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# Global Financial Tightening Conditions and Foreign Exchange Volatility in Kenya

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## Abstract

Emerging-market economies like Kenya are experiencing heightened foreign-exchange (FX) volatility due to ongoing global financial-tightening measures that integrate them into a dysfunctional global economic system yet theoretical models diverge on transmission mechanisms. The Conventional Mundell-Fleming model views flexible rates as shock absorbers, while post-Keynesian-structuralist theory warns of endogenous amplification via balance-sheet fragilities. This study tests these competing frameworks using DCC-GARCH on monthly data (Jan 2004- June 2025) for Kenya's shilling, modeling interactions between US Fed rates (FED), global liquidity (GLI), CBK policy rate (CBR), Foreign exchange reserves, remittances, and global risk factors. Results confirm strong persistence in FX volatility driven by FED tightening and global risk, with significant DCC correlations rejecting transitory absorption. Domestic Monetary policy proxied by Central Bank Rate (CBR) exhibits weak shock response despite high persistence, while FED/CBR and GLI/CBR interactions show procyclical leverage effects, validating Köhler's Minskyan cycles over symmetric Mundell-Fleming adjustment. These findings advance the emerging market theoretisation by demonstrating how global financial tightening triggers contractionary balance-sheet channels in debt-dependent economies, limiting domestic monetary policy autonomy. Kenya should prioritize macroprudential buffers alongside reserve accumulation over sole rate reliance to mitigate future US-led volatility spillovers.

**Keywords:** Foreign exchange volatility, global financial tightening, EGARCH, stochastic volatility, Kenya Shilling, monetary policy, Federal Reserve, exchange rate management

## Introduction

### Background of the study

Emerging-market economies are experiencing heightened foreign-exchange (FX) volatility due to ongoing global financial-tightening measures that integrate them into a dysfunctional global economic system characterized by deep-rooted structural vulnerabilities like excessive foreign currency-denominated debt and shallow financial markets. Kenya's economy stands at a critical crossroads as the ripple effects of global financial tightening intensify, causing unprecedented volatility in the foreign exchange market. With Kenyan shillings experiencing sharp fluctuations against major currencies, understanding how global monetary shifts impact Kenya’s exchange rate stability has never been more urgent. Exchange rate instability endangers macroeconomic stability and makes policy options to stimulate growth and decrease poverty in this emerging economy a difficult task (World Bank, 2023; Wanzala et al., 2024; Mosbei et al., 2021). This study examines Kenya's exchange rate volatility during global financial tightening through empirical evidence, providing empirical insights into the transmission mechanisms of global influence on Kenya's economic outlook and discussing the resulting challenges they pose. In addition, the study contributes novel theoretical perspectives via post-Keynesian and structuralist approaches to emerging-market economies and challenges the traditional notion of flexible exchange rates being simply a shock absorber to foreign-exchange-rate volatility (Köhler, 2023).

Post-Keynesian theories demonstrate that the depreciation of currencies causes contractionary effects through a variety of channels, including balance-sheet effects, with respect to emerging-market economies with high levels of public and private sector external debt. By contrast, institutional weaknesses amplify the effects of external shocks through the creation of endogenous boom-bust cycles based on the structuralist views of the world (Köhler, 2023; Stockhammer & Köhler, 2021). Traditional Mundell-Fleming models assume a symmetric adjustment process in terms of the emergence of foreign-exchange-rate volatility, while an emerging-market theoretic framework reveals numerous asymmetries: as a result of global tightening, interest-rate differentials narrow, causing capital outflows resulting in greater levels of volatility than predicted by advanced economies, where flexible exchange rates typically create self-fulfilling expensive eight to ten-year boom-bust cycles, rather than simply absorb shocks (Krugman, 1998; Köhler, 2023; Bruno & Shin, 2015). In the Kenyan economy, these dynamic processes are particularly evident, as evidenced by the depreciation of the Kenyan shilling being a consequence of U.S. policy changes associated with the commodity dependency of the Kenyan economy.

Most existing studies on exchange rate volatility in Kenya have primarily focused on domestic factors such as inflation, interest rates, and remittances, overlooking how global financial dynamics shape currency behavior. Scholars have yet to thoroughly examine the direct and indirect impacts of global financial tightening—especially through U.S. federal fund rate changes and worldwide financial stress—on the Kenyan shilling (Abdii et al., 2020; Kiptui, 2019). Given Kenya's openness to international market movements, this external dimension remains critical yet underexplored. Recent work seeks to address this by investigating how global financial tightening episodes affect exchange rate volatility, offering fresh empirical insights into external shock transmission (Eguren-Martin & Sokol, 2022). Furthermore, limited attention has been given to global commodity price fluctuations, even though Kenya's trade structure makes it vulnerable to such shocks; integrating commodity prices as key variables can thus enhance understanding of the external forces influencing exchange rate movements (Miriti, 2024).

**Impact of Global Financial Tightening on Kenya's Exchange Rate**

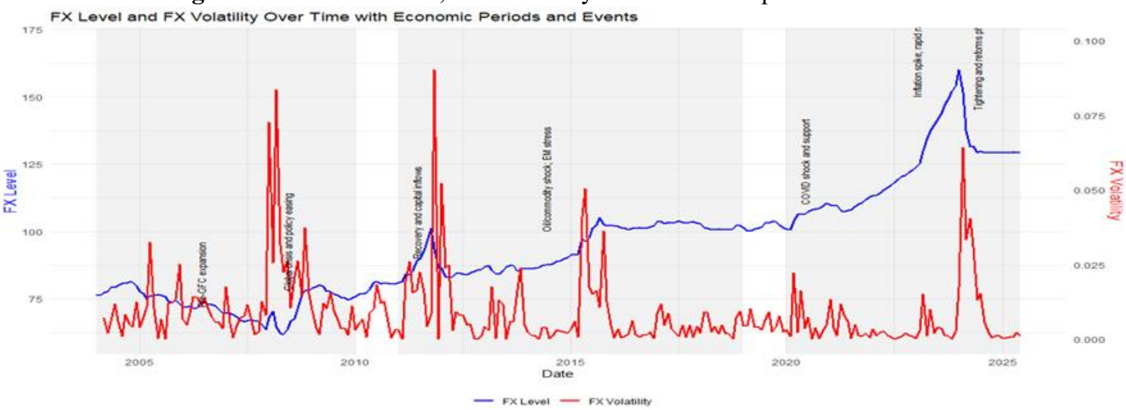
Global monetary tightening by advanced economies has triggered financial market challenges that have severely affected Kenya's economic stability. The Kenyan shilling lost more than 20% of its value against the US dollar during 2022-2024 when it reached its lowest point at KES 160.80 per dollar in January 2024 amid rising international interest rates, reflecting intensified capital outflow pressure. The exchange rate decline resulted from international interest rate hikes, domestic supply chain disruptions, and shifting commodity market values (Mbugua & Maseno, 2024). The Kenyan shilling depreciation pattern mirrored the global monetary policy-tightening phases and investors' increasing skepticism about emerging market economies.

As global interest rates increase, emerging markets are increasingly challenged to finance their external needs, which causes a sharp decline in foreign exchange inflows. Like other emerging markets, these capital outflows in Kenya have not only led to considerable depreciation of shilling but have also heightened the Forex volatility against the US dollar. This volatility not only increases uncertainty for businesses but also for policymakers trying to manage the economy. Along with these bouts of global monetary tightening (such as the U.S. Federal Reserve's series of interest rate hikes), Kenya has weathered sustained depreciation pressures and a vacillating foreign exchange market (Abdi, Muturi & Olweny, 2020). In April 2022, the Central Bank of Kenya (CBK) took steps to address market instability through foreign exchange scarcity relief measures, including commercial bank dollar purchase restrictions. The scale of external shocks and the ongoing global financial market volatility restrict the effectiveness of these interventions. Monetary policy constraints worsened because Kenya faced reduced foreign exchange reserves and a deteriorating external position when dealing with unfavorable global liquidity conditions (Barasa, 2022; Sumba, Nyabuto & Mugambi, 2024).

## Stylized Facts

Figure 1 indicates the foreign exchange rate of the movement of Kenya Shilling (KES) against the US Dollar (USD) from 2004 to mid-2025, with shaded sections indicating the major political and economic events that influenced this exchange rate. Kenyan Shilling to US Dollar exchange rate (KES/USD) (blue) and FX volatility (red) from 2004 to 2025. Kenyan Shilling maintained stable exchange rates with slight appreciation from 2004 to 2007 because of economic expansion, market reforms, and political stability, which attracted foreign investors. The FED rate increase led to a stronger US dollar value until the 2008 global financial crisis triggered a rapid dollar value decline due to US monetary policy relaxation, as shown in Figure 2. However, the 2008–2009 global financial crisis and Kenya's post-election violence led to sharp depreciation and heightened volatility as capital flights and domestic unrest undermined its currency.

**Figure 1:** FX movement, FX Volatility and Economic periods and Events




Source: Author construction from the data

Following this crisis, the FED Rate remained near zero for several years during the recovery and capital-inflow phases. However, in Kenya, between 2010 and 2012, economic recovery efforts, renewed foreign investment, and the adoption of a new constitution helped temporarily appreciate the shilling. This was followed by depreciation from 2014 to 2016, driven by global commodity shocks, fiscal challenges, regional security concerns, and political instability. However, as depicted in Figure 2, during the same period, the FED rate gradually increased as the economy faced oil and commodity shocks, along with emerging market stress.

From 2017 to 2019, while the FED rate continued to tighten steadily, Kenya shilling saw relative stabilization backed by monetary tightening, reforms such as the interest rate cap, and managed political transitions. During the COVID-19 pandemic period (2020–2021), global monetary policy easing was observed, with the FED rate plunging rapidly to nearly zero as the FED responded to the COVID-19 shock through emergency support measures. However, in Kenya, the COVID-19 pandemic has caused economic disruptions and shilling volatility, although policy interventions have provided some support.

As shown in Figure 1, the Kenyan shilling has experienced a rapid decline from 2022 to 2023, fueled by inflation spikes, supply chain disruptions, drought, and rapid interest rate hikes, compounded by fiscal pressures and sociopolitical unrest. Similarly, there was a sharp rise in the FED rate from 2022 to 2023, owing to an inflation spike and rapid rate hikes, as indicated in Figure 2. The tapering of the FED rate in 2024 and 2025 signifies a period of tightening and reforms, while shilling, in contrast, began to lose value. In general, the course of shilling represents the influence of these different global megatrends on Kenya's political and economic policies, along with the country's underlying issues. Shilling tends to depreciate during periods of external shocks and inflationary pressure and offers greater stability during reforms and policy tightening. Political shifts, external shocks, fiscal deficits, and inflationary pressure have been the main drivers of exchange rate movement over the past 20 years.

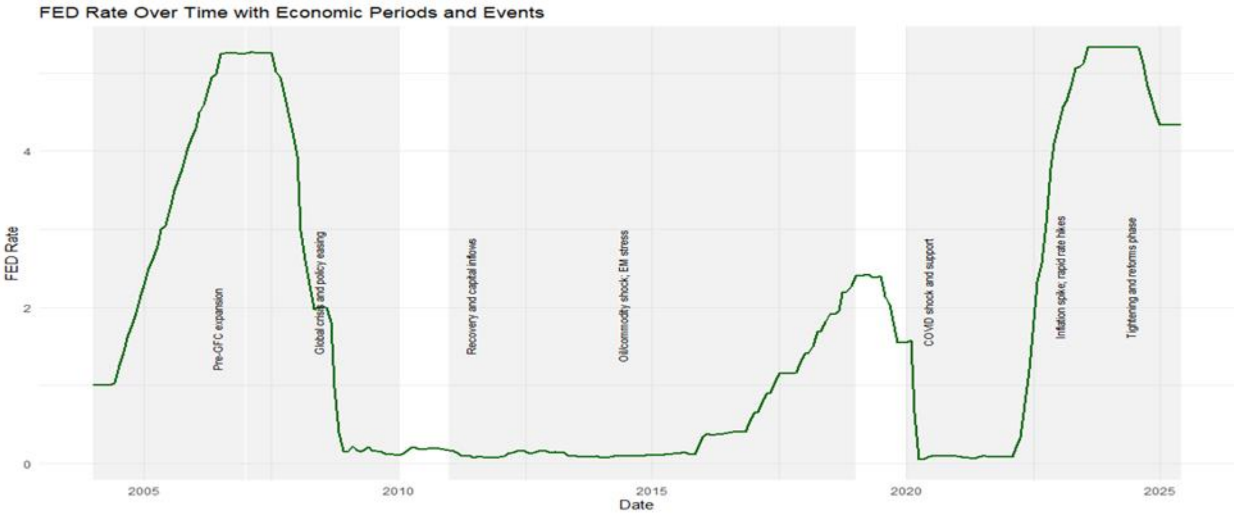



**Figure 2:** US Fed rate Movement over time with Economic periods and events

The relationship between KES/USD exchange rate volatility and global monetary policy is visible, as peaks in the FED rate accompany upward trends in the FX rate. The KES/USD exchange rate becomes highly volatile when the FED rate increases, because markets experience high uncertainty, whereas capital flows and risk perceptions lead to fast market adjustments. The KES exchange rate stabilizes or strengthens when the FED rate decreases, because the dollar value decreases, resulting in decreased FX volatility.

## Statement of the Problem

The Kenyan economy has experienced significant exchange rate volatility over the last 20 years due to global financial tightening. Global money tightening occurred because global interest rates increased and global liquidity decreased in countries such as the U.S.A. After the Global Financial Crisis, the Federal Reserve (FED) gradually initiated an interest rate increase, starting from near zero up to 2018. The Federal Reserve (FED) cut rates and later increased them from 2024 to 2025. The tightening phases led to currency depreciation, capital outflows, and inflationary pressures that hurt monetary stability and undermined economic growth in emerging markets, such as Kenya. According to empirical data, the KES/USD exchange rate became more volatile during these periods, with episodes of sharp depreciation around 2015-2017 and again from 2022 onwards, aligning with periods of FED rate hikes. (Abdi, Muturi & Olweny, 2020; Harikrishnan, Silk & Yoldas, 2023).

Global financial tightening conditions resulted in capital outflows from emerging economies in search of safer assets with higher returns, leading to depreciation pressures on the Kenyan shilling, which in turn raised imports, pushing inflation to upper limits. Despite the CBK's interventions, such as adjusting the Central Bank Rate (CBR), continued global spillovers, and domestic fiscal vulnerabilities, external shocks such as volatile oil prices continue to inhibit the Kenyan shilling exchange rate from stabilizing (Maana, Mwita & Odhiambo, 2010). Such volatility poses great pressure and challenges to economic stability across many Sub-Saharan African Countries by increasing inflation expectations, debt service burdens, and discouraging both foreign direct and domestic investment. As such, the overall economic resilience of Kenya could be adversely impacted by affecting foreign exchange reserves and growth prospects (Matschke, von Ende-Becker & Sattiraju, 2023; World Bank, 2024).

Despite the importance of understanding these linkages, empirical research on the transmission of global financial tightening through exchange rate volatility patterns in Kenya remains poorly documented. The literature fails to identify the mechanisms by which commodity price changes create external financial shocks that affect exchange rates and economic stability in Kenya. The lack of research on this topic prevents policymakers from creating prompt and effective solutions to stabilize foreign exchange markets while preserving economic stability during the ongoing global financial instability (Mwangi, 2015; Abdi et al., 2020).

## Objectives of the Study

The overarching objective of this study is to examine the influence of global financial tightening on exchange rate volatility in Kenya.

## Specific Objectives

The specific objectives of the study are to:

(i) Analyze the Impact of global monetary policy changes on Exchange Rate Volatility
(ii) Examine the Impact of the global liquidity indicator on Exchange Rate Volatility
(iii) Assess the Influence of Global Commodity Prices on Exchange Rate Volatility
(iv) To investigate the Role of Domestic Monetary Policy (CBR) in stabilizing exchange rate volatility amid global financial tightening.

## Literature Review

### Theoretical Literature Review

This study is anchored in post-Keynesian theory, particularly Köhler's Minskyan framework and the Mundell-Fleming Model. The

Mundell-Fleming model assumes international financial tightening (like U.S. interest rate hikes) is an external shock that raises global interest rates and triggers capital flight from emerging markets. They view currency depreciation as being absorbed through increased net exports due to the J-curve effect, which produces short-term currency fluctuations and stabilizes output. This brings about the perspective of the Policy Trilemma (Impossible Trinity). This Trilemma states that a country may simultaneously choose any two of the following three policy goals: monetary independence, exchange rate stability, and financial integration (Aizenman, 2013; Sengupta, 2016; Iqbal, 2022; Obstfeld & Taylor, 2004).

In contrast, post-Keynesian theory, specifically using Köhler's Minskyan frame of reference, considers international financial tightening as an endogenous risk-off shock. They do not see currency depreciation as being absorbed by J-curve effects; instead, they see tightening as a catalyst for increasing the amplitude of the endogenous boom-bust cycle. In their view, international financial tightening leads to capital inflows during monetary easing, which increases the value of a country's currency via its foreign exchange liabilities and improves the country's overall balance sheet. This, in turn, supports increased investment and deficit spending. But, when the U.S. raises interest rates, the action creates capital outflows from emerging markets, which will result in stronger currency devaluation and added contractionary balance sheet effects that ultimately cause the country to force the deleveraging of capital and drive the country deeper into an economic recession (Köhler, 2023; Köhler, 2019).

Not only does Mundell-Fleming assume that all trade led adjustments are symmetrical, as well as, that countries have policy autonomy within the constraints of the trilemma, but Post-Keynesian models (like Köhler's) focus on the asymmetries created by currency mismatches and financial fragility, which makes them more applicable to the debt-burdened emerging markets of the world (e.g., Kenya) and their currency volatility and the associated impacts of international financial tightening. This research challenges the traditional Mundell-Fleming assumption that flexible exchange rates provide complete monetary policy independence, suggesting instead that global financial conditions create a powerful channel through which advanced economic policies affect emerging markets

## Empirical Literature Review

### Global Monetary Policy and Foreign Exchange Volatility

The effects of global monetary policy on foreign exchange (forex) volatility in emerging and developing economies (EMDEs) have garnered significant scholarly attention, particularly in light of recent global economic disruptions. A comprehensive analysis of the literature reveals a complex interplay between global monetary policy, capital flows, and forex volatility. Multiple studies demonstrate that Federal Reserve tightening creates major adverse effects on emerging markets and developing economies (EMDEs). According to Iacoviello and Navarro (2019), U.S. interest rate increases of 100 basis points led to a 0.8 percent decrease in GDP growth in emerging economies during the following three years. External sensitivity to U.S. monetary policy shocks remains high for countries that maintain dollar-denominated debt or weak policy frameworks.

Benigno, Beningo & Nisticò (2012) uses a two-country open-economy model to show that higher monetary policy shock volatility leads to major real exchange rate adjustments where the real exchange rate appreciates after inflation-target shock volatility increases but currency risk premiums show less systematic responses. Using Vector Autoregressive Model (VAR), this study demonstrates that increased US monetary policy volatility causes real economic activity to shrink while affecting international prices, which results in enhanced exchange rate fluctuations in both emerging and developed economies (Benigno et al, 2012).

Akinci and Queralto (2019) use a two-country New Keynesian model to study how U.S. monetary policy affects foreign economies through financial frictions and dollar debt in balance sheets. The structural vector autoregression (SVAR) model demonstrates that uncovered interest parity (UIP) deviations from U.S. policy create substantial effects that impact exchange rate volatility. The mechanism shows how U.S. monetary policy actions create global financial system connections that produce international market effects on exchange rates (Akinci and Queralto 2019).

Alba et al. (2024) extend this discussion by studying how US monetary policy announcements affect Mexican financial and macroeconomic indicators, using a VAR Model. Research shows that positive information shocks from the US central bank improve Mexican financial conditions, which results in peso appreciation and reduced forex volatility. Conversely, restrictive monetary policy shocks tighten financial conditions, adversely affecting real activity and increasing forex volatility, thereby emphasizing the direct link between US monetary policy and forex dynamics in the EMDEs.

A recent European Central Bank (ECB) working paper documented how global financial tightening, such as rising interest rates and financial stress, affects the distribution of exchange rate returns. By employing a quantile regression model, the study finds that the currencies of countries with high interest rates, large current account deficits, and low reserves are particularly vulnerable to sharp depreciation during tightening periods. This study quantified the increased risk of extreme exchange rate movements under adverse global conditions (Eguren-Martin & Sokol, 2022). Another study constructs a financial stress index to examine its predictive value for exchange rate volatility in SSA countries. The results showed increased financial stress, often linked to global tightening, significantly increased exchange rate volatility in the region. The findings highlight SSA economies' vulnerability to external shocks and emphasize the need for stronger financial system stability (Rufai, Udaah & Salisu,2023).

In addition, Engler et al. (2023) highlight that changes in US interest rates appreciably strengthen the dollar against major currency appreciation by approximately 3-4% per significant Fed-tightening, leading to increased FX volatility worldwide. Moreover, World Bank research focusing on EMDEs notes that inflation-driven shocks from rising US interest rates cause capital outflows which widen sovereign bond spreads and depress equity valuations while directly contributing to local currency depreciation under pressure from tighter global liquidity conditions (Arteta, Kamin, & Ruch, 2022).

## Global Liquidity and Foreign Exchange Volatility

Research has focused on how global liquidity affects foreign exchange volatility in both emerging and developing economies (EMDEs). Dua and Verma (2024) examine the relationship between gross capital inflows and outflows to show that the Global Financial Cycle (GFCy) affects capital flows in EMDEs. Research shows that the sensitivity of EMDEs' capital flow to global trends depends heavily on both liquidity conditions and macroeconomic indicators in advanced economies. The sensitivity of capital flows affects forex volatility, because exchange rates experience increased pressure when capital flows fluctuate.

Choi, Kang, Kim, and Lee (2017) analyze how global liquidity spread to EMEs and their policy actions from 2000 to 2015. They gather extensive data on liquidity indicators and capital flow information from emerging markets. The authors employ panel regression models together with interactive fixed effects to measure liquidity spillovers and policy impacts. Research shows that liquidity increases from developed economies trigger changes in the exchange rates and financial markets of EMEs, which leads to policy interventions through interest rate changes and capital control implementation to stabilize markets. This study demonstrates how global liquidity conditions and forex volatility are connected, which helps to explain the mechanisms by which global financial tightening affects EMEs (Cevik, Kirci-Cevik, and Dibooglu , 2016).

Literature on the effects of global liquidity indicators on foreign exchange (FX) volatilities in emerging and developed nations reveals nuanced and significant relationships shaped by market structure, economic fundamentals, and investor behavior. Banti, Phylaktis, and Sarno (2011) provide a foundational study by constructing a global liquidity risk measure for the FX market using extensive order flow data across 20 US dollar exchange rates over 14 years. Their findings establish that liquidity risk is an important priced factor in currency returns, with a significant commonality across currencies, indicating that global liquidity shocks affect FX volatilities consistently across markets, but with varying intensity depending on local factors (Banti et al., 2011). This underscores the critical role of microstructural elements, such as dealer behavior and order flows, in explaining FX volatility.

Empirical studies focusing on the relationship between global liquidity and forex volatility in Africa have yielded mixed results, reflecting the diverse economic landscapes and policy regimes across the continent. For instance, Daggash and Abraham (2017) establish evidence that increases in global liquidity tend to be associated with higher forex volatility in African countries, particularly those with more open capital accounts. Conversely, other studies show that increased financial openness also leads to increased income volatility for the de jure measure of financial openness, whereas, for the de facto measure, increased financial openness reduces income volatility (Tolulope & Charles, 2019).

**Global Commodity prices and foreign exchange volatility**

The relationship between commodity prices, particularly crude oil prices, and foreign exchange volatilities has garnered significant attention in recent years, particularly in oil-dependent economies. World Bank studies have examined how trade and financial openness as well as commodity price fluctuations influence real exchange rate volatility. These findings suggest that financial openness can amplify volatility, and commodity price shocks are a significant source of exchange rate fluctuations in developing countries (Hanusch, Nguyen & Algu, 2018).

The relationship between crude oil futures prices and exchange rates was studied using Alam's (2023) time-varying parameter VAR (TVP-VAR). This study established that major events, including the COVID-19 pandemic and geopolitical crises, increased the link between oil prices and foreign exchange rates (Alam, 2023). The research demonstrated that the oil and foreign exchange markets transmit shocks to each other in both directions. This dynamic interplay suggests that fluctuations in oil prices can lead to substantial volatility in foreign exchange rates, particularly in economies heavily reliant on oil exports.

The literature has shown growing interest in the relationship between commodity prices, especially crude oil, and foreign exchange volatilities in sub-Saharan Africa (SSA). Baek and Kim (2020) conducted an extensive examination of how oil price fluctuations affect exchange rates in SSA countries. The NARDL model shows that real exchange rates in these countries exhibit stronger responses to rising oil prices than to falling oil prices over the long term. Exchange rate dynamics are heavily influenced by oil price volatility, because these economies primarily depend on a single product. On the other hand, Yeboah et al. (2025), using Quantile Regression (QQR) and Wavelet Coherence techniques, demonstrated that SSA exchange rates respond to GPR under different market scenarios, with Angola being more vulnerable to GPR during positive market conditions and Mauritius and Tanzania showing resistance. The differences in the exchange rate volatility and crude oil price relationships indicate that external shock mitigation policies require customization based on geopolitical conditions.

Academic research on the effects of crude oil prices on Kenyan foreign exchange volatility has increased because Kenya depends on oil imports and operates as an open economy. Gachara (2015) demonstrated how crude oil price fluctuations cause Kenyan Shilling depreciation, while slowing economic growth. The research employed a Structural Vector Autoregressive model with quarterly data spanning 1991 to 2014 to demonstrate that these shocks produced significant exchange rate volatility by altering monetary aggregates and inflation levels (Gachara, 2015).

**Domestic Monetary Policy and Foreign Exchange volatility amidst global tightening**

The literature on the moderating effect of monetary policy on foreign exchange volatilities due to global financial tightening is complex and mixed, with some studies suggesting a negligible or small effect and others highlighting the significant influence of volatility on productivity growth (Aghion, Bacchetta & Ranciere, 2009). The debate over the effectiveness of foreign exchange interventions has persisted in international finance for decades (Filardo, Gelos & McGregor, 2022). Research shows that foreign exchange interventions function as effective policy tools that achieve success when specific conditions are met (Fratzscher, Gloede & Menkhoff, 2019). Research shows that interventions produce short-term or minimal effects when macroeconomic policies lack consistency. Several studies have investigated how monetary policy affects exchange rate volatility in the African economic context by employing different econometric methods and data sources to evaluate multiple policy tools.

Kamau and Ngugi (2020) employed an event study methodology to analyze how Kenyan shilling reacts to central bank interventions and policy announcements against major currencies (USD, GBP, and EUR). Using criteria such as event significance, directional movement, reversal, and smoothing, and applying the sign test on daily exchange rate data, their research found that central banks' foreign exchange market participation often triggers immediate and directionally consistent exchange rate changes, especially against the US dollar. It also reveals that Central Bank purchases tend to be associated with shilling depreciation, while combined purchases and sales during tight monetary policies often correlate with appreciation. Their study identified mixed, lagged, and persistent responses, indicating that market reactions extend beyond announcement days and vary by currency and event clusters, reflecting the complexity of the policy impact on exchange rate volatility. These findings underscore the challenges policymakers face in managing exchange rate expectations and suggest the importance of clear communication alongside market interventions for effective exchange rate stabilization.

Similarly, Kearns and Manners (2018) investigated the impact of monetary policy on exchange rates using event studies to show how policy announcements can significantly influence exchange rate movements. This study is based on four small open economies (Australia, Canada, New Zealand, and the United Kingdom), using high-frequency intraday data and a rigorous event study methodology. Their findings show that an unanticipated monetary tightening of 25 basis points leads to a rapid and significant exchange rate appreciation of approximately 0.35%, and this effect is even larger if the change shifts expectations about the future path of policy rather than merely altering timing. By focusing purely on unexpected policy moves and isolating the announcement window, this study avoids endogeneity and provides compelling evidence that exchange rates react swiftly and strongly to monetary shocks, consistent with the theory of uncovered interest parity (UIP). This suggests that central banks in open economies can exert potent, immediate influence over currency values via well-communicated, unanticipated policy moves that can then support the strategic use of surprise and signalling in monetary policy to control exchange rate volatility and maintain macroeconomic stability.

Sumba et al. (2024) provide empirical evidence that the pass-through effect from exchange rate depreciation to inflation in Kenya is significant only when monthly depreciation exceeds a 0.51% threshold, using a nonlinear Threshold Autoregressive (TAR) model on data from 2005 to 2023. Sumba et al. (2024) significantly advance the literature on the monetary policy control of forex volatility by empirically confirming the existence and significance of a threshold for ERPT in Kenya. Their demonstration of nonlinearity means that central banks must not only react to inflation, but also proactively manage exchange rate risks by adjusting policy tools in proportion to the scale of currency movements. Similar economies may benefit from incorporating similar frameworks to more effectively safeguard macroeconomic stability amid global volatility.

## Methodology
### Model Specification

This study uses generalized autoregressive conditional heteroscedasticity (GARCH) and Stochastic Volatility (SV) models to investigate exchange rate volatility. Numerous researchers have found these models to be beneficial. Girgin (2023) also employed GARCH and SV models to investigate exchange rate volatility, noting the models' ability to capture conditional variance dynamics and structural changes in the exchange rate. The software tools used in this study were R and/or Python, to facilitate data processing and analysis.

The underlying equation will be

$$Y_{it} = \alpha + \beta_1 X_{i,t} + \beta_2 Z_{it} + \epsilon_{it} \quad 1$$

Where:

- $Y_{it}$ is the Dependent variable for individual $\boldsymbol{i}$ at time $\boldsymbol{t}$
- $X_{it}$ represents a vector of explanatory variables
- $Z_{i,t}$ is the set of control variables
- $\epsilon_{it}$ is the idiosyncratic error term

This specification aligns with the study's objective of quantifying the influence of global financial tightening on Kenya's exchange rate volatility, while controlling for domestic macroeconomic variables and capturing asymmetric volatility effects.

### Dynamic Conditional Correlation (DCC-EGARCH)

Engle (2002) and Tse and Tsui (2002) proposed a dynamic conditional correlation (DCC) model to address the limitations of the constant correlation assumption in earlier models.

Considering an N-dimensional time series, the return equation can be expressed by the mean equation given in Equation 2:

$$r_t = \mu + \epsilon_t \quad \mathbf{2}$$

where $r_t$ is the $Nx1$ vector of returns, and $\mu$ is a $Nx1$ vector of mean returns. $\epsilon_t$ is the $Nx1$ vector of shock terms with mean zero and conditional covariance matrix $\boldsymbol{H}_t$ which can be modelled as:

$$\epsilon_t = H_t^{\frac{1}{2}} z_t \quad \mathbf{3}$$

where $\boldsymbol{H}_t$ is a $NxN$ conditional covariance matrix, $H_t^{\frac{1}{2}}$ is a $NxN$ positive definitive matrix, and $z_t$ is $Nx1$ vector of independent and identically distributed (i. i.d.) standard normal innovations.

$$z_t \sim N(0, I_N) \quad \mathbf{4}$$

From the above $\boldsymbol{H}_t$ can be modeled as equation 5 below

$$\boldsymbol{H}_t = \boldsymbol{D}_t\boldsymbol{R}_t\boldsymbol{D}_t \quad (5)$$

Where

- $\boldsymbol{D}_t = diag(\sqrt{h_{11,t}}, \sqrt{h_{22,t}}, \dots, \sqrt{h_{kk,t}})$ is a diagonal matrix containing the conditional standard deviations.
- $\boldsymbol{R}_t$ is the time-varying correlation matrix.

The EGARCH model for conditional variances follows each diagonal element of $\boldsymbol{D}_t^2$ specified as equation 4

$$\log(h_{ii,t}) = \omega_i + \sum_{k=1}^{p} \beta_{ik} \log(h_{ii,t-k}) + \sum_{k=1}^{q} \alpha_{ik} \left| \frac{\epsilon_{i,t-k}}{\sqrt{h_{ii,t-k}}} \right| + \sum_{k=1}^{q} \gamma_{ik} \frac{\epsilon_{i,t-k}}{\sqrt{h_{ii,t-k}}} \quad (6)$$

For $i$=1,…,8(1 dependent + 7 exogeneous variables),

Where:

- $h_{ii,t}$ is the conditional variance for variables $i$ and time $t$
- $\epsilon_{i,t}$ are the standardized residuals,
- $\omega_i, \alpha_{ik}, \beta_{ik}, \gamma ik$ are parameters to estimate.

The Dynamic Conditional Correlation (DCC) for $\boldsymbol{R}_t$ evolves according to Equation 5 as follows:

$$\mathrm{Q_t} = (1 - a - b)\,\bar{Q} + aZ_{t-1}Z'_{t-1} + bQ_{t-1} \quad (7)$$

Where:

- $\mathrm{Q_t}$ is an intermediate 8×8 positive definite matrix
- $\bar{Q}$ is the unconditional covariance matrix of the standardized residuals $Z_t = D_t^{-1}\epsilon_t$
- $a$ and $b$ are scalar parameters with $a, b \geq 0, a + b < 1$
- $\boldsymbol{R}_t$ is then obtained by standardizing $\mathrm{Q_t}$

$$\boldsymbol{R}_t = diag(\mathrm{Q_t})^{-1/2}\mathrm{Q_t}\,diag(\mathrm{Q_t})^{-1/2}\mathrm{Q_t} \quad (8)$$

This ensures $\boldsymbol{R}_t$ is a proper correlation matrix at every time $t$

**Data Collection Methods**

Data were collected from reputable and publicly available secondary sources such as the Federal Reserve (The Fed), Bank for International Settlement (BIS), Central Bank of Kenya (CBK) and https://www.nancyxu.net/risk-aversion-index. This study compiled monthly time-series data from January 2004 to June 2025. The data included exchange rate volatility (measured monthly as the standard deviation or variance of KES/USD returns), US Federal Reserve interest rates, global liquidity data from the Bank for International Settlements, crude oil prices (WTI), the Central Bank of Kenya's Central Bank Rate (CBR), inflation

(CPI), diaspora remittances, foreign exchange reserves, and global risk aversion measures.

Foreign Exchange Volatility is used as a dependent variable, calculated using the standard deviation of the monthly returns. The Global Monetary Policy is operationalized using US Federal Reserve Rate (FRR) changes. The US Federal Reserve's policy rate functions as the primary benchmark, which determines worldwide interest rates and capital movements. The Bank for International Settlements (BIS) global liquidity indicators represent the global availability of funding and credit, which can be measured through an advanced economy, broad money supply, cross-border bank lending, and shadow banking flows. Global Commodity Prices are operationalized using crude oil prices (WTI prices), deeply integrated with global financing, trade balances, and inflation, act as de facto financial "barometers." The market shows financial tightening when oil prices rise, but the financial conditions ease when prices decrease. Domestic monetary policy is operationalized using the central Bank Rate (CBR).

## Research Findings and Discussion

### Descriptive Statistics

The Foreign Exchange Rate (KES/USD), for which the average during this period was 95.23 (with considerable volatility (standard deviation of 20.52) and a range of 61.9 to 160.08. This is a large range that captures periods of currency depreciation, currency appreciation, and external shocks at varying scales (2008 financial crisis, commodity price shocks), as well as domestic factors such as monetary policy changes and capital mobility. A positive skewness of 0.73 means that in some instances, accompanied by market stress or speculative pressure against shilling, the exchange rate spikes above the normal range. The Central Bank of Kenya was active during this period in trying to mitigate currency depreciation, with concerns about inflationary expectations and external vulnerability to external shocks. Sometimes, monetary adjustments are made, and foreign exchange market interventions are used at other times.

**Table 1:** Descriptive Statistics Results

| Var | Obs | Mean | SD | Min | Max | Skew | Kurtosis | Jarque-bera | Prob | Normality? |
|---|---|---|---|---|---|---|---|---|---|---|
| FX | 258 | 95.23 | 20.52 | 61.9 | 160.08 | 0.73 | 0.08 | 23.076 | 9.75E-06 | Reject normality |
| FED | 258 | 1.73 | 1.92 | 0.05 | 5.33 | 0.81 | -0.91 | 37.423 | 7.48E-09 | Reject normality |
| GLI | 258 | 34.28 | 6.06 | 18.39 | 46.76 | -0.4 | 0.32 | 8.1601 | 0.01691 | Reject normality |
| Oil | 258 | 70.35 | 21.64 | 16.98 | 133.96 | 0.28 | -0.45 | 5.4886 | 0.06429 | Do not reject normality |
| CBR | 258 | 9.1 | 2.76 | 5.75 | 18 | 1.62 | 3.13 | 222.7 | 2.20E-16 | Reject normality |
| Risk | 258 | 3.03 | 0.78 | 2.48 | 8.03 | 3.8 | 17.24 | 3881.5 | 2.20E-16 | Reject normality |
| RM | 258 | 161.05 | 122.99 | 25.15 | 445.39 | 0.74 | -0.76 | 29.518 | 3.89E-07 | Reject normality |
| CPI | 258 | 80.87 | 33.4 | 31.34 | 145.58 | 0.28 | -1.1 | 16.147 | 0.000312 | Reject normality |
| RES | 258 | 5993.2 | 2725.47 | 1313.59 | 11089 | -0.27 | -1.33 | 21.905 | 1.75E-05 | Reject normality |

Source: Author computations based on study data for the period 2005(1)-2025(6)

The US Federal Reserve rate averaged 1.73% against the backdrop of significant global monetary policy cycles. With an extremely low minimum near zero, reflecting the post-2008 crisis policy environment of near-zero interest rates, and a maximum of 5.33%, the FED rates fluctuate in response to global economic conditions. The positive skewness (0.81) highlights episodic increases during the tightening phases, particularly from 2015 onwards. Kenya is particularly vulnerable to these changes in global financial conditions through investor sentiment, capital flows, and trade finance, and changes in the FED rate have indirect effects on Kenya's economy and monetary policy calibrations.

The crude oil price (WTI) averaged $70.35, with modest volatility, given the relatively symmetrical distributions. Oil prices have a significant effect on Kenya's economy as they are wholly dependent on imported fuel for transport and industry. The BIS Global Liquidity Index (GLI), which measures global credit availability, averaged 34.28 and exhibited a mild negative skew. As a proxy for global financial liquidity, GLI fluctuations influence Kenya's access to foreign financing and investment inflows. This period saw phases of ample liquidity, especially pre-2008 and post-pandemic, facilitating capital inflows and remittances, along with sporadic contractions during global downturns. The Central Bank Rate (CBR) in Kenya averages 9.1%, but with high volatility (SD 2.76), strong positive skew (1.62), and high kurtosis (3.13), indicative of monetary policy shifts in response to inflationary conditions, currency fluctuations, and economic shocks such as droughts or food price volatility.

Remittance inflows (RM) averaged $161 million monthly but demonstrated large variability (The positive skewness of 0.74) driven by diaspora earnings, migrant labor conditions, and global economic cycles. The Consumer Price Index (CPI) averaged 80.87, moderate symmetry (skewness) and negative kurtosis which details the implied path of inflation in Kenya. Foreign exchange rates (RES: 61.9-160.08) exhibited similar volatility, primarily from domestic factors amplified by global commodity prices and monetary policy changes. Foreign exchange reserves have a large average size (approximately $6 billion) but also volatility (SD 2725). The volatility of reserves likely reflects the Central Bank's active management of reserves to contain pressure on the shilling and meet external obligations against possible confined capital outflow, rising commodity prices, and debt servicing costs.

Overall, the descriptive results indicate an economy that exhibits extreme volatility and ongoing structural transformation from both global macroeconomic (fed rates, global liquidity, and oil prices) and domestic (monetary policy, domestic inflation, and remittances) conditions. The summary also fits well with Kenya's macroeconomic history, spanning decades of adapting monetary policy, an average economic growth of roughly 4-5% per year, inflation targeting, external vulnerability via remittances and reserves, and perceived efforts to stabilize and grow the economy amid regional and global uncertainties.

## Stationarity Test

This study employed the Augmented Dickey-Fuller (ADF) test for the presence of a unit root in a time series, and the results are presented in table 2. Nonstationary time-series data can have persistent shocks with effects that do not dissipate over time. Non-stationarity is crucial for time-series econometric analyses (Yang et al., 2023). The null hypothesis of the ADF test is that the series has a unit root (is nonstationary), whereas the alternate hypothesis is that the series is stationary.

**Table 2:** Augmented Dickey-Fuller Test Unit Root Test

| ADF test at Level and 1st Difference | | | | Critical Values | | | Decision |
|---|---|---|---|---|---|---|---|
| | | Test Statistic | p-value | 1% | 5% | 10% | |
| FXR | Level | -10.5836 | < 2.2e-16 | -3.98 | -3.42 | -3.13 | Stationary |
| FED | Level | -9.8162 | < 2.2e-16 | -3.98 | -3.42 | -3.13 | Stationary |
| | 1st Diff | -9.8162 | < 2.2e-16 | -3.98 | -3.42 | -3.13 | Stationary |
| lnGLI | Level | -10.6424 | < 2.2e-16 | -3.98 | -3.42 | -3.13 | Stationary |
| lnOil | Level | -3.8189 | 1.26E-09 | -3.98 | -3.42 | -3.13 | Stationary |
| CBR | Level | -3.7543 | 2.18E-02 | -3.98 | -3.42 | -3.13 | Stationary |
| Risk | Level | -3.7127 | 0.02385 | -3.98 | -3.42 | -3.13 | Stationary |
| lnRM | Level | -2.7121 | 0.276 | -3.98 | -3.42 | -3.13 | Non-Stationary |
| | 1st Diff | -7.1050 | 0.0100 | -3.98 | -3.42 | -3.13 | Stationary |
| lnCPI | Level | -1.0316 | 0.932 | -3.98 | -3.42 | -3.13 | Non-Stationary |
| | 1st Diff | -6.3956 | 0.0100 | -3.98 | -3.42 | -3.13 | Stationary |
| lnRES | Level | -1.8238 | 0.1573 | -3.98 | -3.42 | -3.13 | Non-Stationary |
| | 1st Diff | -6.4367 | 0.0100 | -3.98 | -3.42 | -3.13 | Stationary |

The Augmented Dickey-Fuller (ADF) test results indicate which variables are stationary at level and require differencing based on the 5% critical value of -3.42. Variables such as FX, FED, lnGLI, lnOil, CBR, and Risk have test statistics that are more negative than this level. Therefore, their null hypothesis of a unit root is rejected, meaning that these series are stationary without any difference. On the other hand, the test statistics of the FED, lnRM, lnCPI, and lnRES variables at level are above the threshold of -3.42, suggesting that these series are non-stationary at level. Nevertheless, their first differences have strongly negative test statistics with significant p-values, and we conclude that these variables are stationary after differencing. This information informs modeling choices, especially for the GARCH-family models. In general, since p-values of .05 are common, using the 5 percent cutoff provides a reasonable guideline for identifying stationarity in the data.

## ARCH Effects Tests

Autoregressive Conditional Heteroskedasticity (ARCH) effects are a prerequisite for GARCH modeling. The ARCH effects indicate that the variance of the errors is not constant over time but depends on past errors. A GARCH model, including a multivariate model such as the DCC-GARCH model, is built on the premise that the conditional variance of a time series changes over time. The ARCH LM test and the Box-Ljung test on the squared residuals are presented in table 3.

**Table 3:** ARCH LM test and Box-Ljung test Results

| | LM Test | Box-Ljung Test | Remarks |
|---|---|---|---|
| FX | 48.657(2.401e-06) | 74.268 (5.051e-11) | highly significant |
| FED | 17.752 (0.1234) | 22.852(0.02901) | significant at 5% |
| GLI | 41.383 (4.228e-05) | 27.021 (0.007674) | highly significant |
| Oil | 33.17 (0.0009) | 39.66 (8.187e-05) | highly significant |
| CBR | 2.3359 (0.9987) | 2.4989 (0.9982) | highly insignificant |
| Risk | 18.375 ( 0.1048) | 25.953 (0.0109) | significant at 5% |
| RM | 75.775 (2.622e-11) | 239.27 ( 2.2e-16) | highly significant |
| CPI | 245.95 (2.2e-16) | 2736.5 (2.2e-16) | highly significant |
| RES | 2.02(0.9994) | 1.9336(0.9995) | highly insignificant |

For Foreign Exchange (FX), the Global Liquidity Indicator (GLI), Crude Oil price (oil), Diaspora Remittances (RM), and Consumer Price Index (CPI), both tests provide strong statistical evidence for the presence of **ARCH effects**. This means that the conditional variance of these series is significantly time-varying and can be modeled using ARCH or GARCH-type models. For both tests, two variables, namely the Central Bank rate (CBR) and Foreign Exchange Reserves (RES), suggest that there are no statistically significant ARCH effects at the conventional significance level (e.g., 5%). This implies that the variance in the residuals appears to be constant over time for these series. However, for the US Fed Rate (FED) and Risk Aversion (Risk), while the ARCH LM test does not reject the null hypothesis of no ARCH effects at the 5% level, the significant Box-Ljung test on squared residuals suggests that there might be some autocorrelation in the squared residuals, which is indicative of ARCH effects. The benefit of the DCC model is that it can model and analyze the time-varying volatility and correlations of the entire system, even if some individual components have constant volatility (Ampountolas, 2023).

## Regression Results

This study employs dynamic conditional correlation-exponential generalized autoregressive conditional heteroskedasticity (DCC-EGARCH) to investigate the dynamic correlations among variables. The DCC

EGARCH results in table 4 provide parameter estimates that describe the dynamic volatility of each variable, including foreign exchange volatility (FX) as the dependent variable and the eight other independent variables that influence FX volatility.

**Table 4:** Results from multivariate EGARCH (DCC) model

| | mu | omega | alpha1 | beta 1 | gamma |
|---|---|---|---|---|---|
| FX | 0.000539 | -2.199951 | 0.12769 | 0.734689 | 0.756541 |
| | (0.001096;0.623) | (0.476462;0) | (0.09062;0.159) | (0.058322;0) | (0.1687;0.0001) |
| FED | 0.839675 | -0.37832 | -0.065537 | 0.892581 | 2.251151 |
| | (0.012197;0) | (0.053209;0) | (0.09917;0.509) | (0.049932;0) | (0.246691;0) |
| GLI | 3.500334 | -1.095542 | 0.073498 | 0.861225 | 2.144205 |
| | (0.023649;0) | (0.177873;000) | (0.04205;0.081) | (0.03249;0) | (0.169581;0) |
| Oil | 4.312856 | -1.096456 | -0.067324 | 0.698241 | 1.617419 |
| | (0.062585;0) | (0.71358;0.124) | (0.14530;0.643) | (0.2724;0.0104) | (0.25811;0) |
| CBR | 8.890787 | -0.168265 | 0.064357 | 0.875876 | 1.791936 |
| | (0.012364;0) | (0.07605;0.027) | (0.14328;0.653) | (0.08112;0) | (0.43957;0.000) |
| Risk | 2.608649 | -0.309485 | 0.129342 | 0.846486 | 1.945845 |
| | (0.023464;0) | (0.51115;0.545) | (0.45008;0.774) | (0.130668;0) | (0.7686;0.0113) |
| RM | 4.88221 | -0.199028 | 0.053749 | 0.972401 | 0.985377 |
| | (0.051736;0) | (0.08552;0.020) | (0.01626;0.001) | (0.021658;0) | (0.4552;0.0304) |
| CPI | 4.590644 | -0.420402 | 0.059682 | 0.976878 | 1.917797 |
| | (0.076691;0) | (0.10504;0.000) | (0.0488;0.2212) | (0.069374;0) | (0.6453;0.0030) |
| RES | 8.990709 | -0.671611 | -0.224407 | 0.824935 | 1.205491 |
| | (0.080381;0) | (0.2230;0.0026) | (0.14416;0.120) | (0.055326;0) | (0.157542;0) |
| FED_CBR | 6.350086 | 0.330203 | -0.9534 | 0.839008 | 2.141308 |
| | (0.038892;0) | (0.2209;0.135) | (0.1457; 0.5123) | (0.039418;0) | (0.203;0) |
| GLI_CBR | 31.655878 | 0.066229 | 0.275914 | 0.877628 | 2.536691 |
| | (0.001714; 0) | (0.0575; 0.2494) | (0.2391; 0.2485) | (0.022725; 0) | (0.40017; 0) |
| dcca1 | | | 0.29696 | | |
| | | | 0.000 | | |
| dccb1 | | | | 0.624847 | |
| | | | | 0.000 | |

Note: GARCH models were estimated with the student's t distribution. Asymptotic standard errors and P-values are given in parentheses.

**Foreign Exchange Volatility (FX)**

FX volatility is highly responsive ($\alpha = 0.906$, $p < 0.001$) and strongly persistent ($\beta = 0.734$, $p < 0.001$) to shocks. The strong positive asymmetric effect ($\gamma = 0.76$, $p < 0.001$) indicates that adverse/negative shocks (e.g., depreciation or unexpected stress) increase volatility more than favorable/positive shocks, consistent with the financial theory of higher uncertainty during currency depreciation. This aligns with the financial market theory, where FX volatility in Kenya exhibits persistent temporal clustering and reacts more intensively to adverse shocks, reflecting market risk aversion and external financial shocks.

**US Federal Funds Rate (FED):**

Fed rate volatility as the core tightening channel has a very high persistence ($\beta = 0.89$, $p < 0.001$) with positive asymmetry ($\gamma = 2.25$, $p = 0.0077$), reflecting stronger impacts from global monetary tightening shocks than cuts, especially US Fed rate hikes, which have strong, lasting, and disproportionately large effects on the financial markets. Tightening spikes US rate volatility, dynamically spilling FX volatility via DCC correlations. The findings highlight the significance of U.S. monetary policy as a global benchmark, particularly the implications of U.S. monetary policy on global liquidity conditions and capital flows. This result is in agreement with those of Alba et al. (2024), Eguren-Martin and Sokol (2022), and Engler et al. (2023). Rate hikes tend to tighten capital, leading to a reduction in global liquidity and an increase in risk premiums, giving rise to capital outflows from emerging economies and causing FX markets, including KES/USD, to increase volatility (Habib & Venditti, 2018; Uz Akdogan , 2023). Positive asymmetry means that increases in U.S. rates have a greater effect on volatility than decreases in rates, as markets are more sensitive to the tightening cycle with increased borrowing costs and lower global demand.

**Global Liquidity Indicator (lnGLI):**

Volatility in global liquidity is persistent ($\beta = 0.86$, $p < 0.001$), indicating stable volatility shocks related to global liquidity conditions, whereas a strong positive asymmetry ($\gamma = 2.14$, $p < 0.001$) implies that positive liquidity shocks notably increase volatility. This result contradicts the results of Olds, Steenkamp, and Van Jaarsveld (2021), who found that higher FX liquidity is associated with lower FX volatility. However, this study agrees with the findings of Daggash and Abraham (2017) and Le et al. (2024). This aligns with the theory that improved global liquidity increases market activity and volatility, whereas tightening it reduces liquidity and causes a sharp rise in volatility. Changes in global liquidity directly impact FX volatility through funding and capital flow in Kenya. In general, rising global liquidity lowers funding costs and facilitates capital flow into emerging markets, leading to increased trading volume and market activity and resulting in higher FX volatility by increasing price discovery and speculative trading. However, decreased liquidity raises risk premia, and as a result, there may be an increase in volatility due to elevated uncertainty (Cevik et al., 2016).

**Crude Oil Price (lnOil):**

Oil price volatility is moderately persistent ($\beta = 0.70$, $p < 0.001$), with positive asymmetry ($\gamma = 1.62$, $p < 0.0001$), meaning that price surges or negative oil price shocks increase volatility more than they decrease it. As an oil-importing economy, rising oil prices drive inflation and trade deficit pressures, increasing FX market uncertainty and volatility and increasing import costs and inflationary pressures. These findings are consistent with those of Alam (2023), Monday and Abdulkadir (2020), and Mukherjee and Bardhan (2024). From an economic standpoint, higher oil prices increase import costs and inflationary pressure, aggravate the trade balance of payments and create further uncertainty in the foreign exchange market. Inflationary pressures and trade deficits increase exchange rate volatility through trade deterioration, monetary policy uncertainty, and changes in capital flow. Empirical and theoretical research indicates that oil price shocks in oil-importing countries result in cost-push inflation and external imbalances that further increase financial market volatility and adversely affect macroeconomic performance.

**Kenya's Central Bank Rate (CBR):**

The CBR volatility is highly persistent ($\beta = 0.88$, $p < 0.001$) with significant positive asymmetry ($\gamma = 1.79$, $p < 0.001$), showing high persistence and asymmetric effects, meaning that monetary policy shifts exert influential and uneven effects on FX volatility. This means that shocks, especially positive ones, such as rate hikes, strongly and persistently increase volatility. As the key monetary policy instrument, increased uncertainty or tightening in CBR tends to raise FX volatility by affecting interest rate differentials and capital flows, heightening exchange rate uncertainty as market participants adjust their expectations of currency value and capital flows. This finding highlights the role of domestic policy in stabilizing or amplifying currency risk. These findings are in line with those of Huertas (2022) but contradict those of Ndagara et al., who opined that central bank interventions do not reduce foreign exchange volatility. Evidence from Kenya shows that CBR's monetary policy decisions shape FX markets, but intervention is typically a reaction to volatility and not an effort to fully control it. Accordingly, this reinforces the need for the Central Bank to effectively gauge its policy communication to anchor the market expectations of its policy action, leading to less excessive fluctuations in the FX market.

**Risk Aversion (Risk)**

Volatility also showed high persistence (Î ² = 0.85, $p < 0.001$) and positive asymmetry (Î ³ = 1.95, $p = 0.017$). Increasing risk aversion increases market uncertainty and flight-to-safety behavior, thus increasing FX volatility. This means that increases in risk aversion drive larger increases in volatility than decreases. This pronounced asymmetric effect indicates that increments in risk aversion and capital flight risk amplify FX market instability more than decreases in it mitigate it.

**Remittances (lnRM)**

Remittances exhibit extremely persistent volatility ($\beta = 0.97$, $p < 0.001$), and Gamma1 (~0.99 significant) implies near-unit persistence, reflecting the stabilizing nature of inflows but with pronounced asymmetric volatility responses. Fluctuations in remittance flows create uncertainty in foreign currency supply, directly influencing FX volatility by changing the pressure on the exchange rate demand and supply. Fluctuations in remittance flows affect the foreign exchange supply-demand balance, where unexpected reductions tighten FX availability, increase volatility, and surges temporarily stabilize the market. The high persistence reinforces the critical buffering role of remittances, but also implies that shocks reverberate over extended periods, complicating FX market forecasting and policy responses.

**Consumer Price Index (lnCPI)**

CPI volatility shows strong persistence ($\beta = 0.97$, $p < 0.001$) and positive asymmetry ($\gamma = 1.92$, $p = 0.003$). Strong persistence means inflation shocks strongly and persistently affect FX volatility, with asymmetric impacts, while positive asymmetry indicates that inflation shocks increase volatility more than deflationary shocks. This aligns with purchasing power parity (PPP) theory and monetary policy reaction frameworks, where inflation shocks increase the uncertainty surrounding real economic conditions and monetary policy, thus feeding into FX volatility through heightened unpredictability in purchasing power and exchange rate expectations. This implies that inflation uncertainty influences exchange rate expectations, destabilizes currency markets, and monetary policy anchors inflation but does not fully eliminate volatility.

**Foreign Exchange Reserves (dRES)**

Reserves present strong volatility persistence ($\beta = 0.82$, $p < 0.001$) and asymmetry ($\gamma = 1.21$, $p < 0.001$), indicating that changes in reserves reflect intervention capacity and market confidence, impacting volatility persistence and asymmetry. An insignificant shock effect ($\alpha = -0.22$, $p = 0.120$) coupled with positive asymmetry suggests that shocks may initially reduce volatility without causing adverse effects (possibly signaling no loss and no intervention capacity needed) that can undermine market confidence. Positive asymmetry (**gamma1 = 1.20, $p < 0.001$**) implies that some shocks, likely negative ones, significantly increase volatility. This complex pattern suggests that reserves affect market confidence and volatility, and sharp decreases or concerns about reserve adequacy may trigger FX volatility spikes. This reflects the theoretical role of adequate reserves as both a buffer and a confidence signal: adequate reserves reduce market uncertainty by assuring intervention capability under the central bank's stabilization hypothesis, whereas drops, declines, or perceived inadequacy trigger market fears and spike volatility.

**The interaction effects of CBR with FED and GLI**

The interaction terms FED_CBR and GLI_CBR exhibit high volatility persistence (β=0.84 and 0.88, respectively) and strong leverage effects (γ=2.41 and 2.54, both $p<0.001$), indicating that Kenya's CBR stance dynamically moderates but does not fully offset global tightening and liquidity shifts in their impact on FX volatility, with time-varying correlations strengthening during shocks (DCC α=0.30) (Adrian, Natalucci & Wu, 2024; Ahmed, Akinci & Queralto, 2024). **The interaction between FED rate and CBR shows Persistent Volatility (β=0.84) indicating that the** Combined US hikes and CBR adjustments sustain FX volatility clustering, suggesting procyclical policy responses amplify spillovers rather than dampen them. This aligns with IMF evidence that EM rate hikes (avg. +780bps post-pandemic) create buffers only if credible and timely (Adrian, Natalucci & Wu, 2024). In addition, the **Strong Leverage (γ=2.41) depicts those Negative shocks** (e.g., hawkish Fed and tight CBR) disproportionately raises volatility, implying CBR hikes amid US tightening exacerbate outflows via widened differentials under the Mundell-Fleming autonomy in practice (Ahmed, Akinci & Queralto, 2024; Yoldas, E. (2024). These results imply that Central bank of Kenya monetary policy tightening partially counters FED effects (via stance), but shallow transmission dues to insignificant alpha1 means net amplification as per post-Keynesian financial fragility.

**Equally the interaction between global liquidity and CBR interaction shows High Persistence (β=0.88). This illustrates that** Global liquidity contractions paired with CBR changes prolong FX volatility while easing reversals (low GLI) interact with domestic stance to cluster shocks. There exists Asymmetric amplification during liquidity squeezes with policy tightening, highlighting vulnerability when global funding dries up despite CBR defense as indicated by **Leverage Effect of (γ=2.54). These results** Support Emerging Markets resilience via proactive hikes (wider differentials buffer outflows), but interactions confirm domestic monetary policy as **conditional moderator is only ef**fective against liquidity easing and not purely tightening as per the Bruno-Shin leverage (Checo, Grigoli & Sandri, 2024; Adrian, Natalucci & Wu, 2024; Bruno & Shin, 2015; Bruno & Shin, 2013).

**DCC Parameters (dcca1 = 0.0296, dccb1 = 0.656)**

These significant positive values confirm the dynamic or time-varying interdependence and evolving correlations among volatilities, showing that shocks to these macro variables co-move and jointly affect FX volatility over time. Specifically, the findings indicate that volatility shocks to any of these factors tend to move together over time, collectively influencing the FX volatility.

**Dynamic Conditional Correlation**

Pairwise conditional correlation is typically used to assess the change in behavior between two variables over time in response to market shocks and past volatility. When assessing volatility clustering, high values of the estimated parameter tend to indicate persistent correlation over time. Figure 3 shows the pairwise conditional correlation coefficients between Foreign Exchange, the key global tightening variables, and domestic monetary policy.

The top-left plot shows the dynamic conditional correlation between FX and the Federal Reserve policy rate). This plot illustrates how their correlation fluctuates over time, with periods of positive and negative correlation, suggesting shifts in co-movement regimes between monetary policy and FX. Periods of Negative correlation likely suggest increased FX volatility when the Fed tightens monetary policy, potentially reflecting shifts in capital flows and pressures to appreciate the dollar (Acharya et al., 2025). In turn, this can increase volatility in the KES/USD exchange rate as the market adjusts to interest rate differentials and financial tightening in global markets. Positive correlation episodes suggest co-movement, potentially when the Fed is in an easing cycle or when the market moves in tandem across asset classes. The magnitude of fluctuations suggests complicated macro-financial linkages related to changes in the Fed rate, market expectations in FX, and risk sentiment.

The graph in the top-right plot shows the dynamic conditional correlation between FX and GLI (which could be a global liquidity index or similar index). Dynamic switching between positive and negative values reflects how global liquidity conditions influence FX volatility in different ways over time. The periods of negative correlation suggest a tightening global liquidity environment, causing increased FX volatility in the KES/USD. Positive correlations may reflect abundant liquidity phases and dampen exchange rate volatility by stabilizing capital flow (Pham, 2018). The graph captures the sensitivity of emerging market currencies to shifts in global financial cycle conditions as measured by the GLI.

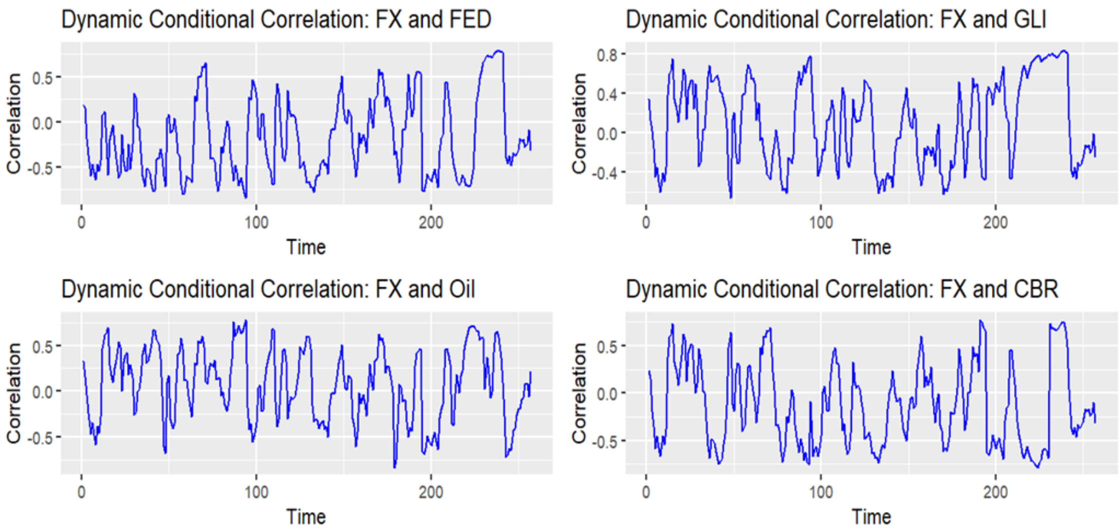



**Figure 3:** Dynamic Conditional Correlations between the FX and Key Variables

The bottom-left plot captures the dynamic conditional correlation between FX and Oil prices. The co-movement of oil and foreign exchange rates (KES/USD) is often due to trade, commodity price channels, and inflation expectations, which are reflected in the time-varying correlations. Negative correlations could indicate that oil price spikes lead to a weakening of KES and an increase in FX volatility. Positive correlation spells may arise when global commodity price trends coincide with synchronized capital markets, or when inflation expectation movements influence FX (Saidu et al., 2021). The dynamic nature of the model reflects the interaction between commodity shocks and exchange rate volatility. Kenya, an oil-importing nation, is susceptible to exchange rate shocks from oil prices.

The Bottom-right plot indicates the dynamic conditional correlation between FX and CBR (possibly the central bank rate or related financial variable). This plot shows how the FX and central bank rate relationships evolve dynamically. Negative correlation periods reflect scenarios in which domestic monetary tightening leads to FX depreciation volatility through interest rate differentials and capital flow adjustments (Ulm & Hambuckers, 2022). Positive correlation episodes indicate coordinated domestic policy easing and exchange rate stabilization. This evolving correlation mirrors the influence of monetary policy on forex market volatility, inflation expectations and investor confidence in Kenya. CBR shapes domestic interest rate differentials and liquidity through investment inflows and currency demand. A proactive monetary policy that adjusts CBR can moderate volatility by anchoring inflation expectations and increasing market confidence.

**DCC-GARCH Summary**

The model indicates that volatility in global monetary policy rates, global liquidity, risk sentiment, remittances, inflation, reserves, oil prices, and local monetary policy significantly influences FX volatility in Kenya. Most variables exhibit strong persistence and asymmetric impacts, meaning that volatility shocks tend to endure, and that positive and negative shocks affect volatility differently. These dynamics confirm that domestic fundamentals and global financial conditions shape FX market volatility in an important and interconnected way. Specifically, the findings reveal that FX volatility responds asymmetrically, with negative shocks increasing the market uncertainty. Variables representing **domestic monetary conditions** (CBR, CPI, and RES) strongly shape FX volatility by influencing inflation expectations, policy uncertainty, and reserve adequacy. Specifically, Domestic Monetary Policy through the Kenya's central bank rate plays a dual role as both a signaling mechanism and an active market stabilizer or amplifier. Inflation and reserves reflect the macroeconomic fundamentals that shape the FX dynamics.

**Summary**

The DCC-EGARCH model, the US Federal Reserve rate (FED), as a proxy for global monetary policy, exhibits high volatility persistence and asymmetry, indicating that global financial tightening shocks not only have lasting effects on volatility but also increase interest rates, provoking stronger volatility responses relative to decreases. This observation concurs with global financial cycle theory, whereby US monetary policy significantly influences capital flows, risk premia, and emerging market exchange rate volatility, including that of Kenya. From the SV model, a significant positive beta means that increases in the US FED rate (global financial tightening) tend to increase the volatility of Kenya's shilling against the USD due to global uncertainty and pressures in emerging market currencies, making FX volatility persistent.

The BIS Global Liquidity Indicator (GLI) is a proxy for global liquidity conditions and shows a particularly persistent volatility component with high asymmetry. The results from the DCC model underscore the critical role that global liquidity plays in shaping exchange rate volatility in emerging markets through liquidity shocks and sudden tightening, which is consistent with liquidity preference theory and international portfolio balance models. Similarly, in the SV model, a positive and significant beta implies that tighter global liquidity conditions (i.e., lower GLI values) are associated with higher FX volatility. Reduced global liquidity can limit capital flows and increase exchange rate fluctuations due to risk aversion and liquidity constraints. The third objective is to use crude oil prices (oil) as a proxy for major global commodity prices that have a notable influence on volatility dynamics. Although their mean returns and short-term volatility responses are moderate, oil price shocks have asymmetric effects, reflecting Kenya's exposure to oil price fluctuations through import costs and inflation. This reflects commodity price channel theory, which states that trade balance and inflation expectations mediate the effect of oil price volatility on currency risk. The same findings are portrayed in the Stochastic Volatility model, which shows a significantly positive beta, meaning that fluctuations in crude oil prices increase FX volatility. Importer: oil importer. Thus, oil price shocks directly affect import costs and inflation expectations, thereby influencing currency stability and volatility.

The final objective was motivated by domestic monetary policy as a control measure for Kenya's financial market. The DCC-EGARCH model results indicate that the Kenya Central Bank Rate (CBR) captures the transmission of the domestic monetary policy stance to foreign exchange rate volatility. The results for CBR volatility exhibit strong persistence with asymmetric responses, suggesting that changes in the policy rate send significant signals to markets, affecting foreign exchange volatility in a lasting and uneven manner. This is consistent with standard monetary transmission theories in which policy decisions influence investor expectations, liquidity conditions, and exchange rate volatility. Similarly, the SV model, with a significantly positive beta, indicates that changes in Kenya's monetary policy rate increase FX volatility. Tightening by raising CBR can signal economic stress or an attempt to manage inflation, which impacts currency uncertainties.

The significant DCC-EGARCH statistics (alpha 1 and beta 1) show a moderate and persistent time-varying correlation over time between these variables, demonstrating interdependence among global financial conditions, domestic policy, macroeconomic fundamentals, and forex market volatility. Similar time-varying interdependence is an important feature in the literature on international financial integration and spillovers. Furthermore, the parameters in the latent SV model—the persistence parameter phi (~0.87) and the volatility parameter sigma (~0.86)—also exhibit moderate to strong persistence in latent volatility shocks and latent volatility variability, which is consistent with the stylized facts of financial time series. The negative mu parameter represents the logarithm of the variance, and the exponential transformation of mu serves as the estimated baseline level of volatility. Collectively, these results illustrate how the dynamics of FX volatility in Kenya are influenced by a web of global monetary policies, liquidity conditions, commodity prices, and domestic macroeconomic fundamentals, demonstrating the importance of both international economic theory and domestic economic management in understanding FX market behavior.

## Conclusions

This study demonstrates that global financial tightening, captured by US Fed rates (FED) Global Liquidity and global risk, significantly drives persistent FX volatility in Kenya through strong GARCH persistence ($\beta$=0.73) and leverage effects, with dynamic DCC correlations confirming time-varying spillovers that align with post-Keynesian theory's emphasis on balance-sheet amplification rather than Mundell-Fleming absorption.

In particular, findings reveal that while CBK's Central Bank Rate (CBR) shows high persistence, it has a weak response to shocks (insignificant $\alpha$) and exhibits procyclical interactions with FED ($\gamma$=2.41) and GLI ($\gamma$=2.54) which demonstrates limited monetary policy autonomy. This means that domestic monetary policy tightening moderates but often exacerbates volatility during risk-off episodes, validating Köhler's Minskyan framework of endogenous cycles in debt-laden emerging markets. Reserves and remittances provide stabilizing persistence, they are not sufficient to entirely offset global dominance, underscoring structural vulnerabilities like commodity dependence and shallow transmission that sustain pro-cyclical FX behavior. These results advance emerging market theoretisation by rejecting the notion that flexible exchange rates as mere shock absorbers, instead formalizing how global tightening triggers contractionary channels for the Kenyan economy. Furthermore, this research provides evidence to policymakers that macro-prudential buffers are a more effective strategy for mitigating the impacts of future cycles of volatility driven by US Financial Constraints than simply relying on interest rate increases to manage their impact.

## Policy Recommendations

Based on the study findings and the prevailing economic context of Kenya’s foreign exchange market, the following policy recommendations are proposed to stabilize Kenyan Shilling amidst global financial tightening: (i) Strengthening Coordination with Global Monetary Conditions, given the dominant influence of US Federal Reserve rate changes and global liquidity; (ii) Enhance Domestic Monetary Policy Credibility and Flexibility by prioritizing Short-term Monetary Actions to Reduce FX Volatility by tightening Monetary Policy promptly but gradually; (iii) Build and Maintain Adequate Forex Reserves-The Central Bank can enhance its ability to control currency fluctuations through reserve strengthening by diversifying foreign exchange inflows between diaspora remittances and export revenues; and (iv) Mitigate Commodity Price Vulnerabilities by implementing energy diversification strategies, hedging mechanisms, and petroleum reserve development will help decrease the currency's exposure to price shocks. Others include Managing Macroeconomic Uncertainty and Risk Aversion, leveraging remittances as a stabilizing force, and enhancing Data Monitoring and Market Development to help policymakers make quick and effective decisions by better monitoring capital movements, FX market activities, and global financial data.

## Areas of Further Research

Based on the results, conclusions, and policy recommendations of this study, several areas for further research have emerged. First, future studies could explore the role of financial market microstructure factors and capital flow composition in shaping FX volatility, providing finer insights into liquidity impacts and speculative behavior beyond aggregate macroeconomic variables. Second, expanding the modeling framework to incorporate nonlinear dynamics and regime-switching effects could better capture the structural breaks, prolonged shocks, or crisis periods that affect volatility and correlations. Third, research on the effectiveness and timing of various policy intervention tools, including macroprudential measures, along with monetary and fiscal policies, would enhance the understanding of optimal stabilization strategies in the face of global tightening.

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