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IS THE STOCK MARKET A "BAROMETER" OF THE ECONOMY? BASED ON SOUTH AFRICA COMPREHENSIVE ANALYSIS

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ABSTRACT

An efficient stock market supports economic growth and is a barometer of South Africa's financial health. Our research delves into how macroeconomic variables impact stock prices in South Africa by investigating yearly time series data ranging from 2000 to 2023. We utilise Johansen's cointegration test and the Vector Error Correction Model (VECM) to investigate the equilibrium relationship between stock market prices and critical macroeconomic factors like inflation (INFL), trade rate (TR), money supply (MS) and exchange rate (EXCH). The study findings indicate that these factors are correlated in the long run, indicating a lasting correlation between specific macroeconomic indicators and stock market prices. Stock market prices are affected positively by exchange rates and inflation, as well as by the money supply; however, trade rates have a negative impact according to the analysis of short-term financial dynamics, which suggests that adjustments are made to reach a long-term equilibrium despite the lesser immediate effects of macroeconomic factors. Granger causality tests show that macroeconomic factors influence stock market prices over long and short-term periods. This highlights the importance of the stock market as an indicator of trends and signals potential shifts in the broader economy, which policymakers and investors should keep a close eye on as an early warning system.

Keywords: *Stock Market, Barometer of the Economy, Cointegration, Vector Error Correction Model (VECM), South Africa*

1. INTRODUCTION

The stock market fosters economic progress and serves as a gauge of economic development since stock prices are influenced by a company's projected earnings, which reflect the overall economic trajectory. The stock market's growth serves as a catalyst for driving economic expansion directly. Based on this notion, the effectiveness of the South Africa stock market indicator is examined.

The study main objective is to determine whether economic factors in South Africa affect the stock prices in aggregate. The findings can provide meaningful insight to policymakers and practitioners in a developing country like South Africa.

The stock market functions as a financial marketplace which enables investors to purchase and

exchange securities including stocks bonds and derivatives (Verma & Bansal, 2021). Supply and demand forces govern these assets' prices (Hendricks et al., 2020; Hendricks & Singhal, 2014). The stock market plays a role in helping companies secure long-term funding by gathering investments from diverse sources to support business growth and creativity. Investors can invest extra money and minimise risks while aiming for financial growth (Greenwood & Scharfstein, 2013; Masoud & Hardaker, 2012). The market index is a standard for evaluating individual portfolio's performance and predicting trends (Wilkens & Zhu, 2001). The stock market provides liquidity, investment opportunities, and risk management in developed countries. It mobilises household savings for productive investments, supports local companies' growth, and attracts foreign investment, contributing to economic development and job creation. The developing country has made various efforts to establish and stabilize its stock markets (Zolfaghari & Sahabi, 2021). According to them, the stock market is crucial for supporting business funding and promoting development while improving corporate transparency and governance practices in general.

Over the past few decades¸ academics and professionals have shown a keen interest in exploring how stock returns are connected to various macroeconomic factors, especially in certain countries where previous studies have uncovered a significant correlation between stock markets and specific macroeconomic indicators¸ as highlighted by Bhuiyan and Chowdhury (2020). Their research examines how indicators affect various stock market sectors in both the United States and Canada (Bhuiyan & Chowdhury, 2020). Silva and Antunes (2015) discovered that the state of the economy significantly influences changes in the stock market and causes uncertainty among the parties involved. The discovery has sparked research interest among experts to study the connection between stock markets and macroeconomic factors (Silva & Antunes, 2015).

Research conducted in the United States has proven that economic indicators such as inflation and exchange rates affect the stock market's performance patterns throughout time. The research findings show that the stock market serves as an economic health indicator which provides essential predictions about future economic trends (Danso, 2020). Research studies have recently focused on the relationship between stock prices and macroeconomic indicators in both established and emerging economies (Karanasos et al., 2022; W. Wang et al., 2021; Younis et al., 2020). The research conducted by Chinzara (2011) and Shawtari et al., (2016) lacks modern economic data from South Africa because it fails to account for recent global commodity price changes and exchange rate fluctuations and monetary and fiscal policy adjustments. The relationship between South Africa's stock market and macroeconomic factors has not received sufficient in-depth research until recently which resulted in knowledge gaps. Earlier findings might not be sufficient because of this. The current economic dynamics require updated analysis to capture their essence. The analysis of this data will reveal fresh connections between stock market performance and macroeconomic indicators which will benefit both policymakers and investors.

The research investigates the connection between South African stock market performance and its four main macroeconomic indicators which include exchange rates and inflation and trade balance and money supply. The study employs Johansen's cointegration test together with the VECM to analyse both short and long-term dynamics. The Granger causality test serves to establish if changes in these macroeconomic indicators can forecast stock market movements. The research uses these methods to gain a better understanding of how macroeconomic forces influence stock market behavior in South Africa.

Following the introduction section, Section 2 presents an overview of the relevant literature. Section 3 delve into the research methodology of this study. Section 4 explains the estimation results and interpretation (model estimations). The final sections of the paper present the conclusion and policy implications.

2. LITERATURE REVIEW

2. 1. THEORETICAL FRAMEWORK AND CONCEPTUAL UNDERSTANDING

Stock market functions as an economic indicator which shows both economic conditions and market participant attitudes. Stock prices closely reflect economic conditions because they are directly related to macroeconomic variables including inflation and exchange rates and trade balances and money supply. Ross (1976) established the theoretical connection between stock market prices and economic variables through his Arbitrage Pricing Theory (APT). The (APT) discusses the impact of factors that affect fluctuations in stock market performance due to changes in income levels and volatility factors present in the market environment. The degree to which these economic variables influence stock market returns depends heavily upon the assumptions embedded within the model. The APT emerged as a substitute for the Capital Asset Pricing Model (CAP M) when Ross presented it in 1976 (Ross, 1976).

The Efficient Market Hypothesis (EMH) introduced in 1970 (Fama, 1970) is another theory that help to explain the relationship where it states that, asserts that stock prices inherently reflect available information, encompassing macroeconomic updates that are crucial for understanding the dynamic relationship between economic conditions and market movements (Masoud & Hardaker, 2012). Scholars such as Parasuraman and Ramudu propose that stock prices fully reflect information about securities, and in addition to macroeconomic factors, economic uncertainty can also be considered an important factor that influences stock market performance (Parasuraman & Ramudu, 2011). Moreover, the influence of inflation, exchange rates, money supply, and trade balances on stock prices has been substantiated in several theoretical models (Bird et al., 2011), emphasizing both their direct and indirect impacts on asset returns.

In addition to these established theories, Schwartz's work on market design and information economics enhances our understanding by highlighting how market imperfections, such as information asymmetries and transaction costs, cause inefficiencies in the reflection of macroeconomic indicators in stock prices. According to Schwartz (1999), imperfect information and market structure can lead to deviations from models like the EMH, which assumes prices always reflect all available information (Schwartz, 1999). This insight suggests that the relationship between economic indicators and stock prices is not merely linear but is mediated by the peculiarities of how markets operate, providing a more nuanced perspective of market efficiency (Yeap & Gan, 2017).

2. 2. STOCK MARKET PERFORMANCE, AND MACRO-ECONOMIC VARIABLE NEXUS

Academic research continues to analyse the connection between stock market performance and macroeconomic variables through both direct and indirect connections between these factors. Research conducted by Cheng (2010) shows that stock prices react to economic news and macroeconomic variables explain stock market fluctuations (Hou & Cheng, 2010). Research has been conducted to analyze the stable and balanced relationship between stock market and macroeconomic factors including inflation, exchange rates and money supply. Inflation (INFL) is one of the most scrutinized macroeconomic variables, with empirical research indicating that it affects stock prices in various ways. Higher inflation typically induces uncertainty, leading to decreased investor confidence and declines in stock prices (Knio & Houmani, 2024). Similarly, Omar et al. found that inflation is negatively and significantly linked with stock market in long run and short run (Omar et al., 2022).

Researchers Kormak, Aydemir, and Demirhan discovered a causal relationship between inflation rates, exchange rates, money supply, and Turkey's stock market (Aydemir & Demirhan, 2009; Korkmaz, 2020). Furthermore, Rui Wang and Lianfa study revealed a positive correlation

between stock market prices and inflation (R. Wang & Li, 2020). Girardin and Joyeux 2013 studied how macroeconomic factors affected the Chinese stock market's long-term volatility by discovering that consumer price index inflation positively affected the A-share market after China joined the World Trade Organization in 2001 while trading volume influence decreased (Girardin & Joyeux, 2013).

The stock market depends heavily on exchange rates (EXCH) because South Africa as an emerging economy conducts most of its international trade activities. The changes in exchange rates affect both export earnings and import expenses which in turn affect stock prices through direct and indirect mechanisms (Imhanzenobe, 2023). Research indicates a link between exchange rate volatility and increased market volatility, emphasizing the importance of currency fluctuations in stock performance (Karki et al., 2023). Bhargave and Tandon (2023) examine exchange rates and discover that major exchange rate changes lead to increased market volatility which demonstrates how exchange rates affect market sentiment in India (Bhargave & Tandon, 2023). However, Okere et al. employed a linear autoregressive lag method to explore the connection between stock market prices and selected critical macroeconomic factors. The research results showed that exchange rates do not have a significant impact on stock market performance in Nigeria's short-run and long-run asymmetric test (Okere et al., 2021). On the other hand, the study by Bahmani-Oskooee and Saha (2018) found that in countries like Brazil, Chile, Germany, and Singapore, stock prices have a significant long-term impact on exchange rates, highlighting the importance of considering country-specific dynamics in understanding the relationship between stock prices and exchange rates (Bahmani-Oskooee & Saha, 2018).

The money supply (MS) functions as a fundamental market liquidity driver which enhances stock prices during short-term periods because higher money supply leads to lower interest rates that facilitate borrowing for stock investments (Suroso et al., 2018). However, excessive growth in money supply can lead to inflationary pressures and detrimental effects on stock market performance (Mallika & Randeni, 2022). Anigbogu and Nduka (2014) examine the connection between money supply and stock market performance in Nigeria, they found significant long-term connections, affirming economic theories that associate increased liquidity with market growth (Anigbogu & Nduka, 2014). Hamza conducted research in 2005 to study the connection between Singapore stock prices and economic indicators which included money supply and inflation and exchange rates. The stock market index shows co-integration with money supply and exchange rates and inflation (Hamzah, 2005). Lastly, the trade balance has been shown to correlate positively with stock market dynamics, suggesting that trade surpluses may indicate economic robustness capable of increasing stock market growth (Brown et al., 2017). Omar et al. (2022) used the AutoRegressive Distributed Lag bounds testing approach to study how stock market development responds to macroeconomic factors. Their study concludes the existence of cointegration among the variables and established that inflation and trade had a negative influence on stock in the long run (Omar et al., 2022).

2. 3. EMPIRICAL EVIDENCE FROM SOUTH AFRICA

Research on macroeconomic factors and South African stock market performance exists although it remains less extensive than global research in this area. Alagidede and Panagiotidis studied the stock price relationship with inflation for specific African stock markets (Paul Alagidede & Panagiotidis, 2012). The research shows that South African stock prices initially decrease when consumer prices rise but eventually increase in response to inflation. Stocks function as an inflation protection mechanism during extended periods. The research conducted by Arjoon, Botes, Chesang, and Gupta in 2012 demonstrated that inflation rate changes do not impact stock prices in the long term but short-term stock price deviations will adjust to actual stock prices over time (Arjoon et al., 2012).

Using dataset from 1986 to 2018, John (2020) carried out data analysis to investigate how changes in the money supply impact the performance of stock markets in Nigeria, South Africa, and Ghana. The research findings demonstrated that money supply maintains a long-term connection with stock market performance (John, 2020). Gay (2021) investigates the temporal connections between stock market index prices and macroeconomic elements of exchange rates and trade balances with stock market performance. His research revealed no meaningful relationship between present and past stock market performance (Gay, Jr., 2011).

Shawtari et al. (2016) employ VECM to study the long-term equilibrium relationship between particular macroeconomic indicators and South Africa's stock index, their findings suggest that Money supply affect South Africa's stock market (Shawtari et al., 2016). For them, Money supply shows its significant in affecting the stock market.

However, Chinzara explained that stock market volatility strongly depends on macroeconomic uncertainty while financial crises boost stock market volatility and short-term exchange rate volatilities create the most significant impact on stock market volatility. Stock market volatility shows minimal sensitivity to inflation volatility when compared to other influencing factors (Chinzara, 2011). Within the framework of regional trade agreements in Southern Africa, Guei and Choga (2022) investigate the influence of currency rate fluctuations on trade. The findings indicate that non-linear volatility positively and substantially influences trade, whereas linear volatility does not affect trade. According to Gueu and Choga (2022), the industry information study suggests that volatility's influence on trade outcomes cannot be definitively determined (Guei & Choga, 2022).

The entire body of empirical research investigates the connection between stock market performance and macroeconomic indicators. Our research aims to address the existing knowledge gap about how macroeconomic factors affect stock prices in South Africa. Using Johansen's cointegration test, the Vector Error Correction Model (VECM), and Granger causality tests, we examine the connection between these factors based on recent data and highlight that existing research has not conclusively determined the link between stock market performance and economic indicators such as exchange rates, inflation rates, trade rates, and money supply according to a comprehensive literature review. Henceforth, this study adds to the knowledge of stock prices and what influences them by presenting fresh findings using carefully selected factors crucial to various stakeholders such as government officials and investors.

3. THE EMPIRICAL ANALYSIS

3. 1. METHODOLOGY

The research, in question, utilizes time series information gathered from four outlets: the Johannesburg Stock Exchange (JSE), the South African Reserve Bank, the Federal Reserve Economic Data (FRED), and the World Integrated Trade Solution (WITS).

We study the enduring and dynamic relationship between stock market values in South Africa and various economic factors by examining data from 2000 to 2023 (24 data points). The economic indicators we examine include the exchange rate, inflation rate, trade rate, and money supply.

Examining these factors in this research project will allow the goal to evaluate whether the South African stock market truly reflects the state of the economy by comparing and contrasting it with observations from other stock markets.

3. 2. VARIABLES AND DATA SOURCE

Table 1. Data Source

Variables	Abbreviation	Indicator	Data source
Stock Market Price	SMP	JSE All-Share Index (or JSE Stock Market Index Stock Exchange (JSE).	Johannesburg Stock Exchange (JSE)
Consumer Price Inflation	INFL	Consumer Price Index (CPI) measures the price changes of goods and services, used to measure inflation.	South African Reserve Bank (SARB)
Exchange Rate	EXCH	Rand to US Dollar Exchange Rate (ZAR/USD)	South African Reserve Bank (SARB)
Trade Rate	TR	Trade-to-GDP Ratio (Exports + Imports/GDP)	World Integrated Trade Solution (WITS) by the World Bank
Money Supply	MS	M2 Money Supply	Federal Reserve Economic Data (FRED)

Source: Author's own creation

3. 3. EMPIRICAL STRATEGY

The study examines the connection between stock market prices and macroeconomic conditions using a tried-and-true paradigm. The study will use empirical analysis steps like testing for stationarity and cointegration and estimating a VECM.

The unit root test will be performed using ADF and Philips-Perron (PP) to determine if the time series variables are stable over time. The time series unit root (i.e., non-stationarity) is the null hypothesis (H0) for both tests. The Johansen multivariate cointegration test is suitable for the variables in issue if they are initially non-stationary but become stationary after being differenced once or twice. We use the cointegration test to determine if there is a consistent and long-lasting balance between the variables in the model. If the variables are cointegrated, it indicates a stable and balanced long-term connection between them. If the variables have the same order of integration, like I(1), the Johansen Multivariate Cointegration test shows that they are cointegrated.

Testing co-integration across a whole system of equations is made possible by Johansen's co-integration methodology, which is regarded as a complete information maximum likelihood method.

As seen below, the Johansen co-integration techniques can be represented as a vector autoregressive framework of order p.

$$Y_t = A_0 + \sum_{j=1}^{p} B_j Y_{t-j} + \varepsilon_t \quad (1)$$

The components of the model are as follows, ε_t is a n*1 vector of white noise terms, Y_t is an n*1 vector of non stationary I(1) variables, A_0 is an n*1 vector of constants, p is the maximum lag length, and B_j is an n*n matrix of coefficient. The transformation of equation (4) into a vector error correction model (VECM) is required for Johansen's method. This could be stated as:

$$\Delta Y_t = A_0 + \sum_{j=1}^{p-1} \Gamma_j \Delta Y_{t-j} + \Pi Y_{t-p} + \varepsilon_t \quad (2)$$

Where Δ is the first difference operator, $\Gamma_j = -\sum_{i=j+1}^{p} B_j$ and $\Pi = -I + \sum_{i=j+1}^{p} B_j$, and I is an n*n identity matrix.

To determine the co-integration test for the Y^' s, we analyse the matrix rank by studying its

eigenvalues. The rank of a matrix is equivalent to the count of its eigenvalues that are not equal to zero. The hypothesis can be stated as H_0: Π = αβ', where α and β are loading matrices of eigenvectors with dimensions n*r. The matrix β represents the co-integration vectors, whereas α is referred to as the adjustment factors that determine the extent to which each co-integration enters each equation of the VECM.

The goal is to find the number of r co-integrating vectors, such as β1, β2, …… βr. The maximum eigenvalue test and the subsequent trace statistic can be used to determine the number of distinctive roots.

$$\lambda_{trace}(r) = -T\sum_{i=j+1}^{p}\ln(1-\hat{\lambda}_j), and\ \lambda_{max}(r, r+1) = -T\ln(1-\hat{\lambda}_{r+1}) \quad (3)$$

In this scenario, "r" stands for the number of co-integrating vectors considered accurate, "T" stands for the total count of valid observations, and $\hat{\lambda}_j$ represents the estimated value of the j^{th} ordered roots or eigenvalue from the Π matrix.

The existence of a substantial co-integrating vector becomes evident when an eigenvalue shows a significant non-zero value. The trace statistics function as a joint test, where the undefined general alternative is that there are more than r co-integration vectors, and the null hypothesis is that there are less than or equal to r. The statistical analysis of the eigenvalue indicates that the number of co-integrating vectors is either equal to or less than r. The approach stands in contrast to the recommendation of r + 1 (MW & Enders, 1995). The confirmation of co-integration requires the use of a dynamic VECM because it demonstrates both the feedback mechanism and the rate at which short-term deviations move toward their long-term equilibrium. It also shows how any variables change in the short run compared to others.

3. 4. CAUSALITY ANALYSES

The co-integration results show that there is a causal relationship between the co-integrated variables but they do not indicate which way the causal relationship runs. Engel and Granger (2015) mentioned that when variables show co-integration, there is always a way to represent error correction where the short-term behaviour of the variables influenced by deviations from equilibrium can be evaluated. The variables must have a unidirectional or bidirectional relationship according to Engel and Granger for long-term co-integration to exist. The VECM framework should be used to analyze the short- and long-term causal relationships between the variables (Engle & Granger, 2015).

The VECM framework allows us to model the short-term stock price dynamics that correspond to model (1) with log transformation

$$\Delta Ln\,SMP_t = \mu_1 + \gamma_1\,Z_{t-1} + \sum_{i=1}^{p}\theta_{1i}\Delta\,Ln\,SMP_{t-i} + \sum_{i=1}^{p}\delta_{1i}\Delta\,Ln\,EXCH_{t-i} + \sum_{i=1}^{p}\tau_{1i}\Delta\,Ln\,INFL_{t-i} + \sum_{i=1}^{p}\rho_{1i}\Delta\,Ln\,TR_{t-i} + \sum_{i=1}^{p}\omega_{1i}\Delta\,Ln\,MS_{t-i} + \varepsilon_t^{SMP} \quad (4)$$

The model includees p as the lag length, μ as a constant term and γ, θ, δ, τ, ρ, and ω as parameters to be estimated and Zt-1 as the error correction term derived from the co-integrating vector. It is assumed that SMP is a stationary random process with zero mean and constant variance. It is possible to write the VECM for other variables similarly.

Both short-term dynamics and long-term equilibrium linkages between time series variables can be captured by the VECM. It can therefore distinguish between Granger causation that is short-term and Granger causation that is long-term. When compared to the null hypothesis H_0: $Y_1 = 0$, the coefficient for the lagged error correction term shows long-term Granger causality. T-statistics can be used to observe this.

3. 5. MODEL SPECIFICATION

This study aims to establish a robust model for analysing the correlation between stock market prices and macroeconomic variables using a regression framework, specifically replicating the methodology employed by (Chen-Roll-Ross, 1993) within the APT context. The model is defined as follows:

$$Y_t = (SMP_t, EXCH_t, INFL_t, TR_t, MS_t) \quad (5)$$

where:

SMP: stock market price
TR: Trade rate
MS: Money supply
INFL: Inflation rate
EXCH: Exchange rate

In terms, the connection between stock market prices (abbreviated as SMP) and certain independent variables (EXCH, INFL, TR, MS) is mathematically expressed as:

$$SMP_t = \beta_1 EXCH_t + \beta_2 INFL_t + \beta_3 TR_t + \beta_4 MS_t + \varepsilon_t \quad (6)$$

In this expression, the coefficients (β_1, β_2, β_3, β_4) are anticipated to have a value that signifies a clear connection between the stock market and broader economic influences. To validate the accuracy of the analysis using regression techniques, the model is altered into a logarithmic linear structure:

$$Ln\ SMP_t = \alpha + \beta_1 Ln\ EXCH_t + \beta_2 Ln\ INFL_t + \beta_3 Ln\ TR_t + \beta_4 Ln\ MS_t + \varepsilon_t \quad (7)$$

This change enables us to see coefficients as elasticities, which helps us understand how shifts in macroeconomic factors influence stock market values.

4. ESTIMATION RESULTS AND DISCUSSION

4. 1. SUMMARY STATISTICS

The summary statistics for our econometric model variables appear in Table 2. The South African stock market demonstrates significant variability according to the results.The minimum and maximum values for the stock market price are 9.03 and 11.23, with an average of 10.36, indicating notable differences in the Johannesburg Stock Exchange. The standard deviations suggest that the variables are moderately dispersed around their mean values. Skewness is mostly positive, except for the money supply, which exhibits negative skewness. All kurtosis values are positive, indicating leptokurtic distributions, which suggests a higher likelihood of extreme values. The Jarque-Bera test results show that all variables deviate from normality.

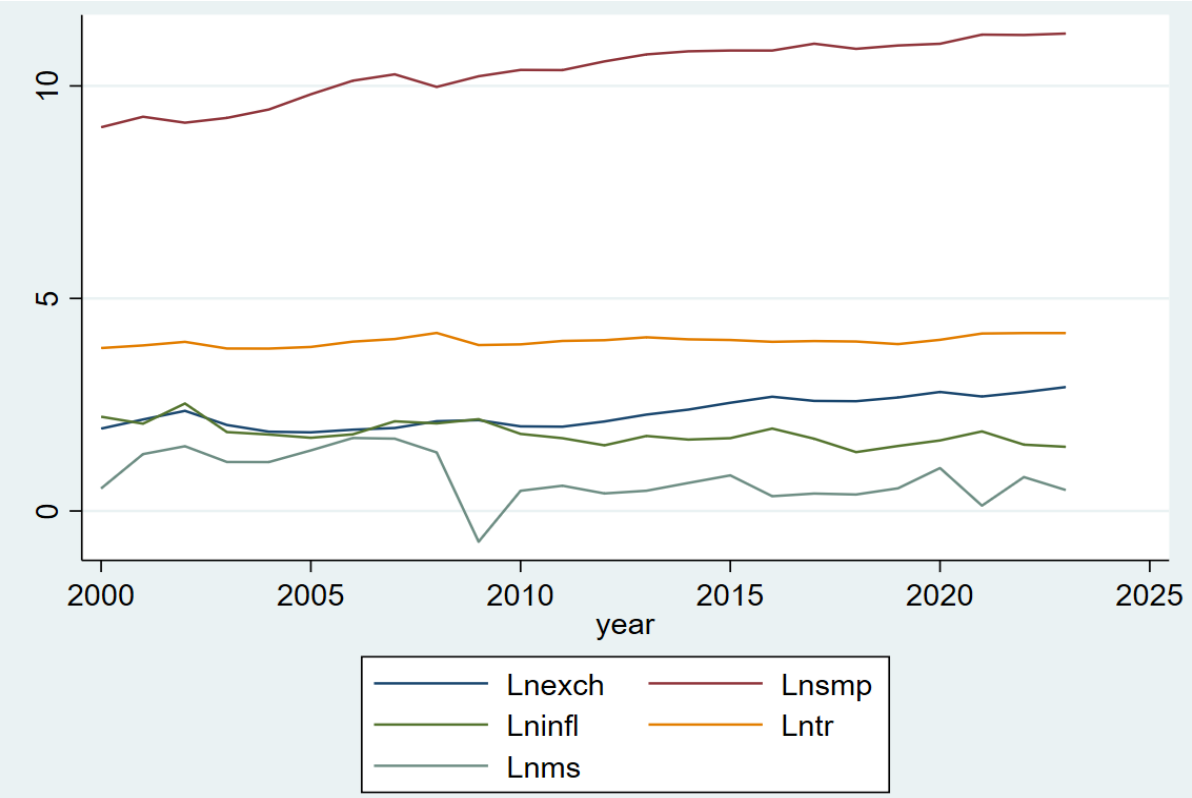
Table 2. Summary statistics

Stats	LnSMP	LnEXCH	LnINFL	LnTR	LnMS
Mean	10.35578	2.30458	1.820439	3.995136	0.7811253
Std. Dev.	0.707373	0.345154	0.263755	0.1126213	0.5687523
Median	10.47746	2.210155	1.782099	3.992514	0.6264762
Maximum	11.23234	2.915078	2.528761	4.189269	1.717036
Minimum	9.027645	1.849923	1.384617	3.820863	-0.723606
Skewness	0.580948	0.269275	0.776567	0.2573949	-0.309019
Kurtosis	2.052037	1.610404	3.448423	2.322354	3.3230670
Jarque-Bera	2.249	2.221	2.613	0.7242	0.4863000
N	24	24	24	24	24

Source: Authors' computation

Figure 1 illustrates the trends of five key macroeconomic indicators in South Africa from 2000 to 2023, showing moderate upward movements and persistent fluctuations. The stock market (LnSMP) and money supply (LnMS) exhibit steady growth. Meanwhile, the exchange rate (LnEXCH) shows upward pressure, indicating currency depreciation, while trade openness (LnTR) remains relatively stable.

Figure 1. Time series plots of macroeconomic variables



Source: Author's own creation

4. 2. CORRELATION ANALYSIS, AND VIF

In Table 3, the highest correlation coefficient among the independent variables reaches 0.5673 which falls below the ± 0.7 threshold that indicates high correlation. This suggests that collinearity or multicollinearity does not pose a significant issue in our data.

The Variance Inflation Factor (VIF) in Table 4 analysis further supports the absence of collinearity issues in our model. The maximum VIF is 1.32, with a mean VIF of 1.17, both of which are well below the commonly used threshold of 10 in the literature. This confirms that multicollinearity is not a concern for the variables in our econometric model.

Table 3. Correlation matrix

	SMP	EXCH	INFL	TR	MS
SMP	1.000				
EXCH	0.8683***	1.000			
	0.000				
INFL	-0.618***	-0.3638	1.000		
	0.0013	0.0805			
TR	0.676***	0.567***	-0.2092	1.000	
	0.0003	0.0038	0.3265		
MS	-0.53***	-0.421**	0.3709*	-0.0966	1.000
	0.0077	0.0405	0.0744	0.6535	

*** p<0.01, ** p<0.05, * p<0.1

Source: authors' computation

Table 4. Inflation factor variance (VIF)

Variable	VIF	1/VIF
EXCH	1.90	0.526835
TR	1.53	0.651617
MS	1.35	0.738021
INFL	1.24	0.807503
Mean VIF	1.51	

Source: authors' computation

4. 3. UNIT ROOT AND COINTEGRATION ANALYSIS

The Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF) tests were used to evaluate the stability of the dataset. The results in Table 5 show that all series are non-stationary at the intercept level (I(0)), but become stationary at the 5% significance level after first differencing, indicating they are integrated at order I(1). The Johansen approach was used to examine the existence and number of cointegrating relationships among the variables in a VECM. The number of cointegrating vectors are determined by the trace statistic and maximum eigenvalue, based on the results of the stationarity tests to further investigate the long-term relationships between the variables.

Table 6 showed that the first null hypothesis was rejected at a 5% significance level. The results from the trace test statistics and maximum Eigenvalue statistics at a 5% significance level indicate that there is a cointegrating equation among the variables. This means that there is a long-run relationship among the variables under consideration. In line with Yussuf's (2022) research, the study found the cointegration between macroeconomic variables and stock market prices. These results point towards a lasting equilibrium relationship between them, the case of the East African Community (Yussuf, 2022).

Table 5. Unit Root Test

Variable	Augmented Dickey-Fuller (ADF)	5% Critical level	Philips Perron (PP)	5% critical level	Order of integration ADF	PP
LnSMP	-1.289	-3. 284	-1.641	-3. 284	I(1)	I(1)
DLnSMP	-3.673	-3. 284	-4.964	-3. 284		
LnEXCH	-0.358	-3. 328	-0.528	-3. 328	I(1)	I(1)
DLnEXCH	-4.510	-3. 328	-3.824	-3. 328		
LnINFL	-2.021	-3.000	-2.654	-3.000	I(1)	I(1)
DLnINFL	-3.997	-3.000	-6.175	-3.000		
LnTR	-1.994	-3.000	-2.216	-3.000	I(1)	I(1)
DLnTR	-4.103	-3.000	-5.090	-3.000		
LnMS	-2.268	-3.000	-1.384	-3.000	I(1)	I(1)
DLnMS	-4.733	-3.000	-7.063	-3.000		

Source: Authors' computation

Table 6. Johansen Co-integration Test

	Unrestricted Cointegration Rank Test (Trace statistic)				Unrestricted Cointegration Rank Test (Max statistic)			
Hypothesised no. of CE(s)	Eigenvalue	Trace statistic	Critical value at 5%	Prob.[b]	Eigenvalue	Max statistic	Critical value at 5%	Prob.[b]
None[a]	0.79984	80.5058	68.52	0.012	0.79984	35.3902	33.46	0.0297
At most 1	0.61066	45.1156	47.21	0.0847	0.61066	20.7526	27.07	0.1593
At most 2	0.503	24.363	29.68	0.377	0.503	15.3815	20.97	0.3069
At most 3	0.32582	8.9815	15.41	0.6444	0.32582	8.6735	14.07	0.785
At most 4	0.0139	0.308	3.76	0.966	0.0139	0.308	3.76	0.578

Source: Authors' computation

Trace test indicates 1 cointegrating eqn(s) at the 0.01 level

Max statistics test indicates one cointegrating equation at 0.05 level.

[a], represents rejection of the hypothesis at 5% level

[b], represent MacKinnon–Haug–Michelis (1999) p-values

CE, stands for cointegrating equations

4. 4. THE LONG RUN RELATIONSHIP

The Johansen multivariate cointegration technique generates the normalised cointegrating equation. The equation shows the relationship between stock market prices and macroeconomic variables. In this term, we are looking at how different factors interact, showing a steady and reliable connection between stock market prices and broader economic conditions over time.

The coefficients of the first normalised cointegrating equation appear in Table 8 with standard errors in brackets and test statistics in parentheses. The test statistics (or t-values) are computed by taking each variable's coefficient ratio by its respective standard error. All the variables in the table show high statistical significance.

Table 8. Long-run normalised cointegrating equation

Cointegrating equation	LnSMP(-1)	LnEXCH(-1)	LnINFL(-1)	LnTR(-1)	LnMS(-1)	C
Coint equation 1	1.000	1.13507	3.00196	-1.6951	0.4394	-9.5194
		(0.2136)	(0.2645)	(0.7986)	(0.1297)	
		[5.31]	[11.35]	[-2.12]	[3.39]	

Source: Authors' computation. Standard errors in ( ) and t-statistics in [ ]

Using the normalised cointegrating coefficients and their t-values, we can now construct the long-run equation as follows (The t-statistics are given in brackets):

$$\text{Ln SMP} = -9.5194 + \underset{(5.31)}{1.13507}\,\text{LnEXCH} + \underset{(11.35)}{3.00196}\,\text{LnINFL} - \underset{(-2.12)}{1.6951}\,\text{LnTR} + \underset{(3.39)}{0.4394}\,\text{LnMS} \quad (8)$$

The estimated long-run relationship among the variables is resented in equation 8 above. As expected, the South African stock market prices (SMP) are positively and significantly influenced by exchange rates (EXCH), money supply (MS), and inflation (INFL), this is supported by (Shawtari et al., 2016) and (Ntshangase et al., 2016) suggesting that a 1% increase in these variables leads to a corresponding increase in SMP. Conversely, trade rates (TR) have a negative impact, with a coefficient of -1.6951, meaning a 1% increase in TR results in a fall in SMP.

4. 5. ERROR CORRECTION ESTIMATES FROM VECTOR ERROR CORRECTION MODEL/SHORT RUN DYNAMICS

In Table 9, the error correction estimates from the VECM are displayed; this model analyses short-term changes within the framework of determined long-term connections. The fact that SMP has a coefficient (0.21219**) indicates that time plays a role in adjusting deviations from the long-term balance point and has a notable impact on the stock market. When the stock market strays from its trend over time and moves away from it much, it usually corrects itself and comes back closer to that trend line. This reinforces the notion that the stock market acts as a signal that reflects changes in circumstances. The impact of variables like EXCH, INFL, TR, and MS show levels of influence on the stock market performance; however, only SMP seems significant at a 5% level of confidence. This underscores the significance of the stock market as an indicator compared to factors that may have a delayed effect on its changes, as discussed by Sachdev in 2021 (Sachdeva et al., 2021).

Table 9. Error correction estimates from vector error correction model/Short Run Dynamics

Error Correction	D(LnSMP)	D(LnEXCH)	D(LnINFL)	D(LnTR)	D(LnMS)
Coint equation 1	-0.21219**	-0.104756	-0.17186	-0.0215	-0.32776
	(0.08902)	(0.071521)	(0.11766)	(0.04121)	(0.23282)
	[-2.38]	[-1.46]	[-1.46]	[-0.52]	[-1.41]

**denotes the rejection of the null hypothesis at a 5% significance level

Source: Authors' computation. Standard errors in ( ) and t-statistics in [ ]

4. 6. DIAGNOSTIC AND STABILITY TESTS

To assess the validity of our model, we performed some diagnostic tests, the results of which are illustrated in Table 10. Our results inform us that the data in the model is free from autocorrelation problems and serial correlation. In addition, we do not find heteroskedasticity and function misspecification problems in our model.

Table 10. Heteroscedasticity Test for all the Models

	Breusch-Pagan-Godfrey Heteroscedasticity Test:		Breusch-Godfrey Serial Correlation LM Test		Durbin-Watson test
	F-statistic	P-value	F-statistic	P-value	F-statistic
Model	1.08	0.2990	2.559	0.1096	1.309272

Source: authors' computations

Table 11 displays the eigenvalues and their magnitudes for a Vector Autoregression (VAR) model. It verifies the stability of the model because all eigenvalues fall within the unit circle. This suggests that the VAR model is robust and dependable for studying the relationship between the South Africa stock market and macroeconomic indicators, because it ensures that responses to disturbances will diminish over time. This suggests that the stock market can serve as a "barometer" for the economy by mirroring the economic situation.

Table 11. Eigenvalue stability condition

Eigenvalue	Modulus
0.953208	0.953208
.1463316 + .92406i	0.935575
.1463316 - .92406i	0.935575
-.8339221 + .419705i	0.933584
-.8339221 - .419705i	0.933584
-.2229382 + .8666662i	0.894881
-.2229382 - .8666662i	0.894881
.6386234 + .6129345i	0.885172
.6386234 - .6129345i	0.885172
.5087535 + .7029095i	0.867705
.5087535 - .7029095i	0.867705
-0.7856894	0.785689
0.71736	0.71736
0.3392126	0.339213
-0.3250331	0.325033

Source: authors' computation

4. 7. GRANGER CAUSALITY TEST

To ensure the robustness of our findings, we conduct Granger causality tests to assess the consistency of causation across the dataset. In Table 12, this research findings show that exchange rates, and inflation have a unidirectional impact on stock market prices, meaning changes in these variables affect the stock market, but not vice versa. In contrast, money supply and stock prices as well as trade and stock prices influence each other in a bidirectional manner, indicating an interactive relationship between the two. All results reinforce the notion that the stock market acts as a "barometer" of the economy, responding to changes in macroeconomic indicators rather than leading them, this result is collaborated by (Bhowmik & Wang, 2020; Younis et al., 2020).

Table 12. Granger causality test

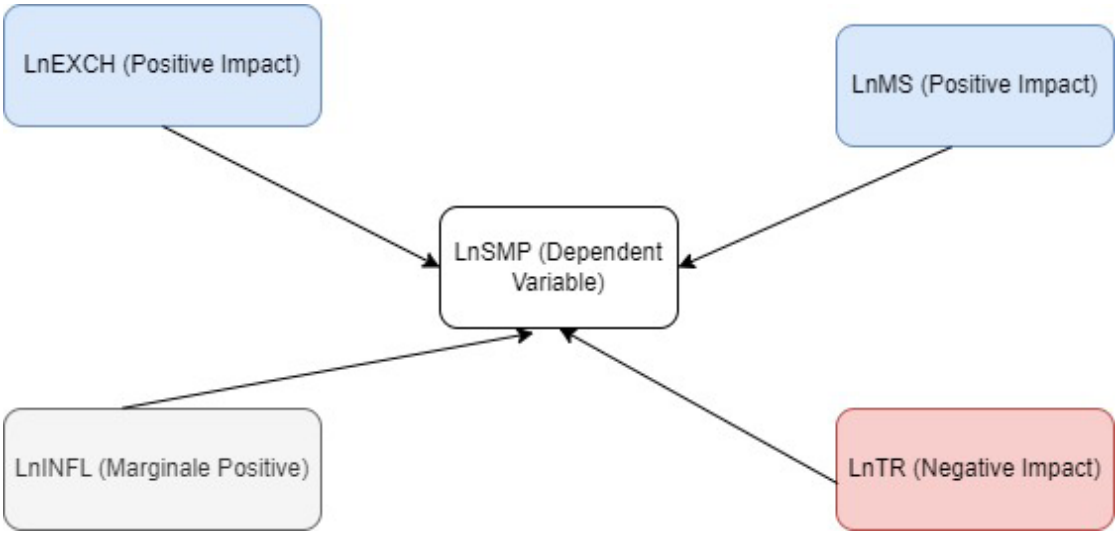
Null Hypothesis	F-Statistic	Probability
LnEXCH does not Granger Cause LnSMP	82.516	0.000
LnSMP does not Granger Cause LnEXCH	2.4049	0.493
LnINFL does not Granger Cause LnSMP	92.55	0.000
LnSMP does not Granger Cause LnINFL	0.3892	0.942
LnTR does not Granger Cause LnSMP	50.805	0.000
LnSMP does not Granger Cause LnTR	8.458	0.037
LnMS does not Granger Cause LnSMP	70.611	0.000
LnSMP does not Granger Cause LnMS	44.718	0.000

Source: authors' computation

4. 8. VISUAL SUMMARY OF LONG-RUN CAUSAL EFFECTS

To enhance interpretability, a visual summary of the estimated long-run relationships from the VECM is presented in Figure 2. The figure 2 illustrates the causal relationships between Stock Market Price (LnSMP) and key macroeconomic variables, based on the results from the Vector Error Correction Model (VECM). The arrows indicate the direction of influence, with positive impacts from LnEXCH, LnMS, and LnINFL, while LnTR has a negative impact on LnSMP. The relationship between LnINFL and LnSMP is marginally positive.

Figure 2: Summary of Long-Run Causal Relationships from the VECM Model



Source: Author's own creation

5. CONCLUSION AND POLICY IMPLICATION

5. 1. CONCLUSION

The dynamics of South African stock market are studied using cointegration analysis alongside error correction modeling and Granger causality testing to examine stock price and macroeconomic variable relationships. The research shows that stock prices in South Africa maintain both positive and negative significant relationships with these variables to highlight the need for economic stability. During the studied period the cointegration equation shows that stock market performance depends heavily on exchange rates and money supply and inflation but trade exerts negative influence. These findings match previous research by Ho and Shawtari about South Africa (Ho, 2019; Shawtari et al., 2016), and the Indian research by Yadav (Yadav et

al., 2022), as well as negative trade effects on the Pakistan stock market (Omar et al., 2022).

The findings align with Arbitrage Pricing Theory (APT), showing that inflation, exchange rate, and money supply are key systematic factors influencing stock prices. The negative effect of trade openness indicates possible deviations from Efficient Market Hypothesis (EMH), suggesting market inefficiencies. These results reinforce the relevance of macroeconomic theory in explaining stock market behavior in South Africa.

The error correction model indicates the market adjusts to its equilibrium after experiencing brief disturbances that demonstrate its ability to uphold enduring principles. The Granger causality tests demonstrate that these macroeconomic factors enable predictions about stock market movements which indicates a causal relationship between stock market and the macroeconomic variables included in this study. The study emphasizes that these indicators need close monitoring by policymakers and investors for making informed choices about economic conditions. The stock market of South Africa functions as both an economic trend indicator and economic performance barometer while macroeconomic instability prevents it from efficiently allocating capital.

5. 2. POLICY IMPLICATION

The research results demonstrate that stock market performance is influenced by inflation rates and currency exchange values as well as money supply in the economy according to policymakers and investors. The stock market functions as an indicator that allows authorities to create strategies for economic stability and growth and enables investors to make risk management decisions. This study demonstrates the necessity to monitor stock market movements for predicting economic changes and it opens opportunities to study these intricate relationships.

The analysis of currency exchange rates' effects on trade outcomes requires businesses to review their trade strategies for better market resilience and competitiveness. These findings enable investors to base their decisions on the understanding that stock values react to economic transformations. The spread of investments between sectors that show less sensitivity to market fluctuations seems wise for investors.

To enhance the effectiveness of policy recommendations, the South African Reserve Bank should implement a real-time dashboard to monitor inflation trends and develop strategies to mitigate currency volatility while increasing transparency in monetary policy decisions. Investment and financial market regulators are encouraged to strengthen regulatory frameworks, promote investor education on the impacts of macroeconomic indicators, and facilitate data sharing among financial institutions to create a more informed investment environment. Institutional investors should focus on diversification strategies that include sectors less sensitive to economic fluctuations, conduct regular assessments of macroeconomic conditions to adjust portfolios accordingly, and engage with policymakers to advocate for regulations that support market stability and growth.

Limitation of the Study

This study focuses on selected macroeconomic indicators, which means other influential factors such as interest rates or investor sentiment may have been overlooked due to unavailable data in some countries. Additionally, the model does not capture structural or non-quantifiable factors like political developments. Future research should consider a broader range of variables and methods to offer a more comprehensive analysis by exploring nonlinear models and machine learning methods to detect asymmetries, regime shifts, and complex patterns that linear models may overlook, enhancing both robustness and predictive accuracy. Additionally, while this study captures long-run relationships, it does not explicitly account for structural breaks

caused by major crises such as the 2008 global financial crisis or the COVID-19 pandemic, future research could integrate structural break tests or regime-switching models to assess their disruptive impact on stock–macro dynamics.

Conflict Of Interest

There are personal, financial, or professional interests that could have influenced the research, writing, or publication of this article.

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