Selected Monetary and Fiscal Factors and Exchange Rate Volatility: An Empirical Analysis of Money Supply, Inflation, Foreign Reserves and External Debt in East Africa Partner States

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ABSTRACT

This paper empirically investigates the effect of money supply, inflation, foreign reserves, and external debt, on exchange rates among East African partner states over the period from 2000 to 2023.The study analyzed data from countries in the East African region, utilizing fixed-effects regression model. Secondary data was sourced from world bank databases. The final sample included countries that met the inclusion criteria, providing meaningful observations for analysis. The results suggest that money supply and external debt have significant positive relationships with exchange rate, indicating that increases in these factors are associated with appreciating exchange rates. Foreign reserves were found to have a negative and significant effect on exchange rates, indicating that higher foreign reserves help stabilize or strengthen currencies. However, inflation was found to have no significant effect on exchange rates, suggesting that its impact may be overshadowed by other macroeconomic factors. The findings of this study provide valuable insights for policymakers in East Africa, highlighting the importance of managing money supply, external debt, and foreign reserves to stabilize exchange rates. Policymakers can use these results to develop strategies aimed at controlling inflationary pressures and strengthening foreign reserves to mitigate exchange rate volatility. The study also offers guidance for future economic planning and policy formulation.

Keywords: Money supply, inflation, foreign reserves, external debt, exchange rate, fixed effect model, East Africa Partner States

INTRODUCTION

Exchange rate volatility has become a critical issue for countries across the globe, reflecting significant fluctuations in the value of one currency relative to another. Such volatility can impact economic stability, trade competitiveness, and investment flows. In the East African Community (EAC), where economies are increasingly interconnected through trade and investment, exchange rate fluctuations are particularly pronounced, posing risks to economic stability and development (World Bank, 2022). The ability to manage and mitigate these fluctuations is essential for ensuring economic stability and fostering sustainable growth in the region.

In the EAC, which includes Kenya, Uganda, Tanzania, Rwanda, Burundi, and South Sudan, exchange rate volatility is influenced by both domestic and external factors. Regionally, the EAC countries face challenges related to their dependence on commodity exports, which are subject to global price fluctuations, and their varying levels of economic development and integration into the global economy (IMF, 2021). Recent studies have highlighted the impact of these factors on exchange rate stability, underscoring the need for effective policy responses to address these challenges. For instance, fluctuations in the prices of key exports like coffee and tea can lead to significant currency swings, affecting the broader economic environment (Gupta & Singh, 2018).

Fiscal policy plays a crucial role in influencing exchange rate volatility. In many EAC countries, fiscal deficits and public debt levels are high, leading to pressures on currency values and exacerbating exchange rate instability (Kasekende & Ngirande, 2020). Expansive fiscal policies, characterized by increased government

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spending and borrowing, can lead to higher inflation and currency depreciation, as observed in countries like Kenya and Uganda (Mordi, 2014). Effective fiscal management, including efforts to reduce deficits and manage debt levels, is therefore vital for stabilizing exchange rates and ensuring macroeconomic stability.

Monetary policy also significantly affects exchange rate volatility. Central banks in the EAC implement monetary policies that influence interest rates, money supply, and inflation, all of which can impact currency values. For instance, high inflation rates, driven by expansive monetary policies, can lead to a loss of confidence in the currency and increased volatility (Fischer, 2019). Recent studies have shown that changes in monetary policy, such as interest rate adjustments and monetary expansions, can lead to substantial shifts in exchange rates, highlighting the importance of maintaining sound monetary policies to manage volatility effectively (Gupta & Singh, 2018). Exchange rate behavior is important for the people of each country as the exchange rate volatility has a direct effect on the prices of basic commodities (Nor, 2015). The fall down of the Bretton Woods fixed exchange rate system pushed bilateral exchange rates to considerably fluctuate over time (Chit et al., 2010; Flood & Rose, 1999; Frömmel&Menkhoff, 2003; Nor, 2015).

Despite the fact that the issue of exchange rate is given exceptional consideration worldwide owing to its negative consequences on the economy, it also continues to be a hot matter in the emerging economies (Chit et al., 2010; Nor, 2015; Prasad et al., 2003). In the context of emerging market economies, countries are facing continuing challenges in handling boom–bust capital flow cycles as these capital flows have increasingly become volatile. Such situation creates dislocation during the bust and puts upward pressures on currencies during the boom (Ostry, 2016). The emerging economies' exchange rates have been examined completely due to the numerous and frequent currency crises that occurred in the previous two decades (Nor, 2015). To identify a common policy direction for such disastrous events, numerous studies have analyzed exchange rate volatility of the developing countries (Chit et al., 2010; De Gregorio et al., 2000; Devereux & Lane, 2003; Edison & Reinhart, 2001; Glick & Hutchison, 2005). Notwithstanding the enormous attempts put in examining the volatility of exchange rates, the findings of Meese and Rogoff (1983) are still integral, which suggest that movements in exchange rates are primarily unpredictable (Devereux & Lane, 2003).

In the early 1990s, all nations in the East African Community (EAC) implemented a series of changes that were backed by the International Monetary Fund (IMF) and the World Bank as part of the Structural Adjustment Programme. These reforms, along with others, were aimed at promoting trade that is more focused on international markets and implementing exchange rate policies that are determined by market forces. Following the implementation of market-determined exchange rate regimes, the exchange rates of the member nations of the East African Community (EAC) have experienced regular fluctuations. In certain member states of the East African Community (EAC), the fluctuations in currency rates have occasionally reached excessive levels, leading to instabilities caused by both domestic and international disturbances. The high level of volatility could result in decreased trade flows, Foreign Direct Investment (FDI), and instability in inflation rates. The volatility of macroeconomic indicators has negative consequences for households' decision-making, firms' profitability, financial stability, and a country's overall economic performance in terms of export performance, foreign direct investment, and inflation. Researchers have contended that an abundance of exchange rate fluctuations has diminished economic growth by affecting both trade and investment. There is increasing and strong evidence that exchange rate volatility, which refers to instability, fickleness, or uncertainty, and is also a measure of the risk associated with exchange rate movements, has significant effects on trade volume (Farrell et al. 1983; IMF, 1984; Côté, 1994; McKenzie, 1999; UK Treasury, 2003; Clark et al. 2004; and Ozturk, 2006).

Hagen and Zhou (2005) highlighted that exchange rate volatility is generally viewed in a negative light, particularly in the context of developing nations, due to its adverse impact on capital inflows and investments. Excessive volatility in currency rates typically hampers the global movement of capital by diminishing both foreign direct investment in operational facilities and financial portfolio investment. International trade and investment decisions are further complicated by unpredictable exchange rates, as increased volatility leads to higher exchange rate risk. Due to fluctuations in currency rates, exporters may opt to transition to domestic operations, where profits are comparatively more predictable, instead of continuing to engage in foreign commerce. Additionally, McKinnon and Ohno (1997) observed that an excessive level of fluctuation in exchange rates might result in increased pricing of items that are traded globally. This is because traders will

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factor in a risk premium to protect themselves from unexpected fluctuations in exchange rates. This will ultimately contribute to inflationary pressures in the tradable goods sector.In the second quarter of 2015, the currencies of all East African Community (EAC) countries experienced a significant decline in value compared to other major currencies. This was mostly caused by the global increase in the value of the US Dollar. Since the end of January 2017, there has been another significant decrease in the value of East African Community (EAC) currencies. This is causing concerns about the impact of the rapid depreciation of the currencies on other macroeconomic factors and the overall economy.

There is a lack of information regarding whether the reported changes in exchange rates have led to volatility and to what extent this volatility has affected macroeconomic indicators such as growth, inflation, and trade flows. This study analyzed the level of exchange rate volatility in EAC countries and its consequent effects on macroeconomic indicators. The ratified agreement for the formation of a monetary union among the member states of the East African Community (EAC) is anticipated to foster monetary integration, enhance trade, attract substantial investment, and stimulate economic growth. In order to guarantee that economies participating in the monetary union are extensively interconnected and possess stable macroeconomic indicators, the member states of the East African Community (EAC) must satisfy specific pre-established conditions known as the macroeconomic convergence criteria. Nevertheless, the documented oscillations in currency exchange rates in those nations raise apprehension regarding their impact on the volatility of other macroeconomic factors. Moreover, the unpredictability resulting from fluctuations in exchange rates poses dangers to economic actors, potentially disrupting the distribution of resources. Hence, comprehending the fluctuations in exchange rates holds significant significance for both enterprises and policymakers.

Therefore, it is crucial to analyze the magnitude of currency fluctuation and its potential influence on macroeconomic factors in the East African Community (EAC) nations. The study aims to analyze the fluctuations in exchange rate volatility and their effects on macroeconomic variables in the three original East African Community (EAC) countries. The study aims to precisely quantify the level of fluctuation in currency rates in Tanzania, Kenya, and Uganda. Additionally, it seeks to evaluate the influence of exchange rate volatility on trade flows, foreign direct investment (FDI), and inflation in these three countries. For the rest of the paper, we proceed as follows. Section 2 discusses previous literature and hypotheses development. Section 3 introduces the research method. We present the results and discussion in Section 4. Section 5 concludes our research, and we provide limitations and future studies.

LITERATURE REVIEW AND HYPOTHESES

Money Supply and Exchange Rate

The purpose of the study conducted by Hassan and Teleb (2022) was to evaluate if the behavior of the money supply in Egypt is determined exogenously or endogenously by studying data from 2004 to 2019. The purpose of this study was to determine the factors that determine the amount of money that is available in Egypt as well as the most essential techniques that the central bank use in order to regulate this supply. This research utilized the Johansen-Juselius test (1990) to investigate the factors that determine the money supply in Egypt over the long run, and the error correction model was utilized to investigate the factors that determine the money supply in the short run. According to the findings of the study, the real gross domestic product (GDP), the discount rate, the budget deficit, and net foreign assets all have large long-term influence on money supply. On the other hand, the exchange rate and net domestic assets have very little impact.

Daoud & Al-Ezzi (2023) examined the cointegration associations among money supply, exchange rate, and economic growth in Iraq, through the utilizing of quarterly data throughout the time frame from 2004 to 2020, as well as the make use of of Johansson's cointegration test, The Vector Error Correction Model (VECM), and Granger's causality test, the economic growth the model has demonstrated the following results: Long-term factors such as the exchange rate and the amount of money in circulation have a positive and considerable influence on the expansion of the economy during the period of 2004-2020. In the near term, however, the real gross domestic product is influenced in a positive way by its value and money supply in lag periods, and it is influenced in a negative way by the real exchange rate, interest rate on loan, and inflation; nonetheless, the effect of interest rates is not considerable. Regarding the equation for the exchange rate, the relationship

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between gross domestic product and money supply demonstrated that it is direct with the exchange rate in Iraq during the period of 2004-2020 in the long term. Additionally, the exchange rate has been positively impacted by its lag value during previous periods of time, and the impact of the interest rate on lending and inflation affects the exchange rate in a positive way, but it is not significant in the short term. It was demonstrated by the equation for the money supply which the gross domestic product has a strong connection to the money supply, while the former is linked to an inverse correlation with the exchange rate in Iraq during the period of 2004-2020 in the long term. On the other hand, the money supply is related to a direct relationship with the real exchange rate and is negatively affected by the rate of inflation. Regarding the interest rate on lending, its influence on the currency rate in the short term is favorable, but it is not significant enough to be considered significant. Therefore, the following hypothesis was developed from the above literature:

H1. Money supply has a significant effect on Exchange rate

Inflation and Exchange Rate

Udiyana et al., (2023) studied the impact of inflation, interest rates, and money supply on the fluctuations of the rupiah exchange rate to the United States dollar during the Covid-19 pandemic. The inflation variable is examined through purchasing power parity theory, focusing on inflation variations between two nations, whereas the interest rate variable is assessed utilizing the International Fisher Effect Theory. The money supply is denoted by M2, which refers to the entire amount of money in circulation or held in banks. The data utilized is secondary data from January 2020 to December 2022, spanning 36 months. Smart PLS 4.0 Software utilizes multiple linear regression, t-test, and F-test to assess the impact of dependent factors on independent variables both collectively and individually. The findings indicated that inflation had a partially positive and insignificant impact on the fluctuations of the rupiah exchange rate against the US dollar. The interest rate had a significant negative effect on these fluctuations, while the money supply had an insignificant negative effect on the rupiah exchange rate against the US dollar. The variables inflation, interest rates, and money supply have a notable impact on the swings of the rupiah exchange rate against the US dollar.

Oktavia & Wahyudi (2022) stated that... Inflation is the general and ongoing increase in the prices of goods and services, affected by factors including reference interest rates, exchange rates, and the money supply. This study aimed to examine the impact of the BI rate and the exchange rate on inflation in Indonesia, with the money supply serving as an intervening variable. The study focused on analyzing the population consisting of Inflation, BI Rate, Rupiah/USD Exchange Rate, and Money Supply. The data from the 2010-2019 timeframe was examined using WarpPLS and Sobel Test. The study demonstrated that the BI rate, exchange rate, and money supply significantly impact inflation. Additionally, the money supply can act as a mediator in the relationship between the BI rate, exchange rate, and inflation, as confirmed by the Sobel test.

Hervé (2016) aims to present empirical evidence on the correlation between foreign exchange reserves and inflation in four West African countries: Cote d'Ivoire, Senegal, Ghana, and Nigeria. The Autoregressive distributive lag model (ARDL) introduced by Pesaran, Shin, and Smith (2001) is used to compare empirical evidence based on annual data from 1972 to 2014. The empirical findings indicate a positive association between the change in foreign exchange reserves and inflation rate in the long run for the mentioned nations. However, the overall short-term estimation of our model is not statistically significant at the conventional level. An increase in foreign exchange reserves results in an increase in the inflation rate. The economy of West African countries is rising rapidly, leading to an increase in exchange reserves. Inflation is also a pressing issue that needs to be addressed. Hence, it remains crucial for these nations to mitigate the adverse impact of the high foreign exchange reserves.

The results of Kun et al. (2012) shows that there exists a significant correlation between exchange rate movements and inflation and output movements. Inflation targeting also has significant impacts on the movements of inflation, output and exchange rate. Inflation targeting is associated with higher volatility in exchange rate movement in majority economies and the effect is negative. Comparing the performance of inflation targeting across economies, we observe that the volatility in exchange rate has increased dramatically and it is very volatile in emerging Asia compare to the developed economies. Therefore, the following hypothesis was developed from the above literature:

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H2. Inflation has a significant effect on Exchange rate

External Reserves and Exchange Rate

Aizenman, et al., (2024) conducted an investigation into the relationship between the real exchange rate and international reserves using nonlinear regressions and panel threshold regressions over a period of 110 nations from 2001 to 2020. This investigation took place during an era of substantial financial integration. According to the findings of their research, the level of development of financial institutions is a significant factor in determining the buffer impact of international reserves. It is possible for nations that have a low level of development in their financial institutions to manage their international reserves as a shield in order to deal with the adverse effects that terms-of-trade shocks have on the real exchange rate.

Lee and Yoon (2020) conducted an investigation on the relationship between changes in international reserves and fluctuations in the foreign exchange rate for five countries located in the Far East: China, Japan, Taiwan, Hong Kong, and Korea. This was accomplished by employing the quantile Granger causality test as well as the quantile autoregressive model in order to understand the reasons behind the intervention of the monetary authority. They were able to identify the intent of the mercantilists in China and Hong Kong, which was to amass their foreign reserves in order to react to the appreciation of currencies. The monetary authorities in Korea and Japan had a rather high level of incentive for the precautionary stabilization of their respective currencies with regard to the situation. Furthermore, they were able to determine the asymmetric causal relationship that exists between the variables. When the causal relationship is taken into consideration, together with the significant regression coefficients, it is discovered that these traits are more significant in every country. In the conclusion, they validate the characteristics of the quantile- and tail-dependent relationship that exists between the individual variables. Additionally, in comparison to other countries, Korea had a tail-dependence that was substantially stronger. That is to say, the causal relationship between the Korean foreign exchange reserves and the exchange rate is stronger when the variables are experiencing rapid changes, and this association is weaker when the variables are experiencing moderate variations.

Through the utilization of time series data spanning from 1986 to 2021, Dodo et al., (2023) conducted an investigation of the impact that the exchange rate has on the foreign reserves of Malaysia. Based on the findings of the study, which utilized the autoregressive distributed lag (ARDL) method for its statistical analysis, it was determined that the exchange rate has a significant and positive impact on foreign reserves in the short run, but that in the long run, the exchange rate has a significant and negative impact on foreign reserves.

Ho et al., (2023) conducted an investigation into the relationship between the real exchange rate and international reserves using nonlinear regressions and panel threshold regressions over a period of 110 nations from 2001 to 2020. This investigation took place during an era of substantial financial integration. After reaching a threshold of 17%, we were able to capture the buffer impact of international reserves, which is more evident in Europe and Central Asia. The buffer effect of international reserves was demonstrated by our research, which, in contrast to earlier research, demonstrated that the development of financial institutions plays a key part in understanding the phenomenon. Countries that have financial institutions that are not very established may be able to use international reserves as a shield to protect themselves from the adverse effects that terms-of-trade shocks have on the real exchange rate they are experiencing. The buffer effect was also shown to be more pronounced in nations that had moderate levels of financial openness, according to our findings.

A study conducted by Brafu-Insaidoo, (2019) looked into the impact that the accumulation of international reserves has on the maturity structure of Ghana's external debt and the volatility of the country's exchange rate. The theories that the accumulation of international reserves alters the maturity structure of external debt in the direction of more long-term obligations and increases exchange rate stability were put to the test. Additionally, it examined the notion that the accumulation of foreign reserves and the acquisition of a greater proportion of long-term external debt interact with one another to strengthen the stability of the exchange rate. In order to conduct an analysis of the data that was collected from the databases of the World Bank, the International Monetary Fund, and the Bank of Ghana, an ARDL model was utilized. According to the findings of the study,

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the accumulation of international reserves not only reduces the volatility of exchange rates but also interacts with increasing proportions of long-term external debt to strengthen the stability of exchange rates.

Nwachukwu et al., (2016) analyzed the connection between the Bureau De Change exchange rate and external reserves in Nigeria using a Threshold Vector Error Correction Model (TVECM) with daily data from Jan 1, 2014 to Jul 31, 2015. The relationship between BDC exchange rates and foreign reserves can be modeled based on the influence of the BDC exchange rate premium, which is regulated by the central bank of Nigeria's policies. The supLM test result showed a non-linear long-term relationship between the series, supporting the use of a TVECM standard. Cointegration occurs when the difference between the two variables exceeds the estimated threshold point. The model suggests two regimes: the "usual" regime, which encompasses 93.1% of the data, and the "unusual" regime, which represents approximately 6.9% of the sample's observations. The error correction coefficients for both the bureau de change exchange rate and foreign reserves equations were not statistically significant at the 5% significance level. During the second phase, the error correction coefficient for the external reserves equation was determined to be statistically significant at a 10% level. The adjustment mechanism between the two variables flows from external reserves to BDC exchange rate. Therefore, the following hypothesis was developed from the above literature:

H3. External reserves has a significant effect on Exchange rate

External Debt and Exchange Rate

Khan et al., (2023) analyzed certain how macroeconomic factors from 1990 to 2020 to investigate the impact of foreign debt on Pakistan's economic growth. Pakistan's economic growth is considerably and negatively affected by debt servicing and currency rate variations, as indicated by the dynamic autoregressive distributed lag models. The Granger causality results show that there is neither unidirectional or bidirectional causal relationship between GDP and foreign debt. Previous research' proposal of a direct relationship between the two is refuted. The analysis revealed that foreign debt has a detrimental impact on Pakistan's economic performance through its influence on inflation, exchange rate, and debt payments.

Zahra et al., (2023) analyzed the impact of currency rates, fiscal deficits, foreign direct investment, and economic growth on foreign debt using time series data from Pakistan spanning from 1973 to 2021. The research utilized the auto regressive distributed lag model to conduct co-integration analysis of variables and assess their presence. The study confirmed a positive and significant association between the exchange rate, foreign direct investment, fiscal deficit, economic growth, and external debt in the long term. In the near term, there was a negative correlation between the real effective exchange rate and fiscal deficit with external debt, whereas economic growth showed a positive correlation with external debt.

Ghobadi&Komijani (2023) examined the impact of determinants such as money liquidity, weighted average interest rate on banking deposits, currency rate, and state debt on inflation and economic growth in Iran. The analysis was based on quarterly data from 1989 to 2008. This study is centered on the theoretical framework established by Sargent and Wallace (1981), specifically emphasizing the Fiscal Theory of Price Level (FTPL) method. This study estimates created models using VECM and SVEM methods by depending on the structural relationship between variables and economic shocks, while applying necessary constraints. The study's results align with both the quantity theory of money as understood by Sargent and Wallace (1981) and the FTPL. The inflation rate is primarily influenced by monetary exchange rate policies and fiscal policy. While the weighted average interest rate may not have a substantial impact on the long-term connection, an increase in public debt via boosting money liquidity does have a notable effect on the growth in price levels. There is no significant long-term association between changes in money availability, interest rates, state debt, and output level. Economic development mostly responds to technology shocks and improvements in productivity variables.

Coulibaly et al., (2023) explored how these reserves can mitigate the adverse effects of exchange rate depreciation, taking into account exchange rate policies. The results indicated a clear connection between the amount of foreign currency reserves and external debt levels in Africa. We showed that increased foreign currency reserves generally lead to a reduction in the ratio of state debt to GDP. This effect is particularly pronounced during periods of substantial exchange rate depreciation, such as 10% or more. However, this

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impact varies among nation groups, with only countries using a floating exchange regime benefiting from this buffer effect compared to those using anchoring regimes.

Baidaa et al., (2023) attempted to examine the influence of public debt on the exchange rate in Iraq, positing a direct and positive correlation between public debt and the exchange rate in Iraq. The study utilized yearly data from 2004 to 2022 and employed the Autoregressive Distributed Time Lapse (Ardle) model. The study found that there is a significant correlation between government debt (both internal and foreign) and the parallel exchange rate in Iraq, particularly for subsidized capital items.

Mendoza and Gonzalez (2022) used correlational time series analysis to examine how external debt, debt services, and foreign reserves influenced the currency rate of the Philippines from 1980 to 2019. The associations between variables were examined using multiple regression analysis according to the established theoretical framework. Empirical findings indicated that external debt and debt services have a positive effect on the exchange rate, whereas foreign reserves have a negative correlation. The coefficients suggest that a modification in any of the independent variables will result in notable yet slight changes in the exchange rate for the Philippines.

Zareei et al., (2022) stated that changes in External net assets lead to changes in a country's money supply and the central bank's debt. In countries like Iran, the exchange rate is crucial as a substantial part of the government's income is generated from the external trade of natural resources. The exchange rate has a direct impact on the government's financial status, affecting both income and costs. External debt is a significant source of funding for budget deficits. How this debt is utilized can impact exchange rate swings either favorably or negatively. This study aimed to analyze the impact of external debt on the exchange rate through a monetary method, utilizing time series data from 1981 to 2017. Nonlinear models were utilized for estimation because of the nonlinear relationship between the variables as indicated by the LR and BDS tests. The study findings indicated that external debt and money supply exerted positive and significant impacts on the exchange rate. Monetary policy can cause the currency rate to deviate from its long-term trend. The disparity between domestic and foreign production has a notable adverse impact on the currency rate.

Okoh et al., (2021) used Dynamic Ordinary Least Square and Granger causality techniques to study the interaction between foreign debt and currency rate variations in Nigeria. Analyzed the main variables from 1990 to 2017. The analyses verified that there is an insignificant direct association between exchange rate fluctuation and external debt. The exchange rate fluctuation and debt service payments have a considerable direct correlation. The foreign reserves have a strong and favorable impact on the exchange rate fluctuations. Foreign reserves influence external debt through one-way feedback.

Aderemi et al., (2020) stated that a significant challenge in Nigeria recently is the external debt and swings in currency rates. This study investigated the correlation between external debt and currency rate volatility in Nigeria from 1981 to 2018. The study utilized the Autoregressive Distribution Lag Model to achieve its purpose. The primary discoveries described in this study are as follows: In Nigeria, external debt, debt service payment, and foreign reserves significantly influence short-term exchange rate changes. Therefore, the following hypothesis was developed from the above literature:

H4. External debt has a significant effect on Exchange rate

Sample and data

The target population for this study was all East African partner states over the period of 2000 to 2023. The selection of countries was based on two criteria: first, the country must have been a member of the East African partner states during the study period; second, the country must have published complete data over the study period. The study variables included money supply, inflation, international reserves, public debt, and exchange rate. The data for this research was secondary in nature and was sourced from official government publications and international financial databases. The final sample consisted of countries that met the inclusion criteria and had the necessary data available for the entire study period, totaling the relevant observations for analysis. Somalia, South Sudan and Burundi were excluded because of data unavailability.

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Measurement of variables

The measurements and abbreviations for the research variables are presented in Table I.

Table I. Measurement of variables

Variable	Definition	Measurement
Exchange Rate (EXR) Volatility	It is the degree of fluctuation in the value of a currency relative to another currency over a specific period (Judson & Owen, 2016).	Weighted currency fluctuations
Money Supply (MS)	It represents the total amount of money available in an economy, including currency in circulation, demand deposits, and other liquid assets, influencing economic activity and price levels (Mankiw, 2019).	M3
Inflation Rate (IF)	is the rate at which the general level of prices for goods and services rises over time, leading to a decrease in the purchasing power of money (Mishkin & Eakins, 2016).	Consumer Price Index
Foreign Reserve (FR)	are assets held by central banks and monetary authorities, including foreign currencies, gold reserves, and special drawing rights, used to intervene in foreign exchange markets and maintain exchange rate stability (Sarno & Taylor, 2020)	Total foreign reserve in USD
External Debt (ED)	is the total amount of money owed by a government to its creditors and foreign bondholders, representing accumulated government borrowing over time (Mishkin & Eakins, 2016).	Total External borrowing

Source, Researcher (2025)

Regression models

In order to analyze the factors affecting the exchange rate variability a fixed effect regression model was used which took the following forms:

The model in function form

EXR = f (MS, IF, FR, ED)

The explicit function of the exchange rate volatility involves linearization of the model;

$$EXR = \beta_0 + \beta_1 MS_{it} + \beta_2 IF_{it} + \beta_3 FR_{it} + \beta_4 ED_{it} + \varepsilon_{it}$$

The following is the transformed model:

$$LnEXR = \beta_0 + \beta_1 LnMS_{it} + \beta_2 LnIF_{it} + \beta_3 LnFR_{it} + \beta_4 LnED_{it} + \varepsilon_{it}$$

FINDINGS AND DISCUSSION

Descriptive statistics

Table 3 shows the descriptive statistics for all the variables used in the study. The table indicates that the mean exchange rate in the East African Partner States (Kenya, Tanzania, Uganda, and Rwanda) was 1260.625 (minimum = 67.32 and maximum = 3727.069; standard deviation = 1090.997), suggesting a high level of variability in the exchange rate within the region. This indicates that the countries experience varying levels of exchange rate fluctuations. Further, inflation in the region had a mean of 7.096 (minimum = -0.391 and maximum = 26.24; standard deviation = 4.555), showing that inflation rates differ significantly across these countries, with some countries even experiencing negative inflation, or deflation, during certain periods.

The money supply in the East African Partner States had a mean of 8.46E+12 (minimum = 1.14E+11 and maximum = 4.40E+13; standard deviation = 1.11E+13), which demonstrates considerable variation in the

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monetary base across the countries in the region. Foreign reserves, with a mean of 3.10E+09 (minimum = 1.91E+08 and maximum = 9.49E+09; standard deviation = 2.35E+09), reflect substantial differences in the reserves held by these countries, with some having relatively low reserves and others holding larger amounts.

Finally, external debt in the East African Partner States had a mean of 1.88E+09 (minimum = 26,200,000 and maximum = 1.14E+10; standard deviation = 2.08E+09). This suggests that there is a significant variation in external debt among the countries, with some nations facing lower debt levels while others carry significantly higher external obligations. These descriptive statistics reveal notable variability across all key economic indicators within the East African Partner States.

Table II. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Exchange rate	96	1260.625	1090.997	67.31763	3727.069
Inflation	96	7.095726	4.555347	-0.39135	26.23982
Money supply	96	8.46E+12	1.11E+13	1.14E+11	4.4E+13
Foreign reserves	96	3.1E+09	2.35E+09	1.91E+08	9.49E+09
External debt	96	1.88E+09	2.08E+09	26200000	1.14E+10

Source: Authors computation

Correlation analysis

The purpose of pairwise correlation is to determine the nature and strength of the relationship between research variables. The pairwise correlation coefficients are shown in Table 4.9. The table shows that exchange rate and inflation are negatively correlated ($r = -0.2315$; $\rho < 0.05$), indicating that an increase in the exchange rate tends to be associated with a decrease in inflation. The correlation between exchange rate and money supply is positive and strong ($r = 0.8086$; $\rho < 0.05$), suggesting that as the exchange rate increases, the money supply also tends to increase.The correlation between exchange rate and foreign reserves is weak ($r = 0.0302$; $\rho > 0.05$), suggesting that there is no significant relationship between these two variables. Similarly, the correlation between exchange rate and external debt is also negative but weak ($r = -0.1178$; $\rho > 0.05$), indicating that exchange rate changes do not significantly impact external debt.

Table III. Pearson pairwise correlation

Variable	Exchange rate	Inflation	Money supply	Foreign reserves	External debt
Exchange rate	1				
Inflation	-0.2315*	1			
Money supply	0.8086*	-0.2269*	1		
Foreign reserves	0.0302	-0.0598	0.3961*	1	
External debt	-0.1178	0.059	0.0457	0.1126	1

Note: *p<0.05

Source: Authors computation

Regression results

The study tested four direct hypotheses to understand the relationship between key macroeconomic factors and exchange rates in East African partner states over a period of 2000 to 2023. The outcome variable, exchange rate, was regressed against four explanatory variables: money supply, inflation, foreign reserves, and external debt. Both fixed-effects (FE) and random-effects (RE) models were applied, with the Hausman test supporting the use of the fixed-effects model for testing the hypotheses. The model's R-squared values indicated a strong fit: the within R-squared of 0.8725 showed that 87.25% of the variation in exchange rates within individual countries was explained by the model, while the between R-squared of 0.776 reflected the variation explained between countries. The overall R-squared of 0.6646 suggested that approximately 66.46% of the total variation

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in exchange rate was explained by the model. The F-statistic of 150.61, along with a p-value of 0.000, indicated that the model was highly significant, meaning that at least one of the explanatory variables had a significant effect on exchange rates. The high correlation between individual effects (rho = 0.944156) suggested considerable unobserved heterogeneity across the countries, which the fixed-effects model successfully accounted for.

The first hypothesis (H01) tested whether money supply had no significant effect on exchange rate. The results showed a positive and significant relationship between money supply and exchange rate ($\beta = 0.560182$, p-value < 0.05), leading to the rejection of H01. This indicates that an increase in the money supply is associated with a rise in the exchange rate, suggesting that monetary liquidity plays a critical role in influencing exchange rate movements. This result aligns with previous studies that highlight the correlation between money supply and currency fluctuations, with an increase in money supply often leading to currency depreciation or appreciation (Ali, Mahmood & Bashir, 2015; Aid &Benelbar, 2023).

The second hypothesis (H02) tested whether inflation had no significant effect on exchange rate. The regression results indicated an insignificant effect of inflation on exchange rate ($\beta = 0.003631$, p-value = 0.846), leading to the acceptance of H02. This suggests that inflation does not directly influence exchange rate variations in East African partner states. It may also imply that other macroeconomic factors, such as money supply or foreign reserves, have a more dominant role in determining exchange rate movements, with inflation potentially overshadowed by these factors.

The third hypothesis (H03) examined the effect of foreign reserves on exchange rate. The results revealed a negative and statistically significant relationship between foreign reserves and exchange rate ($\beta = -0.06465$, p-value < 0.05), leading to the rejection of H03. This indicates that countries with higher foreign reserves tend to have lower exchange rates, suggesting that reserves may help stabilize or strengthen a country's currency. This finding supports the view that foreign reserves play a vital role in mitigating exchange rate volatility, which is consistent with literature on the stabilizing effect of reserves on exchange rates (Kuncoro, 2024).

Finally, the fourth hypothesis (H04) tested whether external debt had no significant effect on exchange rate. The results showed a positive and statistically significant relationship between external debt and exchange rate ($\beta = 0.063844$, p-value < 0.05), leading to the rejection of H04. This suggests that higher external debt is associated with an appreciation in the exchange rate, likely due to the pressure on countries to service their debt, which can influence currency values. This finding aligns with studies that suggest external debt can affect exchange rates through its impact on investor confidence and market expectations (Djalo, Yusuf &Pudjowati, 2023; Ali, 2022).

Table IV. Fixed effect model results

Variable	Coef.	Std. Err.	t	P>|t|	95% Conf. Interval		
Money supply	0.560182	0.027845	20.12	0.00	0.5048461 to 0.6155184		
Inflation	0.003631	0.018636	0.19	0.846	-0.0334042 to 0.0406663		
Foreign reserves	-0.06465	0.030746	-2.1	0.038	-0.1257549 to -0.0035519		
External debt	0.063844	0.02426	2.63	0.01	0.0156314 to 0.1120555		
_cons	-1.71E-10	0.01762	0	1	-0.0350157 to 0.0350157		
sigma_u						0.709853	
sigma_e						0.172638	
rho						0.944156	
R-sq within						0.8725	
R-sq between						0.776	
R-sq overall						0.6646	
F(4,88)						150.61	
Prob > F						0	
corr(u_i, Xb)						0.4405	

Source: Authors computation

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CONCLUSIONS

Analyzing data from East African partner states over the period between 2000 and 2023, our study aimed to investigate the impact of macroeconomic factors such as money supply, inflation, foreign reserves, and external debt on exchange rates. By utilizing secondary data from official publications and international financial databases, we performed fixed-effects regression to explore these relationships. The final sample included data from countries that met the criteria for inclusion, yielding meaningful insights. The findings highlight the significant role of money supply, foreign reserves, and external debt in determining exchange rate movements, while inflation was found to have no significant effect.

The results contribute to the existing literature by emphasizing that money supply and external debt significantly influence exchange rates, with higher money supply and external debt both contributing to exchange rate appreciation. Furthermore, foreign reserves were found to play a stabilizing role, with higher reserves associated with a reduction in exchange rates. These findings suggest that countries with robust foreign reserves are better positioned to manage exchange rate volatility. These results have important policy implications, suggesting that countries in the East African region could benefit from strategies that focus on controlling money supply and managing external debt to stabilize exchange rates. Policymakers should also consider strengthening foreign reserves as a tool for reducing exchange rate volatility.

However, the study has limitations. First, the analysis focused solely on East African partner states, and the findings may not be directly applicable to countries with more advanced or differing economic systems and governance structures. Additionally, the study utilized secondary data, which may have limitations in terms of accuracy and completeness. Future research could explore the role of other macroeconomic factors or incorporate primary data to gain deeper insights into the dynamics influencing exchange rates in the region.

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