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Nexus between Macroeconomics Variables and the Stock Prices Index: An Empirical Review of the Botswana Stock Market

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Abstract:- This study investigates the nexus between the Botswana stock index and five macroeconomic variables which include interest rates, exchange rates, Gross Domestic product, and Money Supply and inflation rates. The Botswana stock market and the Bank of Botswana provided the statistical data for this study. This study set out to determine whether there were any correlations between macroeconomic factors and the behaviour of stock prices in the financial market for long-term sources of funds traded on the Botswana Stock exchange (BSE). The paper examines the causal relationship between the stock prices and five macroeconomic variables, including the inflation rate, risk free interest rate, Gross Domestic Product, Money supply and exchange rates for Botswana, using monthly data from January 2013 to December 2015. This study used statistical analysis to create a regression equation and discovered negative links between three independent variables and the Botswana domestic stock index as well as positive relationships between historical and current domestic stock returns. The study initially took into account the Stationarity test and found that all of the variables at the second level at the 1%, 5%, and 10% level of test are stationary. This study's findings agreed with those of a number of other studies, which found that these three macroeconomic factors are linked to domestic stock indices and both had a negative impact on the benchmark stock index, or BSI. A unidirectional link between the domestic stock index and the inflation rate, exchange rate, and prime rate was demonstrated by the Augmented Dickey Fuller test (ADF). Another finding of this study was that the parameters utilised are significant when the p-values are smaller than the test statistics at 0.1. This study suggests that additional research be done over a longer time period, on average, twenty years, using a variety of other macroeconomic indicators. The macroeconomic variables that will be used should include this variable as well.

I. INTRODUCTION

As a result of the liberalized and globalized policies adopted by the majority of emerging and developed governments, economic theory and evidence show that the stock market plays a significant role in the mobilisation of capital in emerging and developed countries, resulting in the growth of industry and commerce of the country. As a young, promising emerging nation, Botswana needs greater funding to achieve the growth envisioned and detailed in its national development strategy number eleven. According to Jasra, Azam, and Khana (2014), a variety of indicators can be used as signals by stock market players to determine whether they should anticipate a better or lower return when investing in stocks. The direction and returns on stock price returns are thought to be largely influenced by macroeconomic conditions. According to Charles Barnor (2014), an essential part of assuring a country's economic growth is the stock market. The stock market offers investors the ability to access different channels or avenues to invest, gives long-term capital to industries, and offers liquidity in the financial market. The relationship between macroeconomic variables and stock prices in industrialized countries like the United States, Great Britain, and India is extensively understood theoretically and empirically.Thus studies to be carried out in less developed nations such as Botswana, Zimbabwe and the Latin American countries.

II. BACKGROUND OF THE STUDY

Gyau (2015) argued that the relationship between macroeconomic factors and stock prices is crucial for macroeconomic policy makers as well as investors and industry participants. Policy makers, policy advisers, analysts, economists, financial managers, government officials, speculators, and academia have all taken notice of the significance of the relationship between macroeconomic variables and the domestic stock index. According to Erdugan (2012), investing in the stock market with the intention of earning a favourable return without risk is difficult and complex. Financial analysts suggested that investments entail risks and uncertainty, and that managing and reducing risk and uncertainty of investments in the capital market requires a grasp of macroeconomic variables and how they affect stock price fluctuations.

According to economic theory and data, stock investments are made with the hopes of maximising profits and lowering risks. Thus, a number of theories, including the Markowitz portfolio theory, the efficient market hypothesis, and many others, build evidence for how important macroeconomic factors influence investing in stock assets. Investment in stock assets determines how well the economy performs, so policymakers, economists, and a wide range of other stakeholders are interested in learning how macroeconomic factors can affect stock price movement and what can be done to control asset returns so that they can have an impact on investment and return on assets. Gyau (2015) made suggestions about a variety of elements, including those relating to businesses, the environment, macroeconomic factors, market expectations for future

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growth, sociopolitical events, monetary policy, fiscal policy, international trade, and more. According to Gyau (2015), among the variables that influence security prices, macroeconomic variables have drawn a lot of attention from researchers. Thus, it may be said that macroeconomic elements are simple to track and assess, and they can offer greater information and evidence to support decision-making than other aspects. This researcher recommended using macroeconomic indicators, which he believed were crucial for Botswana, and collecting data from the nation's official sources.

Investment in capital assets is seen as essential for economic growth and development in Botswana, a less developed nation. Since gaining independence in 1966, Botswana's economy has been politically and economically stable, with a slow rise in economic activity. For nearly fifty years, the amount of investment in capital assets has remained below the anticipated average. The Botswana Stock Exchange (BSE) has seen a gradual increase in the number of companies listed over the past 50 years, suggesting that businesses have recognised the necessity to receive financial resources through the BSE. The objective of the study was to determine how macroeconomic factors affected the stock prices of the companies listed on the Botswana Stock Exchange and to establish a correlation between stock prices and the five macroeconomic factors, risk-free interest rate, inflation rate, real Gross Domestic Product, money supply, and exchange rate.

III. THEORETICAL REVIEW

A. Asset Pricing Theory (APT

According to Omorokunwa & Ikponmwosa (2014), **asset pricing theory** (APT) explains how and why prices are related to macroeconomic variables, how financial assets are valued, and how they are priced. Omorokunwa & Ikponmwosa, the multi-factor model on which the **APT model** is built assumes that each investor thinks the stochastic characteristics of capital asset returns are consistent with the factors' structure. APT assumes that investors profit from market-wide arbitrage possibilities. According to the theory, projected returns on financial assets can be predicted as a linear function of numerous macroeconomic factors or hypothetical market indices, with each factor's susceptibility to change represented by a factor-specific beta coefficient. APT also contends that using model-derived rates of return, financial assets are priced accurately. As a result, arbitrage should bring prices back into line if they diverge (Omorokunwa & Ikponmwosa, 2014). Macroeconomic factors and stock prices are correlated, as demonstrated by Sangmi& Hassan (2013), and it is assumed that this correlation is based on the arbitrage pricing hypothesis. Sangmi& Hassan (2013) looked at how macroeconomic factors affected stock prices on the Indian Stock Market; they discovered a strong correlation between inflation, the exchange rate, and interest rates.

B. Capital Asset Pricing Model (CAPM),

According to Mugambi and Okech (2016) the Capital Asset Pricing Model **(CAPM),** which was developed from earlier work by Harry Markowitz (1959), was first introduced by William Sharpe and John Lintner in 1964. Mugambi and Okech (2016) assert that if businesses can forecast the projected cash flows from the asset, the model may be used to derive a theoretically reasonable necessary rate of return for an asset, and consequently its price. Furthermore, Mugambi and Okech (2016) noted that the CAPM explains the relationship between risk and expected return that is taken into account when hazardous securities are priced. The fundamental tenet of CAPM is that investors should only be reimbursed for risk and time value of money. The risk free rate compensates for time value of money, whereas the beta compensates for risk (Mugambi and Oketch, 2016). According to this theoretical perspective, the risk free rate, also known as the prime rate, is the interest rate employed in this study, and the beta co-efficient assesses the risk, which includes, among other things, fluctuations in inflation and the exchange rate. According to this theory, the three macroeconomic variables included in this study affect stock prices. According to Erdugan (2012), numerous studies have been carried out to see whether the CAPM may be utilised to predict stock price fluctuations. Others have tested the CAPM on stock returns include Fama and French (2006) and Kassimatis (2008).

C. Arbitrage Pricing Theory (APT)

According to Talla (2013), Ross (1976) proposed the Arbitrage Pricing Theory (APT) to explain how stock prices and macroeconomic factors are related. The Author claims that this is an improvement over the Capital Asset Pricing Model (CAPM), with the exception of the model's use of many variables as opposed to just the mean variance risk factor. Evidence supports Ross's (1976) multifactor approach to explaining asset pricing. The equation displayed below was used by Ross 1976to explain stock pricing.

$$R_i = \alpha_i + \beta_{i1} i_1 + \beta_{i2} i_{12} + \cdots + \beta_{in} i_1 \beta_{in} + \epsilon_i$$

Where lj=the value of the jth index that affects the return on stock and ai=the expected amount of return for stock i if all indices have a value of zero i, bij is the return on stock i's sensitivity to the jth index. ei is a random error term whose variance and mean are both equal to. Talla's (2013) model, changes in predicted levels of industrial production, inflation, and changes in the form of the term structure of interest rates are only a few examples of the economic factors that might affect stock returns. According to the hypothesis, there will be a linear link between any stock's return and a group of related indexes. According to the hypothesis, both expected and unexpected events affect stock returns. As a result, among other things, stock price changes are related to macroeconomic issues.

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D. Efficient Market Hypothesis (EMH),

According to Joseph Tagne Talla (2013), Fama developed the efficient market hypothesis (EMH), which was also known as the random walk theory, in 1970. According to Fama, the market is efficient in weak, semi-strong, and strong forms depending on the market's performance and because of a number of other circumstances. According to this hypothesis, the stock price index will respond to macroeconomic variables in a variety of ways. According to the efficient market hypothesis, market prices should always reflect the most recent knowledge. According to Fama's definition of the EMH, an efficient market is one in which prices consistently represent all available information. This idea is predicated on the notion that the market is filled with a large number of rational, profit-driven investors who act swiftly when fresh information is released. Investors reevaluate a stock's underlying value and modify its price whenever new information about macroeconomic conditions or other factors impacting equities is revealed. Events including the appointment of new directors, mergers, and acquisitions, as well as political and social considerations, are all included in this material. The fundamental tenet of the EMH is that stock prices at any particular moment accurately reflect all information that is currently available and are the best indication of the stock's true value. The hypothesis suggests that knowledge concerning macroeconomic variables, such as mergers, inflation, and political instability, might induce instantaneous adjustments in stock prices to reflect the new information, according to Cleary (2001), who argues in favour of this idea. Macroeconomic factors are therefore regarded as stock price indicators. One of the main effects of the EMH is that stock prices respond quickly to changes in the information that is available, making it challenging to forecast future stock price fluctuations. Since the theory assumes that the market has no memory and behaves randomly, it is impossible to anticipate future price changes using historical price patterns. The EMH concludes that there is no obvious causal relationship between stock prices and macroeconomic variables. The study referenced in the passage uses the semi-strong form of the EMH, which examines information that is readily available to the public and how it affects stock price fluctuations, to explore the relationship between stock price movements and macroeconomic issues.

E. Rational Expectations Hypothesis (REH)

The **Rational Expectations Hypothesis** is founded on the presumption that people are rational and make educated economic decisions after carefully analysing all relevant information and using that information wisely for their own self-interest, as noted by Cleary (2001), and Tvaronaviiene & Michailova (2010).According to this theory, people make judgements based on what they believe to be the correct conclusions by observing macroeconomic variables, their past behaviour, and impacts (Tvaronaviiene &Michailova, 2010). So, in accordance with the idea, investors research macroeconomic indicators and make stock price predictions. Expectations about economic events, particularly those related to macroeconomic variables, have a considerable impact on the return on the stock market (Erdugan 2012). According to Gwartney & Stroup (1987), cited by Erdugan (2012), people should consider all of the evidence before forming expectations about future economic events, such as the likely future inflation rate. This includes knowledge about the likely effects of current and future economic policy. Rational expectation theory proponents contend that stock prices can be examined using historical data to forecast future stock price movements.

F. Behavioural Finance Theory

Behavioural finance theory is extremely distinct from the random walk and efficient market theories, according to Tvaronaviien & Michailova (2006). The hypothesis, assumes that trading in the stock market involves significant psychological and behavioural factors that present opportunities for savvy investors is to profit. According to Tvaronaviien & Michailova (2006), behavioural finance theorists would explain price increases in a particular stock or industry that become "hot" to mass psychology (also known as the "follow the herd instinct" when there is no change in the company's fundamentals. In light of this, they might view the stock in the long term, certain that the psychological bubble will eventually pop and they would profit. This theory's proponents contend that investor emotions, not statistical information, can explain variations in stock market values. Therefore, according to this theory, there should be no correlation between macroeconomic factors and stock prices, but the bubble hypothesis or human behaviour in general can affect stock prices. In contrast to other theoretical models, this study seeks to confirm the theory's assertion that stock price swings are unrelated to macroeconomic factors in the African environment.

IV. EMPIRICAL EVIDENCE

A. Macroeconomic factors determine Domestic stock index.

Ross's theory of arbitraging pricing, which was mentioned by Nkechukwu (2013), Chen, Roll & Ross (1986), Fama (1981, 1990), Fama & French (1989), and Freson & Harvey (1991) showed that macroeconomic factors like interest rates and others were related to US stock prices. Nkechukwu (2013) added that Mireku, Sarkoie&Poku used co-integration analysis with APT and produced the same outcomes. According to Fama& French (1989), Ferson& Harvey (1991), and others, there is a correlation between stock market returns and changes in macroeconomic factors such as industrial production, interest rate changes, inflation, and yield curves. The relationship between stock returns on the Istanbul Stock Exchange (ISE) and the macroeconomic factors affecting the Turkish economy was examined by Samontaray, Nugali & Sasidhar in 2014. By using the co-integration tests and the vector error correlation method (VECM) on quarterly data sets, they discovered a long-lasting, stable relationship between the ISE index and four macroeconomic variables, including the GDP, exchange rate, interest rate, and current account balance. By applying causality tests, they discovered unidirectional relationships between macro indicators and the ISE index. The existence of a long-term relationship between five macroeconomic variables CPI, industrial production, money supply, exchange rate, and oil price, as well as a proximate measure of the S&P 500 and the SASI (Saudi All stock index) was explored by

Samontaray, Nugali & Sasidhar (2014). They employed time series analysis on the monthly data collected between 1994 and 2013. They discovered a long-term association between the five variables, and they all had an impact on stock price, unlike the S&P 500 index, which had no effect on Saudi stock prices. The long-term causal relationship between the explanatory variables and the stock prices is demonstrated using the vector error correlation model.

In their 2014 study, Samontaray, Nugali & Sasidhar examined the relationship between exchange rates and stock prices in emerging financial markets like the Philippines, Korea, Pakistan, and India. They discovered that, aside from the Philippines, all sample countries showed unidirectional granger casualty between exchange rates and stock prices. Maghayereh (2003), quoted in Singh (2014), used co-integration analysis and monthly time series data from January 1987 to December 2000 to examine the long-term link between the Jordanian stock prices and a few macroeconomic indicators. The study shows that Jordan's capital market reflects macroeconomic factors such foreign reserves, exports, interest rates, inflation rate, and industrial index. Consequently, stock price predictions can be made using macroeconomic indicators.

On the Korean stock market, Kwon & Shin (1999) used vector error correction model and Granger causality tests and Engle-Granger co-integration test. Maghayereh (2003) used co-integration analysis and monthly time series data from January 1987 to December 2000 to examine the long-term link between the Jordanian stock prices and a number of macroeconomic indicators. Various macroeconomic factors' effects on Turkey's stock return were examined by Erdogan & Ozlale in 2005. In their study of New Zealand's macroeconomic indicators, Gan, Lee, Yong & Zhang (2006) studied the correlation between stock prices and these variables. The relationship between the Indian stock market index (BSE Sensex) and several macroeconomic factors, such as the industrial output index, wholesale price index, money supply, treasury bill rates, and exchange rates, was examined by Naik & Padhi (2012) from 1994 to 2011. Ray (2013) looked at the connection between macroeconomic factors and stock prices; Sireesha (2013) looked at how macroeconomic factors affected the movements of the Indian stock market; Mishra &Gupta (2014) looked at the main causes of the market's up-and-down movement; and Kumar (2014) studied the exchange rate and crude oil prices to understand their effects on the Indian stock market by looking at S&P CNX Nifty. All of them came to the same conclusion: stock prices are influenced by macroeconomic factors, and some of these factors can also be influenced by stock prices. Asaolu and Ogunmuyiwa (2011) examined the effects of macroeconomic variables on the Average Share Price (ASP) of the Nigerian Stock Market in Muhammad Arshad Haroon &Hummera Jabeen (2013). They used analysis techniques like the ADF test, Granger Causality test, Co-integration and Error Correction Method (ECM) to collect annual data from 1986 to 2007 on the following variables: External Debt, Inflation Rate, Fiscal Deficit, Exchange Rate, Foreign Capital Inflow, Investment, Industrial Output, and ASP of the Nigerian Stock Market. They found that there was only a weak correlation between the ASP and the macroeconomic variables of Nigeria. Real Gross Domestic Product, Interest Rate, and Inflation Rate effects on Nigerian stock prices from 1997 to 2006 were examined by Daferighe & Aje (2009). They developed a model to describe stock prices via the Stock Market Value Index (SMVI = 0 + 1 INT + 2 INF + 3 RGDP + u) using regression analysis. The findings indicated that 95.6% of the fluctuation in Nigerian stock prices was due to external factors. They also came to the conclusion that lower interest rates and inflation were driving up stock prices, while higher RDGP had a favourable effect on Nigerian stock prices over the review period. In less developed countries like Botswana, the link between interest rates, inflation, and stock prices is negative, claim Daferighe & Aje (2009).

Omran & Pointon (2001) examined the impact of the inflation rate on the activity and liquidity of the Egyptian stock market. Utilising annual data on the Inflation Rate, Market Activity, and Market Liquidity for the years 1980/1981 to 1997/1998, statistical procedures such as the ADF test, co-integration analysis, and Static Long-Run Regression via Ordinary Least Squares (OLS) were utilised. Inflation rate was shown to be inversely connected with stock market returns and stock market prices, according to the study's findings, which also showed a negative relationship between inflation rate and stock market liquidity and activity. In their research, Nishat & Shaheen (2005) examined the effects of various variables on KSE share prices. The study's findings showed that only pay-out ratio, size, and dividend yield accounted for half of the variation in KSE share prices during the pre-reform period (1981–1990), while the same variables were responsible for a third of the variation during the post–reform period (1991–2000). Overall, they discovered that four out of six variables size, pay-out ratio, leverage, and dividend yield were having numerous effects or impacts on share prices.

According to the evidence from the different studies mentioned above, the macroeconomic variables employed in this study are important drivers of stock price changes and can be applied to Botswana to predict changes in the country's stock prices.

B. Nexus between Inflation and DSI

Fama &Schewert (1977) and Li Li& Zuliu (1998), stock prices react to news about the money supply because investors anticipate inflation. Li Li& Zuliu (1998) also pointed out that unanticipated greater inflation may result in the anticipation of more restrictive monetary policies, which will limit cash flow and lower stock prices because demand for the stock will decrease as investors have less money to use for investment. This is because investors will have less money to use for investment as a result of the lowered cash balances. Positive inflation surprises may prompt agents to modify their savings, which could raise interest rates, it was also highlighted. This indicates that increased interest rates have a negative impact on expected returns, demand for business stock, and stock prices.

Ozbay, Fama &Schewert (1977), Saunders & Tress (1981), Fama & Gibbon (1982), Kaul (1987),Naka, Mukhurejee&Tufte (1998),Maghayereh(2002),Nishat & Shaheen (2004),Al- Sharkas (2004) ,Gan, Lee Yong & Zhang (2006),Humpie& Macmillan (2007),Haguet (2008), Ozbay (2009),Kahn, Kahn, Rukh, Imdadullah&Rechman (2012) and Kaul (1987) concluded that inflation and the stock prices have a negative relation.

On the other hand Firth (1979), using UK data, Maysami et al(2004), using Singapore data, Adam &Tweneboah (2008) using Ghana and Rjoub (2009) report positive relationship between inflation and stock prices.

Talla (2009) pointed out that consumer price index can be used as a proxy of inflation. He concluded that the relationship between inflation and stock prices can be positive or negative depending on whether the economy if facing unexpected or expected inflation. According to Talla (2009) expected inflation occurs when demand exceed supply, causing an increase in prices to stimulate more supply, In support, Reilly & Brown (2003) and Tvaronaviien & Michailova (2006) who suggested that there may not be a direct and steady correlation between inflation and stock prices. They state that stock's cash flow may fluctuate in line with inflation. According to Reilly & Brown (2003) in Tvaronaviien & Michailova (2006), depending on the source of the inflations, unforeseen inflation can have a beneficial or negative impact on stock returns.

C. Nexus between Interest Rate and DSI

Dinenis & Staikouras (1998), Jefferis & Okeahalam (2000) Reilly ,Wright & Johnson (2007),Alam & Uddin (2009),Ahmed, Rehman & Raoof (2010), Ahmet Büyükşalvarc (2010),Büyükşalvarc (2010), Wang (2010), Yogaswari, Nugroho & Astuti (2012) and Ciftci (2014) conquered that interest rate has a negative relationship with stock prices.

Cleary (2001),Reilly & Brown (2003), Andrews (2004), Tvaronavičienė& Michailova (2006), Wang (2010) and Yogaswari, Nugroho & Astuti (2012) independently found a uni-directional causal relationship between stock market volatility and interest rate volatility.

D. Nexus between Exchange Rate and DSI

Aggarwal (1981), Soenen&Hennigar (1988), Bahmani-Oskooee & Sohrabian (1992), Abdalla &Murinde (1997), Bhattacharya & Mukherjee (2003), Smyth &Nandha (2003), Farooq & Keung (2004), Aquino (2004), Aquino (2005), Homma et al. (2005), and Hartmann &Pierdzioch (2007), Ahmed, Rehman & Raoof (2010), Ahmet Büyükşalvarc (2010) and Yogaswari, Nugroho & Astuti (2012) concurred that theory and empirical evidence from many studies demonstrates that changes in the exchange rate have an important bearing on a firm's overall profits through firm's foreign operation which results fluctuations in stock prices. The intensity and direction of changes in share prices depends upon the nature of the firm. Thus exchange rate has uni-directional relationship with stock index.

E. Nexus between GDP and DSI

Nishat & Mustafa (2007), Ake & Ognaligui (2010), Hunjra, Chani, Shahzad, Farooq & Khan (2014),Coovadia (2014)and Ndlovu, Faisai, Resatoglu & Tursoy (2018) revealed a positive relationship between stork price movements and GDP.Regression analysis and the Granger causality test on annual data were used in a different study by Kibria (2014) to explore the effects of macroeconomic factors on stock returns. The results revealed a uni-directional relationship between GDP and stock returns.

V. METHODOLOGY

The Granger Causality test was used to assess the relationship between individual explanatory variables and (either unidirectional, bidirectional, or no relation), and Ordinary Least Squares (OLS) was used to analyse the association between macroeconomic variables and the Botswana Stock Price Index (BCI). The following model was utilised by the study from Talla (2013):

$$DSI = \alpha + \beta_1 er + \beta_2 infl + \beta_3 ir + \beta_4 gdp + \beta_5 ms + \varepsilon$$

Where;
DSI represents the domestic stock index
errepresents exchange rate
$infl$represents inflation
ir Interest rates
gdprepresents gross domestic product
msrepresents money supply

The Botswana Stock Exchange (BSE) calculates the local stock index, which serves as a market indicator for the country's stock market. The natural logarithm of the BSE for each year from 2007 to 2016 was used to create the DSI, which measures the market's cumulative gain. The exchange rate used in this study was the quantity of Pulas required to exchange for one South African Rand. Botswana is one of South Africa's main trading partners and is said to be significantly dependent on it. The widespread loss of the Pula's purchasing value is referred to as inflation. According to Fama's (1981) study and hypothesis, economic activity and stock returns are positively correlated. The price of money is referred to as the interest rate.It is the part of borrowed money that a lender requests be used for other purposes. In other words, interest can be viewed as the compensation that investors receive in exchange for their liquidity in the form of a return on their investment. The value of finished products and services produced within a nation's borders over a given time period, often a year, is represented by the gross domestic product (gdp). This analysis anticipates a favourable link between GDP and domestic stock index performance based on the findings of Khan et al. (2014). M2 serves as a stand-in for the money supply variable in this study. M2 is an acronym for money in use and money in accounts, together with savings accounts and deposits.It was anticipated that the money supply would be positively correlated with Botswana's domestic index.

VI. DIAGNOSTIC CHECKS

The Pair-Wise correlation matrix which has the results as below was used to check whether explanatory variables do not have serial relationship.

Table 1: Correlation matrix

	LOGDSI	LOGER	LOGGDP	LOGINFL	LOGIR
LOGDSI	1.000000	0.543842	0.688933	-0.752346	-0.499258
LOGER	0.543842	1.000000	0.360633	-0.257990	-0.192593
LOGGDP	0.688933	0.360633	1.000000	-0.742428	-0.836625
LOGINFL	-0.752346	-0.257990	-0.742428	1.000000	0.028295
LOGIR	-0.499258	-0.192593	-0.836625	0.028295	1.000000

Source: Own calculation

A. Stationarity/Unit root tests

As indicated by Table **II**, some variables were stationary variable exchange rate was the only variable stationary at level while some were stationary after first differencing.

Table 2: Augmented Dickey -Fuller (ADF): Stationarity/Unit root tests

Variable	ADF Statistic	Critical Value@5%	P-Value	Order of integration
Domestic stock index (DSI)	-7.249722	-2.941145	0.0000	I (1)
Exchange rate (ER)	-3.669252	-2.938987	0.0086	I (0)
Gross domestic product (GDP)	-6.851440	-2.941145	0.0000	I (1)
Inflation (INFL)	-1.380504	-2.941145	0.0013	I (1)
Interest rates (IR)	-6.550953	-2.941145	0.0000	I (1)

Source: Own calculation

B. Cointegration test

Co-integration test is done in researches to test if variables used in the model have a long run relationship. In this case the researcher tested the error term using Augmented Dick-Fuller methodology.

Null hypothesis: ERROR term has a unit root
Alternative hypothesis: ERROR term has no unit root

Table 3: Cointegration test

Null Hypothesis: ERROR has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.483318	0.0000
Test critical values:	1% level	-2.625606	
	5% level	-1.949609	
	10% level	-1.611593	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ERROR)
Method: Least Squares
Date: 21/07/23 Time: 16:58
Sample (adjusted): 2007Q2 2016Q4
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERROR(-1)	-0.685132	0.152818	-4.483318	0.0001

R-squared	0.345900	Mean dependent var	5.730904
Adjusted R-squared	0.345900	S.D. dependent var	621.4164
S.E. of regression	502.5796	Akaike info criterion	15.30269
Sum squared resid	9598277.	Schwarz criterion	15.34535

Log likelihood	-297.4025	Hannan-Quinn criter.	15.31800
Durbin-Watson stat	1.527757		

As shown by Table **III**, the ADF statistic of -4.483318 is higher than the critical value of -1.949609 at 5%. This means that the error term is stationary and hence variables have a Cointegration. Thus, the variables used in this model have a long run relationship.

C. Table IV: Heteroskedasticity test

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Table 4: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.218473	Prob. F(4,35)	0.9264
Obs*R-squared	0.974405	Prob. Chi-Square(4)	0.9137
Scaled explained SS	0.787577	Prob. Chi-Square(4)	0.9401

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 21/07/23 Time: 17:40
Sample: 2007Q1 2016Q4
Included observations: 40

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.018653	0.029541	0.631441	0.5319
DLOGGDP	-0.004083	0.006444	-0.633627	0.5304
DLOGINFL	-0.000547	0.001672	-0.327425	0.7453
DLOGIR	1.62E-05	0.003231	0.005020	0.9960
LOGER	-0.000263	0.004198	-0.062688	0.9504

R-squared	0.024360	Mean dependent var	0.000766
Adjusted R-squared	-0.087142	S.D. dependent var	0.001127
S.E. of regression	0.001175	Akaike info criterion	-10.53861
Sum squared resid	4.83E-05	Schwarz criterion	-10.32750
Log likelihood	215.7723	Hannan-Quinn criter.	-10.46228
F-statistic	0.218473	Durbin-Watson stat	1.509789
Prob(F-statistic)	0.926357		

One of the assumptions of the classical linear regression models is that variables should have constant variance (homoscedastic).

Null hypothesis: Variables have inconsistent variance
Alternative hypothesis: Variables have constant variance

As shown by Table IV, a p-value of Chi2 of0.9401 is greater than 0.05 hence rejecting the null hypothesis and conclude that variables are homoscedastic.

D. Autocorrelation test

Checking for the absence of serial correlation inside the residual is one of the diagnostic checks for time series data. The test's null hypothesis is that the residuals do not exhibit serial correlation up to the predetermined sequence. Therefore, the alternative, which holds that there is a serial correlation inside the residual, is compared to this hypothesis. The alternative hypothesis is rejected by the Breusch-Godfrey Serial Correlation LM Test results, which show that there is no serial correlation issue with the data because the p-value of the f-statistic is greater than 0.05.

Table 5: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	4.907473	Prob. F(1,34)	0.0635
Obs*R-squared	5.045275	Prob. Chi-Square(1)	0.0747

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 21/07/23 Time: 17:38
Sample: 2007Q1 2016Q4

Included observations: 40
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.191966	0.710738	0.270093	0.7887
LOGGDP	-0.039274	0.154907	-0.253534	0.8014
LOGINFL	0.014743	0.040467	0.364316	0.7179
LOGIR	-0.036699	0.078912	-0.465064	0.6449
LOGER	-0.008535	0.100315	-0.085081	0.9327
RESID(-1)	0.366113	0.165267	2.215282	0.0335

R-squared	0.126132	Mean dependent var	9.39E-16
Adjusted R-squared	-0.002378	S.D. dependent var	0.028026
S.E. of regression	0.028059	Akaike info criterion	-4.171536
Sum squared resid	0.026768	Schwarz criterion	-3.918204
Log likelihood	89.43071	Hannan-Quinn criter.	-4.079939
F-statistic	0.981495	Durbin-Watson stat	1.814218
Prob(F-statistic)	0.443223		

E. Jarque-Bera Normality test

The primary goal of this test, which serves as the study's final diagnostic check was to determine whether the error term exhibits characteristics of a normal distribution. The following is the suggested hypothesis:

Null hypothesis: Residuals are normally distributed
Alternative: Residuals are not normally distributed

The likelihood of the Jarque-Bera test and the histogram demonstrate that the residuals are normally distributed, as shown by Figure I below, with a p-value of 0.108941 that is higher than 0.05.

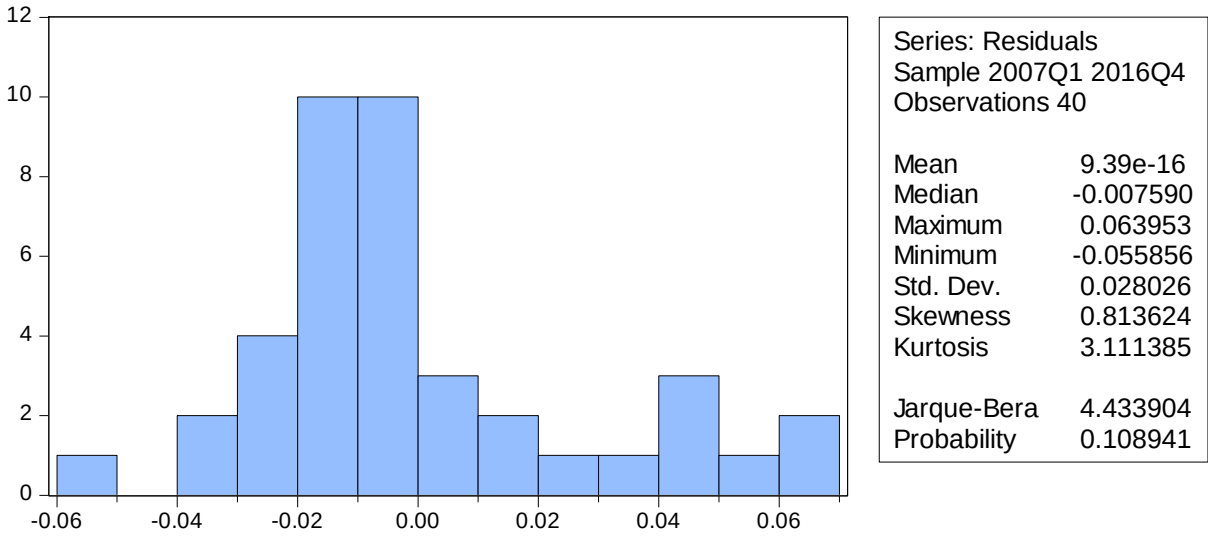

Fig. 1: The residuals are normally distributed

VII. DESCRIPTIVE STATISTICS

The descriptive statistics utilised in this study, which covered a ten-year period, are summarized in the table below. It includes the mean, standard deviation, minimum and maximum values for each variable used in the model as well as other pertinent information. To provide an overview of the variables employed in this research, each of the five variables is briefly explained. The Domestic Stock Index had a maximum observable value of 4.024680 and a minimum value of 3.794703, as shown in Table VI below. Its mean value for this particular variable was 3.911980, and its standard deviation was 0.067665. The exchange rate variable utilised in this study represented the value of the Pula in terms of the Rand, with a high value of 0.286007 and a minimum value of 0.024527 across the study period. The greatest values for the GDP, inflation, and interest rates were 4.355394, 1.167317, and 1.176091, respectively. On the same vein, the minimum values for these variables were 4.171551, 0.362671, and 0.724276, respectively.

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Table 6: Descriptive Statistics

Z	LOGDSI	LOGER	LOGGDP	LOGINFL	LOGIR
Mean	3.911980	0.074144	4.274150	0.787624	0.957540
Median	3.901383	0.066004	4.267427	0.854295	0.977724
Maximum	4.024680	0.286007	4.355394	1.167317	1.176091
Minimum	3.794703	0.024527	4.171551	0.362671	0.724276
Std. Dev.	0.067665	0.049613	0.057711	0.205307	0.132955
Skewness	0.117148	2.410303	-0.006254	-0.381775	0.237666
Kurtosis	1.712519	10.21258	1.542904	2.390481	2.192198
Jarque-Bera	2.854169	125.4326	3.538808	1.590869	1.464143
Probability	0.240008	0.000000	0.170435	0.451385	0.480912
Sum	156.4792	2.965766	170.9660	31.50496	38.30159
Sum Sq. Dev.	0.178563	0.095997	0.129892	1.643888	0.689400
Observations	40	40	40	40	40

Source: own Computation

A. Regression Results

In order to examine the relationship between the BSE all shares price index (DSI) as the dependent variable and some chosen macroeconomic variables namely inflation (infl), exchange rate (er), Gross domestic product (gdp), Money supply (ms), and interest rate (ir) as the independent variables, this study used multivariate regression analysis computed by using standard Ordinary least square formula. Equation 1 then develops the multivariate regression model.

$$DSI = \alpha + \beta_1 er + \beta_2 infl + \beta_3 ir + \beta_4 gdp + \beta_5 ms + \varepsilon \quad 1$$

$$DSI = 0.789875 + 0.341320er - 0.299311_2 infl + 0.403585ir + 0.689282gdp$$

According to this equation, the exchange rate, interest rate, and GDP are all positively correlated with the Botswana stock index. It also showed that there is a negative correlation between the BSI and the consumer price index, which measures inflation. It does not imply any connection with prior data that would imply that the market is not short-term weak. According to one theory, stock returns rise as inflation rates fall because falling prices boost market confidence and demand for investments, while rising prices undermine investor confidence, reduce investment demand, and lower the domestic price index. This study demonstrates a positive relationship between interest rates and domestic stock price indices, suggesting that as the government raises interest rates and the prime rate, the country will attract more foreign investment, shift demand upward, and drive up domestic price indices prices.

According to this study, there is a positive correlation between exchange rate (er) and stock returns, with a coefficient of 0.34132. These findings were confirmed by Ahmed, Rehman and Raoof (2010) who examined information on Pakistani stock returns and currency rates and discovered a considerable favourable impact on the stock returns using data from 1998 to 2009. Both citizens and non-citizens may become more interested in buying shares of Botswana if the exchange rate rises.This is as a result of both possible expectations and possible beliefs on the part of all investors that the rate will continue to increase and investors will continue to profit. Thus our result is supported by behavioural finance theory. Tvaronaviien & Michailova (2006) noted that the theory presupposes significant psychological and behavioural factors involved in stock market investment that present chances for successful investing for savvy investors. This theory's proponents contend that investor emotions, not statistical information, can explain variations in stock market values. Therefore, according to this theory, there should be no correlation between macroeconomic factors and stock prices, but the bubble hypothesis or human behaviour in general can affect stock prices.These findings contradict those of Ajayi & Mougoue (1996), who noted that when a currency depreciates, stock prices immediately decrease and that it is therefore expected that stock prices and exchange rates have a negative relationship. Investors are quite concerned and uncertain about the growth potential of companies due to this inverse link, which is explained as increased inflation in the future is projected when currency values decline.Because the exchange rate is a good predictor of domestic stock returns and because the variables are significant in determining stock price, the p-values of 0.0027 are less than 0.1 (10%). A reliable predictor of the movement of the stock return is the macroeconomic variable that is being employed. According to literature, empirical data from numerous researches and this study, the domestic stock index and exchange rate can have a positive or negative relationship.

This study discovered a negative relationship between inflation (infl) and stock returns, with a coefficient of -0.299311 and a P-value of 0.0000. These findings corroborated those of Omran & Pointon (2001), who examined the Egyptian stock market, and Gyau (2015), who noted that in Ghana, inflation increases the cost of living, and as a result, more resources are used for consumption, leaving fewer resources for investment. Gyau (2015) claims that a decline in stock demand and trading along with rising living expenses lowers corporate profitability, which in turn results in lower dividend payments, acts as a signal and lowers stock returns, and depreciates the domestic stock index.The parameter appears to be effective in predicting the movement of the domestic stock index because the p-values of 0.0000 are less than 5% (0.05). The p-value of 0.0000 is smaller than the t-test's value of 7.112, indicating that the

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variable may be somewhat trustworthy.Thus, we can draw the conclusion that in Botswana, as inflation rises, the domestic stock index declines as investors lose faith in the market, cut down on stock investment, reduce demand for investment, and lower stock index returns.

The interest rate employed in this study was measured using domestic prime rates. In order to demonstrate that interest rates significantly explain domestic stock index, this study discovered a positive association between interest rates and the domestic stock index for Botswana, with a coefficient of 0.403585 and p-values of 0.000, which is less than 0.05. These findings substantiated the Ratanapakorn and Sharma study's (2007) finding that the S&P 500 and US Treasury bill rates have a favourable association. These findings conflict with those of Humpe & Macmillan (2007), who used data from Japan & the USA, and Alam & Uddin (2009), who discovered a substantial negative association between the prime rate and the share price for 15 developed and developing nations using data from 1988 to March 2003.Thus, it may be inferred from studies that prime rate has a variable impact on stock values. But our research found a link between the prime rate and the domestic stock index of Botswana. This makes it challenging for investors to find funding, which hurts their stock investments and the DSI. A decrease in the prime rate has an impact on the interest rate and makes funds more affordable. Investors will also find it less appealing to invest in the money market and will instead purchase more stocks, which will raise demand for stocks and drive up the price of domestic equities.

Gross domestic product and the domestic stock index in Botswana were found to be positively correlated in this study, with a coefficient of 0.689282 and a P-value of 0.002 suggesting that GDP considerably influences the domestic stock index. This analysis supports the conclusions of Fama (1990), which found a relationship between annual stock returns and real GDP. Similar findings were obtained by Schwert's (1990) study, which used American data from 1889 to 1988. It might be claimed that when the gross domestic product grows, people earn more money, have more money to save, and have more money available to invest, which increases demand for stock investments.As income rises, so does the demand for goods and other services, which raises the company's profitability. As profits rise, so does the demand for securities, which raises the price of local stocks. According to Erdugan (2014), stock prices should be equal to discounted predicted future cash flow. So, as the economy expands, so does the anticipated cash flow. With everything else remaining constant, a growth in the supply of funds affects the interest rate at the same time that the economy expands, individuals make more money, save more money, and there are more financial resources available on the financial market.We can therefore draw the conclusion from this study and other studies that the Gross Domestic Product of a country positively influences the domestic stock index. Thus, we draw a conclusion and offer evidence in favour of the null hypothesis that the domestic stock index is positively impacted by gross domestic product.

The findings of the study demonstrate that macroeconomic factors such the gross domestic product, inflation, interest rate, and currency rate have a significant impact on the domestic stock index in Botswana. Inflation has a negative association with the domestic stock index, but GDP, interest rates, and exchange rates have positive relationships with the domestic stock index, according to this study. The conclusion was supported by research that demonstrated how, depending on the stock under consideration, such results can be directional.

VIII. CONCLUSION

The nature of the relationship between the return on Botswana's stocks and important macroeconomic factors such the exchange rate, prime rate, gross domestic product, money supply, and inflation is examined in this paper. Due to their multicollinearity with the interest rate and GDP, money supply variables were removed. Multiple linear regression approaches were used to evaluate quarterly data from January 2007 to December 2016. These methods revealed the regression equation, which revealed a positive association between the Botswana domestic stock index, the GDP, the exchange rate, and the interest rate, and a negative relationship between inflation and the current domestic stock index.The findings also demonstrated that short-term stock returns are positively impacted by exchange rates, GDP, and interest rates. The outcomes also demonstrated an adverse link between inflation and Botswana stock return. For important stakeholders like investors, the government, and companies listed on the BSE, the report offers helpful advice. The results, however, indicated that Botswana has a small economy, few investors, and a poor information flow, which could indicate that the results may not have a substantial impact on stock returns.

IX. RECOMMENDATIONS

- Since inflation, exchange rates, and interest rates can affect the Botswana stock index, the Bank of Botswana must implement practical policies to keep these variables within reasonable limits.
- The listed companies must make a concerted effort to increase the appeal of the shares to investors. This is due to the fact that many investors view the stock market as a means of long-term risk hedging. To increase their profitability, the listed corporations must engage in productive business endeavours. This is true because investors are urged to fund ventures with promising futures.
- The businesses must take action to lower production costs while also raising productivity. The overall result will be higher profit margins and, as a result, higher returns on their shares. This is consistent with the correlation between past and present stock returns being favourable. As a result, managers should make sure that all operations are effectively handled. Returns gained today will define the future of the company and its capacity to raise further capital and continue to be profitable.

- To determine how stock prices respond to particular macroeconomic announcements or events, such as changes in interest rates or GDP releases, conduct event studies. Recognise that various industries and sectors may react to macroeconomic variables in different ways. To acquire more detailed insights, examine how these variables affect particular sectors and industries.
- Over various time frames, various macroeconomic factors may have differing effects on stock values. Take into account both short- and long-term analysis to get a full picture. Keep up with news and happenings in the economy because sudden changes in macroeconomic factors can have an instant impact on the stock market.
- Although macroeconomic indicators might offer insightful information, it's critical to understand that a wide range of factors affect the stock market. Your investment portfolio's diversification can aid in reducing the dangers brought on by macroeconomic volatility.

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