International Journal of
Financial Studies

MDPI

Article

The Effects of Investor Sentiment on Stock Return Indices Under Changing Market Conditions: Evidence from South Africa

Fabian Moodley *, Sune Ferreira-Schenk and Kago Matlhaku

School of Economic Science, North-West University, Gauteng 1174, South Africa;
sune.ferreira@nwu.ac.za (S.F.-S.); 53754638@mynwu.ac.za (K.M.)
* Correspondence: fabian.moodley@nwu.ac.za

Abstract: The objective of the study is to examine the effects of investor sentiment on the Johannesburg Stock Exchange (JSE) index returns in bull and bear market conditions. Accordingly, this study uses monthly data to construct a new market-wide investor sentiment index and test its effects on the JSE aggregated and disaggregated index returns in alternating market conditions for the period March 2007 to January 2024. The findings of the Markov regime-switching model reveal that when the JSE is in a bull market condition, the JSE oil and gas sector returns and the JSE telecommunication sector returns are affected positively by investor sentiment. Similarly, in a bearish state, the JSE health sector returns and JSE telecommunication sector returns are negatively affected by investor sentiment. Collectively, the findings suggest that the effects of investor sentiment on JSE index returns are regime-specific and time-varying, such that they are dependent on the market conditions (bull or bear) and the type of JSE index (aggregated or disaggregated index). Accordingly, investors must consider this information to ensure resilient investment decisions and risk management strategies in sentiment-induced markets and alternating market conditions.

Keywords: stock market returns; market conditions; investor sentiment; principal component analysis

Academic Editors: Miguel A. Alonso Neira, Víctor Espinosa Loyola, Carolina Cosculluela-Martínez and Zied Ftiti

Received: 3 March 2025
Revised: 19 April 2025
Accepted: 22 April 2025
Published: 30 April 2025

Citation: Moodley, F., Ferreira-Schenk, S., & Matlhaku, K. (2025). The Effects of Investor Sentiment on Stock Return Indices Under Changing Market Conditions: Evidence from South Africa. *International Journal of Financial Studies*, *13*(2), 70. https://doi.org/10.3390/ijfs13020070

1. Introduction

In the last decade, the traditional finance school of thought has dominated empirical literature for its seamless propositions regarding the rationality of market participants or investors. The efficient market hypothesis (EMH) suggests that investors are rational, as they base their investment decisions on fundamental information (Fama, 1965). This implies that stock market prices fully reflect all information, and when stock prices deviate from their fundamental values, known as mispricing, they will instantly converge back to equilibrium due to the rational prospects of investors (Sobaih & Elshaer, 2023). In recent years, the propositions of rationality have been contested by the new school of thought known as behavioral finance. The behaviorist perspective contends that the underlying assumptions of investors' rationality are limiting, as not all investors base their investment decisions on fundamental information; instead, they use their cognitive emotions and past experiences to make informed decisions, which leads to irrational behaviour (Konstantinidis et al., 2012).

The concept of irrational investors is explained by several factors, one of which is investor sentiment (Ah Mand et al., 2023). Investor sentiment is the perception and attitude of investors to securities risk and cashflows that are not provided for by fundamental

information (Baker & Wurgler, 2006). Investors' attitudes and perceptions are reflected in stock prices through daily trading activities leading to increases and decreases in stock prices and stock market anomalies (Kurov, 2008). Keynes (1936) and De Long et al. (1990) argue that investors' 'animal spirits' lead stock prices to fluctuate from their fundamental value, which draws irrational investors into the market, making it more difficult to eradicate mispricing, as prices do not return to their equilibrium level.

These two schools of thought have generated debate in the literature, where academics have argued that investor sentiment does not influence stock market prices, making stock markets efficient. However, other academics have argued that investor sentiment is an important determinant of stock market prices, making stock markets inefficient (T. H. Muguto et al., 2019, 2022; Steyn et al., 2020; Agyei et al., 2023). The adaptive market hypothesis was introduced by Lo (2004) to resolve this unresolved debate. It postulates that there are periods where investor sentiment does not influence stock market prices and periods where it does (Lo, 2005). This makes the stock market adaptive, giving rise to a nonlinear effect, where market conditions, such as bullish and bearish periods, cause investor sentiment to have time-varying and regime-specific effects (Moodley et al., 2022).

Many researchers have embraced this proposition by Lo (2004) and examined the effects of investor sentiment on stock market returns under bull and bear market conditions. However, the literature's focus is centered on linear effects in South Africa and emerging markets, with literature on nonlinear effects relating only to developed countries, with no evidence in emerging market settings like South Africa (Wang et al., 2022; Tiwari et al., 2022; Phan et al., 2023; Luong et al., 2023). Given that developed and emerging markets differ in terms of size and market structure, it is impossible to use the findings of developed markets to make informed decisions in emerging markets (Monke, 2021). Consequently, if left unstudied, this will have far-reaching implications for investors in South Africa, who experience excessively fluctuating economic conditions. Investors will be exposed to heightened losses, as no study has demonstrated how asset selection or portfolio rebalancing should be conducted in the South African stock market in market conditions with heightened sentiment levels. Moreover, according to Lo (2004), any financial market experiencing changing market conditions exhibits alternating efficiencies, making the market adaptive. These periods of efficiency and inefficiency allow investors to "beat" the market and earn excess returns, which brings into disrepute financial market policies from the Market Regulation Division of the JSE (Alam et al., 2017). It is therefore essential to study the nonlinear effects of investor sentiment on stock markets in South Africa not only to assist investors in loss mitigation but also to assist financial market policy makers in South Africa to develop policies in line with new evidence of asset markets being adaptive.

Accordingly, this study investigates how investor sentiment affects JSE equity market returns in the face of changing market conditions. In achieving the desired objective, the following research question is answered: How do JSE index returns respond to changes in investor sentiment in both bull and bear market conditions? By addressing this research question, this study will contribute to the body of knowledge in the following ways:

(1) Practical innovation: For the first time, a study in the South African context will provide insight into how investor sentiment influences equity market returns in both bull and bear market conditions. Because they may use the study's findings to make more informed decisions regarding asset selection, portfolio rebalancing, portfolio formulation, and portfolio diversification during sentiment-induced markets and changing market conditions, investors will be able to minimize losses.
(2) Theoretical innovation: The study introduces Lo's (2004) proposition that asset markets are adaptive. Consequently, the findings of the study can be used by policy makers to develop financial market policies that align with the new evidence that

markets are adaptive. This will reduce unfair market behaviour and asset price manipulation, which cause financial market mispricing.

(3) Empirical innovation: The study introduces new evidence that investor sentiment has a nonlinear effect on stock market returns in South African and emerging markets, thereby shifting the dominant focus of empirical literature on the linear effect to the nonlinear perspective. Moreover, the study introduces a new methodology, the Markov regime-switching model, and market-wide investor sentiment index to examine the nonlinearity between sentiment and stock market returns. By providing an appropriate model and sentiment index to analyze the nonlinear relationship between sentiment and asset returns in emerging markets, this significantly advances research in South African and emerging markets.

The remainder of the study is organized as follows: Section 2 presents the literature review, Section 3 outlines the data, Section 4 presents the empirical model, Section 5 provides the empirical results and a discussion of the results, and the conclusion is considered in Section 6.

2. Literature Review

2.1. Investor Behavior Conceptualization

The basis of finance is the classical financial theory (CFT), one of the first theories developed to explain stock markets. It assumes that investors are rational, risk averse, and aim to maximize profit (Harzallah & Abbes, 2020). Accordingly, the efficient market hypothesis (EMH) is the foundation of CFT (Agudelo Aguirre & Agudelo Aguirre, 2024; Antoniou et al., 2013). Fama (1965) argues that stock market prices contain all available information, making stock markets efficient. Therefore, EMH is based on various assumptions, including the existence of many market participants that analyze stock prices, investors who are constantly competing to alter the stock prices, and any new information pertaining to a stock arrives in random events (W. Huang et al., 2024). These assumptions are based on the random walk process, such that any changes to the prices of a stock are independent of past prices of stocks (Palamalai et al., 2021). Consequently, Fama (1965) argues that stock markets can be classified as weak-form efficient, semi-strong-form efficient or strong-form efficient (Gupta & Basu, 2007).

These versions of EMH illustrate that investor behaviour does not influence stock market prices, since the influence of irrational investors on stock market prices is rectified by the process of arbitrage of rational investors, which drives stock market prices to their fundamental value (Hens & Rieger, 2016). The irrationality of investors causes elevated interest in the underlying stock. When this occurs, the underlying stock price deviates from its fundamental value, causing mispricing (Ying et al., 2019). Market participants take note of such deviations and then buy and sell the same stock at different prices and earn immediate profits. A large number of market participants attempts this process, which results in mispricing reaching the attained fundamental value (Ying et al., 2019). This implies that investors are not privy to excess returns, which is coherent with the random walk process.

However, given that stock markets are highly competitive, this is not always true, as stock prices tend to perform contrary to the notion of efficient markets, which is known as market anomalies. Market anomalies arise due to mispricing, limits to arbitrage, selection biases, and unmeasured risk, all of which are a result of irregular investor behaviour (Latif et al., 2011). Despite CFT being the pilar of traditional finance, the inability of CFT to explain market anomalies and irregular investor behaviour has ignited a debate among scholars such that CFT does not explain real market performance that is governed by irrational investor behaviour (Woo et al., 2020; Spulbar et al., 2021). According to

Modigliani and Cohn (1979), stock market efficiency as proposed by EMH does not hold substance in competitive stock markets, owing to irrational investor behaviour. In a competitive stock market, investors continually compete to earn excess returns. When this occurs, investors base their investment decisions on their cognitive abilities. This causes investors to act irrationally in a competitive market. To explain the inefficiency of stock markets caused by irrational investors, the behavioural finance theory was introduced by Tversky and Kahneman (1974).

The behavioural finance theory illustrates that the rationality of investors is held in contempt to the current events dictating the performance of stock markets. These include investor's perception of the stock market and, more importantly, the perceived notion dictating stock market pricing (Konstantinidis et al., 2012). Consequently, investors act irrationally by allowing their cognitive risks and emotions to determine their preferred stock to invest in, which is known as irrational trading. Despite the ability of behavioural finance to explain the inefficiency of stock markets caused by sentiment-driven investors and market anomalies, critics of behavioural finance suggest that the theory is not able to explain the efficiency and inefficiency (alternating efficiency) of stock markets (see Lo, 2004; Lekhal & El Oubani, 2020; Erer et al., 2023).

Consequently, the adaptive market hypothesis (AMH) was introduced by Lo (2004) to reconcile EMH and BF. The premise of AMH is that the alternating efficiency of stock markets is due to bull and bear market conditions (changing market conditions) (Lo, 2004). Economic shocks, economic instability and market participants' behaviour and perception regarding an underlying stock give rise to bull and bear conditions (Moodley et al., 2022). Therefore, the premises of AMH provide a consensus between EMH and BF. Consequently, AMH implies that changing market conditions will cause an adaptive effect of investor sentiment on stock market prices. Investors are optimistic when stock prices are increasing over time (bull market conditions), whereas they are pessimistic when stock prices are decreasing over time (bear market conditions), and affect the stock market differently (Aissia & Neffati, 2022). Consequently, in the AMH framework, the effect of investor sentiment on stock market prices still needs to be examined in South Africa as market conditions create an asymmetrical effect.

2.2. Empirical Review

The literature review demonstrates that most of the literature is centered around developing markets as opposed to emerging markets like South Africa. For example, Y. H. Liu et al. (2020) used a regression model to examine the effect of investor sentiment on Taiwan's stock market companies' returns in different market states. The authors found that 83% of the companies formulated for the sample period were influenced by investor sentiment. Specifically, the effect was evident in a bull and neutral market. Moreover, when the market is presented with uptrends, investors are more optimistic of future prospects and invest in the Taiwan stock market with the perception of earning increased returns. In addition, it was found that investor sentiment drives market conditions in stock markets. Coherent with this, He et al. (2020) and Pan (2020) found that investor sentiment influences Chinese stock market returns, where the effects vary with differing market states. This means that the effect is nonlinear in bull and bear regimes. Moreover, optimistic and pessimistic investors drive stock market conditions and increase irregular trading.

Wang et al. (2022) examined the effect of investor sentiment on 40 global stock index returns in bull and bear market conditions using the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models. Investor sentiment, proxied by share turnover, has a negative effect on global stock market returns in a bear regime but a positive effect in a bull regime. Therefore, when the bull market condition prevails, investors are optimistic, causing stock returns to increase, but when bear market conditions prevail, investors are pessimistic about the outlook of the market, causing a negative effect. In accord with this, Tiwari et al. (2022) evaluated the response of Australian stock market returns to changes in investor sentiment in changing market conditions. The quantile regression model and the Granger causality test revealed that sector returns are influenced by investor sentiment, but the effect is time varying. Therefore, there is a bidirectional relationship between consumer sentiment and sector returns. The effect in a bull market is positive, but in a bear market it is negative. The findings are supported by Cevik et al. (2022) as their panel vector autoregression (PVAR) model illustrates that increased sentiment has a positive influence on the stock market returns of 20 countries during stable market conditions. However, in a volatile market, such as during COVID-19, the effect is negative.

Phan et al. (2023) examined the effect of investor sentiment on Vietnam sector returns in bull and bear periods using a quantile regression. The principal component analysis (PCA) was used to develop an investor sentiment index using proxies. The findings illustrate that when the market is volatile, the market-wide investor sentiment index has a negative effect on Vietnam sector returns. However, a positive effect is identified during a stable market. It was also found that in a stable market investor sentiment has no significant effect on the returns of several sectors. The findings indicate that there were no noise traders in the market, since the sector returns were not impacted by irrational behaviour. The findings are supported by Dhasmana et al. (2023). The authors used a Markov regime-switching model to examine the effect of investor sentiment on environmental, social and corporate governance (ESG) index returns. The results revealed that ESG index returns are influenced by investor sentiment, but the effect alternates with market conditions. This implies that investor sentiment negatively influences ESG returns in a boom but there is no influence in a recession, which suggests that the stock market does not contain an influx of noise traders.

Shen et al. (2023) used the Glosten-Jagannathan–Runkle GARCH (GJR-GARCH) model and value at risk (VaR) model to investigate the influence of investor sentiment on Chinese stock market returns. The findings show that investor sentiment has a greater influence on stock returns in volatile markets like COVID-19, but the effect is insignificant in stable market conditions. The findings illustrate that sentiment during uncertainty positively contributes to noise trading and therefore influences stock market returns negatively. In contrast, Guo et al. (2023) focus on initial public offerings (IPO). The Markov regime-switching model demonstrates that investor sentiment has a significant influence on the returns of IPOs in both a bull and bear regime. The findings indicate that investors are optimistic of future earnings during bull market conditions, whereas they are pessimistic in a bear regime. This contributes to irrational behaviour in the market and thus affects stock returns differently in each market condition. In keeping with this, Luong et al. (2023) found that investor sentiment has a time-varying effect on stock market returns of G7 countries in market conditions. This implies that the effect is different when the stock market of each country fluctuates. Consequently, the relationship between investor sentiment and stock market returns is better modelled using nonlinear models.

The literature review highlights two important aspects. First, no existing study in South Africa has examined the impact of investor sentiment on stock market returns in regime-switching conditions. Second, there is a lack of scholarly consensus regarding the specific nature of the effect investor sentiment has on stock market returns. While some scholars find there is no effect, making stock markets efficient, some find there is a linear effect, making stock markets inefficient, and some find a nonlinear effect, making stock markets adaptive. However, in emerging markets the nonlinear effect is yet to be considered in the AMH framework. Consequently, the current study in the South African context adds to the empirical literature by assisting investors in risk mitigation, and enhancing their return, thereby contributing to economic growth in South Africa.

3. Data

3.1. Sample and Measurement of South African Stock Market Returns

The objective of the study is achieved by constructing a market-wide investor sentiment index and testing it against one aggregated sector (JSE All-Share index (JSE_ALL)) and ten disaggregated sector returns. The disaggregated sector returns form part of the financial 25 index (financial index (JSE_FIN)), industrial 15 index (industrials index (JSE_INDU), consumer goods index (JSE_CONG), healthcare index (JSE_HEAL), consumer services index (JSE_CONS), telecommunications index (JSE_TELCOM), utilities index (JSE_UT) and technologies index (JSE_TECH)), while resource 10 index (oil and gas index (JSE_OG) and basic materials index (JSE_BM)) are selected for the stock market (refer to Appendix A). According to AMH, the influence of investor sentiment on stock market returns will differ for each stock market index due to the time-varying effect (T. H. Muguto et al., 2022). Consequently, it is crucial to consider disaggregated indices, as they will increase the robustness of the findings, allowing for the comparison of findings between each subsector and the overall market. The analysis therefore sheds light on the different effects of investor sentiment on disaggregated index returns and the overall market. Thus, it provides insight into whether investor sentiment contributes to the spread of risk among disaggregated index returns in relation to the overall market. Appendix A outlines the relevant monthly data spanning the sample period from March 2007 to January 2024, comprising a total of 203 observations. This period encompasses several historical stock market shocks, including the contagion effects of the US housing bubble, the dot-com bubble, the 2008 global financial crisis, the COVID-19 pandemic, and the European debt crisis. These historical events are essential to enhance the robustness of the model specification as the Markov regime-switching model uses these periods to classify the JSE sector returns in both bull and bear regimes. Thus, introducing a sample period that includes numerous historical events enhances the model specification. The data are obtained from Bloomberg and the IRESS BFA database.

3.2. Measuring Investor Sentiment

The review of empirical literature highlights two types of measurements for investor sentiment, direct and indirect. Direct measures of investor sentiment include but are not limited to market-based sentiment, social media sentiment, media-based sentiment, and non-fundamental-based sentiment (Hu et al., 2021). Indirect measures comprise survey-based sentiment. Given the variety of sentiment measures, market-based sentiment is the most widely used measure of sentiment in financial markets. Baker and Wurgler (2006) contend that market-wide investor sentiment serves as a more effective measure than individual sentiment proxies or survey-based indicators. Empirical evidence supports this view, showing that a comprehensive market-wide sentiment index outperforms individual proxies and alternative sentiment measures (Brown & Cliff, 2004; Beer & Zouaoui, 2013;

Stambaugh et al., 2012). Based on this rationale, the market-wide investor sentiment index developed by T. H. Muguto et al. (2019) will be enhanced and updated to align with the current study's sample period. This will lead to the development of a newly constructed investor sentiment index, contributing significantly to emerging market research, particularly within the South African context. Notably, this sentiment index is the first of its kind in South Africa to capture the sentiment of both foreign investors and general consumers. Given its foundation in the South African financial market, it is therefore especially relevant to this study, and is expected to yield robust findings, consistent with those reported by T. H. Muguto et al. (2019). Baker and Wurgler (2006) emphasize the importance of regularly updating investor sentiment indices to ensure robust results, as this allows for a more accurate reflection of market-wide sentiment within a given sample period. Moreover, studies frequently employ the market-wide investor sentiment of other scholars. For instance, Aristei and Martelli (2014) used Spyrou's (2013) investor sentiment index but updated it for their sample period. The investor sentiment proxies used in the study are given below.

3.2.1. Investor Sentiment Proxies

Share Turnover Ratio

The choice of the share turnover proxy is based on the rationale presented by Baker and Stein (2004), who argue that heightened short selling in a financial market tends to attract noise traders. This phenomenon is closely linked to the inability of rational arbitrageurs to eliminate noise traders from the market. The proxy is calculated by dividing the total volume of shares traded on the Johannesburg Stock Exchange (JSE) by the average number of shares listed on the JSE. Its inclusion is supported by previous studies, including those by Rupande et al. (2019), T. H. Muguto et al. (2022), and Muzindutsi et al. (2023). This proxy is maintained in alignment with the index employed by T. H. Muguto et al. (2019).

Advance/Decline Ratio Index

Brown and Cliff (2004) highlight that investors closely monitor the advance/decline ratio, as it serves as a key indicator for determining whether to enter or exit the market. A higher number of advancing shares signals positive market breadth and sentiment, suggesting favorable conditions for market entry. Conversely, a greater number of declining shares indicates negative market breadth and sentiment, discouraging entry. The proxy is calculated by dividing the number of advancing shares by the number of declining shares, considering their respective trading volumes. The use of this proxy aligns with the approaches taken by T. H. Muguto et al. (2019), Reis and Pinho (2020), and Gong et al. (2022), who employed similar measures in their analyses. In line with these studies, this research retains the proxy as applied in T. H. Muguto et al. (2019).

Equity-Issue Ratio

Baker and Wurgler (2006, 2007) identify the equity-issue ratio as a reliable proxy for investor sentiment, as it helps in assessing expected market returns. A high level of equity issuance typically signals lower future returns, reflecting elevated market sentiment. During such periods, companies tend to issue more shares, leading to overvaluation of securities. This overvaluation may cause investors to underestimate risk and overestimate potential returns. The proxy is calculated by dividing the total number of equity issues by the total debt issuance on the JSE. Its use as a sentiment indicator is well established in the literature, with studies such as T. H. Muguto et al. (2019) and Muzindutsi et al. (2023) adopting the same approach. Accordingly, the current study retains the proxy as it appears in the sentiment index developed by T. H. Muguto et al. (2019).

South African Volatility Index

This study has chosen to incorporate the South African Volatility Index (SAVI) to replace the Rand/Pound bid-ask spread, as used in T. H. Muguto et al. (2019). The decision to exclude both rand-denominated bid-ask spreads (Rand/Dollar and Rand/Pound) stems from the concern that including both would lead to heightened correlation. Therefore, the use of the SAVI will strengthen the robustness of the investor sentiment index constructed in this study. The SAVI measures market volatility, with high volatility linked to negative sentiment and low volatility associated with positive sentiment. This proxy's inclusion is further justified by Rupande et al. (2019), who also utilized it in their sentiment index construction for the South African market.

Rand/Dollar Bid-Ask Spread

Hengelbrock et al. (2013) suggest that the Rand/Dollar bid-ask spread reflects demand for South African securities, with negative sentiment often linked to weak economic conditions that reduce capital inflows. As a result, the bid-ask spread widens when foreign investors withdraw rand-denominated assets from their portfolios. This proxy was used to capture investor sentiment in the South African market in studies by T. H. Muguto et al. (2019, 2022) and Rupande et al. (2019). Accordingly, it is also adopted in this study.

South African Consumer Confidence Index

Junaeni (2020) suggests that financial markets consist of investors from various financial backgrounds, including both high-end and low-end individuals. When constructing a market-wide investor sentiment index, it is important to consider the sentiments of both groups, rather than focusing solely on high-end individuals, as this can distort the overall sentiment in the market. In response, this study introduces the South African Consumer Confidence Index (CCI) to improve the robustness of the sentiment index. The CCI provides insight into household savings and consumption, reflecting the financial status of consumers (Organization for Economic Co-Operation & Development [OECD], 2022). Rahman and Shamsuddin (2019) argue that while stock prices may not directly influence consumers' views of the financial market, they do correlate with overall market sentiment. Specifically, market participants with lower income levels may be less likely to engage in the market, whereas those with higher income levels are more likely to participate. Therefore, increased consumer confidence in the economy's future outlook is seen as a positive indicator, encouraging investor participation in the market. The CCI has become a prominent proxy in sentiment analysis, with studies by Koy and Akkaya (2017) and Hamurcu (2021) incorporating it into their research. However, previous studies in the South African context, such as those by T. H. Muguto et al. (2019), Rupande et al. (2019), and Muzindutsi et al. (2023), did not account for consumer sentiment, which is concerning, given that domestic consumers also interact with the JSE. Therefore, the inclusion of the CCI proxy contributes to a more comprehensive measure of investor sentiment in South Africa.

CNN Fear and Greed Index

N. Liu et al. (2020) distinguish between two types of investors in financial markets: domestic and foreign investors. Building on this, Beirne et al. (2024) emphasize the importance of including both investor groups in any comprehensive market-wide sentiment index. Accordingly, this study incorporates the CNN Fear and Greed Index, which will replace the term structure of interest rate proxy used in the sentiment index by T. H. Muguto et al. (2019). The decision to include this proxy is supported by the JSE's

annual report, which highlights that the top foreign investors in South Africa are from China, the United Kingdom (UK), and the United States (US) (JSE, 2023). Given that this study aims to construct a market-wide investor sentiment index specific to the South African financial market, particularly the JSE, it is crucial to focus on the US, which has the largest stock exchange globally. This will enhance the robustness of the constructed index. Additionally, as there is no direct proxy for foreign investor sentiment in South Africa, the US is the only country from the list of foreign participation in South African market that has a formulated index and will provide a better gauge for foreign investor sentiment in South Africa. This approach is unique to this study, as previous South African research by T. H. Muguto et al. (2019), Rupande et al. (2019), and Muzindutsi et al. (2023) did not capture foreign investor sentiment. In contrast, studies by Liutvinavičius et al. (2017), Halliday (2018), and Chen et al. (2021) have successfully used this proxy to gauge foreign investor sentiment.

4. Model Specification

4.1. Principal Component Analysis

The Principal Component Analysis (PCA) was employed to construct the investor sentiment index, following the methodology outlined by Baker and Wurgler (2006). The initial step involved standardizing the proxies used to measure investor sentiment. According to Baker and Wurgler (2006), PCA is calculated based on variance, which is influenced by the unit of measurement. Consequently, standardizing the proxies eliminated disparate measurement units, ensuring significant changes in the range of data did not dominate the limited data range. Following Kassambara (2017), the standardized proxies were given by:

$$\zeta = \frac{(Value - Mean)}{Standard\ deviation} \tag{1}$$

The second step entailed orthogonalizing each proxy against macroeconomic variables. This ensured that the explanatory proxies were behavioral and not incremental to risk factors, which isolated sentiment in each proxy (Moodley et al., 2024). The macroeconomic variables considered include the growth rates of gross domestic product, short-term growth, inflation, and long-term growth. The choice of macroeconomic variables followed that of L. X. Liu and Zhang (2008), who argue that these variables proxy systematic risk in an economy:

$$I_t = C_t + b_1 \Delta ST\_INT_t + b_2 \Delta CPI_t + b_3 \Delta GDP_t + b_4 \Delta LT\_INT_t + \varepsilon_t \tag{2}$$

where I_t is the investor sentiment proxies, C_t is the intercept, ΔST_INT_t is short-term interest growth rate, ΔCPI_t is inflation growth rate, ΔGDP_t is gross domestic product growth rate, ΔLT_INT_t is long-term interest growth rate and ε_t is the error term. EViews 12 was used to convert gross domestic product from quarterly to monthly data using the quadratic method presented by Dlamini (2017), as it is not available in monthly figures.

The residuals were then captured, and the principal component analysis was run. Baker and Wurgler (2006) argue that certain proxies take long periods to express sentiment. Consequently, the study used the Varimax rotation mechanism to rotate the PCA matrix. Therefore, the first PCA index of the current values and one period-lagged value was estimated. The correlations were compared, and the highest correlation was selected. The formulated investor sentiment index (SENT) with current values and one period lagged values was:

$$\begin{aligned} SENT_t = {} & \theta_1 Sturn_{t/lag1} + \theta_2 Eissue_{t/lag1} + \theta_3 AdvDec_{t/lag1} + \theta_4 R/\$BidAsk_{t/lag1} \\ & + \theta_5 SAVI_{t/lag1} + \theta_6 CNN_{t/lag1} + \theta_7 CCI_{t/lag1} \end{aligned} \tag{3}$$

where share turnover is denoted by *Sturn*, equity issue ratio is given by *Eissue*, advance/decline index is *AdvDec*, Rand/Dollar bid-ask spread is $R/\$BidAsk$, South African volatility index is SAVI, CNN fear and greed index is CNN and the consumer confidence index is *CCI*. Therefore, the newly constructed investor sentiment index is given by Equation (3), which is yet to be considered in empirical literature. Moreover, the newly constructed investor sentiment index contributes significantly to emerging market literature, especially in South Africa.

4.2. Markov Regime-Switching Model

A nonlinear model capable of capturing bull and bear market conditions was necessary to achieve the study's objective. As a result, the study opted for the Markov regime-switching model. The advantage of this model lies in its ability to naturally account for dynamic transitions between bull and bear regimes. Consequently, a rolling window approach is not aligned with the study's objective, as it isolates effects to these specific market regimes (Banerjee, 2022). Additionally, the switching mechanism is driven by an unobservable state factor that follows a first-order Markov chain (Hamilton, 1989). This allows for continuous shifts over different time periods, unlike other nonlinear models that impose exogenous changes at fixed time intervals (Camacho et al., 2018). The Markov regime-switching model is defined as follows:

$$\begin{aligned}\Delta \mathrm{I}_t = \mu_{ct} + \alpha_{0ict}\Delta SENT_t + \varphi_{1ict}\Delta CPI + \varphi_{2ict}\Delta ST\_INT + \varphi_{3ict}\Delta \mathrm{LT\_}INT \\ + \varphi_{4ict}\Delta \mathrm{GDP} + \varepsilon_{c_{t,}}\end{aligned} \tag{4}$$

where $\varepsilon_{c_{t,}}$ i.i.$d\left(0, \sigma^2_{c_{t,}}\right)$, $\Delta \mathrm{I}_t$ is the JSE sector returns, the state dependent mean and variance is given by μ_{ct} and $\sigma^2_{c_{t,}}$. The model considers two market conditions (C_t,), bull (1) and bear (2) market conditions. $\Delta SENT$ is the primary explanatory variable which is the investor sentiment index. ε_{c_t} is the volatility associated with state-dependent mean. The macroeconomic variables are the control variables measured by state-dependent variables, such as, ΔCPI is the change in inflation rate, ΔST_INT is the change in short-term interest rate, $\Delta \mathrm{LT\_}INT$ is the change in long-term interest rate, and ΔGDP is the change in gross domestic product. Moodley et al. (2022) found that macroeconomic variables influence stock market returns in changing market conditions. Consequently, to cater for research biases, this study implemented these control variables to enhance the robustness of the findings.

The market conditions adhere to a first-order Markov process, facilitated by the constant transition probability matrix (Corredor et al., 2013). Therefore, the probability of transitioning between bull and bear market conditions is represented by:

$$Prob = \begin{bmatrix} Prob(C_t = 1/C_{t-1} = 1) & Prob(C_t = 2/C_{t-1} = 1) \\ Prob(C_t = 2/C_{t-1} = 2) & Prob(C_t = 1/C_{t-1} = 2) \end{bmatrix} = \begin{bmatrix} Prob_{11} & Prob_{21} \\ Prob_{22} & Prob_{12} \end{bmatrix} \tag{5}$$

where $Prob_{11}$ represents the probability that the JSE sector return is in a bullish state and remains unchanged, $Prob_{21}$ is the probability that the returns are in a bullish state and transition to a bearish state, $Prob_{22}$ is the probability that the returns are in a bearish regime and remain unchanged, $Prob_{12}$ is the probability that the returns are in a bearish regime and shift to a bullish state (Brooks, 2019).

4.3. Preliminary and Diagnostic Tests

The study employed the Brock, Dechert, and Scheinkman (BDS) test to assess the presence of nonlinearity between the dependent and independent variables. This is essential for the estimation of the Markov regime-switching model, which requires that both the dependent and independent variables exhibit nonlinearity (Wang et al., 2021). While other nonlinearity tests, such as quantile regression, could be used to examine nonlinearity across different distribution levels of the dependent variable, these are beyond the scope of this study. To assess potential multicollinearity among the independent and control variables, the Variance Inflation Factor (VIF) test was conducted. Additionally, the study applied the Augmented Dickey-Fuller (ADF) unit root test, the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test for stationarity, and the ADF breakpoint unit root test to verify whether the variables are stationary at levels and in the presence of structural breaks. Once these tests confirmed the existence of nonlinearity, absence of multicollinearity, stationarity in levels, and structural breaks, the study proceeded with estimating the Markov regime-switching model. Finally, the robustness of the model was evaluated using the Breusch-Godfrey LM test and the Durbin-Watson autocorrelation test, which assess the presence of autocorrelation in the residuals.

5. Empirical Results

5.1. Preliminary Tests

5.1.1. Descriptive Statistics

Table 1 provides the descriptive statistics for the JSE sector returns, macroeconomic variables (control variables) and the investor sentiment index. The JSE consumable goods sector has the highest average return, whereas the JSE health sector has the lowest average return for the period March 2007–January 2024. Consequently, if investors had incorporated companies that formed part of the JSE consumable goods sector and not the JSE health sector in their profile for the sample period, they could have earned higher returns. The JSE oil and goods sector returns are the most volatile as depicted by the standard deviation, whereas the JSE consumable goods sector returns are the least volatile. The implication is that risk-taking investors who are exposed to high volatility can incorporate companies that form part of the JSE oil and goods sector, but risk-averse investors who are immune to high volatility must consider companies that form part of the JSE consumable goods sector. All sectors besides the JSE utilities sector returns and JSE oil and gas sector returns are negatively skewed. This indicates that there are more extreme negative returns than positive ones, as the mean is positioned to the left of both the median and mode. All JSE sectors exhibit a kurtosis greater than 3, suggesting that the returns have sharp peaks and flatter tails, deviating from a normal bell curve. This is further validated by the Jarque-Bera test for normality.

The mean of the investor sentiment index is negative, indicating that it predominantly reflects the impact of negative historical market shocks, such as the 2007/2008 global financial crisis and the COVID-19 pandemic. However, the presence of positive maximum values shows that the index also captures positive sentiment, which enhances its robustness (Boido & Fasano, 2014). The positive skewness suggests that the sentiment values are concentrated above the mean. Additionally, with a kurtosis value less than 3, the distribution of investor sentiment appears flat with thin tails, implying that the sentiment index does not follow a normal bell-shaped curve, as further confirmed by the Jarque-Bera test for normality.

Table 1. Descriptive Statistic Results.

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Observations	BDS
JSE_ALSI	0.8232	1.0702	0.9463	−1.0311	7.4712	−0.2456	3.7283	7.5889	0.0225	203	0.0174 ***
JSE_FIN	0.6307	0.9791	1.7315	−3.2605	5.4672	−1.2714	10.3277	15.5859	0.0000	203	0.0193 ***
JSE_INDU	0.5793	0.6305	8.5462	−2.8568	5.1475	−0.7670	6.6413	15.5160	0.0000	203	0.0084 *
JSE_CONG	1.0812	1.1792	9.8064	−1.2778	5.1505	−0.1670	4.4015	20.4121	0.0000	203	0.0174 **
JSE_HEAL	−0.1731	0.9188	4.5585	−2.9965	5.6542	−0.1544	4.4137	28.8037	0.0000	203	0.0793 ***
JSE_CONS	0.8614	1.1468	7.9583	−3.9257	6.8627	−0.8984	7.4930	23.0261	0.0000	203	0.0183 ***
JSE_TELCOM	0.4441	0.5401	7.7318	−2.4236	6.8502	−0.3428	3.6334	8.5670	0.0138	203	0.0128 ***
JSE_UT	0.6191	0.6707	0.9521	−2.9295	6.2903	0.0368	5.8606	80.5212	0.0000	203	0.0431 **
JSE_TECH	0.7238	0.5131	2.1223	−2.6199	7.7314	−0.0083	5.8957	82.4565	0.0000	203	0.0151 ***
JSE_OG	0.7390	−0.4890	8.0293	−3.3026	9.8284	7.0602	8.2238	73.3810	0.0000	203	0.0138 ***
JSE_BM	0.4943	0.2811	2.6136	−2.5829	7.2335	−0.3800	3.5703	8.8789	0.0118	203	0.0106 *
ΔSENT	-3.76×10^{-2}	−0.1180	4.6239	−3.4905	1.8943	0.2031	1.9804	11.8442	0.0027	203	0.1440 ***
ΔCPI	−0.1330	1.5893	2.0000	−2.4615	7.4515	−8.0843	1.8314	98.6191	0.0000	203	0.0183 ***
ΔST_INT	0.2135	2.8941	4.6667	−2.2867	5.1370	2.3049	9.0844	27.5293	0.0000	203	0.0187 ***
ΔLT_INT	0.1619	2.4789	3.6986	−4.2857	3.9722	−1.0387	9.9488	51.7247	0.0000	203	0.0162 **
ΔGDP	0.5594	0.8937	2.2345	−2.3363	8.1251	0.3945	4.8147	38.5068	0.0000	203	0.0217 ***

Notes: 1. ***, ** and * indicate a statistical significance level of 1%, 5% and 10% level of significance, respectively. 2. BDS has two dimensions. Source: Author's own estimations (2024).

The control variables reveal that inflation has the lowest average growth rate, followed by long-term interest rates, short-term interest rates, and the gross domestic product (GDP) growth rate. Similarly, inflation exhibits the lowest growth rate, while short-term interest rates show the highest growth rate. Additionally, the inflation growth rate displays significant fluctuations around its mean, as evidenced by the highest standard deviation among the control variables. The skewness of short-term interest growth rates and GDP growth rates is positive, indicating that their growth rates are concentrated to the right of the mean. In contrast, inflation growth rates and long-term interest rates show negative skewness, suggesting that their growth rates are skewed to the left of the mean. This indicates that the distributions do not follow a standard bell curve, as the returns fluctuate throughout the sample period. Furthermore, the kurtosis of short-term interest growth rates, long-term interest growth rates, and GDP growth rates exceeds 3, indicating that these variables have a leptokurtic distribution, while the inflation growth rate has a kurtosis of less than 3, indicating a mesokurtic distribution. These observations align with the skewness findings. The BDS test confirms that the variables used in the study are nonlinearly dependent, as the null hypothesis (that the variables are independently and identically distributed) is rejected at all levels of significance.

5.1.2. Multicollinearity Test

The findings of the VIF test are presented in Table 2 below. It is evident that the VIF test for the explanatory and control variables is between 1 and 2. Consequently, the findings show that there is no multicollinearity among the explanatory and control variables. Therefore, having found the existence of nonlinearity and no multicollinearity, the study proceeded to estimate the unit root and stationarity test.

Table 2. Variance Inflation Factor Results.

	Coefficient	**Uncentered**	**Centered**
Variable	Variance	VIF	VIF
C	0.0854	1.0099	NA
SENT	0.0237	1.0023	1.0023
CPI	0.0015	1.0073	1.0070
ST_INT	0.0033	1.0077	1.0053
LT_INT	0.0054	1.0104	1.0087
GDP	0.0013	1.0224	1.0175

Source: Author's own estimations (2024).

5.1.3. Unit Root and Stationarity Test

Table 3 below displays the results of the unit root and stationarity tests. The ADF test indicates that all variables are stationary, as the null hypothesis of a unit root is rejected in favor of the alternative hypothesis that the variables are stationary. Additionally, the KPSS test supports the ADF test findings, as the t-statistics are lower than the corresponding critical values. The ADF breakpoint test further confirms that the variables are stationary even in the presence of structural breaks. Therefore, all variables are stationary at levels and integrated of order I(0). With the presence of nonlinearity, no multicollinearity, stationarity at levels, and structural breaks established, the Markov regime-switching model was estimated.

Table 3. Unit root and Stationarity Results.

	Levels		
	ADF	**KPSS**	**ADF-Break Point**
JSE_ALSI	−16.0062 ***	0.31844	−16.8339 ***
JSE_FIN	−15.5809 ***	0.2264	−18.0504 ***
JSE_INDU	−13.6570 ***	0.4335	−15.2348 ***
JSE_CONG	−17.8068 ***	0.5671	−18.7547 ***
JSE_HEAL	−15.4891 ***	0.2019	−41.3849 ***
JSE_CONS	−14.1033 ***	0.1688	−16.0058 ***
JSE_TELCOM	−15.1835 ***	0.4455	−15.7918 ***
JSE_UT	−14.5223 ***	0.1225	−15.6826 ***
JSE_TECH	−14.8732 ***	0.2909	−15.4748 ***
JSE_OG	−15.8351 ***	0.1669	−19.8100 ***
JSE_BM	−16.3124 ***	0.1232	−17.0500 ***
ΔSENT	−3.7508 ***	0.0904	−20.7143 ***
ΔCPI	−14.1264 ***	0.0975	−14.5357 ***
ΔST_INT	−14.5517 ***	0.4013	−16.5231 ***
ΔLT_INT	−7.5624 ***	0.1668	−12.2402 ***
ΔGDP	−9.7600 ***	0.2033	−12.7333 ***

Notes: 1. *** indicate a statistical significance level of 1%. 2. The KPSS critical values at 1%, 5% and 10% statistical significance level are 0.7390, 0.4630 and 0.3470, respectively. Source: Author's own estimations (2024).

5.2. Empirical Model Results

5.2.1. Investor Sentiment Index Estimation

Table 4 presents the results of the PCA. The PCA incorporates all seven proxies, each weighted equally at 14.29%, where the first principal component of the newly constructed investor sentiment index accounts for 51.04% of the total variance. Omitting any proxies would reduce the index's total variance, thereby diminishing its robustness. Therefore, the 51.04% figure highlights the robustness of the sentiment index, as it explains more than half of the total variation in sentiment for the sample period. In comparison, the constructed investor sentiment indices of Reis and Pinho (2020) and L. Muguto (2022) explain 47% and 43.71% of total variance, respectively, indicating that the current index performs better. Additionally, the first four principal components account for 89% of the total variation in sentiment during the sample period, further validating the robustness of the constructed index. Notably, the consumer confidence index, Rand/Dollar bid-ask spread, and SAVI show the highest correlations with the first component (PC1), while share turnover, equity issue ratio, advance/decline index, and the CNN fear and greed index exhibit negative correlations with PC1. This suggests that the constructed investor sentiment index captures both positive and negative market sentiment. The Wald test confirms that the parameters of the sentiment index are significantly different. The first PCA index of current values shows higher correlations with the proxies compared to the first PCA index of one-period lagged values. The $SENT_t$ is therefore defined by the following equation:

$$SENT_t = -0.2423Sturn_t - 0.2874Eissue_t - 0.0447AdvDec_t + 0.5125R/\$BidAsk_t + 0.5128SAVI_t - 0.2993CNN_t + 0.4915CCI_t \quad (6)$$

Table 4. Principal Component Analysis Results.

Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proposition
1	3.5731	2.4690	**0.5104**	3.5731	0.5104
2	1.1041	0.2217	0.1577	4.6772	0.6682
3	0.8824	0.1559	0.1261	5.5596	0.7942
4	0.7265	0.0742	0.1038	6.2861	0.8980
5	0.6523	0.6143	0.0932	6.9384	0.9912
6	0.0380	0.0144	0.0054	6.9763	0.9966
7	0.0236	---	0.0034	7.0000	1.0000

Notes: 1. The bold figure indicates the total variance. Source: Author's own estimations (2024).

5.2.2. Markov-Regime Switching Model Results

The Markov regime-switching model of conditional mean and constant transition probabilities is presented in this section. The transition probabilities and expected duration are firstly examined, and thereafter the Markov regime-switching model estimation is considered.

Transition Probabilities and Expected Duration

Table 5 displays the transition probabilities and expected durations of JSE sector returns. The transition probabilities in a bull market, associated with the JSE All Share Index returns (0.9857), JSE financial sector returns (0.9880), JSE health sector returns (0.9840), JSE technology sector returns (0.8982), JSE oil and gas sector returns (0.9776), and JSE basic materials sector returns (0.9581) are greater than the associated transition probabilities in a bear market. This indicates that the bull market condition is more persistent among the sector returns as all transition probabilities are closer to one. This is confirmed by the expected duration as the JSE All Share Index returns stayed in a bull market condition for 70 months, JSE financial sector returns for 83 months, JSE health sector returns for 62 months, JSE technology sector returns for 9.8 months, JSE oil and gas sector returns for 44 months, and JSE basic materials sector returns for 23 months, all of which are longer than the bear market condition.

Table 5. Regime Probabilities and Expected Duration Results.

JSE Index Regime	Transition Probabilities		Expected Duration	
	Bull	Bear	Bull	Bear
JSE_ALSI	0.9857	0.9026	69.6889	10.2619
JSE_FIN	0.9880	0.9740	83.4594	38.4876
JSE_INDU	0.1942	0.9673	1.2411	30.6068
JSE_CONG	0.0010	0.9452	1.0010	18.2450
JSE_HEAL	0.9840	0.4881	62.5127	1.9535
JSE_CONS	0.4385	0.9663	1.7809	29.6648
JSE_TELCOM	0.4875	0.5808	1.9514	2.3854
JSE_UT	8.64×10^{-0}	0.9699	1.0001	33.2474
JSE_TECH	0.8982	0.8909	9.8226	9.1641
JSE_OG	0.9776	0.2794	44.7201	1.3877
JSE_BM	0.9581	7.21×10^{-1}	23.8748	1.0000

Source: Author's own estimations (2024).

In contrast, in bear market conditions, the transition probabilities for JSE industrial sector returns (0.9673), JSE consumable goods sector returns (0.9452), JSE consumable service sector returns (0.9663), JSE telecommunications sector returns (0.5808), and JSE utilities sector returns (0.9699) are higher than those observed in a bull market. This suggests that these sector returns remained in a bear market condition for a longer period compared to a bull market. This is further supported by the expected duration, with the JSE industrial sector returns staying the longest in a bear regime (30 months), followed by the JSE consumable goods sector returns (18 months), JSE consumable service sector returns (29 months), JSE telecommunications sector returns (2 months), and JSE utilities sector returns (33 months).

The findings clearly indicate that the JSE was primarily influenced by bull market conditions from March 2007 to January 2024, as evidenced by the JSE All Share Index returns, which reflect the overall market and remained in a bull regime for the longest period. This conclusion is further supported by the observation that bull market conditions, rather than bear market conditions dominate the JSE sector returns. As a result, the JSE sector returns exhibit an upward trend throughout the sample period. These results align with the findings of Moodley et al. (2022), who also identified the prevalence of bull market conditions among JSE sector returns.

Regime-Switching Results

Table 6 presents the Markov-regime switching model estimation results. It is evident that the JSE industrial sector returns, JSE consumable good sector returns, JSE health sector returns, JSE consumable services sector returns, JSE telecommunication sector returns, JSE utilities sector returns, JSE technology sector returns, JSE oil and gas sector returns and JSE basic materials sector returns are positive and significant in a bull market. However, the JSE industrial sector returns, JSE consumable goods sector returns, JSE health sector returns, the returns of the JSE consumable services sector and JSE utilities sector are both negative and statistically significant during bear market conditions. The findings are consistent with Davies (2013), who found that increasing returns are indicative of a bullish market, whereas decreasing returns are indicative of a bearish market. However, Moodley et al. (2022) discovered that only the JSE technology sector returns were positive and significant during a bull market regime, while the JSE consumable services sector returns were positive and significant in a bear market regime.

The contradiction in findings can be attributed to the variation in the sample period, such that Moodley et al. (2022) covered a sample period from February 1996 to December 2018 and the current study's sample period is June 2004 to January 2024. The findings illustrate that when the stock market is in an uptrend investors should incorporate companies that form part of the sector returns that are positive in a bull regime into their portfolio. This will allow for favorable returns because the returns are positive and increasing during an uptrend. However, if investors have companies in their portfolio that form part of the sector returns that are negative in a bear regime, they should rebalance their portfolio because they will experience losses when the market is in a downtrend as returns are decreasing.

The error variance associated with all JSE sector returns, except for JSE basic materials sector returns, is positive and significant in a bull market. In a bear market, the error variance of the JSE industrial sector returns, JSE consumable sector returns, JSE health sector returns, and JSE utilities sector returns is negative and significant. This suggests that the bear market is more volatile for these sectors compared to the bull market. Moodley et al. (2022) also found that the bull market is less risky than the bear market because there are increasing returns rather than falling returns over the period. The findings have two implications. First, because they are not immune to high volatility, risk averse investors should not invest in companies that form part of those sectors that are volatile during a bear market. Rather, they should look at those companies that form part of sectors that are less volatile in a bull market. However, risk taking investors may want to consider companies that form part of those sectors that are more volatile during a bear market condition, as it might generate a higher return for them. This is supported by the risk-return relationship, such that investors must be compensated for the risk they assume.

Table 6. Markov-Regime Switching Results.

	JSE_ALSI	JSE_FIN	JSE_IND	JSE_CONG	JSE_HEAL	JSE_CONS	JSE_TELCOM	JSE_UT	JSE_TECH	JSE_OG	JSE_BM
Panel A: Bull market											
C	−1.2041	−1.5773	**0.8934** ***	**1.1754** ***	**0.9816** ***	**1.4753** ***	**1.8695** **	**0.6564** *	**1.6071** ***	**8.7787** ***	**0.7955** ***
ΔSENT	−0.0229	0.6698	**−0.3644** **	−0.2661	−0.9427	−0.0648	**0.8052** *	−0.1044	**−0.6951** *	**5.3586** ***	**0.3983** ***
ΔCPI	−0.0380	−0.0267	−0.0458	−0.0502	−0.0459	−0.0666	−0.0015	−0.0134	0.0346	**−0.5811** ***	**0.0260** ***
ΔST_INT	−0.1434	0.0091	**−0.0574** **	−0.0471	−0.0659	**−0.1304** **	−0.1538	−0.0370	−0.0606	**1.0649** ***	**0.1240** ***
ΔLT_INT	−0.3597	0.1176	−0.1515	−0.1077	−0.1795	−0.2650	0.0470	−0.1521	0.2213	**−1.6636** ***	**−0.0285** ***
ΔGDP	−0.3349	0.0030	−0.0183	−0.0253	−0.0285	−0.0744	0.0871	−0.0707	**0.2204** **	**1.5377** ***	**0.0814** ***
σ	**1.8811** ***	**2.0775** ***	**1.4401** ***	**1.6421** ***	1.6933 ***	**1.7487** ***	**1.5338** ***	**1.6947** ***	**1.3769** ***	**0.7587** ***	**−4.6490** ***
Panel B: Bear market											
C	**1.0975** ***	**0.8675** ***	**−8.8186** ***	**−0.3384** ***	**−1.4482** ***	**−5.9343** ***	−1.5371	**−1.9975** ***	−0.5645	−0.0056	0.5266
ΔSENT	**−0.2659** *	**−0.4053** **	**3.3646** ***	**0.0470** ***	**−0.2768** ***	0.4490	**−1.9423** **	**7.9656** ***	0.1897	−0.5816	0.0431
ΔCPI	−0.0629	−0.0542	**1.3939** ***	**−0.0299** ***	**−2.7809** ***	−0.1298	−0.0122	**−0.3313** ***	−0.2470	−0.1410	**−0.1152** *
ΔST_INT	−0.0740	−0.0415	**−0.5270** ***	**−0.1267** ***	**−1.5476** ***	−0.3237	−0.0449	**−0.4700** ***	−0.0282	0.0776	−0.0941
ΔLT_INT	0.0063	**−0.1956** *	**2.2951** ***	**0.4712** ***	**1.0954** ***	**3.6073** ***	0.0051	**3.1161** ***	**−0.3549** *	0.2092	−0.1690
ΔGDP	0.0302	0.0019	**−1.1801** ***	**−0.1894** ***	**2.3106** ***	**2.0818** ***	−0.2196	**1.7346** ***	0.0178	−0.0458	−0.0067
σ	**1.3087** ***	**1.2714** ***	**−3.5565** ***	**−4.1781** ***	**−3.8005** ***	**0.8913** ***	**1.9720** ***	**−4.6473** ***	**2.2493** ***	**2.2954** ***	**1.9828** ***
Panel C: Diagnostic test											
LM-STAT	0.4142	0.2774	0.8812	0.6299	0.8323	0.7033	0.0536	1.4521	0.0364	1.5770	2.0826
p-Value	0.6613	0.7580	0.3409	0.7043	0.9210	0.1844	0.9478	0.2362	0.9643	0.2089	0.1270
DW-STAT	2.0987	2.0778	2.0934	2.3138	2.0909	2.1521	2.0643	2.0492	2.0298	2.0896	2.1325

Notes: 1. The bold figures illustrate the significant variables; 2. ***, ** and * indicate a statistical significance level of 1%, 5% and 10% level of significance, respectively. Source: Author's own estimations (2024).

In a bull market, investor sentiment has a positive significant effect on the JSE oil and gas sector returns, JSE telecommunication sector returns, and JSE basic material sector returns. These findings are consistent with those of T. L. Huang (2015) and He et al. (2020), who also concluded that investor sentiment positively impacts stock market returns during bull market conditions. According to Hanna et al. (2020), this implies that when the bull market condition persists, it is accompanied by optimistic behaviour regarding the market's current state and future perspectives, as such optimistic investors give rise to noise traders in the market, which drives trade, and increases stock market returns. Similarly, when the exact market condition is persistent, the JSE industrial sector returns, and the JSE technology sector returns are negatively influenced by investor sentiment. This contradicts the findings in empirical literature as investors are optimistic in a bull market condition, which raises stock market prices. An explanation is that investor perceptions of the future prospects of the stock market are not always the same, as individuals behave in diverse ways. Thus, investor sentiment is also found to affect stock market returns negatively in an optimistic market state as there are two types of noise traders, those that drive trading and those that reduce trading.

During bear market conditions, investor sentiment has a positive and significant impact on returns in the JSE industrial sector, JSE consumer sector, and JSE utilities sector. This finding contrasts with much of the existing literature, which typically suggests that bearish market conditions are marked by investor pessimism, leading to declining stock prices. However, as previously discussed, the current results offer a rationale for the observed positive relationship between sentiment and returns in a bear regime. Conversely, investor sentiment has a negative and significant effect on returns only in the JSE health sector and JSE telecommunications sector. These results are consistent with studies by Cevik et al. (2022) and Shen et al. (2023). The explanation, as outlined by Hanna et al. (2020), is that in bear markets, pessimistic investor outlooks contribute to the presence of noise traders, which lowers market activity and, in turn, reduces stock returns.

The findings reveal that not all JSE sector returns are influenced by investor sentiment in bull or bear market conditions. Iqbal et al. (2023) suggest that the South African stock market is not consistently driven by noise traders who push returns up or down; instead, these traders enter and exit the market frequently. Therefore, an insignificant effect of investor sentiment may indicate the absence of noise traders in a particular sector during the observed period. Similar results were reported by He et al. (2020), Pan (2020), and Dhasmana et al. (2023), who found no significant impact of investor sentiment on stock market returns in either market regime. Additionally, the relationship between investor sentiment and stock market returns appears to be time varying and regime dependent. This observation aligns with the Adaptive Market Hypothesis (AMH), which posits that the influence of investor sentiment on returns is shaped by prevailing market conditions (Lo, 2004). Consequently, the effect of sentiment in a bull market is not necessarily the same as in a bear market. The control variables included in the model also indicate that certain macroeconomic factors significantly influence JSE sector returns across both market regimes. By accounting for these variables, the model's robustness is enhanced. Furthermore, the Breusch-Godfrey LM autocorrelation test supports the model's validity, as the null hypothesis of no autocorrelation in residuals is not rejected. This is corroborated by the Durbin-Watson statistic, which is approximately 2, indicating no evidence of autocorrelation in the model's residuals.

It is evident from the findings of the study that market-wide investor sentiment has a time-varying and regime-specific effect on JSE sector returns in the presence of changing market conditions. These findings suggest that when the JSE is experiencing fluctuating economic conditions such as bull and bear periods, sentiment will not have a constant

effect on JSE sector returns. This contradicts EMH, which postulates that investor sentiment should have no effect on JSE sector returns because market participants are rational, and all information is contained in stock market prices. This raises serious economic implications because the findings suggest that investors in South Africa can now use sentiment and economic conditions of the JSE to determine the return perspective of JSE sectors. Despite these contradictions, the findings align with behavioural finance as the theory postulates that irrationality of investors, measured by investor sentiment, does influence JSE sector returns allowing for access returns.

6. Conclusions

The introduction of AMH permits the re-examination of the influence of investor sentiment on stock market returns. This means that the effect should be nonlinear and vary with the market condition. This study constructed a monthly investor sentiment index for the sample period March 2007 to January 2024 and tested against aggregated sector returns that form part of the Financial 15 sector, Resource 10 sector, and Industrial 25 sector of the JSE (refer to Appendix A). The identification of two regimes (bull and bear) led to the selection of the two-state Markov regime-switching model of conditional mean with constant transition probabilities.

The findings related to the research question indicate that investor sentiment has a time-varying and regime-dependent impact on JSE sector returns. In a bull market, investor sentiment exerts a positive and significant influence on the returns of the JSE oil and gas sector, telecommunication sector, and basic materials sector. Conversely, during bear market conditions, investor sentiment negatively and significantly affects the returns of the JSE health sector and telecommunication sector. Additionally, investor sentiment has a negative and significant effect on the overall JSE market (JSE-ALSI) during bearish periods. The persistence of bullish market conditions across most JSE sectors further supports these observations. Overall, the results align with the Adaptive Market Hypothesis (AMH), which emphasizes shifting market efficiency, regime dependence, and time-varying relationships.

The study's implications can be grouped into three categories: practical, theoretical, and empirical. Firstly, the practical implication is that investors should conduct portfolio rebalancing if their portfolio contains companies that form part of the JSE industrial sector and JSE technology sector (JSE health sector, and JSE telecommunication) sector during a bull (bear) market condition. Moreover, investors should consider the state of the stock market when conducting asset selection in future. They should not select companies that form part of the above sectors as it will yield negative portfolio returns at the prevailing market condition. Secondly, it is evident from the theoretical basis that the stock market can be categorized as adaptive rather than efficient, as proposed by EMH. Therefore, policy makers should reconsider stock market policies in South Africa to take advantage of the new evidence. The irrationality of investors should be considered when formulating stock market policies that govern market behaviour. This will remove unfair market behaviour and asset price manipulation, which give rise to financial market mispricing. Lastly, empirically, the study contributes to the long-standing debate in the literature by demonstrating that the effect of investor sentiment on stock market returns is nonlinear and not linear as proposed by many academics. Consequently, a nonlinear model is necessary, since the effect of investor sentiment on stock market returns fluctuates with changing markets.

The study recommends that the JSE develop a market-wide investor sentiment index in line with the CNN Fear and Greed index for the South African financial market. Investors will be able to gauge sentiment in the market, thereby reducing the time needed to implement the findings of this study in relation to asset selection, portfolio formation

and portfolio rebalancing. Moreover, since any financial market consists of domestic and foreign investors, it is recommended that the JSE include a gauge for foreign investor sentiment in the market when developing the proposed sentiment index, as such sentiment must be captured. The constructed index will also assist researchers with testing investor sentiment in South Africa, since there is currently no measure for sentiment. Therefore, it will enhance the quality of research as researchers will have a measurement for sentiment in South Africa.

A proposed limitation is that by examining the effect of sector returns on investors the study isolates the unidirectional effect of investor sentiment on JSE sector returns and does not look at the bidirectional effect. Moreover, this study does not use additional market efficiency tests to confirm the findings that the equity market is adaptive. However, it is proposed that such tests be carried out in future research. Furthermore, future studies can use the MS-VAR methodology and granger casualty tests to examine the bi-directional relationship between investor sentiment and JSE sector returns. This will further extend the current analysis by determining whether investor sentiment is influenced by sector returns in different market conditions. Moreover, future studies can introduce the different forms of investor sentiment and extend the sample period to capture more historical events.

Author Contributions: It is important to note that the research article was written in its entirety by F.M., a Doctor of Philosophy candidate in Risk Management at Northwest University. The additional authors, S.F.-S. and K.M., are the doctoral candidate's supervisors who assumed advisory roles and provided comments to improve the manuscript. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data is available on request from the corresponding author.

Acknowledgments: We are grateful to the anonymous reviewers whose thorough reviews have helped to improve the published paper.

Conflicts of Interest: No potential conflicts of interest were reported by the authors.

Appendix A

Table A1. Equity market dependent variables.

Variable Name	Abbreviation
JSE All-Share Index	JSE_ALSI
Financial Sector (FIN15)	
Financials Index	JSE_FIN
Industrial Sector (IND25)	
Industrials Index	JSE_IND
Consumer Goods Index	JSE_CONG
Health Care Index	JSE_HEAL
Consumer Services Index	JSE_CONS
Telecommunications Index	JSE_TELCOM
Utilities Index	JSE_UT
Technologies Index	JSE_TECH
Resource Sector (RES10)	
Oil and Gas Index	JSE_OG
Basic Materials Index	JSE_BM

Source: Author's own depiction (2024).

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