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Forecasting the Number of Visitors of the Museums and Ruins by Using Time Series Analysis: The Case of Turkey

Müze ve Ören Yeri Ziyaretçi Sayılarının Zaman Serisi Analizi ile Tahmin Edilmesi: Türkiye Örneği

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Abstract

***Objectives**: As cultural places, museums and ruins are inseparable parts of the creation process of cultural and historical identity. The cultural heritage products covered by museums and ruins can be thought as a representation of a community and its highest values and truths. It is precisely for these reasons that the interest shown to museums and ruins can give clue for future plans of the cultural institutions in a country. The aim of this research is to forecast the number of visitors to the museums and ruins until 2037 in Turkey. **Method**: The research material consists of data about the number of visitors of the museums and ruins, between 2001 and 2019 in Turkey. The data were obtained from the Turkish Statistical Institute (TÜİK). Research data was analysed under the framework of Auto Regressive Integrated Moving Average (ARIMA) time series analysis in order to predict the future numbers of visitors to museums and ruins. **Findings**: The research findings show that time series contain highly usable estimates which indicate an increasing trend for the number of visitors to the museums and ruins in Turkey. **Implications**: In addition to practical implications, the present study is expected to contribute to the literature. **Originality**: The findings can also allow comparative studies, in which the issues about physical and digital users are compared, for museums and ruins which are willing to convert their content to digital platforms.*

***Keywords:** Numbers of visitors; museum visitors; ruin visitors; cultural areas; time series analyses.*

Öz

***Amaç**: Kültürel yerler olarak müzeler ve kalıntılar kültürel ve tarihi kimliğin yaratılmasının ayrılmaz bir parçasıdır. Müzeler ve kalıntılar tarafından kapsanan kültürel miras ürünleri, bir topluluğun ve onun en yüksek değerlerinin ve gerçeklerinin temsili olarak düşünülebilir. İşte tam da bu nedenlerle müzelere ve ören yerlerine gösterilen ilgi, bir ülkedeki kültür kurumlarının gelecek planları için ipucu verebilir. Bu araştırmanın amacı Türkiye'de 2037 yılına kadar müze ve ören yerlerini ziyaret edeceklerin sayısını tahmin etmektir. **Yöntem**: Araştırma materyali, Türkiye'deki müze ve ören yeri ziyaretçi sayılarına ilişkin 2001-2019*

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yılları arasındaki verilerden oluşmaktadır. Veriler Türkiye İstatistik Kurumu'ndan (TÜİK) alınmıştır. Araştırma verileri, gelecekte müzelere ve ören yerlerine gelecek ziyaretçi sayısını tahmin etmek için Bütünleşik Otoregresif Hareketli Ortalama (ARIMA) zaman serisi analizi çerçevesinde çözümlenmiştir. ***Bulgular****: Araştırma bulguları, zaman serilerinin Türkiye'deki müze ve ören yerlerini ziyaret edenlerin sayısındaki artış eğilimine işaret eden oldukça kullanışlı tahminler içerdiğini göstermektedir.* ***Sonuç****: Pratik sonuçlara ek olarak, bu çalışmanın literatüre katkı sağlaması beklenmektedir.* ***Özgünlük****: Bulgular, içeriklerini dijital platformlara dönüştürmek isteyen müzeler ve ören yerleri için fiziksel ve dijital kullanıcılarla ilgili konuların karşılaştırıldığı karşılaştırmalı çalışmalara da olanak sağlayabilir.*
Anahtar Sözcükler: *Ziyaretçi sayıları; müze ziyaretçileri; ören yeri ziyaretçileri; kültürel alanlar; zaman serisi analizleri.*

Introduction

Culture is a traditional, social, innovative, continuous and unique heritage (Rumina and Kishwar, 2010, p. 10). Museums and ruins where tangible and intangible cultural heritage are exhibited are very valuable for the cultural heritage of the countries. In the widely used definitions, museum is described as a place where objects are provided, protected, exhibited, and visitors are given the opportunity to study, research and have fun. In 2007, International Council of Museum (ICOM, 2021) defines museum as non-profit and permanent institution which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage for the purposes of education, study and enjoyment. In a similar vein, Merriam Webster (2019) describes museum as "an institution devoted to the procurement, care, study, and display of objects of lasting interest or value". As Arinze (1999, p. 1) mentioned, the role of the museum is to collect objects and materials of cultural, religious and historical importance, preserve them, research into them and present them to the public for the purpose of education and enjoyment. On the other hand, ruins can be defined as the places where historical structures, spaces or cities are located and presented to the visitors. Ruins and museums are the places which reflect how art, culture and civilization developed while they also give clue about the development of humankind in the area where they are settled and its social organization (Sureka, 2013, p. 2).

Today, museums and ruins provide cultural and historical information for all visitors with information-oriented exhibitions and educational activities. They also respond to the cultural and physiological needs of the visitors with their shops, restaurants, exhibitions and seminar halls. With all these activities, museums and ruins contribute to the cultural economy of the countries by increasing the tourism potential and employment (Sureka, 2013; Yau, 2001).

Museums and ruins have things, which tell the story of history created by nature or man. These two cultural places reflect intercultural relations as well as historical and cultural products of the nations. Through their programmes and activities, the museums and ruins can train their visitors. Visiting of the museums and ruins can be a guide to retrieve information about history and culture. This situation encourages reusing of cultural heritage, and creating cultural heritage of the future. Museums and ruins are among the most important part of cultural tourism. While cultural tourism increases the recognition of collections stored in museums and ruins, museums and ruins emerge as alternative places for tourism, by increasing the number of

tourists, and thus provide economic income to the region where they are located (Chan, 2009, pp. 7-9). All of these factors are supposed to help national growth, creativity and development.

While visitation is one of the core purposes considered for a museum, museum studies are mostly theoretical; the rate of empirical studies on visitors is quite low (Kirchberg and Tröndle, 2012, p. 435). Empirical studies on museums generally focus on users' characteristics, perceptions and behaviours. Almost none of the studies deal with forecasting of the number of visitors to the museums and ruins in the literature. Living museum and ruin services require a sufficient number of visitors and their sustainable interest. By knowing the quantity of visitors, developed museum and ruin services can be provided across the country through good planning. It can also play a decisive role on the processes such as determining the number of visitors to museums and ruins, managing the operations in these areas, planning for future applications and increasing promotion techniques. Yeh and Lin (2005, p. 7) claimed that, the growth of museums requires a better understanding of visitors. In this regard, knowing their numbers, their demographic features, their special interest, etc. can be informative to grow them. Museums and ruins are trying to attract cultural tourists. In order to increase visitor numbers and survive in the future, museums need to know potential visitor numbers. Therefore, visiting estimation can be useful for future plan. Knowing visitor numbers in advance is also important for staff operating at a museum and a ruin. Data about visitor numbers can highlight what days of the week and potentially what seasons of the year people visit museums and ruins. The times of heavy use can be considered predictive due to the fact that they can inform appropriate levels of staff and resource deployment and also strategies. The peak usage times can inform appropriate levels of staff and resource deployment and also strategies. Moreover, assessing trends and changes in numbers of visitors over years can be used to evaluate demanded performance of museums and ruins.

The aim of this research is to forecast the number of the visitors to the museum and ruins until 2037 in Turkey. The findings of this research can be useful for enhancing the number of visitors to the museums and ruins; and finally, for the development of cultural heritage-based tourism. The findings can also allow comparative studies, in which the issues about physical and digital users are compared, for museums and ruins which are opting to convert their content to digital platforms. This study is also expected to contribute to the limited literature on this topic.

Museums and Ruins in Turkey

Museums and ruins of Turkey are organized under the body of the Ministry of Culture and Tourism, the General Directorate of Cultural Assets and Museums (KVGM). Cultural heritage objects situated in museums and ruins have potential appeal to boost the cultural tourism demand in Turkey (Kervankıran, 2014, p. 348). Today, 199 museums and 143 organized ruins still serve as touristic, educational and scientific institutions under the Ministry of Culture and Tourism in Turkey (Kültürel miras 2019, 2020). According to the statistical indicators (2001-2019) data published by the Turkish Statistical Institute - TÜİK, a considerable progress has been made in the field of museum in Turkey. Twenty-eight new museums were founded between 2001-2019. The quantitative distribution of museums on the basis of provinces in Turkey shows that the cities home to the most museums are İstanbul with 76 museums, Ankara

with 46 museums and İzmir with 27 museums. On the other hand, the eight cities that do not have a museum are Artvin, Ardahan, Iğdır, Tunceli, Bingöl, Muş, Siirt and Şırnak (Kültür istatistikleri 2019, 2020).

As it is seen on Table 1, the number of museums in Turkey was 467 in 2019. Out of these, 199 museums were affiliated to the Culture and Tourism Ministry, while 268 of them fall in the private museum category. Number of works increased almost every year. The total number of works affiliated to the Culture and Tourism Ministry was 3.263.251. On the other hand, there were 408.649 works in private museums in 2019.

Table 1

Number of museums in Turkey

	Number of museums			Number of works		
Year	Total	Museums affiliated to Culture and Tourism Ministry	Private museums	Total	Museums affiliated to Culture and Tourism Ministry	Private museums
2001	171	171	-	2.733.657	2.733.657	-
2002	177	177	-	3.095.034	2.744.257	350.777
2003	180	180	-	3.128.694	2.775.194	353.500
2004	270	176	94	3.160.895	2.800.643	360.252
2005	245	156	89	3.127.294	2.790.566	336.728
2006	273	175	98	3.180.068	2.866.303	313.765
2007	247	165	82	3.044.570	2.767.149	277.421
2008	286	159	127	3.287.444	2.989.749	297.695
2009	304	183	121	3.412.581	3.044.197	368.384
2010	334	185	149	3.382.226	3.096.599	285.627
2011	339	189	150	3.431.177	3.149.982	281.195
2012	347	188	159	3.516.491	3.177.446	339.045
2013	350	187	163	3.531.656	3.174.867	356.789
2014	392	192	200	3.591.566	3.217.173	374.393
2015	409	193	216	3.628.715	3.235.113	393.602
2016	417	193	224	3.685.609	3.311.359	374.250
2017	438	199	239	3.692.915	3.306.073	386.842
2018	451	200	251	3.734.223	3.337.766	396.457
2019	467	199	268	3.671.900	3.263.251	408.649

Source: Kültür istatistikleri 2019, 2020.

Museums and ruins are very famous for cultural tourism in Turkey. Every year museums and ruins have numerous visitors. Table 2 and Table 3 show the most visited museums and ruins in Turkey in 2019.

Table 2

Most visited museums in Turkey in 2019

Name of the museum	Number of visitors
Hagia Sophia, Istanbul	3.727.361
Mevlana Museum, Konya	3.464.155
Topkapı Palace, Istanbul	2.364.946
Hacıbektas Veli Museum, Nevşehir	592.727
Museum of the Republic Ankara	515.309
Arkeological Museum, Istanbul	427.643
St. Nicholas (Santa Claus) Church and Museum, Antalya	384.893
Zeugma Mosaic Museum, Gaziantep	367.395
Ataturk Congress and Ethnography Museum, Sivas	345.760
Museum of Anatolian Civilizations, Ankara	327.695

Source: Kültür Varlıkları ve Müzeler Genel Müdürlüğü, 2019.

Hagia Sophia was the most visited museum in the year of 2019 in Turkey. Hagia Sophia had over a million visitors when it was compared with the number of visitors in 2018. Mevlana Museum and Topkapı Palace were among the other mostly visited museums in 2019.

Table 3

Most visited ruins in Turkey in 2019

Name of the ruin	Number of visitors
Denizli Pamukkale Hierapolis	2.557.863
Ephesus İzmir	1.855.694
Nevşehir Goreme Cappadocia	1.403.444
Çanakkale Troia	583.491
Nevsehir Kaymaklı Underground City	632.970
Aksaray Ihlara Valley	566.917
Nevsehir Derinkuyu Underground City	456.369
Sanliurfa Gobeklitepe	400.195
Antalya Aspendos	320.856
Antalya Myra Ruins	274.605
Antalya Olympos Ruins	251.085
Antalya Phaselis Ancient City	237.962

Source: Kültür Varlıkları ve Müzeler Genel Müdürlüğü, 2019.

Denizli Pamukkale Hierapolis was the most visited ruins in the year of 2019 in Turkey. It was visited by 2.557.863 people. Ephesus and Cappadocia were the other popular ruins. They had more than one million visitors in 2019.

When the number of visitors of the museums and ruins in 2019 are evaluated on the basis of provinces, it can be said that İstanbul (7.798.283), Nevşehir (3.805.388), Konya (3.666.108), Antalya (3.087.871), İzmir (3.059.225), Denizli (2.887.050), Ankara (986.538), Muğla (982.924), Çanakkale (838.991) and Şanlıurfa (729.966) are the top ten ranked cities (Kültür ve Turizm Bakanlığı Döner, 2019).

In the museums of Turkey, archaeological and ethnographic artifacts and coins are the objects mostly exhibited. Museums affiliated to many institutions and organizations, including those belonging to the Ministry of Culture and Tourism, serve within the framework of a 360-degree panoramic museum approach (T.C. Kültür ve Turizm Bakanlığı, 2020). Developments in the field of informatics have resulted in virtual museum applications. Virtual museums bring many advantages such as increasing interest in cultural assets and museums, and allowing cultural assets to become more accessible and recognizable by people (Styliani, Fotis, Kostas and Petros, 2009, p. 520). However, in Turkey, digitalisation process is very problematic and also access of the digital objects are very limited.

The development of the museum and historical services offered on digital platforms requires being aware of the number of physical visitors to museums and historical sites. Estimating the number of visitors in advance can also be beneficial in terms of determining the future strategies related to museum and historical site visits.

Methodology

The aim of this study is to model the series of visitors' numbers of museum and ruins in Turkey between 2001-2019 with Box-Jenkins methods and to evaluate the predictions of these models. Regarding museums and ruins, predicted data about visitor numbers may be important for works and functions such as planning, organization, management, and rearrangement of visitor services. Predicted visitor numbers may also be significant for future plans of cultural heritage institutions. These reasons may be shown as motivational factors of the study. Research data encompasses the number of visitors to the museums and ruins of Turkey between the years of 2001 and 2019. Secondary data obtained from TÜİK was used within the scope of the research. Since it is the institution that provides the recorded and shared data on the number of museum and ruin visitors, the data of the research is limited with the data of the TÜİK. SPSS version 25.0 was used for analysis. Table 4 shows the number of visitors to museums and historical sites per years (Kültür istatistikleri 2019, 2020).

Table 4

Visitor numbers of museums and ruins

Year	Total
2001	17.971.247
2002	17.269.739
2003	15.765.033
2004	16.464.956
2005	21.737.901
2006	18.425.453
2007	20.566.682
2008	26.318.933
2009	27.817.977
2010	30.638.655
2011	35.297.920
2012	36.323.169
2013	37.373.837
2014	37.931.568
2015	37.048.066
2016	25.287.530
2017	30.661.676
2018	40.647.844
2019	51.306.549

Source: Kültür istatistikleri, 2019, 2020.

Time series is a series of observations made periodic time points and this series enable the development of an appropriate model and foreseeable prospects using statistical methods (Tekindal, Güllü, Yazıcı and Yavuz, 2016, pp. 966-967). However, the series should be stationary in order to make better estimates of the future values of a series based on their historical values. Since the non-stationary series contain highly variable and highly fluctuating values, the error rate of the estimates based on these series is quite high (Fischer, 1995). Stability can be defined as a probabilistic process whose average and variance do not change over time and its common variance between two periods depends on the distance between the two periods, not on the period in which this common variance is calculated (Gujarati, 2003; Yenice and Tekindal, 2015, pp. 182-184). Several tests are used to investigate stagnation. The most commonly used methods are; ACF (Autoregressive Correlation Function) and PACF (Partial Autocorrelation Function) graphs of the series and augmented Dickey-Fuller (ADF) unit root test (Dickey and Fuller, 1981).

Box-Jenkins Method

ARMA

This method developed by Box and Jenkins consists of a combination of two different processes. The first process expresses the autoregressive model (AR) and the second process expresses the moving average (MA) process. The Box-Jenkins method is expressed by the ARMA model, a combination of these two models. However, Box-Jenkins method is required

to be stationary series. ARIMA (integrated autoregressive moving average) model is obtained with adding the series to the ARMA model by taking the difference from the d degree for stagnation. This model is widely used in estimating time series events due to its statistical characteristics and model structure (Wickramarachchi et al., 2017, pp. 143-144).

ARIMA

The essence of the Box-Jenkins method is the selection of an ARIMA model with the most convenient but limited number of parameters from a variety of model options, depending on the nature of the available data. As a whole, these models are represented as ARIMA (p, d, q). p: Autoregressive model (AR) degree, q: Moving average model (MA) degree, d: non-seasonal difference taking degree. The ARMA can be indicated in equation (1) (Box and Jenkins, 1976).

$$Y_t = \sum_{i=1}^{q} \beta_i \, \varepsilon_{t-i} + \sum_{i=1}^{p} \alpha_i \, Y_{t-i} + \varepsilon_t \quad \textbf{(1)}$$

Equation (2) is obtained when the difference of the non-stationary X_t series is taken once.

$$\nabla X_t = X_t - X_{t-1} = X_t' \quad \textbf{(2)}$$

If the series X_t is still not stationary, the difference is once again performed and the degree of difference is d = 2.

$$\nabla^2 X_t = \nabla(X_t') = X_t' - X_{t-1}' = X_t - 2X_{t-1} + X_{t-2} \quad \textbf{(3)}$$

If the series is not still stationary, d times difference receiving process is continued until the series is stationary and so the ARIMA (p, d, q) model is obtained (Brockwell and Davis, 2002).

$$X_t = \nabla^d Y_t = (1 - B)^d Y_t \quad \textbf{(4)}$$

Seasonal Box-Jenkins models are generally expressed as ARIMA (p, d, q) (P, D, Q)s. Here P is the degree of Seasonal Autoregressive (SAR) model; D is the number of seasonal differencing operations; Q is the order of Seasonal Moving Average (SMA) model; and s is the period (Gujarati, 2003).

$$(1 - \phi_1 B - \phi_2 B^2 - \cdots . - \phi_p B^p)(1 - \phi_1 B^s - \phi_2 B^{2s} - \cdots . - \phi_p B^{ps})(1 - B)^d (1 - B^s)^D Z_t = (1 - \theta_1 B - \theta_2 B^2 - \cdots . - \theta_q B^q)(1 - \Theta_1 B^s - \Theta_2 B^{2s} - \cdots . - \Theta_Q B^{Qs})\varepsilon_t \quad \textbf{(5)}$$

Hence the autocorrelations decay exponentially at lags 12, 24, 36, etc.

- Partial autocorrelation at lag 12 = ϕ_1.
- After lag 12, they equal 0

SARIMA Models

Seasonal ARIMA (p,q,d) (P,D,Q)s models ARIMA (p,d,q) models relationship is represented as below:

ΦP (B) ϕp (B) [1-Bs] D [1-B] dZt = α + ΘQ (B) θq (B) At. (Schwert, 2015, p. 10).

If we want to understand what is meant by the autocorrelation pattern with two autoregressive polynomials and two moving average polynomials, this model is also used if it is also the difference operator (Tekindal, 2008, pp. 139-140).

It can be said that setting up Box-Jenkins ARIMA models involves four basic steps. In the first step, the general model class is determined. Graphs of autocorrelation and partial autocorrelation functions are used to select the general model. Considering the autocorrelation

and partial autocorrelation functions in Figure 1, the properties of the theoretical functions related to ARIMA models are utilized (Yaman, Sarucan, Atak, Aktürk, 2001, pp. 27).

In the second step, a temporary model matching the structure of the data is determined. Autocorrelation and partial autocorrelation functions are used for this purpose. In the model determination stage, a model is selected from the AR, MA, ARMA or ARIMA model class.

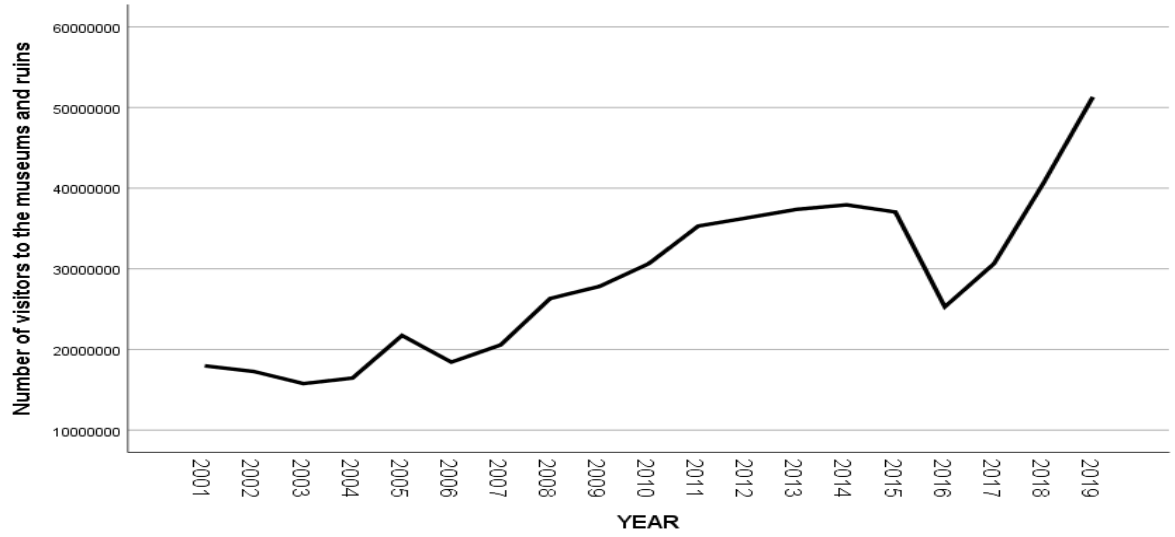
In the third step, the parameters of the transient model are estimated using efficient statistical techniques, and their significance is tested by calculating the standard errors of the coefficients. In the last stage, the conformity check of the determined model for estimation is made. In this context, the autocorrelation function is examined by plotting the autocorrelation coefficients of the errors of the temporary model, which is assumed to be suitable. If the function in question shows a certain shape, it is concluded that the errors are not randomly distributed. Such a finding means that the temporary model determined is not suitable. Therefore, going back to the second stage, this process is repeated until a suitable model is determined with a new temporary model. The model, which passed the conformity check, is now ready to be used for estimation (Yaman et al., 2001, p. 27). Goodness of Fit Criteria Obtained models are evaluated to find fittest one of them. In this context, goodness of fit criteria is determined then the different models compare with each other. R^2 which is in the range of 0-1 is the goodness of fit criterion of the linear model. If the R^2 values are smaller than 0-1 range, this indicate that the model does not have a good fit for the data. Stationary R^2 is preferred for trend or seasonal pattern. A criterion compares the stationary part of the model and the basic model. The Square Root of Mean Square Errors (RMSE), which is the square root of mean square errors, is expected to take smaller values, which show that model forecasting is better. Mean Absolute Percentage Error (MAPE) can be used in the comparison of different series. Mean Average Error (MAE) encompasses the series' own units. Maximum Absolute Error (MaxAPE) indicates the highest error occurring among the forecasted values. It is useful for the worst scenarios among the forecasts. MaxAE shows the maximum absolute error. Normalized Bayesyan Information Criterion (Norm. BIC) is the general measure of the total fit of the model. It provides a comparison between different models when the series are the same, and smaller values indicate a better model (Tekindal et al., 2016, p. 967).

Findings

Time series analysis of the number of people between 2001 and 2019 was carried out in order to estimate the number of visitors to museums and ruins. The time series graph of the number of visitors to the museum and ruins is presented in Figure 1.

Figure 1

Time series graph for museum and ruin visitors



When Figure 1 is examined, it can be said that there are fluctuations and the series is in an upward trend. Seasonality and trend in the series cause the series to be non-stationary. The ACF (autocorrelation) and PACF (partial autocorrelation) graphs of the series are given in Figure 2 and Figure 3 for the study of stability. As it is seen, the series is not stable since more than one delay is outside from the confidence limits. Firstly, the logarithm of the series was taken and the differences between the values of the series would be reduced to partially stabilize. Once the difference was taken for the trend, it was concluded that the series became stagnant. Figure 4, Figure 5 and Figure 6 show the ACF and PACF graphs of the number of visitors to the museum and ruins because of receiving the difference.

Figure 2

ACF graph of the number of visitors to the museums and ruins

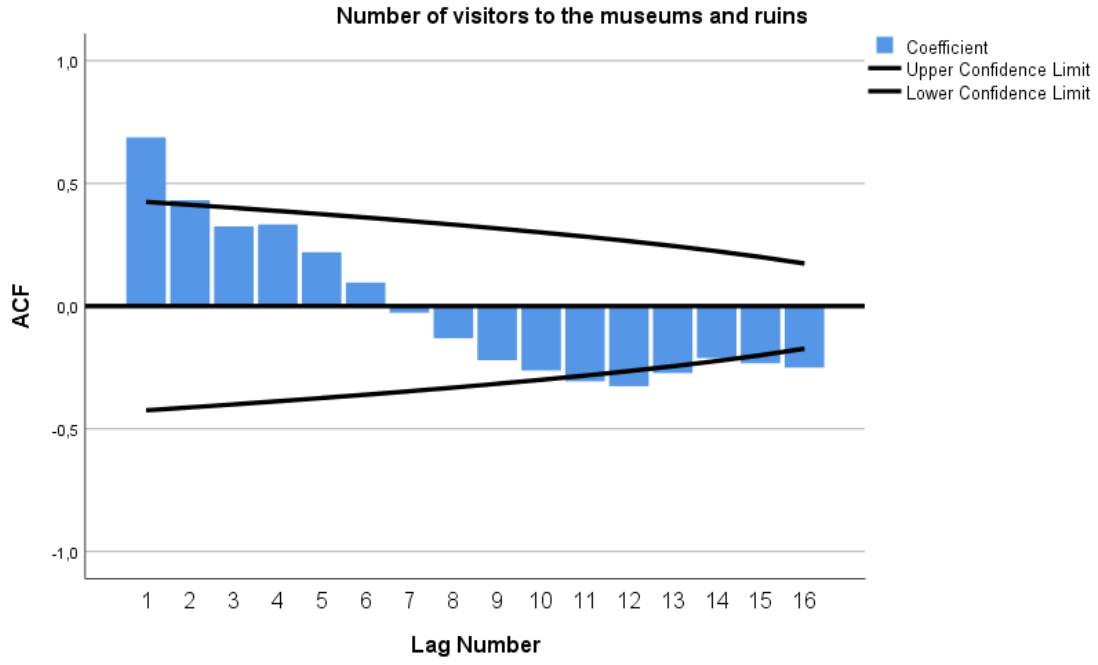


Figure 3

PACF graph of the number of visitors to the museums and ruins

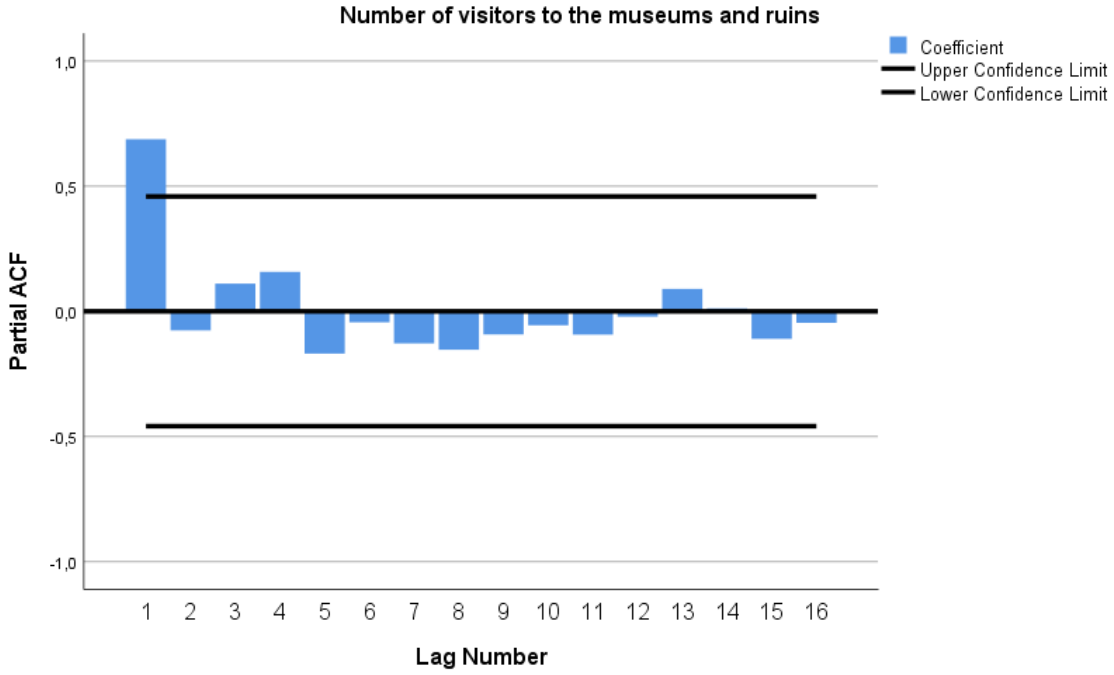


Figure 4

The graph of the differenced series of the number of museum and ruin visitor

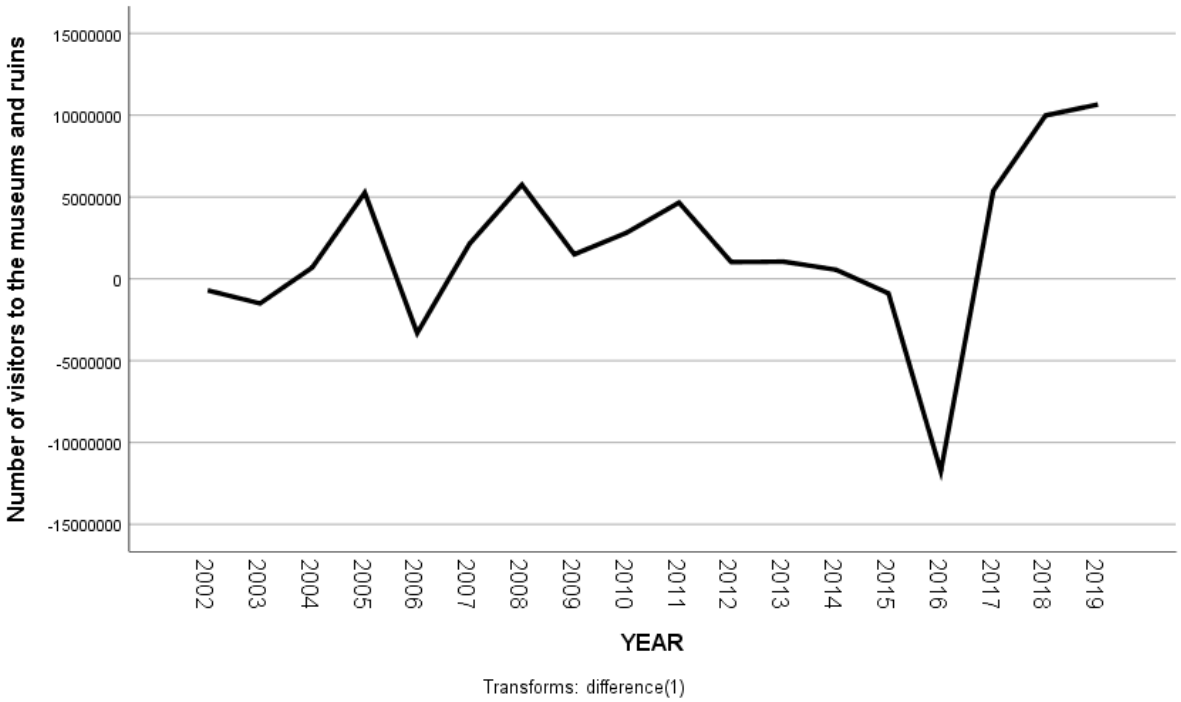


Figure 5

The ACF graph of the differenced series of number of visitors to the museums and ruins visitor

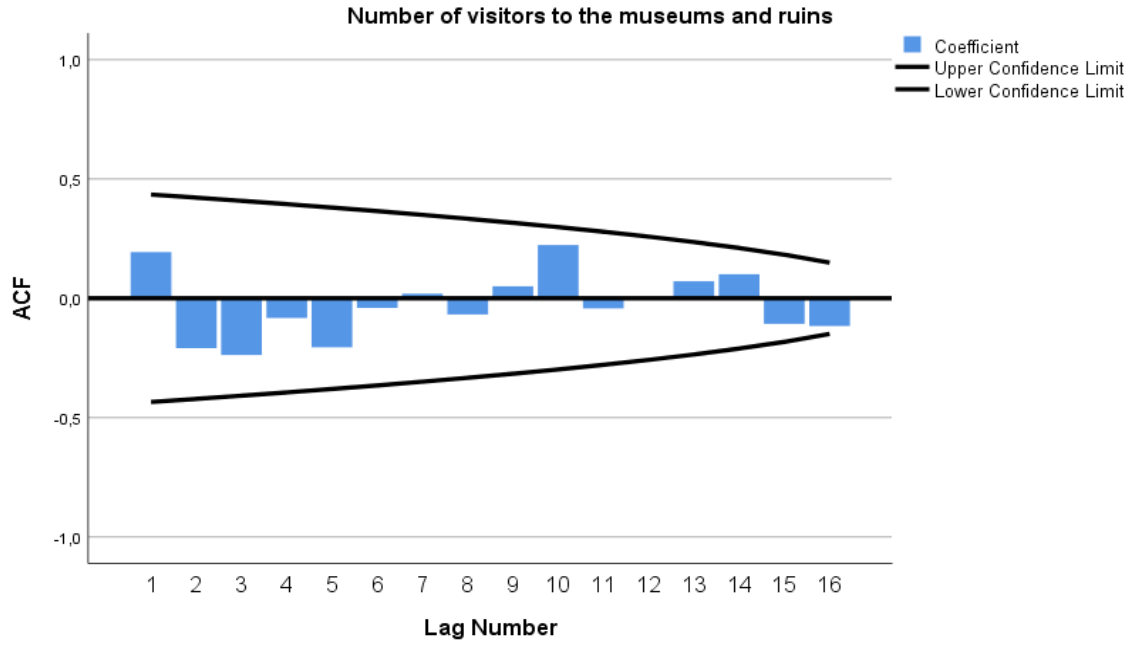
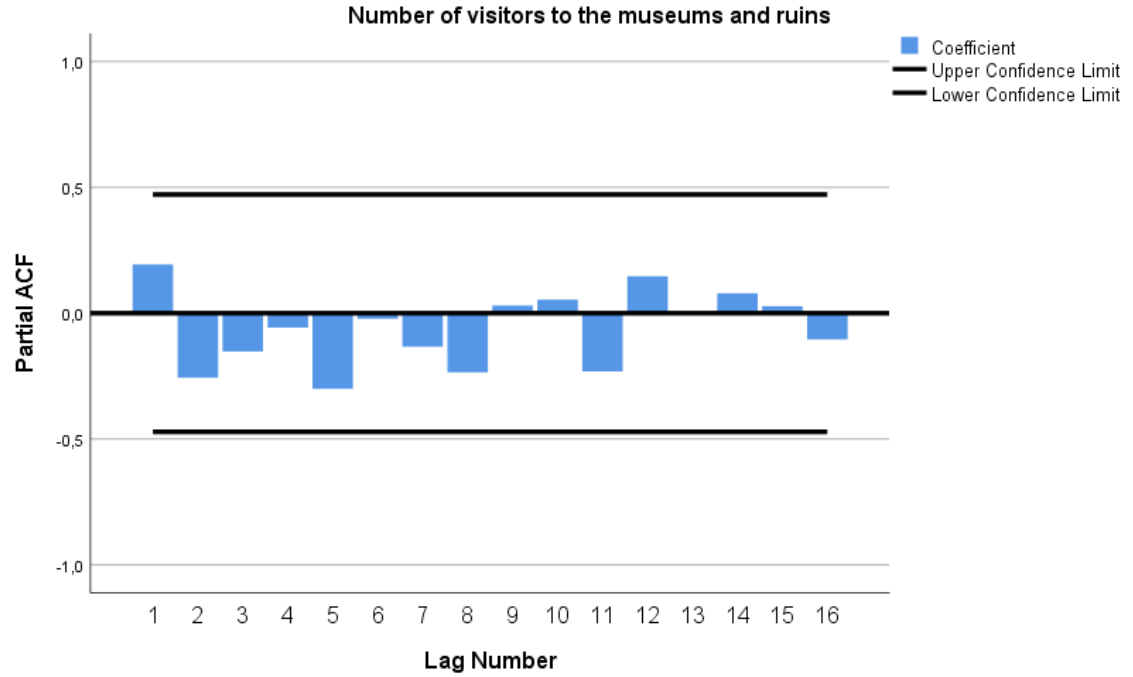


Figure 6

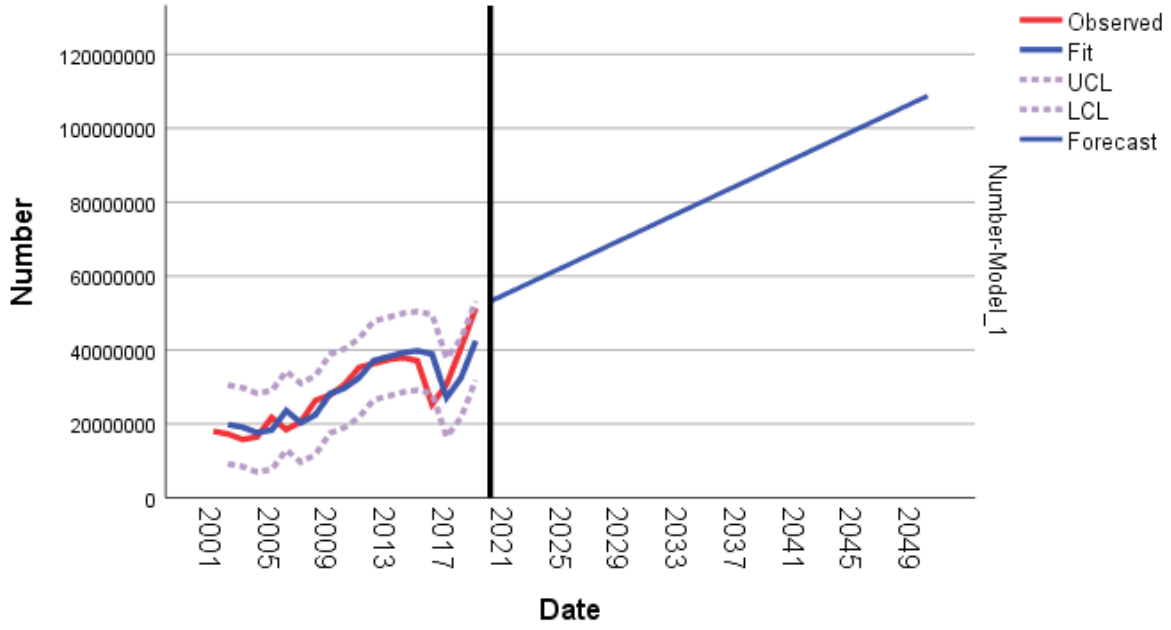
PACF graph of the differenced series of number of visitors to the museums and ruins visitor



When the ACF and PACF graphs in Figure 5 and Figure 6 are examined, it is seen that no delay exceeds the confidence limit and the other two delays are close to the confidence limit. These situations can be neglected and it can be said that the series is still stationary. Stability analysis of the series was also carried out using the augmented Dickey-Fuller (ADF) unit root test. According to the ADF test before the difference, the series is not stationary (t=-0.289; p=0.119) and after the difference, the series is said to be stationary (t=-12,381; p=0.001). While trying to create an appropriate model by making use of these operations, several different models were tried and ARIMA (0,1,0) model was found to be the most suitable model for the number of visitors to the museum and ruins.

Figure 7

The Box-Jenkins model forecast graph of the number of visitors to the museum and ruins per year



The Figure 7 illustrates the graph of observed number of visitors to the museum and ruins per year. Due to scale in the presentation of the graphic, the year range has advanced until 2049. According to the graphic data, it is observed that the number of museums and archaeological sites tend to increase until 2037.

Table 5

Estimates of the number of visitors to the museum and ruins by Box-Jenkins Models

Box Jenkins Model (Number of visitors to the museums and ruins FORECAST)			
Year	Forecast	Upper Limit (UCL)	Lower Limit (LCL)
2020	53.158.510	42.502.720	63.814.301
2021	55.010.471	39.940.908	70.080.035
2022	56.862.433	38.406.062	75.318.803
2023	58.714.394	37.402.813	80.025.975
2024	60.566.355	36.739.283	84.393.427
2025	62.418.316	36.317.066	88.519.566
2026	64.270.278	36.077.706	92.462.850

2027	66.122.239	35.983.112	96.261.366
2028	67.974.200	36.006.828	99.941.572
2029	69.826.161	36.129.593	103.522.730
2030	71.678.122	36.336.863	107.019.382
2031	73.530.084	36.617.342	110.442.825
2032	75.382.045	36.962.045	113.802.044
2033	77.234.006	37.363.688	117.104.324
2034	79.085.967	37.816.268	120.355.667
2035	80.937.929	38.314.766	123.561.091
2036	82.789.890	38.854.939	126.724.840
2037	84.641.851	39.433.160	129.850.542

The estimated values up to 2037 can be seen in Table 5. According to the table, it can be said that number of visitors of museums and ruins have an increasing trend.

Table 6

The goodness of fit criteria of the Box-Jenkins Model

Model	Model Fit statistics							
	Stationary R-squared	R-squared	RMSE	MAPE	MAE	MaxAPE	MaxAE	Normalized BIC
Box Jenkins Model (Number of visitors to the museums and ruins FORECAST)	0,050	0,741	5050579,180	7,8694	3538855,247	53,831	13612497,032	31,031

Table 6 shows the goodness of fit criteria of the Box Jenkins Model. As a result of this study we can conclude that the Box-Jenkins models, which is generated for the number of visitors to museums and ruins, were statistically significant ($p<0.05$). The MAPE value (7.8694) shows that the series contains highly usable estimates.

Discussion

Data of this research covers a 19-year period (2001-2019). These years have been determined in this way within the framework of the data accessible via TÜİK. Visitor number estimates cover the period until 2037. Although it was possible to predict for further years, the reliability of the tests would be unfortunately low in this case. The dynamic structure of estimation research should be preserved by updating the predictions regarding the number of visitors within the framework of new data released every year.

Conclusion

Forecasting the future is very important for social, economic and cultural development of a country. It is possible for all institutions in decision-making to maintain and improve their situation in the future. Forecasting provides to estimate future events and to find appropriate solutions within the framework of a good plan. In this study, we tried to determine the future

number of visitors to the museums and ruins in Turkey by looking at the present and past number of visitors. Time series were used to estimate the future number of visitors to the museums and ruins. Among the Box Jenkins models, the best predictive one was seen to be the ARIMA (0,1,2) model.

An independents unit should be set up to organize such data and to make prediction analysis in Republic of Turkey Ministry of Culture and Tourism. In this way, the predictions for the future situation of the number of visitors can be made regularly. Thus, useful policies may be developed through forecasts for the future for having more effective cultural tourism and other related activities. In addition, museums and ruins as exhibition places of cultural heritage can make their future plan which is a key managerial task. An effective organizational plan prevents loss of time and effort.

As a country case, Turkey has many museums and ruins. However, museums mostly include archaeological and ethnographic artefacts. Museums and ruins contribute to the development of international tourism with their works reflecting the common history of humanity. Thus, they enable inter-communal communication to be strengthened and cultural riches specific to different societies to be recognized.

This study shows how forecast can become subject to measurement of visitor numbers of museums and ruins. The analysis of this study highlights the success of the estimation models. Forecasting studies may contribute to the establishment of stronger future plans for not only museums and ruins but also all of the cultural heritage places and institutions. In this context, relevant institutions should include their forecasting work as a routine action plan.

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