Journal of Economic and Administrative Sciences

Macroeconomic indicators and the Johannesburg Stock Exchange Financial 15 Index nexus in South Africa

Keitumetse Mashabela
School of Economics, College of Business and Economics, University of Johannesburg, Johannesburg, South Africa, and
Charles Shaaba Saba
DSI/NRF Trilateral Chair in Transformative Innovation, The Fourth Industrial Revolution and Sustainable Development, College of Business and Economics, University of Johannesburg, Johannesburg, South Africa

Received 21 November 2025
Revised 2 February 2026
9 June 2026
Accepted 10 August 2026

Abstract

Purpose – This study explores the macroeconomic indicators and the JSE Financial 15 index in South Africa using quarterly data from 2004Q1 to 2024Q4.

Design/methodology/approach – A Vector Error Correction Model (VECM) is used to model short- and long-run linkages between the variables of the study, after unit root and structural break tests; Granger causality is applied to identify predictive directions.

Findings – Inflation (CPI) and interest rate (INT) are positively associated with the long-run JSE Financial 15 index (LJSE15), whereas exchange rates (EXR) and LGDP exhibit an inverse long-run relationship. In the short run, only CPI at lag 1 and INT at lag 2 significantly and positively affect changes in LJSE15. Granger causality runs from INT and EXR to LJSE15, indicating their usefulness for forecasting Financial 15 movements.

Research limitations/implications – The model excludes some standard financial determinants, such as money supply, which could refine stock price dynamics. From a structural perspective, the findings show how sensitive South Africa's financial sector is to macroeconomic conditions. Therefore, when the economy gets a shock, the financial sector plays a key role in how that shock spreads and how it assists in softening the impact. This suggests that clear, transparent and predictable interest rate signalling, as well as exchange rate stability to avoid sharp depreciations, is important for maintaining stability in financial sector equity valuations. The findings are expected to enhance insights for more informed investment decisions for pension funds, asset managers and investors aiming to optimize their portfolio allocation strategies.

Originality/value – By focusing on the sector-specific JSE Financial 15 index rather than aggregate market indices, the study offers nuanced evidence to guide investors, researchers and policymakers in understanding macro financial linkages and designing informed investment and policy decisions.

Keywords Macroeconomic indicators, Structural breaks, Stock prices, Vector error correction model (VECM), Johannesburg Stock Exchange, South Africa

Paper type Research article

1. Introduction

Instability in stock markets has been linked to major economic crises and remains a central concern in contemporary macro-financial analysis (Demir, 2019). In developing economies,

JEL Classification — E31, E44, G12

Conflict of interest: The author(s) declared no potential conflict of interest regarding the research, authorship and/or publication of this article.

Journal of Economic and Administrative Sciences
Emerald Publishing Limited
e-ISSN: 2054-6246
p-ISSN: 2054-6238
DOI 10.1108/JEAS-11-2025-0842

stock prices often react strongly to movements in key macroeconomic indicators such as exchange rates, gross domestic product and trade flows (Panta, 2020). South Africa is no exception. The Johannesburg Stock Exchange, founded in 1887, is the largest in Africa and ranks around seventeenth globally (JSE, n.d.). Within this market, the JSE Financial 15 Index tracks fifteen highly traded banking, insurance and broader financial services firms that form the backbone of financial intermediation. Over the past year, this index rose by about 26.31% and traded between roughly R16 974.57 and R27 806.87, illustrating both growth and volatility in a core segment of the financial system (Financial Times, n.d.). Because financial institutions are sensitive to inflation trends, interest rate movements, economic growth and currency fluctuations, understanding how these macroeconomic forces affect the JSE Financial 15 Index is relevant for financial stability and inclusive growth.

Even though the JSE Financial 15 Index is a specific services-related sector, how financial institutions perform is linked to the aggregate macroeconomic conditions. Therefore, macroeconomic variables such as inflation, interest rates, exchange rates and real GDP play a crucial role when it comes to the demand for credit, performance of loans, as well as investment behaviour and capital flows. These are important for financial firms, especially for profitability and company valuations.

The nexus between macroeconomic indicators and the JSE Financial 15 Index is closely linked to the Sustainable Development Goals because the index reflects the performance of major financial institutions that support intermediation, credit allocation, savings mobilisation, investment financing and risk management in South Africa (FSDO, 2024). A resilient financial sector contributes to SDG 8 by promoting inclusive growth, employment and decent work, as highlighted in the 2030 Agenda for Sustainable Development (Sayed, 2015; Frey, 2018). Financial sector development also improves access to payments, credit, savings and insurance, thereby supporting poverty reduction, private-sector expansion, job creation and economic resilience (World Bank Group, 2013, 2016). The nexus further relates to SDG 9 through the mobilisation of long-term finance for infrastructure, innovation and industrial development, and to SDG 16 through credible monetary policy, exchange rate stability, effective regulation and transparent capital-market governance, which strengthen institutional trust, investor confidence and macro-financial stability (United Nations Conference on Trade and Development (UNCTAD), 2017). Therefore, analyzing how inflation, interest rates, exchange rates and real GDP affect the JSE Financial 15 Index provides evidence on whether South Africa's financial sector can support sustainable development through stable capital markets, inclusive finance and resilient economic growth. Table 1 presents the macroeconomic indicators, the JSE Financial 15 Index, and the sustainable development channels as they relate to the present study.

Existing empirical work shows that exchange rates, output, inflation and interest rates influence stock prices, but results are often mixed and depend on country group, period and modelling choices. For exchange rates, Areli Bermudez Delgado *et al.* (2018) and Chang *et al.* (2019) report a negative and significant long-run impact on stock market indices, consistent with the idea that currency depreciation raises imported input costs and compresses profits (Bahmani Oskooee and Saha, 2015). At the same time, Megaravali and Sampagnaro (2018) and Chang *et al.* (2019) find a positive short-run relation, while Ogunsakin and Awe (2020) report an inverse and significant effect in the short run. For output, Humpe *et al.* (2025) and Ogunsakin and Awe (2020) show that real GDP is positively related to stock prices. These findings suggests that stronger economic growth is associated with higher stock prices.

Inflation and interest rate effects are similarly ambiguous. Humpe *et al.* (2025) find that consumer prices are negatively related to stock prices in Anglosphere economies but positively related in BRICS economies, where equities may hedge against inflation. Chang *et al.* (2019), Giri and Pooja (2017) and Keswani *et al.* (2024) also document that consumer prices tend to undermine stock performance in the short run, although some evidence points to

Table 1. Macroeconomic indicators, JSE Financial 15 Index and sustainable development channels

Variable	Transmission to JSE financial 15 index	Relevant SDG	Sustainable development relevance
Inflation	High inflation can reduce real returns, increase uncertainty, raise operating costs and weaken investor confidence in financial-sector equities	SDG 8	Price stability supports investment, savings, credit affordability and sustainable growth (FSDO, 2024; Sayed, 2015; Frey, 2018)
Interest rate	Repo-rate changes affect bank lending rates, credit demand, loan performance, discount rates and financial-sector valuations	SDG 8; SDG 16	Predictable monetary policy strengthens financial stability, investor confidence and institutional credibility (Sayed, 2015; World Bank Group, 2013, 2016)
Exchange rate	Rand depreciation or appreciation affects foreign capital flows, imported inflation, external liabilities and investor sentiment	SDG 8; SDG 9	Exchange-rate stability supports investment planning, trade financing and capital-market resilience (FSDO, 2024; Sayed, 2015; UNCTAD, 2017)
Real GDP	Economic growth affects credit demand, household income, corporate earnings and financial-sector profitability	SDG 8	Stronger growth improves financial-sector performance and supports employment and productive investment (Sayed, 2015; World Bank Group, 2013, 2016)
JSE Financial 15 Index	Reflects the performance of leading banking, insurance and financial services firms	SDG 8; SDG 9; SDG 16	A stable financial-sector index signals stronger intermediation, capital mobilisation, infrastructure financing and macro financial confidence (FSDO, 2024; Sayed, 2015; World Bank Group, 2013, 2016)

Source(s): Authors' compilation

a positive relation in the long run. For interest rates, the Fisher effect suggests that nominal rates and expected inflation move together, so higher rates are usually associated with lower stock prices. Chang *et al.* (2019), Tursoy (2019), Bhuiyan and Chowdhury (2020) and Keswani *et al.* (2024) find an inverse association between interest rates and stock prices, and Ramatlo (2019) shows that unexpected repo rate increases reduce JSE All Share Index returns, although Bhuiyan and Chowdhury (2020) also report cases with no long run relationship. Overall, the literature confirms that macroeconomic indicators matter for stock prices but does not provide a clear message on the magnitude or sign for financial sector indices in South Africa.

Most South African studies have focused on broad market indices. Hackland (2015) finds that higher GDP growth raises the JSE Financial 15 Index while prime lending rate shocks reduce it, but the sample ends in 2014 and does not capture the post COVID-19 policy cycle. More recent work by Mokoena (2023) and Maake *et al.* (2024) concentrates on the JSE All Share Index or Top 40 indices, leaving sector-specific dynamics largely unexplored. In addition, many studies do not explicitly allow for structural breaks associated with episodes such as the global financial crisis, load shedding-related growth shocks or the COVID period, even though such events can alter macro financial relationships over time. This creates a practical problem for investors, portfolio managers and policymakers who need reliable guidance for asset allocation, risk management and the design of monetary and exchange rate interventions.

Motivated by these gaps, this study examines the relationship between macroeconomic indicators and the JSE Financial 15 Index in South Africa using quarterly data from 2004 to 2024. The main research questions are, first, what is the causal nexus between interest rates,

inflation, GDP growth and exchange rate movements and the JSE Financial 15 Index and, second, what are the short-run and long-run effects of these macroeconomic indicators when estimated through a Vector Error Correction Model (VECM)? Figure 1 documents that consumer prices, GDP, the exchange rate and the JSE Financial 15 Index all follow rising trends over the sample, with visible breaks around 2008 quarter four, 2020 quarter one and 2020 quarter three. These visual patterns motivate formal tests for structural breaks and the explicit incorporation of break dummies into the econometric framework.

The study contributes by focusing on a systemically important sector index rather than an aggregate market index, by extending the sample to 2024 to cover multiple policy rate cycles, load shedding episodes and the COVID shock, and by jointly modelling long-run cointegration and short-run adjustment dynamics with structural breaks. The evidence is expected to support more informed investment strategies for institutional and retail investors,

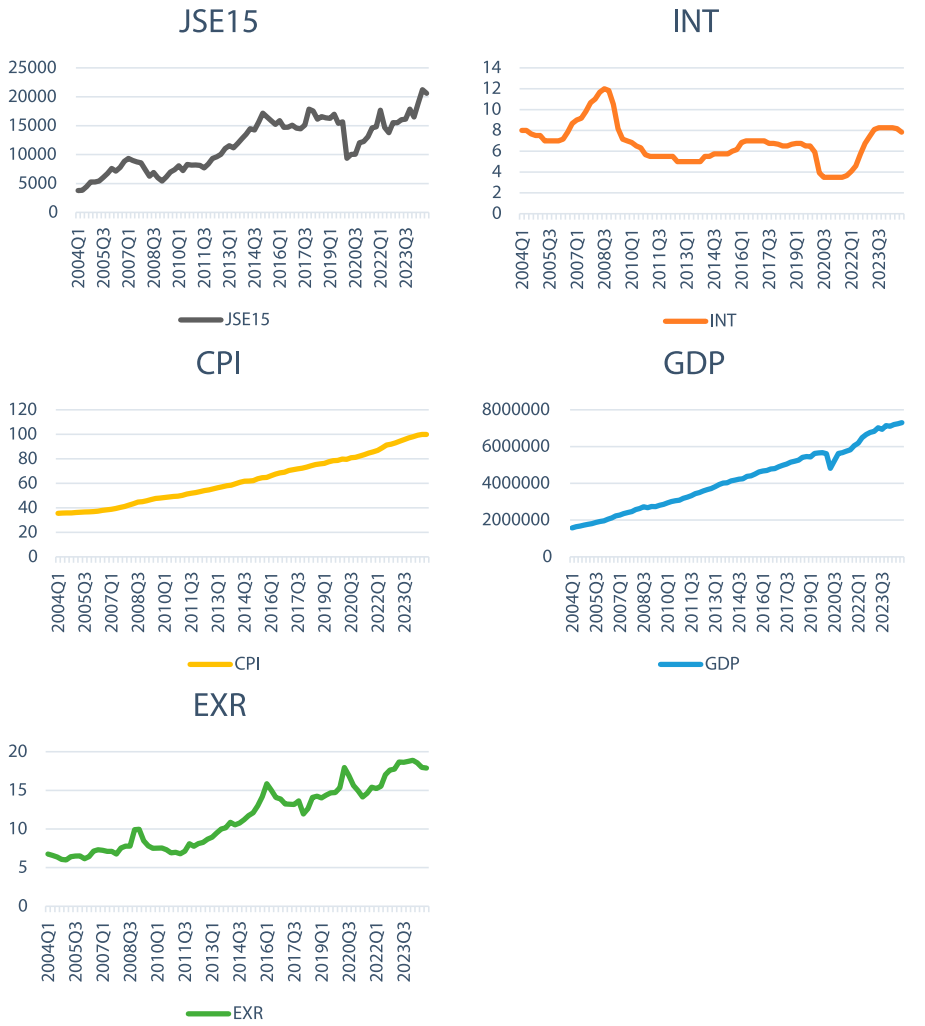

Figure 1. Variables' performance overtime. Source: Authors' own

while providing the South African Reserve Bank, National Treasury and other authorities with practical insight on how interest rate decisions and exchange rate developments are transmitted into the valuations of major financial institutions that underpin growth and progress toward the Sustainable Development Goals.

2. Literature review

The purpose of this literature review is to examine existing research on the relationship between macroeconomic indicators and how the stock market performs by focusing on the JSE Financial 15 index, covering articles and empirical studies published between 2015 and 2025. Unlike the resources and industrial sectors, which are mainly affected by global commodity prices and overseas demand, the JSE15 is more sensitive to what is happening in the local economy, changes in interest rates and regulations. However, exchange rate fluctuations also play an important role, especially because they influence the cost of foreign borrowing, the value of investments abroad and capital flows.

All these factors give the financial sector a unique mix of risks and opportunities compared to other parts of the market. Macroeconomic variables affect the financial sector in several ways, through the monetary policy transmission mechanism, real economic activity, as well as global factors. These mechanisms can influence the profitability of firms, expectations of investors and future cash flow valuations, which can influence stock market movements. Monetary conditions can influence stock prices, particularly through interest rates and inflation. Interest rates and inflation can affect the cost of borrowing, discount rates and real returns. Stock price movements can also be affected by real economic activity through corporate earnings changes, while exchange rates reflect external shocks and capital flows.

2.1 Monetary policy transmission mechanism and stock prices

Monetary variables, particularly, interest rates and inflation, are essential for explaining stock market movements. According to the Fisher's effect, nominal interest rates and expected inflation tend to move together. As a result, interest rates and stock prices are generally expected to be inversely related due to the impact of inflation. Empirical studies largely support this inverse relationship between interest rates and stock prices. For instance, a study conducted by Chang *et al.* (2019) has indicated that the nominal interest rate significantly affects stock prices and that they are negatively related in the long run. Similarly, Ramatlo (2019) found that an unexpected rise in the repo rate is estimated to reduce the JSE All Share Index returns. Tursoy (2019), Bhuiyan and Chowdhury (2020), Keswani *et al.* (2024) and Rizk and Challita (2026) also discovered that the interest rates and stock prices are inversely related. However, Rizk and Challita (2026) also discovered that interest rates and stock prices have a positive relationship in the short run.

Humpe *et al.* (2025) have found that CPI, which is a measure of inflation, is negatively related to stock prices for Anglosphere countries in the long run. However, they also found that CPI and stock prices have a positive relationship in BRICS countries as this may help protect investors' money from losing value over time in response to economic instability these countries may have faced in the past. Similarly, Rizk and Challita (2026) found that inflation has a positive but statistically insignificant effect on stock prices in both the short and long run. This highlights the difference between macroeconomic conditions in developed and developing countries. In contrast to Chang *et al.* (2019), Giri and Pooja (2017) as well as Keswani *et al.* (2024) who discovered that the performance of the stock market is negatively affected by CPI in the short run.

2.2 Exchange rate and stock prices

Exchange rates can influence stock prices both positively and negatively due to the reduction in import input costs, which enhances profits when the domestic currency appreciates, while a

domestic depreciation results in the rise of import input costs, which reduces profits for domestic producers (Bahmani-Oskooee and Saha, 2015). For instance, Chang *et al.* (2019) and Areli Bermudez Delgado *et al.* (2018) results indicate that the exchange rate has an inverse and statistically significant impact on the stock market index in the long run using monthly nominal exchange rate and quarterly data, respectively. However, Megaravali and Sampagnaro (2018) and Chang *et al.* (2019) found that the exchange rate and stock prices are positively related in the long run and short run using monthly and quarterly data, respectively. While Ogunsakin and Awe (2020) findings indicate that the exchange rate has an inverse and statistically significant influence on the performance of the stock market in the short run.

2.3 Gross domestic product and stock prices

Real economic activity represents another important channel that links macroeconomic factors to stock market performance. GDP can affect stock prices both positively and negatively. This is because an increase in GDP is normally due to an increase in consumption spending, capital formation, among other components, which can lead to investors expecting high corporate revenue and earnings in the future and therefore increasing stock prices. However, GDP can negatively affect stock prices because strong GDP growth can increase inflation due to demand-pull inflation. This high inflation results in lower stock prices due to higher uncertainty and expected discount rates (Humpe *et al.*, 2025).

Humpe *et al.* (2025), when there is high economic growth, it usually means that companies are earning more and their value has increased. Humpe *et al.* (2025) found that real GDP significantly affects stock prices in Anglosphere countries and has a positive relationship using quarterly data from 1995 to 2023. Similar to Ogunsakin and Awe (2020), who found a direct relationship in both short-term and long-term periods. This shows that economic growth is important for improving how the stock market can perform. However, Rizk and Challita (2026) have found that there is an inverse relationship between economic growth and stock prices.

The nexus between stock prices and various macroeconomic variables has been explored by previous studies. However, some results contradict each other. Whether the variables are directly or inversely correlated depends on a number of factors, such as whether the data is for developed or developing economies, whether structural breaks are considered, as well as the short- or long-term periods. Some of these studies have looked at the overall indices like the JSE All Share Index, and limited studies have looked into sectoral indices. This research seeks to fill this gap by analyzing the relationship between macroeconomic indicators and the JSE15 index using a data set from 2001Q1 to 2024Q4. It considers structural breaks such as the COVID-19 shock. Table 2 presents the summary of empirical studies.

3. Methodology

The purpose of this methodology section is to explore the data as well as the research methodology that this study utilizes to examine the relationship between the JSE Financial 15 index and the macroeconomic indicators.

3.1 Data selection and variable design

The following quarterly data from 2004Q1 to 2024Q4 is utilized due to availability of data; the dependent variable, long-run JSE Financial 15 index (LJSE15) was accessed from Reuters, independent variables such as inflation using Consumer Price Index (CPI) as its proxy, Repo rate, a proxy for interest rate (INT) as well as the exchange rate (EXR) data for ZAR against USD are all accessed from EasyData by Quantec. Lastly, real Gross Domestic Product (GDP) data are accessed from SARB.

Previous studies such as those by Chang *et al.* (2019) as well as Giri and Pooja (2017) have found that inflation and stock prices have an inverse short-run relationship. Bhuiyan and

Table 2. Summary of empirical studies

Author(s)	Year	Key findings
Chang *et al.*	(2019)	Inverse relation between nominal interest rate and stock prices
Ramatlo	(2019)	Unexpected increase in the repo rate can reduce the JSE All Share Index returns
Humpe *et al.*	(2025)	CPI negatively affects stock prices for Anglosphere countries while it positively affects stock prices in BRICS countries in the long run
Areli Bermudez Delgado *et al.*	(2018)	Exchange rate negatively affects the stock market in the long run
Megaravali and Sampagnaro	(2018)	Exchange rate and stock prices are positively related in the long run
Ogunsakin and Awe	(2020)	Exchange rate inversely influences the stock market performance in the short run
Keswani *et al.*	(2024)	Positive nexus between economic growth and stock prices using monthly data
Ogunsakin and Awe	(2020)	Positive relationship between GDP and stock prices
Rizk and Challita	(2026)	Inverse relation between economic growth and stock prices
Rizk and Challita	(2026)	Positive relationship between inflation and stock prices
Rizk and Challita	(2026)	Positive short run relationship between interest rates and stock prices and negative relationship in the long run

Source(s): Authors' compilations

Chowdhury (2020) and Tursoy (2019) found that, in the long run, the S&P 500 index, all sector indices and long-term interest rates are inversely related. Areli Bermudez Delgado *et al.* (2018) results indicate that the exchange rate is statistically significant and negatively related to the stock market index. Humpe *et al.* (2025) and Ogunsakin and Awe (2020) found that stock prices and GDP are positively related. We therefore expect CPI, INT and EXR to have a negative relationship with the LJSE15, while GDP to be positively related to the index.

The justification for including the independent variables in the model:

Inflation (CPI): Can affect the stock markets through interest rates, as they are used by the central bank, such as the South African Reserve Bank, to control inflation. A continuous increase in inflation can erode real returns and also negatively affect investor confidence in financial markets.

Economic growth (GDP): Is an essential macroeconomic indicator that shows the overall performance of economic activity. When GDP increases, it means that there is more consumer spending, an increase in demand for goods and services or an increase in capital formation, which can lead to investors expecting high corporate revenue and profit in the future. As a result, this tends to increase stock prices as stock prices rely on the current value of the expected future earnings.

Interest rate (repo rate): Is set by the Reserve Bank. When they increase the interest rate (repo rate), the prime rate also increases, affecting consumer spending and investment spending. Increases in interest rates tend to result in reductions in corporate earnings expectations and asset valuation, which can then affect stock prices.

Exchange rate (EXR) movements: Can influence trade balances, import and export prices as well as foreign investor behavior. For example, when the Rand depreciates against the US Dollar, it can reduce investment in domestic assets as well as increase exports as goods become cheaper for foreign buyers.

These variables were selected due to their theoretical and empirical relevance in explaining aggregate stock market movements. Firm-specific variables such as asset size or market share were not included as control variables because the main analysis of this study is a sectoral stock market index rather than individual institutions. The focus of this study is therefore on macroeconomic influences operating at the aggregate level rather than micro-level institutional influences.

3.2 Theoretical underpinning and model specification

Theoretically, financial markets are affected by macroeconomic fundamentals proposed by various asset pricing models such as the Arbitrage Pricing Theory. It provides a theoretical framework that explains the link between macroeconomic fundamentals and stock prices (Fromentin, 2022). According to Bhuiyan and Chowdhury (2020), some studies using Arbitrage Pricing Theory have found that even though stock returns and factors such as changes in the term structure, industrial production and shifts in the risk premium are positively related, anticipated and unexpected inflation showed a negative relationship with the returns of stocks mainly due to how they negatively affect expected dividends and the discount rate.

The appropriate model for analyzing the nexus among the variables depends on their order of integration and whether cointegration exists. VECM is used as all variables are integrated of order one and cointegration is confirmed using the Johansen cointegration test. VECM not only explores the short- and long-run relationships but it also corrects any deviations caused by shocks in the short run from the variables' state of long-run equilibrium state (Shao *et al.*, 2021; Xuan, 2025). The following model is used:

$$\Delta Y_t = XY_{t-1} + \sum_{i=1}^{p} K_i \Delta Y_{t-i} + \varepsilon_t \tag{2}$$

Where:

(1) $\boldsymbol{Y_t}$ is the level vector of endogenous variables:

$$\Delta \boldsymbol{Y_t} = \begin{bmatrix} \Delta \boldsymbol{LJSE15_t} \\ \Delta \boldsymbol{INT_t} \\ \Delta \boldsymbol{CPI_t} \\ \Delta \boldsymbol{EXR_t} \\ \Delta \boldsymbol{LGDP_t} \end{bmatrix}$$

(2) $\boldsymbol{X} = \boldsymbol{\alpha\beta'}$, where:

- $\boldsymbol{\beta'}$ contains the cointegration vectors.
- $\boldsymbol{\alpha}$ contains the adjustment coefficients

(3) $\boldsymbol{K_i}$ are the short-run dynamics

(4) $\boldsymbol{\varepsilon_t}$ is the error term

3.2.1 Unit root test. A unit root test is performed in order to see if a time series is stationary or not (Fame *et al.*, 2019). By conducting a unit root test, it can assist in making sure that the data can be used for forecasting and modelling. According to Moniz and Kantar (2024), data that is not stationary can lead to spurious regression results. There are different unit root tests that can be utilized, such as the Kwiatkowsi–Philips–Schmidt–Shin (KPSS) test, Phillips–Perron (PP) test as well as the Augmented Dickey-Fuller (ADF) test. This study uses the ADF test to test for stationarity and the PP and KPSS tests for robustness. The following ADF model is used:

$$\Delta y_t = a_0 + \gamma y_{t-1} + a_2 t + \sum_{i=1}^{p} \beta_i \Delta y_{t-1} + \varepsilon_t \tag{1}$$

Where:

(1) $\Delta y_t = y_t - y_{t-1}$: First difference of the series

(2) $\sum_{i=1}^{p} \beta_i \Delta y_{t-1}$: Lagged difference terms to control for autocorrelation

(3) γ: The main coefficient tested (unit root test)

(4) a_0: Intercept (constant)

(5) $a_2 t$: The time trend

(6) ε_t: White noise error term

H_0: $\gamma = 0$ (Variable has a unit root.)

H_1: $\gamma \neq 0$ (Variable does not have a unit root.)

3.2.2 Johansen cointegration test. This study makes use of the Johansen Cointegration test. This test tests whether there is a long-run equilibrium relationship between the variables (Xuan, 2025).

3.2.3 Structural breaks. According to Parab and Reddy (2020), results may be deteriorated by structural breaks, as they are unexpected changes that can occur in time series data. Therefore, including structural breaks in time series is important in order to indicate changes in the behaviour of the data and ignoring them can lead to misleading conclusions as well as biased estimates. There are different tests that can be conducted for structural breaks, such as the Chow test, Quant Andrews and the Bai–Perron tests. According to Bhattachrjee and Das (2023), the Bai–Perron test can test for multiple breakpoints in the data. To account for potential structural changes over the sample period 2004–2024, the Bai-Perron multiple breakpoints test was applied. Once the breakpoints were identified, they were then incorporated into the VECM as dummy variables to improve model robustness and control regime shifts.

3.2.4 Granger causality test. This study uses the pairwise Granger causality test in order to establish whether, in the short run there exists causality between the variables. This test is used to determine if one variable can be used to predict the other variable (Bhattacharjee and Das, 2023).

3.2.4.1 Post-estimation diagnostics. For robustness and reliability of the estimated VECM, a series of post-estimation diagnostic tests are conducted:

(1) Serial correlation test: The Breusch-Godfrey LM test is utilized to detect whether there is autocorrelation in residuals.

(2) Heteroscedasticity test: This test shows that the model is well-defined, suggesting that the performance variance of the dependent variable is well-defined (Keswani *et al.*, 2024). The White test is applied.

(3) Residual normality test: The Jarque–Bera test is conducted to assess whether the residuals are normally distributed.

4. Results and discussion

The purpose of this results and discussion section is to explore and discuss the results of this study. To explore the relationship between the JSE Financial 15 index and the macroeconomic variables, an econometric model such as the VECM was used. The results and discussion of the results are based on the descriptive statistics, unit root tests, Structural break test, Johansen cointegration test, VECM, Granger Causality test, as well as the Diagnostics.

4.1 Descriptive statistics

Descriptive statistics have been conducted to evaluate the properties of the variables. The results in Table 3 indicates that this data has 84 observations. The highest and lowest means are indicated by CPI (62.7726) and INT (6.7579), respectively. LJSE15 and LGDP are both negatively skewed, suggesting that the observations' mean is not greater than the median,

Table 3. Descriptive statistics

Statistics	LJSE15	CPI	EXR	INT	LGDP
Mean	9.2928	62.7726	11.4014	6.7579	15.1674
Median	9.3934	61.2833	10.8143	6.7500	15.2508
Maximum	9.9633	99.9333	5.99873	3.5000	15.8036
Minimum	8.2381	35.4856	5.9887	1.8823	14.2676
Standard deviation	0.4226	1.9109	4.1235	1.8823	0.4337
Skewness	−0.5440	0.2740	0.2885	0.6567	−0.4016
Kurtosis	2.3166	1.9109	1.6902	3.7223	2.0719
Jarque–Bera	5.7780	5.2026	7.1692	7.8632	5.2727
Probability	0.0556	0.0742	0.0277	0.0196	0.0716
Observations	84	84	84	84	84

Source(s): Authors' computation

while the other variables are positively skewed. The Jarque–Bera test indicates that LJSE15, CPI and LGDP are normally distributed, while CPI and INT are not normally distributed.

4.2 Unit root test

The ADF test in Table 4 indicates that, at levels, we fail to reject the null hypothesis that CPI has a unit root; however, at first difference we reject the null hypothesis as it has a *p*-value that is less than 0.05 and conclude that it is integrated of order 1. These results are the same for EXR, log of GDP (LGDP), INT, and the log of JSE15 (LJSE15), which indicates that their *p*-values are greater than 0.05 at levels and less than 0.05 at first difference, and concludes that they are all integrated of order 1. These results are consistent with the PP test, which also shows that all the variables are integrated of order 1. However, the KPSS test results indicate that only CPI, LGDP, and LJSE15 are integrated of order 1, while EXR and INT are integrated of order 0. Given that ADF and PP tests share the null hypothesis of a unit root, the variables are all treated as integrated of order 1. This decision is further supported by the stationarity of the first differences.

4.3 Structural break test

The multiple breakpoint tests in Table 5 Panel A indicate that the break dates are 2012Q4 and 2020Q1. The Chow test performed in Panel B indicated that the F-statistics for both dates are statistically significant; therefore, we cannot accept the null hypothesis that there are no breaks at these specified breakpoints. Dummy variables for the structural break dates were created and included in the VECM.

4.4 Johansen cointegration test

Before conducting the Johansen cointegration test, a lag length selection test was conducted and according to Table 6, AIC indicates that the optimal lag is 5. Table 7 results of the cointegration test indicate that the Trace test shows that there are about 3 cointegrating equations that exist in this study. The test fails to accept the hypothesis that there are no cointegrating equations with the *p* value that is less than 0.05. The test also did not accept the hypothesis that there are at most 1 and 2 cointegrating equations, indicating that there exist 3 cointegrating equations.

4.5 Vector Error Correction Model (VECM)

Table 8 panel A shows that in the long run, a CPI and INT's 1% increase will result in a 4% and 0% increase in LJSE15, respectively. This implies that there is a positive relation between CPI

Table 4. Unit root test results

ADF test Variable	Level Probability value	First difference Probability value
CPI	0.5639	0.0000
EXR	0.0606	0.0000
LGDP	0.4598	0.0000
INT	0.0587	0.0014
LJSE15	0.2359	0.0000
Phillips-Perron test		
CPI	0.5795	0.0000
EXR	0.1464	0.0000
LGDP	0.5036	0.0000
INT	0.2526	0.0011
LJSE15	0.2132	0.0000

KPSS test Variable	Level Asymptotic critical value at 5% level	KPSS test statistic
CPI	0.1460	0.2768
EXR	0.1460	0.1340
LGDP	0.1460	0.2933
INT	0.4630	0.3488
LJSE15	0.1460	0.1585

Variable	First difference Asymptotic critical value at 5% level	KPSS test statistic
CPI	0.1460	0.0653
EXR	0.1460	0.0403
LGDP	1.1460	0.0625
INT	0.4630	0.0804
LJSE15	0.1460	0.0658

Note(s): All variables tested with constant and trend except INT which is tested with constant only
Source(s): Authors' computation

and INT and LJSE15, respectively. The results for CPI are consistent with those of Giri and Pooja (2017) and Chang *et al.* (2019). These results, however, contradict the Fisher's effect and the findings of Tursoy (2019), Bhuiyan and Chowdhury (2020) and Keswani *et al.* (2024) because, according to this effect, expected inflation and nominal interest rates tend to move together; as a result, interest rates are generally expected to have a negative correlation with stock prices due to the impact of inflation. On the other hand, a 1% increase in EXR and LGDP results in a 1% and 2% reduction in LJSE15, respectively, suggesting that the exchange rate and real GDP are inversely related to LJSE15. The results for EXR are consistent with Keswani *et al.* (2024) and Chang *et al.* (2019), while Ogunsakin and Awe (2020) and Keswani *et al.* (2024) results indicate a direct long-term relationship between economic growth and stock returns.

In panel B, the speed of adjustment or the error correction term (CointEq1) is negative and statistically significant. This means that, in the case there are disturbances in the short run, the

Table 5. Structural break test

Panel A: Bai-Perron multiple breakpoint tests

Break dates	Sequential	Repartition
1	2012Q4	2011Q3
2	2020Q1	2020Q1

Panel B: Chow test

2012Q4		2020Q1	
F-statistic	28.4665	F-statistic	8.2057
Prob. F(5.74)	0.0000	Prob. F(5.74)	0.0000

Note(s): Null hypothesis: No breaks at specified breakpoints, reject hypothesis if Prob.F value is less than 0.05

Source(s): Authors' computation

Table 6. Lag length selection criterion

Lag	LogL	LR	FPE	AIC	SC	HQ
0	−489.8299	NA	0.2937	12.9641	13.4207	13.1468
1	140.9739	1120.2296	5.02e-08	−2.6227	−1.4051*	−2.1357
2	188.5839	79.14383	2.82e-08	−3.2100	−1.2314	−2.4186*
3	217.9846	45.0557	2.59e-08	−3.3242	−0.5848	−2.2285
4	246.5175	40.0201*	2.48e-08	−3.4160	0.0844	−2.0159
5	275.0498	36.3139	2.45e-08*	−3.5078*	0.7537	−1.8032
6	292.7503	20.2292	3.35e-08	−3.3182	1.7042	−1.3093
7	319.4509	27.0473	3.82e-08	−3.3624	2.4211	−1.0490

Note(s): * indicates the lag order selected by the following criterion; Hannan-Quinn information criterion (HQ), Akaike information criterion (AIC), Final prediction error (FPE), Schwarz information criterion (SC) and Sequential modified LR test statistic (each test at 5% level). This study uses the AIC

Source(s): Authors' computation

disequilibrium caused by these disturbances will be corrected in the long run as the CointEq1 coefficient towards equilibrium in the long run is 20% with JSE15 as the dependent variable. This indicates a very slow correction to its equilibrium state. The previous quarter's change in LJSE15 has a statistically insignificant, small and negative impact on the current period (quarter). This suggests that a percentage change in LJSE15 itself will reduce LJSE15 by 6%. However, in other lags, changes in LJSE15 have a positive effect on LJSE15 itself.

In the short run, only previous quarters' CPI and INT at lags 1 and 2 change negatively and significantly affect LJSE15 in the current period, respectively. This suggests that a percentage change in inflation and interest rates can result in a decline in JSE Financial 15 index returns. This is because a continuous increase in inflation can erode real returns and also negatively affect investor confidence in financial markets. This result is consistent with Kaur and Chaudhary (2022). Tursory (2019) found similar results using the ARDL bound test, suggesting that a rise in interest rates will lower stock prices. This is because increased interest rates tend to result in a reduction in corporate earnings expectations and asset valuation, which can then affect stock prices. However, CPI at lags 2 and 3 indicate that there is a positive, insignificant relationship between CPI and LJSE15, suggesting that when inflation increases, it will increase LJSE15. This is consistent with the findings of Giri and Pooja (2017) as well as Chang *et al.* (2019).

Table 7. Johansen cointegration results

Hypothesized No. of CE(s)	Trace statistic	0.05 critical value	Probability
None[a]	104.1383	69.8189	0.0000
At most 1[a]	57.3386	47.8561	0.0050
At most 2[a]	31.2308	29.7971	0.0340
At most 3	13.1452	15.4947	0.1096
At most 4	1.0277	3.8415	0.3107

Hypothesized No. of CE(s)	Max Eigen statistics	0.05 critical value	Probability
None[a]	46.7997	33.8769	0.0009
At most 1	26.1079	27.5843	0.0763
At most 2	18.0855	21.1316	0.1267
At most 3	12.1175	14.2646	0.1063
At most 4	1.0277	3.8415	0.3107

Note(s): Trace test shows 3 cointegrating equations at the 0.05 level. Max-eigenvalue test shows 1 cointegrating equations at 0.05 level, [*]Represents a rejection of the hypothesis at the 0.05 level

Source(s): Authors' computation

Lags 1 and 3 of EXR show a negative, insignificant effect on JSE Financial 15. This suggests that when exchange rates increase, the LJSE15 decreases. Bahmani-Oskooee and Saha (2015) as well as Ogunsakin and Awe (2020), also found similar results using an ARDL model. However, Chang *et al.* (2019) found a positive short-term nexus between the exchange rate and stock prices. LGDP has positive coefficients for all lags and a statistically insignificant effect on the LJSE15. This indicates that there is a positive relation between economic growth and JSE Financial 15 returns, suggesting that when LGDP rises, LJSE15 can increase as a result. However, it also implies that LGDP does not significantly affect LJSE15. Ogunsakin and Awe (2020) found a similar positive short-run nexus. Suggesting that as economic growth rises, stock prices will increase as a result.

Lastly, the dummy variable DM1 for 2012Q4 results show a statistically insignificant impact in the short run. This implies that any shock or shift occurring in this quarter did not significantly affect the JSE Financial 15 index return in the short run. However, the dummy variable for DM2 for 2020Q1, representing the beginning of the COVID-19 pandemic, has a negative and statistically significant coefficient of −6% (−0.6449). This indicates that the pandemic had negative, significant impact on the JSE Financial 15 index return in the short run, which is consistent with the global market disruptions observed at the time.

4.6 Granger causality test

The results in Table 9 show that D(INT) and D(EXR) have a probability value that is lower than 0.05. Therefore, we reject the null hypothesis that INT and EXR do not Granger-cause D (LJSE15) and conclude that INT and EXR Granger-cause LJSE15. This indicates that they can be included when forecasting LJSE15. D(CPI) and D(LGDP), on the other hand, have a *p*-value that is more than 0.05, failing to reject the null hypothesis that CPI and LGDP do not Granger-cause LJSE15. Keswani *et al.* (2024) also found similar results that INT and EXR do Granger-cause stock prices, implying that in the short run, the fluctuations in the stock prices are explained by these variables. However, their results are contradictory to this study as they have found that GDP and interest rates also do granger cause Indian stock prices. D(LJSE15) has a probability value that is higher than the 5% level; therefore, we cannot reject the null

Table 8. VECM estimates

Panel A: Long-run relationship Cointegrating Eq	CointEq1
LJSE15(−1)	1.0000
CPI(−1)	0.0402
t-statistics	[6.3152]*
EXR(−1)	−0.1003
t-statistics	[−4.6431]*
INT(−1)	0.0050
t-statistics	[0.3220]
LGDP(−1)	−2.3298
t-statistics	[−10.5664]*
C	24.6516

Panel B: Short-run relationship Error correction	D(JSE15)
CointEq1	−0.1962
t-statistics	[−2.5497]*
D(LJSE15(−1))	−0.0573
t-statistics	[−0.5097]
D(LJSE15(−2))	0.0628
t-statistics	[0.5149]
D(LJSE15(−3))	0.3215
t-statistics	[2.6510]*
D(LJSE15(−4))	0.1588
t-statistics	[1.3310]
D(CPI(−1))	−0.0909
t-statistics	[−2.8346]*
D(CPI(−2))	0.002821
t-statistics	[0.09234]
D(CPI(−3))	0.0055
t-statistics	[0.1852]
D(CPI(−4))	−0.0357
t-statistics	[−1.1860]
D(EXR(−1))	−0.0220
t-statistics	[−1.3225]
D(EXR(−2))	0.0252
t-statistics	[1.5093]
D(EXR(−3))	−0.0091
t-statistics	[−0.5540]
D(EXR(−4))	0.0029
t-statistics	[0.1759]
D(INT(−1))	0.0180
t-statistics	[0.5457]
D(INT(−2))	−0.1017
t-statistics	[−2.6812]*
D(INT(−3))	0.03141
t-statistics	[0.8263]
D(INT(−4))	0.0254
t-statistics	[0.7642]
D(LGDP(−1))	0.6751
t-statistics	[1.2359]
D(LGDP(−2))	0.6267
t-statistics	[1.1145]
D(LGDP(−3))	0.3318

(*continued*)

Table 8. Continued

Panel B: Short-run relationship Error correction	D(JSE15)
t-statistics	[0.5700]
D(LGDP(−4))	0.4108
t-statistics	[0.7894]
DM1	−0.0065
t-statistics	[−0.0783]
DM2	−0.6449
t-statistics	[−7.3670]

Note(s): t-statistics values with * indicate that variable is statistically significant
Source: Authors' computation

Table 9. Granger causality test

Null hypothesis (H_0)	Probability value	Result
D(INT) does not granger cause D(LJSE15)	0.0240*	Reject H_0
D(CPI) does not granger cause D(LJSE15)	0.4283	Accept H_0
D(EXR) does not granger cause D(LJSE15)	0.0398*	Reject H_0
D(LGDP) does not granger cause D(LJSE15)	0.5282	Accept H_0
D(LJSE15) does not granger cause D(INT)	0.4369	Accept H_0
D(LJSE15) does not granger cause D(CPI)	0.6343	Accept H_0
D(LJSE15) does not granger cause D(EXR)	0.0005*	Reject H_0
D(LJSE15) does not granger cause D(LGDP)	0.0104*	Reject H_0

Note(s): Probability values with * indicate that the variable is statistically significant at 5% level
Source(s): Authors' computation

hypothesis that D(LJSE15) does not Granger-cause D(CPI) and D(INT). This implies that LJSE15 cannot be included when forecasting INT and CPI. However, it does granger cause D (EXR) and D(LGDP) because it has a probability value is not greater than 0.05.

4.7 Diagnostics

In Table 10 panel A, the probability value is higher than the 5% level; therefore, accept the null hypothesis that there is no serial correlation at lag 5. In panel B, the joint components/variables have a *p*-value of 0.2361, which is higher than the 0.05 level; therefore, we can conclude that it is normally distributed. The heteroscedasticity test results in panel C indicate that, for the joint test, the *p*-value of 0.1096 is greater than 0.05; therefore, we can conclude that this model is not heteroskedastic.

5. Conclusion and policy implications

This study's findings have shown that a long-run nexus exists between the chosen macroeconomic indicators and the JSE Financial 15 index. It also indicated that a short-run nexus between the macroeconomic indicators and the JSE Financial 15 index exists, although some variables indicated a statistically significant relation while others indicated a statistically insignificant relation between the variables. Some results were contradictory to previous studies due to data frequency, time periods as well as lags chosen. INT and EXR do Granger-cause LJSE15; therefore, when forecasting the JSE Financial 15 Index returns, INT and EXR

Table 10. Residual diagnostics

Panel A: Residual serial correlation LM tests				
Lag	LRE*stat	*p*-value	Rao F-stat	*p*-value
1	60.8091	0.0001	2.7026	0.0001
2	21.4739	0.6660	0.8541	0.6676
3	26.3727	0.3879	1.0634	0.3900
4	20.5839	0.7156	0.8167	0.7171
5	19.3667	0.7792	0.7658	0.7805

Panel B: Residual normality tests		
Variable	Jarque-Bera	*p*-value
1	0.6684	0.7159
2	6.3495	0.0418
3	0.0552	0.9728
4	1.1880	0.5521
5	4.5210	0.1043
Joint	12.7821	0.2361

Panel C: Residual heteroskedasticity test (levels and squares)	
Chi-sq	*p*-value
704.9490	0.1096

Source(s): Authors' computation

can be included while CPI and LGDP can be excluded. The COVID-19 pandemic shock in the short run had a significant, negative impact on LJSE15 indicated by the DM2 results.

The fact that INT (Repo rate) Granger-causes LJSE15 means that monetary policy has a predictive and transmission effect on the performance of the financial sector. The South African Reserve Bank should therefore continue to use interest rate policies that are clear, transparent and predictable because, according to the findings of Ramatlo (2019), unexpected rate changes can significantly influence market movements. While the exchange rate Granger causality results show that the financial market is sensitive to currency fluctuations, authorities should aim for exchange rate stability because unexpected and sharp depreciations can have a negative impact on financial stocks and excessive appreciation could reduce competitiveness in exports. Investors and portfolio managers should also avoid relying only on domestic macroeconomic indicators when creating short-term investment strategies for the JSE Financial 15 index. They should also focus on firm-specific determinants and global financial trends which can affect the performance of the index.

While the model captures key macroeconomic variables, it omits certain financial variables that are commonly used in stock price modelling, such as money supply, credit growth and global financial indices. Future researchers should consider incorporating firm-specific variables as well as global financial indices to explore whether they add further explanatory value.

Ethical approval

This article used secondary data and no qualitative data such as surveys were utilized for analysis.

Data availability
All data generated or analyzed during this study are not included in this submission but can be made available upon reasonable request.

Consent for publication
This manuscript is an original work produced by the author(s). KM and CSS are aware of its content and approves its submission. It is also important to mention that the manuscript has not been published elsewhere in part or in entirety and is not under consideration by another journal. The author(s) has given consent for this article to be submitted for publication in *Journal of Economic and Administrative Sciences*.

Author(s) contributions
KM conceived the key ideas for this research paper. She collected and analyzed the data. KM and CSS worked on the introduction, literature review, methodology, results and conclusion.

Acknowledgments
During the preparation of this work the author(s) used ChatGPT in order to proofread. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication. Thanks to the DSI/NRF Trilateral Chair in Transformative Innovation, the 4IR and Sustainable Development for its support.

References

Areli Bermudez Delgado, N., Bermudez Delagado, E. and Saucedo, E. (2018), "The relationship between oil prices, the stock market and the exchange rate: evidence from Mexico", *The North American Journal of Economics and Finance*, Vol. 45, pp. 266-275, doi: 10.1016/j.najef.2018.03.006 (accessed 26 June 2025).

Bahmani-Oskooee, M. and Saha, S. (2015), "On the relation between stock prices and exchange rates: a review article", *Journal of Economic Studies*, Vol. 42 No. 4, pp. 707-732, doi: 10.1108/JES-03-2015-0043 (accessed 10 Sep 2025).

Bhattacharjee, A. and Das, J. (2023), "Assessing the long-run and short-run effect of monetary variables on stock market in the presence of structural breaks: evidence from liberalized India", *IIM Ranchi journal of management studies*, Vol. 2 No. 1, pp. 70-81, doi: 10.1108/IRJMS-03-2022-0034 (accessed 28 June 2025).

Bhuiyan, E.M. and Chowdhury, M. (2020), "Macroeconomic variables and stock market indices: asymmetric dynamics in the US and Canada", *The Quarterly Review of Economics and Finance*, Vol. 77, pp. 62-74, doi: 10.1016/j.qref.2019.10.005 (accessed 10 September 2025).

Chang, B.H., Meo, M.S., Syed, Q.R. and Abrp, Z. (2019), "Dynamic analysis of the relationship between stock prices and macroeconomic variables", Vol. 8 No. 3, pp. 229-245, doi: 10.1108/SAJBS-06-2018-0062 (accessed 31 August 2025).

Demir, C. (2019), "Macroeconomic determinants of stock market fluctuations: the case of BIST-100", Vol. 7 No. 1, p. 8, doi: 10.3390/economies7010008 (accessed 2 August 2025).

Fahmi, M.S., Geetha, C. and Mohidin, R. (2019), "Testing for unit roots and structural breaks in Malaysia unanticipated macroeconomic variables", *Malaysian Journal of Business and Economics*, Vol. 6 No. 2, pp. 1-12, doi: 10.51200/mjbe.v0i0.2161, available at: https://www.researchgate.net/profile/Muhamad-Shameer-Fahmi/publication/353609088_Testing_for_Unit_Roots_and_Structural_Breaks_in_Malaysia_Unanticipated_Macroeconomic_Variables/links/6105a6031e95fe241a9e5da8/Testing-for-Unit-Roots-and-Structural-Breaks-in-Malaysia-Unanticipated-Macroeconomic-Variables.pdf (accessed 24 June 2025).

Financial Times (n.d.), available at: https://markets.ft.com/data/indices/tearsheet/summary?s=JFINI:JNB (accessed 17 April 2025).

Frey, D.F. (2018), "Economic growth, full employment and decent work: the means and ends in SDG 8", in *The Sustainable Development Goals and Human Rights*, Routledge, pp. 122-142.

Fromentin, V. (2022), "Time-varying causality between stock prices and macroeconomic fundamentals: connection or disconnection?", *Finance Research Letters*, Vol. 49, 103073, doi: 10.1016/j.frl.2022.103073 (accessed 20 June 2025).

Fsdo, D. (2024), *Financing for Sustainable Development Report 2024*, UN Department of Economic and Social Affairs, available at: https://desapublications.un.org/publications/financing-sustainable-developmentreport-2024

Giri, A.K. and Pooja, J. (2017), "The impact of macroeconomic indicators on Indian stock prices: an empirical analysis", Vol. 12 No. 1, doi: 10.1515/sbe-2017-0005 (accessed 25 April 2025).

Hackland, C. (2015), *The Impact of Selected Macroeconomic Variables on Sectors of the JSE*, M.B.A., University of Pretoria, South Africa, available at: https://www.proquest.com/docview/2901485112?accountid=13425https://repository.up.ac.za/handle/2263/52404&sourcetype=Dissertations%20&%20Theses (accessed 15 April 2025).

Humpe, A., Mcmillan, D.G. and Schöttl, A. (2025), "Macroeconomic determinants of the stock market: a comparative study of Anglosphere and BRICS", *Finance Research Letters*, Vol. 75, 106869, doi: 10.1016/j.frl.2025.106869 (accessed 24 June 2025).

Johannesburg Stock Exchange (JSE) (n.d.), "Connecting investors to African opportunities", available at: https://group.jse.co.za/ (accessed 31 October 2025).

Kaur, J. and Chaudhary, R. (2022), "Relationship between macroeconomic variables and sustainable stock market index: an empirical analysis", *Journal of Sustainable Finance and Investment*, pp. 1-18, doi: 10.1080/20430795.2022.2073957 (accessed 31 August 2025).

Keswani, S., Veerma, P. and Jha, R. (2024), "Relationship among macroeconomic factors and stock prices: cointegration approach from the Indian stock market", *Cogent Economics and Finance*, Vol. 12 No. 1, 2355017, doi: 10.1080/23322039.2024.2355017 (accessed 4 September 2025).

Maake, T., Semosa, K., Ogujiuba, K. and Maponya, L. (2024), "An econometric analysis of inflation, exchange rate, and interest rate on stock market performance in South Africa", *International Journal of Economics and Financial Issues*, Vol. 14 No. 6, pp. 357-368, doi: 10.32479/ijefi.17095 (accessed 12 April 2025).

Megaravalli, A.V., Sampagnaro, G. and Murray, L. (2018), "Macroeconomic indicators and their impact on stock markets in ASIAN 3: a pooled mean group approach", *Cogent Economics and Finance*, Vol. 6 No. 1, 1432450, doi: 10.1080/23322039.2018.1432450 (accessed 9 September 2025).

Moizz, A. and Akhtar, S.M.J. (2024), "Dynamic linkages between the monetary policy variables and stock market in the presence of structural breaks: evidence from India", *Asian Journal of Economics and Banking*, Vol. 8 No. 3, pp. 391-411, doi: 10.1108/AJEB-01-2024-0005 (accessed 3 July 2025).

Mokoena, S. (2023), *The Effects of Macro-Economic Variables on the Stock Market Performance*, University of Johannesburg, available at: https://www.proquest.com/dissertations-theses/effects-macro-economic-variables-on-stock-market/docview/3132879369/se-2?accountid=13425https://ujcontent.uj.ac.za/esploro/outputs/graduate/The-effects-of-macro-economic-variables-on/9941999607691 (accessed 21 April 2025).

Ogunsakin, S. and Awe, I.T. (2020), "Macroeconomic determinants of stock market performance in Nigeria", Vol. 10 No. 4, doi: 10.5296/ber.v10i4.17633 (accessed 5 September 2025).

Panta, B.P. (2020), "Macroeconomic determinants of stock market prices in Nepal", Vol. 2 No. 1, pp. 55-56, doi: 10.3126/qjmss.v2i1.29022 (accessed 13 April 2025).

Parab, N. and Reddy, Y.V. (2020), "The dynamics of macroeconomic variables in Indian stock market: a Bai–Perron approach", *Macroeconomics and Finance in Emerging Market Economies*, Vol. 13 No. 1, pp. 89-113, doi: 10.1080/17520843.2019.1641533 (accessed 22 September 2025).

Ramatlo, T. (2019), *Monetary Policy and the Stock Market in South Africa: How Do South African Equity Prices Respond to Expected and Unexpected Changes in the Repo Rate?*, University of

Cape Town, Cape Town, available at: https://open.uct.ac.za/items/5922ae7c-0422-49f9-852d-a354606262a7 (accessed 23 May 2025).

Rizk, R. and Challita, J. (2026), "Impact of economic and geopolitical factors on Lebanese banks' stock prices", *The Journal of Risk Finance*, Vol. 27 No. 3, pp. 440-457, doi: 10.1108/JRF-09-2025-0415 (accessed 12 May 2026).

Sayed, Z. (2015), "Transforming our world: the 2030 agenda for sustainable development", *Ethics and Critical Thinking Journal*, Vol. 2015 No. 3.

Shao, Q., Chen, L., Zhong, R. and Weng, H. (2021), "Marine economic growth, technological innovation, and industrial upgrading: a vector error correction model for China", *Ocean and Coastal Management*, Vol. 200, 105481, doi: 10.1016/j.ocecoaman.2020.105481 (accessed 18 September 2025).

Tursoy, T. (2019), "The interaction between stock prices and interest rates in Turkey: empirical evidence from ARDL bounds test cointegration", *Financial Innovation*, Vol. 5 No. 1, p. 7, doi: 10.1186/s40854-019-0124-6 (accessed 12 September 2025).

United Nations Conference on Trade and Development (UNCTAD) (2017), "The role of stock exchanges in fostering economic growth and sustainable development", available at: https://sseinitiative.org/sites/sseinitiative/files/publications-files/wfe-unctad-exchanges-growth-and-sustainable-development.pdf

World Bank Group (2013), *Global Financial Development Report 2014: Financial Inclusion*, World Bank Publications, Vol. 2.

World Bank Group (2016), *The World Bank Group A to Z 2016*, World Bank Publications.

Xuan, V.N. (2025), "The effect of factors on carbon dioxide emissions in revolution 6.0 in Taiwan: new evidence from VECM methodology", *Results in Engineering*, Vol. 27, 106527, doi: 10.1016/j.rineng.2025.106527 (accessed 30 October 2025).

Corresponding author
Charles Shaaba Saba can be contacted at: sabacharlesshaaba@yahoo.com