Do Geopolitical Risk and Market Conditions Drive JSE Sector Returns?

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ABSTRACT
Although equity markets contribute immensely to economic growth, they are susceptible to various risks, including geopolitical risks. Despite this, emerging markets such as South Africa have failed to examine geopolitical risk as a determinant of equity market returns under various market conditions. On this basis, this study aims to investigate the effect of geopolitical risk on South African sector returns under changing market conditions from February 1996 to December 2023. This study introduces the Markov regime-switching model, and the findings demonstrate that geopolitical risk has a regime-specific effect on the Johannesburg Stock Exchange (JSE) sector returns. Moreover, regardless of the effect of geopolitical risk, the consumable goods and consumables services index performed well. This implies that the JSE aggregated market can be used to track the performance of these two markets. The study concludes that the JSE All-share, Consumable goods, and Consumable services indices could be investors' safe haven during geopolitical tension and equity market uncertainty. However, investors and portfolio managers should be strategic when investing in the JSE industrials and mining indices because they are highly volatile and produce the lowest returns.

KEYWORDS: *Markov model, geopolitical risk, stable regime, volatile regime, JSE.*

JEL CLASSIFICATION: *MG11, G14, G32.*

1. INTRODUCTION

The financial market is a marketplace where various financial assets and securities, including equities, bonds, foreign exchange, and derivative instruments, are bought and sold (Pilbeam, 2018). A financial market comprises various components known as asset markets, including the foreign exchange market, the equity market, the commodities market, and the bonds market, among others. The International Monetary Fund (IMF) (2022) suggests that the financial market in South Africa stands out as the most advanced and liquid on the African continent, and it meets high global standards. This reflects the country's commitment to credible and independent policymaking, a diverse economy, and robust financial institutions. Although the South African economy has been subject to various economic shocks, such as the COVID-19 pandemic and the load-shedding crisis, it remains resilient in its prospects of fostering economic growth. The financial sector contributes significantly to the economic growth of South Africa. That being, the financial sector's assets account for triple of South Africans gross domestic product (GDP), surpassing the averages seen in many emerging market economies (Adrangi & Kerr, 2022). When zooming in on the South African economy, statistics show that the equity market is a major contributor to economic growth. The country's gross GDP is primarily driven by its stock market (Khetsi & Mongale, 2015).

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Although the equity market contributes significantly to economic growth, it is influenced by various factors, including geopolitical risk (GPR). GPR is the threat, realisation, and escalation of adverse events associated with wars, terrorism, and any tensions among states and political factors that affect the peaceful course of international relations (Caldara & Iacoviello, 2022). The South African government engaged in geopolitical diplomacy when it mistakenly believed in maintaining neutrality in the voting process during the United Nations General Assembly session regarding the Russia-Ukraine conflict. During the 1990s, the African National Congress (ANC), the current ruling party, formed a non-alignment policy biased towards Russia. This policy upholds the principles of peace and disarmament, independence and racial equality, universalism and multilateralism, economic equality, and cultural equality (Aye, 2021). Hence, the South African government-maintained neutrality by abstaining from taking sides in the Russia-Ukraine conflict. This decision was taken because the South African government wanted to abstain from taking sides in the ongoing war between the two nations. In May 2023, the diplomatic representative of the United States of America (USA) in South Africa brought attention to South Africa's policy of non-alignment by disclosing the transfer of weaponry from a South African naval base to Russia. The financial markets in South Africa were greatly affected as the rand's value decreased significantly to its lowest level since 2020 following the emergence of the Russian arms scandal. This resulted in the equity markets experiencing a notable decline of at least 1% on the same day (Makina, 2023).

Allan Gray and Momentum Investments have similar views on the impact of the conflict between Russia and Ukraine. Notably, with direct exposure to Russia, the JSE-listed shares for Mondi held by Equity and Balanced funds at Allan Gray saw the two funds experiencing a severe fallout when the share price dropped by 30%. In addition, Allan Gray has an investment in the Naspers & Prosus group that has seen a dive of 35% in share price since the beginning of February 2022. The group's direct exposure to Russia is 2-3% of its total value. The great plummeting is attributed to fear of a fractured world, which has renewed concerns regarding long-term value (Plaut, 2022). Similarly, South Africa faced backlash following its submission of a report accusing Israel of genocide to the International Court of Justice (ICJ). This is because the USA and Israel have strong relations following the USA’s proclamation of Israel’s independence in 1948. Hence, South Africa’s submission to ICJ caused tension between South Africa and the USA, thus causing South Africa to risk losing its preferential trade access from the USA through the African Growth and Opportunity Act (Fabricius, 2024).

The efficient market hypothesis (EMH) suggests that prices reflect all available market information, including historical information, public and private, regarding a financial item, and hence leads to the linear effect of geopolitical risk on stock market prices. In line with this, Iwanicz-Drozdowska et al. (2021) found a linear relationship between GPR and equity market returns, where global uncertainties have substantially determined South Africa's stock market during different economic conditions. On the contrary, there is evidence of a nonlinear relationship, as Balcilar et al. (2018), found that GPR impact stock markets differently. This implies that GPR effects equity market's return in a stable and volatile market conditions, which is supported by the adaptive market hypothesis (AMH). Given the debate among empirical literature, the study examines the effect of GPR on JSE disaggregated sector returns under changing market conditions. Therefore, this study aims to investigate the impact of GPR on JSE sector returns by employing the Markov model, which can capture nonlinear patterns and switching regimes. Various studies have been conducted on advanced economies, and emerging economies such as South Africa are often overlooked. Therefore, investors should be informed about the equity market in South Africa and the extent to which GPR

affects their investments, as South Africa has become a significant player in the geopolitical arena.

The Republic of South Africa maintains various relationships and alliances that are interconnect it with global financial markets, making it susceptible to risks that can adversely affect equity markets and cause investors to panic. One such risk is GPR. Several studies have demonstrated that financial markets respond differently to geopolitical risk, whether linearly or nonlinearly. However, these studies typically employ regression or auto-regressive models to examine the effects of GPR, which do not always account for switching market conditions. Furthermore, investor behaviour varies under different market conditions. Investors should recognise the influence that risk, particularly GPR, has on their investments. This is because there are numerous unresolved tensions between different nations, and it is uncertain how markets will react in any conflict. Although investors typically consider overall indices in their portfolios, geopolitical risk can significantly impact their returns in various market circumstances. As a result, it may affect portfolio returns, necessitating portfolio diversification and rebalancing.

2. LITERATURE REVIEW

2.1. Theoretical background

This section thoroughly reviews the theories underlying the influence of GPR on equities market performance. EMH is first recognised, determining its impact on stock prices and market participants' capacity to earn excess gains. The behavioural finance theory is then investigated to discover why investors attribute irrational behaviour, meaning that capital markets are inefficient. The AMH is evaluated, revealing a nonlinear link between stock market prices and macroeconomic variables.

2.1.1. Efficient Market Hypothesis

The idea of EMH originated in the 1960s, positing that an efficient capital market is one where stock prices represent all available information, which reflects three versions, namely the weak-form, the semi-strong form, and the strong-form. The weak-form version of EMH refers to the current values of stocks considering all past financial information. The theory suggests that investing in financial assets does not result in abnormal profits for investors. The semi-strong form assumes that financial asset prices reflect all available information in a market, including historical prices and other information (which includes the weak form of EMH). Prices also change quickly and without bias to account for different factors. Suppose that a semi-strong version of EMH exists in a capital market. In that case, neither technical nor fundamental research can indicate how an investor can split his money so that the gained profitability is more significant than that produced by investing in a random portfolio of financial assets. The strong-form of EMH posits that prices integrate all the available information on a market, including historical financial information (weak-form), all fresh public information (semi-strong form), and all private information concerning a financial item (Titan, 2015). The EMH is relevant to this study since it allows the conclusion that the GPR influences the performance of the stock market returns, which is linear.

2.1.2. Behavioural Finance

In recent years, there has been a growing interest in behavioural finance, which has called into question the conventional beliefs of the EMH and offered a more sophisticated comprehension of investor behaviour and its repercussions on financial markets. Behavioural finance entails the study of the impact of psychological factors on individual behaviour and

the valuation of financial assets. Traditional financial models assume individuals to be rational and inclined towards risk aversion. Modern Portfolio Theory has primarily influenced conventional academic finance, which assumes that investors behave rationally and base their decisions on maximising expected utility (Ishfaq et al., 2021). However, people can exhibit irrational tendencies and participate in risky activities. To support this, Kahneman and Tversky's (1992) prospect theory explains cognitive biases that can result in irrational decision-making in situations involving risk and uncertainty. The theory elucidates how individuals respond to forthcoming gains and losses contingent upon their respective valuation structures.

2.1.3. Adaptive Market Hypothesis

The EMH has been a good guide to understanding the nature of financial markets, but with numerous criticisms. For instance, it presents an incomplete picture of stock market behaviour since financial crises would not happen if markets were efficient at all times and prices always fully reflect all available information. Besides, behavioural finance postulates that the investors are rational, and classical finance tends to ignore the incentives, emotions, and biases that determine the decision process of the investors. Beyond these, market anomalies indicate that stock return patterns are inconsistent with EMH predictions. That being the case, Lo (2004) formulated the AMH. The AMH is a dynamic process and depends on market conditions and the ability of the participants in the market to adjust to set conditions. It considers the evolving behaviour of participants in the market and the reaction of existing participants to constantly changing market conditions. The AMH is relevant in this study as it demonstrates that GPR will have a nonlinear effect on stock market returns (Dhankar & Shankar, 2016).

2.2. Empirical Review

2.2.1. The Linear Relationship

Yang and Yang (2021) examined the influence of GPR on stock market returns. The authors utilised a GPR index developed by Caldara and Iacoviello (2018) to carry out this research. They analysed the time series trends of quarterly, monthly, and weekly GPR changes and returns of the S&P500 and Dow Jones indexes. The researchers employed the Mixed Data Sampling (MIDAS) model, which utilises distributed lag polynomials to ensure a parsimonious model specification while allowing for data sampled at different frequencies. The findings of this study reveal that real-time GPR shocks have a long-lasting negative impact on stock returns, and the overall model fits are sensitive to the selected sample frequency. In a similar study, Agoraki et al. (2022) examined the consequences of GPR and economic policy uncertainty on stock returns. It employed an unbalanced panel dataset that covers monthly observations for 22 countries between 1985 and 2020. The dataset is controlled for a range of macroeconomic and market structure variables, with the added consideration of the 2007-2009 financial crisis's potential effects. The study utilises an augmented capital asset pricing model (CAPM) to conduct this analysis. The results show that the GPR coefficient is negative and statistically significant. This finding supports the central hypothesis and indicates that increasing GPR will decrease stock returns.

Kunjal (2023) assessed the impact of GPR on exchange-traded fund (ETF) inflows to emerging markets. The study used eight ETFs trading in emerging markets, including Brazil, Chile, China, Egypt, India, Philippines, South Africa, and Taiwan. The data spanning July 2013 to June 2023 was analysed with vector autoregressive modelling methods and their associated impulse response functions and Granger causality tests. It is observed that GPR significantly influences the flow of ETFs within emerging markets positively, except in the

Philippines, where its effect is substantially negative. Further analysis reveals that GPR has a relevant and positive effect on ETF liquidity in emerging markets. These findings suggest that GPR is a strong determinant of ETF flows and liquidity.

Similarly, Zhao et al. (2023) investigated the connections between five renewable energy sub-sectors and the GPR and economic uncertainty indices using daily data from March 30, 2012, to April 1, 2022. They utilised a convergent cross-mapping. The findings reveal that renewable energy exhibits time-varying hedging properties against economic uncertainty and GPR due to its haven characteristics at various levels. Furthermore, constructing more secure and dependable renewable energy systems can aid countries in enhancing their energy independence, thereby safeguarding them against the risks associated with political and economic uncertainty. Both of these studies demonstrate positive outcomes regarding the influence of GPR. This is because, as revealed in Yang's study, renewable energy can be a hedging asset. As indicated in Kunjal's study, ETFs in emerging markets exhibit positive returns regardless of GPRs.

2.2.2. The Nonlinear Relationship

Balcilar et al. (2018) examined the fluctuations in the primary emerging Brizle, Rusia, India, China, and South Africa (BRICS) stock markets through the lens of GPR, presenting a novel approach by considering the complete conditional distributions of stock returns and volatility concerning GPRs. The study analysed the returns on stock and country-specific GPR indexes using a nonparametric quantiles test. The research demonstrates that GPR have varying effects on volatility measures in the market rather than on returns. This emphasises the significance of a robust financial sector and an open economy in ensuring stability in emerging markets such as the BRICS nations. The research examines various details, such as conducting thorough tests to address overall patterns in capital markets and specific effects unique to individual countries, utilising nonparametric causality-in-quantiles tests to assess the influence of GPR on stock markets within BRICS nations, and examining the diverse responses of different BRICS countries to GPR shocks. It can be deduced that global GPRs have a more significant impact on market volatility than returns, with Russia demonstrating the highest susceptibility to such risks. At the same time, India exhibits greater resilience in this regard. The results underscore the significance of implementing changes to enhance internal consumption, decrease reliance on a single currency, and spread out risks specific to individual countries within investment portfolios for developing countries.

Bouri et al. (2023) examined the relationship between GPRs and movements in the Islamic bond and equity markets. The authors extracted price indices from daily and monthly Islamic bond and equity markets and used the GPR index developed by Caldara and Iacoviello (2022). To meet this analysis, they use a nonparametric causality-in-quantiles approach. The results depict that GPRs impact Islamic equities' volatility significantly but have no predictive power over their returns, similar to some trends observed in conventional markets. In contrast, the responses to GPRs were found on both return and volatility for Islamic bonds. This difference is attributed to the nature of Islamic bonds, which sovereign issuers largely issue in politically unstable regions that link their performance to geopolitical factors. The findings contradict the popular belief that Islamic finance instruments are resilient to geopolitical uncertainties and confirm that Islamic equities and bonds are vulnerable to these risks.

Hoque and Zaidi (2020) analysed the impact of GPR on stock markets in vulnerable emerging economies. Their study applied a regression analysis with a multifactor market model and the Markov-switching model. It used the following variables and their lags: monthly stock return,

monthly consumer price changes, monthly interest rates, and monthly exchange rates. They find that GPR uncertainty impacts the stock market in a nonlinear and asymmetrical manner and that the increased volatility regime of global and country-specific GPR affects the performance of stock markets. This study brings innovation in filling the current gap in the literature by analysing the effect of GPR on stock returns of fragile emerging markets. This is important because it provides informative ideas on how the impact of these elements can vary when the market environment and structural characteristics evolve. Intuitively, it is crucial to recognise the multifaceted impacts of GPR on equity markets under different market environments and structures.

Similarly, Hoque et al. (2021) conducted a study and investigated the impact of geopolitical uncertainties on stock market returns in Malaysia, focusing on the relationship between global and country-specific risks and conventional and Islamic stock returns. Using empirical methods like Markov switching regression and quantile regression, the research finds that geopolitical uncertainties negatively impact Malaysian stock returns. The stock market's response to these uncertainties is heterogeneous and depends on factors such as market developments, economic structure, location, and time. The study emphasises the market-specific nature of these responses and their dependency on volatility states and market structures. The findings suggest a nonlinear relationship between GPR and Malaysian stock market returns, with both conventional and Islamic stock returns negatively affected, with significant effects observed in lower quantiles. The study underscores the importance of considering market conditions and volatility states when analysing this relationship. These findings have implications for asset pricing and investment strategies in the Malaysian market, emphasising the need for investors to be aware of and account for geopolitical uncertainties' influence on stock returns.

In a more recent study, Adeleke (2023) examined the relationship between GPR and stock market returns in three Southeast Asian countries: China, South Korea, and Japan. The research uses Bivariate Wavelet Coherence analysis to measure the interdependence between GPR and stock market returns. The study uses monthly frequency data from January 1991 to September 2022 for these countries. The results show that GPR has a negative impact on stock returns in these countries, with the negative effect being more pronounced in earlier periods in China and South Korea (0 to 16 months). In Japan, a negative impact was observed in recent periods (16 to 128 months). The study suggests that GPR plays a significant role in stock market dynamics and that investors and policymakers should consider the impact of geopolitical events on stock returns. The negative effect of GPR on stock returns is nonlinear. Therefore, investors should consider the impact of geopolitical events on stock returns when making investment decisions.

The impact of GPR on equity market returns has been widely studied. These studies have explored the effects of GPR on the equity market and specific assets, such as ETFs, but have primarily focused on developed countries, leaving emerging markets like South Africa underrepresented. The studies reviewed in this article have produced mixed results, with some showing a linear or nonlinear relationship between GPR and equity market returns. On the contrary, others indicate that GPR does not affect returns but causes market volatility. Furthermore, these studies often rely on econometric models that do not account for changing market conditions. This study aims to enhance the existing literature by incorporating the South African context and examining the impact of GPR on the equity markets in South Africa. This research will serve as a foundation for future investigations, adding valuable insights to the existing body of knowledge.

3. METHODOLOGY

3.1. Data

The study has elected to use monthly data from February 1996 to December 2023. This is because monthly data had a higher frequency in the sample period, which is required to capture the switching market conditions (bull and bear regimes). Thus, the selection of the sample period is to cater to the 1997 Asian financial crisis, the adoption of an inflation-targeting regime in South Africa in 2000, the 2002 currency crisis, the 2008/2009 global financial crises, and the Covid-19 pandemic. These events were significant contributing factors to the level of GPR globally and are an important determinant of the South African equity market returns. The study has chosen to use returns for one aggregated index and six disaggregated indices, namely: JSE all-share index, Industrial Metals and Mining Index, Consumer Goods 3000 Index, Consumer Services 5000 Index, Telecommunications 6000 Index, Financials 8000 Index, and Technologies 9000 index. The JSE sectors were selected by Moodley et al. (2022), who found these sectors to be the most dominant in the South African equity market. The study used the geopolitical index of Dario Caldara and Matteo Lacoviello . The relevant data was obtained from the Bloomberg database.

3.2. Empirical Model

To fulfil the desired objective of this study, a regime-switching model that accommodates switching market conditions is required. Accordingly, the Markov regime-switching model was selected as it is the most used nonlinear model in the literature when examining market conditions (Moodley, 2024; Moodley et al., 2024; Moodley et al., 2025;). The model is advantageous because it allows a researcher to describe data that exhibit dynamic patterns during different periods (Kuan, 2002). Additionally, it is suitable for fulfilling the objectives of this study because it improves interpretations of the parameters associated with specific regimes, along with their corresponding probabilities, which have led to improved forecasting performance through the identification and characterisation of persistent regimes and their associated parameters (Song & Wozniak, 2020). The Markov regime-switching model of the conditional mean allowed each regime with an alternate regression model; therefore, such a model that contained a switching intercept, error variance, and regression is given by

$$JR_t = \mu_{at} + B_{oiat}\Delta GPR + \varphi_{oiat}\Delta IFL + \varphi_{1iat}\Delta STI + \varphi_{2iat}\Delta LTI + \varphi_{3iat}\Delta REER + \varphi_{4iat}\Delta GDP + \varepsilon_{at} \quad (1)$$

Where: JR_t is the JSE sector returns, μ_{at} is the state-dependent intercept (mean value), ΔGPR is the change in the GPR index with state-dependent coefficient. The study imposes state-dependent control variables, and these include: ΔIFL is the change in the South African inflation rate, ΔSTI is the change in South Africa's short-term interest rate, ΔLTI is the change in South Africa's long-term interest, $\Delta REER$ is the change in the South African real effective exchange rate and ΔGDP is the change in the South African GDP. The study imposes the above control variables, as Moodley et al. (2022) found that they influence JSE sector returns. An error term (ε_{at}) is further included in determining the volatility of the JSE sector returns under each state-dependent regime (1=stable regime and 2=volatile regime).

The regime probabilities of a two-state Markov regime-switching model with constant transition probabilities are given by:

$$Prob = \begin{vmatrix} Prob(A_t = 1/A_{t-1} = 1) & Prob(A_t = 2/A_{t-1} = 1) \\ Prob(A_t = 2/A_{t-1} = 2) & Prob(A_t = 1/A_{t-1} = 2) \end{vmatrix} = \begin{vmatrix} Prob_{11} & Prob_{21} \\ Prob_{22} & Prob_{12} \end{vmatrix} \quad (2)$$

Where $Prob_{11}$ is the probability that the JSE stock market return is in the initial state (bullish state) at t-1 and remains at time t, $Prob_{21}$ is the probability that the return is at its initial state (bullish state) at time t-1, and at time t, it went to state two (bearish state). $Prob_{22}$ is the probability that the return is in the second state (bear state) at time t-1 and remains at time t, $Prob_{12}$ is the probability that returns in the second state (bearish state) is at time t-1 and enters state one (bullish state) at time t.

4. EMPIRICAL RESULTS

4.1. Preliminary Results

4.1.1. Descriptive Statistics

Table 1 depicts the descriptive statistics of the JSE sector returns. The Consumable Goods Index shows the highest average for the chosen sample period, whereas the Technology index was the lowest. This means that the consumable goods index was over-performing regardless of the impact of GPR during the sample period, and the technology index was underperforming in the overall market. In addition, the industrial and mining index and the consumer services index reported averages similar to the JSE All-share index. This suggests that the aggregated market and these indices have similar trends. Thus, investors could track the performance of the industrial and mining index and the consumer services index by evaluating the technical and fundamental analysis of the JSE All-Share index (aggregated market). The Jarque-Bera test of normality confirmed that the JSE indices returns were normally distributed.

The JSE financials showed reasonable returns throughout the period. The financials also show a moderate standard deviation, which indicates minimum volatility. Similarly, the telecommunications index performed well despite a moderately high standard deviation. In addition, the telecommunication's maximum and minimum values do not deviate much from each other, meaning the returns were consistent throughout the elected sample period. Furthermore, the consumable goods, industries, and mining and services sectors had excellent returns with high standard deviation, which shows high risk and high return. Finally, the GPR had a low average, suggesting that South African equities are not highly affected by geopolitical tensions. As a result, most indices can perform well despite the GPR.

All the indices except for the industrials and mining index are negatively skewed, which implies that the average returns of these indices lie between the left of the median and mean, thus suggesting negative returns. These negative returns could be attributed to the 2008/2009 financial crisis recession, the COVID-19 pandemic, and the Russian-Ukraine war. However, the mining and industrials were skewed to the right, with the most significant disparity between the minimum and maximum returns. This means that there were high fluctuations in the industrial and mining index. This made it very volatile, which supported the highest standard deviation. However, the index still performed well; therefore, investors should be careful when investing in industrial and mining companies or equities. This is because they may compensate the investor well regardless of the volatility in the market. This is aligned with the AMH, which posits that investors should be adaptive according to market conditions rather than expecting higher returns because of high risk, as the EMH states. Therefore, if investors want more satisfactory results, they should instead invest in consumable goods and consumable services that have moderately high returns and perform in line with the JSE-All share index.

Table 1. JSE Index Returns and Geopolitical Risk Descriptive Statistic Results

Variables	JSE_ALL	JSE_FIN	JSE_GODS	JSE_IND	JSE_SERV	JSE_TECH	JSE_TELC	GPR
Mean	0.7363	0.5244	1.0017	0.6250	0.7017	0.4154	0.5879	0.0469
Median	0.8808	0.6704	1.1302	0.3871	1.1013	0.6439	0.6134	0.0394
Maximum	13.1317	21.6516	20.1301	73.3026	19.3705	32.1222	31.6989	0.1855
Minimum	-34.8914	-51.1948	-24.8105	-58.3866	-39.9254	-54.0614	-39.5550	0.0000
Std. Dev.	5.2490	6.2891	6.2251	12.4891	7.5514	10.1780	8.5910	0.0351
Skewness	-0.9940	-1.9993	-0.4256	0.2784	-0.9236	-0.9177	-0.2617	1.3235
Kurtosis	8.8254	18.6446	5.2110	7.8115	6.6715	7.1806	5.2552	5.1740
Jarque-Bera	533.5945	3672.164	79.0587	330.4172	237.9123	293.5953	75.4932	165.2534
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	338	338	338	338	338	338	338	338

Source: authors own estimation

Table 2 shows the descriptive statistics for the macroeconomic variables. In terms of money supply, there is a decrease in the marketability and investment of securities, savings, mutual funds, and other time deposits. People and institutions hoard their finances and choose to save their funds instead of investing them. In addition, it is never known how much of an impact the crisis will have and how long it will last. This is why people withdraw their savings and investments as safe havens, which reduces the money supply in the economy. Moreover, developed countries would remove their investments in developing countries due to lower interest rates, lowering the foreign direct investments (FDI) in developing countries and thus reducing the money supply. The inflation rates show the second-largest standard deviation and highest minimum and maximum values disparity. This means that there were high fluctuations in inflation during the chosen period. These results could be attributed to the savings rate, which means there was more money available to spend, thus prompting the price of goods and services to increase gradually. However, the GDP rate is the only positive rate. This is because there will always be the production of goods and services regardless of the state of affairs; however, it will not be high, as shown in the table. This is because there is not much demand for most goods and services; instead, they are basic needs. Thus, the exchange rate will depreciate because there will be no economic trade or demand for South African Rands.

Table 2. Macroeconomic Variables Descriptive Statistics Results

Variables	CPI	M2	ST_INT	LT_INT	GDP	REER
Mean	-0.0754	-1.5692	-0.0524	-0.0099	0.1205	-0.0300
Median	0.2635	-0.3259	7.93E-06	-0.5632	0.1396	0.0662
Maximum	20.0000	717.1429	20.8299	21.6748	28.1233	9.8633
Minimum	-88.7692	-720.0000	-24.2857	-12.9664	-23.9895	-14.8803
Std. Dev.	6.1732	66.0902	4.3122	3.9580	2.2713	3.1626
Skewness	-8.8449	-0.6496	-0.2458	1.1152	1.9411	-0.5831
Kurtosis	128.4873	86.4456	8.0035	7.4508	107.3544	5.4792
Jarque-Bera	226178.3	98088.61	355.9922	349.0540	153577.6	105.7214
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	338	338	338	338	338	338

Source: author's estimation

4.1.2. Variance Inflation Factor Results

Table 3 provides the Variance Inflation Factor (VIF) tests. It is seen that the VIF analysis for macroeconomic variables indicates minimal multicollinearity throughout the entire dataset. The VIF values for inflation growth, money supply growth, short-term interest rate growth, long-term interest rate growth, GDP growth, and real effective exchange growth are approximately 1, signifying that the correlations among these predictor variables are minor. None of the values surpass the typical multicollinearity thresholds, generally considered VIF values of 5 or higher. Consequently, each variable maintains adequate independence, and no corrective actions, such as removing or transforming variables, are necessary. These low VIF values suggest that the regression model yields reliable coefficient estimates, free from bias due to multicollinearity, and facilitates a clear understanding of the relationships between the dependent variable and the other variables within the macroeconomic framework.

Table 3. Variance Inflation Factor Results

Variables	Coefficient Variance	Uncentered VIF	Centred VIF
C	0.2202	2.8794	NA
GPR	64.4328	2.8976	1.0374
CPI	0.0020	1.0423	1.0421
M2	1.77E-0	1.0093	1.0087
ST_INT	0.0048	1.1664	1.1662
LT_INT	0.0069	1.4245	1.4245
GDP	0.0159	1.0786	1.0756
REER	0.0101	1.3198	1.3197

Source: authors' estimation

4.1.3. Unconditional Correlation

In Table 4, the coefficients of the JSE indices are negatively associated with GPR except for consumable goods and consumables services. That is why they can perform well even during times of geopolitical tension. Consequently, the JSE All-share, industrial mining, and telecommunication indices indicate a significant negative relationship with GPR. Conversely, the JSE consumable indices have a significant positive relationship with GPR. Similarly, inflation growth rate has a positive Signiant effect on the JSE industrial index returns but a negative effect on the JSE technology index returns. Money supply growth only has a significant effect on the JSE telecommunications index returns, whereas the short-term interest growth rate has a significant negative effect on all the JSE index returns. However, short-term interest rates have a significant negative effect on all indices returns besides JSE industrial index returns and JSE technology index returns. The JSE industrial index returns are positively affected by GDP growth rate, but the JSE technology index returns are negatively affected. Similarly, all JSE index returns, besides JSE consumable goods index returns and JSE industrial index, returns are positively affected by the real effective exchange growth rate.

Table 4. Unconditional Correlation Results

Variables	JSE_ALL	JSE_FIN	JSE_GODS	JSE_IND	JSE_SERV	JSE_TECH	JSE_TELC
Panel A: Geopolitical risk index							
GPR	-0.0440	-0.0288	0.0110	-0.0088	0.0368	-0.0543	-0.0276
	(0.0200)	(0.5975)	(0.0390)	(0.0716)	(0.4992)	(0.3193)	(0.0127)
Panel B: Control variables							
CPI	-0.0012	0.0322	0.0247	0.0305	-0.0192	-0.0198	0.0503
	(0.9816)	(0.5551)	(0.6498)	(0.0754)	(0.7240)	(0.0160)	(0.3561)
M2	0.0389	0.0294	0.0444	-0.0044	-0.0471	0.0350	0.0695
	(0.4749)	(0.5898)	(0.4158)	(0.9352)	(0.3878)	(0.5210)	(0.0024)
ST_INTT	-0.1670	-0.1280	-0.1169	-0.0225	-0.2209	-0.0605	-0.1422
	(0.0021)	(0.0185)	(0.0316)	(0.0798)	(0.0000)	(0.0666)	(0.0088)
LT_INT	-0.2527	-0.3606	-0.1253	-0.0727	-0.4401	-0.0872	-0.3213
	(0.0000)	(0.0000)	(0.0211)	(0.1820)	(0.0000)	(0.1095)	(0.0000)
GDP	0.0300	0.0584	-0.0134	0.0012	0.0239	-0.0086	0.0765
	(0.5824)	(0.2838)	(0.8048)	(0.0820)	(0.6615)	(0.0743)	(0.1603)
REER	0.0609	0.2178	-0.0376	0.0774	0.3297	0.0224	0.1899
	(0.0641)	(0.0001)	(0.4902)	(0.1553)	(0.0000)	(0.0813)	(0.0004)

Notes: 1. The parenthesis provides the associated p-values.

Source: authors' estimation

4.1.4. Unit Root and Stationarity Results

Table 5 illustrates the stationarity and unit root tests for the JSE indices, the GPR, and the macroeconomic variables. The stationarity tests are given by the Augmented-Dickey Fuller (ADF) test, and the unit root is given by the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test. The ADF test statistics are more negative than the critical values at a 1% significance. This suggests that the indices are stationary; therefore, the null hypothesis that the data has a unit root is rejected, and the alternative hypothesis is accepted. In addition, the ADF breakpoint test is also negative and significant at a 1% significance level; thus, the null hypothesis that the indices exhibit a unit root in the presence of structural breaks is rejected. Similarly, the KPSS test further confirms the stationarity of the JSE indices. This is because the test statistics across the entire dataset are less than 1% significant. In Panel B, GPR shows a more negative ADF test statistic that is less than the critical 1% significance. Similarly, the ADF breakpoint test is also more negative compared to the percentage significance value, which proves that GPR is stationary in the presence of structural breaks. This is further confirmed by the KPSS value of less than 1, confirming that GPR is stationary. Finally, Panel C the ADF test for the control variables, which are the macroeconomic variables, are also more negative than the 1% significance value. In addition, the KPSS for all the macroeconomic variables is less than 1. Therefore, we reject the null hypothesis that there is a unit root and accept the alternative hypothesis that the data is stationary. The data must be stationary because the Markov regime-switching model requires stationary data. This gives a basis for estimating the Markov model.

Table 5. Unit Root and Stationarity Results

Variables	ADF	KPSS	ADF-Break	Order
Panel A: JSE sector returns				
JSE_ALL	-19.0201***	0.0937	-20.0924***	I(0)
JSE_FIN	-18.7275***	0.0767	-20.6653***	I(0)
JSE_GODS	-20.6368***	0.1556	-21.3245***	I(0)
JSE_IND	-11.2165***	0.0806	-18.6294***	I(0)
JSE_SERV	-15.5082***	0.0648	-16.6699***	I(0)
JSE_TECH	-16.4184***	0.0970	-17.4790***	I(0)
JSE_TELC	-17.4083***	0.2443	-17.8372***	I(0)
Panel B: Geopolitical risk index				
GPR	-11.9421***	0.253604	-13.6939***	I(0)
Panel C: Control variables				
CPI	-18.2663***	0.1214	-29.6603***	I(0)
M2	-6.5585***	0.0977	-16.7895***	I(0)
ST_INT	-12.3468***	0.1256	-13.6749***	I(0)
LT_INT	-13.4924***	0.2109	-15.8455***	I(0)
GDP	-7.7437***	0.2637	-12.0735***	I(0)
REER	-13.9159***	0.0564	-15.9067***	I(0)

Note:
1. ***, **, * indicate a 1, 5, and 10% significance level.
2. The associated critical values for the KPSS test are 0.7390, 0.4630, and 0.3470.

Source: authors' estimation

4.2. Empirical Model Results

4.2.1. Expected Duration and Constant Transition Probabilities Results

The JSE All-share index has a probability of 0,5885 in the bull regime and 0,8612 in the bear regime. This suggests that the JSE All-share returns stayed longer in the bear regime than the bull regime. The proximity of the JSE bear market to 1 suggests that the bear market is persistent. This is supported by the higher duration of 7 months in the bear market compared to the JSE All-share index, which is predominantly bearish during geopolitical tension. Similarly, the JSE financials show a probability of 0,9906 in the bear regime and 0,6873 in the bull regime. The probability of the bear regime is closer to 1, meaning that the JSE financials are also predominantly bearish during geopolitical tension. This is corroborated by 106 months in the bear regime and only 3 months in the bull regime. Therefore, the JSE financial index is more bearish.

The JSE consumable goods have a probability of 0,9426 in the bull regime and a probability of 0,9186 in the bear regime. Although they are both high probabilities, the consumable goods are more persistent in the bull market regime as the probability is much closer to 1. This is supported by the higher duration of 17 months in the bull regime compared to the 12 months in the bear regime. Therefore, this suggests that the JSE consumables goods are primarily bullish during geopolitical tension. The JSE industrial and mining are predominantly bearish in times of GPR. This is because the index has a probability of 0,9827 in the bearish market regime and 0,8453 in the bull market condition. The closer proximity to 1 suggests that the bearish regime is more persistent. This is corroborated by the longer duration of 7 months in the bear market compared to 6 months in the bull regime. Therefore, this concludes that the JSE industrials and mining index is predominantly bearish. The JSE consumables services have a bull regime probability of 0,9821, closer to 1, and a bear regime probability of 0,8587. This suggests that the JSE services are more persistent in the bull regime, which is supported by 56 months compared to the bear regime duration of 7 months. This indicates that the consumable services are primarily bullish in geopolitical tension.

The JSE technology index has a probability of 0,9670 in the bull regime and a probability of 0,9657 in the bear market. Although the probabilities are closer to 1, the bear market probability is much closer, suggesting that the technology index is persistent in the bear market. This is also supported by the 29-month duration in the bear regime compared to the 23 months in the bull market regime. Therefore, the study concludes that the JSE Technology index is predominantly bearish. The JSE Telecommunication has a probability of 0,9829 in the bull market and 0,9917 in the bear market. As the bear regime is closer to 1, the JSE telecommunication index is more bearish in times of GPR. The 120-month duration of the bear regime corroborates this. Therefore, the study concludes that the JSE telecommunication index is persistently bearish in geopolitical tension.

Table 6. Expected duration and constant transition probabilities results

	Bull regime		Bear regime	
Variables	**Probability**	**Duration**	**Probability**	**Duration**
JSE_ALL	0.5888	2.4322	0.8612	7.2080
JSE_FIN	0.6873	3.1989	0.9906	106.9899
JSE_GODS	0.9426	17.4239	0.9186	12.2952
JSE_IND	0.8454	6.4668	0.9827	57.8805
JSE_SERV	0.9821	56.1777	0.8587	7.0815
JSE_TECH	0.9570	23.2742	0.9657	29.2191
JSE_TELC	0.9829	58.6211	0.9917	120.8755

Source: authors' estimation

4.2.2. Markov Regime-Switching Model

In Table 7, the Markov regime-switching results are presented. The constant term represents the average returns of the JSE sector returns. In the bull regime, the equity market has positive and negative returns; however, only the JSE financials and consumable goods are significant. JSE financials had more negative returns, while the JSE consumable goods had significant positive returns, which is shown by the high volatility parameters. Additionally, GPR has a positive effect on the same equity market returns and a negative effect on others. However, only a few of them were statistically significant, where GPR significantly negatively affected the JSE All-share, the JSE financials, JSE consumable goods, and JSE industrials and mining returns. However, GPR positively affected the returns of JSE consumable services, JSE technology, and JSE telecommunication indices.

Moreover, the inflation growth rate positively affected most of the indices' returns, except for the JSE technology index. However, the JSE financials and industrial and mining returns are the only indices that have a significant effect. This suggests that the financial index and industrial returns are more susceptible to inflationary pressures over and above GPR. Contrarily, the money supply growth rate significantly affected the returns in the JSE All-share and telecommunication indices. In contrast, it significantly negatively affected the JSE financials and industrial and mining indices returns in a bull market regime. Similarly, short-term and long-term interest rates significantly negatively affected the JSE all share, JSE financials, the JSE consumable goods, the JSE consumable services, and the JSE telecommunication. This is supported by the significant volatility parameters shown by the standard deviation, which suggests that negative interest rates are significant in the named indices, which affect their returns.

Furthermore, the gross domestic product growth rate significantly positively affects the JSE All-share and the JSE Financials returns in a bull regime. Similarly, the real effective exchange growth rate significantly positively affects the JSE financials, industrial and mining,

and the returns on JSE consumables services. However, it has a negative effect on the JSE's share index returns in a bull market. In the bear regime, the constant represents the average returns of the JSE sector. Only the JSE technology has statistically significant positive returns. This suggests that only the JSE technology returns have increasing returns, as supported by the low volatility parameters. Additionally, GPR significantly affected the JSE All-Share index, consumable goods, industrials and mining, and telecommunication returns. However, it significantly negatively affected consumable goods and technology indices returns. This suggests that the JSE All-share, consumer goods, industrial mining, and telecommunications have positive and increasing returns in a bear regime regardless of geopolitical tension. However, consumable services and technology have decreasing returns in the bear market.

On the contrary, the inflation growth rate does not significantly impact any of the equity market returns in a bear market. The money supply growth rate significantly influences the returns of the JSE All-share positively. In contrast, it negatively influences the return of JSE consumable services under a bearish regime. The short-term interest growth rate has a significant positive effect on the JSE All-share index, but a significant negative effect on the JSE consumable services and technology indices. Conversely, the long-term interest growth rate significantly negatively influences all the JSE indices except for JSE consumable goods, industrial and mining, and technology returns. The GDP growth rate significantly positively influences the JSE All-share index and consumable goods in a bear regime. Finally, the real effective exchange growth rate significantly negatively affects the JSE industrials and mining index returns. However, it has a significant positive influence on the JSE technology and telecommunication indices returns in a bearish regime. The Durbin–Watson test statistic confirms the robustness of the Markov regime-switching model, as the values are 2, indicating that there is no presence of autocorrelation in the residuals of the model. This is further conformed by the LM-stat of the Breusch–Godfrey test.

Table 7. Markov Regime-Switching Results

Variable	JSE_ALL	JSE_FIN	JSE_GODS	JSE_IND	JSE_SERV	JSE_TECH	JSE_TELC
Panel A: Bull Regime							
C	3.1321**	-1.1765*	1.5220***	0.0016	0.0298	-2.0688	-0.8821
GPR	-4.8839*	-164.7555***	-3.7713***	-7.2261***	8.1160***	13.2574*	0.3071**
CPI	0.0849	0.3534***	0.0417	3.4827***	0.0029	-0.0026	0.1919
M2	0.0046*	-0.5590***	0.0048	-0.3609**	-0.0032	0.0239	0.1336**
ST_INT	-0.8862***	-1.5022***	-0.0878	1.2501	-0.1696	0.1007**	-0.2804
LT_INT	-0.1240	-0.3898***	-0.3220***	-0.3520	-0.5465***	-0.6030	-1.2488***
GDP	0.7517**	0.3781***	-0.1198	0.8058	0.1150	1.9152	2.3902
REER	-0.7865***	0.4218**	-0.0790	5.3400***	0.4344***	-0.4579	-0.2811
σ	1.3247***	-0.6190**	1.2939***	2.5325***	1.6848***	2.6056***	2.3523***
Panel B: Bear Regime							
C	-0.0061	0.2167	-0.4855	0.6479	-3.3968	2.1299***	-0.3081
GPR	11.4966*	10.543	5.7078*	3.1266*	-7.3193*	-5.4428**	29.2985**
CPI	-0.0024	0.0443	-0.0140	0.0245	-0.0063	-0.0955	0.0808
M2	0.0038*	0.0047	-0.0017	0.0012	-0.1931*	-0.0033	0.0060
ST_INT	0.2553**	0.0037	-0.2433	-0.1188	-0.5249*	-0.2578**	0.0277
LT_INT	-0.3796***	-0.3576***	-0.1414	-0.1664	-0.9817*	-0.0471	-0.3547**
GDP	0.3041**	0.1594	2.2965**	0.0421	0.1734	-0.1115	0.1221
REER	0.0997	0.1396	-0.3014	-0.4388*	-0.5650	0.3495*	0.3032*
σ	1.8117***	1.5711***	2.0893***	2.3019***	2.2596***	1.6814***	1.8066***
Panel C: Diagnostic Tests							

Variable	JSE_ALL	JSE_FIN	JSE_GODS	JSE_IND	JSE_SERV	JSE_TECH	JSE_TELC
LM-Stat	1.0004	1.7500	1.8457	1.2089	2.2742	2.1042	0.0902
D-W	2.1553	2.2052	2.3070	1.9815	2.0725	1.8188	2.0052

Note:
1. ***, **, * indicate a 1, 5, and 10% significance level.

Source: authors' estimation

4.2.3. Smooth Regime Probabilities

Figure 1 provides the smooth transition probabilities associated with the JSE sector returns. The graph associated with the JSE All-share index depicts significantly high positive returns in the bull regime, which is corroborated by the significant positive constant term in Table 7. The graph indicates that the JSE All-share stays longer in the bear regime between 2010 and 2019, corresponding with the expected duration and transition in Table 6. This can be attributed to budget cuts, deindustrialisation, declining commodity prices, and state capture, amongst other reasons. (Sibeko & Isaac, 2020).

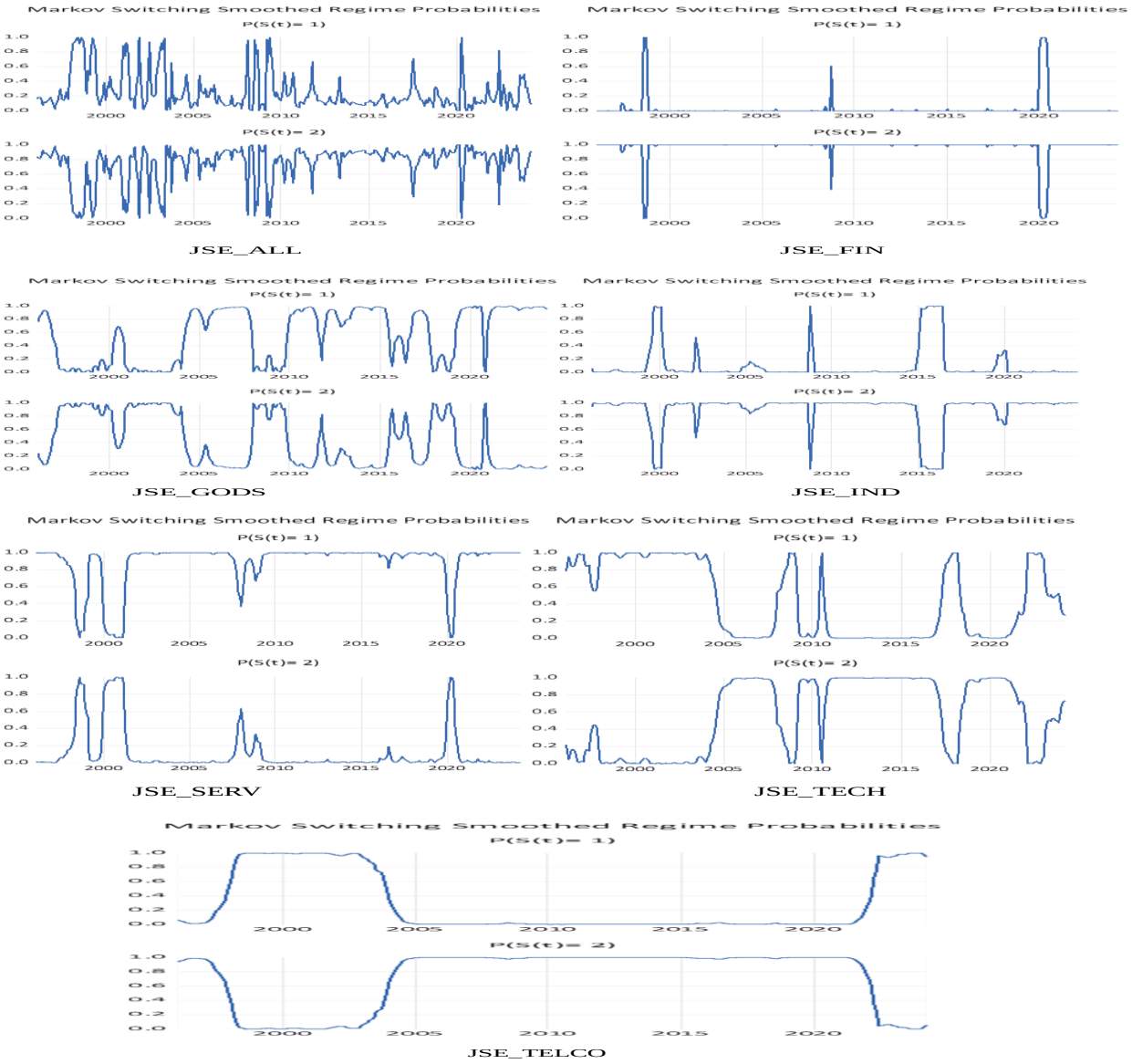

Figure 1. Markov Switching Smooth Regime Probabilities

Source: authors' estimation

Similarly, the JSE financials depict more significant negative returns and the persistent bear regime, which corroborates with the expected duration and the transitions probabilities in Table 6 and the significant negative average returns in Table 7. This downswing can also be attributed to major economic events like the 2008/2009 financial crisis and the COVID-19 pandemic, which had a negative impact on the South African economy. Contrastingly, the graph associated with the JSE consumable goods depicts the over performance of the index throughout the elected sample period. The index shows positive increasing returns and a persistent bull regime. This corresponds to the significant average returns shown by the constant term in Table 7 and the longer duration in Table 6. Similarly, the consumable services depicted a persistent bull regime with positive returns, which is supported by the longer expected duration in Table 6 and the positive significant impact of GPR in Table 7. This can be attributed to the fact that there will always be a demand for consumer goods and services regardless of the economic outlook.

The JSE industrials mining index and the technology index show similar trends. Both the indices stay fairly long in the bear regime, which is supported by the expected duration and transitions in Table 6. The indices both show significant returns in the bull and bear regime. This can be attributed to deindustrialisation between 2015 and 2019, the rise of the technological era, and the impact of the global financial crisis in 2008/2009. The graph associated with the JSE telecommunications shows high returns between 1999 and 2004. However, the bull regime was short-lived because the index remained in a persistent bear regime from 2005 to 2020. This can be attributed to the Telkom monopoly in the early 2000s when the prices of telecommunication channels were high, and the government tried to regulate the prices in the industry. This led to a loss of investment and a decline in industry returns.

5. CONCLUSIONS

Initially, this study proposed to examine the effect of GPR on the JSE sector returns with evidence from switching market conditions. Additionally, the study used macroeconomic variables as control variables because the existing literature shows that these variables significantly influence stock market returns (Moodley, 2020). Furthermore, the aim of this study was achieved through three objectives, which are: (1) to determine the effect between GPR and JSE sector returns in stable market conditions, (2) to examine the extent to which GPR affects the JSE sector returns in volatile market conditions, and (3) to determine if the JSE sector returns are characterised as stable or volatile across the sample period. Therefore, after utilising the Markov regime-switching model, the study concludes that GPR has a significant negative or positive effect on JSE sector returns under changing market conditions. In addition, the JSE financial index was highly impacted by macroeconomic variables, hence, the significant negative returns in the bull market.

Furthermore, regardless of the effect of GPR, the consumable goods and consumables services index performed well, and the JSE aggregated market can be used to track the performance of these two markets. The study concludes that the JSE All-share, Consumable Goods, and Consumable Services indices could be investors' safe haven during periods of geopolitical tension. However, investors and portfolio managers should be strategic when investing in the JSE industrials and mining indices because they are highly volatile and produce the lowest returns. The limitation of this study is that it only shows the effect of GPR on equity market returns; however, it does not show how investors respond to this effect. Therefore, future studies should cover investors' responses to the effect of GPR on equity

market returns. Additionally, these studies should cover the leading emerging economies of Africa to broaden the body of knowledge, considering that most studies are covered in advanced economies.

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