DETERMINANTS OF EXCHANGE RATE VOLATILITY IN UGANDA

BY

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DECLARATION

I, NAKIJOBA VALERIA hereby declare that this research report entitled "DETERMINANTS OF EXCHANGE RATE VOLATILITY IN UGANDA" is my original work and has not been presented by anyone for the award of a degree in any other university.

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Date: 27th /10 /2025

APPROVAL

This is to certify that the research report titled "DETERMINANTS OF EXCHANGE RATE VOLATILITY IN UGANDA" was done by NAKIJOBA VALERIA under my supervision and is approved for submission.

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Date.....27/10/2025.....

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DEDICATION

This research paper is sincerely dedicated to my supportive parents (Ms. Margret Nnattembo and Mr. Grace Tiigo) who encouraged and inspired me in conducting this study. They have never left my side throughout the process and gave me strength and hope. They provided me a great sense of enthusiasm and perseverance in pursuing this degree. Without their love and assistance, this research would not have been made possible.

And lastly, I dedicate this research paper to the Almighty God who gives me strength, wisdom, guidance, power of thinking, security, competence, and for giving me good health while doing this. All these, I offer to you.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ARCH	Autoregressive Conditional Heteroskedasticity
BoU	Bank of Uganda
FY	Financial Year
FDI	Foreign Direct Investment
GARCH	Generalized Autoregressive Conditional Heteroskedasticity
GDP	Gross Domestic Product
IMF	International Monetary Fund
MoFPED	Ministry of Finance, Planning and Economic Development
NDP	National Development Plan
NPA	National Planning Authority
UGX	Ugandan Shilling
U.S	United States
WDI	World Development Indicators

ABSTRACT

This study examined the determinants of exchange rate volatility in Uganda using monthly data spanning the period January 2000 to June 2025. Employing the Autoregressive Conditional Heteroskedasticity (ARCH) family model with multiplicative heteroskedasticity, the study analyzed both the mean and variance equations to capture the dynamic behavior of the Ugandan shilling against the U.S. dollar. The results from the mean equation revealed that interest rates exert a statistically significant negative effect on the exchange rate, implying that a 1% increase in interest rates leads to an approximate 0.13% appreciation of the Ugandan shilling. This finding underscores the critical role of monetary policy in influencing exchange rate movements in Uganda.

In the variance equation, the results demonstrated that inflation and the trade balance significantly reduce exchange rate volatility. Specifically, higher inflation rates were associated with lower levels of volatility, suggesting that price stability contributes to currency stability when supported by consistent policy frameworks. Similarly, an improved trade balance was found to stabilize the exchange rate by reducing external sector imbalances. The ARCH component indicated that recent exchange rate shocks have a strong and immediate effect on current volatility, while the GARCH term showed that such volatility tends to dissipate relatively quickly thus short lived nature of market disturbances.

The findings overall suggest that Uganda's exchange rate dynamics are largely influenced by interest rate policy, inflation management, and trade performance. Several policy implications emerge. The Bank of Uganda should strengthen its monetary policy stance through strategic interest rate adjustments to mitigate exchange rate fluctuations during periods of depreciation pressure. The government should also sustain price stability by maintaining credible inflation targeting frameworks, stabilizing food and fuel prices, and controlling cost-push inflation sources. Enhancing the trade balance through export promotion, diversification into high-value sectors, and investment in trade infrastructure can further stabilize the currency. Finally, coordination between fiscal and monetary policies is critical to ensure policy consistency, promote macroeconomic stability, and prevent conflicting outcomes.

CHAPTER ONE

1.1 Background of the study

Exchange rate volatility remains a critical issue for developing economies influencing trade competitiveness, capital flows, dynamic inflation and overall macroeconomic stability. In low income countries like Uganda where the economy is highly dependent on exports of primary commodities and imports of essential goods, fluctuations in the foreign exchange market can have significant implications for economic growth, fiscal planning and monetary policy effectiveness. The determinants of such volatility are often multifaceted reflecting both domestic macroeconomic fundamentals and external shocks.

A substantial body of literature has examined the drivers of exchange rate movements and volatility in various global contexts. Studies on the global foreign exchange market (Zolotykh et al., 2021; Greenaway-McGrevy et al., 2016, 2017) have highlighted the influence of dominant currency factors particularly the U.S. dollar and the euro on bilateral and multilateral exchange rate movements. Komiya (2024) showed that under inflationary pressures, traditional models such as purchasing power parity and interest rate parity may fail to explain exchange rate behaviour suggesting that volatility can be driven by shifting global interest rate differentials and speculative market expectations. In the context of emerging economies (My & Sayim (2016); Raja & Ullah, 2014) reported that macroeconomic fundamentals such as interest rates, trade balance and capital inflows significantly affect both the level and volatility of exchange rates.

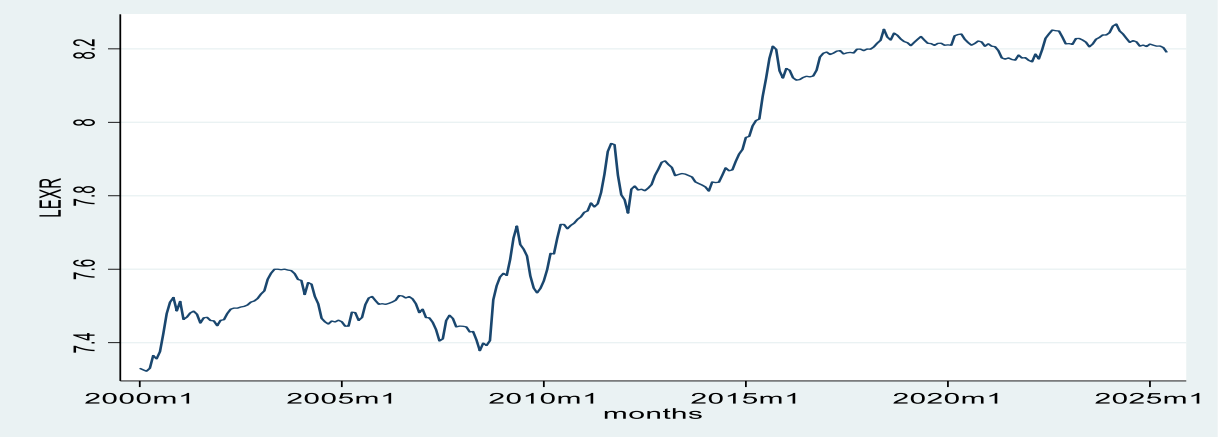
Nenrot et al. (2022) identified a wide range of determinants including trade, money supply, trade openness, domestic investment, interest rate differentials, foreign exchange reserves, inflation, capital inflows, GDP, current account balance, external debt and government spending. Similarly, Akter (2021) emphasized the role of market forces and extraordinary events such as global crises and natural disasters in shaping currency behaviour noting that the interplay of these factors can create complex volatility patterns.

Other scholars have categorized exchange rate determinants into fundamental macroeconomic variables, market related factors and extraordinary events (Solodzhuk & Myhovych, 2022). Empirical studies in emerging markets such as India (Basha, 2015; Venkatesan & Ponnamma,

2017) have found GDP growth, inflation, balance of payments, foreign reserves and foreign investments to be significant drivers of exchange rate fluctuations with policymakers often intervening to manage volatility. Bresser-Pereira et al. (2022) further argued that exchange rates can remain misaligned for extended periods with terms of trade, current account balance and interest rate differentials playing central roles in determining currency values.

Exchange rate volatility matters for Uganda because it quickly transmits to prices, trade competitiveness, external debt service and financial stability in a small, open and import dependent economy. Managing this volatility is explicitly aligned with the country's long term policy agenda as outlined in Uganda Vision 2040 which calls for maintaining macroeconomic stability including prudent monetary and exchange rate policies as a foundation for structural transformation and sustained growth (NPA, 2013). In the medium term, the Fourth National Development Plan (NDP IV, FY2025/26–2029/30) positions macroeconomic stability as an enabling condition for export growth, industrialization and private sector led transformation continuing the Vision 2040 pathway (NPA, 2024). Complementing these plans, the Government's Tenfold Growth Strategy targets a step change in GDP by 2040 through agro-industrialization, tourism, minerals and science & technology objectives that depend on a competitive and predictable exchange rate environment to catalyze exports, investment and technology adoption (MoFPED, 2025).

Figure 1: Uganda's monthly exchange rate from 2000 to 2025



Source: Bank of Uganda, 2025

The graph shows the monthly exchange rate in Uganda from January 2000 to June 2025, indicating a long term upward trend that suggests a persistent depreciation of the Ugandan shilling against the US dollar. Between 2000 and 2009, the exchange rate experienced moderate cyclical fluctuations with limited volatility followed by a sharp acceleration in depreciation from 2010 to 2015 marked by notable spikes in 2011 and 2014–2015 likely driven by global commodity price shocks, domestic inflationary pressures and trade deficits. A significant jump around 2015 points to a major depreciation event after which the exchange rate stabilized from 2017 onwards fluctuating within a narrower range. This recent stability may reflect improved monetary policy, inflation control and better trade balance management although the earlier depreciation levels have been sustained, leaving the currency vulnerable to future shocks.

Emerging market evidence shows that exchange rate behavior and its volatility is driven by a mix of domestic fundamentals such as inflation, interest rate differentials, money supply, productivity, fiscal stance, external balances (trade/current account), capital flows and reserves as well as global risk factors and policy interventions. Mapping studies across developing countries identify trade, money and credit aggregates, openness, FDI and reserves, inflation, GDP, current account balances, debt and policy actions among the most frequent determinants. Volatility spikes are often associated with extraordinary events and shifts in global financial conditions. (Nenrot et al., 2022; Akter, 2021; Solodzhuk & Myhovych, 2022; Basha, 2015; My & Sayim, 2016; Venkatesan & Ponnamma, 2017; Greenaway-McGrevy et al., 2016, 2017; Komiya, 2024). While the specific papers are not focused on Uganda, the Bank of Uganda (BoU) finds similar mechanisms at work domestically and notes that policy responses to short run exchange rate volatility typically combine foreign exchange operations, sterilization to manage liquidity effects and the interest rate channel alongside macro prudential tools to safeguard financial stability (Mugume, 2019).

Despite this broad literature, evidence for Uganda that jointly examines the trade balance with key macro financial drivers to explain exchange rate volatility remains thin. This gap matters for policy for the Vision 2040, NDP IV and the Tenfold Growth Strategy hinge on export diversification, productivity upgrades and deeper integration into global value chains outcomes that are highly sensitive to volatility through pricing to market, hedging costs and investment timing (NPA, 2013). Moreover, recent episodes of shilling pressure and policy adjustments

underscore how global shocks, portfolio flows and domestic fundamentals interact to shape volatility and the monetary stance (Biryabarema, 2024)

This study therefore investigates the determinants of exchange rate volatility in Uganda focusing on the combined role of the trade balance and selected macroeconomic fundamentals such as interest rates and inflation while allowing for volatility clustering typical of frontier and emerging markets.

1.2 Statement of the Problem

Exchange rate volatility poses significant challenges to macroeconomic stability, trade competitiveness and investment flows in developing economies with Uganda being no exception. Persistent fluctuations in the Uganda shilling against major currencies driven by both domestic and global factors create uncertainty in the business environment, raise transaction costs and undermine export competitiveness (BOU, 2023).

Uganda operates a floating exchange rate regime (IMF, 2024). The recent period average USD/UGX reported in the Ministry of Finance's monthly report was about UGX 3,705.9 per USD period averages shown in the July 2025 performance of the economy report (MoFPED, 2025). The shilling fell roughly at 3% in early 2024 prompting the Bank of Uganda to raise its policy rate by 50 basis points in March 2024 to help stabilise the currency. Further, foreign exchange reserves fell about 12% to roughly USD 3.58 billion (Jun 2023 to Jan 2024), leaving cover at 3.4 months, a factor that increases exchange rate vulnerability (Biryabarema, Elias 2024). Despite policy efforts, Uganda’s exchange rate remains vulnerable to shocks from trade imbalances, inflationary pressures, changes in global commodity prices, speculative market activities and external debt dynamics (IMF, 2024).

Uganda’s long term development frameworks including Uganda Vision 2040, the National Development Plan IV (NDP IV) and the Tenfold Growth Strategy emphasize the need for macroeconomic stability as a foundation for sustained economic transformation. However, exchange rate instability threatens the attainment of these ambitions by disrupting foreign direct investment inflows, distorting import and export pricing and increasing the cost of debt servicing in foreign currency.

While existing literature provides evidence on exchange rate determinants in emerging economies (Nenrot et al., 2022; Akter, 2021; Komiya, 2024) there is limited empirical research tailored to Uganda's unique structural context characterized by a narrow export base, high dependence on imported inputs and vulnerability to external shocks. Moreover, previous studies have often examined determinants in isolation, neglecting the potential combined influence of trade balance indicators and macroeconomic fundamentals on exchange rate volatility. This creates a knowledge gap that hinders the formulation of targeted, evidence based policies.

Addressing this gap is crucial for Uganda's policymakers, as understanding the drivers of exchange rate volatility will inform strategies that align with the country's development aspirations under Vision 2040, NDP IV, and the Tenfold Growth Strategy ultimately fostering a stable macroeconomic environment that supports inclusive and sustainable growth.

1.3 Objectives of the Study

1.3.1 General objective of the study

The objective of this study is to investigate the determinants of exchange rate volatility in Uganda.

1.3.2 Specific objectives of the study

i. To investigate the relationship between inflation and exchange rate in Uganda
ii. To examine the effect of interest rate on exchange rate in Uganda
iii. To determine the effect of trade balance on exchange rate in Uganda

1.4 Significance of the Study

The study provides critical insights into the determinants of exchange rate volatility in Uganda offering both academic and policy relevance. By employing the ARCH regression framework, the research identifies the key drivers of exchange rate fluctuations particularly interest rates, inflation and the trade balance and also quantifies their effect and persistence over time. These findings are vital for policymakers at the Bank of Uganda and the Ministry of Finance, Planning and Economic Development to design informed monetary and trade policies aimed at stabilizing the exchange rate and fostering macroeconomic stability.

For investors and businesses, the results will enhance understanding of the risk environment, enabling better financial planning, pricing and hedging strategies. Academically, the study adds to the limited empirical literature on exchange rate volatility in Uganda by applying advanced econometric techniques such as ARCH/GARCH thereby providing a methodological framework for future research in developing economies with similar macroeconomic characteristics.

1.5 Scope of the Study

The study focuses on identifying and analyzing the determinants of exchange rate volatility in Uganda using monthly time series data covering the period from January2000 to June 2025. The research examines the Ugandan shilling's bilateral exchange rate against major foreign currency with the mean equation incorporating interest rates as a key explanatory variable and the variance equation including inflation and the trade balance to capture their effects on volatility. The analysis is conducted within the ARCH/GARCH econometric modeling framework to capture both short term shocks and volatility persistence.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the theoretical, empirical review of the literature and the summary of the literature.

2.2 Theoretical Literature

2.2.1 Purchasing Power Parity (PPP) Theory

This theory posits that exchange rates are determined by relative price levels between countries. According to this theory, a currency will depreciate if domestic prices rise relative to foreign prices to maintain purchasing power parity (Krugman & Obstfeld, 2018). This theory is often used for long-run exchange rate predictions although empirical deviations are common due to trade barriers, transport costs and market imperfections (Salvatore, 2019).

2.2.2 Monetary Approach to Exchange Rate

This approach argues that exchange rates are determined by a country's money supply and demand relative to another. Under flexible prices (the monetarist model) an increase in domestic money supply leads to currency depreciation. The overshooting model (Dornbusch, 1976) adds that due to sticky prices, exchange rates can temporarily overshoot their long-run equilibrium in response to monetary shocks (Kallianiotis, 2013).

2.2.3 Portfolio Balance Approach

This theory emphasizes that exchange rates are determined by the supply and demand for financial assets. Investors choose their portfolio allocations between domestic and foreign assets based on expected returns and risks. Thus the fiscal policies affecting government bonds and assets can influence exchange rates through shifts in investor preferences (Kallianiotis, 2013).

2.3 Empirical Literature

Nenrot et al. (2022) reviewed the key factors influencing foreign exchange rates based on studies from various developing countries using a literature mapping approach covering the period from 1994 to 2020. They reported that variables such as trade, money supply, trade openness, domestic investment, interest rate differentials, foreign exchange reserves, productivity, inflation, capital inflow, gross domestic product, current account balance, external debt, government spending, oil revenue, nominal exchange rate, gold prices, tariffs, investments, central bank interventions, foreign assets and net exports were commonly identified as determinants of foreign exchange rates in these countries.

Akter (2021) stated that the foreign exchange rate plays an important role in reflecting the economic health of a country. According to the study, the exchange rate supports financial stability, strengthens purchasing power and facilitates international trade. Akter explained that exchange rates often change due to market forces that affect the supply and demand for currencies. The study found that factors such as inflation (both nominal and relative), income levels, government actions, global events, natural disasters and unexpected crises like COVID-19 or the Rohingya issue can all influence exchange rates. It was also noted that interactions among these factors could create complex impacts on the currency market.

George (2024) examined the effect of exchange rate volatility on Uganda's trade balance over the period 1980–2020. The study incorporated macroeconomic variables such as the consumer price index (inflation), real gross domestic product (GDP), exchange rate volatility, foreign direct investment (FDI) and gross capital formation (GCF). Using annual time series data, the author applied the Augmented Dickey Fuller (ADF) and Phillips Perron (PP) tests to assess stationarity and found that some variables were stationary at level while others required first differencing. An ARDL bounds test confirmed the existence of long run relationships among the variables. The ARDL model results revealed that in the short run, volatility in the real effective exchange rate had a negative effect on the trade balance whereas in the long run, the effect turned positive. In the long run, real GDP, inflation and GCF positively influenced the trade balance while FDI had a negative effect. Based on these findings, George recommended that the Government of Uganda establish robust hedging facilities such as forward markets to shield

international trade from short run exchange rate risks while maintaining a stable shilling to avoid adverse price and trade balance effects.

Katusiime et al. (2016) investigated the implications of exchange rate volatility on economic growth in Uganda in the context of the disruptions caused by the global financial crisis which had heightened volatility and disturbed trade and capital flows in many developing economies. Using data from 1960 to 2011 and applying an autoregressive distributed lag (ARDL) model, the authors found that exchange rate volatility exerted a positive impact on economic growth in both the short and long run. However, they also observed that political instability in the short run weakened this positive relationship. The results were robust to alternative model specifications underscoring the resilience of the findings.

Stanley (2024) explored the relationship between exchange rate volatility and exports in Uganda aiming to assess the presence of volatility clustering, the short run and long run effects of volatility on exports and the role of FDI. Using World Bank annual data from 1960 to 2023, exchange rate volatility was derived from theoretical models. The ARCH-LM test revealed significant volatility clustering indicating that high volatility tended to persist and low volatility tended to remain low. ARCH-family regression results suggested no statistically significant short-run relationship between exchange rate volatility and exports although FDI showed a significant positive link with exports. In the ARDL model, exchange rate volatility had a negative and significant long-run effect on exports. The study also found that lending interest rates, tax revenue and inflation significantly and positively influenced exports. Stanley concluded that persistent volatility in Uganda's exchange rate could harm export growth and recommended a combination of regulatory measures such as margin requirements, limits on leverage and speculation, market stabilization policies and improvements in market microstructure alongside continued promotion of exchange rate stability, diversification of exports, support for value addition, attraction of FDI and exporter education initiatives.

Solodzhuk & Myhovych (2022) examined how the foreign exchange market functions when exchange rates fluctuate. They categorized the main factors that determine exchange rates into four groups of fundamental factors (like core economic indicators), technical market-related factors, extraordinary events and noneconomic influences. Their study also looked into trends in

forward currency markets including forward contracts, currency swaps, options and other financial instruments. Additionally, they provided a brief overview of income trends from common currency pair quotes.

Basha (2015) explained that the foreign exchange rate refers to the price of one unit of foreign currency in terms of the domestic currency. The study observed that the Indian Rupee (INR) had not been highly valued against the United States Dollar (USD). Basha noted that fluctuations in exchange rates had significant effects on the Indian economy which is why exchange rates are closely monitored and often influenced by government policies. Based on secondary data from 2000–2001 to 2012–2013, the study identified several factors affecting INR fluctuations such as GDP growth rates, inflation, balance of payments, interest rates, foreign reserves and foreign investments. Basha concluded that the global economic outlook, unfavorable balance of payments and capital flows played major roles in determining the future of the INR. The study emphasized that exchange rates in emerging economies like India are a critical monetary policy tool and are subject to more frequent intervention than in advanced economies due to their greater vulnerability to shocks and less mature financial markets. Basha highlighted that exchange rates influence trade, investment returns, firm profits, purchasing power and economic growth making them essential to economic stability and development.

Bresser-Pereira et al. (2022) explained that the exchange rate can stay overvalued or undervalued for long periods. They defined two key concepts of the equilibrium exchange rate and the competitive exchange rate which helps investment projects remain competitive internationally. Unlike the traditional approach that starts with Purchasing Power Parity (PPP), they based their model on the idea of the value of foreign money meaning the exchange rate depends on the supply and demand of foreign currency. According to them, this value is shaped by three main factors of the terms of trade, the current account balance (which affects capital inflows) and interest rate differentials. The authors criticized the idea of a fundamental equilibrium exchange rate and developed two econometric tests. One test checked if the chosen four variables were relevant and the other tested whether their model could effectively predict exchange rate movements over time.

Hasan & Islam (2023) studied how macroeconomic variables affect the stock market in Bangladesh. They used monthly data from January 2017 to December 2022 including variables such as crude oil prices, import payments, inflation rate, call money rate, GDP growth rate and foreign borrowing. The Dhaka Stock Exchange's DSEX index was used as a measure of stock market performance. They applied the Augmented Dickey-Fuller (ADF) test and found that the data was stationary. Therefore, they used the Ordinary Least Squares (OLS) regression method. Their results showed that import payments, inflation and crude oil prices had a significant positive impact on the stock market while the call money rate and foreign borrowing had a significant negative effect. GDP growth rate showed no significant effect. The researchers suggested that financial institutions and investors could use these findings to better predict stock price changes and plan strategies to reduce risks and take advantage of favorable conditions.

Zolotykh et al. (2021) aimed to identify key factors behind structural changes in the global foreign exchange market and assess how these factors influence future trends. They used both secondary sources and statistical tools like correlation and regression analysis. Their findings revealed that different currency pairs react differently to global economic factors. For example, the USD/EUR and USD/GBP pairs were most influenced by the money supply (M2) while the USD/JPY pair was more affected by oil prices. They found no significant link between exchange rates and the economic growth of G7 countries. The study concluded that 79% to 90% of the exchange rate changes could be explained by the selected variables while the remaining influence came from factors not included in their model.

Greenaway-McGrevy et al. (2017) found that exchange rate returns are mainly influenced by two key factors of a dollar factor and a euro factor. They explained that global exchange rates are shaped by risk factors from the U.S., the eurozone and global financial markets. These factors supported a multilateral model which they said worked better than traditional models like the random walk or the purchasing power parity (PPP) approach when forecasting exchange rates. Their study showed that their multilateral model predicted exchange rates more accurately, especially for 24-month-ahead forecasts compared to models using principal components.

Komiya (2024) set out to find how the exchange rate between the Japanese Yen and the U.S. Dollar was influenced by four key variables under recent inflationary conditions. These variables

included the 2-year U.S. treasury bond yield, the inflation rate and two moving averages of the exchange rate used to reflect market expectations. The study revealed that these variables had a strong impact on daily and monthly changes in the Yen/USD exchange rate. Komiya used two different regression models and found that both confirmed the significant role of these variables. The research covered a 30-month period from early 2021 to mid-2023 and showed that traditional theories like interest rate parity and purchasing power parity did not hold. This was largely due to the U.S. Dollar staying strong, supported by rising U.S. interest rates in response to faster inflation in the U.S. compared to Japan.

Kallianiotis (2013) explained that exchange rate determination can be understood through different schools of thought focusing mainly on the asset market approach to solve complex problems. The author discussed various theories such as the monetary approach which includes the monetarist model with flexible prices and the overshooting model with sticky prices, and the portfolio balance approach. Other topics covered included efficiency in the foreign exchange market, exchange rate expectations and news, the link between money markets and exchange rates, the impact of freezing funds risk premiums, public policies affecting exchange rates and the effects of oil prices and the Eurozone debt crisis on exchange rates.

Pachiyappan et al. (2023) studied the relationship between exchange rates and selected macroeconomic variables using data from January 2013 to November 2022. They used monthly data for their analysis. Descriptive statistics were applied to understand data characteristics while correlation analysis and the Ordinary Least Squares (OLS) method were used to determine the relationship and impact level of macroeconomic factors on exchange rates. The study also used the Autoregressive Distributed Lag (ARDL) model to examine whether short-run and long-run associations exist between the variables and exchange rates.

Stamenović & Jelisavac-Trošić (2020) defined the main participants in the international foreign exchange market and examined how natural, political and economic factors influence exchange rate movements. They aimed to analyze the exchange rate as a macroeconomic phenomenon by identifying factors affecting its changes and their impacts on market participants. They also highlighted that proper risk management measures can reduce the effects of these significant factors by determining types and measures of risk exposure.

Greenaway-McGrevy et al. (2016) found that exchange rate returns are driven by two main factors identified as a dollar factor and a euro factor. They stated that exchange rates are influenced by global, U.S. and eurozone stochastic discount factors which can also be interpreted as risk-based factors. Their findings supported the use of multilateral models for bilateral exchange rate forecasting. The study showed that these multilateral models outperformed the random walk model and the bilateral purchasing power parity model in out-of-sample forecasts and they also provided more accurate forecasts over a 24-month period compared to principal components models.

Venkatesan & Ponnamma (2017) observed that the Indian Rupee is expanding its role in the global market with countries like Bhutan and Nepal pegging their currencies to it. They noted that India's high GDP growth compared to other emerging economies along with factors such as gross domestic savings, forex reserves and inflation help to strengthen its foreign exchange rate. They pointed out that recent government initiatives to attract foreign capital and reduce interest rates have contributed to a stable exchange rate. The authors mentioned that the Reserve Bank of India aims for capital account convertibility and a move towards a freely floating currency from the current managed float. However, the recent appreciation of the Chinese Yuan posed challenges for Indian policymakers in supporting domestic industries. Therefore, their study focused on identifying and evaluating macroeconomic factors affecting the exchange rate and modelling them using the ARDL approach to forecast future exchange rates.

My & Sayim (2016) examined how macroeconomic factors affect exchange rates between the U.S. and four major emerging economies of India, Mexico, Brazil and China during 2005–2014. They used Enter and Stepwise multiple regression methods to analyze the impact of market fundamentals on exchange rates. Their findings showed that macroeconomic factors significantly influenced the exchange rates of USD against CNY, INR, BRL and MXN. They emphasized that implementing sound macroeconomic policies is crucial to stabilize exchange rates and reduce their volatility.

Raja & Ullah (2014) conducted a panel data analysis covering four countries. They reported that relative interest rates, trade balance, terms of trade and net capital inflows had significant effects on exchange rates. Their findings showed that higher interest rates and an adverse trade balance

had a significant negative impact on the exchange rate while better terms of trade and increased net capital inflows led to a stronger and more favorable exchange rate for the home country.

2.4 Summary of the literature and gap

The reviewed studies provide extensive evidence on the determinants of exchange rate behaviour across various contexts including both stability and volatility dynamics. Nenrot et al. (2022) mapped out a wide range of factors influencing exchange rates in developing countries including trade, money supply, investment and macroeconomic indicators such as inflation, interest rates, and external debt many of which also contribute to fluctuations in exchange rate volatility. Other scholars such as (Akter, 2021; Solodzhuk & Myhovych, 2022) emphasized the role of market forces, policy interventions and extraordinary events factors often associated with sudden spikes in volatility rather than gradual shifts in currency values. Studies by (Basha, 2015; Venkatesan & Ponnamma, 2017; My & Sayim, 2016) focused on emerging economies finding that GDP growth, balance of payments, foreign investments and government policies significantly affect currency performance with volatility often arising from abrupt changes in these determinants. More recent works by (Greenaway-McGrevy et al., 2017) highlighted the predictive power of multilateral models for exchange rate movements while (Komiya, 2024) demonstrated that traditional theories like purchasing power parity may break down in high inflation environments leading to increased volatility. The use of econometric methods such as ARDL, OLS and regression analysis has been common to examine both the short run and long run dynamics of exchange rate volatility.

Despite the vast literature, there remains a clear gap in understanding the combined influence of the balance of trade and macroeconomic fundamentals on exchange rate volatility in low income developing countries like Uganda where structural vulnerabilities and unique policy contexts can amplify or dampen volatility compared to other emerging economies. Much of the existing research focuses on Asia and large emerging markets such as India, China and Brazil with limited empirical attention to sub-Saharan Africa. Furthermore, while previous studies often isolate determinants, few integrate trade balance indicators with domestic macroeconomic variables in modelling volatility behaviour especially using ARCH and GARCH models to jointly capture long run persistence and short run clustering effects in exchange rate fluctuations.

This study therefore seeks to fill this gap by empirically analysing how the trade balance together with selected macroeconomic factors influences Uganda's exchange rate volatility thereby providing insights relevant for policy formulation in similarly structured low-income economies.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section presents the model description, variable definition and measurement, estimating procedure, estimation technique, and diagnostic tests, data type and source.

3.2 Model description

The study adopts the Balance of Payments (BOP) model that is based on the Balance of Payments Theory of exchange rate also known as the Demand and Supply theory of exchange rate. According to (Salvatore, 2019) this theory explains that exchange rates are determined by the demand for and supply of foreign exchange which arise from a country's balance of payments position. In line with this, the study uses the model described by (Krugman & Obstfeld, 2018) who note that exchange rates are driven by market forces created through a country's external transactions.

The Balance of Payments (BOP) model posits that the exchange rate is influenced by the supply and demand for foreign currency which arises from a country's current account (goods and services trade, remittances, etc.) and capital account (foreign investments, loans, reserves). This is illustrated as;

$E = f(CA, KA)$……. (3.1)

Where E= Exchange rate, CA = Current Account Balance, KA = Capital Account Balance

The dependent variable is Exchange rate (EXR) and the independent variables are Inflation (INF), Interest rate (INT) and Trade Balance (TB). The model explores the relationship between Exchange rate (EXR) and the independent variables and is as follows.

$EXR = f(INF, INT, TB)$……. (3.2)

Therefore, to estimate the parameters β, the equation will take the following form;

$$EXR = \beta_0 + \beta_1 INF + \beta_2 INT + \beta_3 TB + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.3)$$

Where; EXR= Exchange rate, INF= Inflation, INT= Interest rate, TB= Trade balance, ε= error term, β_0= Intercept, $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$= Parameters.

3.3 Definition and measurement of variables.

Exchange rate (REER)

This measures the value of a country's currency against a weighted basket of major trading partners' currencies, adjusted for inflation differentials. It reflects the competitiveness of a nation's goods and services in international markets. The REER is calculated as an annual average of monthly exchange rates (local currency units per U.S. dollar), adjusted by relative consumer price indices (CPI) of trading partners. A rise in the REER indicates an appreciation of the domestic currency and reduced external competitiveness.

Inflation (INF)

This is measured as the annual percentage change in the GDP implicit deflator, which represents the overall rate of price changes in the economy. It is calculated by dividing GDP at current prices by GDP at constant prices and taking the year-on-year percentage growth. High inflation typically erodes the purchasing power of the domestic currency, leading to currency depreciation; thus, the expected sign of its relationship with the exchange rate is positive.

Interest Rate (INT)

This refers to the bank rate applied to short and medium term financing in the private sector. It represents the cost of borrowing or return on investment in the domestic economy. It is measured as an annual average of the central bank's policy or lending rate. Higher interest rates generally attract foreign capital inflows, strengthening the domestic currency; therefore, the expected sign in relation to exchange rate movement is negative.

Trade Balance (TB)

The Trade Balance (TB) represents the difference between a country's total exports and imports of goods and services, measured in local currency units or as a percentage of GDP. It is calculated as:

$$TB = Exports - Imports \quad \text{..... (3.4)}$$

A positive trade balance (surplus) increases demand for the domestic currency, leading to appreciation, while a negative trade balance (deficit) weakens it. The expected relationship between the trade balance and the exchange rate is negative.

The data was converted to monthly frequency to match the model's time series structure and ensure temporal consistency across variables through linear interpolation which distributes annual values evenly across the twelve months of each year while maintaining the overall annual trend.

3.4 Estimation procedure

3.4.1 Research Design

This study adopts a quantitative research design using time series econometric modeling to investigate the determinants of exchange rate volatility in Uganda. Given the inherent heteroskedasticity and clustering effects present in financial and exchange rate series, the study applies the Autoregressive Conditional Heteroskedasticity (ARCH) and Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models as proposed by Engle (1982) and Bollerslev (1986) respectively. These models are suitable for capturing time varying volatility and persistence effects in exchange rate movements thereby providing a robust framework for examining the influence of macroeconomic variables and trade indicators on volatility dynamics.

3.4.2 ARCH and GARCH model estimation

Volatility in financial and macroeconomic time series such as exchange rates often exhibits heteroscedasticity meaning that the variance of the error term changes over time instead of being

constant. Traditional regression models assume constant variance (homoskedasticity) but this assumption is often violated in exchange rate data. This is where ARCH (Autoregressive Conditional Heteroskedasticity) and GARCH (Generalized Autoregressive Conditional Heteroskedasticity) models become important.

1. ARCH Model

The ARCH model was proposed by Engle (1982) and it assumes that the current variance of the error term depends on the squared values of previous error terms. This allows for modeling periods of high and low volatility that are commonly referred to as volatility clustering which is a characteristic of exchange rate series. In the ARCH (q) model, the conditional variance is modeled as a function of the past q squared residuals from the mean equation.

2. GARCH Model

Bollerslev (1986) extended the ARCH model to the GARCH (p, q) framework which incorporates both the past squared residuals (ARCH terms) and past conditional variances (GARCH terms). The GARCH model is more parsimonious than high order ARCH models thus requiring fewer parameters to capture the persistence of volatility. This makes it widely used for analyzing exchange rate volatility in empirical research.

3.5 Model Specification

The exchange rate volatility is modeled in two stages of;

3.5.1 Mean Equation

This is the model of return series or first difference of the log exchange rate. This captures the conditional mean process of the exchange rate returns. This is written as;

$$R_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i R_{t-1} + \sum_{j=1}^{k} \beta_j X_{jt} + \varepsilon_t \quad \text{..... (3.5)}$$

Where:

Where R_t is the log return of the UGX/USD exchange rate, X_{jt} represents the j-th explanatory macroeconomic variable at time t, and ε_t is the error term.

3.5.2 Volatility equation models the conditional variance using ARCH/GARCH processes

1. ARCH (q) Model

The conditional variance equation for an ARCH (q) model is;

$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i \, \varepsilon_{t-i}^2$ ..... (3.6)

Where:

σ_t^2= conditional variance of ε_t

$\alpha_0 > 0$ (constant term)

$\alpha_1 \geq 0$ (ARCH coefficients)

q = order of the ARCH model

2. GARCH (p, q) Model

The conditional variance equation for a GARCH (p, q) model is;

$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i \, \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j \, \delta_{t-j}^2$ ..... (3.7)

β_j= GARCH coefficients capturing the persistence of volatility

p = order of the GARCH terms (past variances)

q = order of the ARCH terms (past squared residuals)

3.6 Diagnosis tests

3.5.1 Serial correlation / Autocorrelation test

Serial correlation tests whether a variable is correlated with its past values over time. The Breusch-Godfrey LM test is used where the null hypothesis assumes no serial correlation and rejection implies the presence of serial correlation.

3.5.4 Normality test

The Jarque-Bera test is used to check if the residuals follow a normal distribution. The null hypothesis assumes normality while the alternative suggests non-normality. The test statistic is calculated as:

$$JB = \left[\left(\frac{S^2}{6} + \frac{(K-3)^2}{24}\right)\right] \quad \text{..... (3.8)}$$

Where; S= Skewness, K= Kurtosis

Data Description and Sources

The study utilizes monthly time series data spanning January 2000 to June 2025. The dependent variable is the exchange rate obtained from the Bank of Uganda (BoU). Independent variables include Inflation, interest rate and trade balance.

CHAPTER FOUR

EMPIRICAL DATA ANALYSIS, DISCUSSION AND INTERPRETATION

4.1 Introduction

This chapter considers the descriptive data analysis, correlation of variables, estimation of the ARCH and GARCH model and diagnostic analysis.

4.2 Descriptive data analysis

Table 1: Descriptive statistics

Stats	EXR	INT	INF	TB
N	306	306	306	306
Mean	2685	20.61	-7.397	-226.8
Standard deviation	838.1	2.341	10.03	428.0
se(mean)	47.91	0.134	0.573	24.47
Min	1514	15.53	-26.17	-3054
Max	3896	27.57	10.71	35.48
Coefficient of variation	0.312	0.114	-1.356	-1.887
Skewness	0.138	0.717	-0.270	-5.653
Kurtosis	1.312	3.171	1.799	34.65
Median	2531	20.10	-6.088	-161.0
Variance	702371	5.480	100.6	183194

Source: own computations

The Ugandan exchange rate averaged at UGX 2,685 with a median of 2,531 suggesting a relatively balanced distribution around the central tendency. The standard deviation of 838.1 and a coefficient of variation of 0.312 indicate a moderate degree of variability in the series. The minimum exchange rate observed was 1,514 and the maximum was 3,896 showing a significant range over the study period. Skewness is close to zero that is 0.138 indicating near symmetry while kurtosis of 1.312 suggests the distribution is flatter than the normal distribution. These

statistics indicate that while the exchange rate has fluctuated over time, its distribution is generally symmetrical without extreme tail risks though notable volatility still exists.

The average interest rate stood at 20.61% with a median of 20.10% suggesting a slightly right skewed distribution of 0.717. The standard deviation of 2.341 and a low coefficient of variation (0.114) imply that interest rates were relatively stable compared to other macroeconomic variables. The minimum recorded rate was 15.53% and the maximum was 27.57% indicating some fluctuations but within a relatively narrow band.

The average inflation rate was –7.397% with a median of –6.088% indicating an overall deflationary trend during the study period. The high standard deviation of 10.03 and negative coefficient of variation of –1.356 result from the negative mean and substantial variability. The inflation rate ranged from –26.17% to 10.71% showing significant swings between deep deflation and moderate inflation. Skewness of –0.270 reveals a slight left skew and kurtosis of 1.799 suggests a distribution flatter than normal meaning fewer extreme events compared to a normal curve but still considerable variability.

Uganda's trade balance averaged –226.8 billion UGX reflecting a persistent trade deficit. The high standard deviation of 428.0 and negative coefficient of variation of –1.887 indicate extreme variability relative to the mean. The minimum trade balance was –3,054 billion UGX representing a severe deficit while the maximum was a surplus of 35.48 billion UGX. Skewness of –5.653 shows a strong skew and kurtosis (34.65) reveals an extreme distribution meaning the data is heavily concentrated around the mean with extreme negative outliers. These statistics confirm that trade balance fluctuations are not only large but also heavily tilted toward sharp deficits.

4.3 Correlation of variables

Table 2: Correlation matrix

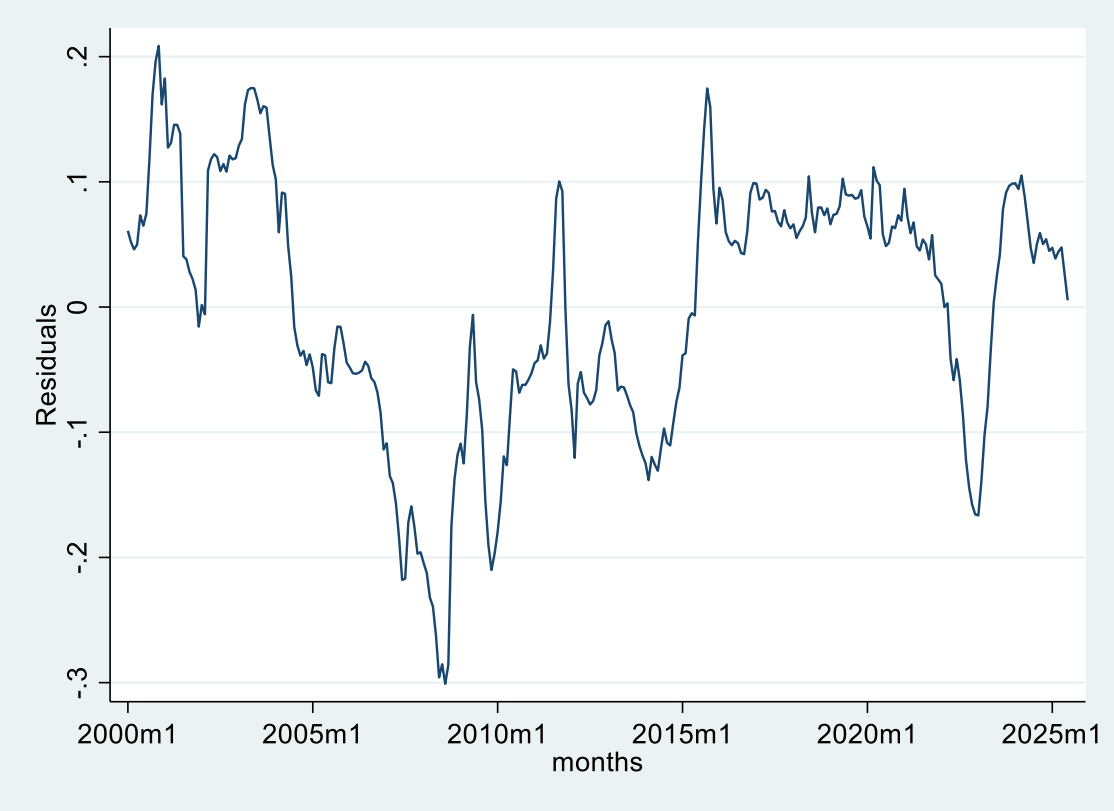
	EXR	INT	INF	TB
EXR	1	1		
INT	-0.1648*	1		
	0.00380			
INF	0.2369*	-0.1536*	1	
	0	0.00710		
TB	0.0509	0.00970	0.109	1
	0.374	0.866	0.0574	

Source: own computations

The correlation matrix indicates the relationships among exchange rate (EXR), interest rate (INT), inflation (INF, and trade balance (TB) in Uganda. Exchange rate volatility shows a statistically significant negative correlation with interest rates (–0.1648, $p = 0.0038$) implying that higher interest rates are associated with a depreciation slowdown or relative stability in the exchange rate. Conversely, EXR has a positive and significant correlation with inflation (0.2369, $p < 0.001$) suggesting that higher inflation tends to coincide with exchange rate depreciation. Interest rates are also significantly and negatively correlated with inflation (–0.1536, $p = 0.0071$) consistent with the idea that tighter monetary policy can help curb inflationary pressures. The trade balance shows weak and statistically insignificant correlations with EXR, INT and INF indicating that its short term fluctuations may not have a direct or immediate relationship with exchange rate movements in the sample period. Overall, the results highlight the stronger influence of monetary variables (interest rates and inflation) compared to trade balance in explaining exchange rate behaviour.

4.4 Volatility of the exchange rate

Figure 2: The volatility of Uganda's monthly exchange rate from 2000- 2025



Source: Own construction

The plot shows the residuals of the exchange rate volatility model over time from around January 2000 to 2025. The residuals rotate around zero which is desirable because it suggests that the model is unbiased in predicting the dependent variable the exchange rate. However, the fluctuations are not uniform over time. Between 2000 and about 2010, there are periods of larger negative deviations and sharp swings indicating episodes where the model's predictions were less accurate and the exchange rate experienced larger shocks. From about 2015 onwards, the residuals appear more tightly clustered around zero though there are still noticeable spikes especially around 2020 and 2023 likely reflecting temporary market shocks or macroeconomic events.

The alternating periods of high and low variability suggest volatility clustering consistent with the earlier LM test for ARCH effects where periods of large residuals tend to be followed by other large residuals (of either sign). This pattern supports the use of an ARCH or GARCH specification in the Determinants of Exchange Rate Volatility in Uganda study as it accounts for such time varying volatility. Overall, the residual series appears mean reverting with no visible long term drift indicating that the model is stable but it still captures the short term bursts of unpredictability that characterize exchange rate movements.

4.5 Autoregressive Conditional Heteroskedasticity (ARCH)

Table 3: LM Test for Autoregressive Conditional Heteroskedasticity (ARCH)

Lags (p)	**Chi²**	**Df**	**Prob > Chi²**
1	261.289	1	0.0000

Source: Own construction

The LM test statistic for detecting ARCH effects with one lag is 261.289 with 1 degree of freedom, and the corresponding pvalue of 0.0000. Since the pvalue is far below the conventional significance levels (1%, 5% or 10%) we reject the null hypothesis of no ARCH effects. This result provides strong statistical evidence that the residuals from the model exhibit autoregressive conditional heteroskedasticity meaning that the variance of the error terms depends on past squared errors. This confirms the presence of volatility clustering in the exchange rate series justifying the use of ARCH or GARCH family models for modeling and forecasting exchange rate volatility.

4.5 Estimation of the ARCH and GARCH model

The estimation of ARCH and GARCH models involves analyzing time series data to capture and forecast volatility patterns by modeling how current variability depends on past variances and shocks.

Table 4: ARCH and GARCH model Estimation of the determinants of exchange rate volatility in Uganda.

Sample: 2000m1 – 2025m6 Number of observations: 107 Log likelihood = 291.0698 Wald chi² (1) = 90.48 (p = 0.0000)					
Equation	**Variable**	**Coefficient**	**Std. Error**	**z**	**P > z**
Mean (LEXR)	LINT (Interest rate)	-0.1293	0.0136	-9.51	0.000
	_cons	8.5922	0.0403	213.25	0.000
Variance (HET)	LINF (Inflation)	-0.8339	0.2668	-3.13	0.002
	TB (Trade balance)	-0.0149	0.0057	-2.62	0.009
	_cons	-12.0275	1.2085	-9.95	0.000
ARCH/GARCH	ARCH (L1)	1.1398	0.3161	3.61	0.000
	GARCH (L1)	-0.0529	0.0197	-2.69	0.007

Source: **Own construction**

The ARCH family regression with multiplicative heteroskedasticity for the study "Determinants of Exchange Rate Volatility in Uganda" was estimated using monthly data from January 2000 to June 2025.

In the mean equation, the coefficient on the interest rate (LINT) is -0.1294 and statistically significant at the 1% level indicating that a 1% increase in interest rates is associated with an approximate 0.13% decrease in the exchange rate (LEXR) holding other factors constant. This negative relationship suggests that higher interest rates tend to appreciate the Ugandan shilling against foreign currency. This is consistent with findings by (Akter, 2021; Solodzhuk & Myhovych, 2022) who underscore the influence of monetary policy on currency stability. In the

Ugandan context, higher interest rates appear to attract short term capital inflows which strengthen the local currency and reduce exchange rate volatility. This finding aligns with the conventional view that interest rate adjustments can be an effective policy tool for managing exchange rate fluctuations though the impact may vary depending on global liquidity conditions and investor sentiment.

In the variance equation, inflation (LINF) and the trade balance (TB) were included to capture the multiplicative effects on volatility. The coefficient on inflation is -0.8339, significant at the 1% level implying that higher inflation is associated with a reduction in exchange rate volatility. The result diverges from the traditional theoretical expectation of a positive association. While conventional models posit that higher inflation erodes currency value and increases volatility, this finding echoes Komiya's (2024) assertion that in high inflation or structurally constrained economies exchange rate behaviour may not conform to standard models. In Uganda's case, the observed effect could be linked to policy interventions such as targeted monetary tightening and foreign exchange market operations that cushion the impact of inflation on currency movements.

Similarly, the trade balance has a coefficient of -0.0149, also statistically significant suggesting that improvements in the trade balance contribute to lower volatility in the exchange rate. The constant term of -12.0276 reflects the baseline log variance when both inflation and trade balance are zero. An improvement in Uganda's trade balance is shown to significantly reduce exchange rate volatility reinforcing the position of (Basha, 2015; Venkatesan & Ponnamma, 2017) that external sector stability is a key determinant of currency stability. A stronger trade balance boosts foreign exchange reserves and investor confidence which in turn dampens speculative attacks and volatility pressures. In economies like Uganda where export performance is sensitive to commodity price shifts, maintaining a favourable trade balance emerges as a critical element of exchange rate management.

The ARCH component reveals that the first lag of the ARCH term has a coefficient of 1.1399 and is statistically significant at the 1% level indicating that recent shocks to the exchange rate have a strong positive and immediate impact on current volatility. The GARCH term at lag one is -0.0530 and significant at the 1% level, implying that past conditional variance slightly dampens current volatility. This combination suggests that while volatility in Uganda's exchange

rate is highly sensitive to recent market shocks, it tends to dissipate relatively quickly rather than persist for extended periods. The Wald chi-square statistic of 90.48 ($p < 0.0001$) confirms that the explanatory variables in the mean equation are jointly significant and the log-likelihood value of 291.07 indicates a good model fit. Overall, the findings show that interest rates are a key driver of exchange rate movements while inflation and trade balance help stabilize volatility with market shocks exerting sharp but short lived effects on the exchange rate.

4.6 Diagnostic analysis

Table 5: Table showing the diagnostic tests

Test	**Probability value**
Serial correlation	0.1200
Normality	0.2500

Source: Own construction

The diagnostic test results show that the probability value for the serial correlation test is 0.1200, which is greater than the conventional significance levels of 0.01, 0.05 and 0.10. This means we fail to reject the null hypothesis of no serial correlation indicating that the residuals from the model are not significantly auto correlated and the model does not suffer from serial correlation problems. Similarly, the probability value for the normality test is 0.2500 which is also above the common significance thresholds. This implies that we fail to reject the null hypothesis of normally distributed residuals suggesting that the model errors follow an approximately normal distribution. These results indicate that the model's residuals meet key assumptions for reliable inference, supporting the validity of the parameter estimates in the determinants of exchange rate volatility.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1. Summary of findings

The study examined the determinants of exchange rate volatility in Uganda using monthly data from January 2000 to June 2025 applying the ARCH family model with multiplicative heteroskedasticity. The results from the mean equation revealed that interest rates have a statistically significant negative effect on the exchange rate with a 1% rise in interest rates leading to an approximate 0.13% appreciation of the Ugandan shilling. In the variance equation, both inflation and the trade balance were found to significantly reduce exchange rate volatility. Specifically, higher inflation rates were associated with lower volatility and improvements in the trade balance also contributed to exchange rate stability. The ARCH component indicated that recent exchange rate shocks strongly increase current volatility while the GARCH term suggested that such volatility tends to fade relatively quickly. The Wald chi-square test confirmed that the mean equation variables are jointly significant and the model demonstrated a good fit based on its log-likelihood value.

5.2. Conclusions

The findings indicate that interest rates play a critical role in influencing Uganda's exchange rate with higher rates contributing to currency appreciation. Additionally, macroeconomic fundamentals particularly inflation and the trade balance are important in moderating exchange rate volatility. However, the exchange rate remains highly responsive to recent market shocks though these effects are short lived. This suggests that policies aimed at managing interest rates, controlling inflation and improving the trade balance can enhance exchange rate stability in Uganda. Nonetheless, given the sensitivity to immediate shocks, timely interventions and robust monitoring mechanisms are essential to mitigate sudden volatility episodes.

5.3. Policy recommendations

The results indicate that higher interest rates are associated with an appreciation of the Ugandan shilling. The Bank of Uganda should strengthen its monetary policy by strategically adjusting

interest rates to manage exchange rate fluctuations especially during periods of depreciation pressure.

The findings further show that inflation has a positive relationship with exchange rate volatility. The government should maintain price stability through credible inflation targeting frameworks, including measures to stabilize food prices and control fuel price shocks, to enhance overall currency stability.

The analysis also reveals that improvements in the trade balance can reduce exchange rate volatility. The government should promote export growth and manage imports through export incentives, diversification into high value sectors, and investment in trade infrastructure to stabilize the shilling.

The results suggest that short term market shocks significantly affect exchange rate movements. Uganda should therefore enhance its market shock monitoring systems, including developing early warning mechanisms and maintaining adequate foreign reserve buffers to cushion against destabilizing capital flows and speculative attacks.

Finally, the results demonstrate that both inflation and trade balance factors jointly influence exchange rate volatility. The government should encourage coordinated fiscal and monetary policy actions to ensure consistency between fiscal discipline and monetary targeting, thereby avoiding conflicting policy outcomes.

5.4. Limitations of the study

The model assumes specific functional forms for volatility persistence which may not fully capture asymmetric effects or structural breaks in Uganda's exchange rate market. The reliance on official monthly macroeconomic statistics assumes accuracy data can have reporting lags or revisions.

5.5. Areas for further study

Future research could include global commodity prices, foreign direct investment inflows and U.S. Federal Reserve interest rate changes to assess external drivers of exchange rate volatility.

Other studies can also look at sectoral trade balance analysis by investigating whether specific export sectors (coffee, gold, tourism) have differential effects on volatility could guide targeted trade policy. Future studies could explore how government spending, debt levels and interest rate policy jointly influence exchange rate stability.

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