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**Effects of the dollar index fluctuations on the performance
of the Kenyan stock market**

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**Submitted in partial fulfillment of the requirements for the Degree of
Bachelor of Science in Financial Economics at Strathmore University**

Strathmore Institute of Mathematical Sciences

Strathmore University

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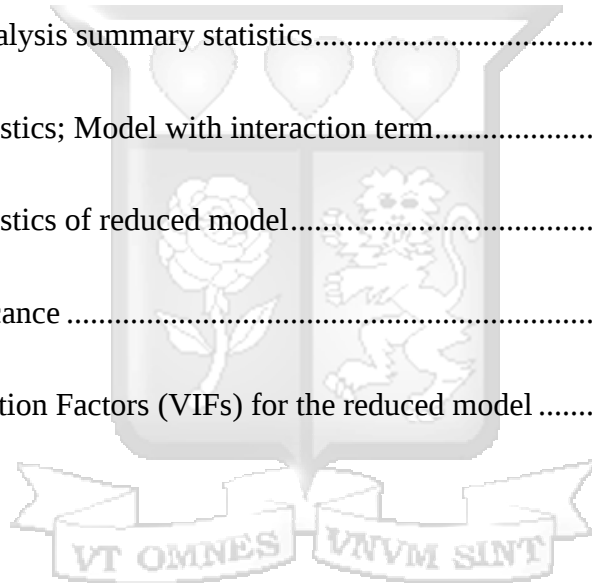
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List of Abbreviations

- **AIC:** Akaike Information Criterion
- **BIC:** Bayesian Information Criterion
- **CBK:** Central Bank of Kenya
- **EMH:** Efficient Market Hypothesis
- **IFE:** International Fisher Effect
- **NSE:** Nairobi Securities Exchange
- **PPP:** Purchasing Power Parity
- **RMSE:** Root Mean Square Error
- **USDx:** Dollar Index



CHAPTER 1: INTRODUCTION

1.1 Background

The performance of a country's stock market serves as a crucial measure of the economic health of that given country. Paytakhti Oskooe, (2010) conducted a structured analysis of the connection between stock market performance and economic growth in Iran and determined that the stock market functions as a precursor to future economic growth. Similarly, Paramati, & Gupta, (2011) explored whether stock market performance drives economic growth or if the reverse is true, while also analyzing both short-term and long-term dynamics of the stock market. Additionally, local studies have been conducted to confirm the role of stock market performance in contributing to economic growth in Kenya concluding that the stock market has a positive effect on economic growth (Olweny & Kimani, 2011). Since the importance of economic growth cannot be disputed, it is therefore necessary to study what factors drive and thus assess the performance of the Kenya's stock market.

The U.S. Dollar Index (USDIX) gauges the value of the U.S. Dollar (USD) relative to a weighted collection of six key foreign currencies. While the Dollar Index is fundamentally derived from the U.S. dollar's value, its fluctuations offer a distinct and valuable perspective on global currency dynamics. By analyzing the USDIX, we shift our focus from the absolute strength of the USD to its relative movements against this weighted basket of major currencies. This relative change is crucial for understanding the currency pressures that directly influence international trade, investment flows, and commodity pricing, all of which are pertinent to the Kenyan stock market. Modeling the USDIX allows us to capture these relative shifts, providing a more refined analysis of the currency-driven effects on the Kenyan market, beyond what a simple USD-centric approach would offer. While we acknowledge the USD's underlying influence, the DXY serves as a tool to isolate and analyze the relative changes in the dollar, which are the primary drivers of the interconnected global market impacts.

As Kenya continues to integrate more deeply into the global economy, external factors that may influence trade and the global economy thus automatically affect Kenya. As a benchmark, the

USDX plays a pivotal role in international trade and finance, influencing commodity prices, investment flows, and global economic stability. The USDX movements directly impact foreign investment in Kenya, the competitiveness of Kenyan exports, and the overall economic sentiment. These effects trickle down to the stock market, affecting investor confidence, stock prices, and market capitalization. Nairobi Securities Exchange (NSE), which serves as the representative of the Kenyan stock market, is thus sensitive to variations in exchange rates, including those involving the U.S. Dollar.

The Dollar Index has shown significant volatility historically as shown in Figure 1 below due to factors such as U.S. monetary policy, geopolitical events, economic data releases, interest rate changes, and global crises. Other asset classes such as equities, commodities, bonds, currencies, and real estate are significantly impacted by changes in the US dollar index. A stronger dollar negatively affects companies' earnings with substantial international exposure, lowers commodity prices, and makes bonds dominated in the USD more attractive, shifting investment away from emerging markets like Kenya. A robust dollar index limits the growth potential of emerging markets, whereas a falling dollar index typically stimulates rapid growth in these markets (Investing, 2023). This implies that the fluctuations in the USDX can potentially impact a given market, thus justifying the need to study its effect on the Kenyan market.

Similarly, the NSE has experienced periods of growth and decline, often in response to global economic conditions and local economic policies. The performance of the NSE can be measured by focusing on the NSE all-share index (NASI) or the NSE 20-share index. Despite the lack of a significant difference between the two indices, the NSE 20 share index serves as a more effective measure of market performance compared to the NASI (Waithaka, 2014).

By examining the trends of these main variables, we can understand why this relationship sparks interest and is important to investigate. Understanding the impact of Dollar Index fluctuations on the NSE performance can help investors make informed decisions, and aid policymakers in developing strategies to mitigate effects on the Kenyan economy. There is limited research specifically focusing on this relationship, thus highlighting a gap that this study aims to fill.

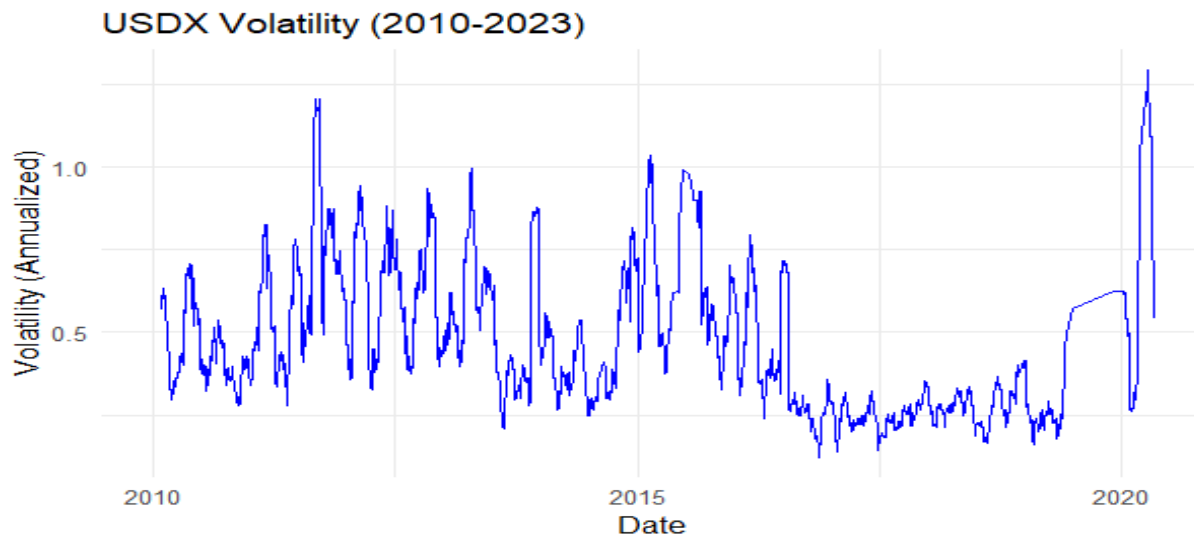


Figure 1-1: USDX volatility 2010-2023

1.2 Problem Statement

Kenya has 67.3% of its external debt and about 56% of its diaspora remittances denominated in US dollars (*Government Finance Statistics | CBK, n.d.*) (*Diaspora Remittances | CBK, n.d.*). Therefore, fluctuations in the dollar index may affect its economy significantly through exchange rate risk among other factors. Considering that emerging markets stock indices and the dollar index have an inverse relationship Ilalan & Pirgaip, (2019), it's crucial to examine the effect the fluctuations in the USDX would have on the Kenyan economy. While extensive research exists on the impact of exchange rate volatility on stock markets globally, there is a notable gap in the literature specifically addressing the effects of the U.S. Dollar Index on the NSE. Studies by Atyang, (2017) and Ouma & Kihui, (2018) have shown that exchange rate variations affect the returns of companies listed on the NSE in Kenya. However, they do not specifically focus on the Dollar Index.

This study therefore aims to address this gap and provide insights by specifically examining the Dollar Index's fluctuations and their impact on the performance of the Kenyan stock market and

providing empirical evidence to support the hypothesis that fluctuations in the Dollar Index will have a significant impact on NSE performance.

1.3 Research Objectives

The main objective of this study is to determine the effects of the dollar index fluctuations on the performance of the Kenyan stock market for the period 2010-2023.

Other objectives for this research include:

- To calculate and compare the annualized volatility of the Dollar Index from 2010 to 2023, identifying periods of significant fluctuation and their potential cause.
- To compute and analyze the annual returns of the NSE-20 Share Index from 2010 to 2023, assessing trends and correlations with major economic events.
- To identify any significant trends or patterns in the correlation between the Dollar Index and the Kenyan stock market performance over the study period.

1.4 Research Questions

To guide this study, the following questions are relevant.

- What is the relationship between the Dollar Index and the performance of the Kenyan stock market?
- How do fluctuations in the Dollar Index affect stock prices in Kenya?

1.5 Significance of the Research

This research is significant for various stakeholders as follows:

Banks, which often have significant foreign exchange exposure and international investments, may be directly impacted by changes in the Dollar Index. The study's insights can help banks manage

their foreign exchange risk and optimize their asset portfolios. Moreover, understanding the relationship between the dollar index and the stock market can assist in hedging strategies and in forecasting currency and equity market movements.

Mutual funds manage large portfolios, often diversified across asset classes, including equities. This research can inform fund managers about the potential risks and returns associated with USDX movements, enabling them to adjust their asset allocation strategies. The results can also aid in developing investment products tailored to mitigate currency risks.

For individuals investing for long-term goals, such as retirement, this study provides valuable insights into how macroeconomic factors like the Dollar Index can influence stock market performance. This knowledge can inform their investment decisions, particularly in balancing their portfolios between domestic and international assets.

Day traders, who engage in short-term trading, are overly sensitive to market volatility and price movements. The findings of this study regarding the relationship between the Dollar Index and stock market fluctuations can assist these traders in predicting market movements and modifying their trading strategies as needed.

Multinational corporations with cross-border operations are exposed to currency risks that can affect their earnings and financial stability. This research can also provide such corporations with a better understanding of how currency fluctuations implied by the USDX fluctuations influence the stock market, helping them make informed decisions about foreign investment and financial planning.

For local businesses, especially those involved in importing goods or raw materials, the movements of the USDX can significantly impact costs and profitability. This study can offer these businesses insights into market trends and potential impacts on their operations, allowing for better financial planning and risk management.

Policymakers have a significant role in influencing and monitoring the performance of the NSE through regulation, oversight, market development, and investor education and protection, among

others. This study's findings can assist policymakers and regulators in understanding the broader economic implications of USDX movements on the financial markets. This understanding can be critical for designing policies that stabilize the market and protect investors, particularly during periods of significant currency volatility.

This research contributes significantly to the academic literature on the interplay between the Dollar Index and stock market performance, particularly in emerging markets like Kenya. It provides a basis for further research and exploration into this relationship for other emerging economies.



CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

2.1.1 The Dollar Index

The USDIX evaluates the value of the US dollar in relation to a group of foreign currencies, such as the Swedish krona, British pound, Euro, Japanese yen, and Swiss franc. Since the Euro serves as the main currency of 19 of the 27 member states of the European Union, about 24 countries are included in this index. However, several other currencies closely track the U.S. Dollar Index, making the USDIX an effective tool for assessing the global strength of the U.S. dollar. (*What Is the US Dollar Index?*, 2021). Additionally, more than 50% of foreign exchange reserves are denominated in dollars, according to the International Monetary Fund (*Currency Composition of Official Foreign Exchange Reserve - At a Glance - IMF Data*, n.d.). The USDIX also accounts for 88% of transactions in the foreign exchange market, with commodities such as oil, gold, and industrial metals priced in U.S. dollars. The dollar's changes i.e., the volatility of the USDIX, have significant impacts on various asset classes, including precious metals, bonds, commodities, and stock markets (*What Is U.S. Dollar Index & How to Use It for Analysis* | CFI AE, n.d.). Fluctuations in the Dollar index can be influenced by a range of factors such as interest rates, inflation, economic data, and geopolitical events.

2.1.2 Stock Market Performance

The performance of stock markets is often measured using indices that represent the value of a portfolio of securities. In Kenya, the NSE All Share Index (NASI) and the NSE 20 Share Index are the commonly used indicators. Since the two indices are not substantially different, Waithaka, (2014) it is okay to use either. In this study, the NSE 20 index will be used. The performance of the stock market may be influenced by domestic economic conditions, political stability, and external economic factors, including exchange rate movements.

2.2 Theoretical framework

Several key economic theories provide a foundation for understanding how fluctuations in the Dollar Index can influence the NSE performance in Kenya.

2.2.1 The Purchasing Power Parity

This theory states that the price levels between two countries should be equal. This implies that exchange rates between two currencies should adjust to ensure that identical goods have the same price across different countries. Price levels can be used as performance indicators. While PPP primarily deals with direct exchange rates, it also implies that fluctuations in a broad currency index like the Dollar Index can affect the relative prices of goods and services internationally (Cassel, 1918). Also, a PPP-based model of export-to-import price indexes is effective in forecasting the future movement of the U.S. Dollar Index with up to 68% accuracy over a six-month period according to (Grossmann & Simpson, 2011).

Research on PPP provides mixed evidence regarding its validity. While some studies, such as those by Holmes, (2001), support the long-term applicability of PPP, suggesting that exchange rates generally return to their average over time, others highlight persistent deviations in the short term due to factors like trade barriers, market segmentation, and differential inflation rates (Taylor & Taylor, 2004). This suggests that while PPP might offer insights into long-term trends, it might be less useful for short-term market predictions.

Critics of PPP argue that the theory oversimplifies the complexities of global trade and ignores factors such as transportation costs, tariffs, and differences in consumption patterns. Empirical studies, including those by Engel & Rogers, (1996), demonstrate that substantial deviations from PPP can persist for extended periods, particularly in the presence of non-tradable goods and services. Thus, while PPP might provide a foundational understanding of exchange rate dynamics, its practical application to the NSE in response to dollar index fluctuations requires a broader consideration of these additional factors.

2.2.2 The International Fisher Effect

The IFE theory states that the expected disparity between the exchange rates of two currencies is approximately equal to the difference between their countries' nominal interest rates (*International Fisher Effect (IFE)*, n.d.). This theory can extend to the Dollar Index, as changes in U.S. interest rates impact the strength of the U.S. dollar relative to other currencies. This theory may serve as a basis for explaining the volatility in the dollar index across time even as this study focuses on researching the effect of this volatility.

Studies supporting the IFE theory include Chinn & Meredith, (2004) who found that over long-term horizons, interest rate differentials are indeed predictive of exchange rate movements, aligning with the IFE. They argue that in the long run, arbitrage forces ensure that interest rate differentials are balanced by corresponding exchange rate adjustments. However, other researchers have critiqued the IFE theory for its limited predictive power in the short term. Obstfeld & Rogoff, (2001) highlighted that short-term exchange rate movements are often influenced by speculative trading, market sentiment, and other factors unrelated to interest rates. Their findings suggest that while the IFE might hold in the long term, it fails to account for the complexities and volatility observed in short-term exchange rate fluctuations.

IFE theory provides a straightforward and logical framework for understanding the relationship between interest rates and exchange rates over extended periods and helps explain the general trends observed in currency markets. However, critics of this theory suggest that it oversimplifies the dynamics of exchange rates. Factors such as political instability, central bank interventions, and differences in economic growth rates can all cause deviations from what the IFE would predict (Fama, 1984). Therefore, while the IFE theory offers valuable insights into the long-term relationship between interest rates and exchange rates, it is essential to consider its limitations, especially when examining short-term volatility in the Dollar Index.

2.2.3 The Efficient Market Hypothesis

EMH asserts that in an efficient market, stock prices fully reflect all available information. Thus, if the NSE market is efficient, all information on the volatility of the dollar index will be promptly reflected in the stock prices and hence the NSE 20 Share Index. This would mean rapid adjustments in stock prices based on the anticipated effects of Dollar Index movements. As investors incorporate information about Dollar Index changes into their investment decisions, the prices of NSE-listed stocks and hence the performance of the NSE may be affected accordingly.

Numerous studies support the EMH. Fama, (1970) argued that in an efficient market, stock prices should follow a random walk, and any new information should be rapidly integrated into the stock price. This theory has been validated in many developed markets, where stock prices quickly respond to new information. For example, Malkiel, (2003) found that stock prices in the U.S. tend to adjust almost instantaneously to new information, supporting the notion that markets are generally efficient. However, some researchers have criticized the EMH, particularly in the context of emerging markets like the NSE. Lo & MacKinlay, (1988) presented evidence of return predictability in stock prices, suggesting that markets are not perfectly efficient. In emerging markets, where information dissemination may be slower and investor behavior more heterogeneous, stock prices might not fully reflect all available information immediately (Bekaert & Harvey, 2003).

In an efficient market, it is expected that the NSE 20 Share Index would quickly incorporate any changes in the Dollar Index, reflecting investors' expectations about the impact of currency movements on the Kenyan economy and listed companies. However, critics point out that market anomalies, behavioral biases, and information asymmetries can lead to inefficiencies. For example, Shiller, (2003) argues that investor psychology and speculative bubbles can cause deviations from what would be expected in an efficient market. These factors might lead to delayed or incomplete adjustments in stock prices in response to Dollar Index volatility. Therefore, while the EMH

provides valuable insights, it is essential to consider its limitations, especially in the context of the NSE.

2.3 Empirical Review

This section highlights previously done research on this topic indicating methodology, findings, and conclusions. However, since studies on the dollar index specifically are limited, studies involving the US dollar, the exchange rate, and stock markets that are closely related to this study have been highlighted. Since the USDIX measures the strength of the US Dollar, a strong Dollar therefore implies a higher value of the Index.

2.3.1 Global studies

Aggarwal, (1981) examined the hypothesis that the decline or strengthening of the stock prices in the US market was due to the corresponding changes in the value of the US Dollar in the foreign exchange markets. He noted that exchange rate changes do not only affect the value and stock prices of firms that have foreign investments, export sales, or use imported products but also affect the value and stock prices of firms that operate exclusively in domestic markets. This implies that the volatility of the USDIX is not only relevant for multinational firms in Kenya but also to all other firms operating in the country. In this study, three different indexes of the US stock prices were used: the New York Exchange Index (NYSE), the Standard and Poor's 500 Stock Index (S&P 500), and the Department of Commerce Index of 500 Stocks (DC 500). The independent variable was closely related to the USDIX as it was the average value of the US Dollar weighted by US trade with its 46 largest trading partners. The regression results of each of the indexes against the trade-weighted value of the US Dollar were significant. In conclusion, it was found that stock prices and exchange rates are positively correlated supporting the hypothesis that the US stock prices are correlated with the external value of the US dollar. This study thus suggests that the fluctuations in the Dollar Index are correlated with the movement of stock prices. However, a negative relationship may be expected for Kenya since a higher dollar index may imply a weakening of the Kenya shilling against the Dollar.

Ilalan & Pirgaip, (2019) examine how the US Dollar Index affects the stock markets of developing economies. The research employs simultaneous Granger causality tests and rolling correlation analysis to examine the evolving relationship between the US Dollar Index and the returns in the stock markets of these economies. The methodology includes the application of time-series econometric techniques, specifically focusing on how changes in the Dollar Index affect stock market volatility and performance over time. The findings imply that the USDIX significantly impacts emerging market stock returns, with causality observed in both directions in many cases. The rolling correlation analysis reveals that the relationship between the Dollar Index and stock market returns fluctuates, with periods of strong correlation alternating with weak or negative correlation periods. In conclusion, the study highlights the critical role of the US Dollar Index in influencing stock market dynamics in emerging economies. These findings are relevant as they suggest that fluctuations in the Dollar Index could similarly impact NSE performance.

Bruno et al., (2022) explores the influence of the broad dollar index on stock returns in emerging markets, highlighting a financial channel through which exchange rate fluctuations impact stock performance. Introducing the concept of "dollar beta," the study measures the sensitivity of stock returns to the dollar index. The findings reveal a significant positive correlation between local currency appreciation against the dollar and stock returns, indicating that higher dollar beta countries experience higher average returns. This underscores the dollar index's critical role in shaping global financial conditions and its implications for stock markets. Additionally, the broad US dollar index proved to be a more significant predictor of stock market returns than the bilateral exchange rate for emerging market economies when both the broad US dollar index and the bilateral dollar exchange rate were used as explanatory variables in the regression. The research also highlights that the dollar index impacts market liquidity and investor risk-taking behaviors, emphasizing the importance of global financial conditions in determining stock market performance. Applying this framework to the NSE, understanding the sensitivity of the NSE to dollar index fluctuations can provide valuable insights into market behavior and investor risk perceptions while also enhancing the comprehension of exchange rate influences on the NSE.

Phylaktis & Ravazzolo, (2005)) found that a strong link exists between the stock and foreign exchange markets, which has implications for exchange rate policies. The study examines the long-

term and short-term interactions between stock prices and exchange rates through cointegration analysis and multivariate Granger causality tests over the period 1980-1998 for a group of Pacific Basin countries. This study also identifies the US stock market as a significant variable that represents the influence of world markets, by serving as a channel through which the foreign exchange market and the local stock markets are connected. Since the US stock market impacts the US dollar, and hence the Dollar Index, we can therefore conclude that the Dollar Index can be used as a representation of world markets and thus a relevant research area.

Chow et al., (1997) investigated the relationship between exchange rate fluctuations and stock returns, with a particular emphasis on the exchange rate risk exposure of asset returns in the United States. The authors found that firms with substantial international exposure were sensitive to exchange rate fluctuations. The findings suggest that fluctuations in the Dollar Index can significantly influence the stock returns of internationally exposed firms. Applying these insights to the NSE, it is reasonable to hypothesize that Dollar Index fluctuations will impact the stock returns of firms listed on the NSE, particularly those with significant exposure to international markets.

In their paper, Boz et al., (2017), assessed the relationship between global trade and the US Dollar and documented that the exchange rate of the US Dollar has a more substantial impact on global trade and price dynamics compared to bilateral exchange rates. The research highlighted that the US dollar's strength is a crucial indicator of global trade volumes and price inflation for both consumers and producers. This was established through price pass-through and trade elasticity regressions, which showed that fluctuations in the US dollar exchange rate have a more pronounced effect on international prices and trade activities than changes in bilateral exchange rates. These findings further assert that the US dollar's value can significantly influence trade volumes and price levels in emerging markets, including Kenya.

2.3.2 Local studies

Festus, (2014) assessed the effects of foreign exchange exposure on the share prices of firms listed on the NSE. In this study, the market share price of the firm was regressed on five independent variables including exchange rate volatility and foreign exchange exposure. The model significance was tested by conducting an Analysis of Variance (ANOVA) and testing the significance of the ANOVA statistics at the 95% confidence level and 5% significance level. The relationship between share price and both exchange rate volatility and foreign exchange exposure was found to be negative and statistically significant. This study highlights the importance of considering external financial metrics, such as the dollar index, in evaluating stock performance.

Wambui, (2017) examined the effects of exchange rate changes on the stock market performance in the NSE. From this study, the performance of the NSE was described as both unpredictable and declining for the period starting from January 2012 to December 2016. The analysis revealed that a weak and negative association exists between exchange rates and the performance of the NSE. This study further associated the decline in NSE performance with the fact that a high percentage of imports are paid for using the dollar, and with the shilling depreciating against the dollar, the firms were incurring arbitrage losses. From this study, the relative value of the Kenya shilling to the US dollar is seen to be significant in the performance of the NSE. Noting that the value of the US dollar to the Kenya shilling can also be implied from the value of the Dollar index, the relevance of this study is further supported. Also, viewing the Dollar Index fluctuations as a broader measure of exchange rate changes that affect international trade and investments, we can argue that the fluctuations in the dollar index impact the NSE performance.

Chirchir, (2014) investigates the nexus between share prices and exchange rates in Kenya from November 1993 to April 2011. Utilizing the Toda and Yamamoto procedure, the research identifies a bi-directional causal relationship, indicating that changes in exchange rates can influence share prices and vice versa. The findings highlight a negative sign of causality in both directions, emphasizing the significant impact of exchange rate fluctuations on the NSE. Similarly,

Komba et al., (2024), using time-series data from 2014 to 2021 for Tanzania, and the Autoregressive Distributed Lag (ARDL) bound test approach, found that exchange rates significantly and inversely affect stock returns in both the short and long-term.

Ouma & Kihui, (2018),), examined the relationship between exchange rates and stock market performance in the NSE using monthly data from January 2010 to July 2015. This study considered five major foreign currencies, the US Dollar, British Pound, Euro, Japanese Yen, and Chinese Yuan, and evaluated stock market performance using the NSE20 index. Johansen's cointegration method and the Vector Error Correction Model (VECM) framework were utilized to analyze both short-term and long-term equilibrium relationships between exchange rates and stock market performance. Granger causality tests were performed to identify the direction of causality, while impulse response analysis evaluated the impact of exchange rate shocks on stock performance. The empirical results indicate both short-term and long-term relationships between exchange rates and the NSE20 index, revealing that shocks to major foreign currencies, especially the USD, can have significant and enduring effects on the NSE's stock market indices.

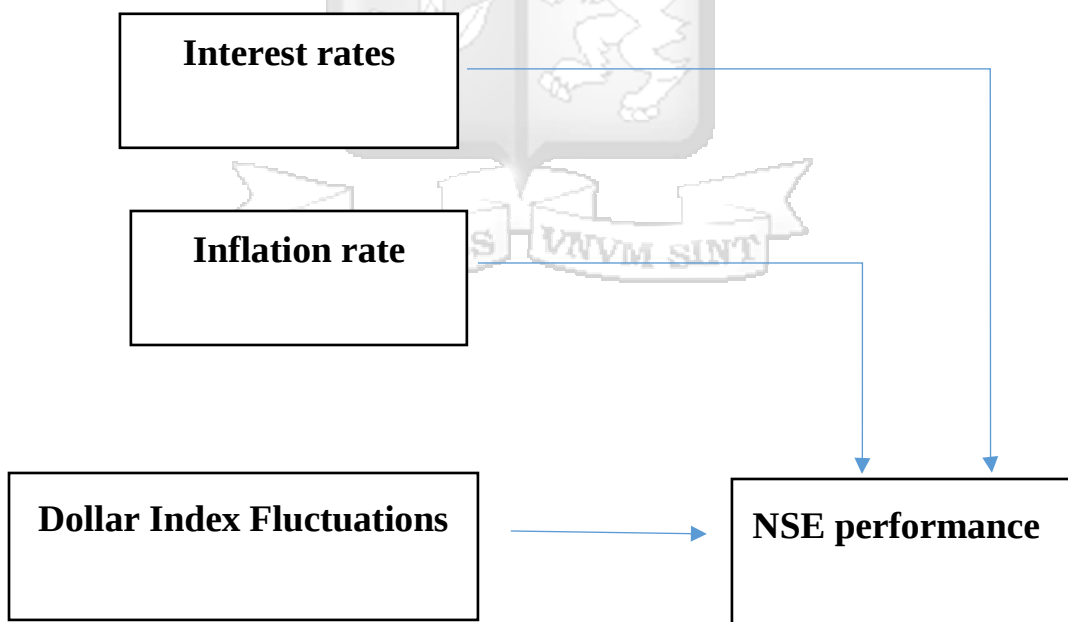
2.4 Gaps in Literature

While existing research has explored how exchange rates and stock market performance relate, there is a significant gap in the literature addressing the specific influence of the Dollar Index on the NSE. Also, other studies have conflicting findings. For instance, Koskei, (2021) found that the relationship existing between exchange rates and stock prices is weak but positive while Kiprop & Koskei, (2024) pointed out that fluctuations in exchange rates had a negative and statistically insignificant impact on the performance of the NSE in Kenya during the Coronavirus period. Despite their findings, they do not account for the impact of the Dollar Index and primarily focus on broader exchange rate metrics without isolating the Dollar Index's role, especially during periods of turbulence in the economy such as the Coronavirus pandemic. This leaves a critical gap in understanding how fluctuations in the Dollar Index affect emerging markets like Kenya. This study seeks to bridge this gap by specifically examining the impact of the Dollar Index movements

on the performance of the NSE 20 Share Index, over the period from 2010 to 2023, which encompasses the pre-pandemic, pandemic, and post-pandemic economic conditions.

2.5 Conceptual Framework

This study will explore the impact of Dollar Index fluctuations on the performance of the NSE, with a particular emphasis on the NSE 20 Share Index as the dependent variable. The independent variables considered alongside Dollar Index fluctuations are inflation and interest rates. Inflation is included because it directly influences the consumers' and businesses' purchasing power, influencing corporate profitability and, consequently, stock prices. Interest rates, set by the CBK, are another critical variable as they determine the cost of borrowing, influence consumer spending, and affect investor sentiment. Together, these variables interact to shape the overall performance of the NSE, reflecting both global economic influences through the Dollar Index and domestic economic conditions via inflation and interest rates. This framework will guide the analysis of how these factors contributed to the NSE's performance over the period from 2010 to 2023.



CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the research methodology used to examine the impact of Dollar Index fluctuations on the performance of the Kenyan stock market, focusing specifically on the NSE 20 Share Index. It includes details on research design, population and sampling, data types and collection methods, and data analysis techniques

3.2 Research Design

This study employs a quantitative research design, specifically a correlational approach. A quantitative approach is suitable as it allows for statistical analysis and objective data measurement, providing a clear picture of the relationship between the Dollar Index fluctuations and stock market performance. The design is appropriate as it allows for the investigation of the extent to which Dollar Index movements, along with inflation and interest rates, are related to changes in the NSE 20 Share Index. The correlational approach is selected over other designs since it allows for the identification of patterns and relationships among the variables without manipulating them, which is ideal given the historical nature of the data involved.

3.3 Population and Sampling

This study will focus on the period from 2010 to 2023, a period chosen to capture a comprehensive view of how Dollar Index fluctuations have impacted the NSE over different economic conditions, including pre- and post-pandemic periods. The target population for this study will include all companies listed on the Nairobi Securities Exchange (NSE). To obtain a representative sample, the NSE 20 Share Index will be used. This index includes companies from all sectors represented on the NSE, ensuring proportional inclusion. The NSE 20 Share Index serves as a benchmark, comprising the top 20 companies based on market capitalization, trading volume, and other performance metrics. Monthly data will be selected to balance the need for sufficient data points for analysis and the stability of the trends being examined. Monthly frequency is appropriate as it

smooths out short-term volatility while offering sufficient detail to observe meaningful relationships.

3.4 Data Collection

Data for this study will be sourced from reputable financial and economic databases, including the CBK¹ for interest rates, KNBS² for inflation rates, and financial market data provider, Investing.com³ for the Dollar Index and NSE 20 Share Index.

The variables included in the analysis are as follows:

Variable	Description
NSE 20 Share Index	Represents the performance of the top 20 companies listed on the NSE. It is the dependent variable reflecting overall stock market performance in Kenya.
Dollar Index	Independent variable influencing exchange rates and international trade, with potential impacts on the NSE.
Inflation Rate	The rate at which the general level of prices for goods and services is rising in Kenya. Independent variable affecting purchasing power, consumer spending, and corporate profitability.
Interest Rate	The central bank's policy rate that influences borrowing costs and investment decisions in the economy. Independent variable that impacts consumer spending, business investments, and overall economic activity.

Table 3-1: Model Variables

3.5 Data Analysis

¹ <https://www.centralbank.go.ke/>

² <https://www.investing.com/>

³ <https://www.knbs.or.ke/>

3.5.1 Diagnostic Tests

Diagnostic tests will be conducted to ensure the validity of the assumptions underlying the regression model. These tests address key assumptions in time series analysis and multiple regression.

3.5.1.1 Stationarity Test

For a time series regression, stationarity of the data is required to overcome spurious regression in the analysis. Thus, stationarity tests will be carried out for all the data sets of both the dependent and independent variables. Stationarity implies that their statistical properties such as mean, variance, and autocorrelation are constant over time. The test for stationarity to be used is the Augmented Dickey-Fuller (ADF) test. Unit root or non-stationarity is the null hypothesis for this test i.e., $H_0: \beta = 0$, and the alternative hypothesis is the time series data is stationary i.e., $H_1: \beta < 0$.

The regression estimated for the test is given by:

$$\Delta y_t = \alpha + \beta y_{t-1} + \sum_{i=1}^k \delta_i \Delta y_{t-i} + \varepsilon_t$$

Where:

- Δy_t - the first difference of the time series y_t ,
- α - a constant term,
- β - the coefficient for y_{t-1} (lagged level of the series),
- δ_i - represents the coefficients of lagged differenced terms, and
- ε_t - the error term.

The null hypothesis is rejected if the ADF test statistic is less than the critical value, or if the p-value is less than 0.05, indicating that the series is stationary. If the data is non-stationary, differencing will be required to transform the series into a stationary one.

3.5.1.2 Multicollinearity Test

Multicollinearity arises when two or more independent variables are highly correlated, which can lead to unreliable estimates of regression coefficients. The Variance Inflation Factor (VIF) test will be computed for all independent variables.

The equation for this test is:

$$VIF_j = 1/(1 - R_j^2)$$

Where, R_j^2 - the coefficient of determination of the regression model with the j^{th} independent variable regressed on all other independent variables.

A $VIF > 10$ indicates high multicollinearity, suggesting that the variable j is highly correlated with the others while a $VIF \leq 10$ indicates that multicollinearity is not a concern. If high multicollinearity is detected, strategies such as removing highly correlated variables or combining variables may be used to mitigate the multicollinearity effect.

3.5.2 Model Specification

A multiple linear regression model will be specified in the form:

$$\begin{aligned} & \text{■} (NSE\ 20\ Index@Returns_t) \\ &= \beta_0 + \beta_1 Dollar\ Index_t + \beta_2 Inflation\ Rate_t \\ &+ \beta_3 Interest\ Rate_t + \varepsilon_t \end{aligned}$$

Where:

- β_0 - is the intercept,
- $\beta_1, \beta_2, \beta_3$ - the coefficients of the respective independent variables,
- ε - represents the error term.

The equation is designed to capture the effects of dollar index fluctuations, inflation rate, and interest rate on the NSE 20 returns.

3.5.3 Model Validation

Model validation involves evaluating how well a statistical model performs in terms of its predictive power and accuracy. After model estimation, it is crucial to assess whether the model accurately represents the data and can make reliable predictions. Validation helps in determining if the model's assumptions hold true and if the model generalizes well to new data.

The following validation techniques will be used in this study:

- **Overall model significance:**

Overall model significance is a crucial technique in model validation, assessing whether the model provides meaningful predictive power or if the observed results are due to random chance. This is typically achieved through hypothesis testing, where the null hypothesis assumes that the model has no predictive value, and the alternative hypothesis suggests that the model explains a significant portion of the variance in the dependent variable. Common statistical tests, such as the F-test in regression models are employed to evaluate overall model significance. A low p-value (usually less than 0.05) indicates that the model significantly improves predictions over a baseline model. Ultimately, overall model significance helps confirm that the model captures meaningful patterns rather than just fitting random noise, ensuring that the model's predictions are reliable and robust.

- **Residual Analysis:**

Residual analysis evaluates the accuracy and reliability of the model by examining the distribution of prediction errors. This method assesses whether the residuals, differences between observed and predicted values, are randomly distributed, which indicates a well-fitted model. A proper residual analysis ensures that key assumptions, such as homoscedasticity (constant variance of residuals) and normality, are met. Patterns in the residuals, such as systematic trends or heteroscedasticity, may indicate model deficiencies, necessitating further refinement. By incorporating residual analysis, we enhance the robustness of model validation and ensure that predictions are unbiased and reliable.

CHAPTER 4: DATA ANALYSIS AND FINDINGS

4.1 Introduction

This chapter presents the analysis of the data collected to investigate the relationship between fluctuations in the US dollar index (DXY) and the performance of the Nairobi Securities Exchange (NSE) in Kenya. The analysis focused on the NSE 20 index, which represents the performance of the top 20 companies listed on the NSE. The chapter begins with the results of exploratory data analysis (EDA), including trend analysis, descriptive statistics, correlation analysis, and visualizations followed by the results of regression analysis, including the estimated coefficients' statistical significance, and model fit.

4.2 Exploratory Data Analysis

Trend analysis

Figure 4-1 below depicts the trends in the variables across the study period. The trend analysis of the economic indicators reveals a notable inverse relationship between the DXY and the NSE20 Index. As shown in the graphical trends, the appreciation of the DXY Index coincides with a steady decline in the NSE 20 Index, suggesting that fluctuations in the dollar's strength have an inverse relation with the stock market performance in Kenya. The exchange rate seems to be trending upwards while the interest rate exhibits a downward trend. The inflation rates, however, seem inconsistent with major fluctuations around the year 2017-2018.

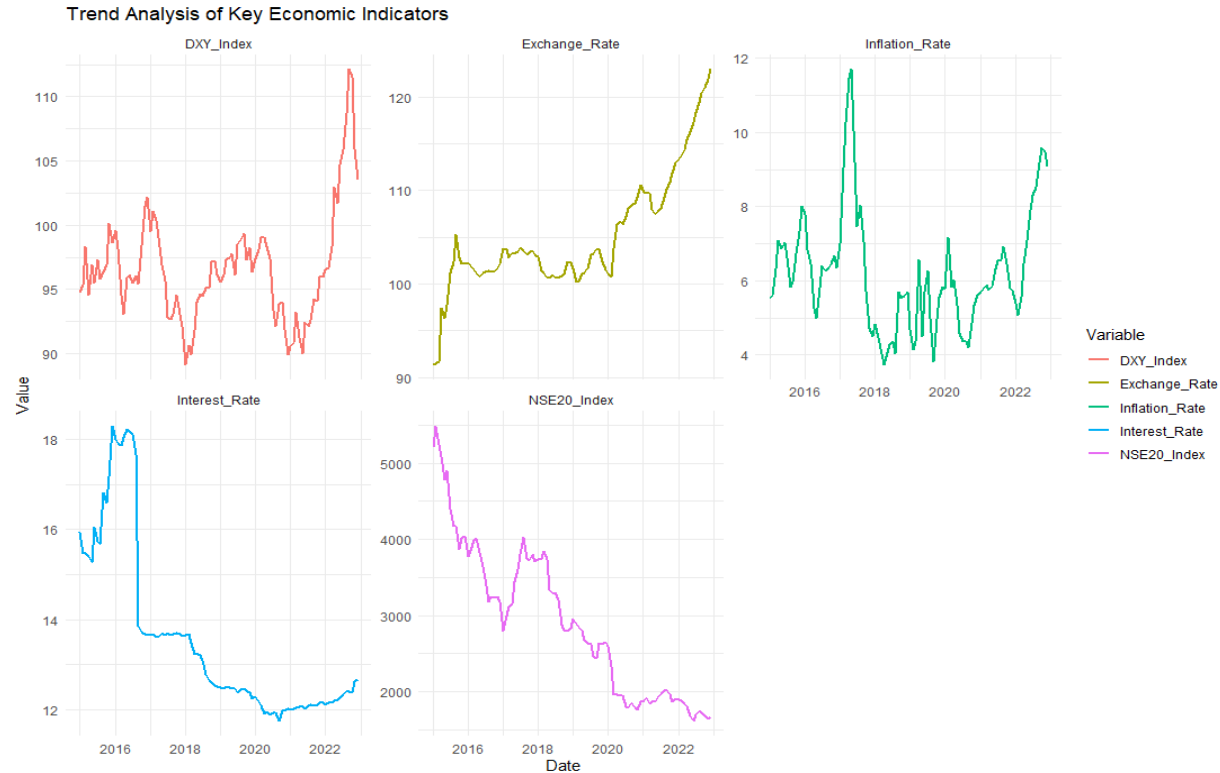


Figure 4-1: Trend analysis of key economic indicators

4.2.1 Descriptive Statistics

The descriptive statistics as shown in table 4-1 below provide insight into the distribution of the key variables used in the study. The average monthly return of the NSE 20 index was -1.23%, with a standard deviation of 4.675%. This indicates that the NSE 20 experienced an average monthly decline of 1.23% during the sample period, with substantial volatility. The minimum and maximum values show that the index fluctuated significantly, with monthly returns ranging from a decline of 17.28% to an increase of 8.6%. The average monthly return of the DXY was -0.088%, with a standard deviation of 1.894%. This suggests that the DXY was relatively stable during the sample period, with an average monthly decline of 0.088% and moderate volatility. The minimum and maximum values indicate that the DXY returns fluctuated between a decline of 4.62% and an increase of 5.13% monthly. The average exchange rate was 105.04 Kenyan shillings per US dollar,

with a standard deviation of 5.93. The exchange rate fluctuated between 91.49 and 121.90, suggesting significant volatility in the relative value of the two currencies. The average inflation rate indicates that, on average, the general price level of goods and services in Kenya increased by 6.195% per year during the sample period. The inflation rate fluctuated between 3.73% and 11.7%, suggesting some variability in price levels. The average commercial banks' lending rate was 13.52%, with a standard deviation of 1.90. This indicates that, on average, banks charged an interest rate of 13.52% on loans to businesses and individuals. The interest rate fluctuated between 11.75% and 18.3%, suggesting some variability in the cost of borrowing.

Table 4-1: Descriptive statistics

Variable	Mean	Median	Standard Deviation	Minimum	Maximum
NSE20 Return	-0.01232	-0.00549	0.04675	-0.17282	0.08603
DXY Return	-0.00088	-0.00233	0.01894	-0.04621	0.05133
Exchange Rate	105.04	103.14	5.92649	91.49	121.90
Inflation Rate	6.195	5.840	1.60643	3.730	11.700
Interest Rate	13.52	12.53	1.89995	11.75	18.30

4.2.2 Diagnostic tests

Stationarity tests

Stationarity is a crucial property of time series data that ensures the statistical properties of the series, such as the mean and variance, remain constant over time. Time series analysis techniques, including correlation and regression, rely on the assumption of stationarity. To assess the stationarity of the variables used in this study, Augmented Dickey-Fuller (ADF) tests were conducted. The null hypothesis of this test is that a time series has a unit root, which implies non-

stationarity. If the p-value of the test is less than the significance level (typically 0.05), the null hypothesis is rejected, and the series is considered stationary.

Initially, ADF tests were conducted on the original datasets. However, the results indicated that only the NSE20 share index series was stationary as shown by the results in table 4-2 below. To address this, the first differences of these variables were calculated, creating the Inflation, Exchange Rate, and Interest Rate differenced variables. ADF tests were then performed on these differenced variables to confirm their stationarity and results indicated in table 4-3 below. For NSE 20 and DXY index, the log returns were obtained since the use of prices may lead to spurious regressions despite stationarity of NSE 20 price data. The results clearly show that all variables used in the final analysis are stationary, as their p-values are less than 0.05. This confirms that the data meets the stationarity assumption required for valid correlation and regression analysis.

Table 4-2: ADF tests of the variables

Variable	ADF Statistic	P-Value	Stationary? ($p < 0.05$)
NSE20 Index Price Data	-3.629012	0.034573	YES
DXY Price Data	-2.359220	0.428008	NO
Exchange Rate Data	-1.086130	0.920448	NO
Inflation Rate Data	-1.832727	0.645567	NO
Interest Rate Data	-2.068331	0.548210	NO

Table 4-3: Stationarity tests of differenced variables

Variable	ADF Statistic	P-Value	Stationary? (p<0.05)
NSE20 log returns	-3.9966	0.01279	YES
DXY log returns	-3.9301	0.01596	YES
Exchange Rate differenced	-3.5698	0.04003	YES
Inflation Rate differenced	-5.5644	0.01	YES
Interest Rate differenced	-4.0425	0.01061	YES

Collinearity tests

To examine the relationships between the variables, a Pearson correlation analysis was conducted. The Pearson correlation measures the strength and direction of the linear association between two variables. Table 4-4 below presents the results of the Pearson correlation analysis.

Table 4-4: Pearson correlation analysis

Variable	NSE20 Return	DXY Return	Exchange Rate diff	Inflation diff	Interest Rate diff
NSE20 Return	1	-0.005865	-0.20388	0.107412	0.027807
DXY Return	-0.005865	1	-0.071025	0.11572	0.13377
Exchange Rate diff	-0.20388	-0.071025	1	0.036626	0.101991
Inflation diff	0.107412	0.11572	0.036626	1	-0.005277
Interest Rate diff	0.027807	0.13377	0.101991	-0.005277	1

The correlation between NSE20 Return & DXY Return is very weak (-0.006), suggesting little to no linear relationship between NSE 20 returns and DXY returns. This implies that movements in the US dollar, as reflected in the DXY, do not have a strong direct linear impact on the Kenyan stock market. The correlation between NSE20 Return & Exchange Rate diff is -0.204, indicating a weak negative relationship. This suggests that when the Kenyan shilling appreciates (exchange rate decreases), NSE 20 returns tend to be slightly higher. Weak positive relations are also observed between NSE Return and both inflation and interest rates. The association among the independent variables is seen to be weak implying that multicollinearity is not an issue for this analysis and thus the variables may be used together in regression analysis.

4.3 Regression analysis

4.3.1 Initial model

NSE 20 returns were regressed against four predictors, DXY Returns, inflation rate, exchange rate and interest rate. The summary statistics of the model are as shown in Table 4-5 below. The results of the regression model show that the intercept is statistically significant only at the 10% level, indicating that when all other variables are zero, there is a slight negative trend in NSE 20 returns for the period under study. The coefficient for DXY Return is not statistically significant, indicating that changes in DXY alone do not have a strong direct impact on NSE 20 returns. The coefficient for Exchange Rate Diff is negative and statistically significant at the 5% level, suggesting that an appreciation of the Kenyan shilling is associated with higher NSE 20 returns as seen under correlation analysis. The coefficients for Inflation Diff and Interest Rate Diff are not statistically significant, suggesting that these variables do not have a strong linear relationship with NSE 20 returns in this model.

The R-squared value for this model is 0.05903, indicating that the model explains only a small portion of the variance in NSE 20 returns. This suggests that other factors not included in the model explain about 94% of the Kenyan stock market's performance. The adjusted R-squared, which accounts for the number of predictors in the model, is even lower at 0.01674.

Table 4-5: Regression analysis summary statistics

	Coefficient	Standard Error	t-value	p-value	Significance Level
(Intercept)	-0.008908	0.005028	-1.772	0.0799	10%
DXY Return	-0.105576	0.258968	-0.408	0.6845	Not significant
Exchange Rate Diff	-0.009352	0.004475	-2.09	0.0395	5%
Inflation Diff	0.007099	0.006101	1.163	0.2477	Not significant
Interest Rate Diff	0.005788	0.010739	0.539	0.5912	Not significant
R-square: 0.05903 Adjusted R-squared: 0.01674 Residual Std Error: 0.04635					

4.3.2 Model with interaction terms

To explore potential interaction effects, an interaction term between DXY Returns and Exchange Rate Diff was added to the model. This was motivated by the observation that the impact of DXY changes on NSE returns might depend on the direction and magnitude of exchange rate movements.

The results of the model with the interaction term are presented in Table 4-6 below. The results show that the interaction term (DXY Return* Exchange Rate Diff) is statistically significant at the 5% level, p-value 0.03106 is less than 0.05, confirming the presence of an interaction effect. This suggests that the effect of DXY Return on NSE20 Return depends on the level of Exchange Rate Diff.

Table 4-6: Summary statistics; Model with interaction term

	Coefficient	Standard Error	t-value	p-value	Significance Level
(Intercept)	-0.008518	0.004927	-1.729	0.08734	10%
DXY Return	0.013457	0.259359	0.052	0.95874	Not significant
Exchange Rate Diff	-0.013323	0.004742	-2.81	0.00611	5%
Inflation Diff	0.007924	0.005987	1.324	0.18907	Not significant
Interest Rate Diff	0.003333	0.010576	0.315	0.75343	Not significant
DXY Return*Exchange Rate Diff	-0.548873	0.250466	-2.191	0.03106	5%
R-squared	0.1077	Adjusted squared	R-	Residual Std Error	0.04539
			0.05702		

4.3.3 Reduced Model

Since Inflation Diff and Interest Rate Diff were not statistically significant in the initial model and in the model with the interaction term, they were removed to create a more parsimonious model. The decision to remove these variables was further supported by the Akaike Information Criterion (AIC) comparison, which showed that the model without these variables had a lower AIC value, indicating a better balance of goodness of fit and model complexity. The reported AIC values were AIC Initial Model: -303.8086 & AIC Reduced Model: -308.8626

The final reduced model is:

$$\begin{aligned}
 NSE20 \text{ Return} = & -0.009028 + 0.061581 * DXY \text{ Return} - 0.012808 * \\
 & ExchangeRate \text{ Diff} - 0.535788 * DXY \text{ Return} * \\
 & ExchangeRate \text{ Diff}
 \end{aligned}$$

The results of the regression of the reduced model are as shown in Table 4-7 below.

Table 4-7: Summary statistics of reduced model

Variable	Coefficient	Standard Error	t-value	p-value	Significance Level
(Intercept)	-0.009028	0.004891	-1.846	0.06822	10%
DXY Return	0.061581	0.254313	0.242	0.80922	Not significant
Exchange Rate Diff	-0.012808	0.004717	-2.715	0.00794	5%
DXY Return * Exchange Rate Diff	-0.535788	0.248296	-2.158	0.0336	5%
R-squared	0.08911	Adjusted R-squared	0.05875	Residual Standard Error	0.04535

The results of the reduced model are consistent with the previous models, showing a significant interaction effect between DXY Return and Exchange Rate Diff. The adjusted R-squared is similar to the model with the interaction term, indicating that removing Inflation and Interest Rate did not negatively impact the model fit.

4.4 Model validation

Overall model significance

To assess the overall significance of the regression models, F statistics were extracted from the regression summary statistics. The F-test evaluates whether the model explains a significant amount of variance in the dependent variable. This is determined by examining the p-value associated with the F-Statistic. If the p-value is less than the chosen significance level (typically 0.05), then the model is considered statistically significant. In this study, the initial model, which included DXY Return, Exchange Rate, Inflation, and Interest Rate as predictors, was found to be statistically insignificant ($F(4, 89) = 1.396$, $p = 0.2419$) as shown in table 4-8 below. This indicates that the combination of these four predictors does not provide strong evidence of a relationship between these predictors and the stock market performance in Kenya.

However, the reduced model, which includes only DXY Return, Exchange Rate, and their interaction term, exhibits a different result as shown in Table 4-8 below. The F-test for the reduced model shows a statistically significant result ($F(3, 90) = 2.935$, $p = 0.0376$). This suggests that the reduced set of predictors, particularly the inclusion of the interaction term, does explain a significant portion of the variance in NSE20 Return. Therefore, the reduced model provides stronger evidence of a relationship between these specific predictors and the returns on the NSE 20 index.

Table 4-8: Model significance

Model	F-Statistic	P-Value
Initial model	1.396	0.2419
Reduced model	2.935	0.03764

Multicollinearity (Reduced Model)

To assess multicollinearity in the final reduced model, Variance Inflation Factors (VIFs) were calculated for the explanatory variables. Multicollinearity occurs when there is high correlation between the predictor variables in a multiple regression model, which can lead to inflated standard errors and unstable coefficient estimates. A VIF of 1 indicates no multicollinearity, while higher VIFs suggest increasing levels of multicollinearity. A common rule of thumb is that VIFs greater than 5 or 10 indicate problematic multicollinearity.

The VIFs for the explanatory variables in the reduced model are presented in Table 4-9.

Table 4-9: Variance Inflation Factors (VIFs) for the reduced model

Variable	VIF
DXY Return	1.041086
Exchange Rate	1.020367
DXY Return*Exchange Rate	1.042994

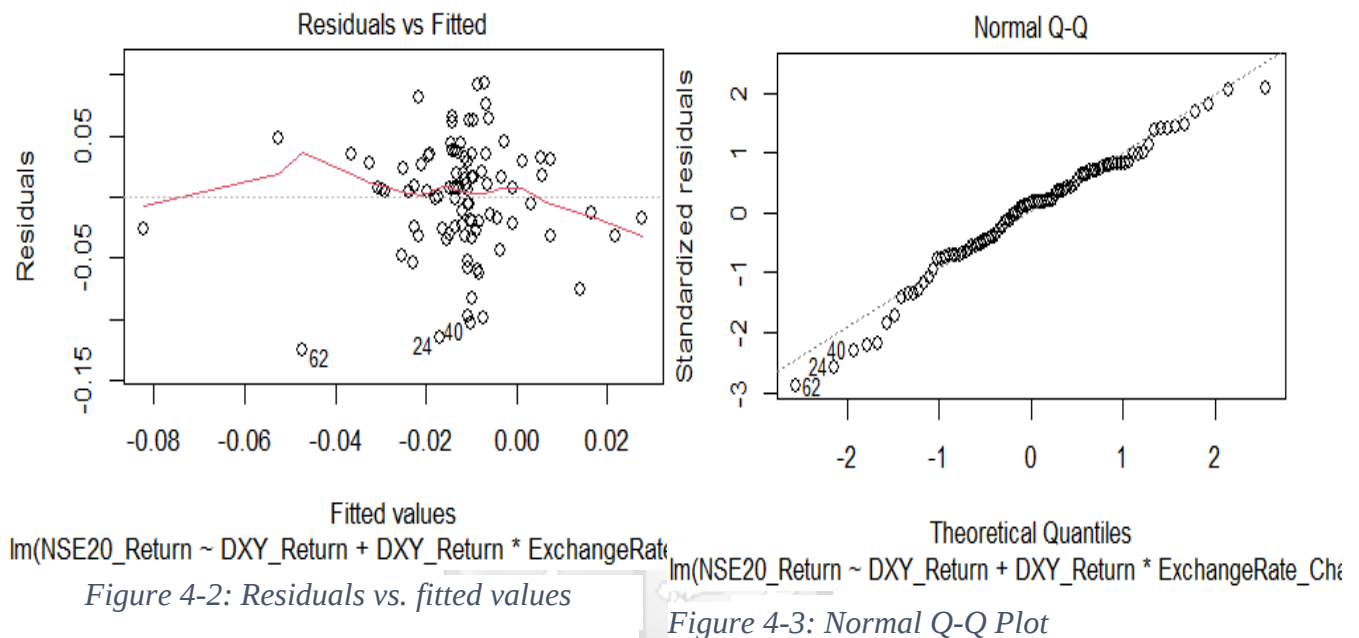
As shown above, all VIF values are close to 1, indicating that there is no significant multicollinearity between the explanatory variables in the reduced model. This suggests that the predictor variables are not highly correlated with each other, and therefore, the estimated coefficients are reliable and can be interpreted individually without the concern of inflated standard errors due to multicollinearity.

Residual Analysis (Reduced Model)

Residual analysis involves examining the residuals to assess whether the model's assumptions are met. These assumptions typically include linearity, homoscedasticity and normality of residuals.

To assess the linearity and homoscedasticity assumptions, a plot of residuals versus fitted values was generated (Figure 4-2). If the model is well-fitted, the residuals should be randomly scattered around zero, with no discernible pattern or trend. To evaluate the normality assumption, a normal

Q-Q plot was created (Figure 4-3). If the residuals are normally distributed, the points on the Q-Q plot should approximately fall along a straight diagonal line.



The residual plots show no obvious patterns or deviations from normality. In the residuals vs fitted plot, the residuals appear to be randomly scattered around zero, with no clear trends, supporting the assumptions of linearity and homoscedasticity. In the normal Q-Q plot, the points generally follow the straight diagonal line, suggesting that the residuals are approximately normally distributed.

The model validation checks provide strong evidence for the reliability and validity of the reduced model. The reduced model is statistically significant overall, indicating that the included predictors explain a significant portion of the variance in NSE 20 returns. The absence of multicollinearity ensures that the estimated coefficients can be interpreted reliably, and the residual analysis

suggests that the model's assumptions are reasonably met, further supporting the model's adequacy. The model validation process confirms the robustness of the reduced model and strengthens the validity of the conclusions drawn from the analysis.



CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

This study aimed to assess the effect of dollar index fluctuation on NSE performance in Kenya, using monthly data from February 2015 to December 2022. The analysis focused on the NSE 20 index and employed a multiple linear regression model with the interaction between the DXY return and the change in the exchange rate. The findings of this study reveal several key insights:

The results indicate that fluctuations in the US dollar index (DXY) alone do not have a statistically significant direct impact on the returns of the NSE 20 index. This suggests that changes in the DXY do not directly translate into immediate changes in the Kenyan stock market's performance. However, there is a statistically significant interaction effect between the DXY return and the change in the exchange rate. This implies that the effect of DXY fluctuations on NSE 20 returns depends on the direction and magnitude of changes in the Kenyan shilling's exchange rate. Specifically, when the shilling appreciates, a stronger dollar tends to be associated with lower NSE 20 returns, while the opposite is observed when the shilling is depreciating.

The analysis also shows a significant negative relationship between changes in the exchange rate and NSE 20 returns. This suggests that an appreciation of the Kenyan shilling tends to be associated with higher returns on the NSE 20 index. The overall explanatory power of the regression model is relatively low, as indicated by the R-squared value. This suggests that other factors not included in the model, such as domestic economic conditions, political events, or global market sentiment, might play a significant role in influencing the performance of the NSE 20 index.

5.2 Conclusion

This study has provided valuable insights into the complex relationship between the US dollar index (DXY), exchange rate fluctuations, and the performance of the Nairobi Securities Exchange (NSE) in Kenya. While there is no direct effect of DXY changes on NSE 20 returns, the presence of a significant interaction effect with exchange rate changes highlights the importance of considering currency dynamics when analyzing the Kenyan stock market. The findings also underscore the role of exchange rate appreciation in attracting foreign investment and potentially boosting stock market performance.

5.3 Recommendations

Based on the findings of this study, the following recommendations are made:

For Investors: Investors should pay close attention to exchange rate movements when making investment decisions in the Kenyan stock market. Diversification strategies could be employed to mitigate the risks associated with currency fluctuations. Understanding the broader economic and political context is crucial for making informed investment decisions.

For Policymakers: Policymakers in Kenya should be aware of the potential impact of exchange rate policies on the stock market and the broader economy. Maintaining a stable macroeconomic environment and managing exchange rate policies effectively can promote investor confidence and attract foreign investment, contributing to the growth and stability of the Kenyan economy.

5.4 Areas for Further Research

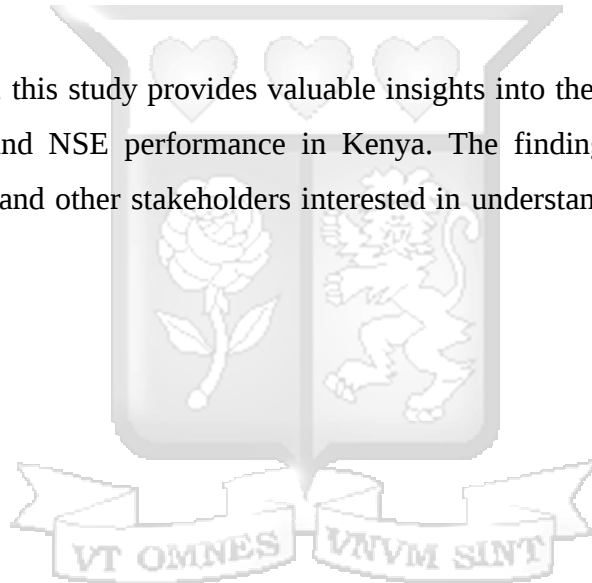
Future research could build on this study by expanding the dataset to include a longer time period or higher frequency data (e.g., daily or weekly) to capture more nuanced patterns and dynamics. Also, incorporating additional variables in the model to investigate the role of other factors that might influence NSE performance, such as domestic economic indicators (GDP growth, interest rates), political events, global market sentiment, and commodity prices would be a valuable

addition to this research. It may also be important to explore the existence of any non-linear relationship between the variables.

5.5 Limitations of the Research

The sample size used in the analysis is relatively small, which might limit the generalizability of the findings. Also, the model may not include all relevant factors that could influence NSE performance as seen by the R squared of the model. The study also relied on secondary data, which might have limitations in terms of accuracy or completeness. The study also relied solely on the existence of linear relationships between the variables which may have influenced their significance.

Despite these limitations, this study provides valuable insights into the relationship between the DXY, exchange rates, and NSE performance in Kenya. The findings have implications for investors, policymakers, and other stakeholders interested in understanding the dynamics of the Kenyan stock market.



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