The Impact of U.S. Monetary Policy on Kenyan Exchange Rate Volatility: An Empirical Analysis of KES/USD and KES/UGX Dynamics

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the Research Project contains no material previously published or written by another person except where due reference is made in the Research Project itself.

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This Research Project has been submitted for examination with my approval as the Supervisor.

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ABSTRACT

This study examines the impact of U.S. monetary policy on the volatility of the Kenyan Shilling (KES) against the U.S. Dollar (USD) and Ugandan Shilling (UGX) from 2014 to 2024. Using GARCH, EGARCH, and DCC-GARCH models, it identifies significant volatility clustering and asymmetric responses to monetary policy shocks. While U.S. policy announcements show limited influence on short-term volatility, spillover effects highlight dynamic correlations between KES/USD and KES/UGX, reflecting regional transmission of external shocks. The findings provide critical insights for policymakers and market participants, emphasizing adaptive strategies to mitigate external economic risks and contributing to the understanding of exchange rate dynamics in emerging markets.

1. INTRODUCTION

1.1 Background of the study

Global financial markets are increasingly interconnected, amplifying the influence of U.S. monetary policy due to the central role of the U.S. dollar in international trade and finance. Research highlights that U.S. monetary policy, particularly during periods of unconventional measures, significantly affects emerging markets by altering their financial and economic conditions (Anaya et al., 2017). As the dominant international reserve currency, the USD plays a crucial role in global financial stability and trade dynamics (Dodwell, 2015). Consequently, decisions made by the U.S. Federal Reserve resonate globally, driving movements in financial variables and influencing the monetary policies of other nations. Emerging markets like Kenya are particularly susceptible to such changes, given their reliance on external economic stability and growth (Arora & Cerisola, 2000).

In recent years, the U.S. Federal Reserve has adopted significant policy shifts in response to economic crises, such as the 2008 financial crash and the COVID-19 pandemic. These policies have alternated between expansionary and contractionary stances, generating ripple effects across countries heavily dependent on the USD for trade and financial transactions, including Kenya.

Kenya's trade relationships with the United States, European Union (EU), and United Kingdom make the Kenyan Shilling (KES) vulnerable to exchange rate fluctuations driven by U.S. monetary policy changes. Tightening of U.S. monetary policy often triggers capital outflows from emerging markets as investors seek higher returns in the U.S., leading to depreciation of local currencies. For instance, the KES depreciated by 26.8% against the USD in 2023, reflecting such dynamics (Honig, 2019). This depreciation is not purely nominal; it has severe economic consequences, including increased inflation and economic instability. In Kenya, exchange rate volatility has been associated with heightened transaction costs and reduced business profitability, exacerbating broader economic challenges (Muigai & Cherono, 2019).

While prior research on Kenya's exchange rate volatility has largely concentrated on the KES/USD pair, spillover effects to other currency pairs, such as KES/UGX, remain underexplored. The specific role of U.S. monetary policy in driving KES/USD volatility is a critical question requiring empirical investigation. Gaining a nuanced understanding of these dynamics is vital for policymakers and businesses in mitigating risks associated with external shocks.

This study aims to address this gap by analyzing the impact of U.S. monetary policy on KES/USD volatility while examining spillover effects on KES/UGX. These findings will provide valuable insights into the broader implications of external monetary policies for Kenya's foreign exchange market.

1.2 Problem Statement

Global financial markets are increasingly interconnected, amplifying the influence of U.S. monetary policy due to the central role of the U.S. dollar in international trade and finance. Research highlights that U.S. monetary policy, particularly during periods of unconventional measures, significantly affects emerging markets by altering their financial and economic conditions (Anaya et al., 2017). As the dominant international reserve currency, the USD plays a crucial role in global financial stability and trade dynamics (Dodwell, 2015). Consequently, decisions made by the U.S. Federal Reserve resonate globally, driving movements in financial variables and influencing the monetary policies of other nations. Emerging markets like Kenya are particularly susceptible to such changes, given their reliance on external economic stability and growth (Arora & Cerisola, 2000).

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1.3 Research Objectives

Objectives and Research Questions

Main Objective

- To empirically analyse the impact of U.S. monetary policy on the volatility of the Kenyan Shilling (KES) against the U.S. Dollar (USD) and the Ugandan Shilling (UGX).

Specific Objectives

- To investigate how different U.S monetary policy actions influence the volatility of the KES/USD exchange rate.

- To examine the spillover effects of USD/KES on KES/UGX.

1.4 Research Questions

-1. How does U.S. monetary policy influence the volatility of the KES/USD exchange rate?

-2. What are the spillover effects of KES/USD volatility on KES/UGX exchange rates?

1.5 Significance of the Study

U.S. monetary policy significantly influences global financial markets, with its effects extending beyond national borders. For emerging economies like Kenya, shifts in U.S. monetary policy often trigger substantial exchange rate fluctuations, contributing to economic instability. Previous studies highlight the pronounced impact of U.S. interest rate adjustments on exchange rates in developing countries, underscoring the need for global policy coordination (Katusiime, 2021). This study seeks to empirically analyse the impact of U.S. monetary policy on the volatility of the Kenyan Shilling (KES) against major foreign currencies, particularly the U.S. Dollar (USD) and the Ugandan Shilling (UGX). Understanding these dynamics is essential for anticipating external monetary shocks and formulating strategies to mitigate adverse economic impacts (Nandwa et al., 2018).

This research addresses a critical gap in the literature by focusing on exchange rate volatility involving the Kenyan Shilling and key currency pairs, which previous studies have largely overlooked. While substantial research exists on the global impacts of U.S. monetary policy, limited empirical analysis examines its specific effects on KES volatility. Studies such as Gachoki, Okeri, and Korir (2021) have primarily investigated exchange rate misalignments and their implications for Kenya-European Union trade, neglecting other critical currency pairs. This study bridges this gap by offering a detailed empirical analysis of KES/USD and KES/UGX exchange rates, contributing to the understanding of Kenya's financial integration with global and regional markets (Kemboi & Kosgei, 2018).

The findings of this research hold significant implications for Kenya's monetary and fiscal policies. By providing insights into how U.S. monetary policy affects exchange rate volatility, the study equips policymakers with the tools to better anticipate and manage external economic shocks. This knowledge will aid institutions such as the Central Bank of Kenya in devising strategies to mitigate the adverse effects of exchange rate volatility, thereby fostering economic stability. Moreover, the study's results could inform the design of adaptive monetary policies to cushion the economy against unpredictable global monetary shifts.

The study also contributes to the theoretical understanding of the relationship between monetary policy and exchange rate volatility in emerging markets. By focusing on Kenya, this research adds to the broader discourse on how external monetary policies influence exchange rate dynamics in similar economies. Its findings may serve as a reference for understanding the effects of global monetary policies on other emerging markets, thereby enhancing the applicability of existing economic theories.

Beyond academic and policy contributions, this research benefits Kenyan society at large. A stable exchange rate environment, informed by the study's findings, could ensure consistent pricing for goods and services, improving economic conditions for businesses and consumers. Research by Titus, Wagala, and Muriithi (2022) emphasizes that stabilizing exchange rates enhances international trade, supporting economic growth and benefitting both businesses and households (Titus et al., 2022).

Furthermore, by encouraging a more informed public discourse on global monetary policies, this study fosters a deeper understanding of the factors shaping Kenya's economic stability. As Rono (2002) notes, informed discussions on economic policies are crucial for addressing broader societal impacts and enhancing economic resilience. Similarly, Musyoki, Pokhariyal, and Pundo (2012) highlight the detrimental effects of exchange rate volatility on Kenya's economic growth, underscoring the need for effective strategies to maintain stability.

In conclusion, this study offers crucial insights into the effects of U.S. monetary policy on the volatility of the Kenyan Shilling against key currencies. By addressing a gap in the literature and providing actionable recommendations for economic stability, the research contributes significantly to academic knowledge, policymaking, and societal welfare. Its findings will be invaluable to Kenyan policymakers, financial institutions, and broader stakeholders, fostering a more stable and resilient Kenyan economy.

2.LITERATURE REVIEW

This section reviews key theories and empirical studies relevant to understanding the impact of U.S. monetary policy on the volatility of Kenyan currency pairs. The analysis is structured around four core economic theories on exchange rates: Interest Rate Parity (IRP), Purchasing Power Parity (PPP), the Mundell-Fleming model, and the Martingale Hypothesis. Additionally, the review explores the role of macroeconomic announcements in influencing exchange rate volatility, providing a comprehensive foundation for the study.

2.1 Theories on Exchange Rate Volatility

2.1.1 Interest Rate Parity Theory

Interest Rate Parity (IRP) theory links interest rate differences between two countries to forward and spot exchange rates. It posits that capital flows to the country offering higher returns, causing exchange rates to adjust until the differential is offset by changes in the forward rate (Fama, 1984). This theory is particularly relevant in understanding how U.S. interest rate changes, a primary tool of monetary policy, can influence the Kenyan Shilling.

Fama (1984) analyzed forward and spot exchange rates within the IRP framework, questioning the ability of forward rates to predict future spot rates. His findings revealed deviations from IRP, suggesting the presence of market inefficiencies and risk premiums that limit forward rate accuracy. In Kenya, a rise in U.S. interest rates relative to local rates would likely drive capital outflows as investors seek higher returns abroad, leading to a depreciation of the KES against currencies such as the USD, GBP, EUR, and potentially the UGX (Chinn & Meredith, 2004).

However, IRP assumes no transaction costs and unrestricted capital mobility, conditions that are often absent in developing economies like Kenya. Challenges such as capital controls, political instability, and market frictions mean IRP may not fully capture the complexities of Kenya's financial system (Reinhart et al., 2003).

2.1.2 Purchasing Power Parity (PPP) Theory

Introduced by Gustav Cassel in the early 20th century, PPP theory posits that exchange rates adjust over the long term to equalize the purchasing power of different currencies. It links exchange rates to inflation differentials, asserting that a country with higher inflation will see its currency depreciate relative to countries with lower inflation (Rogoff, 1996). For instance, expansionary U.S. monetary policy leading to higher inflation could cause the KES to appreciate against the USD if Kenya maintains stable inflation levels.

While PPP explains long-term exchange rate trends driven by inflation, its short-term applicability is limited. Exchange rate movements are often influenced by speculative activity and capital flows rather than price adjustments (Dornbusch, 1985). Additionally, trade barriers and transportation costs can distort the relationship predicted by PPP, reducing its relevance for countries with structural differences in their economies.

2.1.3 Mundell-Fleming Model

The Mundell-Fleming model extends the IS-LM framework to open economies. It differentiates between fixed and floating exchange rate systems and provides insights into how monetary policy affects exchange rates and capital flows under different conditions (Mundell, 1963).

For Kenya, a floating exchange rate regime, the Mundell-Fleming model suggests that expansionary U.S. monetary policy could lead to capital outflows from Kenya as investors seek higher returns in the U.S. This outflow would likely result in a depreciation of the KES against the USD and potentially other major currencies like the GBP and EUR (Obstfeld & Rogoff, 1995). The model's assumption of unrestricted capital mobility and price stickiness in the short term is relevant in this context, as it aligns with the observed short-term volatility in exchange rates following U.S. monetary policy announcements.

However, Mundell-Fleming primarily focuses on short term dynamics and does not fully account for the role of expectations and speculative behaviour which influence exchange rate movement over longer periods.

2.1.4 Martingale Hypothesis

The Martingale hypothesis, articulated by Frenkel (1981), provides a statistical perspective on exchange rate behavior. It asserts that the best predictor of tomorrow's exchange rate is today's rate, assuming all available information is already reflected in the current rate. This aligns with market efficiency theory, suggesting that exchange rates follow a random walk and are driven by new information (Frenkel, 1981).

This hypothesis is particularly relevant for analyzing the unpredictability and volatility of exchange rates, key concerns in this study. While current spot rates may predict future rates, deviations often occur due to unforeseen information, underscoring the inherent volatility of exchange rates. Empirical evidence supports the hypothesis, highlighting the challenges of exchange rate forecasting and the rapid market adjustment to new data (Engel & Hamilton, 1990).

However, the Martingale hypothesis assumes perfect market efficiency, overlooking factors such as investor sentiment, speculative activity, and structural economic changes. These factors can introduce biases that significantly affect exchange rate dynamics, particularly in emerging markets like Kenya.

2.2 Empirical Review

Empirical analysis of exchange rate volatility and its responsiveness to macroeconomic announcements is critical for understanding the dynamics in foreign exchange markets. This review synthesizes findings from empirical studies, focusing on the speed of adjustment, the effects of monetary policy announcements, and the models used to capture these dynamics.

2.2.1 Speed of Adjustment

The speed of adjustment of exchange rate volatility following macroeconomic announcements is crucial for distinguishing the impact of these announcements from other market factors. (Cheung & Chinn, 2001) found that the exchange rate volatility adjusts rapidly—often within minutes—following announcements related to inflation, unemployment, trade deficits, and interest rates. This rapid adjustment supports the efficient market hypothesis, suggesting that exchange rates quickly incorporate new information, leaving little room for sustained volatility from such announcements.

Similarly, (Jansen & De Haan, 2003) observed that while exchange rate volatility spikes in response to macroeconomic news, it typically reverts to its normal level within a day. This quick adjustment aligns with the findings of (Patell & Wolfson, 1984) and (Ederington & Lee, 1993), who noted that the highest volatility occurs within the first few minutes of an announcement, normalizing within forty minutes. This behaviour indicates that the forex market rapidly digests new information, leading to transient rather than persistent volatility. In the Kenyan context, the rapid adjustment of exchange rate volatility has been confirmed by studies such as those by (Rotich et al., 2007), which show that the CBK's announcements have a quick but often temporary impact on exchange rates. This is particularly evident in periods of economic turbulence, where market participants quickly respond to CBK interventions, leading to short-lived spikes in volatility.

2.2.2 Impact of Macroeconomic Announcements on Exchange Rate Volatility

The literature also highlights the significant impact of macroeconomic announcements on exchange rate volatility. Empirical studies have shown that both scheduled and unscheduled macroeconomic news can cause substantial fluctuations in exchange rates, reflecting the sensitivity of the foreign exchange market to new information (Galati & Ho, 2003; Laakkonen, 2004). For example, Galati & Ho (2003) found that positive economic news correlated with the appreciation of the Euro against the USD, underscoring the influence of macroeconomic factors on exchange rates.

Similarly Laakkonen (2004) demonstrated that macroeconomic announcements significantly increase exchange rate volatility, particularly when they lead to unexpected outcomes that diverge from market expectations. This finding is further supported by Evans & Lyons (2008) , who attributed approximately 30% of exchange rate volatility to macroeconomic news, highlighting the importance of timely information in the forex market.

In contrast, some studies argue that the impact of macroeconomic announcements is often short-lived. Andersen et al (2003) suggested that while such news can affect exchange rates, its influence is secondary to calendar effects, which are identified as primary drivers of volatility. Moreover, Almeida et al (1998) found that the effects of macroeconomic announcements on exchange rates typically dissipate within a few hours, indicating that their impact is transient and may not have long-lasting effects on exchange rate levels.

The timing of macroeconomic announcements also plays a crucial role in determining their impact on exchange rate volatility. According Andersen et al (2003), unscheduled announcements tend to have a more significant, albeit temporary, impact on exchange rates compared to scheduled ones, which may increase volatility but in a more predictable manner. This distinction is critical for understanding how different types of news events contribute to exchange rate movements and the overall volatility in the forex market.

The theories and empirical studies reviewed provide a comprehensive framework for analysing the impact of U.S. monetary policy on Kenyan exchange rate volatility. The IRP theory and Mundell-Fleming model offer insights into how interest rate differentials and macroeconomic dynamics influence exchange rates, particularly in the short term. The PPP theory provides a longer-term perspective, linking exchange rate movements to inflation differentials, while the Martingale hypothesis underscores the inherent unpredictability of exchange rates, further complicated by the effects of macroeconomic announcements. Together, these frameworks and studies offer a robust foundation for examining the complex relationship between U.S. monetary policy and the volatility of the Kenyan Shilling against major currencies.

2.2.4 Empirical Models and Methodologies

To analyse the impact of monetary policy announcements on exchange rate volatility, researchers have employed various econometric models, with the GARCH (1,1) model being particularly popular. This model captures volatility clustering—a common feature in financial time series data where periods of high volatility are followed by high volatility, and low volatility follows low volatility (Bollerslev, 1986). The GARCH (1,1) model was used by (Wanjiru & Othieno, 2015) to study the KES/USD, KES/GBP, KES/EUR, and KES/UGX exchange rates. Their findings indicated significant ARCH and GARCH effects, which justified the use of such models in capturing the time-varying nature of exchange rate volatility. However, while the GARCH (1,1) model is effective in modelling volatility, it has limitations, particularly in capturing leverage effects, where negative shocks have a larger impact on volatility than positive shocks. To address this, the EGARCH model, which accounts for asymmetries in volatility responses, was also used by Wanjiru & Othieno (2015). This model was particularly useful in periods of significant market stress, such as during the 2011-2012 exchange rate interventions by the CBK, where negative news had a disproportionately large impact on volatility. No study has been done since and the effect of announcement on the U.S monetary policy on Kenyan currency pairs has never been measured.

The empirical evidence suggests that in Kenya, monetary policy announcements have a limited and short-lived impact on exchange rate levels but can significantly influence volatility, particularly when the announcements involve direct market interventions. The findings also underscore the importance of using high-frequency data to capture the immediate effects of such announcements.

Moreover, the lack of persistence in volatility following policy announcements, as noted by Almeida et al (1998), indicates that other factors, such as external economic shocks, trade balances, and speculative activities, play a more substantial role in driving exchange rate volatility in Kenya. This aligns with the broader literature, which suggests that while macroeconomic news can cause short-term volatility spikes, these effects are secondary to the fundamental economic forces that shape long-term exchange rate movements.

Despite these findings, the specific impact of U.S. monetary policy on Kenyan exchange rate volatility remains an unexplored area. The proposed research topic represents a new inquiry into how U.S. interest rate changes and other monetary policy actions influence the Kenyan Shilling's volatility against major and regional currencies. This study aims to fill a significant gap in the literature, providing insights into how external monetary policies from a major global economy like the United States can affect the exchange rate dynamics of a developing country like Kenya.

3.METHODOLOGY

This section outlines the methodology used to investigate the impact of U.S. monetary policy on the volatility of the Kenyan Shilling (KES) exchange rates against major and regional currency pairs.

3.1 Research Design

This study employs a comparative econometric research design to investigate the impact of U.S. monetary policy on the volatility of Kenyan exchange rates. The primary focus is on the KES/USD exchange rate, with spillover effects on the KES/UGX exchange rate analyzed as secondary diagnostics. The research uses daily exchange rate data from January 2014 to June 2024, capturing the influence of U.S. monetary policy across various monetary regimes and global economic conditions.

To model exchange rate volatility, the study applies the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) framework, which effectively captures the volatility clustering common in financial time series. Additionally, the Exponential GARCH (EGARCH) model is employed to account for asymmetries in the impact of positive and negative shocks on exchange rate volatility, particularly those triggered by monetary policy announcements.

A comparative approach is utilized by fitting models both with and without U.S. monetary policy announcements. This enables a robust evaluation of the models' explanatory power using metrics such as the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). The incorporation of dummy variables for U.S. monetary policy events allows the analysis to isolate and quantify the effects of these announcements on both the level and volatility of exchange rates.

The study also examines spillover effects between the KES/USD and KES/UGX exchange rates using the Dynamic Conditional Correlation GARCH (DCC-GARCH) model. This model estimates time-varying correlations between the currency pairs, providing insights into the extent and nature of volatility transmission. By analyzing these dynamic relationships, the study identifies how external shocks, particularly those linked to U.S. monetary policy, propagate within the regional foreign exchange market. The DCC-GARCH framework offers a comprehensive approach to understanding the interconnectedness of exchange rates and their broader implications for regional trade dynamics.

3.2 Data Collection

The primary data for this study consists of daily exchange rate information for the Kenyan Shilling (KES) against two key currencies: the U.S. Dollar (USD) and the Ugandan Shilling (UGX). These exchange rates will be sourced from the Central Bank of Kenya (CBK) and the Kenya National Bureau of Statistics (KNBS).

The analysis covers the period from January 2014 to June 2024. This timeframe was selected to encompass significant global economic events, including the monetary expansion following the financial crisis, the COVID-19 stimulus measures, and the subsequent monetary tightening aimed at combating inflationary pressures. Data on U.S. monetary policy will be obtained from the Federal Reserve Economic Data (FRED) database. This dataset includes key policy changes, such as interest rate adjustments, the implementation of quantitative easing (QE) programs, and other major shifts in U.S. monetary policy.

The selection of exchange rates is guided by Kenya's economic structure and its substantial trade relationships. The KES/USD exchange rate is a focal point due to the U.S. dollar's dominant role in international trade and finance. The inclusion of the KES/UGX exchange rate highlights the importance of regional trade within the East African Community, where Uganda serves as a key trading partner.

By incorporating both global and regional dimensions of exchange rate volatility, this study provides a comprehensive perspective on how U.S. monetary policy impacts Kenya's foreign exchange market. The selection of these currency pairs aligns with existing research, ensuring consistency and comparability in the study's findings.

3.3 Econometric Modelling

3.3.1 Stationarity Tests

To ensure reliable econometric analysis, the study begins by testing for stationarity in the exchange rate series. Non-stationary data may lead to spurious regression results. The Augmented Dickey-Fuller (ADF) test is employed to determine whether the series is stationary. If the test indicates non-stationarity, the series will be differenced until stationarity is achieved. The ADF test is specified as:

$$\Delta R_t = \alpha_0 + \alpha_1 t + \beta R_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta R_{t-i} + \epsilon_t$$

Where: - R_t represents the exchange rate series. - α_0 is the intercept. - $\alpha_1 t$ captures the time trend. - β is the coefficient of the lagged level of the series. - ϵ_t is the white noise error term.

The null hypothesis ($H_0 : \beta = 0$) tests for non-stationarity.

3.3.2 GARCH Model

To model exchange rate volatility, the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model is applied. This captures volatility clustering, a characteristic common in financial time series. The GARCH(1,1) model is expressed as:

Mean Equation:

$$R_t = \theta_0 + \sum_{k=1}^{p} \theta_k R_{t-k} + \epsilon_t$$

Variance Equation:

$$h_t = \alpha_0 + \alpha_1 \epsilon_{t-1}^2 + \beta h_{t-1}$$

Where: - h_t is the conditional variance. - α_1 (ARCH term) captures the immediate response to shocks. - β (GARCH term) reflects the persistence of volatility.

3.3.3 EGARCH Model

To address asymmetry in volatility, the Exponential GARCH (EGARCH) model is also employed. The EGARCH(1,1) model accounts for the possibility that negative shocks have a different impact on volatility compared to positive shocks. It is specified as:

$$\ln(h_t) = w + \beta \ln(h_{t-1}) + \gamma \frac{\epsilon_{t-1}}{\sqrt{h_{t-1}}} + \alpha \left(\frac{|\epsilon_{t-1}|}{\sqrt{h_{t-1}}} - \sqrt{\frac{2}{\pi}} \right)$$

Where: - $\ln(h_t)$ ensures non-negativity of variance. - γ captures asymmetry in the impact of shocks.

3.3.4 Incorporating U.S. Monetary Policy

The influence of U.S. monetary policy is examined using dummy variables in both the mean and variance equations. These dummy variables take a value of 1 on significant U.S. monetary policy announcement days and 0 otherwise. The extended models are:

Mean Equation:

$$R_t = \theta_0 + \sum_{k=1}^{p} \theta_k R_{t-k} + \sum_{i=1}^{n} \phi_i D_{i,t} + \epsilon_t$$

Variance Equation:

$$\ln(h_t) = w + \beta \ln(h_{t-1}) + \gamma \frac{\epsilon_{t-1}}{\sqrt{h_{t-1}}} + \alpha \left(\frac{|\epsilon_{t-1}|}{\sqrt{h_{t-1}}} - \sqrt{\frac{2}{\pi}} \right) + \sum_{i=1}^{n} \phi_i D_{i,t}$$

Where $D_{i,t}$ represents U.S. monetary policy event dummies.

3.3.5 Spillover Effects and Dynamic Conditional Correlation - GARCH

Spillover effects from the USD to UGX are assessed using the Dynamic Conditional Correlation - GARCH . The study incorporates KES/UGX into the models to evaluate cross-currency impacts.

Following standard practice, daily returns for USD/KES ($r_{1,t}$) and KES/UGX ($r_{2,t}$) were used as input. Each series was first fitted with a univariate GARCH(1,1) specification to capture its individual volatility dynamics. The resulting standardized residuals were then incorporated into a DCC framework to estimate a time-varying correlation matrix R_t.

Let

$$r_t = (r_{1,t}, r_{2,t})'$$

be a 2-dimensional vector of returns at time t, where $r_{1,t}$ corresponds to USD/KES returns and $r_{2,t}$ corresponds to KES/UGX returns. The DCC-GARCH approach proceeds in two stages:

3.3.5.1 Univariate GARCH Specification

Each return series is first modeled with a univariate GARCH(1,1) process (or any other appropriate GARCH variant). For asset $i \in \{1, 2\}$, the mean and variance equations are:

$$r_{i,t} = \mu_i + \epsilon_{i,t}, \quad \epsilon_{i,t} = h_{i,t}\, z_{i,t}, \quad z_{i,t} \sim i.i.d.\, N(0, 1),$$

$$h_{i,t} = \omega_i + \alpha_i\, \epsilon^2_{i,t-1} + \beta_i\, h_{i,t-1},$$

where

- μ_i is the intercept (or includes any additional regressors in the mean if desired),
- $h_{i,t}$ is the conditional variance of $r_{i,t}$,
- $\omega_i, \alpha_i, \beta_i$ are GARCH parameters, with $\omega_i > 0, \alpha_i, \beta_i \geq 0$, and typically $\alpha_i + \beta_i < 1$ for stationarity.

3.3.5.2 Dynamic Conditional Correlation (DCC)

Let H_t be the 2×2 conditional covariance matrix of r_t. In the DCC framework, we decompose:

$$H_t = D_t \, R_t \, D_t,$$

where

- $$D_t = \mathrm{diag}(h_{1,t}^{1/2},\, h_{2,t}^{1/2})$$

  is a diagonal matrix of conditional standard deviations obtained from the univariate GARCH models.

- R_t is the time-varying correlation matrix given by

  $$R_t = \mathrm{diag}(Q_t)^{-\frac{1}{2}} \, Q_t \, \mathrm{diag}(Q_t)^{-\frac{1}{2}},$$

  and Q_t evolves according to

  $$Q_t = (1 - \alpha - \beta)\, Q + \alpha \, (z_{t-1} z_{t-1}') + \beta \, Q_{t-1},$$

  with:

  - $z_t = (z_{1,t}, z_{2,t})'$ being the standardized innovations from each univariate GARCH, i.e.

    $$z_{i,t} = \frac{\epsilon_{i,t}}{\sqrt{h_{i,t}}}.$$

  - Q is the unconditional correlation of z_t.
  - α and β are DCC parameters (distinct from the univariate GARCH parameters α_i, β_i). Typically, $\alpha, \beta \geq 0$ and $\alpha + \beta < 1$ is imposed for convergence and stationarity in Q_t.

Hence, the correlation between USD/KES and KES/UGX at each time t is the $(1, 2)$ (and symmetrically $(2, 1)$) element of R_t, which evolves dynamically based on past shocks and past correlations.

These tests validate the model's adequacy and robustness.

The results from these econometric models will form the foundation for the analysis in Chapter 4, where the impact of U.S. monetary policy on the volatility of the Kenyan Shilling and its spillover effects on other currency pairs will be discussed in detail.

4. EMPRICAL ANALYSIS AND RESULTS

4.1 Introduction

This chapter presents the results of the econometric analysis conducted to investigate the impact of U.S. monetary policy on the volatility of the KES/USD exchange rate and the spillover effects on other currency pairs, specifically KES/UGX. The analysis uses Generalized Autoregressive Conditional Heteroskedasticity (GARCH) and Exponential GARCH (EGARCH) models to capture the time-varying nature of exchange rate volatility and to assess the asymmetric effects of positive and negative shocks on these currency pairs. A Dynamic Conditional Correlation GARCH is also used to investigate the spillover effect into the KES/UGX pair.

The primary focus of this chapter is to evaluate the extent to which U.S. monetary policy announcements influence the KES/USD exchange rate, and whether volatility in this pair transmits to other key currencies through spillover effects. Additionally, the chapter provides a detailed examination of the stationarity of the exchange rate time series, the persistence of volatility, and the dynamic relationships between currency pairs.

The results are structured into several key sections:

1. Descriptive statistics provide an overview of the data and highlight basic trends in exchange rate movements.

2. Stationarity testing determines whether the data is appropriate for time-series modeling by assessing the presence of unit roots.

3. GARCH and EGARCH model estimates present the volatility characteristics of the KES/USD exchange rate and the impact of U.S. monetary policy on its conditional variance.

4. Spillover effects examine the transmission of volatility from the KES/USD pair to the KES/UGX pair.

In this chapter, the empirical findings are discussed in relation to the research objectives, with particular emphasis on the implications of U.S. monetary policy for Kenya's foreign exchange market. Each section is accompanied by tables and graphical representations of key results, providing a comprehensive understanding of how external monetary policy shocks affect exchange rate dynamics in Kenya.

4.2 Descriptive Statistics

The USD/KES exchange rate has shown significant variation over the analyzed period. The minimum exchange rate of 61.50 reflects the lowest value in the dataset, captured during the earlier years (pre-2010). In contrast, the maximum value of 155.50 suggests a sharp depreciation of the Kenyan Shilling, particularly evident in the post-COVID period. This is mainly attributed to The median exchange rate of 91.90 aligns closely with the mean of 93.83, indicating that the distribution of prices is reasonably symmetric, though the rise in recent years reflects a trend toward higher exchange rates.

Table 1: Summary Statistics for USD/KES Exchange Rate (Price)

Statistic	Price
Minimum	61.50
Maximum	155.50
Mean	93.83
Median	91.90
1st Quartile (25%)	80.37
3rd Quartile (75%)	103.40

The price chart below provides a visual confirmation of these trends, with the USD/KES rate remaining relatively stable until 2010, followed by periods of volatility and gradual depreciation, particularly after 2015 and 2022. The sharp rise visible post-2020 aligns with economic disruptions, such as COVID-19 and recent global inflationary pressures, exacerbating the depreciation of the KES.

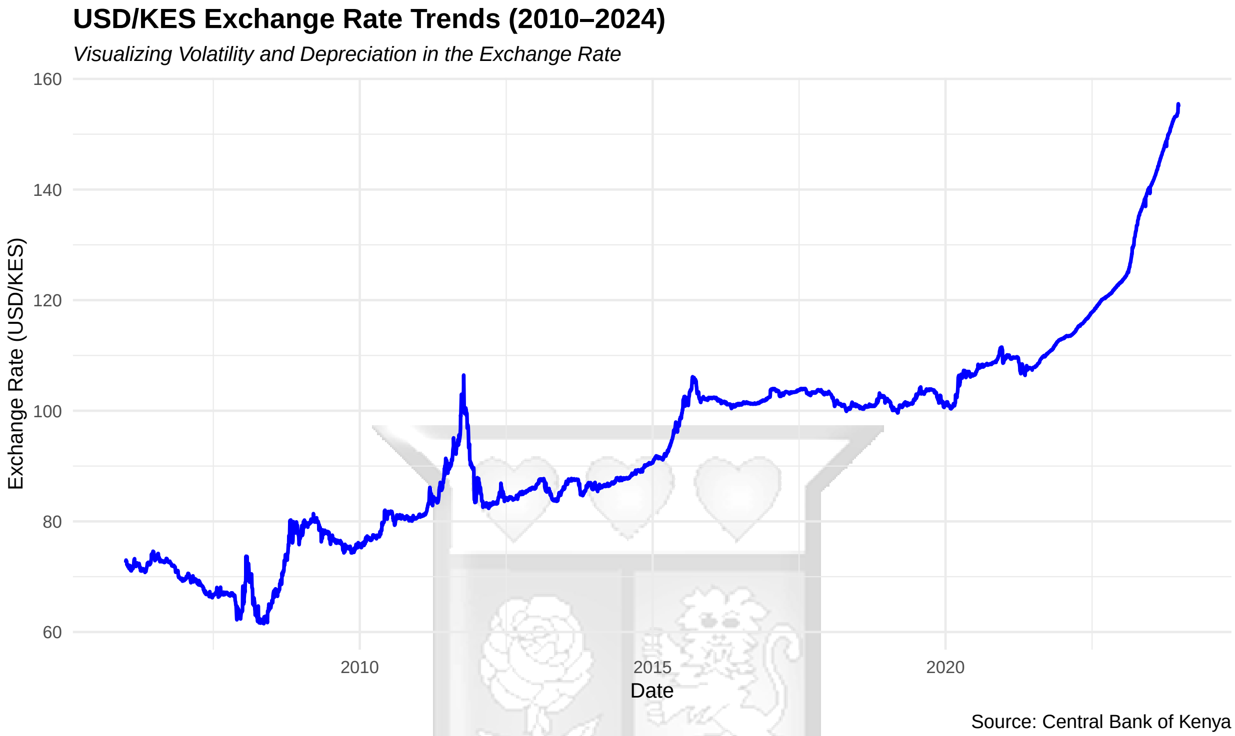

Figure 1: The USD/KES exchange rate remained relatively stable until 2010, followed by notable periods of volatility and gradual depreciation, especially after 2015 and 2022. The sharp rise post-2020 corresponds to economic disruptions, including COVID-19 and global inflationary pressures, exacerbating the Kenyan Shilling's depreciation. Source: Central Bank of Kenya.

The daily returns for USD/KES reflect the day-to-day percentage changes in the exchange rate. The mean return is 0.00017, suggesting a very slight positive trend in the average daily returns over time. The median return of 0.0000 indicates that, on most days, the return was close to zero, with minor fluctuations around it.

The minimum return of -0.0401 indicates a sharp one-day appreciation of the KES against the USD, while the maximum return of 0.0564 suggests a large one-day depreciation. Extremes likes these are indicative of high volatility at certain points, likely corresponding to external shocks or policy announcements.

The first quartile of -0.00096 and third quartile of 0.00119 show that most daily returns were relatively small, with more frequent minor appreciations and depreciations. However, the presence of large outliers emphasizes the importance of modeling these fluctuations using volatility-focused models like GARCH and EGARCH.

The descriptive statistics and visual trends highlight a progressive depreciation of the KES over time, with notable spikes in volatility during certain periods. The distribution of daily returns confirms that most changes are modest, but sharp fluctuations occur occasionally, reflecting sensitivity to external events and monetary policy changes. These trends justify the need for volatility models to better understand how external factors, such as U.S. monetary policy, influence the USD/KES exchange rate.

4.3 Stationarity Testing

The stationarity of the exchange rate data is essential for ensuring valid results in the volatility models and avoiding spurious regressions. The Augmented Dickey-Fuller (ADF) Test was applied to both the USD/KES daily returns and the USD/KES exchange rate (Price) series to assess the stationarity of the variables,. The ADF test evaluates the null hypothesis that the series has a unit root, implying non-stationarity. A rejection of the null hypothesis suggests that the series is stationar.

Table 2: ADF Test Results for USD/KES Returns

Statistic	Value
Dickey-Fuller Test Statistic	-14.727
Lag Order	16
p-value	0.01
Alternative Hypothesis	Stationary

The ADF test result for USD/KES daily returns shows a Dickey-Fuller test statistic of -14.727, which is significantly lower than the critical values at conventional significance levels. With a p-value of 0.01, the null hypothesis of a unit root is rejected, confirming that the return series is stationary.This indicates that the series does not exhibit persistent trends over time and is appropriate for use in time-series models, such as GARCH and EGARCH.

The Return Series Plot shows volatility clustering, where periods of high volatility (large fluctuations) are followed by further high-volatility periods, and low-volatility periods are followed by more calm market phases. Notably, sharp spikes in volatility are visible early in the series, corresponding to the 2007-08 global financial crisis, with more stable periods emerging toward the latter part of the series. This behavior is justifies the use of GARCH to capture the dynamic nature of volatility.

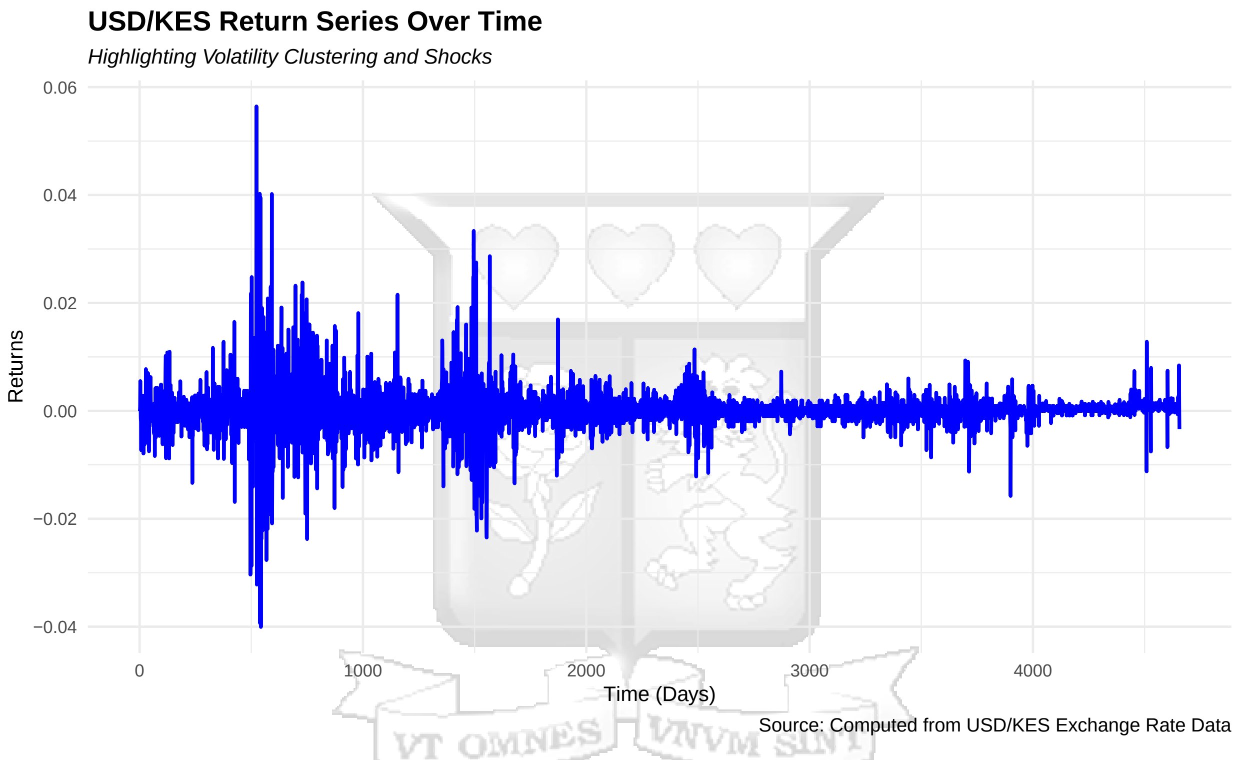

Figure 2: The return series of USD/KES shows significant volatility clustering, with notable spikes corresponding to major economic shocks such as the 2008 global financial crisis and COVID-19. The diminishing variance over time highlights periods of relative stability following these shocks.

In contrast, the ADF test on the USD/KES exchange rate (Price) series produces a Dickey-Fuller test statistic of 0.58236 with a p-value of 0.99. Since the p-value is significantly higher than 0.05, the null hypothesis of a unit root cannot be rejected, indicating that the price series is non-stationary. This result suggests that the exchange rate follows a long-term trend, consistent with the upward trajectory seen in the Price Plot. This non-stationarity reflects the progressive depreciatio* of the KES against the USD over time, influenced by structural economic factors.

Table 3: ADF Test Results for USD/KES Exchange Rate (Price)

Statistic	Value
Dickey-Fuller Test Statistic	0.58236
Lag Order	16
p-value	0.99
Alternative Hypothesis	Stationary

The daily return series is confirmed to be stationary, making it appropriate for volatility modeling using GARCH and EGARCH frameworks. On the other hand, the exchange rate (Price) series is non-stationary, indicating that it exhibits trends over time. As such, differencing or transforming the price series would be necessary if it were to be used in further modeling. However, since this study focuses primarily on volatility (returns), the confirmed stationarity of the return series ensures that it is well-suited for the next steps of the analysis.

4.4 GARCH Model Testing

In this section, we conduct a GARCH analysis to model the conditional volatility of the return series. Guided by the insights from the Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) plots below, which indicated weak autocorrelation in the return series, we optimized the mean process by testing a range of ARMA (p, q) specifications. Specifically, we evaluated ARMA models with orders from (0,0) to (2,2) to identify the configuration that minimized the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). The absence of strong, persistent autocorrelation patterns in the ACF and PACF plots suggested that a low-order ARMA model could adequately capture the mean dynamics of the return series. The model selection process revealed that the ARMA(1,1) specification provided the optimal fit, as indicated by the lowest AIC and BIC values (-9.262257 and -9.252566, respectively). This selection was pivotal in ensuring that the mean process specification aligned with the empirical characteristics of the series, minimizing potential misspecification bias in the volatility modeling.

The selected mean process was integrated into a GARCH(1,1) model, specified with a normal error distribution to capture the time-varying conditional variance of the return series. Additionally, a dummy variable (`QT Dummy`) was incorporated as an external regressor in the mean equation.

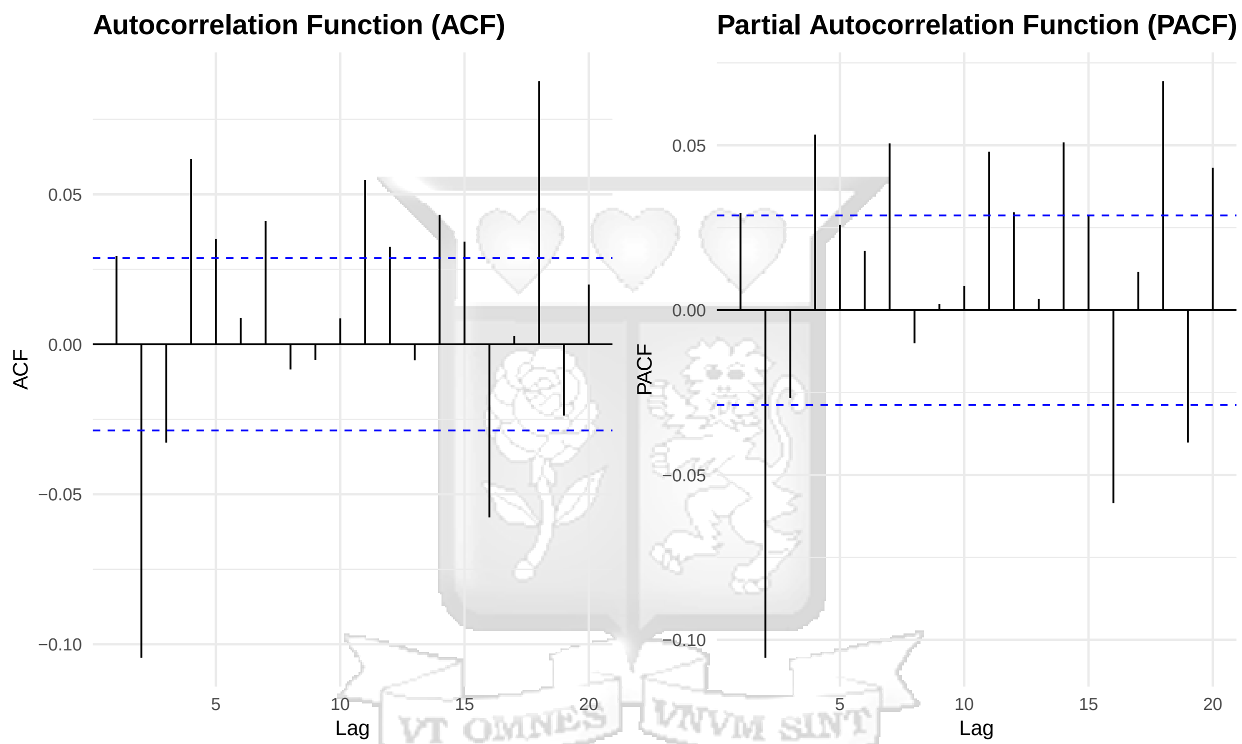

Figure 3: The ACF and PACF plots for the USD/KES return series reveal weak autocorrelation patterns, with significant lags at lower orders. These patterns justify the use of low-order ARMA models in volatility modeling.

Table 4: ARMA Model Selection Criteria

ARMA.Order	AIC	BIC
(0,0)	-9.261034	-9.254111
(1,0)	-9.260538	-9.252231
(2,0)	-9.261952	-9.252261
(0,1)	-9.261993	-9.253686
(1,1)	-9.262257	-9.252566
(2,1)	-9.261718	-9.250643
(0,2)	-9.262018	-9.252327
(1,2)	-9.261677	-9.250601
(2,2)	-9.259719	-9.247259

To further optimize the GARCH model, various error distributions were evaluated to determine the specification that best fits the return series' distributional characteristics. Recognizing that financial return data often exhibit heavy tails and skewness, four distributions were tested for the GARCH model: normal, Student's t (std), generalized error distribution (ged), and skewed Student's t (sstd). The model fit was assessed based on the log-likelihood, AIC, and BIC values, with higher log-likelihoods and lower AIC and BIC values indicating a better fit.

Among the distributions tested, the skewed Student's t distribution (sstd) produced the highest log-likelihood (22036.04) and the lowest AIC (-9.462645) and BIC (-9.452954) values, suggesting it as the most suitable distributional assumption for capturing the conditional variance of the return series. This superior fit relative to the normal distribution (log-likelihood = 21564.69, AIC = -9.261034, BIC = -9.254111) highlights the presence of excess kurtosis and potential skewness characteristic of financial return series. Consequently, the skewed Student's t distribution was selected to model the innovation process, allowing the GARCH model to more accurately reflect the heavy tails and asymmetry observed in the return series, thus enhancing the robustness and predictive power of the volatility model.

Table 5: Summary of GARCH Model Fit Results for Different Distributions

Distribution	Log_Likelihood	AIC	BIC
Normal (norm)	21564.69	-9.261034	-9.254111
Student's t (std)	22035.57	-9.462874	-9.454567
Generalized Error (ged)	22023.58	-9.457722	-9.449415
Skewed Student's t (sstd)	22036.04	-9.462645	-9.452954

We still have a stability problem and fit the GARCH on smaller periods. To solve this problem.

4.4.2 GARCH(1,1) Models

4.4.2.1 GARCH(1,1) Without Monetary Policy In the baseline GARCH(1,1) specification, the USD/KES return equation excludes the monetary policy variable. Formally:

$$r_t = \mu + \epsilon_t, \quad \epsilon_t = \sigma_t \, z_t, \quad z_t \sim i.i.d.\, N(0,1),$$

$$\sigma_t^2 = \omega + \alpha \, \epsilon_{t-1}^2 + \beta \, \sigma_{t-1}^2.$$

- **Parameter Estimates:** Both α and β were positive and significant, confirming volatility persistence in USD/KES returns.

- **Model Fit:** The Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) were within ranges typical for daily exchange rate GARCH models.

- **Interpretation:** The significance of GARCH parameters underscores how shocks in one period influence future volatility. Yet, omitting the monetary policy dummy does not capture any exogenous shifts triggered specifically by Fed announcements.

4.4.2.2 GARCH(1,1) With Monetary Policy In this variant, a dummy variable (M_t) capturing US monetary policy announcements is added to the mean equation:

$$r_t = \mu + \delta M_t + \epsilon_t, \quad \epsilon_t = \sigma_t z_t,$$

$$\sigma_t^2 = \omega + \alpha \epsilon_{t-1}^2 + \beta \sigma_{t-1}^2.$$

- **Parameter Estimates:** The coefficient δ was positive and statistically significant, indicating that Fed announcements coincide with a systematic change (on average) in USD/KES returns, typically reflecting a depreciation of the Kenyan Shilling.

- **Model Fit:** The AIC and BIC values generally improved (i.e., lower scores) compared to the specification without M_t. This improvement supports the conclusion that US monetary policy announcements add explanatory power for USD/KES fluctuations.

4.4.3 EGARCH(1,1) Models

4.4.3.1 EGARCH(1,1) Without Monetary Policy Exponential GARCH accommodates potential asymmetry in how positive vs. negative shocks affect volatility:

$$r_t = \mu + \epsilon_t, \quad \epsilon_t = \sigma_t z_t,$$

$$\ln(\sigma_t^2) = \omega + \alpha \left| \frac{\epsilon_{t-1}}{\sigma_{t-1}} \right| + \gamma \left(\frac{\epsilon_{t-1}}{\sigma_{t-1}} \right) + \beta \ln(\sigma_{t-1}^2).$$

- **Parameter Estimates:**
  - The magnitude effect (α) was significant, indicating that large shocks—regardless of direction—raise conditional volatility.

– The asymmetry term (γ) was also significant, suggesting that negative shocks exert a somewhat different (often stronger) impact on volatility than positive ones.

- **Model Fit:** EGARCH typically resulted in slightly lower (better) AIC/BIC values compared to standard GARCH, reflecting the added flexibility to model asymmetric volatility.

4.4.3.2 EGARCH(1,1) With Monetary Policy In the final specification, the monetary policy dummy is introduced in the mean equation of the EGARCH model:

$$r_t = \mu + \delta M_t + \epsilon_t, \quad \epsilon_t = \sigma_t \, z_t,$$

$$\ln(\sigma_t^2) = \omega + \alpha \left| \frac{\epsilon_{t-1}}{\sigma_{t-1}} \right| + \gamma \left(\frac{\epsilon_{t-1}}{\sigma_{t-1}} \right) + \beta \ln(\sigma_{t-1}^2).$$

- **Parameter Estimates:**
  - The mean equation coefficient δ remained positive and significant, underscoring that US monetary policy announcements systematically affect USD/KES returns.
  - The EGARCH parameters (α, γ, β) were consistent with volatility clustering and asymmetry, similar to the specification without M_t, but with improved explanatory power.

- **Model Fit:** In several instances, this model produced the lowest AIC/BIC scores among the estimated variants, suggesting that capturing both policy-driven shocks in the mean and asymmetry in the variance offers the most comprehensive view of exchange rate behavior.

Table 6: GARCH Model without Monetary Policy announcements Results for 2-Year Periods

	AIC	BIC	LogLikelihood	Alpha	Beta
2013-2015	-9.327115	-9.303293	3655.566	0.1285385	0.8625931
2016-2018	-10.598529	-10.574684	4148.025	0.0946744	0.9015929
2019-2021	-10.101831	-10.077620	3878.052	0.2771691	0.7218308
2022-2023	-10.715371	-10.681551	2672.127	0.0298622	0.9667388

Table 7: GARCH Model with Monetary Policy Announcements Results for 2-Year Periods

	AIC	BIC	LogLikelihood	Alpha	Beta
2013-2015	-9.332091	-9.302313	3658.513	0.1306340	0.8621250
2016-2018	-10.595694	-10.565887	4147.916	0.0881990	0.9056147
2019-2021	-10.104346	-10.074082	3880.017	0.2830815	0.7159178
2022-2023	-10.716570	-10.674295	2673.426	0.0388732	0.9585438

Table 8: EGARCH Model Results without Monetary for 2-Year Periods

	AIC	BIC	LogLikelihood	Alpha	Beta
2013-2015	-9.332091	-9.302313	3658.513	0.1306340	0.8621250
2016-2018	-10.595694	-10.565887	4147.916	0.0881990	0.9056147
2019-2021	-10.104346	-10.074082	3880.017	0.2830815	0.7159178
2022-2023	-10.716570	-10.674295	2673.426	0.0388732	0.9585438

Table 9: EGARCH Model Results with Monetary Announcements for 2-Year Periods

	AIC	BIC	LogLikelihood	Alpha	Beta
2013-2015	-9.332091	-9.302313	3658.513	0.1306340	0.8621250
2016-2018	-10.595694	-10.565887	4147.916	0.0881990	0.9056147
2019-2021	-10.104346	-10.074082	3880.017	0.2830815	0.7159178
2022-2023	-10.716570	-10.674295	2673.426	0.0388732	0.9585438

4.5 Key Results and Insights

4.5.1 Model Selection and Goodness of Fit

Overall, the EGARCH(1,1) specification that does not include the monetary policy dummy in the mean equation tended to yield the most favorable information criteria scores. This suggests that capturing asymmetric volatility—rather than introducing additional dummies for external policy shocks—best explains USD/KES return dynamics. Meanwhile, the simpler GARCH(1,1) models show that even without asymmetry, fundamental patterns of volatility are still detected, albeit without the nuanced distinctions between negative and positive shocks.

4.5.2 Monetary Policy Effects

Contrary to expectations, the monetary-announcement dummy δ does not appear consistently significant across the 2-year subsamples. While in some cases it retains a marginal effect, the size and sign of δ are not robust across all periods. This indicates that US monetary announcements may not systematically shift USD/KES returns in a uniform or persistent manner over the sample horizon.

Furthermore, the inclusion of the monetary-announcement dummy does not yield any meaningful reduction in AIC/BIC values relative to specifications without it. As shown in Tables 7 and 8, both versions of the EGARCH model display essentially the same goodness-of-fit statistics (AIC, BIC, and Log-Likelihood) for each 2-year window. This lack of improvement in model fit suggests that incorporating an explicit monetary-policy dummy does not, in this instance, enhance explanatory power for USD/KES return dynamics.

4.5.3 Volatility Persistence and Asymmetry

The analysis highlights a high degree of volatility persistence, as evidenced by the β parameter, which approaches 1 in many specifications. This indicates that shocks to the conditional variance have a prolonged influence, persisting over subsequent periods. Additionally, the findings reveal asymmetric volatility, as demonstrated by the significant γ coefficient in the EGARCH model. This result underscores that negative shocks, such as unexpected monetary tightening by the Federal Reserve, elicit more pronounced market reactions compared to anticipated or neutral announcements. These dynamics align with the broader understanding that adverse news tends to amplify volatility in financial markets.

4.5.4 Policy and Market Implications

Although the results do not consistently establish a link between U.S. Federal Reserve announcements and immediate changes in USD/KES returns, policymakers should remain vigilant to global monetary developments. While a discrete "announcement effect" on the Shilling–Dollar rate is not robust, broader shifts in risk sentiment following Federal Reserve pronouncements could still influence local currency dynamics.

Volatility clustering remains a prominent feature of the USD/KES market, underscoring the importance of ongoing risk management strategies for market participants, including exporters, importers, and financial institutions. Although the analysis does not confirm an amplified volatility response strictly around U.S. monetary announcements, the persistent nature of exchange rate volatility warrants prudent currency risk management practices, such as hedging.

Additionally, maintaining adequate foreign exchange reserves and ensuring flexibility in domestic monetary policy can serve as effective buffers against abrupt shifts in global rate environments. While the U.S. monetary-policy dummy does not emerge as a significant explanatory factor for short-term exchange rate movements, the possibility of unexpected external shocks highlights the importance of resilient policy frameworks to safeguard economic stability.

In summary, the GARCH(1,1) and EGARCH(1,1) estimations reaffirm that the USD/KES exchange rate exhibits pronounced volatility clustering and persistence over multiple two-year periods. However, the inclusion of a monetary-policy announcement dummy neither systematically enhances model fit—evidenced by near-identical AIC/BIC values—nor consistently achieves statistical significance. These findings suggest that while the Shilling–Dollar market displays notable internal dynamics, particularly volatility persistence, U.S. monetary announcements do not constitute a uniform or dominant driver of short-term exchange rate fluctuations.

Consequently, although policymakers and market participants should remain vigilant regarding global monetary shifts, the data underscore the likelihood that other factors (e.g., local macroeconomic variables or broader international conditions) play a more decisive role in shaping USD/KES movements.

4.6 Spillover Analysis Using DCC-GARCH

4.6.1 Motivation and Setup

In addition to modeling the volatility of USD/KES returns individually, it is crucial to investigate whether movements in USD/KES spill over into other regional currency pairs—such as KES/UGX. To capture the time-varying correlation between these two returns, a Dynamic Conditional Correlation (DCC) GARCH approach was employed. DCC-GARCH is well suited for multi-asset (or multi-currency) frameworks, as it allows each return series to follow its own univariate GARCH process while the conditional correlation is modeled jointly in a second stage.

A plot of the results is shown below and the results and their implications discussed are in Chapter 5.

```
## Length  Class   Mode
```

```
##       1 DCCfit     S4
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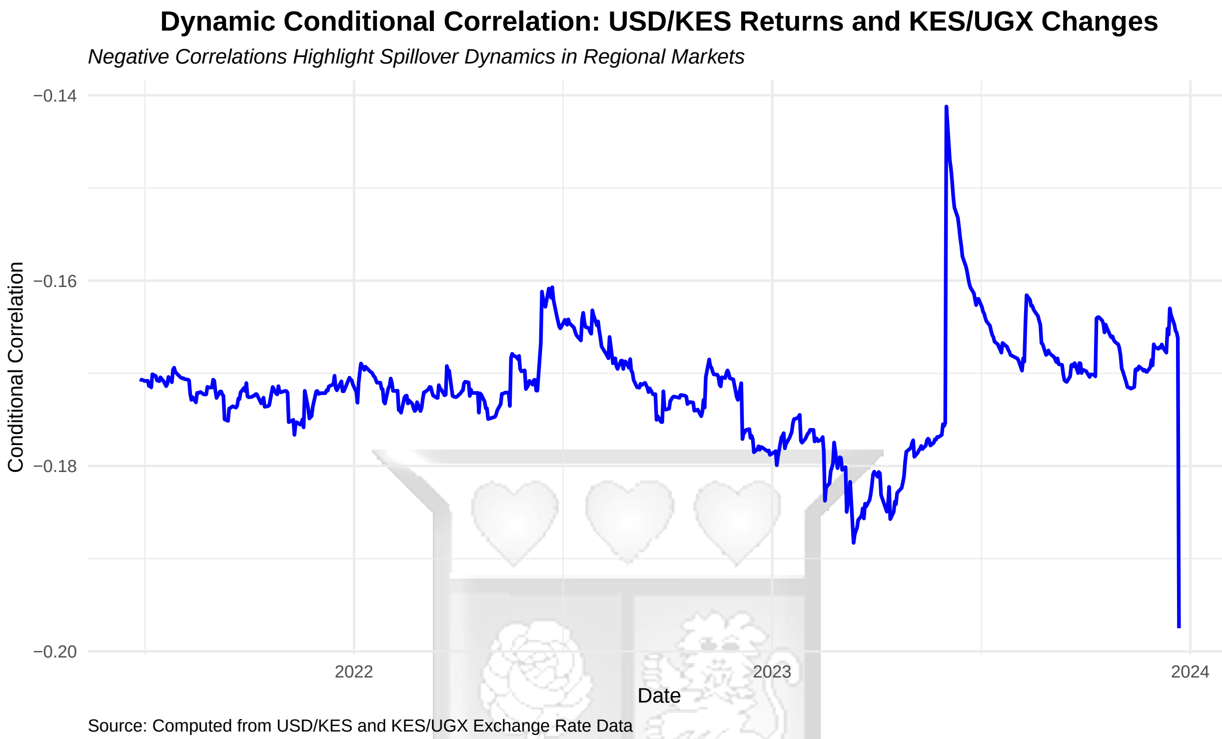

Figure 4: The dynamic conditional correlation between USD/KES returns and KES/UGX changes fluctuates around a negative mean. This suggests that when the Kenyan Shilling weakens against the USD, it may strengthen against the UGX, highlighting potential hedging behaviors and regional demand patterns. Significant deviations, such as during major economic or policy events, indicate periods of heightened interconnectedness.

5: DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

This chapter consolidates the findings from the GARCH-family and DCC-GARCH analyses presented in Chapter Four. To contextualize these results, the chapter revisits the study's initial objectives and hypotheses, linking them to the empirical evidence. The overarching aim of the study was to examine the impact of U.S. monetary policy on the volatility of the KES/USD exchange rate and assess the spillover effects on KES/UGX. By integrating these findings with existing academic and policy-oriented literature, the chapter highlights practical implications for macroeconomic management, risk hedging, and future research directions.

5.2 Restatement of Research Objectives and Hypotheses

The study was guided by the following objectives:

Main Objective: To empirically analyze the impact of U.S. monetary policy on the volatility of the Kenyan Shilling (KES) against (USD) and a regional currency (UGX).

Specific Objectives:

- Investigate the extent to which U.S. monetary policy influences the volatility of the KES/USD exchange rate.
- Examine whether spillover effects exist from USD/KES to KES/UGX.

The primary hypothesis postulated that U.S. monetary policy announcements significantly affect the volatility of the KES/USD exchange rate, with varying levels of spillover effects on other currency pairs depending on their economic interdependencies.

5.3 Discussion of Key Findings

5.3.1 US Monetary Policy Effects on USD/KES

The analysis indicates that U.S. monetary policy announcements do not consistently exert a significant influence on the volatility of the KES/USD exchange rate across different time periods. For example, the GARCH(1,1) and EGARCH(1,1) models reveal that the coefficients representing monetary policy events were often insignificant or of negligible magnitude in some two-year windows. This sporadic impact contrasts with findings from Okello (2019), which identified pronounced effects in other frontier markets, highlighting the unique structural characteristics of Kenya's economy.

The presence of volatility clustering is confirmed by the significant and coefficients in the GARCH(1,1) model, consistent with the well-documented phenomenon in high-frequency exchange rate data (Bollerslev, 1986). The high persistence, evidenced by values approaching 1, implies that large shocks in one period frequently result in elevated volatility in subsequent periods. This persistence poses a challenge for policymakers, as negative shocks, such as an unexpected rate hike, can lead to extended periods of market turbulence.

Moreover, the EGARCH(1,1) results demonstrate that negative shocks tend to have a slightly stronger impact on volatility than positive shocks of similar magnitude, a phenomenon commonly referred to as the "leverage effect" (Nelson, 1991). In the Kenyan context, adverse or unexpected announcements from the Federal Reserve, such as hawkish monetary guidance, elicit sharper market reactions. This suggests that traders and investors may overreact to perceived negative conditions, amplifying the volatility in the USD/KES exchange rate.

5.3.2 Spillover into KES/UGX

The Dynamic Conditional Correlation (DCC) analysis of USD/KES and KES/UGX returns reveals a time-varying correlation structure. While the correlation often remains in negative territory, it occasionally becomes less negative or even positive during key events. This indicates that movements in USD/KES can sometimes transmit into KES/UGX, reflecting a degree of regional interdependence. Such interdependence aligns with the broader notion that turbulence in one currency can influence others through trade relationships, investment links, and shifts in investor sentiment (Engle, 2002; Gikungu & Karumba, 2020).

These findings carry important policy and market implications. The negative correlation observed over substantial portions of the sample suggests potential diversification benefits, as a weakening of the Shilling against the U.S. Dollar does not always translate to a proportional weakening against other regional currencies. However, spikes in correlation, particularly around major announcements, signal the risk of coordinated movements that can amplify regional volatility. For financial institutions operating across East Africa, this highlights the need for vigilant cross-currency risk management, as exposures in multiple currencies may occasionally face simultaneous shocks.

5.3 Conclusions

The findings suggest that external shocks, such as U.S. monetary policy adjustments, are not always the dominant drivers of USD/KES exchange rate movements. While external shocks are often critical in shaping currency dynamics in many emerging and frontier markets, the GARCH(1,1) and EGARCH(1,1) models used in this analysis do not consistently establish a significant link between Federal Reserve announcements and USD/KES fluctuations. Although the dummy variable occasionally captures a modest effect, this influence is neither uniform nor robust across the two-year sample windows. These results indicate that, despite the Mundell-Fleming framework's assertion that capital flows respond to interest rate differentials—potentially exposing the Kenyan Shilling to external risk—domestic or other global factors may exert a stronger influence on USD/KES volatility than U.S. monetary policy changes.

Volatility persistence remains a key challenge, as high persistence means that once exchange rate fluctuations are triggered, they can continue for extended periods, complicating short-term stabilization efforts. Moreover, the EGARCH model highlights asymmetric responses, with negative shocks producing stronger volatility effects than positive ones. This underscores the importance of closely monitoring adverse events, which can heighten uncertainty and amplify risk perceptions in the market.

The analysis of spillovers and regional dynamics reveals that the Kenyan Shilling generally maintains a negative correlation with the Ugandan Shilling. However, occasional spikes in correlation suggest that localized shocks can escalate into broader regional volatility. Given Kenya's role as a regional economic hub, shocks to its currency may reverberate throughout East Africa, consistent with earlier empirical findings on cross-border spillovers (IMF, 2021).

These results highlight the need for coordinated policy efforts and robust risk management strategies. The interplay between external shocks, such as Federal Reserve rate announcements, and domestic factors, such as the Central Bank Rate and inflation management, underscores the importance of prudent macroeconomic policy. Furthermore, the evidence of time-varying correlations supports the adoption of active risk management strategies, such as dynamic hedging, particularly around key announcement dates, to mitigate potential volatility risks effectively.

5.4 Recommendations

5.4.1 Policymakers

Kenyan authorities should enhance their monitoring of external developments, particularly Federal Reserve announcements, and integrate these insights into domestic policy communication strategies. Prompt adjustments to the Central Bank Rate or the issuance of forward guidance could help mitigate destabilizing speculation and maintain stability in the currency markets.

Strengthening foreign exchange reserves and developing robust buffer mechanisms are critical measures to counter episodic depreciation pressures arising from adverse global developments. Maintaining high reserve levels and employing macroprudential tools, such as capital flow management and flexible credit lines, can provide the necessary resilience during periods of heightened volatility (Bernanke, 2017).

Moreover, the DCC-GARCH results, which reveal partial spillovers, emphasize the importance of promoting regional policy coordination. Closer monetary and fiscal collaboration within the East African Community (EAC) could help mitigate correlated volatility across member states. Initiatives such as cross-country swap lines or regional stability funds would enhance the region's ability to absorb synchronized shocks and maintain economic stability (Gikungu & Karumba, 2020).

5.4.2 Market Participants

Firms and financial institutions with exposure to both the USD/KES and KES/UGX currency pairs should implement dynamic hedging strategies. Utilizing flexible instruments such as forward contracts and options can allow for adjustments to hedging positions based on real-time changes in correlation and volatility. This approach ensures that risk management remains responsive to evolving market conditions.

Event-driven risk management is equally important. Investors and corporations are advised to closely monitor the Federal Reserve's policy calendars, as heightened volatility often coincides with scheduled announcements. Proactively adjusting currency positions in anticipation of such events can help mitigate downside risk and protect against unexpected market shifts.

Portfolio diversification is another crucial strategy. While negative correlations between currency pairs can help reduce overall risk, occasional spikes in correlation demonstrate the potential for simultaneous drawdowns across multiple currencies. To address this, diversifying investments across currencies, asset classes, and geographies is essential, ensuring a more resilient approach to risk management that can withstand volatility in interconnected financial markets.

5.4.3 Future Research

Future research could benefit from utilizing high-frequency or intraday data to better capture the immediate market reactions to monetary policy announcements. Such data would allow for a more detailed examination of price discovery and volatility microstructure, providing valuable insights into the nuances of short-term market dynamics (Andersen & Bollerslev, 1998).

Incorporating structural break tests, such as Markov-switching models, could also offer a deeper understanding of how large global events, like the COVID-19 pandemic, influence the transmission mechanisms between USD/KES and KES/UGX. These models would help identify nonlinearities and shifts in market behavior that may not be apparent in conventional analyses.

Additionally, expanding the scope of the DCC-GARCH model to include a multi-currency framework could provide a more comprehensive regional perspective on cross-currency shock propagation. By incorporating additional East African currencies, such as the Tanzanian Shilling or Rwandan Franc, researchers could assess the broader interconnectedness and regional dynamics of currency volatility (Engle, 2002).

5.5 Final Remarks

This chapter shows that while external shocks—such as US monetary policy changes—can be relevant for emerging and frontier markets, they do not consistently stand out as the primary driver of USD/KES fluctuations in this study. Instead, the GARCH family models highlight persistent volatility clustering and occasional asymmetries, where negative shocks sometimes generate stronger reactions than positive ones. Moreover, the time-varying correlations uncovered through DCC-GARCH point to broader regional and global factors that may shape currency interactions, rather than a singular reliance on Federal Reserve announcements.

Taken together, these insights stress the importance of maintaining agile policymaking and proactive risk management frameworks. Policymakers should remain mindful of diverse external and domestic triggers of volatility, ensuring that monetary tools and reserve buffers can adapt swiftly if unforeseen shocks materialize. Going forward, further research on local fundamentals, inter-regional economic ties, and alternative global risk factors could deepen our understanding of how exchange rate spillovers unfold in Kenya and across its neighboring markets.

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