymmetric impact on stock returns, meaning that the effect of a change in interest rates differs depending on whether rates are increasing or decreasing. This finding challenges the idea that interest rates uniformly influence stock market performance and underscores the need for further investigation into the specific factors driving this asymmetry. Additionally, understanding this relationship is essential for investors and policymakers to make informed decisions and manage risks in the South African stock market.

Following the introduction, Section 2 reviews the literature, Section 3 describes the research methodology, Section 4 presents the results, Section 5 discusses the results, Section 6 concludes the study, and Section 7 offers policy recommendations.

2. Literature review

2.1 Theoretical Review

According to Fama's (1970) Efficient Market Hypothesis (EMH), financial markets price assets efficiently by incorporating all available information. The EMH posits that it is not possible to consistently achieve above-average returns through aggressive trading or market timing strategies. This idea has sparked extensive debate, leading to the development of various forms of market efficiency: weak, semi-strong, and strong. The weak version of market efficiency suggests that asset prices reflect all historical data, making it challenging to predict future price movements based solely on past performance (Fama, 1970). Building on this, the semi-strong version asserts that asset prices already include all publicly available information, preventing investors from gaining an advantage through news or fundamental research (Fama, 1970). Finally, the strong version of efficiency claims that asset prices instantaneously and accurately reflect even insider or private information, meaning no investor can consistently outperform the market (Fama, 1970). Despite critiques highlighting its disregard for human behavior and irrationality, the EMH remains a crucial framework f or understanding financial asset pricing. Critics argue that biases and emotions can lead to above-average profits and market inefficiencies. However, proponents of EMH believe that these inefficiencies will eventually be corrected by rational investors. They advocate a passive investing approach that prioritizes diversification and risk management. In the context of South Africa's volatile stock market, the EMH suggests that investors should rely on rational decision-making rather than emotions or preconceived notions. By minimizing market inefficiencies, this strategy enhances the chances of achieving above-average long-term returns. Nevertheless, the inherent volatility of South Africa's market still offers opportunities for savvy investors to identify undervalued assets and capitalize on temporary market inefficiencies.

2.2 Empirical Review

There is a large body of literature on the impact of interest rates on stock market performance. Numerous studies have assessed the relationship between interest rates and stock market performance, yielding varying results.

For instance, Mapfumo (2022) used monthly data from Thomson Reuters and the South African Reserve Bank from 2002 to 2020 to evaluate the effect of interest rates on the country's equity market. The relationship between interest rates and the South African equity market was examined using the Vector Auto Regression (VAR) model. To assess the short- and long-term dynamic link between interest rates and the equity market, the Vector Error Correction Model and Johansen Cointegration tests were used. The study concluded that interest rates and the equity market are negatively correlated.

Using time-series data from 2014 to 2021, Komba et al. (2024) examine the effects of interest and exchange rate volatility on stock returns in Tanzania's banking industry. To assess long- and short-term impacts, the study employed the autoregressive distributed lag (ARDL) bound test technique. The study found a long-term inverse relationship between interest rates and financial sector stock returns; however, from June 2014 to April 2021, interest rates were insignificant.

Using an OLS regression model, Kganyago and Gumbo (2015) analyzed data from Zimbabwe covering the period between April 2009 and December 2013, revealing a negative relationship between money market interest rates and stock market performance. Similarly, Mbulawa (2015) found comparable results by employing the Vector Error Correction Model (VEC) to empirically investigate the interconnections between interest rates, exchange rates, and stock market performance.

Based on a five-year period between 2010 and 2014 and using the structural vector autoregression method, Chen and Hu (2015) confirmed an association between interest rates and stock returns in China.

Using a wavelet-based method, Moya-Martínez et al. (2014) examined the relationship between interest rate changes and the Spanish stock market at the industry level from January 1993 to December 2012. According to the findings, interest rate sensitivity is generally strong across Spanish industries, whereas interest rate exposure differs significantly across industries and over different time periods. The sectors most affected by interest rate changes include banking, highly indebted sectors like telecommunications, real estate, technology, and regulated sectors such as utilities.

3. Methodology

3.1 Data Source

The data is collected from secondary sources, specifically the South African Reserve Bank (SARB) and the World Bank, with all macroeconomic data sourced from SARB and market data from the World Bank.

Tables 1: Study variables

Variables	Definition
SMR	Stock market return
IR	Interest rates
SPV	Stock price volatility
MC	Market capitalization
EXR	Exchange rate
INF	Inflation

3.2 Unit Roots

Augmented Dickey-Fuller (ADF) Test

The ADF test enhances the Dickey-Fuller test by incorporating lagged differences in the variable to address autocorrelation. It compares the null hypothesis that the series is stationary with the alternative hypothesis that it has a unit root (indicating non-stationarity).

The general form of the ADF test is:

$$\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \sum_{i=1}^{p} \delta i \, \Delta Y_{t-1} + \epsilon_t \quad (1)$$

- Y_t is the variable being tested (e.g., stock market returns or interest rates).
- Δ is the first difference operator.
- α is a constant.
- β is the coefficient on the time trend (if any).
- γ is the coefficient testing for unit roots (i.e., whether the series is stationary or not).
- p is the lag length of the differenced terms.
- ϵ_t is the error term.

The null hypothesis (H0) is that $\gamma = 0$ (the series has a unit root), while the alternative hypothesis (H1) is that $\gamma < 0$ (the series is stationary).

Phillips-Perron (PP) Test

Another method for assessing stationarity is the Phillips-Perron (1988) test, which tests the null hypothesis that a unit root exists. As opposed to the ADF test, the PP test uses nonparametric statistical methods rather than lagged difference terms to address heteroscedasticity and autocorrelation in the error terms.

The general form of the PP test resembles that of the ADF test; however, it employs a modified test statistic that adjusts for heteroscedasticity and autocorrelation.

3.3 Non-linear Autoregressive Distributed Lag (NARDL)

We employ the NARDL cointegration approach developed by Shin et al. (2014) to analyze the short-run and long-run asymmetric effects of interest rates on stock market returns in South Africa. This model enables us to investigate how changes in interest rates influence stock market returns in a non-linear manner, accounting for both positive (increases) and negative (decreases) shocks. By utilizing the NARDL framework, we can effectively capture the varying dynamics of interest rate fluctuations and their impact on stock market performance.

Model Specification

$$R_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 R_{t-i} + \sum_{i=0}^{qi} (\beta_1^+ \Delta IR_{t-i}^+ + \beta_1^- \Delta IR_{t-i}^-) + \varepsilon_t \quad (2)$$

Where

- Stock market return at time t is represented by R_t
- $\Delta IR_t^+ \; and \; \Delta IR_t^-$ are positive and negative changes in interest rates.
- The asymmetric effects of interest rate changes are represented by β_1^+ (increases) and β_1^- (decreases), respectively.
- ε_t is the error term.

Decompose the changes in interest rates into positive and negative components.

$\Delta IR_t^+ = \max \; (\Delta IR_t, 0)$ (positive changes)
$\Delta IR_t^- = \min \; (\Delta IR_t, 0)$ (negative changes)

Asymmetric Effects

As we can separately estimate coefficients β_1^+ and β_1^- for the positive and negative effects of interest rate changes in the NARDL model, the model is particularly effective at capturing asymmetric effects. Using this method, we can determine if stock market returns are affected differently by interest rate hikes and cuts.

Positive Changes (IR_t^+): When interest rates increase, we expect β_1^+ to capture the resulting effect on stock market returns. Stock returns typically decline when interest rates rise, as higher borrowing costs can lower corporate profits.

Negative Changes (IR_t^-): When interest rates decrease, β_1^-eflects the effect of these reductions. In general, lowering interest rates tends to stimulate economic activity, improve corporate earnings, and boost stock market returns.

Short-Run and Long-Run Asymmetries

Both can be accounted for by the NARDL model:

Short-run asymmetries: Stock market returns are affected immediately by interest rate changes.

Long-run asymmetries: Despite adjustments over time, interest rate changes continue to have persistent equilibrium effects.

Interest rate changes have lagged effects, which converge at the long-run equilibrium. As a result of this convergence, we can determine whether stock markets fully adjust to interest rate changes over time and how their responses differ between increase and decrease in rates over time.

4. Results/findings

4.1 Descriptive Statistics

Table 2 displays descriptive statistical findings, providing insight into the average values of various financial indicators. On average, stock market returns are relatively high at 12.61151, suggesting potentially positive performance. Interest rates average 10.80063, indicating a moderate level of borrowing costs. Stock price volatility is also notable, with a mean of 19.14962, reflecting fluctuating market conditions. Market capitalization averages 250.5990, representing the total value of a company's outstanding shares. The average exchange rate is 85.84947, which reflects the value of one currency in terms of another. Lastly, the inflation rate averages 112.4117, highlighting the typical rate of price increases over time. When comparing these figures to their averages, we observe that the standard deviation of stock market returns is slightly higher than its average, indicating a marginally increased level of stock price volatility. Interest rates are slightly lower than their average, suggesting a potential decrease in borrowing costs. Stock price volatility is also slightly above its average, implying greater fluctuations in stock prices. Conversely, both market capitalization and exchange rates are significantly lower than their respective averages, which may indicate a decline in the overall value of companies and a decrease in currency value relative to others. Finally, the inflation rate is considerably below its average, suggesting a slowdown in price increases. Overall, these economic indicators present a mixed picture of the current market state.

Table 2: A summary of descriptive statistics

Description	SMR	IR	SPV	MC	EXR	INF
Mean	12.61151	10.80063	19.14962	250.5990	85.84947	112.4117
Median	13.55191	10.25000	19.29905	251.3648	83.04000	107.2600
Maximum	38.90451	17.00000	34.10648	352.1564	108.9900	174.9900
Minimum	-13.60202	7.000000	12.98573	121.3611	64.68000	58.14000
Std. Deviation	12.43241	2.558710	4.442484	66.10959	11.95657	37.16027
Skewness	0.120613	0.659412	0.969357	-0.106650	0.269724	0.211790
Kurtosis	2.495979	2.626748	4.065728	2.049024	1.831482	1.624717
Jarque-Bera (JB)	1.235901	7.436177	19.37362	3.759829	6.556740	8.197014
Probability	0.5329.10	0.024280	0.000062	0.152603	0.037690	0.016597
Observations	95	95	95	95	95	95

Source: Authors' Estimation using EViews 14.

The standard deviations of various economic indicators reveal uncertainty and instability in the market. The standard deviation of stock market returns is 12.43241, while for interest rates it is 2.558710, stock price volatility is 4.442484, market capitalization is 66.10959, exchange rates are 11.95657, and inflation is 37.16027. The high standard deviations of stock market returns and exchange rates indicate significant fluctuations and unpredictability. In contrast, the relatively low standard deviations of interest rates and stock price volatility suggest a degree of stability in those areas. However, the alarmingly high standard deviation of the inflation rate raises concerns about its potential impact on consumers and businesses. Overall, these varying standard deviations highlight the mixed and complex nature of the current economic landscape.

The skewness of stock market returns is 0.120613, for interest rates it is 0.659412, for stock price volatility it is 0.969357, for market capitalization it is -0.106650, for exchange rates it is 0.269724, and for inflation it is 0.211790. These skewness values offer deeper insights into the distribution of returns and fluctuations in these key economic indicators. The positive skewness in stock market returns, interest rates, and stock price volatility indicates some level of asymmetry in their distributions. Conversely, the negative skewness of market capitalization suggests potential downside risk. In contrast, the skewness of exchange rates and inflation reveals a more balanced distribution, although still subject to some degree of dispersion. Overall, the combination of standard deviation and skewness values underscores the nuances and challenges present in the current economic environment.

The kurtosis of stock market returns is 2.495979, for interest rates it is 2.626748, for stock price volatility it is 4.065728, for market capitalization it is 2.049024, for exchange rates it is 1.831482, and for inflation it is 1.624717. These values indicate that stock market returns, and interest rates exhibit a more peaked distribution compared to market capitalization and inflation. The higher kurtosis of stock market returns, and interest rates suggests a greater likelihood of extreme values, potentially leading to increased market volatility. In contrast, the lower kurtosis of market capitalization, exchange rates, and inflation indicates a more stable and balanced distribution of values. This combination of statistics provides a comprehensive understanding of the various risks and uncertainties present in the current economic landscape.

4.2 Unit Root Test Results.

Time series datasets are tested for stationary or non-stationary behavior using a unit root test. If the test indicates a unit root, it signifies that the dataset is non-stationary and has a stochastic trend. Conversely, if the test does not reveal a unit root, the dataset is stationary and does not display a stochastic trend. Stationary time series data is essential for reliable statistical analysis and forecasting.

Table 3: ADF and PP Unit Root Test Results

Variables	ADF Test		PP Test	
	t-statistic	Status	t-statistic	Status
lnSMR	-4.166730***	I(0)	-4.382561***	I(1)

lnIR	-6.954122**	I(0)	-7.048832***	I(1)
lnSPV	-3.041630**	I(0)	-4.096128***	I(1)
lnMC	-3.566589***	I(1)	-4.836380***	I(1)
lnEXR	-7.779816***	I(1)	-7.794500***	I(0)
lnINF	-4.931731 ***	I(1)	-7.257942 ***	I(1)

Source: Authors' Estimation using EViews 14.

The results of the ADF and PP unit root tests indicate that the variables are either integrated of order I(0) or I(1). This means that some variables in the analysis are stationary (I(0)), while others are non-stationary (I(1)). Further investigation is needed to clarify the relationship between stationary and non-stationary variables. If these variables are found to be cointegrated, it would suggest a long-run relationship between them. Understanding this information is essential for analyzing the dynamic interactions between the variables and for making accurate forecasts.

4.3 F-Bounds Test

The F-Bounds Test is a statistical method that assesses non-linear relationships between variables, especially concerning interest rates and stock market returns. This study utilizes empirical data from South Africa to explore the significant asymmetric effects of interest rates on stock market returns in this specific market. The results are presented in Table 4.

Table 4: F-Bounds Test

Model I				
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	6.451414***	10%	2.070	3.160
K	6	5%	2.330	3.460
		1%	2.840	4.100

***, ** and *denotes significant at 1%, 5% and 10% significance level, respectively.
Source: Authors' computation using EViews 14.

The bound test presented in Table 4 indicates that the null hypothesis of no cointegration is rejected. The F-statistic of 6.451414 exceeds the upper bound for I(1) at the 1 percent significance level. This result suggests evidence of a long-run relationship between the variables in the model. The rejection of the null hypothesis implies that the variables are cointegrated, meaning they move together over time. Consequently, the bounds test results support the existence of a stable and meaningful relationship between the examined variables.

4.4 NARDL Results

SMR(-1) = -0.546162 is significant at the 1% level. The negative coefficient of SMR(-1) indicates that lagged stock market returns significantly affect future returns in South Africa. This suggests that a decline in stock market returns during the previous

period is likely to result in a decrease in future returns. Consequently, it is crucial for investors to monitor and analyze past stock market performance when making investment decisions to better anticipate potential future returns.

The long-run coefficient results reveal that lnIR_P(-1) has a significant value of -5.446948 at the 1% level, while lnIR_N(-1) shows a significant value of -1.301285 at the 5% level. These coefficients indicate that a 1% increase in lagged positive interest rates would result in a 5.446948% decrease in stock market returns over the long run. In contrast, a 1% increase in lagged negative interest rates would lead to a 1.301285% decrease in stock market returns. These findings suggest that changes in interest rates have a significant asymmetric impact on stock market returns in South Africa, with positive interest rates exerting a stronger influence than negative rates. The study emphasizes the significant impact of interest rates on stock market investments and the need for investors to closely monitor these changes for informed decisions.

Table 5. Long Run and Short Run Results for EMR from the NARDL (2,2,1,2,2,1) model. The model was selected based on Akaike information criteria (AIC).

Long run			**Short run**		
Variables	Coefficient	Pro.	Variables	Coefficient	Pro.
SMR(-1)	-0.546162	0.0000***	SMR(-1)	0.383570	0.0000***
*ln*IR_P(-1)	-5.446948	0.0000**	*ln*IR_P	-2.244543	0.0195**
*ln*IR_N(-1)	-1.301285	0.0261***	*ln*IR_N	-2.681189	0.3215
*ln*SPV_P(-1)	0.058139	0.7502	*ln*IR_P_(-1)	-0.298163	0.7630
*ln*SPV_N(-1)	0.451877	0.0009***	*ln*IR_N_(-1)	1.069486	0.0909*
*ln*MC_P(-1)	0.031073	0.1953	*ln*SPV_P	-1.158267	0.0754*
*ln*MC_N(-1)	0.079939	0.0001***	*ln*SPV_N	-0.313556	0.5840
*ln*EXR_P(-1)	0.489681	0.0001***	*ln*MC_P	0.060639	0.3945
*ln*EXR_N(-1)	-0.214539	0.0596**	*ln*MC_N	0.159800	0.0048***
*ln*INF_P	-0.049626	0.7507	*ln*MC_P(-1)	-0.086542	0.1432
*ln*INF_N	-1.302533	0.0000***	*ln*MC_N(-1)	-0.105519	0.0688*
			*ln*EXR_P	0.080952	0.5621
			*ln*EXR_N	-0.121600	0.2668
			*ln*EXR_P(-1)	-0.225744	0.0984*
			*ln*EXR_N(-1)	0.035927	0.7638
			*ln*INF_P	0.091995	0.7361
			*ln*INF_N	-0.694705	0.0376**
			ECT_{t-1}	-0.546162	0.0000***
			@QUARTER=1	0.161662	0.7834
			@QUARTER=2	0.047445	0.9389
			@QUARTER=3	0.083043	0.8903
			C	7.606957	0.0004***
			@TREND	-0.371197	0.3797
R-squared	0.878603		F-statistic	13.34402	
Adjusted R-squared	0.812761		Pro(F-statistic)	0.000000	
Durbin-Watson stat	2.210248				

Note. (***), (**), and (*) indicate significant at 1%, 5% and 10%. All the variables are log linearized.
Source: Authors' computation using EViews 14.

The stock price volatility coefficient lnSPV_P(-1) shows an insignificant value of 0.058139, while lnSPV_N(-1) demonstrates a significant value of 0.451877 at the 1% level, indicating asymmetric effects on SMR in South Africa in the long run. This suggests that positive interest rates have a minimal impact on stock market performance, whereas negative interest rates have a substantial effect. Investors should be cautious during positive interest rates and adjust their strategies, as negative rates can increase stock price volatility, highlighting the importance of understanding interest rate dynamics.

Other results indicate that the coefficient for positive market capitalization, MC_P(-1), is insignificantly positive at 0.031073, while MC_N(-1) shows a significantly positive asymmetric effect of 0.079939 on SMR in the long run in South Africa. These findings imply that market capitalization has a limited impact on stock market returns over time. However, the significant positive effect of MC_N(-1) suggests that negative shocks to market capitalization may exert a stronger influence on stock market returns than positive shocks. This underscores the importance of evaluating potential downside risks when investing in the South African stock market. Analyzing downside risks and market stability is crucial for investors to make informed investment decisions, as understanding market capitalization's effects can maximize long-term returns.

The exchange rate risk coefficient EXR_P(-1) is significant at 0.489681 at the 1% level, while EXR_N(-1) is significant at 0.214539 at the 10% level. These results indicate asymmetric effects on stock market returns in the long run in South Africa. Exchange rate changes have a significant impact on South African stock market returns. Positive changes in the exchange rate (EXR_P) exert a greater influence on returns compared to negative changes (EXR_N). Exchange rate asymmetry indicates that stronger exchange rates lead to higher stock market returns, while weaker rates may negatively impact returns. Investors should closely monitor exchange rate movements for optimal returns.

The inflation risk coefficient INF_P shows an insignificant value of -0.049626, while INF_N demonstrates a significant value of -1.302533, indicating asymmetric effects on stock market returns in South Africa over the long term. This suggests that an increase in inflation (INF_N) is likely to have a strong negative impact on stock market returns. Conversely, the insignificant coefficient of inflation risk (INF_P) implies that a decrease in inflation may not significantly affect stock market returns. Investors should consider inflation trends when assessing investment opportunities to mitigate risks and improve returns on the South African stock market. Monitoring and predicting trends can help identify market risks and opportunities.

SMR(-1) 0.383570 is significant at the 1% level in the short run, indicating that a one-unit change in the independent variable will result in a 0.383570 unit change in the dependent variable. This significance level suggests that the observed relationship is not due to random chance. Therefore, we can confidently conclude that the independent variable has a substantial impact on the dependent variable in the short run.

The short-run coefficient results reveal that lnIR_P has a significant value of -2.244543 at the 5% level, while lnIR_N has an insignificant coefficient of -2.681189. The lagged lnIR_P(-1) shows an insignificant -0.298163, whereas lnIR_N(-1) has a significant coefficient of 1.069486 at the 10% level. These findings indicate that a positive shock to interest rates results in a significant decrease in stock market returns in the short run, as

evidenced by the negative coefficient for lnIR_P. Conversely, the insignificant coefficient for lnIR_N suggests that a negative shock to interest rates does not significantly affect stock market returns. Additionally, the significant coefficient of lnIR_N(-1) implies that lagged negative shocks to interest rates positively influence stock market returns, though at a lower significance level. This suggests a delayed reaction in the stock market to negative interest rate shocks. Study results show that rising interest rates decrease investor willingness to invest, while falling interest rates have little effect on investor behavior.

The stock price volatility coefficient lnSPV_P shows a significant value of -1.158267 at the 10% significance level, while lnSPV_N exhibits an insignificant value of -0.313556 in relation to asymmetric effects on SMR in South Africa's short run. These results suggest that negative shocks in interest rates have a more substantial impact on the South African stock market in the short term. However, the effects on stock market returns are asymmetric; rising interest rates lead to a significant reduction in investor willingness to invest, whereas falling rates do not result in a notable change in investor behavior. This implies that timing is critical when examining the relationship between interest rates and stock market performance in South Africa.

Other results indicate that the coefficient for positive market capitalization (MC_P) is insignificantly positive at 0.060639, while the negative market capitalization (MC_N) has a significant coefficient of 0.159800 at the 1% significance level. Additionally, the lagged positive market capitalization (MC_P(-1)) shows an insignificant coefficient of -0.086542, whereas the lagged negative market capitalization (MC_N(-1)) has a significant coefficient of -0.105519 at the 1% significance level. These findings suggest asymmetric effects on short-run stock market returns in South Africa, indicating that the size of market capitalization has a limited impact on stock market performance. Furthermore, the negative coefficients for MC_P(-1) and MC_N(-1) imply that past values of market capitalization exert a stronger influence on stock market returns than current values. This underscores the importance of considering historical market trends when analyzing the relationship between market capitalization and stock market performance in South Africa. The study also reveals that this relationship is nonlinear, suggesting that as market capitalization increases, its impact on stock market performance becomes less significant.

The exchange rate risk coefficients show that EXR_P has an insignificant value of 0.080952, while EXR_N has an insignificant value of -0.121600. The coefficient EXR_P(-1) is significant at -0.225744 at the 10% level, and EXR_N(-1) has an insignificant value of 0.035927, indicating asymmetric effects on stock market returns in the short run in South Africa. These results suggest that exchange rate risk does not strongly influence stock market performance in the short term. However, the negative coefficient for EXR_P(-1) implies that previous positive exchange rate shocks may negatively impact stock market returns. Conversely, the insignificant coefficients for EXR_N and EXR_N(-1) suggest that negative exchange rate shocks do not significantly affect stock market performance in the short run. Overall, these findings indicate that other factors may play a more dominant role in driving stock market returns in South Africa.

The inflation risk coefficient INF_P shows an insignificant value of 0.091995, while INF_N presents a significant value of -0.694705 at the 5% significance level, indicating

asymmetric effects on stock market returns in South Africa in the short run. These findings suggest that positive inflation shocks have a minimal impact on stock market returns, whereas negative inflation shocks have a significant adverse effect in the short term. This implies that investors are more sensitive to declines in inflation, likely due to the uncertainty and instability associated with high inflation. Consequently, policymakers should focus on maintaining a stable and low-inflation environment to promote positive stock market performance.

The results indicate a significant negative relationship between interest rates and stock market returns in South Africa during the first quarter. In contrast, during the second and third quarters, this relationship turned positive, although it is not statistically significant. It appears that interest rates in South Africa have a variable impact on stock market returns throughout the year.

The error correction term (ECT) coefficient is statistically significant at the 1% level, with a value of -0.546162. This negative coefficient implies that the ECT plays a crucial role in adjusting the variables toward their long-run equilibrium relationship. Specifically, the negative sign indicates that deviations from this equilibrium are corrected in the opposite direction, helping to align the variables with each other. In this case, the adjusted R-squared value is 0.812761, which implies that changes in interest rates can explain 81.28% of variation in stock market returns. This strong correlation suggests that interest rates have a significant impact on stock market performance in South Africa. Additionally, the F-statistic of 13.34402 demonstrates the statistical significance of the regression model's ability to predict stock market returns, also significant at the 1% level. The Durbin-Watson statistic of 2.210248 indicates that there is no significant autocorrelation in the data, further confirming the validity of the regression results.

4.5 Diagnostics Test

Diagnostic tests, including autocorrelation, heteroskedasticity, and normality, were conducted to validate the model. The results showed that the model assumptions were satisfied, thereby increasing confidence in the accuracy of its predictions, as detailed below.

Table 6: SMR Residual Analysis Results

Items	Test Applied	Values	P-values
Serial correlation	Breusch-Godfrey Serial LM	2.477686	0.0929
Heteroskedasticity	Breusch-Pagan Godfrey	1.460009	0.1034
Normality	Jarque– Bera Test	3.239417	0.197956

Source: Authors' computation using EViews 14.

The NARDL diagnostic test for serial correlation in South Africa yielded a value of 2.477686 (p-value = 0.0929), which exceeds the 0.05 significance level. This allows us to reject the null hypothesis of no serial correlation in the data. Consequently, there is evidence of a significant relationship between the current and lagged values of the variables in the South African context. The presence of serial correlation suggests that

past values of the variables may be useful in predicting future values, indicating a potential autoregressive relationship.

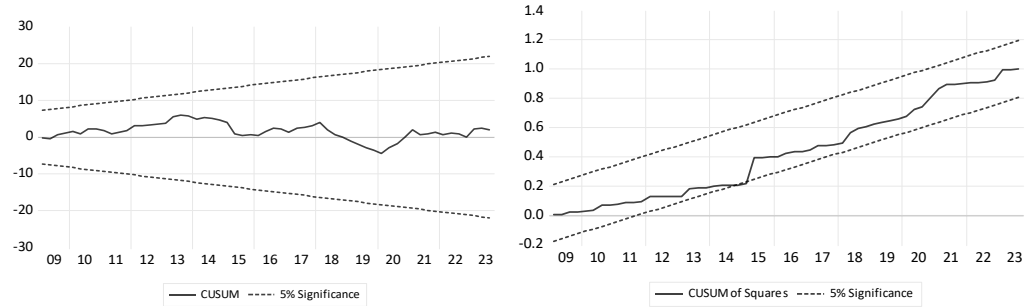
The NARDL diagnostic test for the Breusch-Pagan-Godfrey test in South Africa yielded a statistic of 1.460009 with a p-value of 0.1034. This result indicates no evidence of heteroscedasticity in the data, confirming that the assumption of constant variance holds for the South African dataset. The p-value of 0.1034 implies there is a 10.34% probability of observing a test statistic as extreme as 1.460009 under the null hypothesis of no heteroscedasticity.

The NARDL diagnostic test for normality (Jarque-Bera) in South Africa yields a statistic of 3.239417 with a p-value of 0.197956. Since the p-value exceeds 0.05, we do not reject the null hypothesis of normality at the 5% significance level. Thus, we can conclude that the distribution in South Africa is reasonably close to a normal distribution.

Structural Stability Tests

A stability analysis has been conducted on the models to verify their structural stability. Figure 2 displays the results of the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) stability tests, indicating that their statistics are significant at the 5% level**.**

Figure 1: CUMUM and CUMSUMQ Structural Stability Tests.



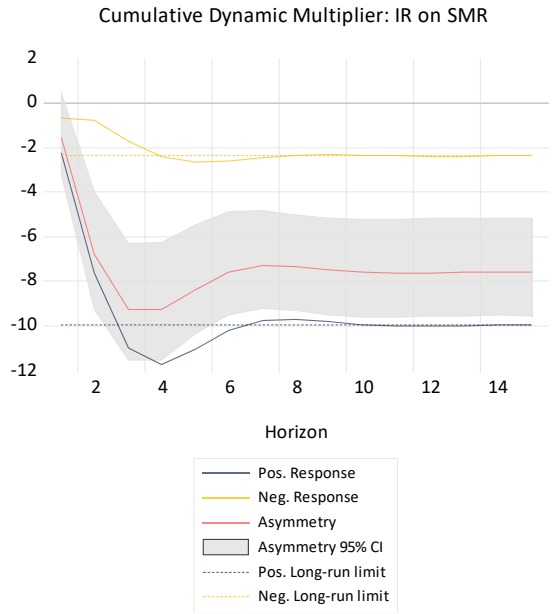
Source: Authors' Estimation using EViews 14

These findings further validate the study's conclusions by demonstrating that the models are structurally stable over time. The significance of the CUSUM and CUSUMSQ tests at the 5% level underscores the strength of the correlations between interest rates and stock market returns in South Africa. Overall, the analysis provides strong empirical support for the asymmetric effect of interest rates on stock market returns in the South African context.

Analysis of the Dynamic Multiplier

An analysis of the dynamic multiplier plots allows for the assessment of asymmetry in the SMR resulting from positive and negative shocks. The results indicate a significant asymmetrical effect of interest rates on stock market returns in South Africa.

Figure 2: Cumulative Dynamic Multiplier for South Africa IR on EMR



Source: Authors' Estimation using EViews 14

Figure 2 illustrates the multiplier impact of interest rates (IR) on stock market returns (SMR) in South Africa. It shows that negative shocks have a more significant effect on SMR than positive shocks. This implies that when interest rates decrease, the stock market tends to respond more positively than it does when interest rates rise. Furthermore, the asymmetry in the effects of interest rates on stock market returns suggests that South African investors may be more responsive to interest rate changes that lead to lower borrowing costs.

5. Discussions

According to the findings, positive interest rate shocks have a significant negative correlation with long-term stock market returns, which is consistent with recent studies by Komba et al. (2024) in Tanzania and Javangwe and Takawira (2022) in South Africa. The rise in interest rates makes fixed-income securities more appealing, reducing demand for stocks in response to positive rate shocks. In contrast, the muted impact of negative interest rate shocks suggests the stock market's reaction to monetary easing is relatively weak. This may be due to persistent investor risk aversion or uncertainty about the broader economic implications of such policies. In the short run, the strong negative effect of positive interest rate shocks aligns with shifts in investor portfolios toward safer assets. The lack of statistical significance for negative shocks indicates that short-term responses to monetary easing are often overshadowed by prevailing market conditions or delayed adjustment mechanisms.

The asymmetric impact of stock price volatility on SMR shows how investor sentiment changes over different time horizons. Over the long term, negative volatility tends to have a more pronounced effect, likely leading to prolonged bearish sentiment and

diminished market confidence. Conversely, positive volatility has a stronger short-term impact, possibly due to speculative activities or fleeting optimism during bullish conditions. This dynamic underscore the need for tailored risk management strategies that consider the varying effects of volatility across different investment horizons.

Market capitalization has asymmetric effects on SMR, with negative changes having a stronger impact than positive ones in both the short and long term. During times of declining market capitalization, investors are more sensitive to negative signals, such as falling corporate valuations, which can heighten risk perceptions and lead to sell-offs. However, the muted impact of positive capitalization, especially in the short term, suggests that market participants may wait for confirmation of sustained growth before making portfolio adjustments.

Short-term effects of exchange rate risk are less significant than long-term effects on stock market returns (SMR). The positive coefficient of lagged positive exchange rate risk (EXR_P(-1)) suggests that increases in exchange rate risk from previous periods positively affect subsequent stock market returns. This may be attributed to improved export competitiveness or favorable valuation adjustments for foreign investors. In contrast, the lesser impact of negative exchange rate risk (EXR_N(-1)) indicates that while currency depreciation can be disruptive, it may not always lead to immediate adverse market outcomes. This observation is consistent with the findings of Javangwe and Takawira (2022) in South Africa, which highlight the prolonged and complex nature of exchange rate influences on financial markets.

Inflation risk exhibits strong asymmetric effects, with rising inflation (INF_N) leading to significant long-term negative impacts on SMR. These findings align with research by Adusei (2014) in Ghana and Chiang and Pei-Ying (2023) in the US, which highlight the erosive effects of inflation on purchasing power, corporate profitability, and investor confidence. The negligible and statistically insignificant impact of rising inflation (INF_P) in the short term indicates that the market may initially absorb inflationary shocks without immediate repricing. However, prolonged inflation risks require proactive measures to protect portfolio value.

The synthesis of findings highlights the asymmetric nature of macroeconomic shocks on South African stock market returns (SMR). The strong impacts of negative interest rate shocks, negative stock price volatility, and inflationary pressures indicate the increased vulnerability of the South African market to adverse developments. Positive changes have more muted effects due to cautious investor sentiment, as market participants are more focused on risks than on opportunities. Understanding these dynamics is crucial for policymakers and investors, as they provide a nuanced perspective on the relationship between macroeconomic factors and stock market performance. South African financial markets can be navigated more effectively by addressing these asymmetries.

6. Conclusions

This study examines the asymmetric impact of interest rates on stock market returns in South Africa from 2000Q1 to 2021Q3. Using ADF and PP unit root tests, the

study confirms that the variables are stationary and identifies their order of integration. The F-bound test indicates a long-term cointegration relationship between interest rates and stock market returns. The NARDL model reveals that interest rates have a significant asymmetric effect on stock market returns. Particularly, the South African stock market is sensitive to changes in monetary policy, as decreases in interest rates have a greater negative impact on returns than increases in interest rates. Additionally, the findings show that exchange rate risk, inflation risk, and market capitalization also exhibit asymmetric effects on stock market returns. Exchange rate fluctuations have a stronger positive impact on returns during periods of appreciation, while inflation has a notable negative effect during times of rising prices. Furthermore, negative changes in market capitalization have a more significant adverse impact on stock market returns compared to positive changes, particularly in the long term. As a result, these dynamics highlight the interconnectedness of financial markets and emphasize the vulnerability of South Africa's stock market.

Policymakers should consider interest rate policies and inflation to minimize market disruptions during monetary easing. By keeping inflation at target levels and reducing exchange rate volatility, they can strengthen investor confidence. Additionally, improved foreign exchange interventions and risk management strategies can create a more stable investment environment.

To mitigate risks associated with interest rates, inflation, and exchange rates, investors should diversify their portfolios across various sectors and regions. It is crucial to monitor announcements from central banks and changes in interest rate policies actively. Investors must anticipate market movements and adjust their portfolios accordingly. In times of rising inflation or economic uncertainty, prioritizing defensive sectors such as utilities and consumer staples is advisable. Incorporating both technical and fundamental analysis into investment strategies can help identify trends and make informed decisions. By following these recommendations, investors can effectively navigate the complexities of the South African stock market, fostering stability and promoting long-term growth.

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