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An overview: Modeling and forecasting of time series data using different techniques in reference to human stress

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ABSTRACT

Forex is an important currency indicator. The index is a major factor in the development of the country. This look examines the effects of currency trading on the Random stroll version, Exponential Smoothing One, Double Exponential Smoothing and Holt-wintry weather models and the performance of the fashion forecast were judged using the accuracy level of each symmetric loss factor and asymmetric used rectangular (MSE) errors, mean Total Deviations (MAD) and mean Total percentage errors (MAPE). From a precision rating, a double slider version of the interpreter can be used to anticipate and smooth out a series of currency exchange rates with three different versions. In an effort to test several models of the Akaike information Criterion (AIC) small currency, we have examined the Autoregressive version that incorporates conventional change (ARIMA) that can be used to anticipate the change in funding for the South Asian Local Cooperation (SAARC). This research allows for the discovery of different strategies and reduces the type of human intelligence which ultimately leads to good health.

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1. Introduction

Researchers often use an econometric or time series model in making financial decisions. The Econometric model occupies a fixed position in the series, but time series data usually does not standstill. Predicting a series of financial times such as exchange rates is essential for investors and puts the government in place. Good financial predictions The series requires a solid background and tools to analyze good information [1]. Values sound natural, stable, and consistent decisions [2,3]. If the data is not corrected, a problem appears as a fraudulent retrieval problem. When a lag dependent variable is present in the model, our first task to test is static. Therefore, our main objective is to develop a data exchange rate model for SAARC countries with lag and then check its stability using unit root tests at appropriate values and check whether they are compact. Dickey-Fuller is used to check the Unit root testing [4]. Unit root testing is one of the most well-known methods used to determine whether a stochastic process has stopped or if it has stopped, by which system. According to Engle and Granger [5], if a series of two random movements have a long-term equality relationship, they cannot be permanently separated. Deviation from their long-term equality relationship should always have a zero definition. In this case, a series of two values is said to be combined.

Naik and Padhi [6] find that the significant economic dynamics and stock market indicators (BSE Sensex) are integrated, and thus there is a long-term relationship between them in the Indian stock market. They found a positive relationship between stock prices and inflation and industrial production but negatively correlated with inflation. Hashimoto and Ito [7] also experimented with similar studies in eight countries in the region during the Asian financial crisis, 1997-1999, and looked at two variables the exchange rate and the number of shares. Researchers in both studies believe that the sharp decline in the Thai baht is due to the decline in other currencies in the region,

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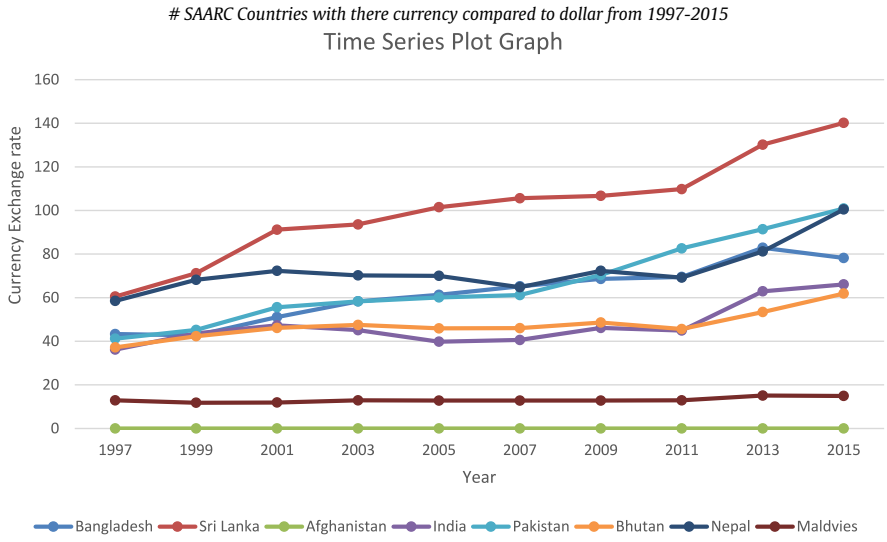


Fig. 1. Time Series Plot of Currency Exchange Rate of different countries.

contributing to the collapse of the stock market. Muhammad and Rasheed [8] studied the relationship between stock prices and exchange rates for four South Asian countries. There is no significant relationship between the variables found in India and Pakistan, but dual direct relations are found in Bangladesh and Sri Lanka. A similar study was conducted by Rahman and Uddin [9] in three Asian countries called Bangladesh, India, and Pakistan. Their research does not show a causal relationship between the country's stock prices and exchange rates. The study of Ahmad et al. [10] examines the relationship between the return on stocks, interest rates, and exchange rates on the Pakistani economy. They conclude that interest rate changes have an opposing advantage while exchange rate fluctuations positively affect stock returns.

To assess instability and stance using nonparametric and parametric tests. Re-examine the long-term relationship between the two SAARC countries and the exchange rate for the integration analysis. Assessing the variables of each value by considering the effect of ARCH on the random errors of the Econometric conversion model. The paper aims to develop time series models and determine the best data prediction model for SAARC international exchange rate measurement error. Finally, using the very low AIC criterion for selecting the best model, [11] predicts the exchange rate data for SAARC countries.

2. Methodology

For analysis, we collect currency exchange rate data for SAARC countries converted from USD from 2005 to 2016. Initially, the stop position was tested using a timeline series, correlogram, random testing, and evaluation of unit roots. Then find out whether the SAARC countries series is integrated and find a link between the two SAARC countries series. Another task is to assess the situation. If flexibility exists, we check whether the ARCH effect is present or not. To investigate the main objectives of this paper, we use a variety of time series methods such as the Time Series Plot, different sliding techniques, different non-focus tests, the ARCH model of instability, and other complex mathematical processes. A few methods are designed to predict and compare with the ARIMA model. Model performance is measured by percentage error (MAPE) error, and root mean square error (RMSE), and square measure error (MAE) [12]. For more than two decades in the Box and Jenkins' Auto-Regressive Integrated Moving Average (ARIMA) technology, [13] and is widely used in the forecast period. Due to its popularity, the ARIMA model was used as a test guide in some modeling methods [14]. Weisang et al. [15] also developed a detailed ARIMA model in the form of case studies using macroeconomic indicators to illustrate the exchange rate of USD / EUR. They have developed an equal exchange rate of USD / EUR monthly from January 1994 to October 2007. Akincilar et al. [16] read the forecast for the exchange rate of the US dollar, the euro, and the pound of Great Britain compared to the Turkish lira. However, ARIMA is one of the most inconsistent models and is based on the assumption that the timeline is irregular, i.e., line and vertical [17].

3. Data analysis

The first step is analyzing the data. It provides an initial indication of the probability of a time series or indicates an upward or downward trend, seasonal variation, or cycle.

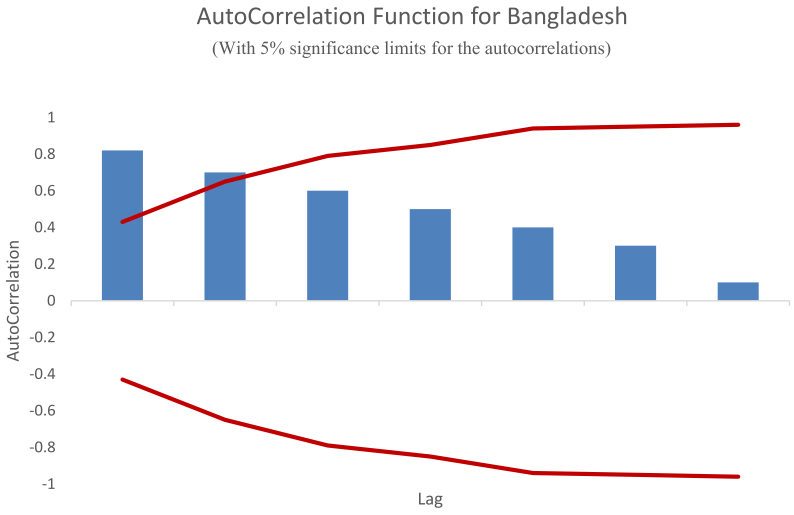
3.1. Time series plot

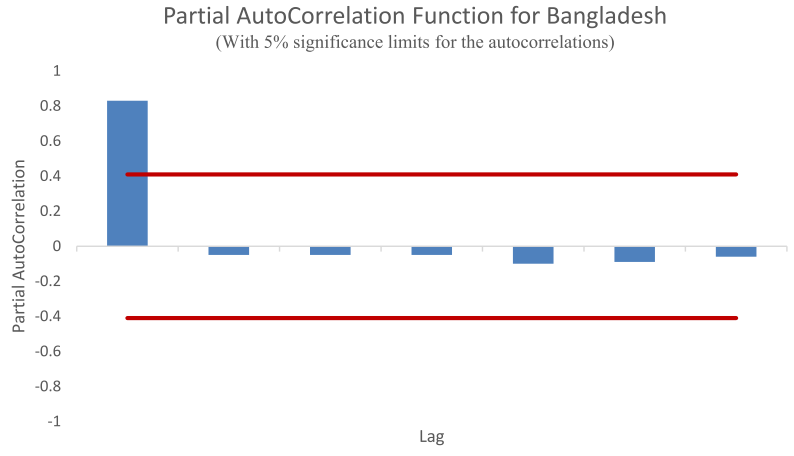
SAARC countries exchange rate has been used from 1997 to 2015. Multiple SAARC countries like India, Nepal, Bangladesh exchange rate has been colored differently so that they can be distinguished easily. All the data collected here is been compared to dollar.

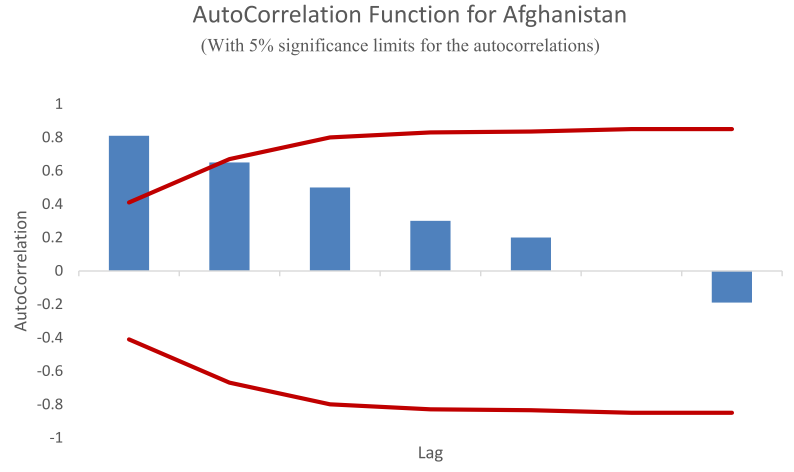
In Fig. 1. we can see that the currency exchange rate of Bangladesh and Sri Lanka follows an upward trend. While currency exchange rate of Afghanistan, India, Pakistan, Nepal, Bhutan, and the Maldives follows an upward and downward trend. So the currency exchange rate of all SAARC countries is non-stationary.

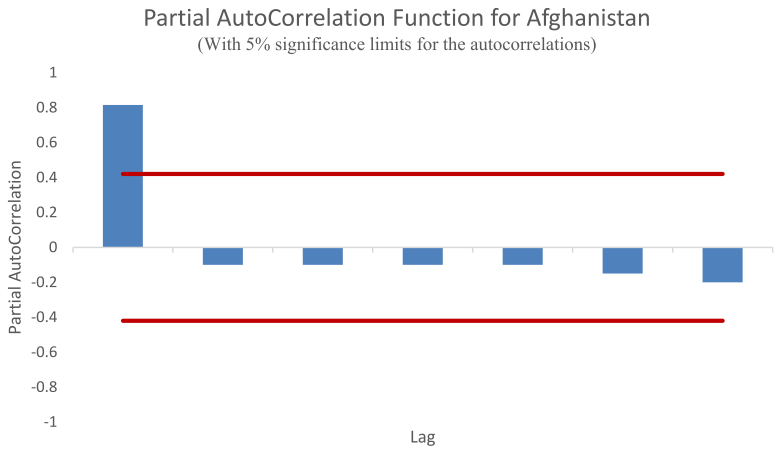
3.2. Correlogram test (graphical analysis)

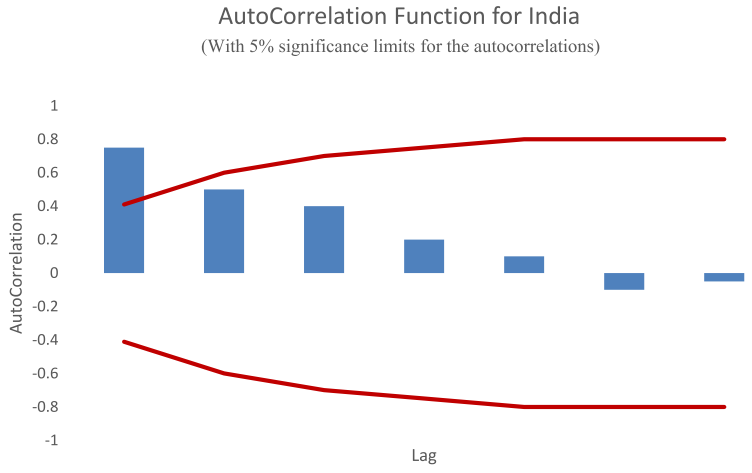
This analysis deals with various countries on Autocorrelation function and Partial Autocorrelation function of the currency exchange rate of various countries of SAARC Countries. 7 lags have been considered for this analysis [26,27].








Partial AutoCorrelation Function for Afghanistan
(With 5% significance limits for the autocorrelations)
Partial AutoCorrelation
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
Lag


AutoCorrelation Function for India
(With 5% significance limits for the autocorrelations)
AutoCorrelation
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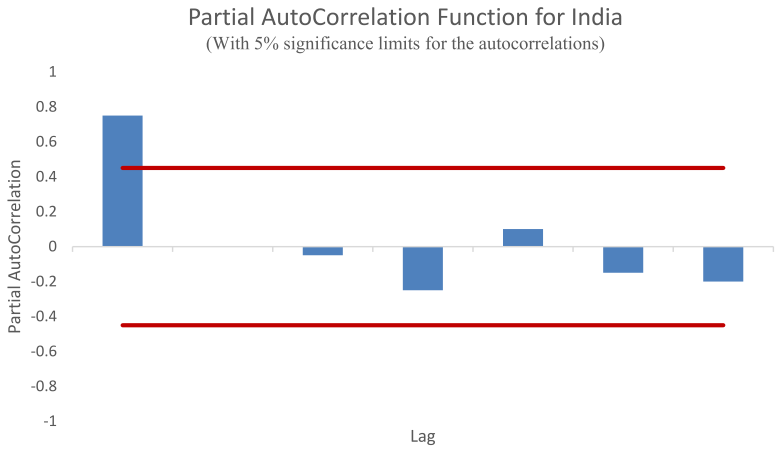
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
Lag


Partial AutoCorrelation Function for India
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0.4
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0
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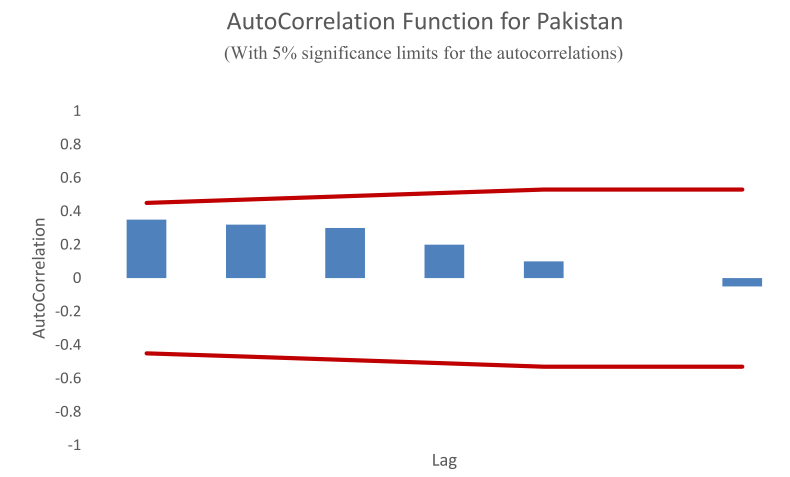
-0.4
-0.6
-0.8
-1
Lag


AutoCorrelation Function for Pakistan
(With 5% significance limits for the autocorrelations)
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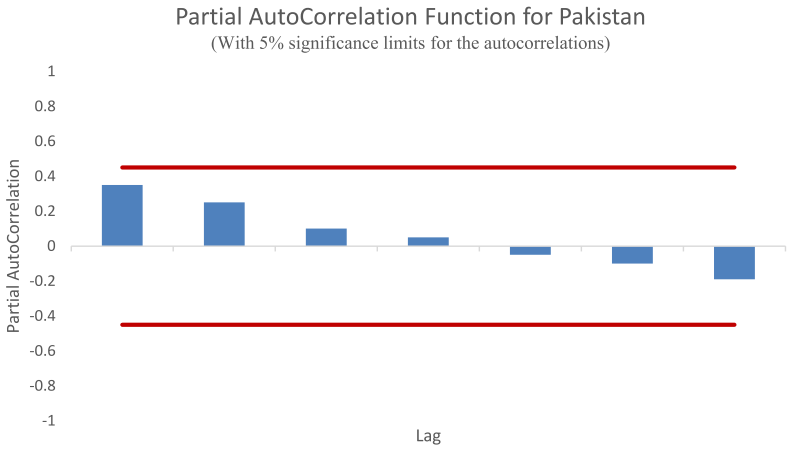
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
Lag


Partial AutoCorrelation Function for Pakistan
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0
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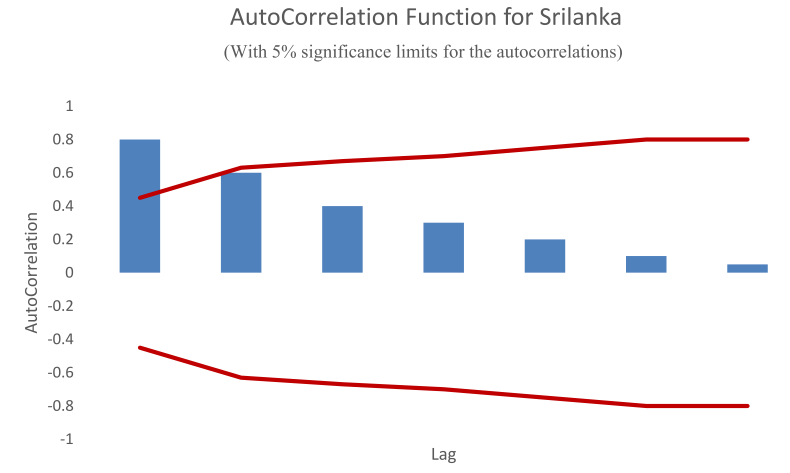
-0.4
-0.6
-0.8
-1
Lag


AutoCorrelation Function for Srilanka
(With 5% significance limits for the autocorrelations)
AutoCorrelation
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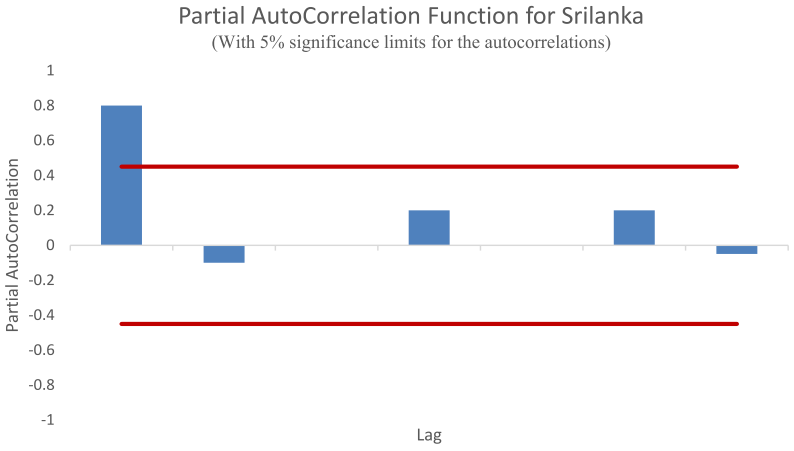
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
Lag


Partial AutoCorrelation Function for Srilanka
(With 5% significance limits for the autocorrelations)
Partial AutoCorrelation
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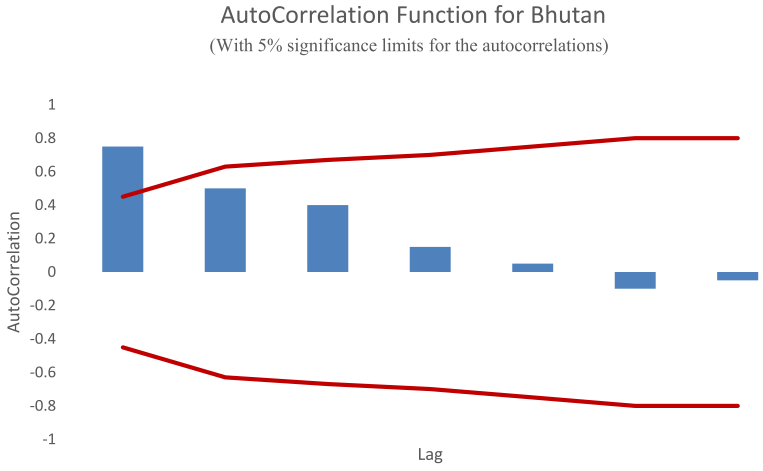
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
Lag


AutoCorrelation Function for Bhutan
(With 5% significance limits for the autocorrelations)
AutoCorrelation
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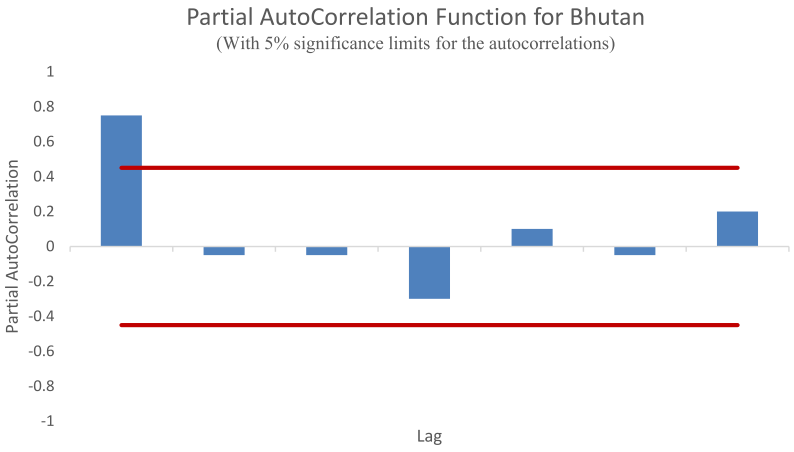
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
Lag


Partial AutoCorrelation Function for Bhutan
(With 5% significance limits for the autocorrelations)
Partial AutoCorrelation
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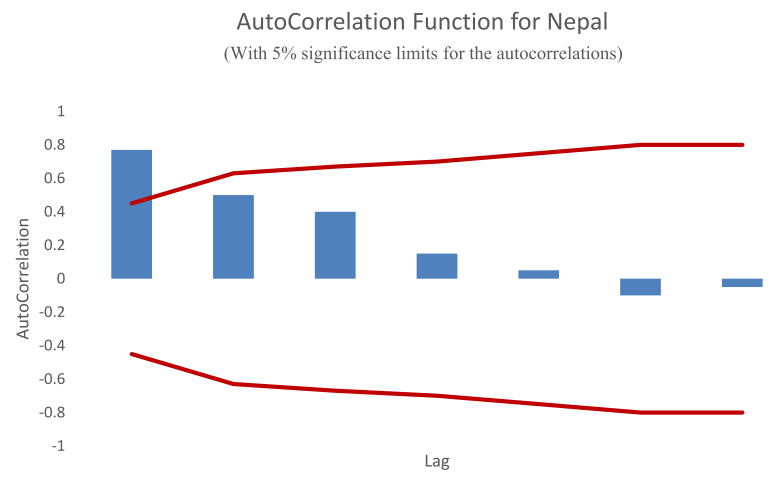
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
Lag


AutoCorrelation Function for Nepal
(With 5% significance limits for the autocorrelations)
AutoCorrelation
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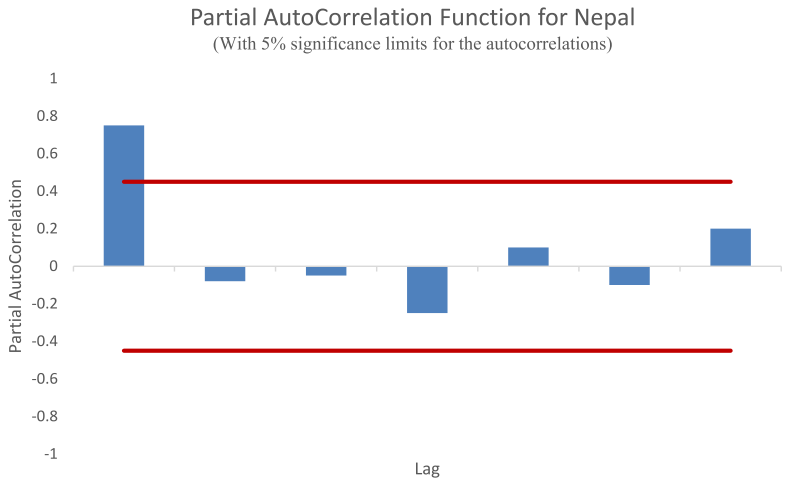
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
Lag


Partial AutoCorrelation Function for Nepal
(With 5% significance limits for the autocorrelations)
Partial AutoCorrelation
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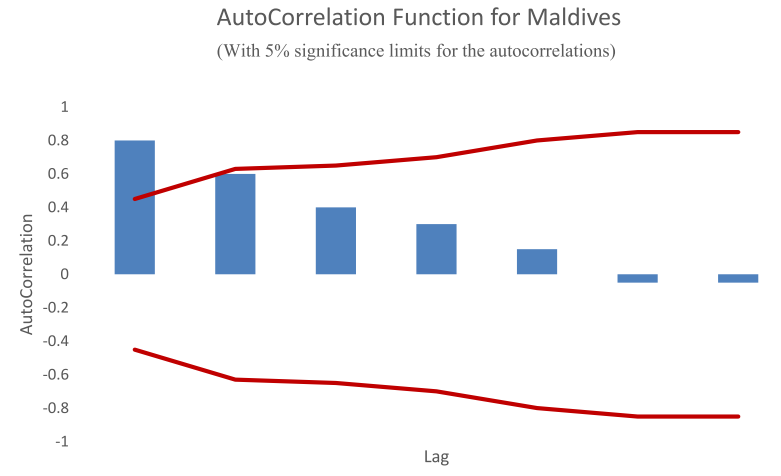
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
Lag


AutoCorrelation Function for Maldives
(With 5% significance limits for the autocorrelations)
AutoCorrelation
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0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
Lag

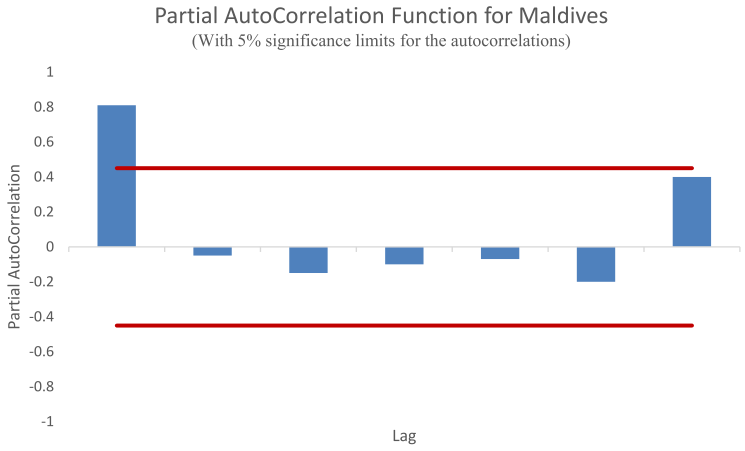

Table 1
Unit Root Test for Different Countries of Currency Exchange Rate where.

Currency Name	Calculated Value	Tabulated Value	Decision
Afghani	-4.335965	-3.029970	Rejected
Indian Rupee	-5.919998	-3.029970	Rejected
Pakistani Rupee	-20.99676	-3.029970	Rejected
Sri Lankan Rupee	-5.382531	-3.029970	Rejected
Ngultrum	-5.361040	-3.029970	Rejected
Nepalese Rupee	-5.303467	-3.029970	Rejected
Maldivian Rufiyaa	-4.595926	-3.029970	Rejected

Table 2
Co-integration test between the currency exchange rate of different countries where.

Currency Name	Calculated Value	Tabulated Value	Decision
AFN VS LKR	-1.24272.	-3.00	not rejected
BTN VS LKR	-1.71202	-3.00	not rejected
INR VS LKR	-1.88108	-3.00	not rejected
MVR VS LKR	-2.32412	-3.00	not rejected
AFN VS BTN	-0.64193.	-3.00	not rejected

Table 3
Volatility Measuring by ARCH Effect where.

Currency Name	Calculated Value	Tabulated Value	Decision
Afghani	0.053775	0.8194	not rejected
Indian Rupee	0.013814	0.9078	not rejected
Pakistani Rupee	0.125294	0.7280	not rejected
Sri Lankan Rupee	0.215234	0.8054	not rejected
Ngultrum	0.312512	0.7243	not rejected
Nepalese Rupee	0.391155	0.5405	not rejected
Maldivian Rufiyaa	0.112446	0.7415	not rejected

From previous graphical analysis, we see that the self-correction coefficient of different lags and the partial self-correction coefficient are very high. Thus we conclude that the time series of the currency exchange rate of SAARC is non-stationary [22,23].

3.3. Unit root test

Above are the entries of different SAARC countries of calculated value and tabulated value. The decision has been given based on their comparison.

From Table 1, we can see that the calculated value is greater than the tabulated value at 5% level of significance for all the currencies of SAARC countries. So we conclude that the series of currencies of SAARC countries is stationary.

From Table 2, the calculated value is less than the set value. We accept the null hypothesis at a value level of 5%. Thus we conclude that the currency exchange rate of Afghanistan and Sri Lanka is not co-integrated.

3.4. Volatility test

The volatility test has been performed on various SAARC countries we have performed different analysis and based on that data decision has been given

From the Table 3, we can see that the calculated value is less than the tabulated value for all the currencies of SAARC countries. So the null hypothesis is accepted**.** So, there is no ARCH effect in the series of currencies of SAARC countries. Thus we may conclude that

Table 4
Estimation Period for the Currency Exchange Rate of Different SAARC Countries.

Country	Model	AIC	Country	Model	AIC
Bangladesh	ARIMA(2,1,1)	1.88033	Sri Lanka	ARIMA(0,2,1)	3.37689
	ARIMA(0,1,0)	1.88373		ARIMA(0,1,0)	3.4433
	ARIMA(0,1,2)	1.8952		ARIMA(1,0,0)	3.46606
	ARIMA(1,0,0)	1.96431		ARIMA(0,2,2)	3.48537
	ARIMA(2,1,2)	1.9781		ARIMA(0,1,1)	3.52356
Afghanistan	ARIMA(0,1,1)	13.9081	Bhutan	ARIMA(0,2,2)	2.50598
	ARIMA1,0,0)	13.9086		ARIMA(1,1,2)	2.54862
	ARIMA(0,1,0)	14.0033		ARIMA(0,1,2)	2.55474
	ARIMA(0,1,2)	14.0546		ARIMA(1,1,2)	2.60046
	ARIMA(1,1,2)	14.0778		ARIMA(0,2,2)	2.65314
India	ARIMA(0,1,2)	2.37263	Nepal	ARIMA(1,1,2)	3.2436
	ARIMA(0,2,2)	2.42602		ARIMA(1,2,2)	3.30671
	ARIMA(1,1,2)	2.47592		ARIMA(0,2,2)	3.39685
	ARIMA(1,2,2)	2.57035		ARIMA(1,2,2)	3.40151
	ARIMA(0,2,2)	2.58244		ARIMA(2,2,2)	3.41271
Pakistan	ARIMA(0,2,1)	5.10956	Maldives	ARIMA(0,1,2)	-0.912075
	ARIMA(1,0,2)	5.30872		ARIMA(0,1,0)	-0.894861
	ARIMA(0,2,2)	5.42182		ARIMA(1,0,0)	-0.868476
	ARIMA(2,0,2)	5.44851		ARIMA(0,2,1)	-0.867983
	ARIMA(0,2,2)	5.52954		ARIMA(0,1,2)	-0.836127

Table 5
Forecasting Currency Exchange Rate of SAARC Countries.

Country	Forecast Year	Forecast Value	95% Limits	
			Upper	Lower
Bangladesh	2017	80.2733	75.1747	85.3718
	2018	82.0128	74.3491	89.6765
	2019	83.8634	74.6117	93.1151
	2020	85.6290	74.8167	96.4412
	2021	87.4596	75.4270	99.4922
Afghanistan	2017	-183.56	-2290.06	1922.94
	2018	-419.18	-3312.98	2474.61
	2019	-654.81	-4163.47	2853.85
	2020	-890.43	-4921.24	3140.37
	2021	-1126.06	-5618.73	3366.61
India	2017	69.4135	63.5710	75.2559
	2018	69.5649	63.3375	75.7923
	2019	71.1350	61.5416	80.7284
	2020	72.7051	60.6516	84.7585
	2021	74.2751	60.1848	88.3655
Pakistan	2017	113.563	88.731	138.395
	2018	123.909	88.494	159.324
	2019	135.544	91.805	179.283
	2020	148.469	97.541	199.397
	2021	162.685	105.272	220.097
Sri Lanka	2017	153.046	142.432	163.660
	2018	158.840	143.326	174.354
	2019	164.762	145.138	184.386
	2020	170.811	147.426	194.197
	2021	176.989	150.027	203.951
Bhutan	2017	70.3533	62.6360	78.0706
	2018	72.7626	62.5885	82.9368
	2019	75.2523	62.9163	87.5882
	2020	77.8221	63.4770	92.1673
	2021	80.4723	64.2067	96.7380
Nepal	2017	108.857	97.713	120.001
	2018	112.490	97.626	127.354
	2019	114.111	96.844	131.377
	2020	117.417	97.629	137.205
	2021	119.311	97.603	141.020
Maldives	2017	15.3076	14.1076	16.5076
	2018	15.5353	14.1965	16.8741
	2019	15.7341	14.3931	17.0750
	2020	15.9328	14.5898	17.2759
	2021	16.1316	14.7864	17.4768

Table 6
Measures of Forecast Accuracy under Different Models for Currency Exchange Rate of Different Countries.

Country	Model	Measures of Forecast Accuracy		
		MAPE	MAD	MSE
Bangladesh	Random Walk Model	2.99915	1.93650	5.83962
	Single Exponential Smoothing Model	3.12668	1.98670	7.32034
	Double Exponential Smoothing Model	2.52047	1.66485	5.68662
	Holt Winters' Model	3.7326	2.4738	10.7960
Afghanistan	Random Walk Model	1522	1088	1629798
	Single Exponential Smoothing Model	528	232	1044742
	Double Exponential Smoothing Model	698	340	1026024
	Holt Winters' Model	1843	1385	2666226
India	Random Walk Model	8.2679	4.0039	22.6938
	Single Exponential Smoothing Model	5.8339	2.8801	15.4379
	Double Exponential Smoothing Model	5.1358	2.4985	12.3498
	Holt Winters' Model	10.5835	5.2	39.2030
Pakistan	Random Walk Model	17.598	13.649	500.758
	Single Exponential Smoothing Model	19.681	12.534	522.047
	Double Exponential Smoothing Model	21.273	16.042	914.866
	Holt Winters' Model	51.17	34.76	1475.32
Sri Lanka	Random Walk Model	4.53304	4.3089	27.5001
	Single Exponential Smoothing Model	5.0730	5.0761	38.6901
	Double Exponential Smoothing Model	4.4120	4.3582	28.5110
	Holt Winters' Model	5.8105	6.0670	51.6527
Bhutan	Random Walk Model	8.3798	4.0712	23.5722
	Single Exponential Smoothing Model	5.3452	2.6470	14.5020
	Double Exponential Smoothing Model	5.8410	2.7436	13.0816
	Holt Winters' Model	11.0672	5.4586	43.7521
Nepal	Random Walk Model	8.3669	6.3752	56.4699
	Single Exponential Smoothing Model	4.8023	3.8019	32.4874
	Double Exponential Smoothing Model	5.5623	4.0945	30.4840
	Holt Winters' Model	10.3845	8.0822	96.8607
Maldives	Random Walk Model	3.90627	0.51101	0.38889
	Single Exponential Smoothing Model	1.86309	0.25598	0.40178
	Double Exponential Smoothing Model	2.40744	0.32347	0.40178
	Holt Winters' Model	3.82658	0.53115	0.61112

the volatility is absent in the time series of the currency exchange rate of SAARC countries, which indicates that the variance of the time series is not varied [20,21].

Table 4 compares the results of fitting different models to the data. The model with the lowest value of the Akaike Information Criterion (AIC) is model, which has been used to generate the forecasts (Table 5).

From Table 6, we see that based on all measures, the maximum model of currency rate was MAD, MSE, MAPE are the smallest for the double exponential smoothing model than the other model. So double exponential smoothing model can be used to predict and smooth the series of the currency exchange rates with the other three models [24,25].

4. Discussion

There are various methods to forecast time series data for future periods, but these are not appropriate for forecasting if time series data are non-stationary [18,19]. In this paper, the model with the lowest value of the Akaike Information Criterion has been used to generate the forecasts. We also tested the Autoregressive Integrated Moving Average (ARIMA) model to forecast exchange rates. These studies outlined that the ARIMA model is a comparatively accurate model to forecast the exchange rate.

The measure of forecast accuracy under four models for the Currency Exchange Rate of SAARC countries. There are models used in the study like the Random walk model, Single exponential smoothing, Double exponential smoothing, and Holt winter's method. By using these models, we forecast the currency exchange rate of SAARC countries and compare the model based on MAPE, MAD, and MSE. Based on all data, we see that the maximum model of currency exchange rate where MAD, MSE, and MAPE are the smallest for the double exponential smoothing model than the other model [28–30].

According to the forecasting results of this research, SAARC countries of currency rates increase continuously. For investors, the above results suggest that there is no way to hedge against the deterioration of financial conditions in any area. It can also be used for further investigating the link between international financial linkages and currency exchange rate behavior in future work.

5. Conclusion

In line with the predictable results of this study, SAARC's international foreign exchange earnings are increasingly increasing for traders, the above results suggest that there is no fence around the deteriorating financial situation in any region during a period of crisis. The objective of this study was to analyze the importance of the currency in the overall economy of the region. It was also focused on

analyzing the factors that affect the stress level of the individual due to increase in forex exchange. Various improvements need to be considered to improve the economy and life of humans.

Declaration of competing interest

Authors declare that they do not have any conflict of interest.

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