

Macro-economic and Global Market Factors Affecting the Exchange Rate Fluctuation in Sri Lanka

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Abstract:

The foreign exchange market plays a critical role in economic performance specially for developing countries such as Sri Lanka. Predicting exchange rate is a crucial task for policymakers, bankers, and investors to make informed decisions. This study has investigated the factors influencing exchange rate fluctuations in Sri Lanka. Analyzing a range of macroeconomic and global market variables, this study revealed that oil prices, the Dow Jones Industrial Average (DJIA) Index, interest rates, and secondary market treasury bill rates exhibit significant Granger causality towards the Sri Lankan exchange rate.

Keywords —Exchange rate, Macroeconomic factors, Granger causality test

I. INTRODUCTION

The exchange rate is one of the most important economic variables that reflects the economy in the long run, especially for export-oriented countries (Chang and Chien 2018). Exchange rate prediction is significant for decision-makers such as policymakers, bankers, and investors (Henriquez and Kristjanpoller 2019). It is a complicated and challenging task since the foreign exchange market is a multivariable, non-linear system (Shen, Chao and Zhao 2015). As Yasir et al (2019) claimed, the exchange rate is affected by several socioeconomic and political factors. In addition, they have emphasized the importance of an accurate exchange rate prediction mechanism. Therefore, forecasting the exchange rate is a challenging task that should be performed accurately to make the right decisions. This research attempts to identify the factors most related to the exchange rate in Sri Lanka which could be used for exchange rate prediction.

prediction. Meanwhile, Moshin et al.(2018) have identified a significant relationship between exchange rates and macroeconomic variables such as current balance, inflation, foreign direct investment, etc.

Even though several researches have been conducted to identify the factors related to exchange rate in Sri Lanka, it is challenging due to its high volatility and unpredictable nature. The managed float exchange rate regime was introduced in Sri Lanka in November 1977 (Weerasinghe 2017). Several studies have been conducted to identify the exchange rate behavior in Sri Lanka. Jayasuriya and Perera (2016) have identified that the net foreign assets, trade balance and workers' remittance can be used to predict the exchange rate successfully. As per the study of Rajakaruna Rajakaruna (2017), the exchange rate is related to inflation, interest rates, remittances, terms of trade, and foreign purchases.

II. PREVIOUS WORK

As Castro and Jimenez (2018) mentioned, a time-varying relationship exists between exchange rates and oil prices. Yasir et.al (2019) have incorporated highly volatile factors such as gold and crude oil prices and sentiment analysis for exchange rate

III. RESEARCH METHODOLOGY

Identifying the correct data set for the study is essential, which leads to more accurate results effectively. As per the findings of the literature survey and the opinions gathered from experts, the following input data were identified, as mentioned in Table 1.

Data	Source
Indicative US Dollar SPOT Exchange rate	Data library of the Central Bank of Sri Lanka website (“Central Bank of Sri Lanka” 2020)
<i>Global market factors</i>	
Oil price	Energy Information Administration of United States web site (“Crude Oil Production” 2020)
Gold price	Data collection of GoldHub web site (“Gold Price Historical Data Gold Price History World Gold Council” 2020)
Dow Jones Industrial Average (DJIA) Index	Federal Reserve Economic Data (FRED) maintained by the Research division of the Federal Reserve Bank of St. Louis (“Dow Jones Industrial Average (DJIA) FRED St. Louis Fed” 2020).
USA Treasury Bill Rates	U.S. Department of the Treasury’s web site (“Daily Treasury Bill Rates Data” 2021)
<i>Macro-economic factors</i>	
Interest rates	Data library of the Central Bank of Sri Lanka website (“Central Bank of Sri Lanka” 2020)
Sri Lanka Secondary Market Treasury Bill Rate	

Table 1: Sources of data

Table 1 shows the resources of the gathered macro-economic and global market data. Exchange rate, macro-economic variables such as interest rates, Sri Lankan secondary market treasury bill rates were downloaded through the data library of the Central Bank of Sri Lanka website (Central Bank of Sri Lanka, 2020).

IV. RESULTS

A. Spearman's Rank-Order Correlation of numeric variables

Using a monotonic function, Spearman’s correlation is used to identify the association between two variables (“Spearman’s Rank Correlation Coefficient - Wikipedia” 2020). As per the results mentioned in Table 2, a very strong monotonic correlation exists between the exchange rate and DJIA stock market index. Meanwhile a strong monotonic correlation exists with the

exchange rate and most USA treasury bill rates. The remaining variables have a moderate, weak, or very weak monotonic relationship with the exchange rate.

Variable	Spearman’s correlation coefficient	P value	Strength of Monotonic correlation
Oilprice	-0.595	0.000	Moderate
DJIA	0.936	0.000	Very Strong
GoldPrice_USD	0.139	0.000	Weak
<i>USA Treasury bill rates</i>			
USA_TBILL_Rate_BD_4_weeks	0.714	0.000	Strong
USA_TBILL_Rate_CE_4_weeks	0.715	0.000	Strong
USA_TBILL_Rate_BD_13_weeks	0.711	0.000	Strong
USA_TBILL_Rate_CE_13_weeks	0.711	0.000	Strong
USA_TBILL_Rate_BD_26_weeks	0.691	0.000	Strong
USA_TBILL_Rate_CE_26_weeks	0.691	0.000	Strong
USA_TBILL_Rate_BD_52_weeks	0.609	0.000	Moderate
USA_TBILL_Rate_CE_52_weeks	0.609	0.000	Moderate
<i>Interest rates</i>			
AvgWeighted_Call_Money_Rate	-0.056	0.011	Very weak
InterBankCallWeightedAvgRate	-0.056	0.011	Very weak
MarketRepoWeightedAvgRate	0.100	0.000	Weak
<i>Secondary market Treasury Bill rates</i>			
TBILLWAY_Secondary_091	0.098	0.000	Very weak
TBILLWAY_Secondary_182	0.082	0.000	Very weak
TBILLWAY_Secondary_364	0.079	0.000	Very weak

Table 2: Spearman's rank-order correlation for numeric factors

B. Identify the most related financial factors with the exchange rate

The Granger causality test is a statistical test that analyzes the causal relationship of financial series (“Granger Causality - Wikipedia” 2021). The Granger causality test can be applied to determine the effective financial series related to exchange rate fluctuations.

The time series of the variables should have a stationery process to conduct the Granger causality test. Therefore, it’s required to check the stationarity of the variables. If the variables are non-stationary, converting the time series variables into stationery variables is necessary to apply the Granger causality test. Augmented Dickey-Fuller test (ADF) was applied to check the stationarity of the financial time series.

Hypothesis

H0: Unit root exists. It is a nonstationary time series

H1: No unit root exists. It is a stationary time series

Hypothesis - Conclusion

p-value > 0.05: Fail to reject the H0. Unit root exists. It is nonstationary time series

p-value <= 0.05: Reject the H0. No unit root exists. It is a stationary time series

Variable	ADF Statistic	P-value
Exchange_rate	-0.666716	0.855184
Oilprice	-1.419858	0.572720
DJIA	-0.796456	0.820161
GoldPrice_USD	-0.992218	0.756092
USA Treasury bill rates		
USA_TBILL_Rate_BD_4_weeks	-1.011289	0.749125
USA_TBILL_Rate_CE_4_weeks	-1.013807	0.748195
USA_TBILL_Rate_BD_13_weeks	-0.967165	0.765051
USA_TBILL_Rate_CE_13_weeks	-0.992243	0.756083
USA_TBILL_Rate_BD_26_weeks	-0.967628	0.764887
USA_TBILL_Rate_CE_26_weeks	-0.973996	0.762630
USA_TBILL_Rate_BD_52_weeks	-0.936202	0.775817
USA_TBILL_Rate_CE_52_weeks	-0.938072	0.775177
Interest rates		
AvgWeighted_Call_Money_Rate	-1.208221	0.670049
InterBankCallWeightedAvgRate	-1.208358	0.669990
MarketRepoWeightedAvgRate	-0.734103	0.837717
Secondary market Treasury Bill rates		
TBILLWAY_Secondary_091	-1.783697	0.388585
TBILLWAY_Secondary_182	-1.926334	0.319776
TBILLWAY_Secondary_364	-1.639916	0.462305

Table 3: Results of the Augmented Dickey-Fuller Test

As per the results shown in Table 3, all the variables are non-stationary variables. Therefore, the variables should be converted into stationary series to apply the Granger causality test.

Most financial time series are non-stationary, with trends and cycles and other features of non-stationary time series. To apply the statistical test, it is required to convert the non-stationary series into a stationary series. Logarithmic transformations were used to convert the series into stationary in this study. The log value of the ratio of consecutive

financial data values is used to convert the data series into a stationary data series.

The calculation of the log value of the ratio of consecutive data values of each series can be denoted for time step t:

$$R_t = \log(P_t/P_{t-1})$$

Hypothesis

H0: Unit root exists. It is a nonstationary time series

H1: No unit root exists. It is a stationary time series

Hypothesis - Conclusion

p-value > 0.05: Fail to reject the H0. Unit root exists. It is nonstationary time series

p-value <= 0.05: Reject the H0. No unit root exists. It is a stationary time series

Variable	ADF Statistics	P-value
exchange_rate	-9.488980	0.000000
Oilprice	-7.847120	0.000000
DJIA	-22.022444	0.000000
GoldPrice_USD	-12.763197	0.000000
USA Treasury bill rates		
USA_TBILL_Rate_BD_4_weeks	-12.863132	0.000000
USA_TBILL_Rate_CE_4_weeks	-12.856940	0.000000
USA_TBILL_Rate_BD_13_weeks	-11.521819	0.000000
USA_TBILL_Rate_CE_13_weeks	-11.521164	0.000000
USA_TBILL_Rate_BD_26_weeks	-17.910337	0.000000
USA_TBILL_Rate_CE_26_weeks	-17.891796	0.000000
USA_TBILL_Rate_BD_52_weeks	-9.208318	0.000000
USA_TBILL_Rate_CE_52_weeks	-9.208875	0.000000
Interest rates		
AvgWeighted_Call_Money_Rate	-6.594125	0.000000
InterBankCallWeightedAvgRate	-6.596139	0.000000
MarketRepoWeightedAvgRate	-12.223390	0.000000
Secondary market Treasury Bill rates		
TBILLWAY_Secondary_091	-8.158853	0.000000
TBILLWAY_Secondary_182	-8.131561	0.000000
TBILLWAY_Secondary_364	-8.582900	0.000000

Table 4: Results of the Augmented Dickey-Fuller Test

Since the p-value is lower than 0.05, H0 is rejected, as shown in Table 4. Therefore, all the financial variables have been converted into a stationary series. Thus, the Granger causality test can be applied. The Granger causality test was performed for 15 lags, and it was observed that the best results

were generated for lag three, as mentioned in Table 5. The null hypothesis was rejected for the probabilities lower than the significance level (0.05). As per the Granger causality test results, oil price, DJIA Index, interest rates, and secondary market treasury bill rates cause exchange rate values for lag 3.

Null Hypothesis	FStat	Prob
Oil price does not Granger cause the exchange rate	6.3975	0.0003
DJIA does not Granger cause the exchange rate	4.7247	0.0027
GoldPrice_USD does not Granger cause the exchange rate	1.3662	0.2513
USA_TBILL_Rate_BD_4_weeks does not Granger cause exchange rate	0.3535	0.7866
USA_TBILL_Rate_CE_4_weeks does not Granger cause exchange rate	0.3542	0.7861
USA_TBILL_Rate_BD_13_weeks does not Granger cause exchange rate	1.2050	0.3064
USA_TBILL_Rate_CE_13_weeks does not Granger cause exchange rate	1.2014	0.3078
USA_TBILL_Rate_BD_26_weeks does not Granger cause exchange rate	0.5747	0.6317
USA_TBILL_Rate_CE_26_weeks does not Granger cause exchange rate	0.5714	0.6338
USA_TBILL_Rate_BD_52_weeks does not Granger cause exchange rate	2.5403	0.0548
USA_TBILL_Rate_CE_52_weeks does not Granger cause exchange rate	2.4188	0.0645
AvgWeighted_Call_Money_Rate does not Granger cause exchange rate	5.2065	0.0014
InterBankCallWeightedAvgRate does not Granger cause exchange rate	5.2792	0.0013
MarketRepoWeightedAvgRate does not Granger cause exchange rate	4.0355	0.0071
TBillWAY_Secondary_091 does not Granger cause exchange rate	1.5707	0.1945
TBillWAY_Secondary_182 does not Granger cause exchange rate	14.1868	0.0000
TBillWAY_Secondary_364 does not Granger cause exchange rate	21.5999	0.0000

Table 5: Results of Granger Causality Test for lag3

V. CONCLUSION

As a result of globalization, the foreign exchange market has experienced a vast development during the last few years. It is a significant, influential economic factor for the smaller economies and export-oriented countries such as Sri Lanka for both domestic and global economies. As per the study results, oil prices, the DJIA Index, interest rates,

and secondary market treasury bill rates affect the exchange rate fluctuation. This study has considered macroeconomic and global market factors to identify the factors that impact the exchange rate fluctuation in Sri Lanka. Exploring additional factors influencing Sri Lanka's exchange rates beyond macroeconomic and global market elements is necessary for future study works.

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