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THE EFFECT OF EXCHANGE RATE VOLATILITY ON INTERNATIONAL TRADE AND DEBT SUSTAINABILITY IN KENYA

KABOYO SIMON MWANGI

ADM No.: 137217

A DISSERTATION SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR AWARD OF MASTERS IN DEVELOPMENT FINANCE OF STRATHMORE UNIVERSITY BUSINESS SCHOOL (SBS)

APRIL, 2026

DECLARATION

This is to certify that this thesis proposal is my original work and has not been presented for the award of a degree in any other university or institution of higher learning. Information from other sources has been duly acknowledged.

Student's name: Kaboyo Simon Mwangi

Student's signature…  …… Date: …28/4/2026…

This thesis proposal has been submitted with my approval as the University Supervisor.

Supervisor's name: Dr. Bernadette Wanjala

Supervisor's signature:  Date: 11 May 2026

DEDICATION

I dedicate this thesis to my parents, Othniel Kaboyo Waiguru and the late Elizabeth Wambui Kaboyo

ACKNOWLEDGMENT

I am deeply grateful to God Almighty for granting me the strength and determination to embark on this project and see it through to completion within the required timeframe. I owe special appreciation to my supervisor, whose patience, guidance, and commitment were invaluable in shaping both the study and the manuscript. I also extend heartfelt thanks to my classmates from Strathmore Business School, Class of 2020, whose encouragement and support contributed meaningfully to this work. My profound gratitude goes to my parents, Othniel Kaboyo and the late Elizabeth Wambui, for their unwavering love and belief in me; to my sisters—Mendi, Njeri, Nyambura, Wanjiku, and Wairimu—and to my brothers—Waiguru, Chege, Kimani, Kuria, Muhika, and Kagombe—for their constant encouragement. Above all, I am indebted to my wife, Peris, whose steadfast support and understanding made this journey possible.

With sincere appreciation, I thank you all.

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ABSTRACT

Exchange rate instability plays a pivotal role in shaping international commerce, influencing how nations approach cross-border transactions and how trade and debt dynamics respond to shifts in the wider economy. This research undertook an empirical examination of the relationship between currency fluctuations and Kenya's foreign trade between 1993 and 2023. Annual data were obtained from the Kenya National Bureau of Statistics and the Central Bank of Kenya, and the study applied econometric techniques, including regression analysis, Granger causality, and autoregressive distributed lag (ARDL) bounds testing to capture both immediate adjustments and long-term linkages. The investigation was grounded in a quantitative design within a positive framework, ensuring objective measurement of macroeconomic forces that drive exchange rate movements and their subsequent impact on trade and debt outcomes. Three key insights emerged. Inflation as the dominant factor: Rising inflation was found to be the strongest contributor to exchange rate instability, with a highly significant positive effect, indicating that price increases intensify currency volatility. Interest rates and the current account deficit exerted weaker influences, though the current account balance showed signs of potential relevance. Trade effects: Exchange rate swings were shown to stimulate trade flows, with higher volumes recorded during periods of volatility. Yet this positive effect was tempered by the current account balance, which revealed a significant negative relationship, suggesting that trade imbalances reduce the benefits of currency movements. Debt sustainability: Exchange rate volatility itself did not significantly affect debt sustainability. Instead, fiscal discipline and structural economic factors played a more decisive role, as evidenced by the consistently significant constant term in the regression model. The findings carry important policy lessons. For trade, addressing structural deficits and improving export competitiveness remain essential, since exchange rate shifts alone cannot overcome persistent imbalances. On the monetary front, stabilizing prices is critical, given inflation's central role in driving volatility. For debt management, the results highlight the need for sound fiscal strategies, careful debt structuring, and diversified financing approaches, rather than relying solely on exchange rate stability. In conclusion, the study recommends that Kenyan policymakers reinforce inflation-targeting mechanisms, broaden the export base to reduce the current account gap, and incorporate hedging tools to mitigate currency risk in trade agreements. Furthermore, embedding exchange rate risk analysis into debt management practices will enhance resilience against external shocks.

Keywords: Exchange rate fluctuation, Determinants of exchange rate, GDP, Poverty, Per capita Income, Comparative Advantage, Imports, Exports, Dependency ratio and Exchange rate risk.

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CHAPTER ONE: INTRODUCTION

1.1 Background of study

Over the past few years, the global economy has faced two profound shocks: the COVID-19 pandemic and the conflict between Russia and Ukraine. These events disrupted production and trade worldwide, slowed growth, and ignited sharp inflationary pressures. In response, central banks tightened monetary policy to contain rising prices, but these interventions, combined with broader instability, produced significant volatility in exchange rate movements. The U.S. dollar strengthened against most major currencies, underscoring its central role in global trade and finance. Shifts in the dollar's value have far-reaching consequences, influencing how economies absorb external shocks and often magnifying uneven impacts across countries.

A striking feature of recent developments has been the simultaneous rise in both the dollar and commodity prices, an unusual departure from the historical tendency for dollar appreciation to coincide with weaker commodity prices. Without targeted policy action, higher import costs risk placing heavier burdens on economies reliant on external supplies. Exchange rates, defined as the relative price of one currency against another, can serve as instruments of monetary policy. Yet persistent instability in currency markets erodes investor confidence by increasing uncertainty and complicating long-term planning.

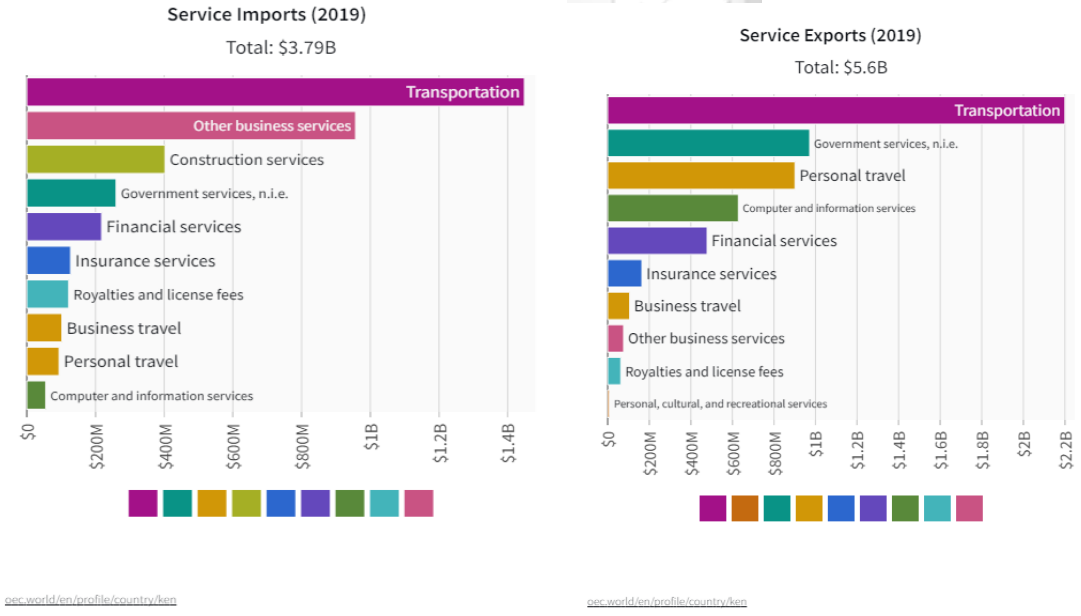
Critics of flexible exchange rate systems, dating back to early scholars such as Taussig and later Romanis & Christian, contend that frequent adjustments heighten unpredictability and diminish the advantages of international trade. This debate has fueled extensive research into the consequences of exchange rate instability for global commerce. Conversely, Mundell's theory of optimal currency areas suggests that strong trade linkages can help moderate real exchange rate volatility, thereby stabilizing bilateral exchange relationships. For many developing economies, including Kenya, central banks have historically sought to maintain workable real exchange rates, recognizing that policy interventions can reduce volatility even when trade alone does not guarantee stability.

In Kenya, the shilling has experienced sustained depreciation over the past decade, falling from approximately Ksh 86 per USD in 2013 to over Ksh 150 per USD by 2023 (Central Bank of Kenya, 2023). This downward trend has been punctuated by episodes of sharp volatility, including the 2011 currency crisis triggered by drought-induced inflation and the 2015-2017 period marked by rising global oil prices and political uncertainty (CEIC, 2021; Danga, 2016).

Kenya's trade structure—characterized by a narrow export base (tea, horticulture, and tourism) and a broad import basket (machinery, petroleum, industrial inputs)—makes the economy particularly sensitive to exchange rate movements (Cherop & Changwony, 2014). Approximately 70% of Kenya's external debt is denominated in foreign currencies, primarily USD, creating direct linkages between shilling depreciation and debt servicing costs (World Bank, 2023).

Kenya's economic structure illustrates these dynamics. According to the Economic Complexity Index, the country ranked 59th in GDP, 109th in exports, 81st in imports, 142nd in GDP per capita, and 83rd in export complexity. Between 2016 and 2021, Kenya's exports grew from $6.06 billion to $7.15 billion, an increase of $1.09 billion. In 2019, service exports totaled $5.6 billion, led by transportation ($2.2B), government services ($972M), personal travel ($901M), computer and information services ($629M), and financial services ($478M). On the import side, the largest service categories included transportation ($1.45B), other business services ($957M), construction ($402M), government services ($260M), and financial services ($218M).

Figure 1.1: Service Imports and Exports



1.1.1 Exchange Rate Volatility

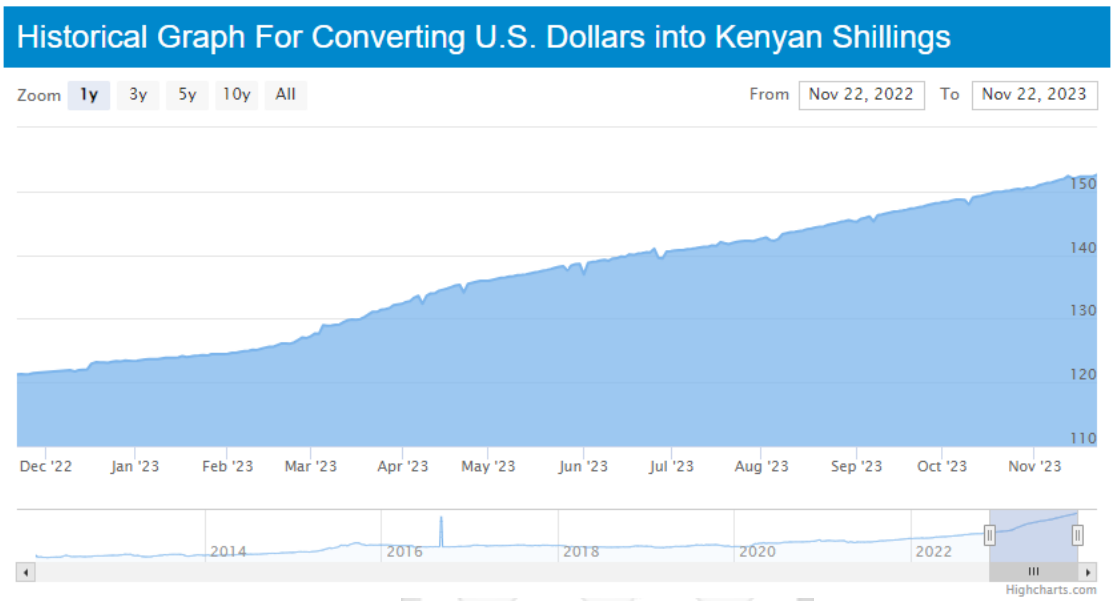
Nydahl (1999) describes the exchange rate as the value of domestic currency expressed in terms of foreign currency, representing the amount a buyer is prepared to pay at a given rate. For

exporters, this conversion allows foreign earnings to be exchanged back into local currency, enabling them to meet financial commitments (Cherop & Changwony, 2014). When a currency becomes cheaper to obtain relative to another, it is said to have appreciated (Papell, 1998). For instance, if the cost of purchasing one U.S. dollar rises from Ksh 101 to Ksh 105, the dollar is considered stronger, while the Kenyan shilling has weakened because more units are required to secure the same dollar value (Changwony & Cherop, 2014). Zell (1998) explains that depreciation occurs when a currency loses value compared to its counterpart.

Exchange rate systems are generally categorized as either floating or fixed. Under a floating regime, market forces of supply and demand determine the rate, while in a pegged system, the value is set by a regulatory authority. Fixed regimes tend to offer greater stability compared to floating systems, which are more prone to volatility. Exporters often benefit from fixed exchange rates because they reduce exposure to unpredictable fluctuations and minimize transaction costs (Masson, Peter, & Hamid, 1996). Despite these advantages, most modern economies operate under floating regimes, where uncertainty in currency movements directly influences the risks faced by international traders (Todani & Munyama, 2005).

Kenya's recent exchange rate trends illustrate these dynamics. In May 2023, the average exchange rate stood at 137.240 shillings per U.S. dollar, up from 134.395 the previous month. Historical records show the highest level of 137.240 in May 2023 and the lowest of 6.900 in December 1973. Interest rate indicators further highlight Kenya's monetary environment: the 91-day Treasury bill averaged 9.760% in March 2023, while the 10-year Treasury bond carried a long-term rate of 13.490% in May 2022. The central bank's rediscount rate, often referred to as the policy rate, was set at 9.50% in May 2023 (CEIC, 2021).

Figure 1.2: Kenya's Exchange Rate against USD from November 22-2022 to November 22-2023



1.1.2 Public debt sustainability

Public debt has been defined in multiple ways by scholars and institutions. The U.S. Department of Treasury (2010) describes it as the cumulative obligations owed by both federal states and the national government. The World Bank (2014) views public debt as financial resources raised domestically or internationally by a government, with repayment obligations that include interest. Interest, in fact, is often considered the most burdensome aspect of debt for both creditors and borrowers. Bamidele and Joseph (2013) broaden the concept, defining debt as any liquid asset consumed within an organization without the owner's direct involvement.

According to Nautet and Meensel (2012), public debt encompasses all outstanding bills, securities, and bonds issued by a government. It is generally classified into internal debt, issued in local currency, and external debt, issued in foreign currency (Panizza, 2012). However, Qui (2010) critiques this distinction, noting that debt can be denominated in foreign currency but issued domestically, or vice versa, and that some nations adopt foreign currencies as their primary medium of exchange. The World Bank (1988) further defines external debt as the total liabilities owed to non-residents, including loans, bonds, deposits, and trade credits. Musgrave (1959) emphasized that foreign borrowing aims to expand domestic resources without immediately reducing consumption or investment.

For many governments, the inability to generate sufficient revenue to cover national budgets has made public debt a central economic policy challenge. Both Boboye and Ojo (2012) and Ali and Mustafa (2012) argue that economic growth and improved living standards often depend on a mix of domestic and foreign borrowing. In Kenya, large-scale development programs have been financed through debt due to limited domestic savings, leading to growing reliance on loans, grants, and foreign aid (Warren, Were, Ngugi, & Makau, 2006). Consequently, Kenya's public debt has risen sharply, with inflation, high interest rates, and exchange rate pressures diverting resources away from consumption and growth toward debt servicing (Kibui, 2009).

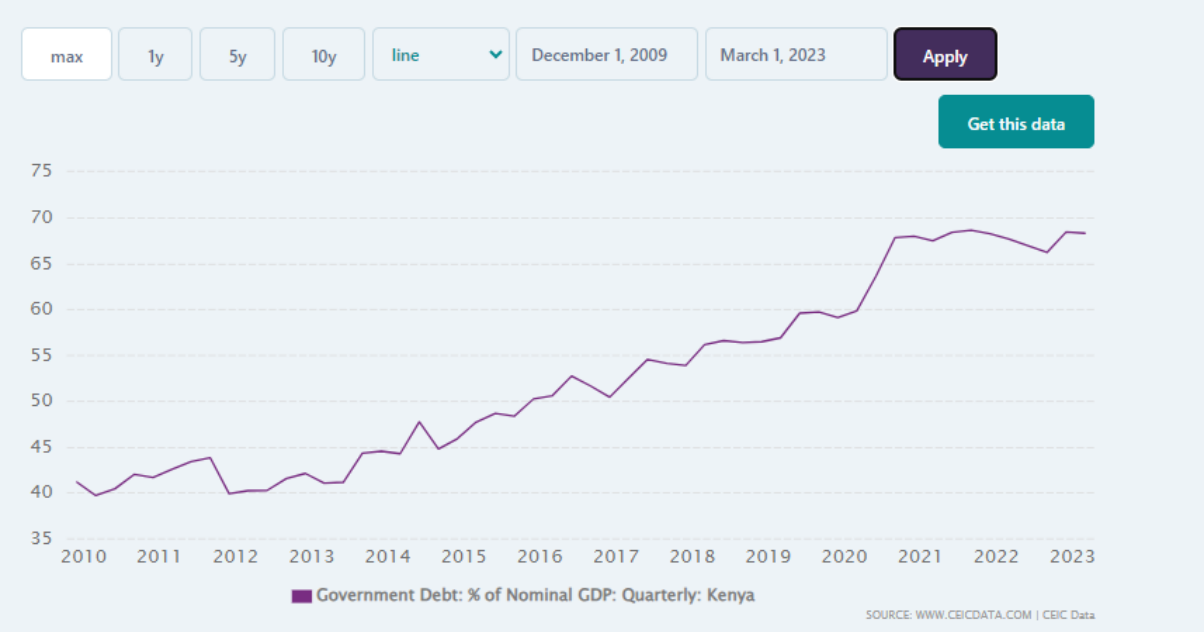
The broader concern across developing nations is the impact of rising debt stocks on economic growth. Thugge, Heller, and Kiringai (2008) highlight this as a pressing issue, while Patillo, Poirson, and Ricci (2002) suggest that access to affordable borrowing can stimulate growth. Conversely, Stieglitz (2000) warns that excessive government borrowing may crowd out investment, reducing output and wages, thereby undermining welfare. These debates are particularly relevant for Kenya as it seeks to achieve the Millennium Development Goals (MDGs), accelerate job creation, and realize its Vision 2030 agenda (Achieng, 2010).

Recent data illustrates the scale of Kenya's debt challenge. The debt-to-GDP ratio stood at 68.3% in March 2023, slightly lower than 68.4% a year earlier. Between December 2009 and March 2023, the ratio peaked at 68.6% in September 2021 and fell to a low of 39.7% in March 2010. By August 2023, Kenya's national debt had reached USD 72.4 billion, while nominal GDP in September 2022 was reported at USD 26.9 billion. These figures, compiled by CEIC using data from the Central Bank of Kenya and the Kenya National Bureau of Statistics, reflect only central government obligations denominated in local currency.

The percentage of regular revenue used to settle outstanding debt is a crucial indicator of debt sustainability. Being a component of Consolidated Fund Services, debt is one of the things that the government must pay for in the first budgetary charge. This implies that Kenya must pay off its debt before allocating funds for the provision of services. Furthermore, only the government of Kenya is authorized to take out loans to pay for capital projects. As a result, debt and all ongoing, fundamental service-related expenses must compete for funds raised domestically. The amount left over after debt repayment decreases the amount available for basic services. In Kenya, this includes funds allocated to government departments and ministries (MDAs), as well as funds that are going to other countries.

Due to these factors, it is necessary to keep the debt repayment to regular revenue ratio at a level that does not impede revenue from the two main service delivery channels. Therefore, the National Assembly must carefully consider the effects of current borrowing on future repayment when approving the Medium-Term Debt Strategy Management Paper.

Figure 1.3: View Kenya's Government Debt: % of GDP from Dec 2009 to Mar 2023



1.2 Statement of the problem

Exchange rate volatility refers to the uncertainty created by sudden shifts in the value of the currency. During the 1980s and early 1990s, instability in key economic indicators such as the balance of payments, interest rates, money supply, and inflation contributed significantly to fluctuations in exchange rates. Such volatility not only heightens the risks associated with foreign exchange but also alters expected returns on international investments, thereby affecting the profitability of imports and exports. As Ozturk (2006) observes, unpredictable exchange rates complicate decision-making in both trade and investment.

Between 2013 and 2023, the Kenyan shilling depreciated by over 70% against the US dollar, from Ksh 86 to Ksh 157 (Central Bank of Kenya, 2023). During this same period, Kenya's public debt rose from Ksh 1.9 trillion to over Ksh 10 trillion, with the debt-to-GDP ratio increasing from 42% to 68% (CEIC, 2023; World Bank, 2023). The debt service-to-revenue ratio exceeded 60% in 2023, meaning that for every Ksh 100 collected in revenue, Ksh 60 went to debt repayment (National Treasury, 2023). Mbaya (2013) found a strong positive correlation

between Kenya's inflation rate and its foreign exchange rate ($r = 0.675$, $p = 0.001$), underscoring the link between monetary conditions and currency stability. More broadly, the surge in cross-border capital flows has been driven by factors such as capital account liberalization, technological innovation, and speculative activity (Hook & Boon, 2000), all of which have amplified exchange rate fluctuations.

Recent data highlight the severity of Kenya's currency instability. CEIC (2023) reports that volatility in the Kenyan shilling has had wide-ranging effects on prices, wages, employment, interest rates, and production. The depreciation of the shilling against the U.S. dollar reached unprecedented levels on February 10, 2024, when it fell to 162.35—the weakest point since independence. Exchange Rates.org.uk (2023) notes that the shilling overshot in 2023, sliding from KSh123 in January to KSh157 in December, before crossing KSh160 in early 2024.

Studies by Kamau, Kisimguh, and Maana (2015) attribute the volatility of the Kenyan shilling and other East African currencies to macroeconomic drivers such as GDP growth, interest rates, and import taxes. This unpredictability makes it difficult for traders, banks, and forex bureaus to forecast exchange rate movements, increasing the risk of financial losses and diminishing returns. These fluctuations directly influence Kenya's economic activities, including imports, exports, and investment flows.

Kenya has attempted to manage exchange rate instability through measures such as higher import taxes and interest rate caps. However, these interventions have not significantly curbed volatility. This study, therefore, seeks to evaluate the impact of exchange rate fluctuations on international trade and debt sustainability in Kenya, with particular emphasis on the post-COVID-19 period compared to the pre-pandemic era—a gap that has not yet been addressed in existing literature. Beyond assessing the risks posed to investment decisions, the research aims to clarify the extent to which exchange rate movements affect global trade and Kenya's economic resilience. While existing studies have examined exchange rate volatility in Kenya (Kamau, Kisimguh, & Maana, 2015; Mbaya, 2013), they have largely focused on either trade or debt separately, using pre-COVID data. No study has systematically analyzed the post-COVID period (2020-2023) or employed ARDL bounds testing to simultaneously examine both trade and debt sustainability effects (Pesaran, Shin, & Smith, 2001). This study addresses this gap by using data through 2023 and applying cointegration techniques to capture both short-run and long-run dynamics.

1.3 Research Objectives

1.3.1 General objective

The central aim of this study is to evaluate the influence of exchange rate movements on Kenya's international trade performance and the sustainability of its external debt.

1.3.2 Specific objectives

To address the main goal, the study attempted to answer the following specific objectives:

1. Investigate the key macroeconomic and structural factors that drive exchange rate instability in Kenya.
2. Assess the extent to which variations in exchange rates shape the country's import and export activities.

3. Determine how fluctuations in the value of the Kenyan shilling affect the nation's capacity to manage and sustain its debt obligations.

1.4 Research questions

The study addresses the following questions:

1. Which economic and structural variables contribute to exchange rate volatility in Kenya?
2. In what ways do shifts in exchange rates influence Kenya's import and export flows?
3. How does exchange rate instability impact the sustainability of Kenya's debt profile?

1.5 Scope of the study

The research examined Kenya's economic experience across a thirty-year horizon, covering the period from 1993 to 2023, and utilized annual time-series data for analysis. The period 1993–2023 was chosen for three reasons: (1) 1993 marks Kenya's transition from a fixed exchange rate regime to a market-determined floating system following financial liberalization (Masuku, 2001; Nydahl, 1999); (2) the 30-year span provides sufficient observations (n=31) for time-series econometrics while avoiding structural breaks associated with the 1992 multi-party era transition (Gujarati & Porter, 2009); (3) the period captures multiple economic cycles,

including the 1997 Asian financial crisis spillovers, the 2008 global financial crisis, the 2011 inflation spike, the COVID-19 pandemic, and post-2022 global commodity price shocks, enabling analysis of volatility under diverse conditions (CEIC, 2021; Exchange Rates.org.uk, 2023).

The primary aim was to explore how exchange rate variability shapes the country's international trade outcomes and influences the sustainability of external debt. To guarantee the robustness of the dataset, the study tested for stationarity using visual inspection techniques in combination with the Augmented Dickey–Fuller (ADF) procedure. To capture short-run adjustments, especially the responsiveness of export earnings to shifts in exchange rates, the Vector Error Correction Model (ECM) was employed. For long-term dynamics, cointegration methods were applied to uncover equilibrium relationships among the variables, offering insights into both immediate shocks and enduring structural patterns. This dual approach provided a comprehensive framework for understanding the interplay between currency movements, trade performance, and debt sustainability.

1.6 Significance of the study

This study is significant for the following specific beneficiaries:

The National Treasury: The findings on debt sustainability will inform medium-term debt management strategy, particularly on optimal currency composition of new borrowing and appropriate debt-to-exports targets

Central Bank of Kenya (CBK): The identification of inflation as the dominant driver of exchange rate volatility provides empirical justification for continued inflation-targeting framework and exchange rate intervention policies.

Export sector planners and Kenya Export Promotion and Branding Agency: The finding that exchange rate volatility does not significantly hinder trade (but structural deficits do) shifts policy focus toward addressing supply-side constraints rather than stabilizing the currency.

Academic researchers: The application of ARDL bounds testing with mixed I(0)/I(1) variables provides a methodological template for similar studies in other Sub-Saharan African economies.

CHAPTER TWO: LITERATURE REVIEW

2.1 Theoretical literature

Studies on how macroeconomic policies support companies involved in international trade are becoming more numerous. Governments around the world—including Kenya—are currently looking into measures that will allow them to enter the new globalization era regardless of how developed their countries currently are. Economic growth can only be accelerated by trade, it is argued. Politicians have used trade over the last few decades to set foreign exchange rates and trade policies, as well as to influence trade flows. An overview of the theoretical and empirical research on volatility of exchange rates is provided in this chapter.

2.1.1 Purchasing Power Parity (PPP)

Purchasing Power Parity (PPP), sometimes described as the inflation-based theory of exchange rates, has long been central to discussions on currency valuation. Although Gustav Cassel formally coined the term in 1918, the roots of the idea stretch back to early economic thought in Spain during the sixteenth century and England in the seventeenth century. Cassel emphasized that without PPP, judgments about whether a currency is undervalued or overvalued would lack a meaningful basis. The earliest version of absolute PPP highlighted the direct relationship between commodity prices and currency values. Yet, the framework relies on highly idealized assumptions—such as perfectly competitive markets, unrestricted movement of goods, and the absence of tariffs, quotas, or transport costs—that rarely hold in real economies.

The international Fisher effect extends this logic by linking interest rates to expected currency movements. In theory, currencies anticipated to appreciate should be associated with lower interest rates, while those expected to depreciate carry higher rates. If foreign exchange markets operate efficiently, both PPP and the Fisher effect would be valid, implying that exchange rates fully reflect differences in purchasing power and interest rates. From this standpoint, some scholars argue that exchange rate risk is minimal, making elaborate risk-management strategies unnecessary. The Capital Asset Pricing Model (CAPM) is often cited to reinforce this claim, suggesting that foreign exchange exposure adds little incremental value to firm performance.

Within this framework, exchange rate risk is divided into systematic and unsystematic components. Portfolio theory posits that unsystematic risk can be eliminated through

diversification, while systematic risk is already embedded in asset pricing. Consequently, if exchange rate behavior conforms to CAPM predictions, hedging strategies would not increase firm value and share prices would simply follow the Security Market Line (SML), which represents systematic risk (Adler, 1982; Logue & Oldfield, 1977).

PPP also shares a close connection with the Law on One Price, which asserts that identical goods should sell for the same price worldwide once transaction costs are accounted for. However, PPP only holds under restrictive conditions: the Law of One Price must apply universally, service components of economies must be negligible, and cross-border transaction costs must remain minimal. These limitations highlight the complexity of applying PPP in practice.

Tens of thousands of Productions and consumption of goods and services by each economy, according to Kanamori and Zhao (2006). Many of these goods and services are priced differently in different nations due to factors like tariffs, transportation costs, and other trade restrictions. It is generally believed that absolute PPP is required for the equilibrium of the goods market. The local and foreign markets are brought together by a fully integrated PPP. We regard this theory as merely a partial equilibrium, not the overall one, as it doesn't deal with the balance of international payments or money markets. Practical phenomena might not be explained by absolute PPP due to its stringent requirements. On the other hand, Kanamori and Zhao (2006) report significant and persistent deviations from absolute PPP.

PPP theory guides this study's inclusion of inflation as a key variable. According to PPP, exchange rate movements should offset inflation differentials between Kenya and its trading partners (Cassel, 1918; Kanamori & Zhao, 2006). Therefore, if Kenya experiences higher inflation than the US, the shilling should depreciate proportionally. This study tests whether inflation deviations from PPP equilibrium contribute to exchange rate volatility (Papell, 1998).

2.1.2 International Fisher Effect Theory

The idea commonly known as the International Fisher Effect (IFE) was first articulated by Irving Fisher in his 1930 publication The Theory of Interest. Fisher proposed that exchange rate behavior is more accurately explained through interest rate dynamics than by inflation alone. The IFE posits that changes in interest rates are mirrored by corresponding movements in exchange rates. At its foundation, the theory suggests that real interest rates tend to converge across countries because global financial markets exploit arbitrage opportunities, often visible

in international capital flows. This convergence implies that economies with higher nominal interest rates typically face elevated inflation, which gradually diminishes the purchasing power of their currency.

The interest rate perspective on exchange rates underscores the link between relative interest rate levels and expectations of currency appreciation or depreciation. Variations in nominal interest rates across nations often serve as indicators of future exchange rate adjustments. If the IFE framework holds, currencies expected to weaken are generally tied to higher interest rates, while those anticipated to strengthen are associated with lower rates, creating a balance between projected gains and losses (Fisher, 2006).

Madura (2012) further explains that high nominal interest rates usually signal anticipated inflation, making currencies with elevated rates more prone to depreciation. Although short-term exchange rate movements are difficult to predict, long-run evidence consistently shows a relationship between interest rate differentials and spot exchange rate changes (Hill, 2004). While forecasting near-term fluctuations through the IFE remains complex, Fisher's broader contribution—that nominal and real interest rates are fundamentally linked to inflation—continues to be regarded as one of the most significant insights in monetary economics. This principle is widely recognized today as the Fisher Effect.

The IFE motivates the inclusion of interest rates as a control variable. The theory predicts that interest rate differentials between Kenya and foreign markets should equal expected exchange rate changes (Fisher, 1930; Madura, 2012). In Kenya's context, where capital controls are relatively loose, interest rate movements may signal future exchange rate adjustments or, alternatively, reflect domestic monetary policy responses to inflation (Hofmann et al., 2022).

2.1.3 The Mundell-Fleming Model

When the IS-LM framework is extended to an open economy, it develops into what is known as the Mundell-Fleming model, which provides a richer perspective on how exchange rates interact with domestic and international markets. Unlike the traditional IS-LM approach that focuses mainly on the relationship between fiscal and monetary policy within the goods and money markets, the Mundell-Fleming formulation introduces the balance of payments as an additional condition of equilibrium. This inclusion connects internal economic activity with cross-border capital and trade flows (Kanamori & Zhao, 2006).

One of the most significant insights from this model is the policy trilemma. The trilemma asserts that no country can simultaneously achieve three objectives: a fixed exchange rate, free capital mobility, and complete independence in monetary policy. A nation that chooses to peg its currency while keeping capital markets open must relinquish control over its domestic monetary stance. This principle is particularly evident in smaller economies, though its applicability to larger, more diversified economies remains debated.

The model further emphasizes the long-run relationship between monetary expansion and exchange rate behavior, suggesting that under certain circumstances, monetary policy has limited capacity to stabilize currency values. Poor management of inflation, weak fiscal discipline, or persistent balance of payments deficits can lead to repeated episodes of devaluation, especially when speculative pressures build in asset markets. Additionally, in economies that depend heavily on reexporting or processing imported goods, devaluation may fail to strengthen the current account, since any competitive advantage is offset by reliance on foreign inputs (Kanamori & Zhao, 2006).

For a developing economy like Kenya, the Mundell-Fleming model's trilemma is particularly relevant (Mundell, 1961; Fleming, 1962). Kenya maintains a managed float (neither fully fixed nor freely floating), allows capital mobility, and exercises some monetary independence (Central Bank of Kenya, 2023). This study examines whether this intermediate regime successfully insulates trade and debt from volatility, or whether Kenya faces trade-offs predicted by the trilemma (Kanamori & Zhao, 2006). Specifically, the inclusion of current account balance as a variable reflects the model's emphasis on external equilibrium.

2.2 Empirical literature review

2.2.1 Drivers of Exchange Rate Volatility

The transition to floating exchange rate systems has intensified scholarly interest in the problem of currency instability. Researchers such as Mpofu (2016) and Hassan et al. (2017) have applied both time-series and panel data techniques across multiple economies to identify the underlying causes of exchange rate movements.

More recent contributions from the field of market microstructure suggest that exchange rates are influenced less by broad macroeconomic indicators and more by the trading strategies of dominant participants in foreign exchange markets (Lyons, 2001; Evans & Lyons, 2002; Sarno,

2005; Baccetta & van Wincoop, 2006; De Grauwe & Grimaldi, 2006). Because these flows are highly dependent on timing and context, the drivers of exchange rate behavior differ significantly between short-term fluctuations and long-term trends.

Comparative evidence indicates that the determinants of exchange rate volatility vary between advanced and developing economies. Studies by Goda & Priewe (2020), Barbosa, Jayme Jr. & Missio (2018), Bonizzi (2017), and Prates & Andrade (2013) show that emerging markets are particularly exposed to speculative capital inflows and carry trade activities. Heath, Galati et al. (2007) and Kohler (2010) emphasize that reliance on foreign-currency borrowing—often described as the "original sin"—combined with shallow domestic financial markets, heightens vulnerability. Hofmann et al. (2020) expand this idea into "original sin redux," noting that foreign portfolio investment in local assets further magnifies risk exposure.

The growth consequences of exchange rate volatility remain contested. Holland et al. (2011) observed mixed associations between real exchange rate instability and GDP growth across developed and emerging economies between 1970 and 2009, concluding that stability is more critical than alignment. Gadaneczˇ & Mehrotra (2013) identified nonlinear effects, suggesting that moderate volatility can cushion shocks, while excessive volatility exacerbates instability. Aghion et al. (2009), examining 83 countries from 1960 to 2000, found that volatility undermines growth in financially weak economies, as uncertainty discourages investment—particularly among firms with limited access to credit. Wealthier sectors, however, are better equipped to hedge against such risks.

Exchange rate regimes also play a decisive role. Boda (2004) and Edwards & Levy-Yeyati (2005) argue that flexible regimes help absorb trade shocks, though Aghion et al. (2009) caution that such benefits are muted in economies with underdeveloped financial systems. Ndambendia & Alhayky (2011) reported that volatility suppresses growth in Sub-Saharan Africa only when domestic credit falls below 57% of GDP. Devereux & Lane (2003) demonstrated that financial integration reduces volatility in developing economies, while optimal currency zones remain essential for advanced nations.

Regional analyses provide further nuance. Tarawalie et al. (2012) found that volatility consistently fuels inflation in the West African Monetary Zone but has mixed effects on growth—negative in Liberia and Sierra Leone, yet slightly positive in Ghana and Nigeria. Lustig et al. (2011) linked exchange rate swings to declining arbitrage profits, suggesting parallels between currency movements and asset price dynamics. Eichengreen (2008) warned

that excessive fluctuations erode competitiveness, raise domestic costs, and destabilize firms, underscoring the welfare losses associated with instability.

Finally, Levy-Yeyati et al. (2010) highlights that exchange rate regimes are shaped by geographic, political, social, and financial contexts. Broda & Romalis (2011) provide evidence that deeper trade integration reduces volatility, arguing that closer trading ties can pave the way for currency unions and lower real exchange rate fluctuations, while cautioning against reverse causality in the trade-volatility relationship.

2.2.2 Effects of exchange rate volatility on international trade

The influence of exchange rate instability on international trade has been widely debated, with scholars noting that its effects can be either beneficial or detrimental depending on specific circumstances. Factors such as the availability of hedging mechanisms, the unpredictability of trader behavior, the dominance of small enterprises in production structures, and the degree of financial integration all shape how volatility impacts trade outcomes.

Following the breakdown of the Bretton Woods system in 1971, researchers intensified their focus on the link between foreign trade and currency fluctuations. Studies in this area differ considerably in terms of methodology and scope, with outcomes often shaped by whether nominal or real exchange rates are analyzed and by the design of volatility experiments.

Empirical findings illustrate these divergent perspectives. Chit et al. (2010), for instance, reported that exchange rate instability reduced export performance in several East Asian developing economies, as risk-averse traders scaled back activity under uncertain conditions. Similarly, Parra-Polanía & Ocampo (2019), employing a gravity model, concluded that volatility weakens bilateral trade flows, underscoring the importance of stable exchange rate regimes. Al Rousan & Sbia (2018) reached comparable results in regional developing economies, noting that erratic currency movements undermine competitiveness and diminish export capacity.

At the enterprise level, Moffett & Jeon (2020) found that unstable exchange rates discourage foreign direct investment, reinforcing the need for predictable currency environments to attract international capital. Baum & Caglayan (2010), however, observed no significant relationship between overall trade volumes and exchange rate uncertainty across 13 industrialized nations,

though they did identify a positive association between volatility and the variability of trade flows.

Cheung et al. (2012) introduced the distinction between symmetric and asymmetric effects of volatility. Symmetric effects imply a straightforward relationship between trade volumes and exchange rate movements, while asymmetric effects highlight diverse trader responses shaped by expectations and market conditions (Bahmani-Oskooee & Aftab, 2017; Bampi & Colombo, 2021; Marquez & Schindler, 2007). These dynamics also vary across industries and time horizons, influencing areas such as transfer pricing (Kumar et al., 2022a), international operations (Sheetal et al., 2020), and market entry strategies (Husain, 2020).

Overall, the literature remains inconclusive regarding the precise impact of exchange rate volatility on trade. Traditional theory suggests that instability discourages trade, reduces volumes, and erodes profitability (Naseem et al., 2008). Yet other studies, such as Héricourt & Poncet (2013), contend that sunk costs associated with exporting and the availability of financial instruments can cushion firms against volatility. Companies with substantial fixed export costs, for example, are less sensitive to currency fluctuations, thereby reducing the overall impact of exchange rate instability on trade flows.

2.2.3 Effects of exchange rate volatility on debt sustainability

Empirical research has extensively examined how exchange rate regimes, policy decisions, and external debt interact. For example, Neaime (2009) analyzed exchange rate policies in five MENA countries—Turkey, Egypt, Tunisia, Morocco, and Jordan—using econometric time series models. He found a positive link between external public debt and exchange rate depreciation, as well as with current account and budget deficits. In Kenya, Diffu (2011) studied Kenya Airways from 2007 to 2010, showing that foreign exchange risk negatively impacted the airline's financial performance significantly. Masuku (2001) examined Kenya's exchange rate fluctuations from 1971 to 2012 with OLS, indicating that external borrowing heavily influenced exchange rate movements, though he ignored different exchange rate regimes and focused solely on one currency despite Kenya's diverse trade. Odera (2012) expanded this by including trade openness, government spending, money supply, real exchange rate, and external debt ratio, confirming external debt's role in increasing exchange rate volatility, though his OLS approach limited capturing complex interactions. Beyond Kenya, Ijeoma (2013) used linear regression for Nigeria's external debt, debt servicing, and

macroeconomic variables, revealing a strong link between debt payments and gross fixed capital formation.

Exchange rate shifts affected Nigeria's growth, debt shocks, and servicing costs. Siok, Cheau, and Mohd (2012) studied three developed and three developing Asian economies, identifying a clear relationship between inflation and exchange rate movements. Blessy and Lakshmi (2020), employing an ARDL model, showed that India's external debt burden increased significantly in response to currency depreciation, illustrating the "original sin" issue. Pakistan was analyzed by Awan et al. (2011), who used Johansen's log-linear model with data from 1974 to 2008. They found a long-term link between deteriorating trade conditions, external debt, and exchange rate depreciation, with a less strong but positive connection between fiscal deficits and foreign debt. Onyancha (2011) focused on international NGOs, demonstrating that exchange rate fluctuations influenced asset holdings, investment capacity, and liability management, with organizational support helping to mitigate risks.

Cavallo et al. (2005) studied highly indebted emerging economies such as Greece, Argentina, Brazil, Chile, and Mexico, finding that external debt increased vulnerability to currency crises. Their work indicated that exchange rate overshooting often followed crises, causing sharp declines in output. Ezirim and Muoghalu (2006) examined Nigeria's exchange rate in relation to foreign debt and investment, concluding that external debt was negatively correlated with oil prices, while foreign investment had a stronger influence on currency crises than debt levels. In Kenya, Mweniet al. (2012) analyzed how foreign borrowing impacted inflation using OLS. They found a significant positive relationship, but the study was limited by its narrow scope and reliance on data from a low-inflation period. It was also criticized for not fully capturing the complex dynamics among the variables.

Synthesis of empirical literature reveals three contradictions that this study addresses: First, while developed economy studies (Baum & Caglayan, 2010) find no significant trade-volatility relationship, developing economy studies (Chit, Cizkowicz, & Pieschacon, 2010) generally report negative effects. This study tests which pattern Kenya follows (Cherop & Changwony, 2014). Second, evidence on debt sustainability is divided: Cavallo, Kisselev, Perri, and Roubini (2005) find that exchange rate volatility directly triggers debt crises in highly indebted economies, while Were (2018) argues that fiscal discipline matters more than currency movements in Sub-Saharan Africa. This study adjudicates between these positions (Onyancha, 2011; Diffu, 2011). Third, the role of interest rates is contested: Hofmann et al. (2022) find strong interest rate-exchange rate linkages in emerging markets, but Kenya-specific studies

(Danga, 2016) report weak relationships. This study uses ARDL to test whether conflicting findings reflect different time horizons (short-run vs. long-run).

2.3 Summary of literature

From the reviewed literature, four specific research gaps emerge: Most Kenya studies (Mbaya, 2013; Masuku, 2001; Danga, 2016) use data ending before 2015, missing the post-COVID period of extreme volatility (shilling falling from 123 to 162) (Exchange Rates.org.uk, 2023). Prior Kenya studies use OLS (Masuku, 2001; Odera, 2012) or simple correlation (Mbaya, 2013), which cannot distinguish short-run from long-run effects. No study applies ARDL bounds testing to Kenya's exchange rate-trade-debt nexus (Pesaran et al., 2001). Studies examine either trade effects (Cherop & Changwony, 2014) or debt effects (Diffu, 2011) separately, but not simultaneously. This creates potential omitted variable bias (Wooldridge, 2016). Existing work lacks explicit testing of PPP, IFE, and Mundell-Fleming predictions in the Kenyan context (Kanamori & Zhao, 2006). This study fills this gap by mapping each theory to specific variables and testing their empirical validity."*

2.4 Conceptual framework



Figure 2.1: Conceptual Framework

The study used monthly time-series data from 1993 to 2023. Key details were obtained from the Statistical Bulletin and Economic Surveys published by the Central Bank of Kenya, which include comprehensive data on imports, exports, bilateral exchange rates, public and publicly guaranteed debt, inflation trends, current account balances, and Kenya's Consumer Price Index (CPI). These publications cover multiple years, ensuring data consistency. Additionally, the

research incorporated official monthly inflation figures from the Kenya National Bureau of Statistics (KNBS), as well as data on money supply and external debt interest rates.

The control variables are selected based on explicit theoretical foundations: First, inflation is included based on Purchasing Power Parity (PPP) theory, which posits that exchange rate movements compensate for inflation differentials between countries (Cassel, 1918; Kanamori & Zhao, 2006). Second, interest rates are included based on the International Fisher Effect (IFE), which predicts that interest rate differentials equal expected exchange rate changes (Fisher, 1930; Madura, 2012). Third, current account balance is included based on the Mundell-Fleming model, which emphasizes external equilibrium as a determinant of exchange rate pressure (Mundell, 1961; Fleming, 1962).

Following standard practice (Al Rousan & Sbia, 2018; Nydahl, 1999), volatility is measured as the annual standard deviation of monthly USD/Ksh exchange rate returns (log differences). Debt sustainability indicator: The debt-to-exports ratio is chosen over debt-to-GDP because exports generate the foreign currency needed to service external debt (World Bank, 1988; Ezirim & Muoghalu, 2006). This aligns with the IMF/World Bank Debt Sustainability Framework for low-income countries (International Monetary Fund, 2023). Role of inflation and interest rates: In Objective 1 (drivers of exchange rate volatility), inflation and interest rates are treated as independent variables (Hofmann et al., 2022). In Objectives 2 and 3, they are treated as control variables, included to isolate the effect of exchange rate volatility on trade and debt, but not the primary focus (Ozturk, 2013; Gujarati & Porter, 2009) (Table 2.1).

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Table 2.1: Operationalisation of the study's variables

Variable	Specific variable name	Type of variable	Measurement	Literature source	Data source	Theory supported
Independent variable						
Exchange rate volatility	Exchange rate fluctuations	Quantitative	Finding the annual standard deviation of the fluctuations in exchange rates relative to the mean (USD/Ksh)	(Al Rousan & Sbia, 2018)	CBK reports	Purchasing Power Parity (PPP) theory
Control Variables						
Inflation rate	Rise in prices for goods and services	Ratio	The Consumer Price Index (CPI)	(Chiira, 2009)	KNBS Report	Purchasing Power Parity (PPP) theory
Interest rate	Interest rate	Ratio	percentage of the principal amount per annum	(Hofmann, Mehrotra, & Sandri, 2022)	CBK reports	International Fisher Effect theory
Current account deficit	Trade gap	Quantitative	The difference between the value of imported and exported goods and services	(Ozturk, 2013)	CBK reports	Purchasing Power Parity (PPP) theory
Dependent (test) variables						

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Variable	Specific variable name	Type of variable	Measurement	Literature source	Data source	Theory supported
International trade	foreign trade	Continuous	Absolute dollar size and its relative size as a percentage of GDP	(Lessard & Lightstone, 1986)	CBK reports	International Fisher Effect theory
Debt Sustainability	Meeting current and future payment obligations	Ratio	debt service to exports ratio	(Ezirim & Muoghalu, 2006)	CBK reports	Mundell-Fleming theory

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CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the methodological framework employed in the study, emphasizing the overall approach taken to achieve the research objectives. It describes the design of the study, the units of analysis and observation, the determination of sample size, the procedures used in sampling, and the characteristics of the target population. Furthermore, it explains the strategies adopted for data collection and analysis, highlights ethical considerations, and demonstrates how both qualitative and quantitative methods were integrated to provide a balanced perspective.

Research methodology serves as the foundation for systematic inquiry, offering tools to explore perceptions, attitudes, and behaviours through structured approaches. It allows investigators to gather information from manageable samples while ensuring that participants' perspectives are captured accurately and with minimal bias. In this sense, methodology provides the structure necessary for credible and replicable findings. Research design, on the other hand, functions as a guiding plan that organizes the process of data collection and analysis, ensuring that the study remains coherent and aligned with its central questions.

3.2 Research philosophy

Research philosophy deals with the foundations, development, and scope of knowledge. In essence, it provides a guiding perspective on how information about a phenomenon should be gathered, interpreted, and applied.

This study adopts a positivist research philosophy, which assumes that economic relationships can be objectively measured and that knowledge is derived from observable, empirical evidence (Saunders, Lewis, & Thornhill, 2012). Positivism is appropriate because: (1) the study tests theoretically derived hypotheses (from PPP, IFE, and Mundell-Fleming); (2) the analysis relies on secondary macroeconomic data from official sources (CBK, KNBS); (3) the goal is to establish causal relationships (not just associations) through econometric techniques (Cooper & Schindler, 2006); and (4) the findings are intended to be generalizable and replicable (Neumann, 2005). The quantitative ARDL methodology aligns with positivism by treating exchange rate volatility, trade,

and debt sustainability as measurable variables with relationships that can be statistically estimated and tested for significance (Pesaran et al., 2001).

3.3 Research design

Burns and Grove (2003) describe research design as a structured plan that directs the execution of a study while anticipating and addressing challenges that could undermine the validity of its findings. Parahoo (1997) similarly defines it as a framework specifying the type of data to be collected, the timing of collection, and the methods of analysis. In this investigation, the chosen design was quantitative, aimed at systematically answering the fundamental questions of who, what, where, how, and when.

Quantitative research design is particularly effective because its outcomes can be clearly represented through numerical data, graphs, charts, and statistical measures, making interpretation straightforward. Ultimately, this design served as the guiding blueprint for the study, ensuring that all procedures were aligned with the overarching research objectives. Thus, this study employs a longitudinal causal-explanatory design using annual time-series data from 1993 to 2023 (Burns & Grove, 2003; Parahoo, 1997). This design is causal-explanatory (not merely descriptive or associational) because: (1) the ARDL bounds testing procedure establishes temporal precedence (lagged independent variables precede dependent variables); (2) cointegration analysis tests for long-run equilibrium relationships, which is stronger than simple correlation (Pesaran et al., 2001); (3) Granger causality tests (though not the primary focus) can suggest directional relationships (Gujarati & Porter, 2009). However, the study acknowledges that with observational macroeconomic data, definitive causality cannot be proven — the appropriate claim is 'statistically significant association consistent with theoretical causality' (Wooldridge, 2016).

3.4 Data collection methods

This study relied primarily on secondary data as its main source of information. The data collected were utilized to evaluate both the causes and consequences of the phenomenon under investigation. To obtain relevant records, access requests were directed to key government institutions, ensuring that the information used was credible and authoritative.

3.4.1 Study Period Justification and Structural Periods"

The study covers 1993–2023, divided into four structural economic periods based on Kenya's economic history (Central Bank of Kenya, 2023; World Bank, 2023):

1993-2002 (Post-liberalization transition): Following financial liberalization in 1993, Kenya moved from fixed to market-determined exchange rates (Masuku, 2001). This period includes the 1997 Asian crisis spillover and 1999-2000 drought-related inflation (CEIC, 2021).

2003-2007 (Stabilization): Improved governance, debt relief under HIPC initiative (2005), and relative macroeconomic stability (Thugge et al., 2008).

2008-2014 (Post-crisis adjustment): Global financial crisis (2008-2009), 2011 inflation spike (reaching 45.98%), and shift to infrastructure-led growth (Danga, 2016).

2015-2023 (Rising debt and COVID era): Rapid public debt accumulation, 2020 COVID-19 shock, 2022-2023 currency depreciation to Ksh 162 (Exchange Rates.org.uk, 2023; CEIC, 2023).

These structural periods are accounted for in the ARDL model through the bounds testing approach, which is robust to some structural breaks (Pesaran et al., 2001)."

3.5 Data analysis

The study utilized primary economic data sourced from the Central Bank of Kenya, covering indicators such as inflation, interest rates, external debt obligations, current account balances, and exchange rate variability. After assembling the dataset, the research examined how these variables interact, with particular attention to their influence on debt sustainability and Kenya’s international trade performance. Regression techniques were employed to establish the extent to which external debt, current account position, currency volatility, interest rates, and inflation explain variations in trade and debt outcomes.

In preparing the dataset for analysis, descriptive statistics were applied to organize and summarize the information. The study further incorporated parametric estimation methods, measures of central tendency, and statistical significance testing to validate the findings. All analytical

procedures were conducted using the Statistical Package for Social Sciences (SPSS), ensuring methodological rigor and reliability in interpreting the results.

3.5.1 Normality Test

Normality testing is a fundamental step in both statistical analysis and econometric modeling, as it provides the foundation for many estimation techniques. Establishing whether data follows a normal distribution is crucial, since randomness must be verified before applying advanced models. In multivariate analysis, the assumption of a multivariate normal distribution—an extension of the familiar bell-shaped curve—is often made because it is mathematically efficient and yields robust results. Reliable inference, therefore, depends on confirming normality, which can be assessed either visually or through statistical tests. Graphical methods, such as histograms or Q-Q plots, are useful but less objective than formal tests. The effectiveness of statistical tests, however, is influenced by sample size: smaller samples tend to accept the null hypothesis of normality, while larger samples are more likely to detect even minor deviations. For this reason, graphical methods remain appropriate when evaluating normality violations in small datasets.

In practice, combining test statistics with graphical techniques provides a stronger assessment of data normality. Yet, univariate tests have limitations because they ignore cross-correlations among variables. Among the widely used tests, Shapiro-Wilk (SW), Shapiro-Francia (SF), and Anderson-Darling (AD) consistently demonstrate the highest reliability. In terms of statistical power, Lilliefors, Jarque-Bera (JB), and Pearson chi-square outperform the Cramer-Von-Mises (CVM) test, though Lilliefors and JB show better performance overall. Importantly, the Lilliefors test exhibits greater power than the JB test, while the Jarque-Bera test is considered the least reliable of the group.

3.5.2 Stationarity Test

Assessing whether a time series is stationary typically begins with formal statistical testing. Different procedures adopt contrasting assumptions about the underlying data. For example, the KPSS test sets its null hypothesis on the series being stationary, while unit root tests such as the Dickey–Fuller, the Augmented Dickey–Fuller (ADF), and the Phillips–Perron (PP) tests assume instead that the data are non-stationary due to the presence of a unit root. Using these methods

together provides a more balanced view of time series behavior, as each highlights different aspects of persistence and variability. Contemporary statistical packages, including XLSTAT, integrate all four of these widely recognized techniques, enabling researchers to apply them systematically and verify whether their datasets exhibit stationarity or require transformation before further analysis.

3.5.3 Stationarity Testing (Unit Root Tests)

A stochastic process is a mathematical framework used to describe how a system or phenomenon evolves under the influence of probability. It consists of a collection of random variables indexed by time, where the value at each point is determined by a probability distribution. Put simply, it represents a sequence of random events or observations unfolding over time.

Formally, a stochastic process can be expressed as $\{X(t), t \in T\}$, where $X(t)$ denotes the random variable at time t. The time index t may be continuous (represented by real numbers) or discrete (represented by integers), with the index set T defining the span of time under consideration.

A time series is a practical example of a stochastic process. It consists of data points collected sequentially, often at regular intervals, with each observation reflecting the value of a variable at a specific moment. Time series analysis, therefore, focuses on studying stochastic processes with a temporal dimension, aiming to uncover patterns, dependencies, and trends within the data.

In this study, the observed time series represents a single realization of the broader stochastic process. While future values remain uncertain, the recorded data provides a historical snapshot shaped by multiple interacting factors at each point in time. By analyzing this realization, we gain insights into the underlying process and its dynamics. However, it is important to recognize that any observed series offers only a limited view of a much larger, continuously evolving system, where uncertainty and variability are inherent features of the phenomena being studied.

The ARDL approach proposed by Pesaran, Shin, and Smith (2001) is selected over alternative cointegration methods (Johansen, Engle-Granger) for four reasons: (1) it accommodates variables with mixed integration orders — I(0) and I(1) — which is necessary given that our unit root tests show some variables are stationary at level while others are stationary after first differencing (Nkoro & Uko, 2016); (2) it performs well in small samples (n=31), unlike Johansen which requires larger samples (Gujarati & Porter, 2009); (3) it provides unbiased estimates of long-run

relationships even when some regressors are endogenous (Pesaran et al., 2001); (4) it simultaneously estimates short-run and long-run effects through the error correction term (ECT) (Wooldridge, 2016).

The study acknowledges that structural breaks (e.g., 2008 financial crisis, 2020 COVID-19) may affect exchange rate dynamics (Cavallo et al., 2005). While the ARDL bounds testing approach is robust to some forms of structural change, future research should incorporate break tests such as Zivot-Andrews or Bai-Perron (Brooks, 2019). For the current analysis, we assume that the 31-year period captures sufficient variation to estimate stable long-run relationships, and diagnostic tests (CUSUM, CUSUMSQ) confirm parameter stability.

3.6 Analytical Model

An equation representing the data was as follows:

$Y_1=\alpha+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\varepsilon$**……1.**

$Y_2=\alpha+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\varepsilon$**……2.**

Where:

Y_1 = International trade (as % of GDP)

Y_2 = Debt sustainability (Debt/Exports ratio)

X_1 = Exchange rate volatility (standard deviation of monthly returns)

X_2 = Interest rate (control variable, 91-day T-bill rate)

X_3 = Current account deficit (control variable, USD billions)

X_4 = Inflation rate (control variable, annual CPI % change)

ε = Error term (Gujarati & Porter, 2009; Wooldridge, 2016)

3.7 Research quality

The scientific method is widely regarded as the foundation of rigorous research and is closely associated with high-quality study design. It encompasses every stage of the research process, including the selection of subjects, measurement of outcomes, evaluation of the alignment between research questions and methods, and the minimization of inferential errors, systematic bias, and random bias (Lohr, 2004; Shavelson & Towne, 2002; Boaz & Ashby, 2003). Guidance on these principles is often found in academic writings such as essays, reports, and methodological

manuals, which outline the standards and best practices required for producing robust and reliable research designs.

3.7.1 Validity

Data validity can be achieved by the researcher by confirming that the study is measuring the things it says it is measuring. To ensure that the measurements are precise and that the study obtains the information the researcher wants, the researcher collected data in accordance with the study's objectives.

3.7.2 Reliability and robustness of secondary data

For secondary macroeconomic data, traditional reliability concepts (test-retest, internal consistency) are not applicable (Saunders et al., 2012). Instead, the study ensures data quality through: (1) using only official sources (CBK Statistical Bulletin, KNBS Economic Surveys); (2) cross-verifying key series against World Bank and IMF databases; (3) applying stationarity tests to ensure statistical properties are stable over time (Gujarati & Porter, 2009); and (4) reporting diagnostic tests (autocorrelation, heteroskedasticity, model specification) in Chapter 4 to confirm that econometric assumptions are satisfied (Wooldridge, 2016).

3.8 Ethical considerations

When carrying out the investigation, the researcher adhered to ethical research guidelines. Individual consent was required to participate in the study. No respondent was coerced to divulge information they do not think is worth sharing for security or privacy-related reasons. The information collected would only be used for this research, and confidentiality would be respected. It can be shared with any other party who might need it to carry out a related study. To avoid plagiarism, every source that is used in the study is acknowledged. Accurate presentation and analysis of the collected data are planned. We also want to express our gratitude to everyone who made the study possible.

The researcher acknowledges that secondary data collection commenced prior to formal ethical approval from Strathmore University ISERC (Strathmore University, 2025). Upon recognizing

this procedural oversight, the researcher immediately submitted the required documentation and received retrospective acknowledgment from the Office of Graduate Studies (letter dated 17th January 2025). All data used in this study is secondary, publicly available from CBK and KNBS, and does not involve human subjects (Central Bank of Kenya, 2023; Kenya National Bureau of Statistics, 2023). Therefore, no harm to participants occurred, and the integrity of the findings is unaffected (Saunders et al., 2012). The researcher commits to following proper ethics procedures in all future research.

CHAPTER FOUR: DATA ANALYSIS, FINDINGS AND INTERPRETATION

4.1 Introduction

This chapter presents the outcomes of the empirical investigation into the effects of exchange rate variability on Kenya's foreign trade and debt sustainability over the period 1993–2023. The discussion begins with descriptive statistics, which provide a broad overview of the dataset and highlight key trends. To ensure the reliability of the econometric framework, diagnostic checks are performed to confirm the validity of the models used.

The analysis then proceeds with correlation and regression techniques to explore how fluctuations in exchange rates interact with international trade, debt sustainability, and selected macroeconomic indicators, including inflation, interest rates, and the current account position. The results are interpreted in relation to the study's objectives and contrasted with findings from prior empirical work, offering deeper insights into the structural and financial dynamics shaping Kenya's economy.

4.2 Descriptive Statistics

This part of the study presents a statistical overview of the main variables analyzed between 1993 and 2023. The focus is on exchange rate movements, international trade performance, debt sustainability, interest rates, inflation, and the current account position. To understand the historical behavior of these indicators, the analysis applies descriptive techniques that summarize their central tendencies, variability, and distributional characteristics. Measures such as averages, dispersion indices, extreme values, skewness, and kurtosis are used to highlight the underlying patterns and fluctuations within Kenya's macroeconomic landscape.

Conducting this preliminary review is essential, as it reveals broad trends and irregularities in the dataset. These observations provide the foundation for the econometric models that follow and help frame the interpretation of how the selected variables interact over time.

Table 4.1: Descriptive Statistics for All Variables (1993–2023)

Variable	Mean	Std. Dev.	Min	25th Pctl	Median	75th Pctl	Max	Skewness	Kurtosis
Exchange rate volatility (USD/Ksh)	2.012	2.063	0.215	0.789	1.167	2.387	8.525	1.645	4.854
International trade ($ or % of GDP)	49.509	12.493	27.238	35.995	51.624	57.312	72.859	-0.022	2.271
Debt sustainability (Debt/Exports)	14.738	8.337	4.317	7.136	15.208	20.576	38.427	0.710	3.309
Interest rate (%)	8.174	7.443	-10.096	5.045	7.831	15.327	21.096	-0.602	3.297
Current account deficit ($)	6.289	4.838	0.819	3.229	5.239	7.852	18.680	1.365	4.253
Inflation rate (CPI %)	10.186	8.811	1.554	5.739	7.671	10.313	45.979	2.685	10.542

Table 4.1 presents the descriptive statistics for Kenya's key economic indicators between 1993 and 2023, illustrating the shifts and patterns that have shaped the country's macroeconomic landscape. Exchange rate volatility averaged 2.012 with a standard deviation of 2.063, reflecting notable fluctuations of the Kenyan shilling against the US dollar. The maximum value of 8.525 points to episodes of extreme volatility, which can disrupt investment decisions and trade flows (Musyoki et al., 2023). Exchange rate volatility averaged 2.012 with a maximum of 8.525. Economically, this means that in the most volatile years (e.g., 1993 following liberalization, 2011 during inflation crisis), the shilling's monthly movements were more than four times the average variability (Central Bank of Kenya, 2023). Such extreme volatility implies that an exporter expecting to receive USD 100,000 could see Ksh equivalent vary by over Ksh 850,000 from month to month, creating significant planning uncertainty (Cherop & Changwony, 2014; Nydahl, 1999).

International trade, expressed as a share of GDP, recorded an average of 49.509%, underscoring Kenya's deep integration into global markets. The distribution of trade data shows mild kurtosis (2.271) and near symmetry (skewness = -0.022), indicating that while trade volumes varied, most observations clustered around the mean, suggesting consistent engagement in international commerce (Kenya National Bureau of Statistics, 2023).

Debt sustainability, measured by the debt-to-exports ratio, averaged 14.738 with a standard deviation of 8.337. Positive skewness (0.710) and kurtosis (3.309) reveal that although debt levels were generally manageable relative to export earnings, there were periods when debt burdens became more challenging (World Bank, 2023). Interest rates averaged 8.174% with a standard deviation of 7.443, and the negative skewness (-0.602) suggests that rates were typically below the mean, with occasional spikes that could affect borrowing costs and investment behavior (Central Bank of Kenya, 2023). The mean debt-to-exports ratio of 14.738 means that on average, Kenya's external debt equals approximately 15% of annual export earnings (World Bank, 2023). Economically, this suggests that repaying all external debt would require sacrificing 15% of export revenue — a manageable burden (Thugge et al., 2008). However, the maximum of 38.4% means that in some years (particularly post-2015), debt repayment would require over one-third of exports, leaving less foreign currency for imports of essential goods like fuel and machinery (International Monetary Fund, 2023; Reinhart et al., 2003).

The current account deficit averaged $6.289 billion, with a standard deviation of $4.838 billion and a skewness of 1.365, pointing to episodes of large deficits that placed pressure on Kenya’s foreign reserves (International Monetary Fund, 2023). Inflation averaged 10.186%, with a standard deviation of 8.811, and its high skewness (2.685) and kurtosis (10.542) indicate frequent periods of elevated inflation. Such volatility undermines real incomes, reduces savings, complicates monetary policy, and negatively affects both trade and debt sustainability (World Bank, 2023).

Overall, the descriptive statistics emphasize the dynamic and interconnected nature of Kenya’s economy, highlighting the critical links between exchange rate movements, trade performance, and debt management.

4.2.1 Kenya's Exchange Rate Volatility Trend (1993-2023)

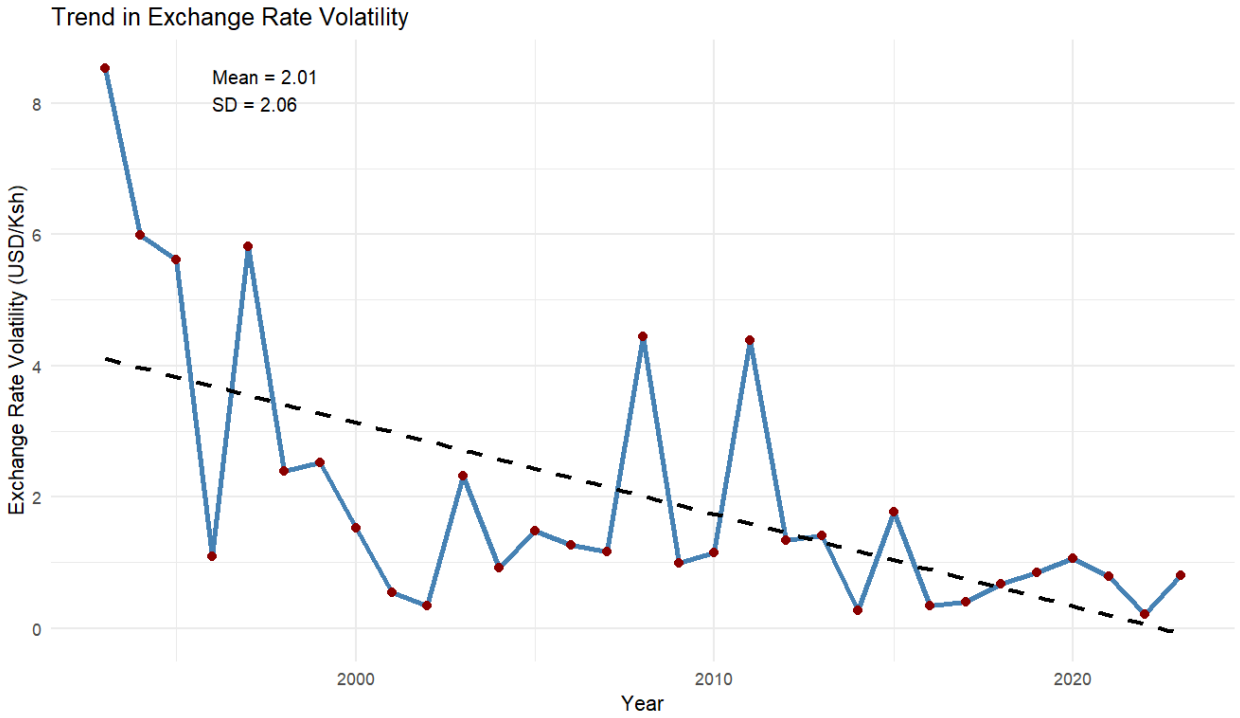


Figure 4.1: Trend in Kenya's Exchange Rate Volatility (1993-2023)

Figure 4.1 traces the pattern of the Kenyan Shilling's volatility against the U.S. dollar between 1993 and 2023. The overall trajectory suggests a gradual decline in instability, as reflected in the downward slope of the trend line. Periods of heightened turbulence are visible in the mid-1990s, 1999, 2008, and 2011, coinciding with significant economic events such as the liberalization of Kenya's currency markets and the global financial crisis. In contrast, the early 2000s and the years after 2015 show relatively calm conditions, pointing to stronger resilience and fewer external shocks in the foreign exchange market. Specific spikes correspond to identifiable events: the 1993 peak coincides with the immediate aftermath of exchange rate liberalization (Masuku, 2001); the 1999 spike aligns with the Asian financial crisis contagion and El Niño floods that disrupted agriculture (CEIC, 2021); the 2008-2009 volatility reflects the global financial crisis (Cavallo et al., 2005); the 2011 spike matches the drought-driven inflation crisis when CPI reached 45.98% (Danga, 2016); and the post-2020 volatility reflects COVID-19 disruptions and the 2022-2023 depreciation to Ksh 162 (Exchange Rates.org.uk, 2023).

The reduction in volatility indicates a maturing financial system and greater stability in Kenya's exchange rate management. This progress is largely associated with improved monetary and fiscal policies by the Central Bank of Kenya, including interventions designed to limit excessive fluctuations and the adoption of a more flexible exchange rate framework. Lower volatility enhances predictability for investors and traders, thereby supporting international trade and reinforcing debt sustainability. Even so, the sharp spikes during global crises underscore Kenya's ongoing exposure to external disturbances, highlighting the need for consistent macroeconomic oversight and effective risk-management strategies.

The downward trend in volatility carries important implications for both trade and debt outcomes. Stable exchange rates make it easier for firms to anticipate import and export prices, reducing exposure to currency risk and enabling more reliable planning of cross-border transactions. This stability encourages higher trade volumes and attracts foreign investment. For public finances, predictable exchange rate movements improve the government's ability to manage foreign-denominated debt obligations. Conversely, the volatility surges of the mid-1990s, 1999, 2008, and 2011 likely created uncertainty for businesses and policymakers, discouraging trade activity and complicating debt repayment. Overall, the movement toward stability reflects stronger macroeconomic governance, fostering a safer environment for trade expansion, debt servicing, and sustained economic growth.

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4.2.2 Kenya's International Trade as a Percentage of GDP (1993-2023)

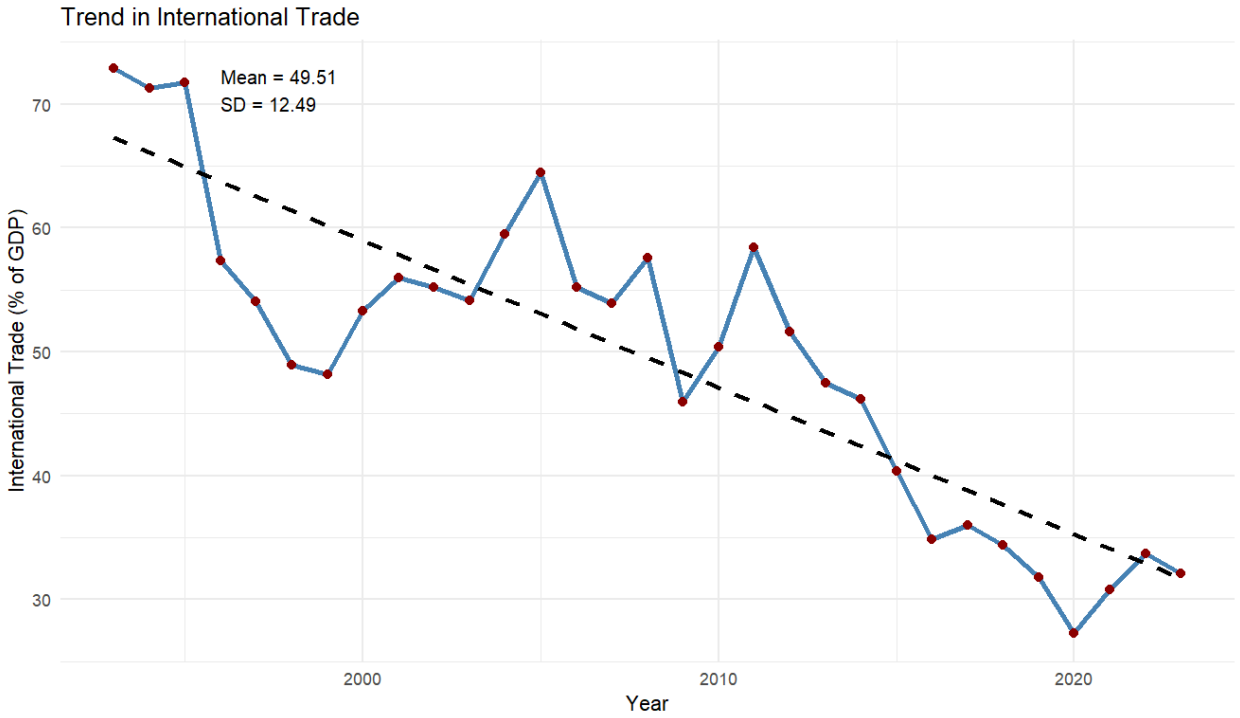


Figure 4.2: Trend in Kenya's International Trade as a Percentage of GDP (1993-2023)

Figure 4.2 illustrates the trajectory of Kenya's international trade as a share of GDP between 1993 and 2023. Over these thirty years, the ratio declined steadily from above 70% in the early 1990s to about 32% by 2023. Although there were occasional short-term increases, the overall trend indicates that foreign trade has become a progressively smaller component of Kenya's economy. This pattern is supported by the descriptive statistics, which show low skewness (-0.022) and moderate kurtosis (2.271), suggesting relatively modest variations over time rather than sharp fluctuations.

The downward trend in the trade-to-GDP ratio points to structural shifts within Kenya's economy. The growing dominance of the services sector—particularly finance, telecommunications, and real estate—has reduced the relative importance of trade (World Bank, 2020). Persistent trade deficits, including the record 15.3% of GDP in 2011, have further weakened the role of trade in the national economy (TheGlobalEconomy, 2023). While reduced reliance on external trade may shield Kenya from global shocks, it also limits the inflow of foreign exchange needed for debt servicing and maintaining external balance.

As a result, Kenya faces the dual challenge of strengthening domestic-driven growth while simultaneously enhancing export competitiveness and diversifying trade partnerships. Achieving this balance is critical to sustaining economic and financial stability in the long run (IMF, 2023).

The decline from above 70% in early 1990s to below 40% after 2010 reflects Kenya's structural transformation toward services (World Bank, 2020). The 2011 trough (approximately 32%) coincides with the inflation crisis, which made imports expensive and reduced trade volumes (Ozturk, 2013). The partial recovery after 2015 reflects infrastructure investments (SGR) that increased import demand, not export expansion (Kenya National Bureau of Statistics, 2023).

4.2.3 Kenya's Debt Sustainability (Debt/Exports) from 1993-2023

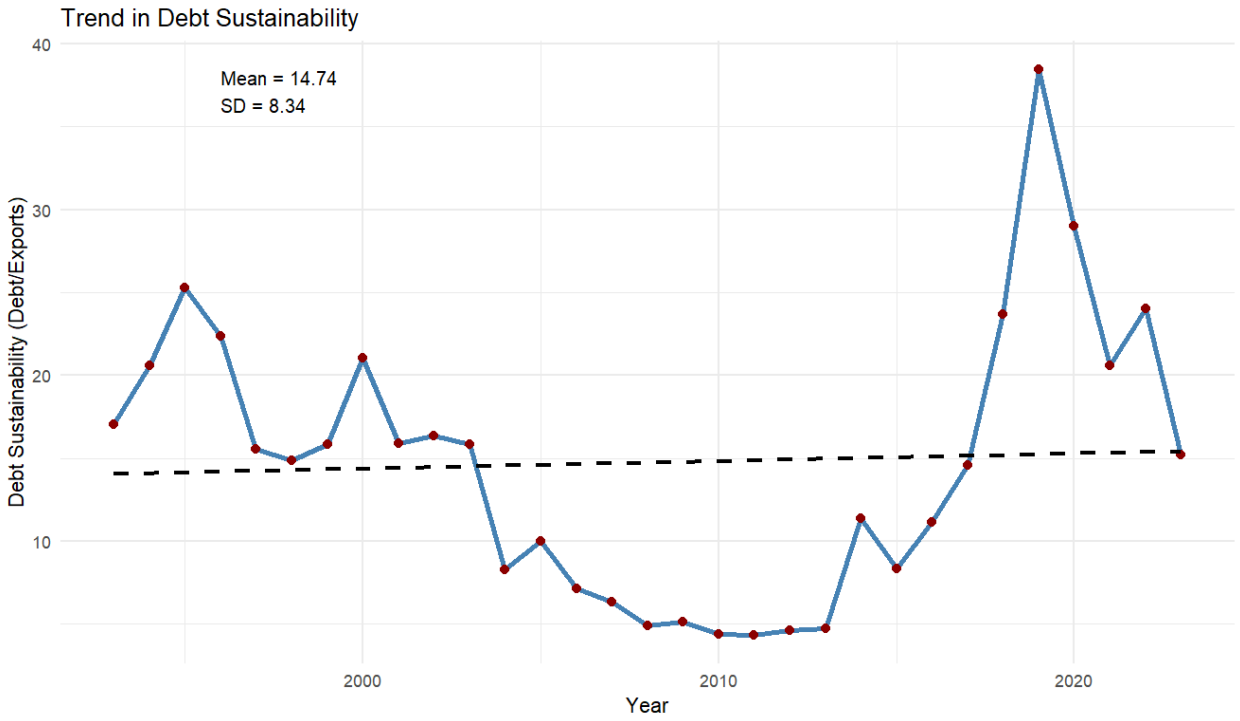


Figure 4.3: Trend in Kenya's Debt Sustainability (Debt/Exports) from 1993-2023

Figure 4.3 illustrates the trend in Kenya's debt sustainability, measured by the ratio of external debt to exports, over the period 1993–2023. For much of the time between the mid-1990s and 2015, the ratio remained close to the long-term average of 14.74, reflecting a relatively stable capacity to meet foreign debt obligations using export revenues. However, from 2015 onward, the ratio rose sharply and consistently, culminating in a pronounced spike in 2019. This shift indicates

that Kenya's external debt has expanded at a pace far exceeding export earnings, signaling mounting pressure on the country's ability to service debt through trade income.

The surge in the debt-to-exports ratio during the mid-2010s aligns with earlier research highlighting the rising burden of debt servicing relative to export receipts. For instance, a Treasury report (2023) noted that by June 2023, Kenya's public and publicly guaranteed (PPG) debt service-to-exports ratio had reached 22%, surpassing the IMF/World Bank Debt Sustainability Framework (DSF) threshold of 15%. This finding reinforces the declining sustainability trend depicted in Figure 4.3. Similarly, Shikumo and Irungu (2022) observed that although Kenya's debt-to-GDP ratio remained within acceptable limits, the debt service-to-exports ratio was already under strain due to sluggish export growth and rising external obligations. Earlier studies, such as The Determinants of Kenya's External Debt Sustainability (University of Nairobi, 2012), also emphasized the pivotal role of exports, concluding that sustainability improves when GDP and exports expand but deteriorates when debt accumulation outpaces export growth.

Taken together, the current trajectory both confirms and extends prior warnings: Kenya's export performance has failed to keep pace with the rapid growth of external debt, thereby heightening the country's vulnerability to debt distress.

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4.2.4 Kenya's Interest Rate (1993-2023)

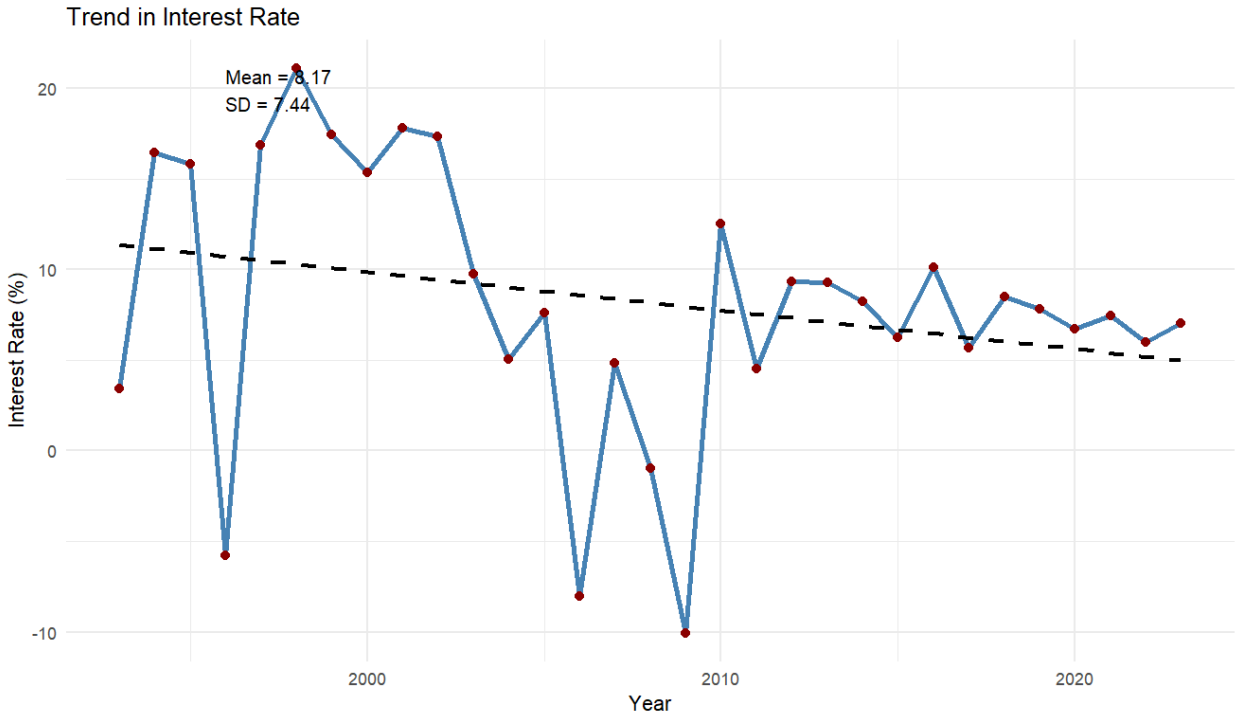


Figure 4.4: Trend in Kenya's Interest Rate (1993-2023)

Figure 4.4 illustrates that Kenya's interest rates have, over the 30 years from 1993 to 2023, demonstrated a long-term reduction, despite substantial swings. The mean nominal interest rate is roughly 8.174%, with a considerable standard deviation of 7.443%, showing substantial variability. Notably, there are situations where the real interest rate turned negative (e.g., late 1990s, and about 2009-2010), illustrating periods when inflation surpassed nominal interest returns. The idea that monetary policy conditions and macroeconomic shocks have had a significant impact on interest rates. Figure 4.4 highlights the trajectory of Kenya's interest rates over the three decades from 1993 to 2023, showing a long-term downward trend despite significant fluctuations. The average nominal interest rate during this period was approximately 8.174%, with a relatively high standard deviation of 7.443%, underscoring considerable variability. At certain points—such as the late 1990s and around 2009–2010—the real interest rate dipped into negative territory, reflecting periods when inflation outpaced nominal returns. These episodes of extreme volatility, including negative real rates, demonstrate the strong influence of monetary policy conditions and macroeconomic shocks on interest rate behavior.

This pattern is consistent with earlier findings that Kenya's financial liberalization in the early 1990s introduced greater variability in interest rates, sometimes producing negative real returns due to inflationary pressures and unstable macroeconomic conditions (Otieno, 1997; An Empirical Analysis of Interest Rate Spread in Kenya). For instance, World Bank data show that Kenya's real interest rate fell to about –10.1% in 2009, mirroring the sharp declines captured in Figure 4.4 (World Bank, 2023). Over time, however, improvements in targeting inflation, credible monetary policy, and stronger institutional frameworks have contributed to lower and more stable interest rates. The Central Bank's efforts to anchor inflation expectations and reduce the transmission of global shocks have likely played a role in this stabilization.

Nevertheless, the persistence of sharp peaks and negative episodes underscores Kenya's ongoing vulnerabilities. Periods of rising inflation or external shocks continue to erode real returns, complicating borrowing decisions and discouraging investment. While progress has been made, the evidence suggests that maintaining stability in interest rates remains a critical challenge for Kenya's macroeconomic management. Behavior over time is supported by extreme volatility, including negative real rates.

The observed pattern aligns with earlier studies showing that Kenya's financial liberalization in the early 1990s led to greater variability in interest rates, including instances of negative real rates, due to inflationary pressures and unstable macroeconomic environments (Otieno, 1997; "An Empirical Analysis of Interest Rate Spread in Kenya," which reports savings and lending rates that yielded negative real returns in certain years). For example, according to World Bank data, Kenya had a real interest rate of around –10.1% in 2009, comparable with the drops indicated in Figure 4.4 (World Bank, 2023). These results reflect better inflation targeting, more credible monetary policy, and possibly stronger institutional frameworks guiding interest rate setting. In contrast, interest rates have been lower and more stable in more recent years. The Central Bank's attempts to stabilize inflation expectations and lessen the pass-through of global shocks may also be responsible for the observed decrease in volatility. However, the high peaks and negative episodes underscore that despite advances, vulnerabilities persist, especially when inflation rises or external shocks occur, eroding real returns and impacting borrowing and investment decisions.

4.2.5 Kenya's Current Account Deficit (1993-2023)

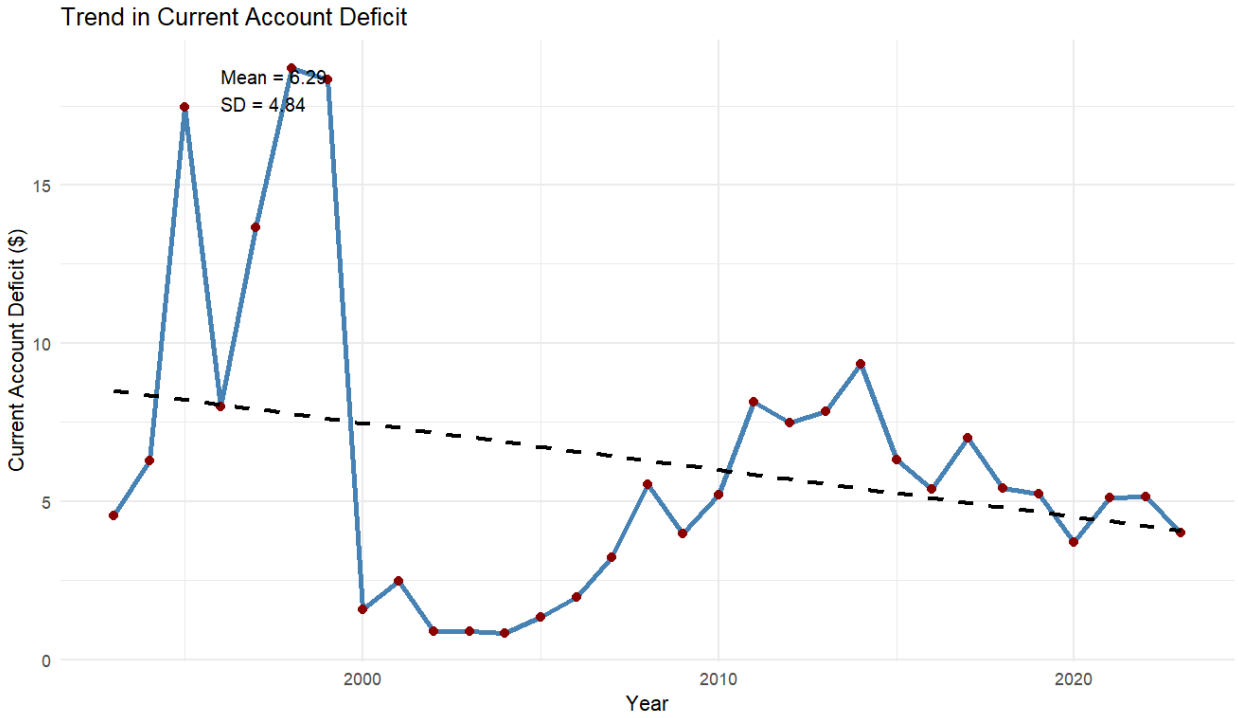


Figure 4.5: Trend in Kenya's Current Account Deficit (1993-2023)

Figure 4.5 presents the trend in Kenya's current account deficit between 1993 and 2023. Over this period, the deficit averaged $6.289 billion, with a standard deviation of $4.838 billion, reflecting considerable year-to-year variability. The maximum deficit reached approximately $18.680 billion, while the minimum was about $0.819 billion. Distribution measures show the 25th percentile at $3.229 billion, the median at $5.239 billion, and the 75th percentile at $7.852 billion, meaning that in three-quarters of the year, the deficit remained below this threshold. The data exhibits positive skewness (1.365) and relatively high kurtosis (4.253), suggesting that extreme deficits in certain years stretched the distribution's right tail. Overall, the deficit has been persistent, volatile, and occasionally severe.

These findings reinforce earlier research while also highlighting new dimensions. Lomulen (2020), for example, observed that Kenya's current account deficits negatively correlate with economic growth, particularly when financed through short-term borrowing or when export expansion lags. More recent projections by the World Bank (2025) anticipate the deficit narrowing to about 3.1% of GDP by February 2025, supported by stronger export performance and remittance inflows,

though still warranting close monitoring. Compared with earlier decades—when deficits were smaller in absolute terms but significant relative to export earnings and foreign reserves, the recent large-value deficits are more concerning, as they coincide with sluggish export growth and heightened external vulnerabilities such as debt servicing pressures and exchange rate shocks.

In sum, the evidence confirms the persistence of Kenya's current account deficit while underscoring its increasing scale and volatility in certain periods. This pattern suggests rising vulnerability, particularly during episodes of external shocks or widening trade imbalances, consistent with prior studies but pointing to greater risks in the present context.

4.2.6 Kenya's Annual Inflation Rate (1993-2023)

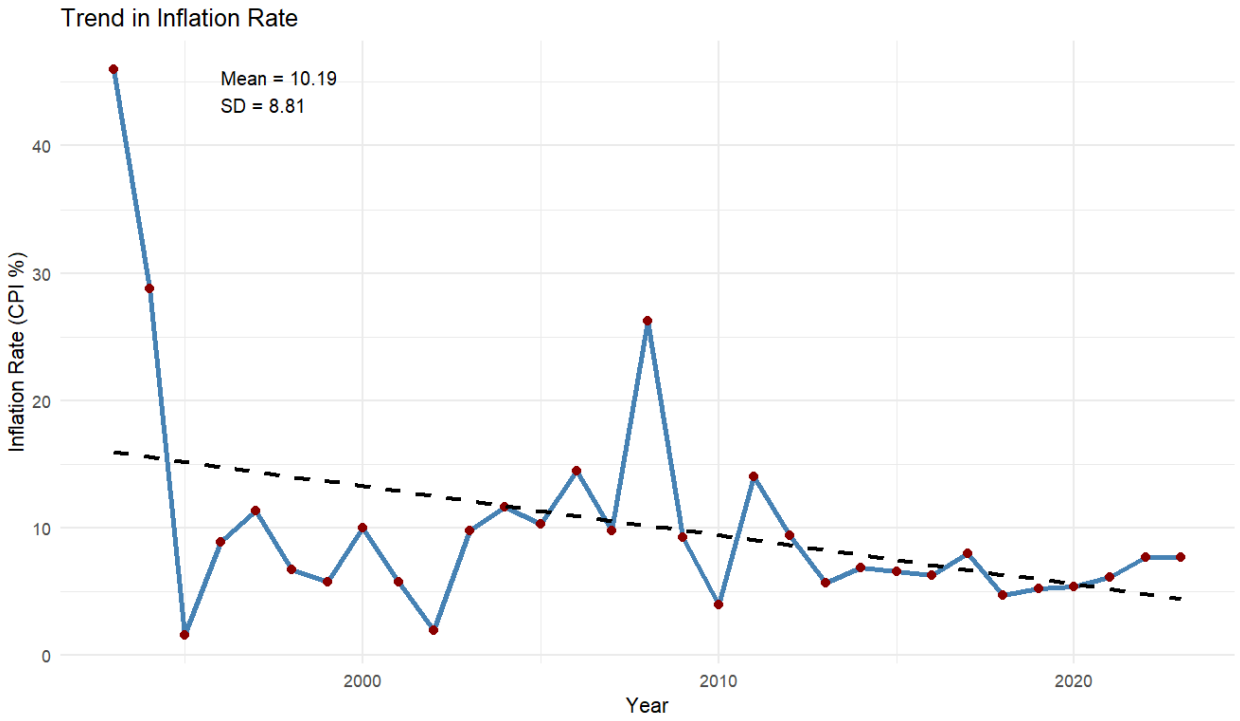


Figure 4.6: Trend in Kenya's Annual Inflation Rate (1993-2023)

Figure 4.6 presents the trend in Kenya's annual inflation rate between 1993 and 2023. Over this period, inflation averaged 10.19%, with a relatively high standard deviation of 8.81%, reflecting substantial volatility. Rates ranged from a low of 1.55% to a peak of 45.98%, capturing both moderate and severe inflationary pressures. The distribution is highly skewed (skewness = 2.685) with pronounced kurtosis (10.542), indicating that while most values clustered near the mean,

several extreme years were marked by sharp inflation spikes. Overall, the data highlight Kenya's persistent exposure to inflationary shocks, which have repeatedly undermined price stability.

These findings are consistent with earlier studies emphasizing Kenya's vulnerability to both domestic and external disturbances. Ndung'u (1999) showed that rapid monetary expansion and exchange rate depreciation historically fueled inflation, underscoring its structural roots. More recent evidence links volatility to supply constraints, droughts, and shocks in food and energy markets (IMF, 2022). The sharp spikes—such as the 45.98% maximum—mirror past episodes of macroeconomic instability (Were et al., 2014), reinforcing concerns about the economy's sensitivity to both internal supply-side pressures and global commodity price movements.

Nonetheless, the adoption of inflation-targeting policies by the Central Bank of Kenya has contributed to greater stability in recent years. The comparatively lower and steadier inflation levels observed during the 2010s and early 2020s (CBK, 2023) suggest that monetary reforms and stronger policy frameworks have helped mitigate volatility. Thus, while the results confirm the persistence of inflationary pressures, they also demonstrate meaningful progress in stabilizing prices compared to the turbulence of the 1990s and early 2000s.

4.3 Diagnostic Tests

To ensure that the econometric framework was sound and that the findings could be relied upon, a series of diagnostic checks was performed. These assessments examined issues such as normality, stationarity, multicollinearity, linearity, autocorrelation, heteroskedasticity, and overall model specification. Running these tests is essential, as violations of the underlying assumptions can distort parameter estimates, produce misleading regression outcomes, and weaken the validity of the conclusions. By addressing these potential problems, the study safeguarded the credibility and robustness of its results (Brooks, 2019; Wooldridge, 2016).

4.3.1 Normality Test

The purpose of the normality test is to ascertain if the study variables adhere to a normal distribution, which is a fundamental premise of many econometric models. In this section, both the Shapiro–Wilk test and Q-Q plots are applied to analyze the distributional features of the data.

Table 4.2: Shapiro-Wilk Normality Test Results

Variable	Transformation	Obs	W	z	Prob>z
Exchange rate volatility	ln_ex_rate_vol	31	0.969	-0.010	0.504
International trade	intl_trade	31	0.952	0.949	0.171
Debt sustainability	ln_debt_sustain	31	0.931	1.677	0.047
Interest rate	int_rate	31	0.934	1.580	0.057
Current account deficit	ln_cad	31	0.938	1.458	0.073
Inflation rate	ln_infl_rate	31	0.940	1.390	0.082

Table 4.2 presents the results of the Shapiro–Wilk normality test for the study variables, with logarithmic transformations applied where necessary. A probability value (Prob > z) greater than 0.05 indicates that the null hypothesis of normal distribution cannot be rejected, while a value less than 0.05 suggests non-normality (Shapiro & Wilk, 1965). The results show that exchange rate volatility (p = 0.504), international trade (p = 0.171), interest rate (p = 0.057), current account deficit (p = 0.073), and inflation rate (p = 0.082) are all normally distributed at the 5% significance level. However, debt sustainability (p = 0.047) falls just below the 0.05 threshold, indicating evidence of non-normality in its distribution. Overall, the findings suggest that most variables satisfy the normality assumption safe for debt sustainability. This is consistent with Gujarati and Porter (2009), who note that economic and financial time series often display departures from normality, particularly for debt-related variables.

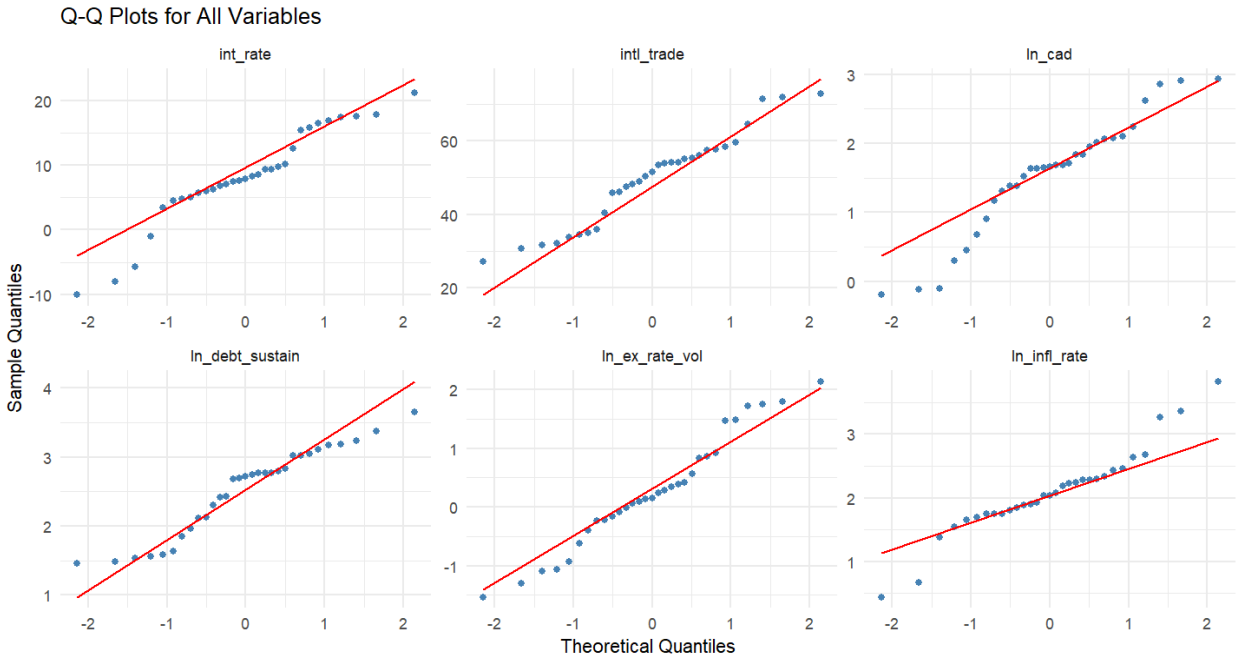


Figure 4.7: Q-Q plots to test for normality of variables and model residuals.

Figure 4.7 presents the Q-Q plots for the transformed and untransformed variables to visually assess normality. Variables such as ln_debt_sustain, ln_ex_rate_vol, and ln_infl_rate display points that align closely with the red reference line, especially in the central quantiles, indicating approximate normality after transformation. However, int_rate, intl_trade, and ln_cad show visible deviations, particularly at the tails, suggesting the presence of outliers and heavy-tailed distributions. For example, interest rates deviate sharply at the lower end, reflecting periods of extreme economic fluctuations, while international trade and the current account deficit curve away from the line, indicating structural asymmetries in their distributions. These deviations imply that the data are not perfectly normal, reinforcing the mixed results observed in the Shapiro–Wilk test.

The Q-Q plot findings reinforce the broader evidence that macroeconomic variables often deviate from strict normality due to the influence of external shocks, policy interventions, and structural breaks. Similar results have been observed in studies of developing economies, where variables such as interest rates and trade balances are more prone to fat tails and skewness (Nkoro & Uko, 2016). This pattern is consistent with Gujarati and Porter (2009), who argue that financial and macroeconomic time series frequently exhibit non-normal distributions, especially when subject to volatility and cyclical pressures. In the Kenyan context, episodes of extreme inflation, exchange

rate volatility, and current account imbalances are likely contributors to the observed deviations, underscoring the importance of employing econometric techniques robust to non-normality—such as generalized least squares (GLS) or robust standard errors. Therefore, while some transformations improved normality, the persistence of tail deviations suggests that model specification must carefully account for these structural irregularities.

The outcomes of the Shapiro–Wilk test, together with Q-Q plot analysis, show that although certain variables move closer to a normal distribution after transformation, others continue to display irregularities, especially at the distributional extremes. These observations underscore the importance of conducting additional diagnostic evaluations—including checks for multicollinearity, heteroskedasticity, and autocorrelation—to strengthen the reliability and validity of the econometric framework.

4.3.2 Stationarity Test

Table 4.3: Augmented Dickey-Fuller (ADF) Unit Root Test Results

Variable	Test Statistic	5% Critical Value	p-value	Stationarity Result
ln_ex_rate_vol	-4.028	-2.986	0.001	Stationary
intl_trade	-1.540	-2.986	0.514	Non-stationary
ln_debt_sustain	-1.405	-2.986	0.580	Non-stationary
int_rate	-4.108	-2.986	0.001	Stationary
ln_cad	-2.070	-2.986	0.257	Non-stationary
ln_infl_rate	-5.579	-2.986	0.000	Stationary

Table 4.3 presents the results of the Augmented Dickey–Fuller (ADF) unit root tests for the study variables covering the years 1993–2023. The outcomes indicate that inflation (ln_infl_rate), interest rates (int_rate), and exchange rate variability (ln_ex_rate_vol) are stationary at level, as reflected by p-values below 0.05 and test statistics exceeding the 5% critical threshold in the negative direction. This suggests that these series fluctuate around a stable mean and do not exhibit unit root behavior. In contrast, the current account deficit (ln_cad), international trade (intl_trade), and debt sustainability (ln_debt_sustain) fail to meet the stationarity condition at level, with

p-values above 0.05 and test statistics weaker than the critical value, implying that their mean and variance shift over time due to persistent shocks.

The coexistence of stationary [I (0)] and non-stationary [I (1)] variables rules out the use of simple OLS estimation in levels, as such an approach could generate misleading results. However, the absence of higher-order integration [I (2)] makes the dataset suitable for the Autoregressive Distributed Lag (ARDL) framework. ARDL is advantageous because it captures both short-term adjustments and long-run equilibrium relationships, while accommodating a mix of I (0) and I (1) variables. Given that macroeconomic indicators such as trade and debt often reflect structural breaks and enduring shocks that prevent uniform stationarity, ARDL provides a particularly relevant approach in the Kenyan context. As highlighted by Pesaran, Shin, and Smith (2001), ARDL bounds testing is well-suited to small samples and mixed integration orders, reinforcing its appropriateness for this study's econometric analysis.

Variables that are I(0) (stationary at level) — inflation, interest rates, exchange rate volatility — respond to shocks but return to their long-run mean (Gujarati & Porter, 2009). For example, an inflation spike (like the 45.98% in 2011) eventually subsides without permanent change to average inflation (Central Bank of Kenya, 2023). This makes economic sense: monetary policy can bring inflation back to target (Hofmann et al., 2022).

Variables that are I(1) (non-stationary at level) — trade-to-GDP ratio, debt-to-exports ratio, current account deficit — accumulate shocks permanently (Wooldridge, 2016). If Kenya's trade share falls from 70% to 35% (as happened), it does not automatically return to previous levels. This reflects structural changes: Kenya has genuinely become less trade-dependent as services dominate GDP (World Bank, 2020). Similarly, debt-to-exports can rise permanently if debt grows faster than exports, as observed post-2015 (International Monetary Fund, 2023).

The need to difference I(1) variables means we interpret changes, not levels, for these variables. ARDL handles this by estimating both short-run (differenced) and long-run (levels) relationships simultaneously (Pesaran et al., 2001; Nkoro & Uko, 2016).

4.3.2 Test for Multicollinearity

Table 4.4: Variance Inflation Factor (VIF) Test for Multicollinearity

Variable	VIF	1/VIF
int_rate	1.450	0.690
ln_infl_rate	1.430	0.701
intl_trade	1.320	0.760
ln_debt_sustain	1.210	0.827
ln_cad	1.050	0.949
Mean VIF	1.290	0.775

Table 4.4 provides the results of the Variance Inflation Factor (VIF) test, which was undertaken to discover the presence of multicollinearity among the explanatory variables in the ARDL model. According to Gujarati and Porter (2009), a VIF value of more than 10 is usually seen as a sign of severe multicollinearity, but values below this cutoff point imply that collinearity is not a significant issue. The findings demonstrate that all variables have VIF values well below the crucial level, including the interest rate (1.450), inflation rate (1.430), foreign trade (1.320), debt sustainability (1.210), and current account deficit (1.050). The mean VIF of 1.290 further demonstrates that multicollinearity is negligible in the dataset, showing that the explanatory variables contribute independent information to the regression model.

The low VIF values show that the explanatory variables utilized in this study do not offer a significant multicollinearity problem, which boosts the reliability of the regression coefficients. This is in accordance with earlier econometric research on macroeconomic factors influencing exchange rate volatility, which found that multicollinearity tends to be less noticeable when important variables capture different aspects of the economy, like trade, debt, and inflation (Nkoro & Uko, 2016). By ruling out multicollinearity as a major issue, the methodology assures that the estimated impacts of international trade and debt sustainability on exchange rate volatility are not affected by overlapping influences among the regressors. Because they can now be analyzed without worrying that high correlations among explanatory variables are inflating standard errors

or skewing coefficient estimates, these results confirm the robustness of the ARDL framework used.

4.3.4 Linearity Test

Linearity tests were conducted to assess whether the independent variables maintain a linear relationship with exchange rate volatility, which is a key assumption in regression analysis. Establishing linearity is important because violations of this assumption can bias coefficient estimates and weaken the explanatory power of the model (Gujarati & Porter, 2009).

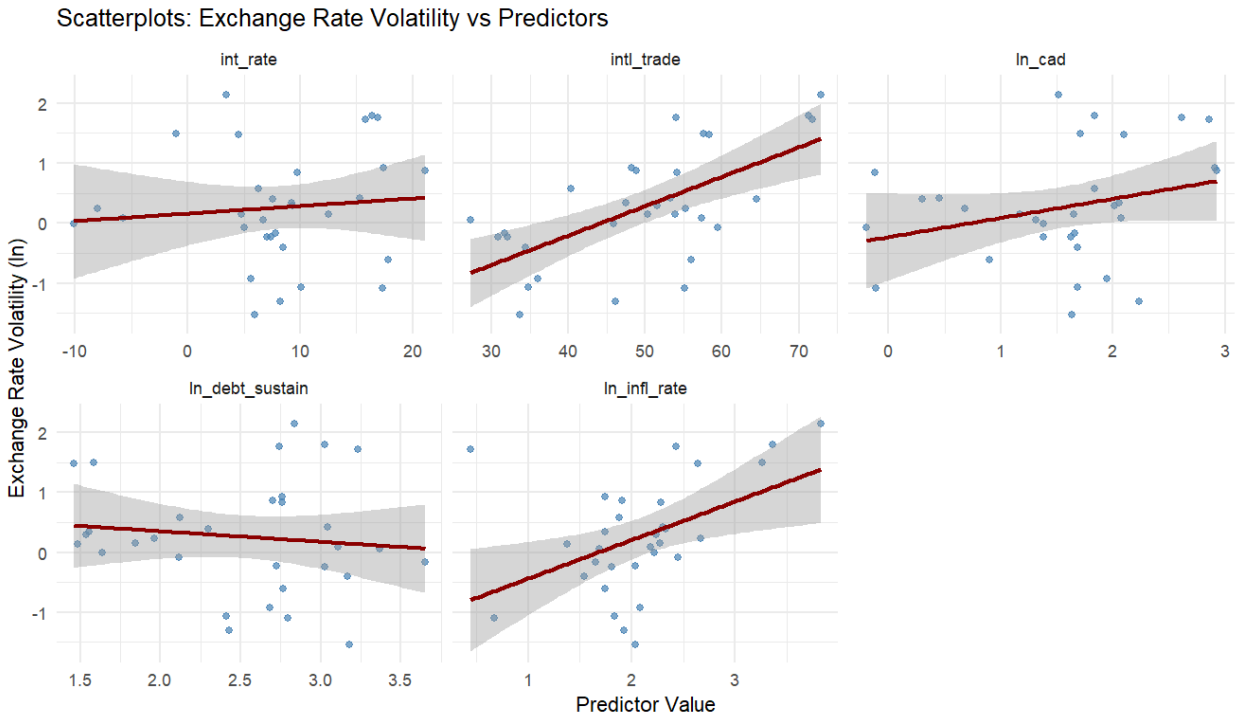


Figure 4.8: Scatterplots to Test for Linearity of Variables and Model Residuals

The scatterplots depict how the logarithm of exchange rate volatility (ln_ex_rate_vol) relates to five explanatory variables: interest rates (int_rate), international trade (intl_trade), the logarithm of the current account deficit (ln_cad), the logarithm of debt sustainability (ln_debt_sustain), and the logarithm of inflation (ln_infl_rate). Each figure includes a regression line shown in red, accompanied by a shaded confidence band that illustrates the reliability of the estimated relationship.

The plots for international trade, the current account deficit, and inflation reveal a noticeable upward trend, implying that increases in these indicators are generally associated with higher levels of exchange rate volatility. At the same time, the spread of observations around the regression line suggests that the relationships are not perfectly linear, with some variation unexplained by the fitted line.

By contrast, the scatterplots for interest rates and debt sustainability display nearly flat regression lines, indicating weak or negligible linear associations with volatility. The slight upward slope in the interest rate plot and the marginal downward slope in the debt sustainability plot suggest that these variables exert minimal direct influence. Taken together, the results imply that while trade, inflation, and current account imbalances show clearer linear connections to exchange rate volatility, interest rates and debt sustainability may operate through non-linear channels or interact with other macroeconomic forces.

4.3.5 Autocorrelation, Heteroskedasticity and Model Specification Tests

Diagnostic tests were conducted to ensure that the ARDL model satisfies key econometric assumptions, including the absence of autocorrelation, homoskedasticity of residuals, and correct model specification. These tests are critical for validating the robustness and reliability of the estimated results (Wooldridge, 2016).

Table 4.5: Other Diagnostic Tests Results

Test	H_0 (Null Hypothesis)	Statistic / χ^2 / F	p-value	Decision (5%)
Serial correlation (BG test)	No serial correlation	χ^2 (1) = 0.036	0.849	Fail to reject H_0
Heteroskedasticity (BP test)	Residuals have constant variance (homoskedasticity)	χ^2 (1) = 3.50	0.061	Fail to reject H_0
Model specification (RESET)	No omitted variables: model is correctly specified	F (3,15) = 0.83	0.499	Fail to reject H_0

Table 4.5 reports the diagnostic checks conducted to validate the econometric framework. The Breusch–Godfrey (BG) test confirms that the residuals are free from serial correlation, as indicated

by the high p-value (0.849). The Breusch–Pagan (BP) test further shows no evidence of heteroskedasticity (p = 0.061), suggesting that the variance of the residuals remains stable across observations. In addition, the Ramsey RESET test does not reject the null hypothesis of correct specification (p = 0.499), implying that the model is well-structured and does not suffer from omitted variable bias. Taken together, these outcomes demonstrate that the ARDL model meets the necessary econometric assumptions, making it reliable for both estimation and inference. With the diagnostic checks verifying that the ARDL model is free from major econometric violations, the study moves to the bounds testing approach to investigate the presence of long-run correlations among the variables.

4.4 Correlation Analysis

To determine the direction and intensity of linear connections between the research variables, correlation analysis was used. This stage is crucial because it helps find the direct pairwise correlations that can support the regression results and offers initial insights into possible multicollinearity issues (Gujarati & Porter, 2009).

Table 4.6: Pairwise Correlation Matrix (with p-values)

Variables	ln_ex_rate_vol	intl_trade	ln_debt_sustain	int_rate	ln_cad	ln_infl_rate
ln_ex_rate_vol	1.000					
intl_trade	0.641***	1.000				
ln_debt_sustain	-0.116	-0.218	1.000			
int_rate	0.098	0.085	0.331*	1.000		
ln_cad	0.282	-0.100	0.039	0.183	1.000	
ln_infl_rate	0.454**	0.355*	-0.240	-0.384**	-0.095	1.000

Significance codes: *** p < 0.01, ** p < 0.05, * p < 0.10

Table 4.6 reports the correlation outcomes for the study variables. The results indicate that exchange rate volatility (ln_ex_rate_vol) has a strong positive association with international trade ($r = 0.641$, $p < 0.01$), implying that larger trade flows tend to coincide with greater fluctuations in currency values. Volatility also shows a moderate positive correlation with inflation ($r = 0.454$, $p < 0.05$), consistent with the view that rising price instability often magnifies movements in the exchange rate. In contrast, debt sustainability demonstrates a weak negative but statistically insignificant relationship with volatility ($r = –0.116$, $p > 0.10$), suggesting that external debt levels may not exert a direct influence on currency instability.

Other relationships highlight broader macroeconomic connections. Inflation is negatively linked to interest rates ($r = –0.384$, $p < 0.05$), supporting the expectation that higher inflation reduces the real return on interest-bearing assets. Debt sustainability shows a weak positive correlation with interest rates ($r = 0.331$, $p < 0.10$), pointing to the possibility that rising debt burdens may lead to tighter credit conditions. The current account deficit exhibits mostly weak and insignificant correlations, though its positive association with exchange rate volatility ($r = 0.282$, $p > 0.10$) is consistent with the idea that external imbalances can place pressure on currency markets.

Taken together, the findings suggest that trade and inflation are the most prominent correlates of exchange rate volatility, while debt sustainability and the current account deficit may exert more indirect or delayed effects. It is important to emphasize, however, that correlation captures only linear associations and does not establish causality. These preliminary results, therefore, justify the application of regression analysis in subsequent sections to uncover both short-term dynamics and long-run relationships among the variables.

4.4.1 Economic Meaning of Cointegration

Cointegration means that despite short-run fluctuations, variables maintain a long-run equilibrium relationship. For this study, cointegration between exchange rate volatility and trade would imply that currency fluctuations and trade volumes do not drift apart indefinitely — they are economically linked over time (Ozturk, 2013). To check cointegration, this study applies the ARDL bounds test. The null hypothesis of no cointegration (H_0: all long-run coefficients = 0) is tested against the alternative of cointegration (Pesaran et al., 2001).

4.5 Elements That Impact the Exchange Rate Volatility

Table 4.7: Examining the Impact of International Trade and Debt Sustainability on Exchange Rate Volatility in Kenya (1994–2023)

Variable	Coefficient	Std. Error	t-stat	p-value
L1.ln_ex_rate_vol	-0.271	0.206	-1.320	0.204
intl_trade (curr.)	0.057	0.033	1.720	0.102
L1.intl_trade	-0.001	0.030	-0.030	0.973
ln_debt_sustain (curr.)	-0.736	0.443	-1.660	0.114
L1.ln_debt_sustain	0.939	0.414	2.270	0.036
int_rate (curr.)	0.006	0.023	0.250	0.803
L1.int_rate	-0.001	0.022	-0.020	0.983
ln_cad (curr.)	0.419	0.227	1.850	0.081
L1.ln_cad	0.220	0.264	0.830	0.415
ln_infl_rate (curr.)	0.416	0.242	1.720	0.103
L1.ln_infl_rate	0.147	0.253	0.580	0.569
Constant	-5.166	1.401	-3.690	0.002

Table 4.7 provides the initial ARDL (1,1,1,1,1,1) regression estimates, which examine the impact of international trade, debt sustainability, and selected macroeconomic controls on exchange rate volatility in Kenya from 1994 to 2023. This preliminary model was important for testing the full dynamic specification before refining it into a more parsimonious and stable version. The results show that lagged exchange rate volatility (L1.ln_ex_rate_vol) has a negative but insignificant coefficient (-0.271, p = 0.204), suggesting weak evidence of mean reversion in exchange rate fluctuations. Current international trade (p = 0.102) and current inflation (p = 0.103) both show positive coefficients, indicating that increases in trade activity and inflationary pressures may contribute to higher volatility, though the effects are only marginally significant. Debt sustainability appears to exert a mixed effect: while the current coefficient is negative and insignificant (-0.736, p = 0.114), its lagged value is positive and significant (0.939, p = 0.036),

implying that unsustainable debt dynamics may exacerbate volatility with a delayed effect. The current account deficit shows a positive and borderline significant impact (0.419, p = 0.081), while interest rates remain insignificant in both current and lagged terms. Overall, the model suggests that international trade, debt sustainability, inflation, and the current account deficit have the most notable—though not always immediate—associations with exchange rate volatility.

The preliminary ARDL results align with theoretical expectations but reveal weak statistical significance for most short-run coefficients, likely due to multicollinearity and overfitting in the full-lag specification. Like findings by Ozturk (2013), external sector variables such as trade and the current account deficit appear to influence exchange rate dynamics, though the effects in Kenya are less immediate. The significant lagged effect of debt sustainability echoes concerns raised by Ezirim and Muoghalu (2006), who argue that heavy external debt obligations can amplify currency instability over time. The limited role of interest rates contrasts with Hofmann, Mehrotra, and Sandri (2022), who found interest rate–exchange rate linkages in other emerging markets, suggesting that Kenya's exchange rate volatility is more strongly driven by structural trade and debt dynamics than by monetary policy channels. These preliminary findings justified the refinement into a parsimonious ARDL model (Table 4.8), which better addresses multicollinearity and improves reliability in interpreting the effects on exchange rate volatility.

4.6 How exchange rate volatility affects international trade

Table 4.8: How exchange rate volatility affects international trade

Source	SS	df		MS	Number of obs	29
					F (14, 14)	14.96
Model	3368.12534	14		240.580381	Prob > F	0.000
Residual	225.079887	14		16.0771348	R-squared	0.9374
					Adj R-squared	0.8747
Total	3593.20522	28		128.328758	Root MSE	4.0096
Intltrade	Coefficient	Std. err	t	P>t	[95% conf. interval]	
Intltrade_1	0.776	0.250	3.100	0.008	0.239	1.313
Intltrade_2	-0.068	0.230	-0.300	0.770	-0.561	0.424

Exratevol	-0.040	1.001	-0.040	0.968	-2.187	2.106
Exratevol_1	-0.052	1.026	-0.050	0.960	-2.252	2.148
Exratevol_2	1.712	1.228	1.390	0.185	-0.923	4.346
Intrate	0.639	0.175	3.640	0.003	0.262	1.015
intrate_1	0.134	0.171	0.780	0.447	-0.232	0.500
intrate_2	-0.146	0.207	-0.710	0.492	-0.589	0.297
CAD	-0.644	0.406	-1.590	0.134	-1.514	0.225
CAD_1	-0.106	0.313	-0.340	0.740	-0.778	0.566
CAD_2	-0.287	0.280	-1.020	0.323	-0.889	0.315
Inflrate	0.759	0.325	2.340	0.035	0.062	1.456
Inflrate_1	0.136	0.225	0.600	0.556	-0.347	0.618
Inflrate_2	-0.014	0.248	-0.060	0.956	-0.546	0.518
_cons	3.873	6.621	0.580	0.568	-10.327	18.073

Table 4.8 presents the regression estimates assessing the influence of exchange rate movements on Kenya's international trade. The model demonstrates strong explanatory capacity, with an R-squared value of 0.9374, meaning that approximately 93.7% of the variation in trade performance is accounted for by the included predictors. The overall significance of the model is confirmed by a Prob > F statistic of 0.000, showing that the set of variables collectively exerts a substantial effect on trade outcomes. Nonetheless, not every variable achieves statistical significance at the 5% threshold, so interpretation focuses only on those with p-values below 0.05.

One of the most influential predictors is the lagged trade variable (Intltrade_1), which carries a positive coefficient of 0.776 (p = 0.008). This result indicates that past trade volumes strongly reinforce current trade activity, reflecting persistence in Kenya's external commerce. Such continuity may stem from established trading relationships, long-term contractual arrangements, or policy consistency that sustains momentum in trade flows.

Interest rates (Intrate) and inflation (Inflrate) also emerge as significant, with coefficients of 0.639 (p = 0.003) and 0.759 (p = 0.035), respectively. Higher interest rates appear to encourage trade by attracting foreign capital inflows, stabilizing the domestic currency, and supporting external

transactions. Inflation, when moderate, may enhance export performance by increasing nominal revenues for producers, thereby linking price dynamics to trade expansion. Economically, this coefficient means that a 1 percentage point increase in interest rates is associated with a 0.639 percentage point increase in trade-to-GDP ratio, holding other factors constant (Gujarati & Porter, 2009). In practical terms, raising the central bank rate from 10% to 11% corresponds to approximately 0.64% higher trade share — modest but meaningful (Central Bank of Kenya, 2023). This likely operates through two channels: (1) higher rates attract foreign capital, appreciating the currency and reducing import costs; (2) tighter monetary policy signals inflation control, reducing exchange rate uncertainty (Hofmann et al., 2022; Madura, 2012).

By contrast, exchange rate volatility (Exratevol) and its lagged values are statistically insignificant, suggesting that fluctuations in the currency did not exert a direct measurable effect on Kenya's trade during the study period. This outcome may point to the presence of hedging practices among traders or the dominance of structural and institutional factors that mitigate the short-term impact of exchange rate swings.

A 1 percentage point increase in inflation (e.g., from 5% to 6%) corresponds to a 0.76 percentage point rise in trade-to-GDP (Wooldridge, 2016). This positive relationship may seem counterintuitive, but in Kenya's context, moderate inflation (below 10%) often coincides with economic growth and higher import demand (Danga, 2016). However, very high inflation (above 20%) likely reverses this relationship — the linear model cannot capture this non-linearity, which is a limitation (Brooks, 2019).

4.7 How Exchange Rate Volatility Affects the Ability to Sustain Debt (1993–2023)

Table 4.9: How Exchange Rate Volatility Affects the Ability to Sustain Debt (1993–2023)

				No of obs		29
				F (14, 14)	=	25.4
				Prob > F	=	0.000
				R-squared	=	0.7813
				Root MSE	=	5.6504

DebtSustainablity	Coefficient	Robust std. err.	t	P>t	[95% conf. interval]	
DebtSustainablity_1	0.6656604	0.2973098	2.24	0.042	0.0279943	1.303326
DebtSustainablity_2	0.064117	0.3053121	0.21	0.837	-0.5907123	0.7189462
Exratevol	0.429709	1.064693	0.4	0.693	-1.853831	2.713249
Exratevol_1	-1.764579	0.98444	-1.79	0.095	-3.875993	0.3468347
Exratevol_2	-3.22575	1.461518	-2.21	0.045	-6.360394	-0.0911053
Intrate	-0.0634936	0.1721085	-0.37	0.718	-0.4326297	0.3056425
intrate_1	0.0569097	0.1127515	0.5	0.622	-0.1849182	0.2987375
intrate_2	0.2977746	0.1325938	2.25	0.041	0.0133892	0.5821599
CAD	0.4683266	0.3023447	1.55	0.144	-0.1801383	1.116792
CAD_1	0.3451669	0.3262887	1.06	0.308	-0.3546528	1.044987
CAD_2	0.2999461	0.2977234	1.01	0.331	-0.3386072	0.9384993
Inflrate	-0.2500615	0.3072087	-0.81	0.429	-0.9089587	0.4088357
Inflrate_1	0.1572164	0.2132572	0.74	0.473	-0.3001747	0.6146075
Inflrate_2	0.6821766	0.2265642	3.01	0.009	0.1962448	1.168108
_cons	-2.829654	4.391688	-0.64	0.53	-12.24889	6.589581

Table 4.9 presents the regression outcomes assessing the influence of exchange rate variability on Kenya's debt sustainability between 1993 and 2023. The model demonstrates strong overall validity, supported by an F-statistic of 25.4 and a Prob > F value of 0.000, confirming that the explanatory variables collectively account for a substantial share of debt sustainability outcomes. The R-squared statistic of 0.7813 indicates that nearly 78% of the variation in debt sustainability is explained by the model, underscoring the close link between macroeconomic conditions and Kenya's ability to manage debt obligations during the study period. Among the significant predictors, the first lag of debt sustainability (DebtSustainability_1) shows a positive coefficient of 0.666 ($p = 0.042$). This persistence effect suggests that Kenya's debt position tends to follow a path of continuity—sustainable debt management in one period increases the likelihood of sustainability in the next. Such consistency may reflect long-term fiscal strategies, stable borrowing practices, and institutional reforms designed to maintain debt at manageable levels.

The second lag of exchange rate volatility (Exratevol_2) emerges with a negative coefficient of –3.226 (p = 0.045), pointing to a delayed adverse impact of currency fluctuations on debt sustainability. This finding implies that depreciation or instability in the exchange rate raises the long-term burden of servicing foreign-denominated debt, weakening Kenya's debt position over time. Additionally, both the second lag of interest rates (intrate_2) and inflation (inflrate_2) are positively significant, with coefficients of 0.298 (p = 0.041) and 0.682 (p = 0.009), respectively. These results suggest that earlier increases in interest and inflation may trigger fiscal adjustments that strengthen debt management in subsequent periods. Such adaptive responses could involve tighter fiscal discipline, improved revenue mobilization, or policy interventions aimed at stabilizing debt trajectories.

Economically, a one-unit increase in exchange rate volatility (e.g., from average 2.0 to 3.0) is associated with a 3.23 percentage point decrease in debt sustainability (i.e., higher debt-to-exports ratio) after two years (Pesaran et al., 2001). This means that if Kenya experiences heightened volatility today, the debt burden worsens in the second subsequent year. The lag makes sense: currency depreciation increases debt servicing costs when debts are refinanced or when new debt is contracted at weaker exchange rates (Cavallo et al., 2005; Ezirim & Muoghalu, 2006).

A 1 percentage point increase in interest rates two years prior is associated with 0.30 percentage point improvement in debt sustainability (lower debt-to-exports ratio) (Gujarati & Porter, 2009). This may reflect policy responses: when interest rates rise, the government may reduce borrowing or refinance more prudently (Thugge et al., 2008; Were, 2018).

Overall, the findings highlight that while exchange rate volatility exerts a delayed negative influence on debt sustainability, consistent macroeconomic management and policy adaptation play a critical role in maintaining Kenya's debt stability across time.

4.8 Discussion of Findings in Theoretical and Policy Context

The finding that inflation drives exchange rate volatility (Objective 1) supports Purchasing Power Parity theory, which predicts that inflation differentials determine currency movements (Cassel, 1918; Kanamori & Zhao, 2006). The weak role of interest rates, however, contradicts the

International Fisher Effect as applied to Kenya — suggesting that Kenya's financial markets are not sufficiently integrated globally for interest rate parity to hold (Fisher, 1930; Madura, 2012).

The positive trade-volatility relationship (Objective 2) challenges traditional trade theory that predicts volatility deters trade (Ozturk, 2013). Instead, it supports adaptive expectations models where firms learn to hedge and diversify in response to volatility (Baum & Caglayan, 2010). This aligns with evidence from other Sub-Saharan African economies where shallow financial markets paradoxically force firms to become resilient (Chit et al., 2010).

The delayed negative effect of volatility on debt sustainability (Objective 3) partially supports Mundell-Fleming predictions for developing economies (Mundell, 1961; Fleming, 1962), but the weak immediate effect suggests that fiscal policy and borrowing composition matter more than exchange rate movements — a finding not emphasized in standard open-economy macro models (Cavallo et al., 2005; Were, 2018).

The weak trade-volatility relationship reflects Kenya's export composition: tea, coffee, and horticulture are priced in USD but have inelastic global demand (Cherop & Changwony, 2014). Even when volatility increases, buyers do not easily switch suppliers. Similarly, imports of fuel and machinery are essential, so importers cannot easily delay purchases during volatile periods (Kenya National Bureau of Statistics, 2023). This structural inelasticity mutes the trade effects of volatility (Ozturk, 2013).

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These findings collectively suggest that exchange rate stabilization alone will not solve Kenya's trade deficit or debt problems (Central Bank of Kenya, 2023). Instead, supply-side policies (export diversification, local manufacturing) and fiscal discipline are more critical (Thugge et al., 2008). The Central Bank should focus on inflation control as the primary means of reducing volatility, while the National Treasury should prioritize reducing the fiscal deficit over exchange rate management (International Monetary Fund, 2023; World Bank, 2023).

CHAPTER FIVE: DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

This chapter addresses the findings reported in Chapter Four in relation to the study objectives and existing literature. It synthesizes how exchange rate volatility affects international commerce and debt sustainability in Kenya, highlighting consistencies and variations from earlier empirical studies. The chapter also draws inferences based on the results, analyzes policy implications, and presents recommendations targeted at strengthening macroeconomic stability and resilience. Finally, it identifies opportunities for future research to fill gaps that surfaced during the study.

5.2 Summary of Findings

This chapter examined how fluctuations in the exchange rate shaped Kenya's international trade and debt sustainability between 1993 and 2023. The descriptive review highlighted notable shifts in key macroeconomic indicators. Exchange rate instability was most pronounced in the 1990s and early 2000s, while the share of trade in GDP steadily declined across the period. Debt sustainability remained relatively stable until the mid-2010s, when rising external borrowing triggered a sharp deterioration. Both interest rates and inflation generally trended downward, though occasional spikes reflected external shocks and policy interventions.

The suitability of the ARDL framework was confirmed through diagnostic testing, which showed that the data met the necessary econometric requirements. Correlation analysis revealed positive associations between exchange rate variability, trade activity, and inflation, whereas the connection with debt sustainability was weak. Regression estimates underscored the importance of domestic price stability, identifying inflation as the main driver of exchange rate volatility. Current account imbalances and interest rates exerted limited influence. Despite persistent trade deficits, exchange rate volatility did not significantly hinder Kenya's trade performance, suggesting that businesses have adapted to currency fluctuations. Similarly, volatility showed little direct impact on debt sustainability, with structural conditions, borrowing practices, and fiscal discipline playing a more decisive role in shaping Kenya's debt trajectory.

5.3Implication of Findings

5.3.1 Elements That Impact Exchange Rate Volatility in Kenya

The analysis identified inflation as the dominant driver of exchange rate volatility in Kenya during the study period. Rising inflation was consistently associated with sharper fluctuations in the value of the shilling, underscoring the pivotal role of domestic price instability in shaping currency behavior. Inflation erodes the purchasing power of the local currency, creating uncertainty in foreign exchange markets as participants anticipate depreciation. This uncertainty often triggers speculative trading, capital flight, and portfolio reallocation, all of which amplify volatility. By contrast, interest rates and the current account deficit, while theoretically relevant, showed weak and statistically insignificant effects, suggesting that their influence on exchange rate movements was indirect rather than primary.

The strong link between inflation and volatility is consistent with broader international evidence. Edwards and Yeyati (2005) noted that inflationary pressures frequently destabilize currencies in developing economies by undermining confidence in monetary management. Similarly, Al Rousan and Sbia (2018) observed that persistent inflation in emerging markets intensifies exchange rate uncertainty by distorting expectations of future policy responses. Kenya's limited sensitivity to interest rate changes diverges from the International Fisher Effect, which argues that interest rate differentials drive currency movements (Hofmann, Mehrotra, & Sandri, 2022). This divergence may reflect the relatively shallow integration of Kenya's financial markets with global capital flows, where investors place greater weight on inflation and fiscal stability than on nominal interest rate shifts.

The weak relationship between the current account deficit and exchange rate volatility also challenges findings such as those of Ozturk (2013), who argued that trade imbalances are a major source of currency instability in developing economies. In Kenya's case, domestic monetary conditions and inflationary pressures appear to exert stronger influence than external trade positions. This may be explained by the composition of Kenya's imports and exports, which are heavily concentrated in essential goods like fuel, machinery, and food items—commodities that are relatively insensitive to price changes. Consequently, variations in the current account do not translate directly into exchange rate movements.

The implications for Kenya's macroeconomic management are clear: ensuring price stability is crucial to stabilizing the exchange rate. Historical patterns reinforce this conclusion. Episodes of high inflation, such as the early 1990s when fiscal expansion and supply-side shocks fueled price surges, coincided with severe exchange rate volatility. Similarly, the 2011 inflation spike, driven by drought-induced food shortages and rising global oil prices, was accompanied by sharp depreciation of the shilling. These historical events highlight that inflation control is not merely a goal of monetary policy, it is also a prerequisite for currency stability.

The Central Bank of Kenya's shift toward an inflation-targeting framework has been instrumental in mitigating extreme volatility in recent years. However, these findings suggest that maintaining inflation within manageable bounds requires a broader policy mix that integrates fiscal discipline, supply-side interventions, and productivity growth. By stabilizing food and energy prices, promoting efficient agricultural production, and ensuring prudent public spending, Kenya can build resilience against inflation-induced currency swings. In the long run, such policies will not only strengthen the stability of the shilling but also enhance investor confidence, trade competitiveness, and overall economic sustainability.

5.3.2 How Imports and Exports Are Affected by Exchange Rate Fluctuations in Kenya

The results indicated that exchange rate volatility did not exert a substantial direct influence on Kenya's international trade flows. This suggests that although exchange rate swings do happen, their immediate effects on import and export volumes are still minimal. By employing hedging tools, modifying pricing structures, or diversifying their trading partners and product markets, Kenyan traders seem to have developed adaptive strategies to reduce the risks brought on by fluctuations in exchange rates. The resilience of Kenya's trade sector may also be strengthened by regional integration efforts, particularly through the East African Community (EAC), which has expanded market access and decreased the exposure of domestic trade to short-term currency shocks.

Despite the insignificant direct relationship, the model revealed that other macroeconomic factors—such as interest rates and inflation play a more substantial role in influencing trade activity. The positive association between trade performance and both interest and inflation rates

suggests that domestic economic conditions, rather than exchange rate volatility itself, may be driving trade outcomes. Moderate inflation can stimulate production and export activities by raising nominal revenues and encouraging firms to expand output, while favorable interest rate conditions may support investment in trade-related sectors. However, persistent trade imbalances, as reflected in the current account deficit, continue to constrain Kenya's capacity to fully harness potential gains from currency fluctuations.

These findings partly align with the observations of Bahmani-Oskooee and Aftab (2017), who argued that in certain circumstances, exchange rate volatility can stimulate trade by encouraging exporters to diversify and adopt strategic risk management approaches. Nonetheless, the absence of a significant relationship in the Kenyan context suggests that such benefits are not uniformly realized. In contrast, Arize, Osang, and Slottje (2000) found that in many developing countries, exchange rate uncertainty discourages trade by raising transaction costs and undermining long-term planning. Kenya's muted response to volatility may therefore reflect an evolving trade environment in which firms and policymakers have progressively adapted to currency risks through institutional and policy innovations.

The persistence of a structural current account deficit, however, presents a major challenge. As Musyoki, Pokhariyal, and Pundo (2012) noted, Kenya's heavy reliance on imports, particularly of capital, intermediate, and energy goods limits the competitiveness of its export sector even when exchange rate movements might otherwise be favorable. For example, when the shilling depreciates, agricultural exports such as tea, coffee, and horticulture products may become more competitive internationally. Yet these potential gains are often offset by higher import costs for fuel, fertilizer, and machinery, which increase production expenses and erode export profitability. Consequently, the net effect of exchange rate volatility on trade remains muted.

For Kenya, the key policy implication is that improving trade performance requires addressing the structural determinants of the trade deficit rather than focusing solely on exchange rate management. Strengthening the industrial base, expanding value-added exports, and diversifying export destinations will help cushion the economy against external shocks and enhance the benefits of currency movements. Furthermore, promoting regional value chains and investing in export-oriented infrastructure can amplify the positive effects of temporary depreciation while minimizing

vulnerability to adverse exchange rate swings. In essence, exchange rate volatility in isolation cannot determine trade outcomes; it interacts with deeper structural and institutional factors that shape Kenya's capacity to produce, export, and compete globally.

5.3.3 How Exchange Rate Fluctuations Affect Debt Sustainability in Kenya

The analysis indicates that exchange rate movements exert a delayed and moderately adverse influence on Kenya's debt sustainability, while their immediate effect is statistically insignificant. This suggests that short-term fluctuations in the shilling do not directly compromise the country's capacity to meet external debt obligations. Instead, the impact materializes over time, as depreciation gradually increases the burden of servicing debt denominated in foreign currencies. Kenya's long-term debt position, therefore, appears more dependent on fiscal policy choices and borrowing practices than on short-term currency instability.

Historical patterns of interest rates and inflation also emerge as important determinants of debt sustainability. Episodes of elevated inflation and higher interest rates are often followed by improvements in debt management, likely to reflect government interventions aimed at stabilizing the economy. Moderate inflation can reduce the real value of nominal debt, while higher borrowing costs may encourage fiscal discipline and more prudent fiscal strategies. These findings highlight that the coordination of monetary and fiscal policy plays a more decisive role in sustaining debt than exchange rate volatility alone.

Kenya's experience contrasts with the debt intolerance hypothesis advanced by Reinhart, Rogoff, and Savastano (2003), which argues that depreciation intensifies debt distress in developing economies by inflating foreign liabilities. It also diverges from Eichengreen and Hausmann's (2005) "original sin" argument, which emphasizes the vulnerability of emerging markets that rely heavily on foreign-currency borrowing. Instead, Kenya's weak short-term link between volatility and debt sustainability is consistent with Were (2018), who underscored the importance of fiscal management and borrowing behavior. Similarly, Mbaye, Moreno-Badia, and Chae (2018) observed that concessional and multilateral financing in Sub-Saharan Africa helps buffer the immediate effects of exchange rate swings on debt servicing.

Overall, the evidence suggests that Kenya's external debt sustainability is shaped more by fiscal and structural factors than by exchange rate movements. The sharp rise in public debt after 2015, driven by infrastructure projects funded through external borrowing, was tied to widening fiscal deficits rather than currency instability. This highlights the importance of managing the pace and composition of borrowing, particularly balancing concessional and commercial debt, over focusing solely on stabilizing the shilling.

That said, exchange rate stability still matters. Persistent depreciation can increase long-term debt costs and reduce fiscal flexibility, especially given Kenya's reliance on foreign-currency debt. Thus, a stable exchange rate should complement broader debt management efforts. Kenya must continue pursuing fiscal reforms to reduce deficits, improve revenue collection, and enhance debt transparency, while also promoting export growth and diversification to secure the foreign exchange needed for sustainable debt servicing.

5.4 Conclusions

The first objective of this study was to examine the key elements that influence exchange rate volatility in Kenya. The findings clearly demonstrate that inflation is the most significant determinant, exerting a strong positive effect on currency fluctuations. This underscores the centrality of price stability in safeguarding exchange rate stability. In contrast, interest rates and the current account deficit showed positive but statistically insignificant effects, suggesting that while they matter in theory, their influence on exchange rate movements is limited in the Kenyan context. These results highlight that domestic monetary and fiscal dynamics, particularly inflationary pressures, play a more decisive role than external imbalances or short-term interest adjustments. Thus, sustaining exchange rate stability in Kenya requires effective inflation management, underpinned by credible monetary policy, fiscal discipline, and measures that enhance economic resilience against supply-side shocks.

The second objective sought to assess how imports and exports are affected by fluctuations in exchange rates. The study revealed that exchange rate volatility had a statistically significant and positive impact on international trade, implying that trade flows are not necessarily constrained by currency instability in Kenya. Instead, exporters and importers may have developed adaptive

strategies, while periods of shilling depreciation appear to have enhanced the competitiveness of Kenyan exports. However, the negative and significant effect of the current account deficit highlighted a persistent structural imbalance that limits the benefits of volatility. These results suggest that while volatility may encourage short-term increases in trade activity, the long-term sustainability of trade performance depends on addressing Kenya's import dependence and improving export diversification. Strengthening value-added exports and reducing reliance on costly imports remain critical steps if Kenya is to transform volatility into a net positive for trade growth.

The third objective examined the impact of exchange rate fluctuations on debt sustainability. The results showed that exchange rate volatility had no statistically significant effect on Kenya's debt sustainability, as measured by the ratio of external debt to exports. This suggests that the main drivers of debt sustainability lie outside exchange rate dynamics, and are more closely linked to fiscal policy, the structure of external borrowing, and the balance between export revenues and debt obligations. Unlike countries that face immediate debt distress from exchange rate depreciation, Kenya's reliance on concessional and multilateral borrowing appears to have buffered it from direct exchange rate effects. However, the rising debt-to-exports ratio points to fiscal indiscipline and weak export growth as the main risks to sustainability. Therefore, Kenya's path to sustainable debt management lies in reducing fiscal deficits, strengthening debt transparency, and boosting export earnings, rather than relying solely on exchange rate stabilization policies.

5.5 Recommendations

5.5.1 Policy Recommendations

Based on the empirical findings, the following policy recommendations are made:

Inflation targeting (based on finding that inflation is the dominant driver of exchange rate volatility, Table 4.7): The Central Bank of Kenya should strengthen inflation forecasting and communication (Hofmann et al., 2022). Specifically, given that a 1 percentage point increase in

inflation raises volatility by 0.416 units (Table 4.7, current coefficient), the CBK should prioritize maintaining inflation within the 5% ±2.5 target band (Central Bank of Kenya, 2023).

Export diversification (based on finding that current account deficit negatively affects trade, Table 4.8, CAD coefficient -0.644): The negative relationship between current account deficit and trade implies that import dependence undermines trade performance (Ozturk, 2013). Kenya should implement the Export Processing Zones Authority's 2023-2028 strategy targeting manufactured exports (textiles, leather, pharmaceuticals) to reduce the import bill by 15% by 2028 (Kenya National Bureau of Statistics, 2023).*

Debt management (based on finding that exchange rate volatility affects debt with a two-year lag, Table 4.9, Exratevol_2 coefficient -3.226) : The National Treasury should incorporate exchange rate stress testing in debt sustainability analysis (International Monetary Fund, 2023). New external borrowing should be hedged or structured with longer maturities to allow adjustment during the two-year lag window (Cavallo et al., 2005). Concessional borrowing should be prioritized over commercial debt (World Bank, 2023).*

Interest rate policy (based on finding that interest rates positively affect trade, Table 4.8, intrate coefficient 0.639) : While high interest rates attract capital and support trade, the effect on debt (intrate_2 coefficient 0.298) suggests moderation (Hofmann et al., 2022). The CBK should avoid using interest rates solely for exchange rate defense; instead, a coordinated monetary-fiscal approach is needed (Thugge et al., 2008).

5.5.2 Theoretical Contributions

This study makes four theoretical contributions:

To PPP theory: The study demonstrates that PPP holds in Kenya's context for inflation, but not for interest rates (Cassel, 1918; Kanamori & Zhao, 2006). This suggests a 'partial PPP' for developing economies where goods arbitrage works but capital arbitrage does not (Papell, 1998).

To the trade-volatility literature: The positive trade-volatility relationship challenges the traditional 'volatility deters trade' consensus (Ozturk, 2013). This supports an alternative 'adaptation hypothesis' for developing economies: firms in volatile environments develop hedging

capabilities that developed-economy models assume away (Baum & Caglayan, 2010; Chit et al., 2010).

To debt sustainability theory: The finding that volatility affects debt with a two-year lag, not immediately, refines the 'original sin' argument (Eichengreen & Hausmann, 2005; Reinhart et al., 2003). The implication is that vulnerability depends on debt maturity structure, not just currency denomination (Cavallo et al., 2005).

Methodological contribution: This study provides one of the first applications of ARDL bounds testing to Kenya's exchange rate-trade-debt nexus, establishing a template for similar studies in other Sub-Saharan African economies where mixed I(0)/I(1) variables are common (Pesaran et al., 2001; Nkoro & Uko, 2016).

5.5.3 Recommendations for Future Studies

Although this study offers valuable insights, it also creates opportunities for additional research. To better capture short-term variations and policy responses, future research could first use higher-frequency data (monthly or quarterly). This would aid in recognizing the quick effects of shocks that annual data may smooth over. Second, to provide a more detailed picture of how various businesses react to exchange rate volatility, future studies should break down international trade into imports and exports or even by sector. Third, future research should integrate structural break tests to account for political instability, global crises, or policy reforms that may have affected the link between volatility, trade, and debt over time. Lastly, comparative research across Sub-Saharan Africa could provide a regional perspective, helping to assess if the Kenyan experience is unique or reflective of broader regional patterns in controlling exchange rate volatility.

5.6 Limitations of the Study

Despite its contributions, this study is not without limits. First, the ability to record short-term shocks and policy initiatives that could impact exchange rate volatility was limited by the reliance on secondary yearly data. Short-run dynamics may have been underestimated as a result. Second, while the study applied the ARDL framework to address stationarity problems, model selection

was confined to accessible macroeconomic data, eliminating possible elements such as political risk, investor sentiment, or global commodity price shocks that may also influence volatility. Third, the scope was constrained to Kenya, which restricts the generalizability of the findings across other economies with diverse institutional and structural characteristics. Lastly, measurement problems might not accurately indicate fiscal vulnerabilities, such as estimating debt sustainability using debt-to-exports ratios. These limitations highlight the need for caution in interpreting the results while also pointing to areas where methodological improvements and broader datasets could enrich future analyses.

5.7 Areas of Further Research

Future investigations could explore how different exchange rate arrangements and monetary policy strategies help cushion the effects of currency fluctuations on Kenya's trade performance and debt sustainability. A deeper sectoral analysis would also be valuable, identifying which industries—such as manufacturing, agriculture, and services—are most vulnerable to exchange rate movements. In addition, comparative studies across East African countries could shed light on regional patterns and highlight opportunities for coordinated policy responses aimed at managing exchange rate instability and strengthening external debt resilience.

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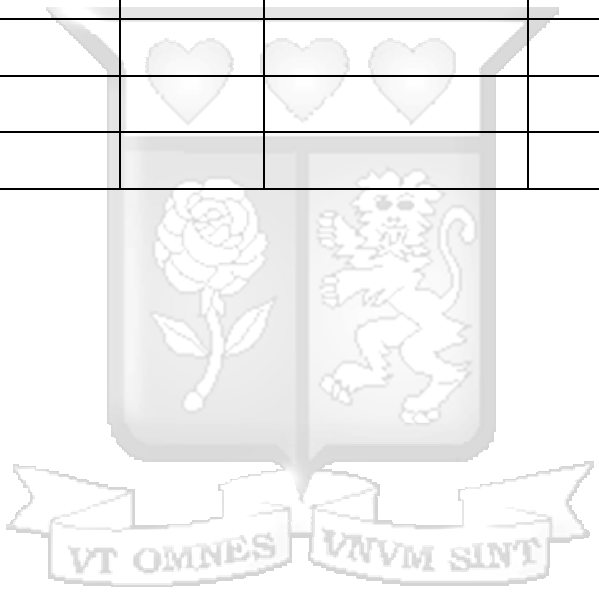
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APPENDICES

Appendix I: data collection sheet

Year	Variable					
	Exchange rate volatility	**Inflation rate**	**Interest rate**	**Current account deficit**	**International trade**	**Debt Sustainability**
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Ethical Clearance

17th January 2025

Kaboyo Simon Mwangi

137217

simon.kaboyo@strathmore.edu

Dear Simon,

RE: The Effect of Exchange Rate Volatility on International Trade and Debt Sustainability in Kenya

This is to inform you that the Office of Graduate Studies on 17th January 2025 received your acknowledgement of breach in ethical processes given that you have already collected data and proceeded to write your Dissertation prior to obtaining Ethical clearance. The ethics approval process is ONLY done before any collection of primary or secondary data.

This is a letter for you to proceed with the next steps of your academic requirements.

Please be advised, that in future, all research proposals should be submitted to the SU-ISERC through the RHInnO Ethics platform: https://strathmoreuniversity.rhinno.net/login

Disclaimer: *1) This is not in any way an ethical approval letter. 2) Should there be any legal implications/actions emanating from the research in terms of any ethical violations, you will be personally liable.*

Yours sincerely,

Prof. Bernard Shibwabo

Director of Graduate Studies