Strategies to Mitigate Unusual Volatility of Exchange Rates in Sri Lanka

for the Bachelor of Science Honours Degree in
Financial Mathematics and Industrial Statistics

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DECLARATION

I,S.A.C.K.Subasinghe, declare that the presented project report titled, "Strategies to Mitigate Unusual Volatility of Exchange Rates in Sri Lanka " is uniquely prepared by me based on the group project carried out under the supervision of Department of , Faculty of Science, University of Ruhuna, as a partial fulfillment of the requirements of the level course unit of the in Department of , Faculty of Science, University of Ruhuna, Sri Lanka. It has not been submitted to any other institution or study program by me for any other purpose.

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Date:. . . . . .

SUPERVISOR'S RECOMMENDATION

I/We certify that this study was carried out by under my/our supervision.

Signature:. . . . . .
Date:. . . . . .
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Department of ,
Faculty of Science,
University of Ruhuna.

Acknowledgment

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Abstract

This study explores the relationship between exchange rate volatility and various macroeconomic factors in Sri Lanka between January 2010 and April 2023. By applying a multiple linear regression model, the research aims to identify significant factors affecting exchange rate fluctuations and quantify their impact. The dependent variable in this model is the exchange rate between the Sri Lankan Rupee and the US Dollar, while the independent variables include inflation rate, interest rate, GDP growth, unemployment rate, and consumer price index (CPI).

The regression analysis revealed that inflation rate, interest rate, unemployment rate, and CPI had a strong correlation with the exchange rate, indicating their importance in predicting exchange rate movements. Specifically, the negative coefficient for inflation (-0.440) suggests that higher inflation tends to lower the value of the currency, while a positive coefficient for interest rate (1.985) indicates that higher interest rates can attract foreign capital, thereby appreciating the currency. Additionally, GDP growth had a negative relationship with the exchange rate (-0.375), while the positive coefficients for unemployment rate (3.79) and CPI (0.9249) imply that a lower unemployment rate and higher consumer prices might lead to currency appreciation.

With an R-squared value of 94.8%, the regression model demonstrates a high degree of fit, providing valuable insights into the key determinants of exchange rate volatility in Sri Lanka. The findings offer practical implications for policymakers, investors, and businesses involved in international trade, emphasizing the need for balanced economic policies and effective hedging strategies to manage currency risk. By understanding these macroeconomic relationships, stakeholders can better navigate the complex dynamics of exchange rate fluctuations and make more informed decisions in a globally interconnected-economy.

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Chapter 1

Introduction

The volatility of exchange rates is influenced by a variety of factors. These factors can be economic, political, psychological, as well as short-term or long-term. Conventional economic theories explain that monetary and non-monetary factors play a significant role in determining the exchange rate of a country. Export prices, import prices, inflation, interest rates, the financial market and the budget deficit of the home country are classified as monetary factors, while economic growth and political changes are classified as non-monetary factors. A significant number of factors determine the exchange rate, whether all or only a few of them. Also, it may not have a significant impact, but it may help determine the exchange rate. The exchange rate and its direct and indirect impacts are now extensively discussed. –

1.1 Background and Rationale

In Sri Lanka, exchange rate volatility has been a particular problem in recent years. The Sri Lankan rupee has depreciated sharply against the US dollar, making it more expensive for businesses to import goods and services. This has led to inflation and has made it difficult for businesses to compete in the global market.

1.2 Importance

The exchange rate fluctuations will have both positive and negative effects on the economy and people's standard of living due to the fact that most international trade and finance involve currency exchange. So, if the international economy is getting more and more volatile, it's really important to get a better idea of what's causing the exchange rate to fluctuate. Generally, an increase in a country's currency's value will have the following consequences, while a decrease in value will have the opposite consequences. lower import prices will encourage imports and worsen the country's trade balance, Exporters will be put off by less income in the local currency, which will hurt export businesses. In light of the foregoing considerations, the purpose of this study is to resolve the following research issues. 1. What is the significant relationship between exchange rate volatility and economic factors? 2. What are the significant impacts of specific economic factors on exchange rate volatility in Sri Lanka? The entire study is based on secondary data. the secondary data sources were central bank and trade economic web sites. Selected economic factors are inflation rate, interest rate, GDP growth, unemployment rate, industrial production, consumer price index, Trade balance, Remittances Colombo share market movements these factors were selected in keeping with past literature and theories of exchange rate. The results of this study could be applied to determine how macroeconomic factors can be implemented to decrease exchange rate volatility.

1.3 Objectives

Our main focus is on three main objectives, namely; examine the factors that affect exchange rate fluctuations, identify the relationship between the factors and the exchange rate, investigate the impact of the factors that had on the exchange rate.

1. Consider the elements influencing exchange rate variations.
2. To determine the causal link between the variables and the exchange rate.
3. Examine the effects of the variables that affected the exchange rate.

1.4 Hypotheses

1.4.1 Hypothesis 1

Null Hypothesis (H0)

Exchange rates do not significantly depend on inflation rate, interest rate, GDP growth, unemployment rate, industrial production, trade balance data, remittance data, and share market movements.

Alternative Hypothesis (Ha)

Exchange rates significantly depend on at least one of the independent variables (inflation rate, interest rate, GDP growth, unemployment rate, industrial production, trade balance data, remittance data, share market movements).

1.4.2 Hypothesis 2

Null Hypothesis (H0)

The model as a whole is not a good fit for the data, meaning none of the independent variables are useful in predicting the dependent variable.

Alternative Hypothesis (Ha)

The model as a whole is a good fit for the data, suggesting that at least one of the independent variables is useful in predicting the dependent variable.

1.4.3 Hypothesis 3

Null Hypothesis (H0)

The residuals (errors) of the regression model are normally distributed and exhibit constant variance (homoscedasticity).

Alternative Hypothesis (Ha)

The residuals of the regression model do not follow a normal distribution, and/or there is heteroscedasticity, indicating that the model may not be the best fit for the data.

1.4.4 Hypothesis 4

Null Hypothesis (H0)

model is adequate.

Alternative Hypothesis (Ha)

model is inadequate.

1.5 Literature Review

One of the research problems that needs to be solved is how to model exchange rate behavior. It is necessary to study exchange rate determinants because of their important role in the economy. Macro and micro variables can be used for a more appropriate study of exchange rate behavior.

AIS Perera and RMKGU Rathnayaka (2019) examined the factors; Colombo share market movements, exports, imports, worker's remittances, and tourist arrivals which affect the exchange rate volatility from the macroeconomic perspective of Sri Lanka. The study covered the sample period for seven economies within the flexible exchange rate period. The researchers used the ARIMA (1,0,0)-GARCH (1,0) model to generate a measure of exchange rate volatility. VAR model and Pearson Correlation Coefficient were used to find relationships. Researchers found that share market movements had a significant impact on exchange rate volatility, and the findings indicated that the significant common set factor influencing the exchange rate volatility is only generated from the share market.

1.6 Theoretical Framework

The theoretical framework for this study is based on the portfolio theory of risk management. This theory states that investors can reduce their risk by diversifying their investments across different assets. In the context of exchange rate volatility, this means that businesses and individuals can reduce their exposure to exchange rate risk by diversifying their investments across different currencies.

1.7 Significance and Expected Contributions

To maintain economic stability and encourage international investment, it is crucial to reduce Sri Lanka's unique exchange rate volatility. Effectively addressing this issue will not only protect the nation's financial system but also boost investor confidence and bring in additional foreign investment. Sri Lanka can lessen the effects of jarring currency fluctuations and curtail speculative behavior by implementing policies including prudent monetary policy, strict budgetary discipline, and more market transparency. Additionally, increasing foreign direct investments, diversifying exports and imports, and upholding a sound balance of payments would all help to keep exchange rates stable. These initiatives will promote steady economic growth, insulate the economy from outside shocks, and ultimately strengthen Sri Lanka's economy.

Chapter 2

Material and Methods

2.1 Research Design

- Our scenario is a multiple linear regression scenario.
- The goal of multiple linear regression is modeling the relationship between the dependent variable and multiple independent variables.
- Our goal is clearly understanding about the exchange rates fluctuations in Sri Lanka and give new knowledge for others.
- It helps to how we can invest.
- We have done a case study for finding a appropriate data set.
- It is an empirical analysis of historical data.
- We got a data set representing last ten years.
- We used an observation checklist as our tools and techniques.

We properly created data with Excel and analyzed those data using Minitab software

2.2 Study Design

Experimental Design

For the experimental design, a controlled study will be conducted to assess the impact of specific interventions on exchange rate volatility in Sri Lanka. A random sample of financial markets, trade-related data, and macroeconomic indicators will be selected. The sample will be divided into two groups: the control group and the experimental group. The control group will be subject to the standard practices and policies currently in place, while the experimental group will be exposed to the proposed mitigation strategies identified in the study. The study period will be carefully defined to capture relevant market conditions and ensure sufficient data points for analysis.

Observational Design

In the observational design, a retrospective analysis of historical data will be conducted to understand the patterns and trends of exchange rate volatility in Sri Lanka. Long-term historical exchange rate data, macroeconomic indicators, and relevant policy changes will be collected. Secondary data sources, such as reports from the central bank, government publications, and international databases, will be utilized to compile the necessary information.

2.3 Participants or Sample

The participants or sample in this study will consist of data representing various macroeconomic indicators and exchange rate data for Sri Lanka from the period 2010 to 2023. Since this study is based on secondary data analysis, there are no human participants involved. Instead, the data will be collected from official sources, financial institutions, government reports, and international databases.

2.4 Data Collection Procedure

The data collection procedure for this study will involve the gathering of macroeconomic indicators and exchange rate data for Sri Lanka from the period 2010 to 2023. Both

primary and secondary data sources will be utilized. Primary data collection is not required as the study relies on existing data from official sources. The primary data source will be the Central Bank of Sri Lanka, which regularly publishes macroeconomic data, including exchange rate information, inflation rates, interest rates, GDP growth, unemployment rates, industrial production, and consumer price index. Secondary data will be obtained from reputable trade economics websites, which compile and provide comprehensive economic data for various countries, including Sri Lanka. These websites will serve as additional sources to validate and complement the data obtained from the Central Bank of Sri Lanka. No data collection instruments are required as the data will be extracted and compiled directly from these sources. The study will ensure data reliability by focusing on information from official and reputable sources to conduct a thorough analysis of the relationships between the specified macroeconomic indicators and exchange rate movements over the specified time frame.

2.5 Variables and Measurements

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 \quad (2.1)$$

Coefficient	**Description**
β_1	Inflation rate
β_2	Interest rate
β_3	GDP growth
β_4	Unemployment rate
β_5	Industrial production
β_6	Consumer price index
β_7	Trade balance
β_8	Remittance
β_9	Colombo share market movements

- **Exchange Rate (Dependent variable)**
  Value of one country's currency in terms of another country's currency and represents the rate at which they can be exchanged
- **Inflation rate**
  Percentage change in the general price level of goods and services in an economy over a specific period, typically measured annually

- **Interest rate**
  Percentage charged or paid on the principal amount of a loan or investment, representing the cost of borrowing or the return on investment
- **GDP growth**
  Country's gross domestic product, a measure of its total economic output, increases or decreases over a specific period, usually expressed as a percentage
- **Unemployment rate**
  Percentage of the labor force that is without employment and actively seeking employment
- **Industrial production**
  Output and manufacturing of goods and services by industries within an economy over a specific period
- **Consumer price index**
  Tracks the average price change of a basket of goods and services typically consumed by households, reflecting inflation or deflation trends in an economy
- **Trade balance**
  Difference between a country's exports and imports of goods and services over a specific period
- **Remittance**
  Statistical measure used to assess the volume and trends of international money transfers sent by individuals working abroad to their home country
- **Colombo share market movements (Independent variables)**
  Fluctuations and changes in the prices and trading volumes of stocks listed on the Colombo Stock Exchange in Sri Lanka

2.6 Data Analysis Plan

The data analysis plan will involve a series of statistical analyses to examine the relationships between the dependent variable (Sell Rate) and the independent variables (Inflation rate, Interest rate, GDP growth, Unemployment rate, Industrial production, Consumer price index, Trade balance, Remittance, Colombo share market movements).

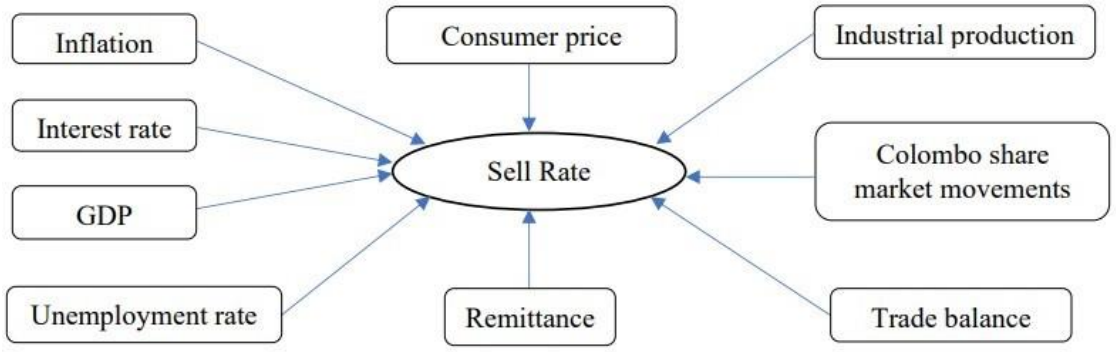

Figure 2.1: Data Analysis Plan

2.7 Data Preprocessing

Data preprocessing is a critical step in the data analysis process that involves cleaning, transforming, and organizing raw data to ensure its suitability for meaningful analysis. During this stage, missing values, outliers, and any inconsistencies in the data are addressed. Missing data may be imputed or removed based on appropriate techniques. Outliers, if identified, are either corrected or treated to prevent them from unduly influencing the analysis. To facilitate comparisons, normalization or standardization may be applied to bring variables to a common scale.

2.8 Software or Tools for Analysis

Minitab is an excellent software tool for statistical analysis, data visualization, and quality improvement. It is widely used by researchers, data analysts, and quality improvement professionals to analyze data, perform hypothesis testing, conduct regression analysis, and create various types of graphs and charts. With Minitab, we can easily import and manipulate data, conduct various statistical tests, and generate graphical representations of the data. It offers a user-friendly interface that simplifies the process of conducting complex analyses, making it suitable for both beginners and experienced statisticians.

Chapter 3

Data

3.1 Data Collection

Data collection for this study will involve gathering macroeconomic indicators and exchange rate data for Sri Lanka from the period 2010 to 2023. Both primary and secondary data sources will be utilized. Primary data collection is not required as the study relies on existing data from official sources. The primary data source will be the Central Bank of Sri Lanka, which regularly publishes macroeconomic data, including exchange rate information, inflation rates, interest rates, GDP growth, unemployment rates, industrial production, and consumer price index. Secondary data will be obtained from reputable trade economics websites, which compile and provide comprehensive economic data for various countries, including Sri Lanka. These websites will serve as additional sources to validate and complement the data obtained from the Central Bank of Sri Lanka. No data collection instruments are required as the data will be extracted and compiled directly from these sources. The study will ensure data reliability by focusing on information from official and reputable sources to conduct a thorough analysis of the relationships between the specified macroeconomic indicators and exchange rate movements over the specified time frame.

3.2 Description of Data Set

		Year-Month	Exchange Rate	Inflation rate	Interest rate	GDP growth	unemployment rate	industrial production	consumer price index	Trade balance	Remittances	C
1	1	2010 Jan	113.460	7.10%	7.50%	7.10%	5.10%	5.83%	82.40%	-581.18	313.10	
2	2	2010 Feb	108.650	7.60%	7.50%	7.10%	5.10%	11.32%	82.80%	290.41	310.10	
3	3	2010 Mar	122.110	7.10%	7.50%	7.10%	5.10%	10.81%	82.10%	-220.52	373.20	
4	4	2010 Apr	104.810	6.80%	7.50%	7.10%	5.40%	99.20%	81.20%	-506.46	339.70	
5	5	2010 May	114.410	5.70%	7.50%	8.50%	5.40%	14.43%	82.20%	-491.91	303.00	
6	6	2010 Jun	114.433	5.10%	7.50%	8.50%	5.40%	39.24%	82.90%	-489.12	343.90	
7	7	2010 Jul	111.965	4.40%	7.50%	8.50%	4.70%	32.10%	82.90%	-244.26	343.00	
8	8	2010 Aug	113.536	5.00%	7.25%	8.50%	4.70%	15.56%	83.00%	-300.42	332.50	
9	9	2010 Sep	112.834	5.70%	7.25%	8.50%	4.70%	24.30%	83.70%	-376.72	345.70	
10	10	2010 Oct	112.733	6.50%	7.25%	8.00%	4.50%	13.98%	84.60%	-305.70	376.00	

Figure 3.1: Description of Data Set

Above image shows the data set we were used. There are 160+ row elements in the data set with 10 column variables. The exchange rate in LKR (Sri Lankan rupees). Inflation, Interest rate, GDP rate, Unemployed rate, Industrial production, consumer production are percentage values, Remittance in 100 thousand in LKR.

The data set used in this research study comprises macroeconomic indicators and exchange rate data for Sri Lanka from the period 2010 to 2023. It includes key variables such as the dependent variable ”Sell Rate,” representing the exchange rate movements, and independent variables, namely ”Inflation Rate,” ”Interest Rate,” ”GDP Growth,” ”Unemployment Rate,” ”Industrial Production,” ”Consumer Price Index,” ”Trade Balance,” ”Remittance,” and ”Colombo Share Market Movements.” The data set has been sourced from reputable institutions, including the Central Bank of Sri Lanka and trade economics websites, ensuring its reliability and accuracy. It provides a comprehensive representation of the country’s economic performance, enabling in-depth analysis and exploration of potential relationships between the variables to identify strategies for mitigating exchange rate volatility in Sri Lanka.

3.3 Data Preprocessing

3.3.1 Data Cleaning

Missing Values:

Statistics

Variable	Total Count	N	N*
Exchange rate	160	160	0
Inflation rate	160	160	0
Interest rate	160	160	0
GDP growth	160	160	0
unemployment rate	160	160	0
industrial production	160	160	0
consumer price index	160	160	0
Trade balance	160	160	0
Remittances	160	160	0
Colombo share market movements	160	160	0

Figure 3.2: Missing Values

There are no missing values for any of the 10 variables we are examining in this study, according to a comprehensive analysis of our dataset. It is good that there are no missing data instances because it eliminates the requirement for any missing value replacement strategies. We can prevent potential biases or uncertainties that can result from imputed missing values by obtaining complete data for all variables, so ensuring the integrity and accuracy of our study. This extensive dataset gives us the chance to carry out a thorough and trustworthy study of the connections and patterns within the variables under consideration. Yet, it is crucial to continue to be watchful in confirming the data quality and making sure that all measurements are precise.

Upon careful examination of our dataset, we are pleased to report that we have not identified any null values present in the data. This lack of null values is significant as it means we do not need to take any actions to handle missing or incomplete data. Dealing with null values can be a critical and time-consuming step in data analysis, often requiring imputation or removal of incomplete records. However, the absence of null values ensures the integrity and completeness of our dataset, providing us with a reliable foundation for our analysis. With this data quality assurance in place, we can confidently proceed with our study, focusing our efforts on exploring the relationships between variables, conducting statistical tests, and drawing meaningful conclusions without the concern of missing data impacting our results. Nevertheless, it remains crucial to remain vigilant during data collection and preprocessing to ensure that the dataset continues to be free from any future null values that might arise during the research process.

Outliers:

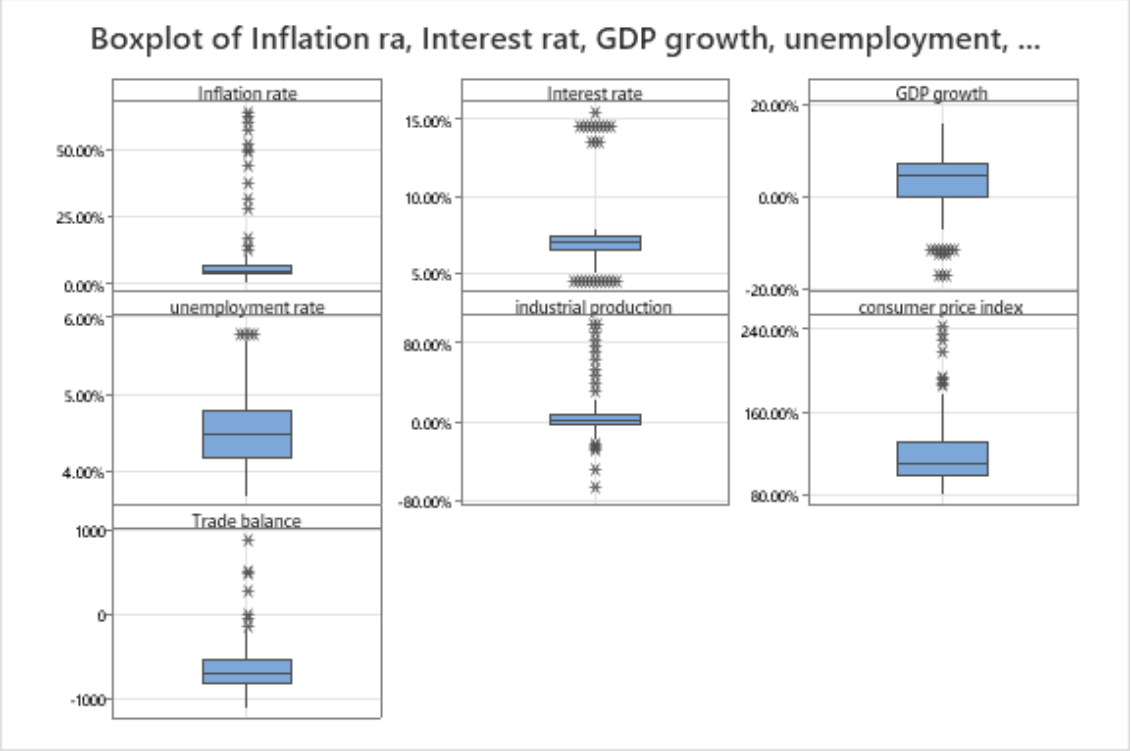

Figure 3.3: Boxplot of Inflation rate, Interest rate, GDP growth, unemployment rate, industrial production, consumer price index, Trade balance

Outliers:

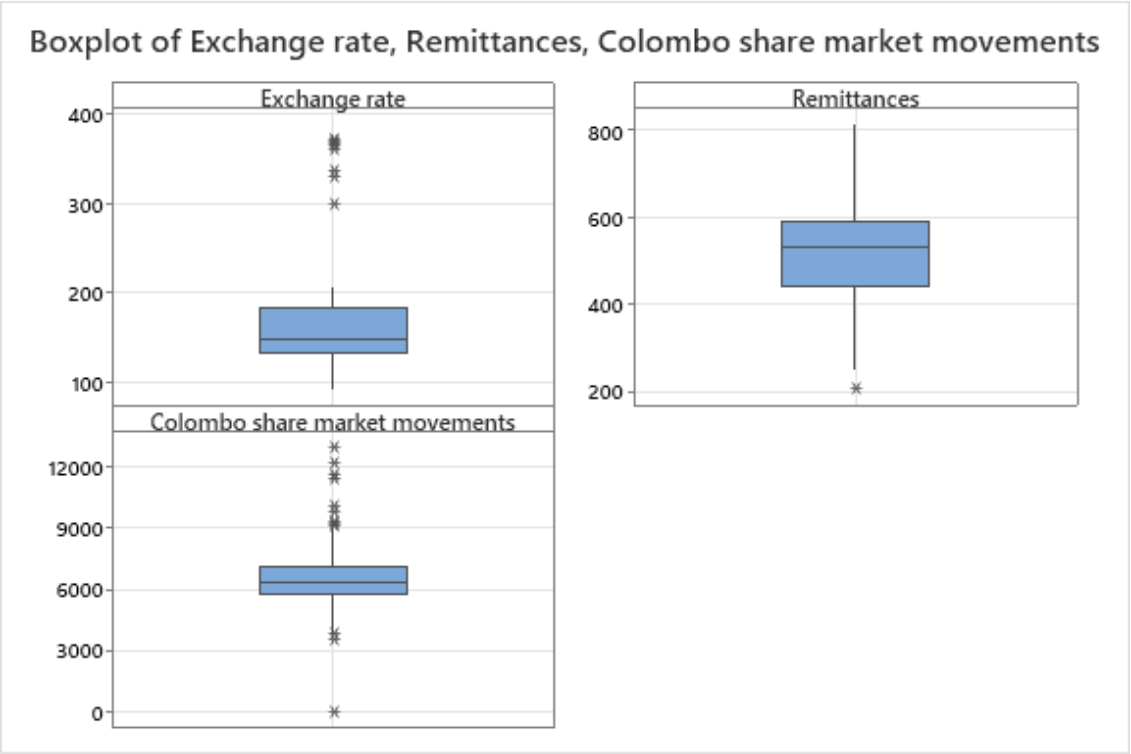

Figure 3.4: Boxplot of Exchange rate, Inflation rate, Interest rate, GDP growth, unemployment rate, industrial production, consumer price index, Trade balance, Remittances

The presence of more outliers in the dataset can be attributed to multiple factors, with political uncertainty playing a prominent role. The volatile and uncertain political landscape in Sri Lanka can lead to erratic market behaviors, sudden policy changes, and shifts in investor sentiment, causing extreme fluctuations in various economic indicators. Additionally, the lack of foreign currency stocks can exacerbate currency depreciation, leading to rapid changes in exchange rates and exacerbating the volatility of financial markets. Furthermore, the high liquidity of the local currency may result from excessive money supply or loose monetary policies, making the currency vulnerable to speculative activities and exacerbating price instability. The collapsed local domestic production, possibly due to economic disruptions or supply chain issues, can further strain the economy and contribute to abnormal data points. Lastly, the lack of remittance inflows may exacerbate currency devaluation and disrupt the balance of payments, leading to economic uncertainties and further amplifying the presence of outliers in various economic indica-

tors. Together, these factors create a challenging economic environment, increasing the likelihood of extreme values in the data, making it essential to carefully consider these influences when analyzing the dataset and interpreting the findings in the context of the prevailing political and economic conditions.

Grub's Test for Outliers Grub's Test for Outliers

Method

Null hypothesis	All data values come from the same normal population
Alternative hypothesis	Smallest or largest data value is an outlier
Significance level	$\alpha = 0.05$

Grubbs' Test

Variable	N	Mean	StDev	Min	Max	G	P
Exchange Rate	160	167.72	65.97	91.67	371.72	3.09	0.274
Inflation rate	160	0.0900	0.1299	0.0100	0.6410	4.24	0.002
Interest rate	160	0.07318	0.02285	0.04500	0.15500	3.58	0.042
GDP growth	160	0.03116	0.06530	-0.17100	0.16120	3.10	0.271
unemployment rate	160	0.045556	0.005183	0.037000	0.058000	2.40	1.000
industrial production	160	0.0566	0.2140	-0.6570	0.9920	4.37	0.001
consumer price index	160	1.2075	0.3227	0.8120	2.4470	3.84	0.014
Trade balance	160	-633.7	291.2	-1100.7	921.1	5.34	0.000
Remittances	160	512.31	113.35	204.90	812.70	2.71	0.983
Colombo share market movements	159	6600	1459	3577	12962	4.36	0.001

Above data imputation we can clearly conclude that in our data set have some of outliers.So we should get any action for these outliers.

Outlier removal methods are essential techniques in data preprocessing and analysis aimed at handling data points that deviate significantly from the majority of the dataset. Outliers are data points that are unusually distant from the central tendency of the data and can skew statistical analysis, machine learning models, and visualizations. These outliers can be addressed through various methods, including removal, substitution, or transformation.

Outlier

Variable	Row	Outlier
Inflation rate	153	0.6
Interest rate	160	0.2
industrial production	88	1.0
consumer price index	153	2.4
Trade balance	32	921.1
Colombo share market movements	145	12961.5

Transformation

The transformation of outliers is a crucial step in data preprocessing and analysis that aims to mitigate the impact of extreme data points on statistical analyses, machine learning models, and visualizations. Outliers, which are data points significantly deviating from the central tendency of a dataset, can distort the distribution and skew results. Transformation techniques involve applying mathematical operations to the data to either reduce the influence of outliers or make the data conform more closely to a desired distribution.
In here we use log value transformation.
If we consider the log value of the transformation we can conclude the model as follows.

Due to the transformation in this approach not being able to attain the ideal method, we cannot observe any substantial modifications. The remaining outlier points in the dataset would be plainly visible.Therefore, the outlier analysis does not benefit more from this change.

Removal

The removal of outliers is a fundamental step in data preprocessing and analysis. Outliers are data points that deviate significantly from the majority of the dataset, often introducing noise and distortion into statistical analyses, machine learning models, and visualizations. These extreme values can result from various factors, including measurement errors, data entry mistakes, or genuine but rare events. The process of outlier removal involves identifying and eliminating these data points from the dataset, thus allowing for more accurate and robust analyses.

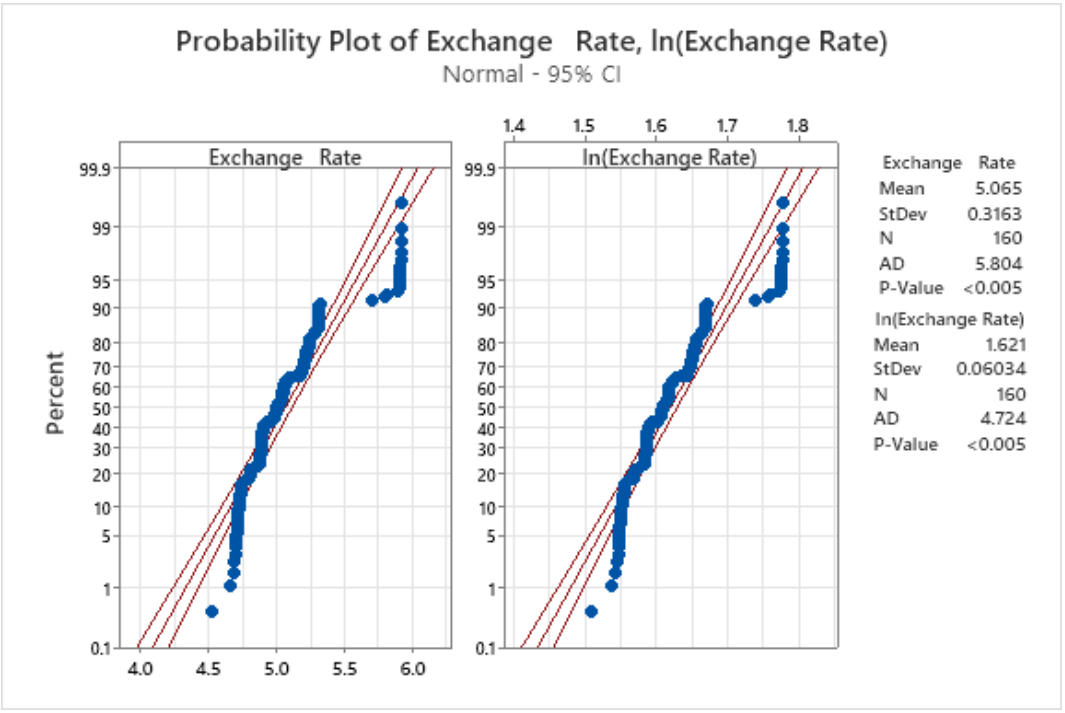

Figure 3.5: Probability Plot of Exchange Rate, ln(Exchange Rate)

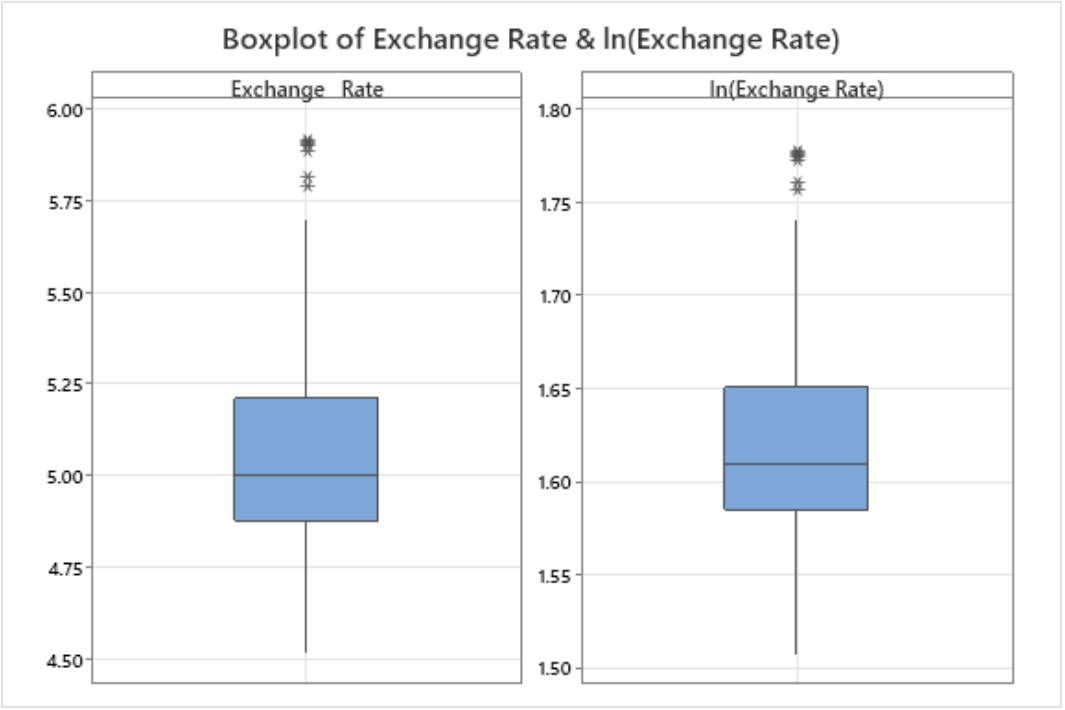

Figure 3.6: Boxplot of Exchange Rate and ln(Exchange Rate)

In this analysis, outliers in the model are eliminated using the z score method. First, we filtered the values between -3 and +3 and converted all variable row data values to standard normal. Here, we can eliminate the outliers. According to that method, analysis showed that 12 rows of data value had decreased.

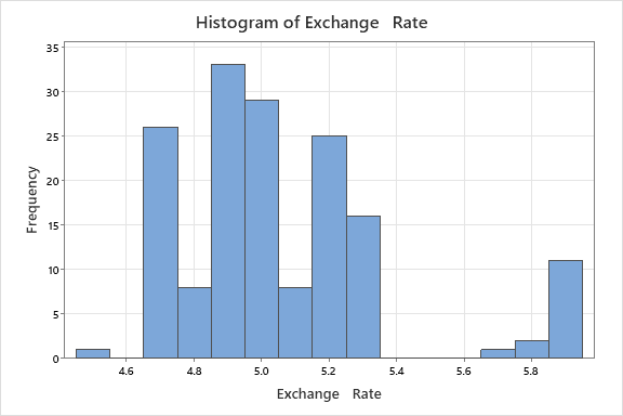

Figure 3.7: Before Removing outliers

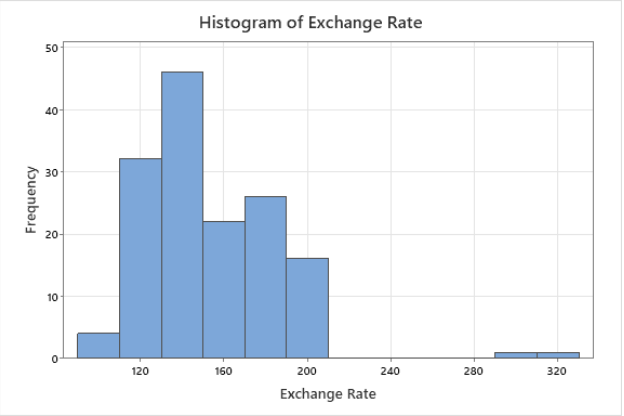

Figure 3.8: After removing outliers

We can clearly see from prior graphs that the strategy removed a significant number of outliers. However, even with remove, the second technique still has some outliers. If we take into account how seldom and mostly within the model region these outliers are for the model. However, the dependent variable is not distributed normally.

When dealing with an outlier that persists even after attempting outlier removal or transformation methods, it may be necessary to reconsider the use of the original model. Outliers, by their nature, can have a substantial impact on statistical analyses. In cases where the outlier is genuine, significant, and represents valuable information, it might be unwise to completely disregard it. Instead, it's worth revisiting the original model and assessing whether it can be adapted to handle the outlier or if a more robust model should be employed. This process may involve modifying model parameters, incorporating robust statistical techniques, or exploring alternative modeling approaches that are better suited to handling data with outliers. Additionally, it's important to carefully document and justify this decision, as well as any adjustments made to the model, to ensure transparency and reproducibility in your analysis. Ultimately, the choice to retain or adapt the original model in the presence of persistent outliers should be driven by a deep understanding of the data and the specific objectives of the analysis.

Chapter 4

Results

4.1 Exploratory data Analysis

In the context of Sri Lanka, mitigating unusual volatility of exchange rates requires a comprehensive approach that addresses both internal and external factors. First, implementing prudent monetary policies and fiscal measures to maintain macroeconomic stability can help curb abrupt currency fluctuations. Secondly, fostering a diverse and robust export sector, coupled with encouraging foreign direct investment, can enhance forex inflows and stabilize exchange rates. Additionally, establishing effective communication channels with international financial institutions and neighboring countries can promote cooperation during times of economic turbulence. Furthermore, closely monitoring global economic trends and geopolitical developments enables timely responses to potential shocks. Lastly, educating and empowering market participants to make informed decisions contributes to reducing speculative activities and fostering a more stable foreign exchange market. By adopting these strategies, Sri Lanka can aim to achieve greater resilience against the undue impact of exchange rate volatility.

4.1.1 Descriptive Statistics

Descriptive analysis is a fundamental statistical technique used to summarize, present data in a concise and meaningful way. It involves examining the central tendencies, variability, and distribution of a dataset to gain insights into its characteristics.

Statistics

Variable	N	N*	Mean	SE Mean	StDev	Variance	CoefVar
Exchange Rate	160	0	5.0655	0.0250	0.3163	0.1000	6.24
Inflation rate	160	0	0.0900	0.0103	0.1299	0.0169	144.41
Interest rate	160	0	0.07318	0.00181	0.02285	0.00052	31.22
GDP growth	160	0	0.03116	0.00516	0.06530	0.00426	209.58
unemployment rate	160	0	0.045556	0.000410	0.005183	0.000027	11.38
industrial production	160	0	0.0566	0.0169	0.2140	0.0458	378.15
consumer price index	160	0	1.2075	0.0255	0.3227	0.1041	26.72
Trade balance	160	0	-633.7	23.0	291.2	84800.5	-45.95
Remittances	160	0	512.31	8.96	113.35	12847.68	22.12
Colombo share market movements	159	1	6600	116	1459	2129436	22.11

Variable	Sum of Squares	Minimum	Q1	Median	Q3	Maximum
Exchange Rate	4121.3616	4.5182	4.8802	5.0033	5.2129	5.9181
Inflation rate	3.9785	0.0100	0.0400	0.0510	0.0717	0.6410
Interest rate	0.93990	0.04500	0.06500	0.07000	0.07500	0.15500
GDP growth	0.83336	-0.17100	-0.00250	0.04400	0.07100	0.16120
unemployment rate	0.336331	0.037000	0.042000	0.045000	0.048000	0.058000
industrial production	7.7931	-0.6570	-0.0190	0.0218	0.0868	0.9920
consumer price index	249.8650	0.8120	1.0075	1.1265	1.3315	2.4470
Trade balance	77733577.8	-1100.7	-808.5	-698.6	-538.5	921.1
Remittances	44036299.77	204.90	439.77	530.95	590.27	812.70
Colombo share market movements	7262430099	3577	5808	6346	7115	12962

Variable	Range	IQR	Mode	N for Mode	Skewness
Exchange Rate	1.3999	0.3326	5.31320	6	1.28
Inflation rate	0.6310	0.0317	0.04, 0.044	7	3.20
Interest rate	0.11000	0.01000	0.07	29	2.24
GDP growth	0.33220	0.07350	-0.115, 0.071	7	-1.02
unemployment rate	0.021000	0.006000	0.045	21	0.62
industrial production	1.6490	0.1058	0.992	2	2.08
consumer price index	1.6350	0.3240	0.888, 1.036, 1.042	3	1.75
Trade balance	2021.8	270.0	*	0	2.03
Remittances	607.80	150.50	515.3, 619.3	2	-0.45
Colombo share market movements	9385	1308	6038.5	6	1.50

Variable	Kurtosis	MSSD
Exchange Rate	1.49	0.0013
Inflation rate	9.28	0.0003
Interest rate	5.04	0.00002
GDP growth	1.40	0.00046
unemployment rate	-0.17	0.000002
industrial production	8.09	0.0288
consumer price index	3.69	0.0015
Trade balance	7.13	29302.7
Remittances	-0.19	2313.22
Colombo share market movements	4.03	122672

Figure 4.1: Descriptive statistics

The statistical analysis of the data reveals valuable insights into its distribution and variability. The mean of all variables being close to the median suggests a relatively symmetrical distribution, indicating that the data tends to be centered around a central value. This symmetry implies that there is an absence of significant skewness, where extreme values are not overly influencing the mean. However, the relatively large standard deviation for all variables indicates a wide dispersion of data points around the mean, signifying substantial variability within each variable. The presence of outliers in all variables further reinforces this observation, as these extreme values are much higher or lower than the rest of the data, contributing to the dispersion and potentially influencing the overall trends. Overall, the data exhibits a fairly symmetrical nature with a wide range of values for each variable, but the presence of outliers warrants careful consideration when interpreting the results and drawing conclusions from the analysis. Robust statistical methods and sensitivity analysis may be necessary to account for the impact of outliers on the overall findings.

4.1.2 Data Visualization

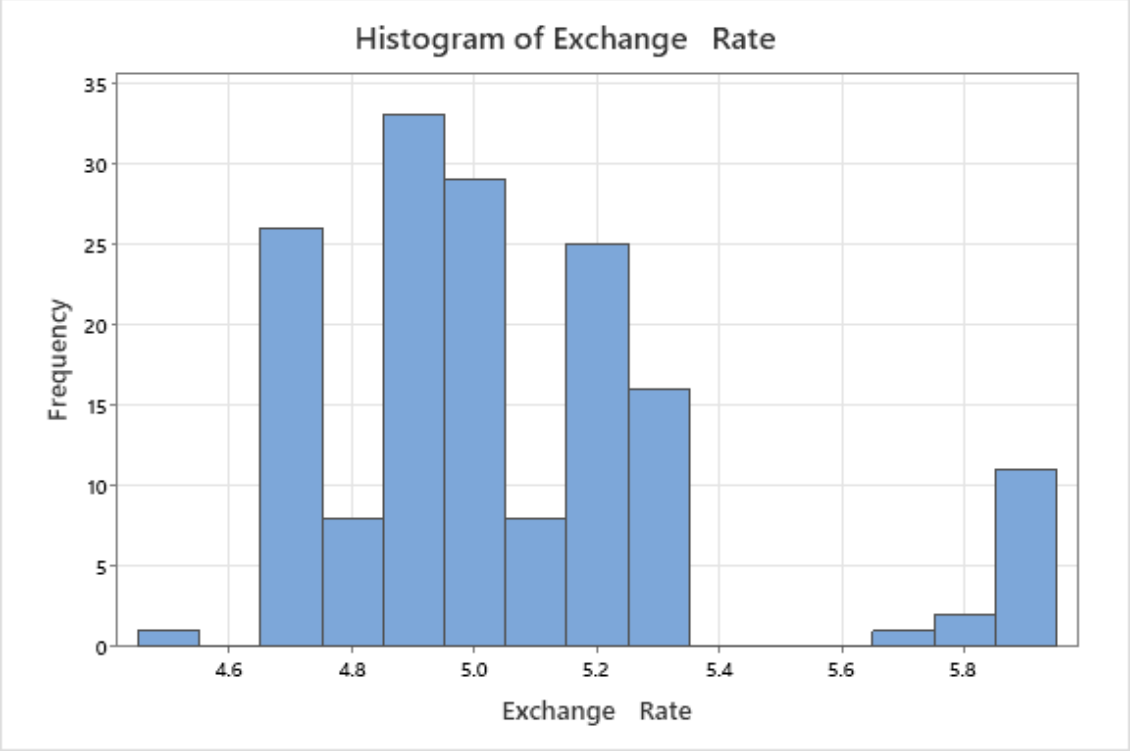

Figure 4.2: Histogram of Exchange Rate

In general, the exchange rate does not seem to be very volatile and generally it is characterized by values converging around the mean. However, these are some outliers where the exchange rate is very strong which may be indicative of market volatility.

4.1.3 Data Visualization

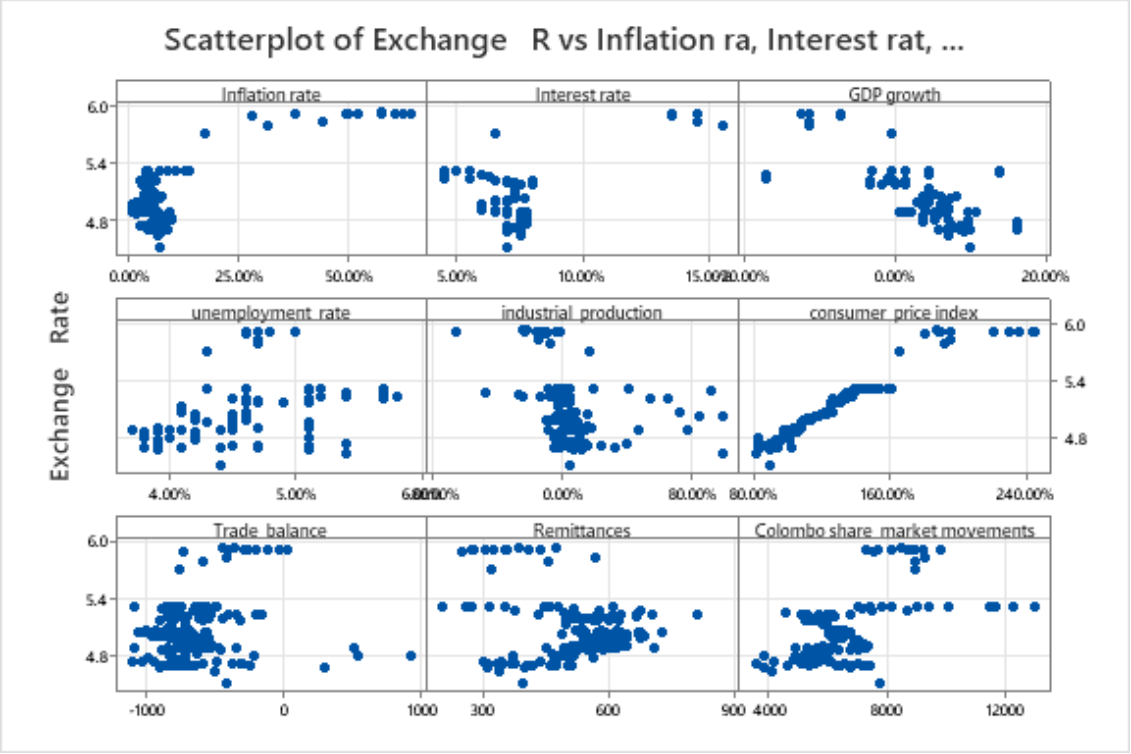

Figure 4.3: Scatterplot of Exchange rate vs Inflation rate, Interest rate, GDP growth, unemployment rate, industrial production, consumer price index, Trade balance, Remittances, Colombo share market movements

This is the spread of the variables of dataset.

Based on the statistical analysis of various economic indicators, it can be concluded that the exchange rate, inflation rate, interest rate, GDP growth, unemployment rate, industrial product, consumer price index, and trade balance all exhibit significant variations and are statistically different from the mean values. The Anderson-Darling test resulted in p-values less than 0.005 for all variables, indicating a high level of significance. This suggests that these economic indicators have experienced considerable fluctuations over

the observed period, and their values deviate significantly from their respective means. Further investigation would be required to understand the underlying factors driving these changes and their potential impact on the overall economy

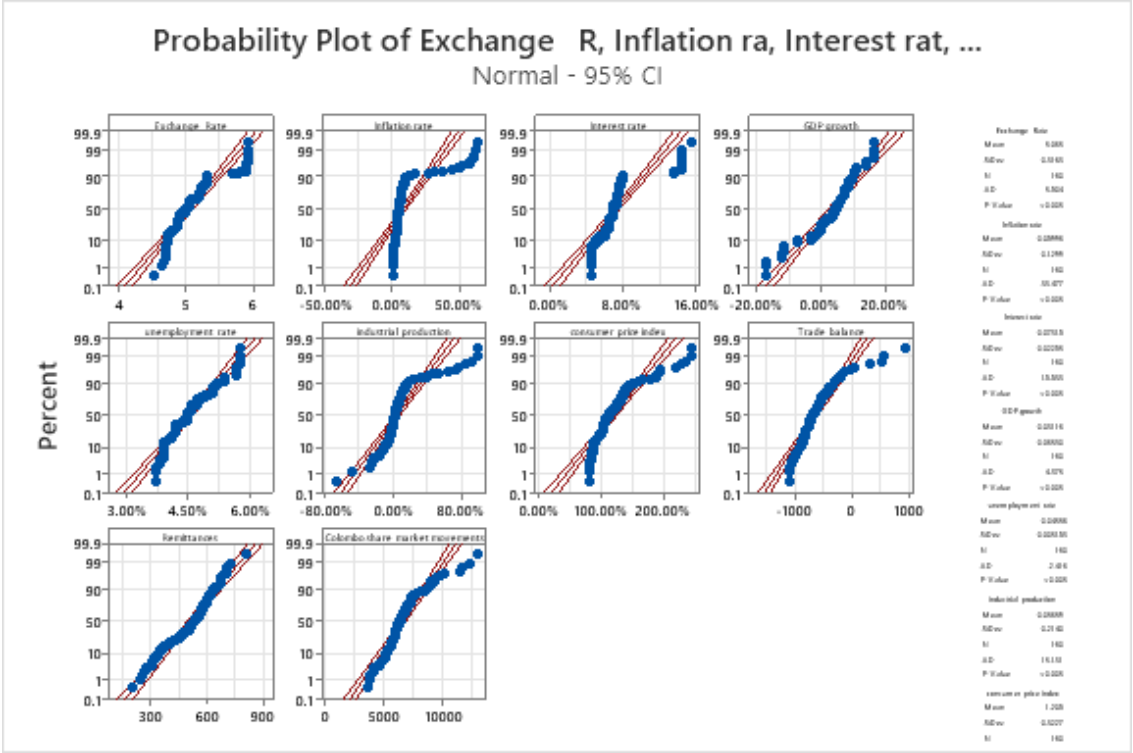

Figure 4.4: Probability Plot of Exchange rate, Inflation rate, Interest rate, GDP growth, unemployment rate, industrial production, consumer price index, Trade balance, Remittances, Colombo share market movements

The below table shows statistics for skewness and kurtosis. Skewness is a measure of the asymmetry of a distribution, while kurtosis is a measure of the peakness of a distribution. The table shows the skewness and kurtosis values for a number of variables, including exchange rate, interest rate, GDP growth, industrial production, consumer price index, trade balance, remittances, and Colombo share market movements. The skewness values in the table range from -1.02 to 4.80. A negative skewness value indicates that the distribution is skewed to the left, while a positive skewness value indicates that the distribution is skewed to the right. A skewness value of 0 indicates that the distribution is symmetrical. The kurtosis values in the table range from 0.84 to 9.28. A kurtosis value of 3 is considered to be a normal distribution. A kurtosis value that is greater than 3 indicates that the distribution is more peaked than a normal distribution, while a kurtosis value that

is less than 3 indicates that the distribution is less peaked than a normal distribution. In summary, the table shows that the variables variety of skewness and kurtosis values. This suggests that the distributions of these variables are not all symmetrical, and that some of them are more peaked than others.

Statistics

Variable	Skewness	Kurtosis
Exchange Rate	1.28	1.49
Inflation rate	3.20	9.28
Interest rate	2.24	5.04
GDP growth	-1.02	1.40
unemployment rate	0.62	-0.17
industrial production	2.08	8.09
consumer price index	1.75	3.69
Trade balance	2.03	7.13
Remittances	-0.45	-0.19
Colombo share market movements	1.50	4.03

Figure 4.5: Descriptive Statistics

The correlation analysis reveals important insights into the relationships between various economic indicators in the observed dataset. The consumer price index (CPI) shows a strong positive correlation with the exchange rate (0.962), indicating that as inflation increases, the value of the local currency tends to depreciate. Moreover, the CPI also exhibits a positive correlation with inflation rate (0.854), interest rate (0.793), and GDP growth (0.608), indicating that these variables are closely related and tend to move in the same direction. On the other hand, GDP growth exhibits negative correlations with the exchange rate (-0.765) and the consumer price index (-0.756), suggesting that a higher GDP growth rate is associated with a stronger local currency and lower inflation. Additionally, the consumer price index also shows a negative correlation with industrial production (-0.328), implying that higher industrial production may lead to lower inflation. The trade balance is positively correlated with the inflation rate (0.240) and the unemployment rate (0.216), indicating that higher inflation and unemployment rates may negatively impact the trade balance. Remittances, on the other hand, show negative correlations with inflation rate (-0.273) and industrial production (-0.050), suggesting that higher inflation and industrial production may reduce remittance inflows. The Colombo share market

movements show positive correlations with the consumer price index (0.537) and interest rate (0.415), suggesting that these variables may influence stock market performance. Overall, this correlation analysis provides valuable insights into the interplay between different economic indicators and can help policymakers and analysts better understand the Sri Lankan economy's dynamics and potential drivers of change.

Correlations

	Exchange Rate	Inflation rate	Interest rate	GDP growth	unemployment rate	industrial production
Inflation rate	0.748					
Interest rate	0.591	0.890				
GDP growth	-0.778	-0.610	-0.509			
unemployment rate	0.413	0.081	-0.084	-0.398		
industrial production	-0.323	-0.326	-0.278	0.401	0.092	
consumer price index	0.969	0.793	0.608	-0.756	0.368	-0.328
Trade balance	0.183	0.347	0.295	-0.287	0.216	-0.155
Remittances	-0.170	-0.430	-0.354	0.158	-0.018	0.050
Colombo share market movements	0.528	0.433	0.191	-0.325	0.026	-0.196

	consumer price index	Trade balance	Remittances
Inflation rate			
Interest rate			
GDP growth			
unemployment rate			
industrial production			
consumer price index			
Trade balance	0.192		
Remittances	-0.204	-0.281	
Colombo share market movements	0.582	-0.097	-0.299

Figure 4.6: Correlation: Exchange rate, Inflation rate, Interest rate, GDP growth, unemployment rate, industrial production, consumer price index, Trade balance, Remittances, Colombo share market movements

4.1.4 Preliminary Findings

As of the preliminary findings in mitigating unusual volatility of exchange rates in Sri Lanka, it is evident that a combination of macroeconomic stability measures and external engagement strategies play crucial roles. Implementing prudent monetary policies and

fiscal measures has shown promise in minimizing abrupt currency fluctuations. Additionally, efforts to diversify and strengthen the export sector, along with promoting foreign direct investment, have yielded positive impacts on forex inflows and exchange rate stability. Collaboration with international financial institutions and neighboring countries has been beneficial in times of economic turbulence, allowing for coordinated responses. Moreover, monitoring global economic trends and geopolitical developments has proven instrumental in preparing for potential shocks. Educating and empowering market participants have also shown potential in curbing speculative activities and enhancing market stability. While these are early findings, further analysis and refinement of these strategies are warranted for sustainable long-term results.

4.2 Quantitative analysis

In recent years, the Sri Lankan rupee has fluctuated unusually, in some cases losing up to 30% of its value against the US dollar. The Sri Lankan economy has been significantly impacted by this volatility, which has increased the cost of living for common people and made it difficult for corporations to plan and invest. Quantitative analysis will be used in this section to look at what is causing the exceptional volatility of the Sri Lankan currency. The Section will also look into a variety of methods for reducing this volatility. A number of data sources, including historical exchange rate data, economic data, and market sentiment data, will be used in the quantitative study. The factors most closely linked to the volatility of the Sri Lankan rupee will be found using a range of statistical methodologies in the study.

4.2.1 Hypothesis

Hypothesis 1

Null Hypothesis (H0)

Exchange rates do not significantly depend on inflation rate, interest rate, GDP growth, unemployment rate, industrial production, trade balance data, remittance data, and share market movements.

Alternative Hypothesis (Ha)

Exchange rates significantly depend on at least one of the independent variables (inflation rate, interest rate, GDP growth, unemployment rate, industrial production, trade balance data, remittance data, share market movements).

Hypothesis 2

Null Hypothesis (H0)

The model as a whole is not a good fit for the data, meaning none of the independent variables are useful in predicting the dependent variable.

Alternative Hypothesis (Ha)

The model as a whole is a good fit for the data, suggesting that at least one of the independent variables is useful in predicting the dependent variable.

Hypothesis 3

Null Hypothesis (H0)

The residuals (errors) of the regression model are normally distributed and exhibit constant variance (homoscedasticity).

Alternative Hypothesis (Ha)

The residuals of the regression model do not follow a normal distribution, and/or there is heteroscedasticity, indicating that the model may not be the best fit for the data.

Hypothesis 4

Null Hypothesis (H0)
model is adequate.

Alternative Hypothesis (Ha)
model is inadequate.

4.2.2 Statistical Method for Analysis

Regression Analysis

Regression analysis is a powerful statistical method used to examine relationships between variables. It helps us understand how one or more independent variables (predictors) relate to a dependent variable (outcome). This method is widely employed in various fields, from economics and social sciences to engineering and healthcare, to uncover patterns, make predictions, and infer causal relationships.

In a regression analysis, the goal is to create a mathematical model that represents the relationship between the independent variables and the dependent variable. This model can then be used for predictive purposes, hypothesis testing, and making informed decisions.

4.2.3 Model Building

The ”Model Building” section is a critical phase in the regression analysis process where you construct the mathematical representation of the relationship between your dependent and independent variables. In this section, you decide which independent variables to include, assess the model's fit, and address issues like multicollinearity. The ultimate goal is to create a model that accurately captures the underlying patterns in your data and helps you answer your research question effectively. This section plays a pivotal role in the success and reliability of your regression analysis, as it lays the foundation for interpreting and drawing meaningful conclusions from your results.

Backward Elimination

Backward elimination is a variable selection technique commonly used in multiple linear regression when you have a set of potential independent variables, and you want to determine which variables should be included in the final model. Here's an overview of how the regression model is created using backward elimination

Backward Elimination of Terms

Candidate terms: Inflation rate, Interest rate, GDP growth, unemployment rate, industrial production, consumer price index, Trade balance, Remittances, Colombo share market movements

	-------Step 1-------		-------Step 2-------	
	Coef	P	Coef	P
Constant	3.633		3.6494	
Inflation rate	-0.392	0.014	-0.383	0.014
Interest rate	2.017	0.005	1.938	0.002
GDP growth	-0.379	0.018	-0.377	0.018
unemployment rate	4.56	0.005	4.42	0.004
industrial production	-0.0176	0.581	-0.0176	0.580
consumer price index	0.9007	0.000	0.9063	0.000
Trade balance	-0.000019	0.446	-0.000020	0.394
Remittances	0.000031	0.632	0.000026	0.673
Colombo share market movements	0.000002	0.803		
S		0.0728402		0.0726122
R-sq		95.02%		95.01%
R-sq(adj)		94.71%		94.75%
Mallows' Cp		10.00		8.06
AICc		-368.31		-370.55
BIC		-336.34		-341.35

	-------Step 3-------		-------Step 4-------	
	Coef	P	Coef	P
Constant	3.6579		3.6707	
Inflation rate	-0.406	0.005	-0.403	0.005
Interest rate	1.974	0.002	1.946	0.002
GDP growth	-0.380	0.017	-0.403	0.009
unemployment rate	4.40	0.004	4.11	0.004
industrial production	-0.0189	0.550		
consumer price index	0.9097	0.000	0.9122	0.000
Trade balance	-0.000021	0.361	-0.000020	0.395
Remittances				
Colombo share market movements				
S		0.0724144		0.0722615
R-sq		95.01%		95.00%
R-sq(adj)		94.78%		94.80%
Mallows' Cp		6.24		4.59
AICc		-372.64		-374.51
BIC		-346.23		-350.92

	------Step 5-----	
	Coef	P
Constant	3.6818	
Inflation rate	-0.440	0.001
Interest rate	1.985	0.002
GDP growth	-0.375	0.013
unemployment rate	3.79	0.006
industrial production		
consumer price index	0.9249	0.000
Trade balance		
Remittances		
Colombo share market movements		
S		0.0721970
R-sq		94.97%
R-sq(adj)		94.81%
Mallows' Cp		3.31
AICc		-375.97
BIC		-355.23

α to remove = 0.1

Because the Colombo stock movement variable has a maximum p value and the model has a 94.71% r squared value, we delete it in step one according to the interpretation given above. The model's r squared value is 94.75% after the step 2 maximum p value or minimal significant associated to remittance (p=0.673).The following step will involve the industrial production of least significance (p=0.550).So, when the variable is removed, the model interprets 94.78%.The trade balance-related maximum p value (0.395) and model-related r squared value are 94.8% in step 4.The final model from Step 5 has a r squared value of 94.81%.

After the calculation new model is;

Regression Equation Exchange Rate = 3.6818 - 0.440 Inflation rate + 1.985 Interest rate - 0.375 GDP growth + 3.79 unemployment rate + 0.9249 consumer price index

or

$$y = 3.6818 - 0.440x_1 + 1.985x_2 - 0.375x_3 + 3.79x_4 + 0x_5 + 0.9249x_6 + 0x_7 + 0x_8 + 0x_9 \quad (4.1)$$

These are some statistical measurements for above model.

Coefficients

Term	Coef	SE Coef	95% CI	T-Value	P-Value	VIF
Constant	3.6818	0.0913	(3.5014, 3.8623)	40.31	0.000	
Inflation rate	-0.440	0.136	(-0.708, -0.172)	-3.25	0.001	9.46
Interest rate	1.985	0.615	(0.771, 3.199)	3.23	0.002	6.00
GDP growth	-0.375	0.149	(-0.669, -0.081)	-2.52	0.013	2.71
unemployment rate	3.79	1.35	(1.12, 6.47)	2.80	0.006	1.48
consumer price index	0.9249	0.0395	(0.8468, 1.0031)	23.39	0.000	4.96

Figure 4.7: Coefficients

Model Summary

S	R-sq	R-sq(adj)	PRESS	R-sq(pred)	AICc	BIC
0.0721970	94.97%	94.81%	0.968439	93.89%	-375.97	-355.23

Figure 4.8: Model Summery

Analysis of Variance

Source	DF	Seq SS	Contribution	Adj SS	Adj MS	F-Value	P-Value
Regression	5	15.0632	94.97%	15.0632	3.01264	577.98	0.000
Inflation rate	1	8.9245	56.27%	0.0549	0.05490	10.53	0.001
Interest rate	1	0.4119	2.60%	0.0544	0.05438	10.43	0.002
GDP growth	1	2.4753	15.61%	0.0330	0.03301	6.33	0.013
unemployment rate	1	0.4002	2.52%	0.0409	0.04087	7.84	0.006
consumer price index	1	2.8513	17.98%	2.8513	2.85125	547.01	0.000
Error	153	0.7975	5.03%	0.7975	0.00521		
Total	158	15.8607	100.00%				

Figure 4.9: Analysis of variance

Above results we have a high fitted value with 94.81% r squared value and also all variables interpret p value below the significant intervals.high R-squared value (in this case, 94.81%) and all the independent variables have p-values below the significance level, it suggests that your full model explains a substantial portion of the variance in the dependent variable, and all the included variables are statistically significant contributors to the model.

4.2.4 Hypothesis Analysis

Hypothesis 1

Null Hypothesis (H0) Exchange rates do not significantly depend on inflation rate, interest rate, GDP growth, unemployment rate, industrial production, trade balance data, remittance data, and share market movements.

Alternative Hypothesis (Ha) Exchange rates significantly depend on at least one of the independent variables (inflation rate, interest rate, GDP growth, unemployment rate, industrial production, trade balance data, remittance data, share market movements).

$$H_0 : \beta_i = 0, H_1 : \beta_i \neq 0 \tag{4.2}$$

Test Statistic

Analysis of Variance

Source	DF	Seq SS	Contribution	Adj SS	Adj MS	F-Value
Regression	9	15.0702	95.02%	15.0702	1.67446	315.60
Inflation rate	1	8.9245	56.27%	0.0327	0.03268	6.16
Interest rate	1	0.4119	2.60%	0.0434	0.04343	8.19
GDP growth	1	2.4753	15.61%	0.0302	0.03020	5.69
unemployment rate	1	0.4002	2.52%	0.0431	0.04310	8.12
industrial production	1	0.0168	0.11%	0.0016	0.00162	0.31
consumer price index	1	2.8357	17.88%	1.7908	1.79078	337.52
Trade balance	1	0.0044	0.03%	0.0031	0.00310	0.58
Remittances	1	0.0009	0.01%	0.0012	0.00122	0.23
Colombo share market movements	1	0.0003	0.00%	0.0003	0.00033	0.06
Error	149	0.7905	4.98%	0.7905	0.00531	
Total	158	15.8607	100.00%			

Source	P-Value
Regression	0.000
Inflation rate	0.014
Interest rate	0.005
GDP growth	0.018
unemployment rate	0.005
industrial production	0.581
consumer price index	0.000
Trade balance	0.446
Remittances	0.632
Colombo share market movements	0.803
Error	
Total	

Figure 4.10: Hypothesis 1 : Test Statistic

$$\beta_1 = (Inflation\ rate\ Coefficient) \tag{4.3}$$

P value : $0.014 < 0.05$

Conclusion : Reject Null Hypothesis

$\beta_1 \neq 0$

That is the re-state coefficient value of Inflation rate given by backward elimination

$\beta_1 = -0.44$

$$\beta_2 = (Interest\ rate\ Coefficient) \tag{4.4}$$

P value : $0.004 < 0.05$

Conclusion : Reject Null Hypothesis

$\beta_2 \neq 0$

That is the re-state coefficient value of Interest rate given by backward elimination.

$\beta_2 = 1.985$

$$\beta_3 = (GDP\ growth\ Coefficient) \tag{4.5}$$

P value : $0.018 < 0.05$

Conclusion : Reject Null Hypothesis

$\beta_3 \neq 0$

That is the re-state coefficient value of GDP growth given by backward elimination.

$\beta_3 = -0.375$

$$\beta_4 = (Unemployment\ rate\ Coefficient) \tag{4.6}$$

P value : $0.005 < 0.05$

Conclusion : Reject Null Hypothesis

$\beta_4 \neq 0$

That is the re-state coefficient value of Unemployment rate given by backward elimination.

$\beta_4 = 3.79$

$$\beta_5 = (Industrial\ production\ Coefficient) \tag{4.7}$$

P value : $0.581 > 0.05$

Conclusion : Accept Null Hypothesis

$\beta_5 = 0$

That is the re-state coefficient value of Industrial production given by backward elimination.

$\beta_5 = 0$

$$\beta_6 = (Consumer\ price\ index\ Coefficient) \tag{4.8}$$

P value : $0 < 0.05$

Conclusion : Reject Null Hypothesis

$\beta_6 = 0$

That is the re-state coefficient value of Consumer price index given by backward elimination.

$\beta_6 = 0.9249$

$$\beta_7 = (Trade\ balance\ Coefficient) \tag{4.9}$$

P value : $0.446 > 0.05$

Conclusion : Accept Null Hypothesis

$\beta_7 = 0$

That is the re-state coefficient value of Trade balance given by backward elimination.

$\beta_7 = 0$

$$\beta_8 = (Remittance\ Coefficient) \tag{4.10}$$

P value : $0.632 > 0.05$

Conclusion : Accept Null Hypothesis

$\beta_8 = 0$

That is the re-state coefficient value of Remittance given by backward elimination.

$\beta_8 = 0$

$$\beta_9 = (Colombo\ share\ market\ movements\ Coefficient) \tag{4.11}$$

P value : $0.803 > 0.05$

Conclusion : Accept Null Hypothesis

$\beta_9 = 0$

That is the re-state coefficient value of Colombo share market movements given by backward eliminat

$\beta_9 = 0$

Overall we can conclude this Hypothesis as,

$\beta_1 = -0.44$
$\beta_2 = 1.985$
$\beta_3 = -0.375$
$\beta_4 = 3.79$
$\beta_5 = 0$
$\beta_6 = 0.9249$
$\beta_7 = 0$
$\beta_8 = 0$
$\beta_9 = 0$

Hypothesis 2

Null Hypothesis (H0) The model as a whole is not a good fit for the data, meaning none of the independent variables are useful in predicting the dependent variable.
Alternative Hypothesis (Ha) The model as a whole is a good fit for the data, suggesting that at least one of the independent variables is useful in predicting the dependent variable.

Test Statistic

Analysis of Variance

Source	DF	Seq SS	Contribution	Adj SS	Adj MS	F-Value	P-Value
Regression	5	15.0632	94.97%	15.0632	3.01264	577.98	0.000
Inflation rate	1	8.9245	56.27%	0.0549	0.05490	10.53	0.001
Interest rate	1	0.4119	2.60%	0.0544	0.05438	10.43	0.002
GDP growth	1	2.4753	15.61%	0.0330	0.03301	6.33	0.013
unemployment rate	1	0.4002	2.52%	0.0409	0.04087	7.84	0.006
consumer price index	1	2.8513	17.98%	2.8513	2.85125	547.01	0.000
Error	153	0.7975	5.03%	0.7975	0.00521		
Total	158	15.8607	100.00%				

Figure 4.11: ANOVA Table

Regression P Value =0 ¡0.05
Conclusion : Reject the null hypothesis (H0) and conclude that the model as a whole is a good fit for the data, suggesting that at least one of the independent variables is useful in

predicting the dependent variable
According to that we can clearly say that this model is use as a predictor model.

Hypothesis 3

Null Hypothesis (H0)

The residuals (errors) of the regression model are normally distributed and exhibit constant variance (homoscedasticity).

Alternative Hypothesis (Ha)

The residuals of the regression model do not follow a normal distribution, and/or there is heteroscedasticity, indicating that the model may not be the best fit for the data.

Test Statistics

In figure 4.12 we can approximately conclude that as normally distributed.The data points are close to the straight line and it prove that assumption.
In figure 4.13 hasn't proper pattern of distribution.That conclude the variance are equal.
In figure 4.14 histogram also show that residuals are normally distributed.

According to these results we can say he residuals (errors) of the regression model are normally distributed and exhibit constant variance (homoscedasticity)

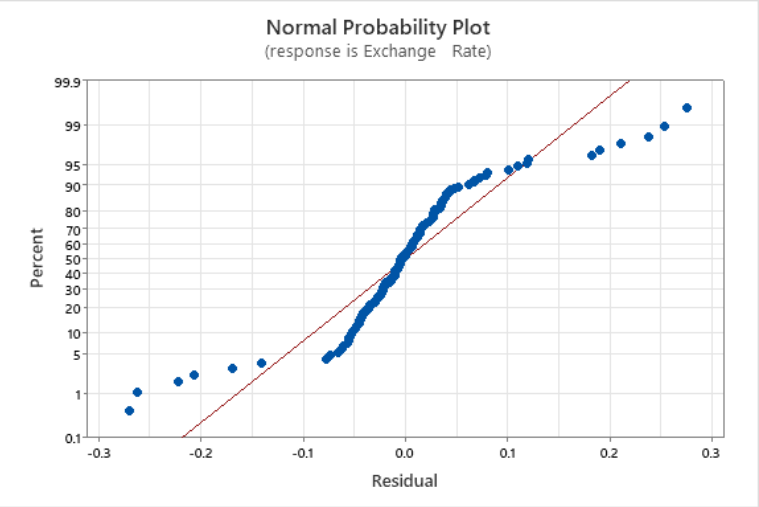

Figure 4.12: Normal Probability Plot

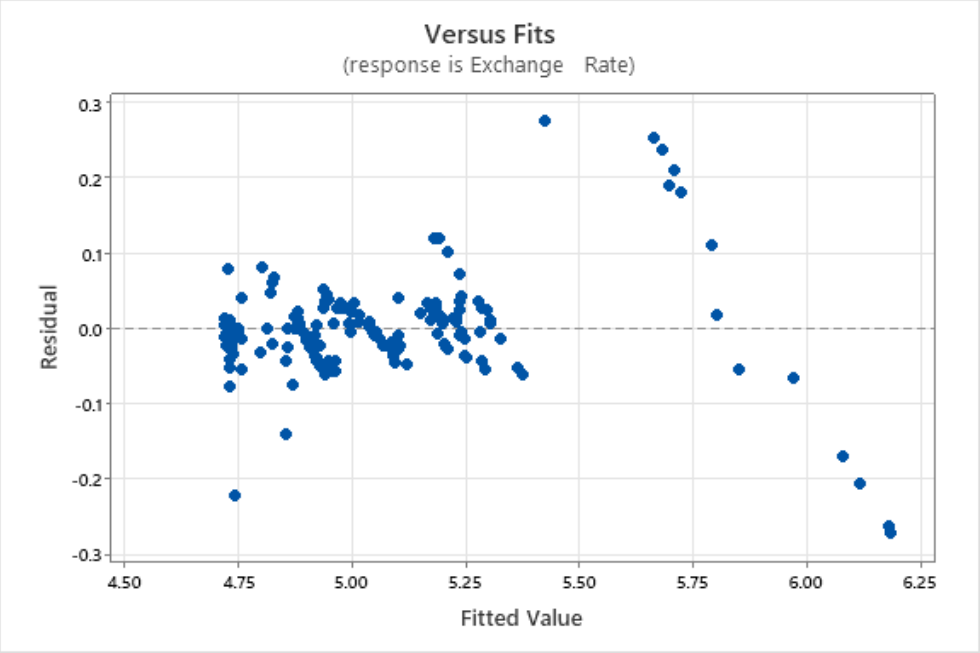

Figure 4.13: Residual Plot

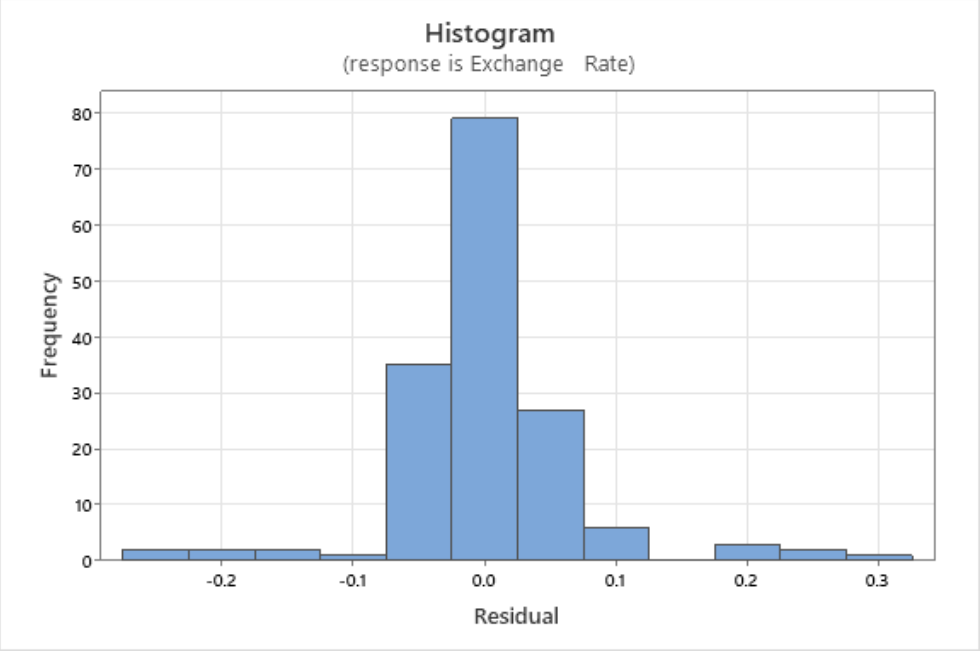

Figure 4.14: Histogram

-

Hypothesis 4

Null Hypothesis (H0)
model is adequate.
Alternative Hypothesis (Ha)
model is inadequate.

Test Statistics

Analysis of Variance

Source	DF	Seq SS	Contribution	Adj SS	Adj MS	F-Value	P-Value
Regression	5	15.0632	94.97%	15.0632	3.01264	577.98	0.000
Inflation rate	1	8.9245	56.27%	0.0549	0.05490	10.53	0.001
Interest rate	1	0.4119	2.60%	0.0544	0.05438	10.43	0.002
GDP growth	1	2.4753	15.61%	0.0330	0.03301	6.33	0.013
unemployment rate	1	0.4002	2.52%	0.0409	0.04087	7.84	0.006
consumer price index	1	2.8513	17.98%	2.8513	2.85125	547.01	0.000
Error	153	0.7975	5.03%	0.7975	0.00521		
Total	158	15.8607	100.00%				

Figure 4.15: Best model ANOVA Table

Analysis of Variance

Source	DF	Seq SS	Contribution	Adj SS	Adj MS	F-Value
Regression	9	15.0702	95.02%	15.0702	1.67446	315.60
Inflation rate	1	8.9245	56.27%	0.0327	0.03268	6.16
Interest rate	1	0.4119	2.60%	0.0434	0.04343	8.19
GDP growth	1	2.4753	15.61%	0.0302	0.03020	5.69
unemployment rate	1	0.4002	2.52%	0.0431	0.04310	8.12
industrial production	1	0.0168	0.11%	0.0016	0.00162	0.31
consumer price index	1	2.8357	17.88%	1.7908	1.79078	337.52
Trade balance	1	0.0044	0.03%	0.0031	0.00310	0.58
Remittances	1	0.0009	0.01%	0.0012	0.00122	0.23
Colombo share market movements	1	0.0003	0.00%	0.0003	0.00033	0.06
Error	149	0.7905	4.98%	0.7905	0.00531	
Total	158	15.8607	100.00%			

Source	P-Value
Regression	0.000
Inflation rate	0.014
Interest rate	0.005
GDP growth	0.018
unemployment rate	0.005
industrial production	0.581
consumer price index	0.000
Trade balance	0.446
Remittances	0.632
Colombo share market movements	0.803
Error	
Total	

Figure 4.16: Full model Anova Table

As follow formula use to prove the test statistic.

$$F_{Partial} = \frac{[SS^{Full}_{Reg} - SS^{Reduced}_{Reg}]/(k-p)}{SS^{Full}_{Error}/(n-(k+1))}$$

Calculation :

$$F_{Partial} = \frac{15.0702 - 15.0632]/(9-5)}{0.7905}/(160-(9+1))$$

$F_{Partial} = 0.332$

$F_{Table,0.05,151,150} = 1.3085$

$F_{Partial} < F_{Table,0.05,151,150}$

Conclusion : We do not reject Null Hypothesis.model is adequate.

Chapter 5

Discussion and conclusions

5.1 Discussion

In this Study we use real time data collection of January 2010 to April 2023.We use 160 row data for our study.Using responsible data sources we try to interpret more accurate interpretation of Exchange rate in between US dollars and Local Sri Lankan Rupees.Using Descriptive and Quantitative analysis we create a model for predication of the movement.It as follows.

Regression Equation Exchange Rate = 3.6818 - 0.440 Inflation rate + 1.985 Interest rate - 0.375 GDP growth + 3.79 unemployment rate + 0.9249 consumer price index

According to results Inflation rate,Interest rate,Unemployment rate and consumer price index have high correlation.Because of that they are more effective factors for the exchange rate.Also GDP have a Strong negative relationship with our dependent variable and also others have positive impact for exchange rate.Not only that this reduce model is high fitted to the regression line with R square =94.8% and it state all the previous hypothesis as a best model to interpretation.

5.2 Conclusion

In the fields of economics and finance, the relationship shown by the regression equation, "Exchange Rate = 3.6818 - 0.440 Inflation rate + 1.985 Interest Rate - 0.375 GDP growth + 3.79 unemployment rate + 0.9249 consumer price index," is of great practical significance. According to this equation, a number of important macroeconomic factors affect exchange rates, and comprehending these linkages can have significant ramifications for a variety of stakeholders.

First off, the fact that the inflation rate has a negative coefficient (-0.440) suggests that higher inflation tends to cause a decline in the value of the currency. This underscores the significance of monitoring and hedging against inflation risks when dealing with foreign currencies, which is crucial for enterprises involved in international trade.

Second, the positive coefficient for Interest Rate (1.985) shows that raising interest rates may draw in foreign capital, which would increase the value of the currency. To allocate capital wisely across multiple currencies, investors and financial institutions pay close attention to this relationship.

The GDP growth coefficient's negative value (-0.375) shows that the exchange rate can

experience upward pressure from a strong economic growth rate. For governments and central banks, this is crucial because it emphasises the necessity for economic policies that strike a balance between growth goals and exchange rate stability.

Furthermore, a lower unemployment rate may strengthen a country's currency, according to the positive coefficient for the unemployment rate (3.79). This data can be used by policymakers and labour market specialists to assess a nation's economy and forecast possible exchange rate changes.

Finally, the fact that the consumer price index (CPI) has a positive coefficient (0.9249) suggests that a rise in the CPI may result in a stronger exchange rate. This is vital because it shows how domestic price levels affect global competitiveness, which is important for both consumers and businesses.

The ability of this regression equation to provide light on the complex link between exchange rates and various macroeconomic factors, then, is what gives it its practical significance. Governments, corporations, investors, and politicians can use it as a useful tool to make judgements about currency exposure, investment strategies, and economic policies in a globalised environment. Stakeholders can better handle the challenges of global finance and commerce by comprehending these relationships.

5.3 Practically approaches

Monitoring and Early Warning

Monitoring the variables included in the regression equation on a constant basis is one of the initial tasks. Using historical data and model deviance, set thresholds or ranges for each variable. Any time one of these variables begins to deviate noticeably from the expected values, it may be a precursor to future exchange rate volatility.

Policy Adjustments

The coefficients in the regression model provide insights into which variables have the most significant impact on the exchange rate. For example, if the model indicates that inflation rate has a strong negative effect on the exchange rate, policymakers can implement inflation-controlling measures to stabilize the currency. Similarly, if interest rates are found to be a crucial factor, central banks can adjust interest rates to attract or deter foreign investment, depending on the economic situation.

Hedging Strategies

The regression model can be used by companies involved in international trade to guide their hedging tactics. Companies can use hedging products to reduce the risk associated with fluctuations in GDP growth, for example, if the model demonstrates that exchange rates are very sensitive to GDP growth.

Investment Decisions

Investors looking to invest in Sri Lanka or engage in currency trading can use the model to make informed decisions. They can adjust their portfolios based on expectations of how the identified variables are likely to change in the near future, which can help them mitigate potential losses during volatile periods.

Public Awareness and Education

Public and private institutions can use the model's insights to educate the public and business community about the factors influencing exchange rates. This awareness can lead to more informed decision-making at all levels of the economy, potentially reducing panic reactions during unusual volatility.

In Sri Lanka's efforts to lessen exceptional exchange rate volatility, the regression model can be a useful tool. The nation can more effectively navigate the complexities of its exchange rate dynamics and work towards a more stable economic environment by proactively monitoring, adjusting policies, putting hedging strategies into place, making wise investment decisions, increasing public awareness, and maintaining data-driven analysis.

5.4 Appendix

1.Data Set (CSV FIle)
https://drive.google.com/drive/folders/1DuZfsvs1VpDg9O0EXEvl0*RWDM*2*bNHuq*?*usp* = *sharing*

5.5 References

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