MATRIX Academic International Online Journal of Engineering and Technology
Volume VI Issue I, ISSN: 2348-3326

Forecasting Number of Inbound Tourists in India Adopting ARIMA Model

Manik Arora

Department of Management and Social Sciences, Amity University in Tashkent, Uzbekistan

Abstract .his study focuses on estimating the occurrence of inbound tourists in India using univariate time series econometrics, the ARIMA model in particular. The tourism industry plays a significant role in India's economy, making accurate forecasts essential for effective planning and decision-making. The ARIMA model is known for its ability to analyze time series data, making it an appropriate tool for predicting future tourist arrivals. Data from previous years of inbound tourist arrivals in India, including factors such as historical trends, seasonality, and economic conditions, is utilized form world bank open data. The ARIMA model will be employed to capture the patterns and correlations within the data, enabling the prediction of future tourist numbers accurately. By adopting this forecasting model, policymakers, tourism authorities, and industry stakeholders can make informed decisions regarding infrastructure development, resource allocation, marketing strategies, and policy formulations. This research aims to contribute to the tourism sector by providing reliable insights into the future trends of inbound tourism in India, facilitating sustainable growth and development in the industry.

Keywords: Inbound tourism in India, Forecasting, Time Series modeling, ARIMA Model

1 Introduction

Over the years, India's tourist industry has experienced tremendous expansion and development, making a major economic contribution to the country. India is a popular travel destination for millions of travelers from around the globe because of its rich cultural legacy, varied landscapes, and historical sites. India's ability to accommodate the interests of every visitor is one of the main reasons for boosting the country's tourist industry. India has a wealth of things to see and do, from the majestic Taj Mahal to the calm beaches of Goa and Kerala to the gorgeous hill towns of the Himalayas. In addition, visiting national parks and animal sanctuaries like Ranthambore and Kaziranga offers the chance to take in the distinctive flora and fauna of the nation.

 DOI No: 10.21276/MATRIX.2023.6.1.2

The Indian government has launched several programs to increase travel, such as the "Incredible India" campaign, which highlights the nation's natural beauty and cultural variety. Additionally, e-visas have simplified travel to India and encouraged hassle-free admission. The Ministry of Tourism reports that 10.89 million foreign visitors visited India in 2019, an increase of 9.8% over the previous year [15], [16]. Additionally, in that same year, the tourism industry added 9.2% to India's GDP and employed millions of people. Numerous factors impact Indian tourism and contribute to the country's rise in appeal as a travel destination. These elements include government initiatives, infrastructure development, cultural heritage, natural attractiveness, and advantageous economic circumstances.

India's many natural features are one of the main drivers of tourism in the country. Travelers from all over the world are drawn to the area by its natural beauty and opportunities for adventurous pursuits including hiking, wildlife safaris, and water sports. The rich cultural legacy of India also has a big impact on travel [5]. Numerous historical monuments, UNESCO World Heritage Sites, and historic temples can be found throughout the nation, demonstrating the creative architecture and rich cultural diversity of the place.

The development of infrastructure and government initiatives are key factors in the growth of tourism in India. The government has also made investments to upgrade traveler-friendly amenities, lodging choices, and transportation systems, which will facilitate tourists' exploration of the nation. Exchange rates and a healthy economy affect Indian tourism as well. India is a popular vacation destination for backpackers and visitors on a tight budget because of its relatively low cost of living and depreciating currency.

1.1 Literature Review

[17] determine the primary factors influencing the demand for travel to India. They do this by using econometric approaches like regression models. The study considers several variables that affect the quantity of visitors, such as income, currency rates, the quality of the transportation system, political stability, and tourism laws. The study's conclusions identify several important factors that influence Indian tourists' desire for travel. The correlation between income levels and tourism activities is evident, with greater incomes being positively correlated with increasing tourism both domestically and globally. The demand for tourism is also found to be significantly influenced by the exchange rate, with a more favorable rate drawing more tourists to the nation [1], [2], [6], [7], [8]

The relationship between tourist development and economic growth in India is examined in paper by [13]. The paper sheds light on the potential financial advantages of tourism for the Indian economy by presenting empirical evidence and conclusions based on in-depth data analysis. After a thorough review of pertinent literature and prior research, [13] propose a theoretical framework emphasizing the beneficial correlation between economic progress and the development of tourism. They list several ways that tourism can boost economic activity, including foreign exchange gains, investment inflows, the creation of jobs, and the improvement of infrastructure. They use a range of statistical methods, such as vector error correction models (VECM) and cointegration analysis, to look at the short- and long-term dynamics between India's economic growth and tourism development [11].

[4] offers a thorough analysis of the body of research on tourism and employment, emphasizing the contribution of the tourism industry to job creation. Additionally, it highlights the distinctive qualities of the Indian tourist sector and its potential to significantly boost employment. Using secondary data from a variety of sources, including the International Labour Organization (ILO), the Ministry of Tourism in India, and the World Travel and Tourism Council (WTTC), the researchers used an empirical analysis technique. Since the data was gathered over a long period of time, it was possible to conduct a thorough analysis of the employment trends related to India's tourism industry. The analysis's main conclusions point to a strong correlation between Indian tourism and job creation. According to the study, the tourism industry, with its many subsectors including lodging, travel, and transportation, significantly boosts national employment. The study also emphasizes the possibility of tourism-related knock-on effects, which could help other areas of the Indian economy.

[12] look on the worries that travelers have. The aim of this empirical study is to examine the many elements that lead to travelers' concerns and comprehend how they affect the travel and tourism sector. The study employs a thorough research methodology that involves gathering data from 450 foreign visitors to well-known tourist locations. The researchers were able to obtain important insights into the issues that affect travelers' decision-making processes using both structured questionnaires and in-person interviews. The results highlight several important issues that are frequently raised by visitors.

The goal of the study by [3] is to forecast monthly foreign visitor arrivals (FTAs) to India by comparing several quantitative models. The models that are taken into consideration in this case are the seasonal autoregressive integrated moving average (SARIMA) model, the grey models, the vector error correction (VEC) model, and the Naive I and II models [9], [10]. Additionally, a model based on the simple average (SA) approach combining of single forecast data has been used. A comparison of these models' forecasting abilities under the mean absolute percentage error (MAPE) and U-statistic (Ustat) criteria has been conducted. Comparing the combination model to the other separate time series models examined here, empirical results indicate that the combination model forecasts FTAs to India more accurately.

In the current era of globalization, technological advancement, and sustainable development, seasonality in visitor arrivals is regarded as a major policy concern that impacts the world tourism sector by causing volatility in demand and earnings. Prediction attempts for policymaking are distorted by the seasonal component in a time-series. In this regard, offering a precise technique for generating a trustworthy estimate of the number of international visitors arriving is crucial. The effectiveness of the Holt-Winters and Seasonal ARIMA models for predicting the number of foreign visitors to India was assessed in this study [14]. The projection for the period of July 2018 to June 2020 was prepared using data on inbound tourism from India from January 2001 to June 2018.

1.2 Research Question

It is evident that the efforts of the government are towards increasing the tourist's activity via various initiatives. Within this it becomes important to plan for proper infrastructure, management, and strategies for future intake of the inbound tourists. Therefore, it becomes relevant for the policy makers to estimate the expected number of flows of tourists in coming times, especially after the drop during the pandemic years. This paper attempts to forecast the number of inbound tourists in India based on yearly observation on total number of tourists arriving in India. This is expected to provide support and guidelines to the policy makers to take appropriate measures in future.

2 Methodology

We collect the data from the world bank open data on the number of arrivals of foreign tourists in India from 1995-2019. Since we are having yearly observations over the period, we adopt time series modeling using Auto Regressive Integrated Moving Average (ARMA) model to forecast the number of tourists for the coming 5 years. The steps involved in the analysis are as follows:

The first step is to investigate the characteristics of the series by visualizing the data in the timeline graph. It is expected to help identify the presence of any trends, cycles, or seasonality in the data. Further to see the patterns of Auto Regressive process and Moving Average process, we adopt the Auto Correlogram and Partial Auto Correlogram Functions. This helps to decide the order of the AR and MA process as present in the series. The Augmented Dicky-Fuller test will be conducted to look at the stationarity of the series as it is one of the most important aspects to implement the ARIMA model. If the series requires a differencing, it will be done as per the unit root test. Different models of different orders will be fitted, and the best will be chosen based on AIC and BIC criterion. After fitting the best model, the forecast will be performed.

3 Results and Discussion

Figure 2 below shows the data obtained from 1997 to 2019 in a timeline graph.

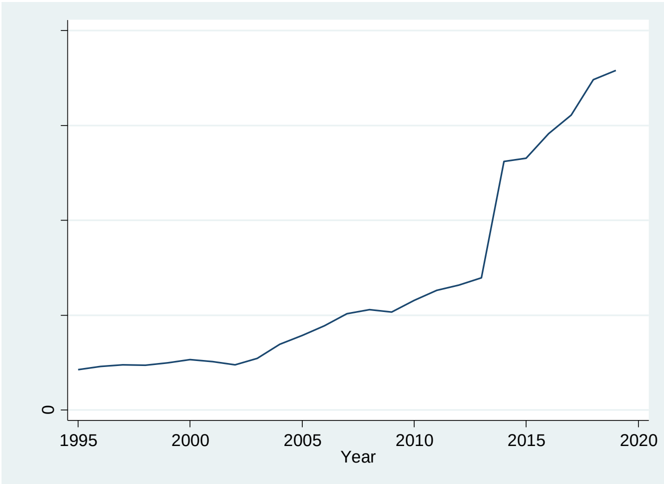

Fig. 1. Timeline Graph Number of Inbound Tourists

The graph indicates a clear increasing trend over the period of time. Looking more closely, it also reveals that there are no sesonal patterns in the series as the fluctiations and absent in the data. Tentatevely this indicates that seasonal ARIMA is not needed however AR patterns must be present. It may also have the error terms correlated. To insure, we plot the ACF and PACF as shown in figure 3 and 4 below.

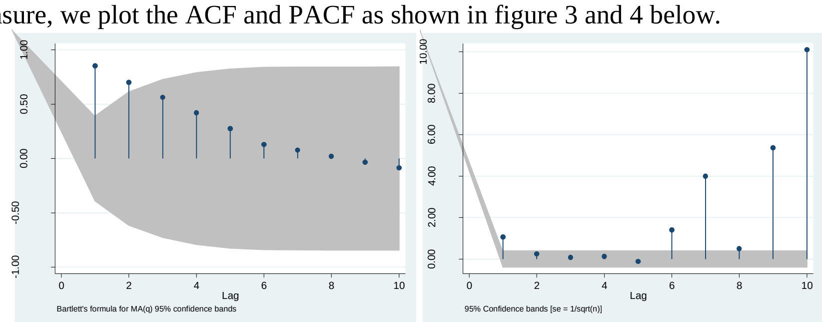

Fig. 2. & 4: ACF Pot and PACF Plot

As expected, the ACF plot shows the presence of an Auto Regressive pattern in the series. It is confirmed from the decreasing patterns of the spikes at almost each interval. However, the PACF plot indicates no such patterns meaning the MA process may not be relevant in this case. To check the stationarity of the series, the ADF test is conducted, initially on the original series and then on the first difference. The results show that the series is stationary at the first difference as reported below with p value less than .05 at firs difference.

The P value at first difference being less than 0.05 confirms that the series in stationary at the first difference. Therefore, while deciding the d order we will choose 1. In addition, since the AC plot suggested the presence of AR order, we first choose AR order to be 1 and MA to be 0 as PACF plot indicates no presence of MA process in the series. Thereby, we first fit the ARIMA model of order (1,1,0). The results are shown in table below:

ARIMA regression ARIMA (1,1,0)

```
  Sample:  1997 - 2019                            Number of obs     =
23
                                                Wald chi2(1)        =
29.36
  Log likelihood = -359.3847                      Prob > chi2       =
0.0000

  ------------------------------------------------------------------------
--------------------
  D2.                       |                 OPG
  numberofinboundtourists |       Coef.   Std. Err.       z     P>|z|
[95% Conf. Interval]
  ------------------------+-----------------------------------------------
--------------------
  numberofinboundtourists |
                    _cons |   38638.09   271045.2     0.14   0.887    -
492600.7    569876.8
  ------------------------+-----------------------------------------------
--------------------
  ARMA                      |
                       ar |
                      L1. |   -.561653   .1036498    -5.42   0.000    -
.7648028   -.3585032
  ------------------------+-----------------------------------------------
--------------------
                   /sigma |     1467050      132142     11.10    0.000
1208056     1726044
  ------------------------------------------------------------------------
--------------------
```

The AR coefficient at first lag is significant at 1% and the coefficient of constant is significant at almost 10% level. The model is expected to produce a reliable forecast as per the results. However, it needs to be tested for an alternative model as well. Therefore, we also run ARIMA (0,1,0) model as well considering no presence of AR order. The results are as follows:

ARIMA regression ARIMA (0,1,0)

```
  Sample:  1997 - 2019                            Number of obs     =
23
                                                Wald chi2(.)        =
.
  Log likelihood = -363.8579                      Prob > chi2       =
.

  ------------------------------------------------------------------------
--------------------
  D2.                       |                 OPG
  numberofinboundtourists |       Coef.   Std. Err.       z     P>|z|
[95% Conf. Interval]
```

```
------------------------+-------------------------------------------
--------------------
numberofinboundtourists |
                  _cons |     14217.4    375215.2      0.04    0.970
-721191    749625.8
------------------------+-------------------------------------------
--------------------
                 /sigma |     1795814    125908.6     14.26    0.000
1549038     2042591
--------------------------------------------------------------------
--------------------
```

Model 2 although gives significant coefficient for the constant term but fails to report the probability for the model. To choose between the two models, therefore it is important to look at the AIC and BIC criterion. We chose the model with the lowest AIC and BIC statistics. The results are reported in the table below.

Akaike's information criterion and Bayesian information criterion

```
--------------------------------------------------------------------
--------
Model |        Obs          (model)     df       AIC             BIC
-------------+------------------------------------------------------
--------
Model 1        23      -359.3847        3       724.7694
728.1759
Model 2   23 -363.8579    2       731.7157      733.9867
--------------------------------------------------------------------
--------
```

As the statistics indicate, the first model (ARIMA (1,1,0)) has lower AIC and BIC values. Relying on this we will produce the forecasts based on the results of model 1.

Given the results of model 1 following are the forecast of the number of inbound tourists in India for coming 5 years.

Year	No. of Tourists#	In Millons*
2019	17914000	18.9
2020	19200000	19.2
2021	20200000	20.2
2022	21400000	21.4
2023	22500000	22.5
2024	23700000	23.7

Actual
*Forecasted

The forecasted values are plotted against the actual values in the graph below:

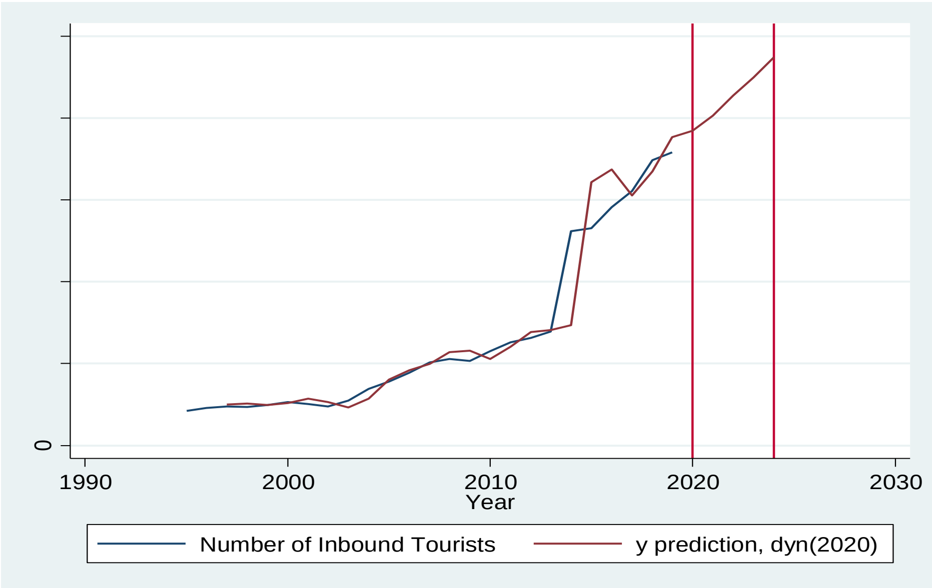

Fig. 3. Actual and Predicted values.

The blue line in the figure above represents the actual data points and the red one indicates the predicted values form the model (ARIMA (1,1,0)). The predicted values closely follow the actual series indicating the strength and robustness of the model that we fit. Thereby the forecasted value for coming years seems to be highly reliable.

4 Conclusion

In conclusion, the forecasting of the number of inbound tourists in India utilizing the ARIMA (1,1,0) model holds great potential for accurately predicting future trends. The ARIMA model has proven to be an effective tool in time series analysis and forecasting, aiding decision-making processes for businesses and policymakers in the tourism industry. By incorporating historical data and trends, the ARIMA (1,1,0) model can capture the complex patterns and seasonality observed in the number of inbound tourists in India. It considers both the trend and seasonality components of the data, providing a comprehensive picture of the expected future influx of tourists. The accuracy of the ARIMA (1,1,0) model is further enhanced by its ability to account for short-term fluctuations and variations in the data, providing a more reliable estimate of the number of inbound tourists. This is crucial for stakeholders in the tourism sector as it allows them to make informed decisions regarding resource allocation, marketing strategies, and infrastructure development.

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