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2020
**2020 Asia-Pacific
Statistics Week**

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Forecasting of International Tourists Arrival in Nepal: An application of ARIMA

Action Area: Modernizing statistical business processes (SD3)
Surveys, data management and uses

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UNITED NATIONS
ESCAP
Economic and Social Commission for Asia and the Pacific



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Introduction

✓ International tourism

Temporary visits across international borders and remains for more than 24 hours (WTO,2008).

- ✓ Leading industries in the world economy.
- ✓ Holds number of employees, participation in social product, national income and total consumption
- ✓ Significant impacts on global economy and gross domestic product (GDP).
- ✓ contribute directly or indirectly to all of the sustainable development goals (SDGs)





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- ✓ Among various benefits, the two are:
process of creating jobs and **direct impact on the GDP**.
- ✓ The study in European Parliament Research Service, tourism activities in the **accommodation and food services sector had almost 10 million jobs (4% of total EU employment) in 2013**.
- ✓ Tourism is an important growing profession to many country of the world and forms as growing portion of the world's economy.



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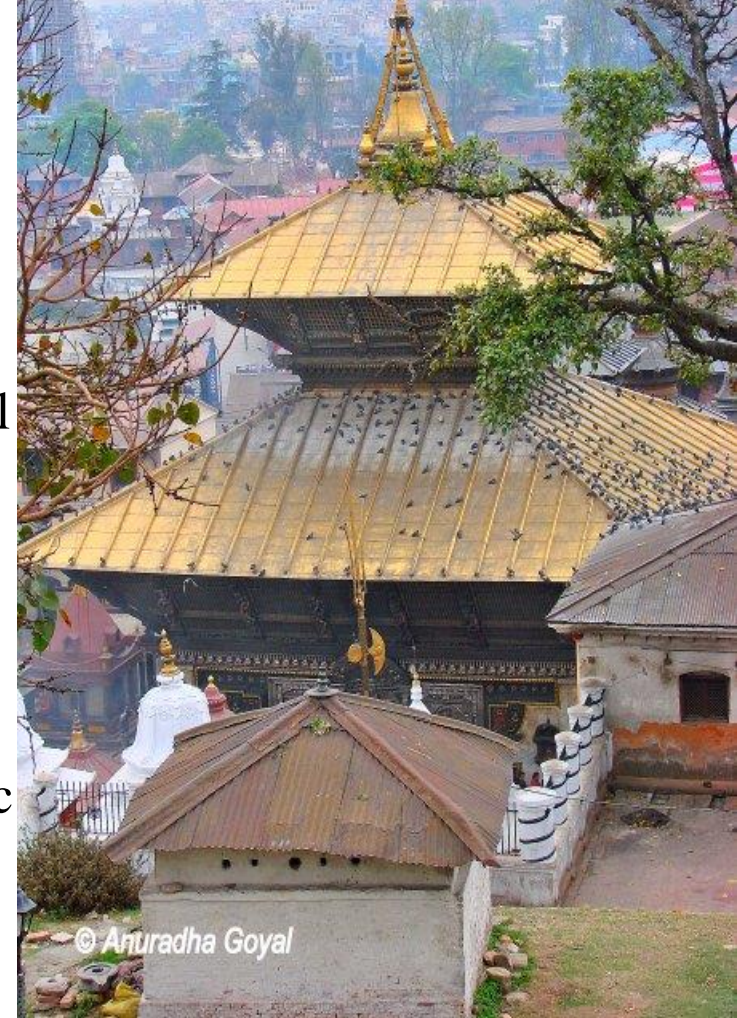
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- ✓ Over 238 million jobs had created by the travel & tourism economy had and contributed to 9.9% of global GDP in 2008, expected to provide more than 296 million jobs and 10.5% global GDP by 2018 (WTTC, 2017).
- ✓ To be able to create a massive volume of job vacancies and can contribute to growing the other macroeconomic indicators like GDP.





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Objective

✓ To predict the international tourist arrivals to Nepal in the year 2019 and 2020.

✓ The results useful for tourist industry of Nepal.

✓ The tourist industry has been impacted on processing of job generation, revenue, GDP and directly or indirectly to all sustainable development goals (SDGs).





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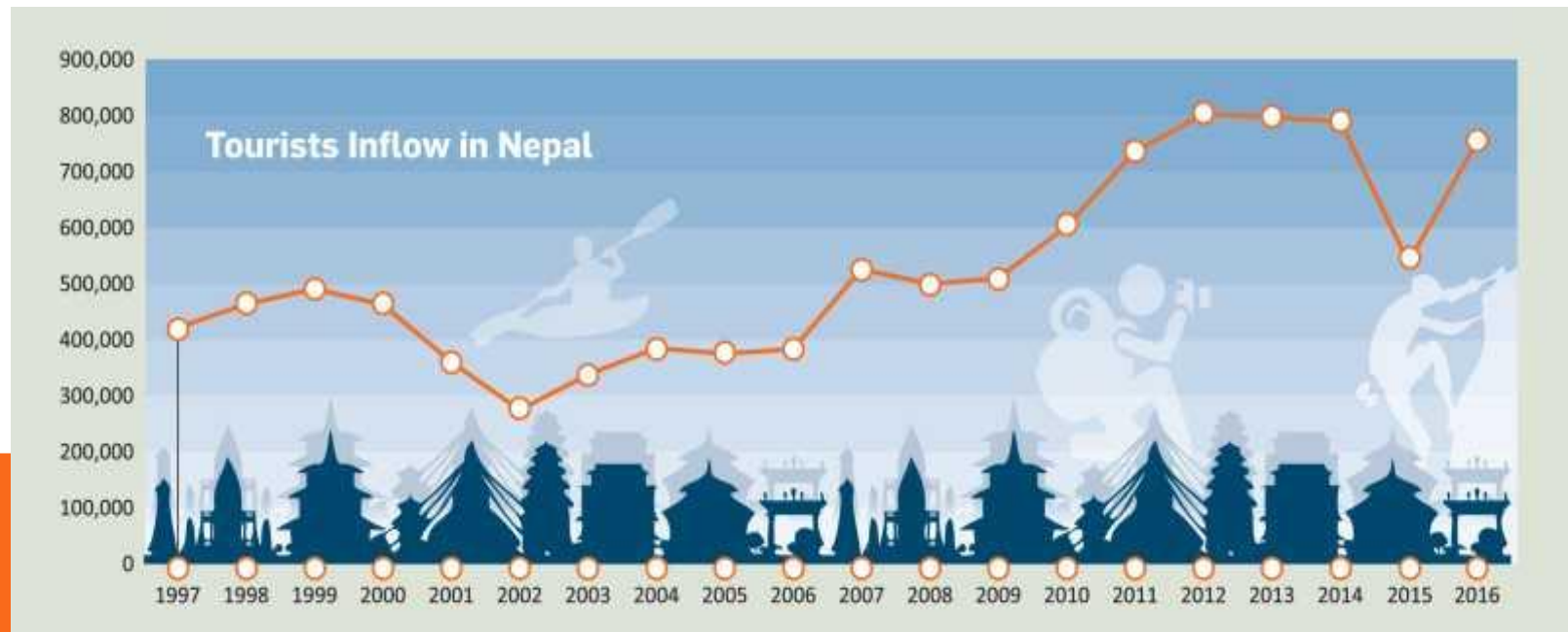
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II. Methodology

Data

Ministry of Culture, Tourism & Civil Aviation Planning & Evaluation Division
Research & Statistical Section, Nepal.

Data from 1993 to 2018 years.





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II. Methodology

Model

- ✓ In statistics and econometrics, particularly in time series analysis, an autoregressive integrated moving average (ARIMA) model is a generalization of an autoregressive moving average (ARMA) model.
- ✓ Both of these models are fitted to time series data to predict future points.
- ✓ ARIMA models are employed in cases where data show evidence of non-stationary.





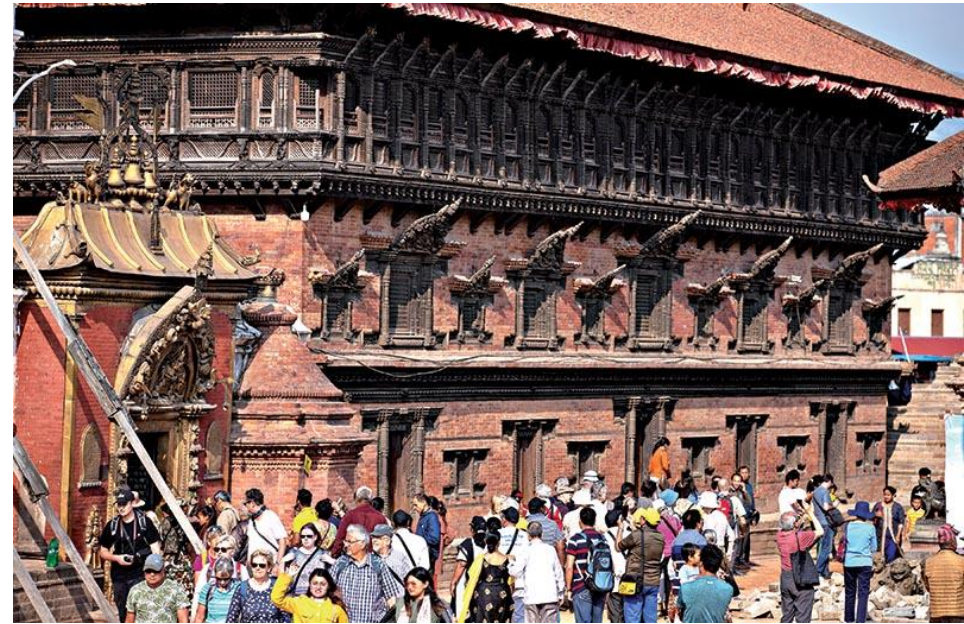
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II. Methodology

An autoregressive-moving average ARMA (p,q) model has an autoregressive type component or an average moving type component.

The model is given as

$$Y_t = a_0 + a_1 Y_{t-1} + a_2 Y_{t-2} + \dots + a_p Y_{t-p} - b_1 \varepsilon_{t-1} - b_2 \varepsilon_{t-2} - \dots - b_q \varepsilon_{t-q} + \varepsilon_t$$



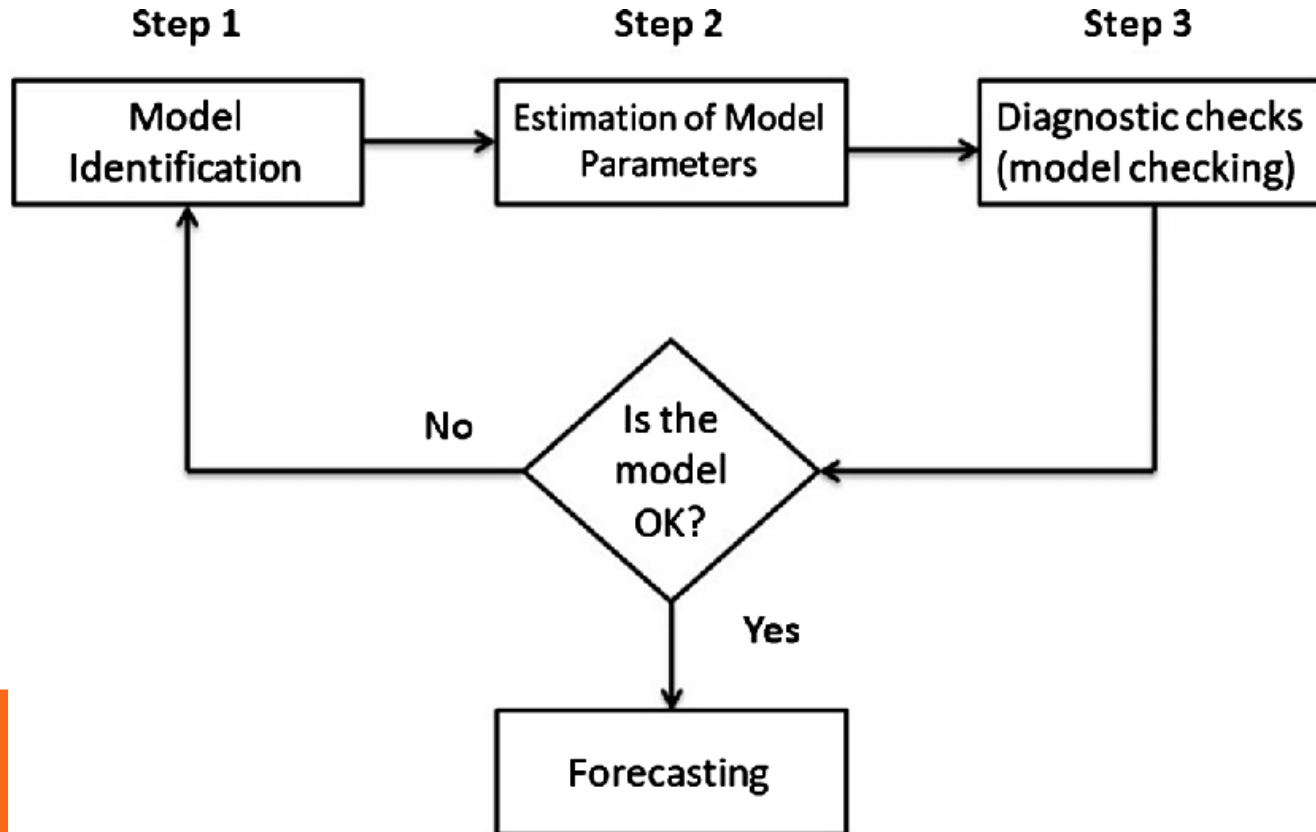


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Box-Jenkins Methodology





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Ljung-Box Test

The Ljung–Box test may be defined in term of hypothesis as:

H₀: The data are independently distributed (absence of serial correlation)

H_a: The data are not independently distributed (presence of serial correlation).

The test statistic is,

$$Q = n(n + 2) \sum_{k=1}^h \frac{\hat{\rho}_k^2}{n - k}$$

Where, n = sample size,

$\hat{\rho}_k$ = sample autocorrelation at lag k ,

and h = number of lags being tested





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Bayesian Information Criterion (BIC)

- ✓ Bayesian information criterion (BIC) is a criterion for model selection among a finite set of developed models. Lower the BIC value, better the model is.

Mathematically BIC can be written as: $BIC = \ln(n)k - 2\ln(\hat{L})$;

Where, \hat{L} = maximum value of likelihood function of the model,
 n = number of data points,
 k = number of free parameters to be estimated.



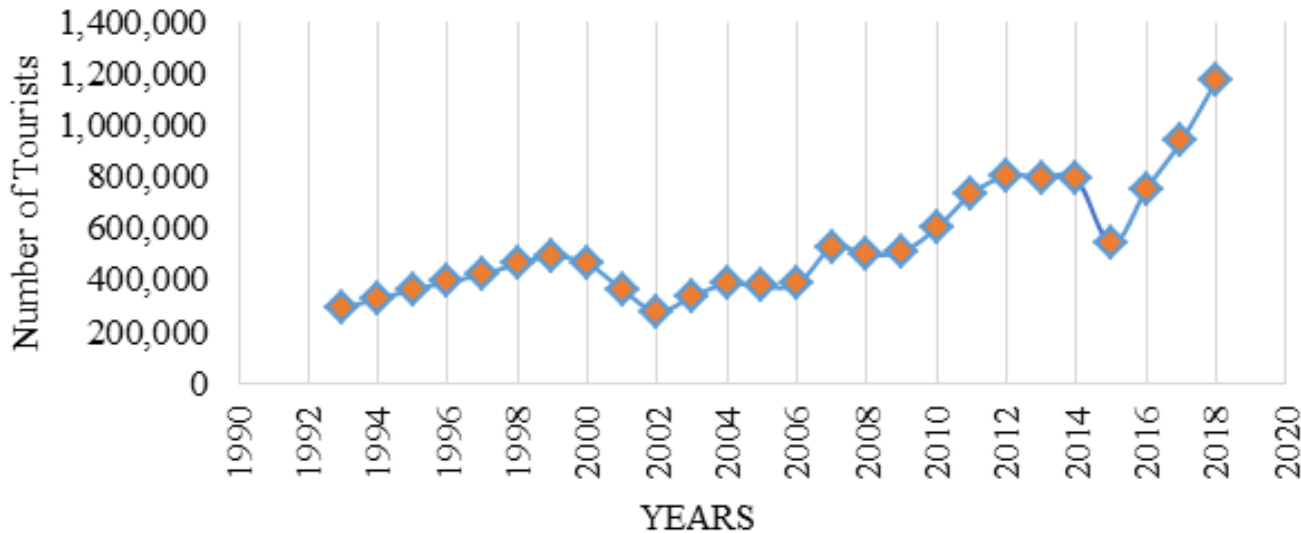


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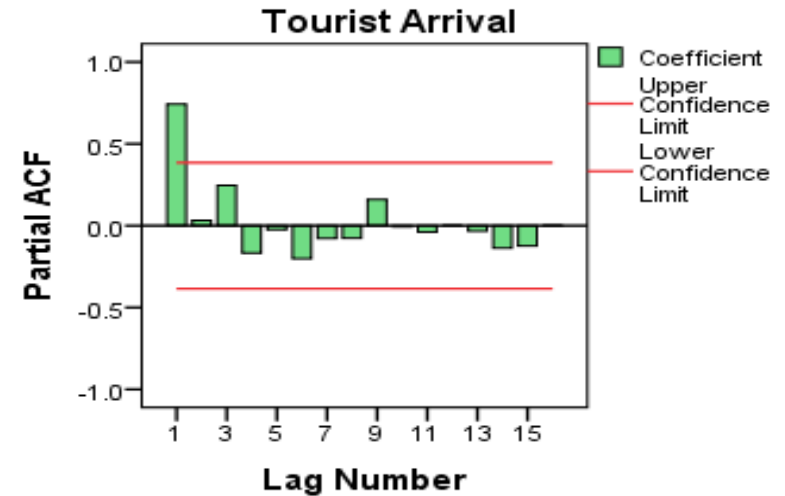
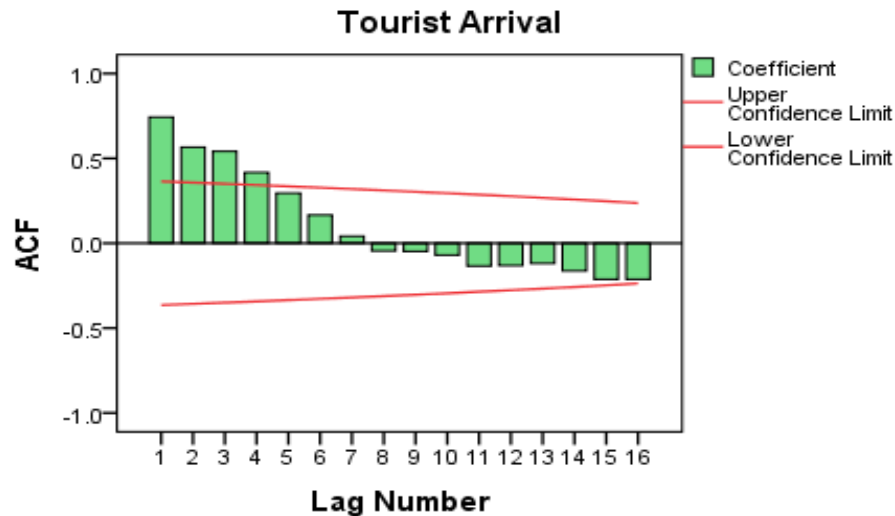
III. Results



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III. Results



- ✓ This figure shows high correlations, all of them are statistically significant and sizable even at higher-lags, and slowly decreasing. This is a definite indication of non-stationary series



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Autocorrelation and partial autocorrelation

Lag	Autocorrelation	Partial Autocorrelation	Ljung-Box Statistic		
			Value	df	p-value
1	0.703	0.703	14.405	1	0.000
2	0.480	-0.030	21.381	2	0.000
3	0.359	0.065	25.469	3	0.000
4	0.410	0.279	31.031	4	0.000
5	0.340	-0.130	35.043	5	0.000
6	0.266	0.019	37.626	6	0.000
7	0.159	-0.071	38.596	7	0.000
8	0.031	-0.229	38.635	8	0.000
9	-0.042	0.006	38.711	9	0.000
10	-0.099	-0.115	39.154	10	0.000
11	-0.144	-0.082	40.157	11	0.000
12	-0.206	-0.018	42.371	12	0.000
13	-0.204	0.031	44.697	13	0.000
14	-0.240	-0.081	48.202	14	0.000
15	-0.285	-0.060	53.580	15	0.000
16	-0.305	-0.003	60.369	16	0.000

The Ljung-Box statistics are also statistically significant shows non-stationery series.



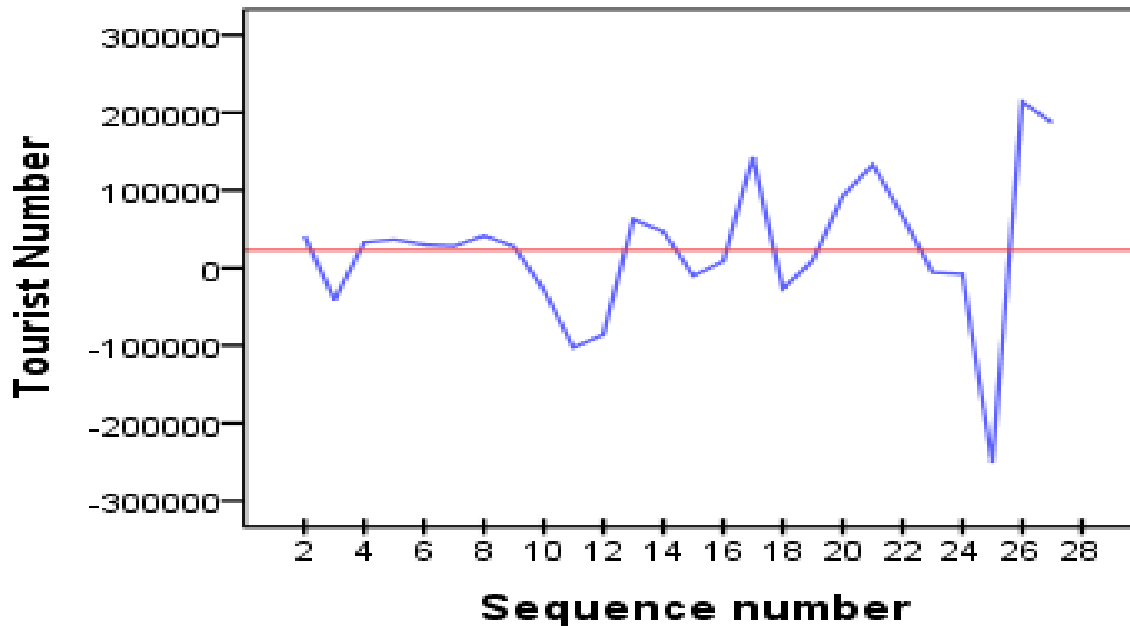


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III. Results



Graph of first differencing



- ✓ The first difference of the time series should be a stationary time series which can be presented in above figure. The plot shows mean and variance fairly constant over time, the strong indications of stationary series

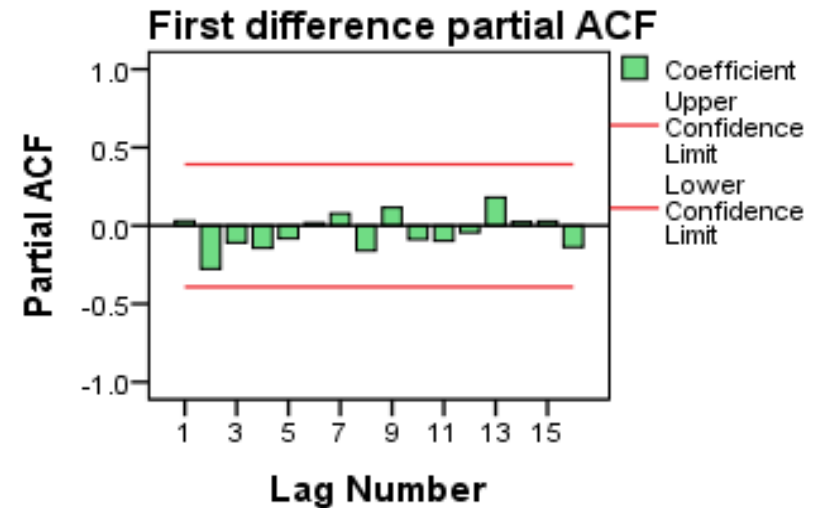
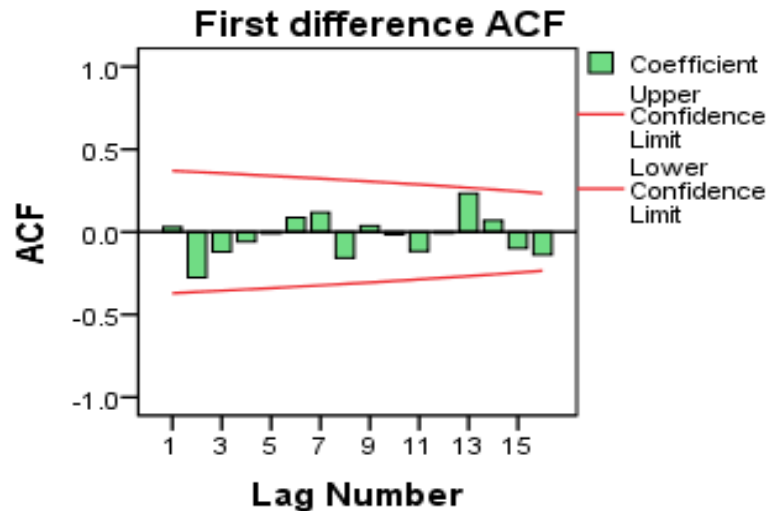


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III. Results



- ✓ Figure reveals that there is no partial autocorrelation coefficient above the critical level of significance;
- ✓ that indicates the absence of non-stationary data series and the necessity of change, implying the differentiation of order 1 for these variables when applying a regression analysis.



Model Adequacy

- ✓ No fixed algorithm in establishing an exact ARIMA (p,d,q) model optimally; it is necessary to complete an iterative process through which the 3 parameters will take different values.

Model	Model Fit statistics			Ljung-Box Statistic			Number of Outliers
	R ²	MAPE	Normalized BIC	Statistics	d.f.	p-value	
Tourist No. Model_1	0.81	13.458	23.614	13.980	16	0.600	0

- ✚ Best-Fitting Models according to R-squared, MAPE and Normalized BIC (larger R², smaller MAPE and smaller Normalized BIC indicates better fit)

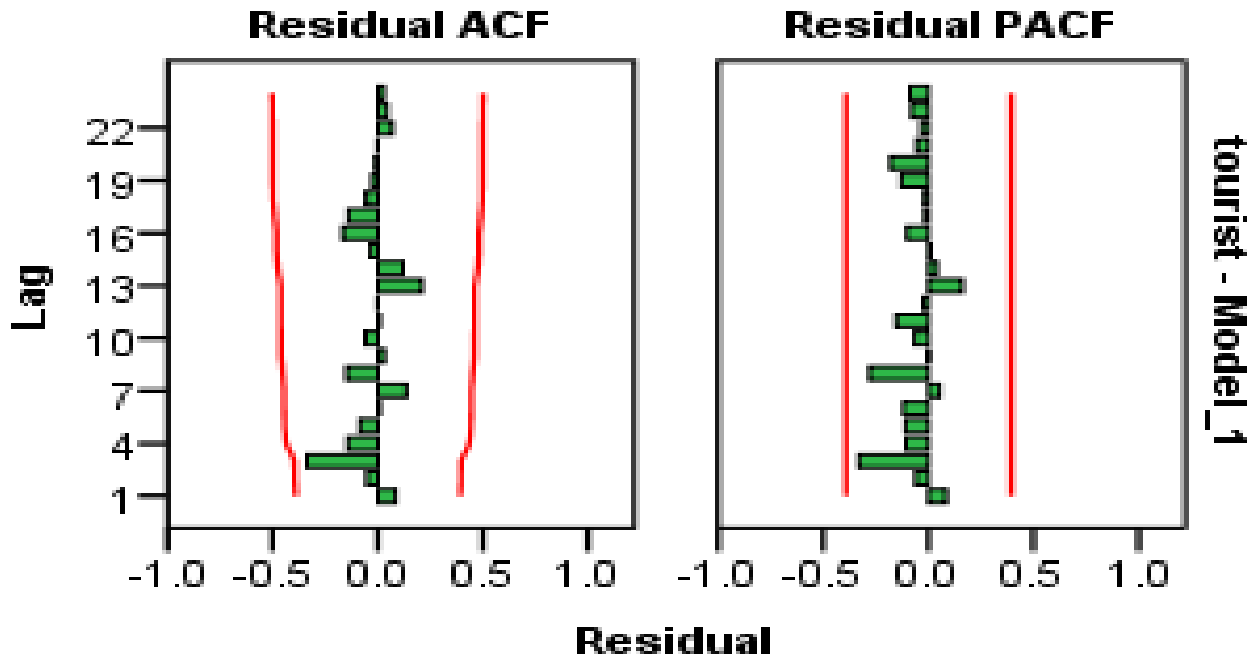


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Residual Analysis



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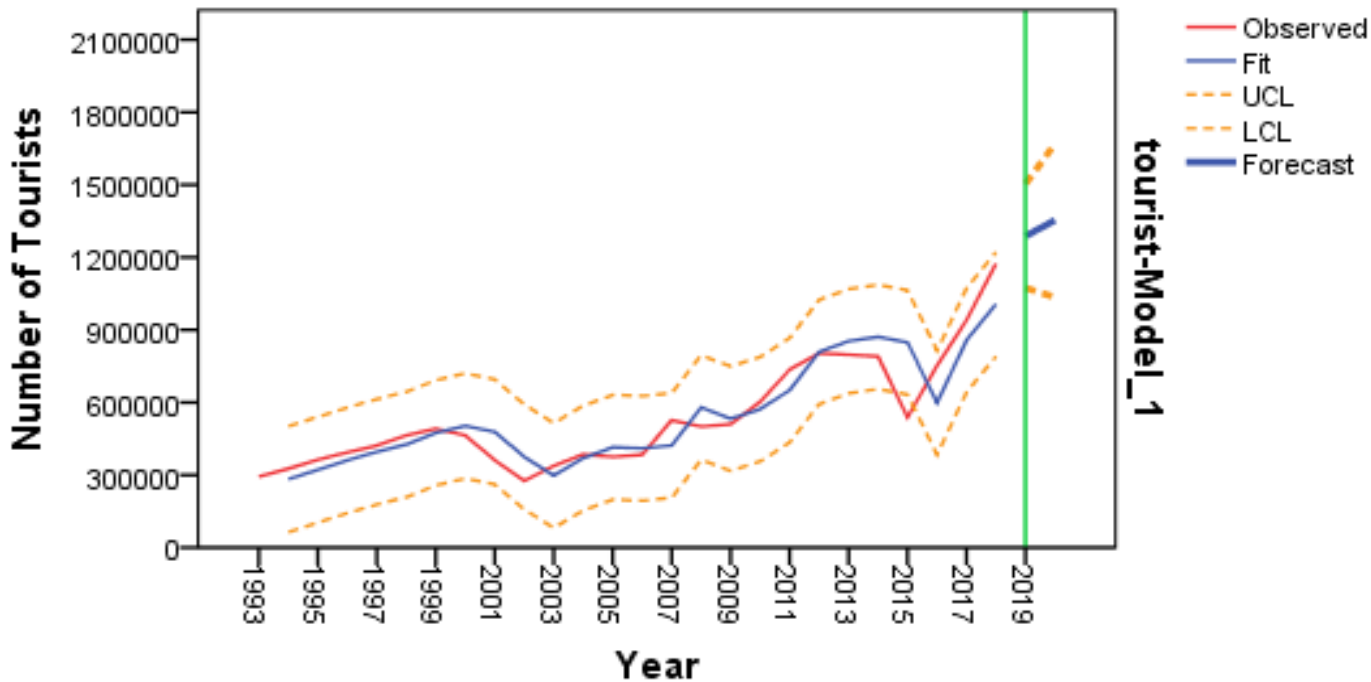


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Forecasting by ARIMA (1,1,1)



Model		2019	2020
Tourist No.-Model_1	Forecast	1,288,564	1,353,133
	UCL	1,503,735	1,670,868
	LCL	1,073,393	1,035,398



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IV. Conclusions

- ✓ Tourism in Nepal plays a significant role in strengthening the economy, particularly in terms of job creation and contribution on GDP.
- ✓ As per the latest trends shown in figure, tourist arrivals is raising, implying tourism industry is raising and its effects contribute to the real economic growth by stimulation of the growth of GDP, creating new jobs, motivating entrepreneurship, encouraging investment etc.
- ✓ This research forecasts that the upward trend in the international tourism demand will continue in the near future, pointing to positive impulses and outlooks of a continuous increase by 2020.
- ✓ Clearly, higher the tourists, in general higher the economic growth is.



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IV. Conclusions

- ✓ Tourism can impact at community level, can play the role of national poverty reduction by promoting entrepreneurship and small businesses, and empowering less favored groups, particularly youth and women.
- ✓ The paper clarifies that the proposed model does not deliver ‘the solution’, but only supports in finding international tourists.
- ✓ Can not do the job all by the model but outcomes may be presented as a framework.



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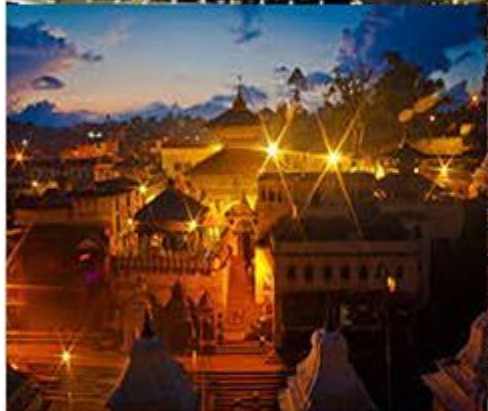


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NEPAL



THANK YOU



TOURISM



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