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# **FORECASTING TOURISM DEMAND – THE CASE OF THE CITY OF RIJEKA**

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### ***Abstract***

*Tourism demand, as a set of goods and services people consume during their travels, greatly affects tourism development in a destination. Hence, forecasting tourism demand is the subject of numerous studies in the field of tourism. Many of these studies use a time series analysis approach to examine tourism demand, foremost through tourist arrivals but also through the number of overnights and tourist expenditure. The purpose of this paper is twofold: to examine trends in tourist arrivals in the city of Rijeka, Croatia over the last ten-year period and to forecast tourist arrivals in the near future. The time series analysis method is applied to this end, with tourism demand being measured by the overall number of tourist arrivals. The research findings provide deeper insights into, and a better understanding of, tourism demand forecasting as a factor of efficient tourism planning.*

***Keywords:* tourism demand, forecasting, destination, tourism development**

## 1. INTRODUCTION

After deindustrialization, the city of Rijeka, Croatia was faced with the momentous question of how to define, and in which direction to focus, its development strategy. Given the city's tangible resources and exceptional historical and architectural heritage, the logical perspective that arose referred to the development of tourism. However, since gaining competitive advantage no longer relies merely on natural resources, tourism forecasting plays a crucial role in Rijeka's tourism planning. Such rationale led to the objective of this study, which was to find a quantitative solution to the number of tourists that could constitute tourism demand for Rijeka's tourism facilities, services and programmes which are the result of the experience and knowledge of Rijeka Tourist Board which serves the role of destination management organization (DMO). Following this objective, the study employs the Holt-Winters triple exponential smoothing as a forecasting technique to predict tourism demand. The model estimation is based on the quarterly data of the realized number of tourist arrivals in the city of Rijeka in the period from the first quarter of 2006 to the last quarter of 2015 and was used to forecast values for the period from the first quarter of 2016 to the last quarter of 2020.

The remainder of this study is organized as follows. The next section considers the fundamental precepts and theoretical determinants of tourism demand and forecasting methods in tourism demand forecasting, followed by an extensive description of research methodology. The research results are discussed in the fourth section. The final part summarizes conclusions and implications of the study.

## 2. LITERATURE REVIEW

### 2.1. Conceptualisation of tourism demand

Tourism is seen as a highly-sophisticated integrated system within a national economy; its scope and structure exceeds the economic categories of activities, branches, industries and sectors, and it is composed of interrelated, heterogeneous, interdependent and complementary fragments of diverse economic branches and activities that together form a logical, functional and evenly balanced whole (Kesar, 2006, p. 86).

The development of a tourist destination is foremost determined and characterised by tourism demand. Notwithstanding the numerous definitions that exist, tourism demand is most often defined, for the purposes of tourism statistics, as the total number of persons participating in tourism traffic, or wishing to participate in tourism traffic, to consume various tourism services in places away from their usual places of residence and/or work (Cooper, Fletcher, Gilbert and Wanhill, 1998, p. 24). From an economic perspective, tourism demand can be defined as the quantity of goods and services that can be sold on the tourism market under specific conditions and at specific prices, that is, the quantity of goods and services for which potential tourism consumers show a realistic and objective interest (Vukonić and Čavlek, 2001, p. 329).

Understanding tourism demand is an exceptionally complex process that is based on the following knowledge: a) demand is affected by an entire array of factors, in addition to prices; b) demand includes not only persons taking part in tourism traffic, but also those persons who wish to take part but are not able to for certain reasons; and c) tourism demand conditions relations in the tourism market. The first assumption implies that the creation of tourism demand is affected not only by people/tourists, but also by society, the state, the environment, suppliers and the entire economy. The second statement points to the conclusion that in addition to there being several types of demand – ideal, potential, real and effective – there is also suppressed demand. Finally, the last assumption indicates that potential tourism demand is the major determinant of tourism supply. Namely, the tourism market is based on the preferences of potential tourism demand that is willing to spend on products and services under specific conditions. In addition, tourism demand is dislocated (demand is physically separated from tourism supply), heterogeneous (the diversity of needs and motivations), elastic (in relation to the income of tourists), dynamic (mobility) and seasonal (due to climate constraints and free time available to tourists) (Čavlek et al., 2011, p. 57).

The characteristics of tourism demand and the many factors that affect it make it very difficult to forecast the scale of tourism demand. However, relevant research studies are nowadays focusing on investigating tourism demand trends to help transform potential demand into actual demand as the primary precondition to tourism development.

## **2.2. Forecasting tourism demand**

The distinctly competitive tourism market of today, where tourism supply exceeds tourism demand (Čavlek et al., 2011, p. 57), is driving the need for the effective planning of tourism development in destinations, with tourism demand forecasting playing a crucial role (Burger, Dohnal, Kathrada and Law, 2001, p. 404). Tourism forecasts are valuable for both the private and public sector. Namely, they enable avoiding shortages or surpluses in goods and services, calculating tourism's contribution to GDP and examining its impact on resources.

With regard to quantitative research methods, two basic groups of methods can be used to forecast tourism demand (Song and Li, 2008, p. 204): time series models and causal econometric approaches. Based on the assumption that historical data regarding an observed phenomenon are the key to predicting the future, time series methods use data patterns from the past to forecast future values of a given phenomenon. These methods include the naïve method, the moving average method, the exponential smoothing method and autoregressive integrated moving average models. On the other hand, causal methods mathematically simulate a cause-effect link between variables by using an array of explanatory variables that affect tourism demand. Causal methods include regression analysis and structural econometric models.

In the quantitative forecasting literature, many studies regarding tourism demand forecasting and modelling employ time series analysis. More precisely, the results of comprehensive research (Song and Li, 2008) that reviewed 121 studies dealing with tourism demand forecasting and modelling show that the majority of studies (72) applied time series methods. Most of these studies were focused on investigating historical trends and seasonality to forecast the future values of series.

### 3. RESEARCH METHODOLOGY

In line with the objectives of this paper, the methodological approach to forecasting tourism demand is based on classical time series analysis (the method of statistical time series analysis), which is focused on analysing the basic characteristics of individual time series and forecasting their future value based on values for the past and present periods (Dragutinović Mitrović and Bošković, 2013, p.28). A time series is defined as a “chronologically arranged set of values of a variable that represents a given phenomenon or statistical process in time” (Šošić, 2004, p. 549). Biljan-August, Pivac and Štambuk (2009, 97) maintain that a time series is a “set of values of a phenomenon, arranged in chronological order”. The values of the observed variable of a time series are called frequencies and are designated as:

$$\{Y_t\}, t = 1, 2, \dots, N$$

The time series of economic phenomena can be written as follows:

$$Y_t = f(t) + u_t$$

where:

$f(t)$  = deterministic component, which represents the systematic part of the series  
 $u_t$  = random variable, which represents the stochastic part of the series.

The systemic part  $f(t)$  is affected by three components: the trend component (long-term course of development of a phenomenon over time), the cyclical component (a phenomenon repeats itself over a period of two or more years) and the seasonal component (a phenomenon repeats itself over a one-year period) (Bahovec and Erjavec, 2009, p. 190). Understanding these components is essential to analysing and interpreting research results.

This paper focuses on tourist arrivals, the most commonly used measure of tourism demand (Song, Witt and Li, 2012, p. 2) of the city of Rijeka in the period from 2007 to 2016. The Croatian Bureau of Statistics (2015) defines a tourist as a person spending at least one night in a hospitality facility or other tourist accommodation facility, away from their place of residence, for the purpose of undertaking activities pertaining to leisure or recreation, health-care, education, sport, religion, family, public missions or gatherings. The term tourist does not refer to migrants, cross-border workers, diplomats, members of armed forces on regular duty, displaced persons or nomads.

Data on the number of tourist arrivals in Rijeka were collected from the publications of the Croatian Bureau of Statistics. The sources of data on tourist arrivals in Rijeka at the annual level were the publications First Release – Tourist Arrivals and Overnights for 2015 and 2016, while the source of data on tourist arrivals in Rijeka by month were the publications First Release – Tourism, for the period January 2006 – December 2016. Following the recommendations of similar studies, the collected data are presented on a quarterly basis.

The time horizon of analysis covers the period from the 1st quarter of 2006 to the 4th quarter of 2020. A model was built based on data for the period from the 1st quarter of 2006 to the 4th quarter of 2015 and was used to forecast values for the period from the 1st quarter of 2016 to the last quarter of 2020.

Time series modelling is based on decomposition, that is, on separating the time series into trend, seasonal and cyclical components to identify their influences. To this end, the Hodrick-Prescott filter was used to detrend the time series.

The Hodrick-Prescott filter is based on the resolution of the following minimisation problem:

$$\min \sum_{t=1}^N (y_t - \tau_t)^2 + \lambda \sum_{t=2}^{N-1} [(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2$$

where  $y$  is the time series,  $\tau$  is the trend component, and  $\lambda$  is the smoothing parameter (Kožić and Gatti, 2012, p. 489). Given the quarterly presentation of data, and as recommended by Hodrick and Prescott (1997),  $\lambda = 1600$  is used in this study.

In accordance with the attributes of tourism demand in Rijeka in the observed period, the Holt-Winters model was used for the short-term forecasting of tourist arrivals. The Holt-Winters multiplier model involves triple exponential smoothing (overall smoothing, trend smoothing and seasonal smoothing) and is suitable for data that display a trend component and a seasonal component. After the values of level, trend and seasonality were calculated, the following equation was used for forecasting:

$$\hat{Y}_{t+h} = (L_t + hb_t)S_{t-s+h}$$

where:

- $\hat{Y}$  – forecast value of a phenomenon
- $L$  – level of the series
- $S$  – seasonal component
- $b$  – trend of the series
- $h$  – number of periods of forecasting
- $s$  – number of seasonal periods in one year
- $t$  – time period

Triple exponential smoothing is based on the estimation of three smoothing constants – alpha, beta and gamma. In this paper, smoothing constants were chosen whose forecast values gave the lowest absolute percentage error

( $\alpha=0.1$ ;  $\beta=0.3$ ;  $\gamma=0.3$ ).

To test the forecasting accuracy of the Holt-Winters model, the mean absolute percentage error (MAPE) was calculated. The mean absolute percentage error is expressed in generic percentage terms and it is computed by the following formula:

$$MAPE = \frac{1}{n} \sum_{t=1}^n \frac{|(A_t - F_t)|}{A_t} \times 100$$

where:

$A$  – actual value

$F$  – forecast value

$t$  – some time period

Forecasting accuracy was established according to the following MAPE values (Baggio and Klobas, 2011, p. 151):

- Lower than 10% - highly accurate;
- 11%-20% - good;
- 20-50% - reasonable;
- Higher than 50% - inaccurate.

Data detrending was carried out using the Hodrick-Prescott filter (Addin) in Microsoft Excel (version 2016), while the R GUI programme (version 3.3.1) was applied for forecasting, using the Holt-Winters model of triple exponential smoothing.

## 4. RESEARCH RESULTS

### 4.1. Attributes of tourism demand in Rijeka

Understanding the basic attributes of tourism demand is essential because the economic effects of tourism development are most often expressed through a variety of tourism demand parameters such as the number of tourist arrivals, the length of stay in a destination/accommodation facility, and the amount of tourist expenditure. Presented below are the basic characteristics of tourism demand in Rijeka in 2016 - a period for which the latest statistical data at the annual level are available, followed by an extensive analysis of Rijeka's tourism demand in the period from 2007 to 2016.

In 2016 a total of 205.485 tourist arrivals were recorded in Rijeka, of which 40.929 were domestic and 164.556 were foreign. According to the available statistical data at the county level, the town of Rijeka accounted for 7,65% of all tourist arrivals in Primorje-Gorski Kotar County in 2016 (CBS, 2017). Data in Table 1 indicate that foreign tourist arrivals accounted for more than three-quarters of all tourist arrivals, thus confirming the prevalence of foreign tourism demand. A comparison of these indicators for 2016 and 2015 reveals that while the number of foreign tourist arrivals is dropping (-9,40%), the number of domestic tourist arrivals is noticeably rising (+20,00%).

The seasonal character of tourism at the national level (MINT, 2013) is also evident in changes in tourism demand in Rijeka, as demonstrated in Figure 1. In 2016, the months of July and August saw the largest number of tourist arrivals (37.258 and 42.684, respectively), while January and December the lowest (5.546 and 6.115, respectively). In the pre-season and post-season, the number of tourist arrivals in Rijeka plummets. Additionally, it should be pointed out that seasonality in Rijeka's tourism demand in the observed period results from changes in foreign tourist arrivals, with the lowest number being in January (2.753) and the highest in August (38.113). Similar oscillations were not recorded for domestic guests, as the lowest number of domestic arrivals was 2.502 (recorded in December), and the highest 4.571 (recorded in August).

Figure 2 illustrates the total number of tourist arrivals in Rijeka in the period from 1<sup>st</sup> quarter of 2007 to 4<sup>th</sup> quarter of 2016, together with the trend component and seasonal component. In the observed ten-year period, the largest number of arrivals (142.301) was recorded in the 3<sup>rd</sup> quarter of 2011, and the smallest (14.650) in the 1<sup>st</sup> quarter of 2013. The most frequent number of tourist arrivals per quarter is 14.650, while the average number is 55.763.

Table 1  
Tourist arrivals in Rijeka from 2007 to 2016

Year	Arrivals	Number	Share (%)	Index
2016	Domestic	40.929	19,92	120,00
	Foreign	164.556	80,08	90,60
	TOTAL	205.485	100,00	95,20
2015	Domestic	34.203	15,84	96,08
	Foreign	181.681	84,16	86,98
	TOTAL	215.884	100,00	88,30
2014	Domestic	35.598	14,56	131,04
	Foreign	208.868	85,44	116,65
	TOTAL	244.466	100,00	116,80
2013	Domestic	27.165	12,98	79,91
	Foreign	179.062	87,02	86,73
	TOTAL	209.301	100,00	87,05
2012	Domestic	33.993	14,14	110,43
	Foreign	206.458	85,86	89,88
	TOTAL	240.451	100,00	92,30
2011	Domestic	30.783	11,81	67,07
	Foreign	229.706	88,19	136,56
	TOTAL	260.489	100,00	121,66
2010	Domestic	45.896	21,44	131,40
	Foreign	168.207	78,56	99,03
	TOTAL	214.103	100,00	104,55
2009	Domestic	34.926	17,06	56,06
	Foreign	169.853	82,94	115,03
	TOTAL	204.779	100,00	97,99
2008	Domestic	61.316	29,34	69,28
	Foreign	147.652	70,66	106,93
	TOTAL	208.968	100,00	92,22
2007	Domestic	88.495	39,06	/
	Foreign	138.087	60,94	/
	TOTAL	226.582	100,00	/

Source: Croatian Bureau of Statistics, First Release – Tourism, 2008 – 2017

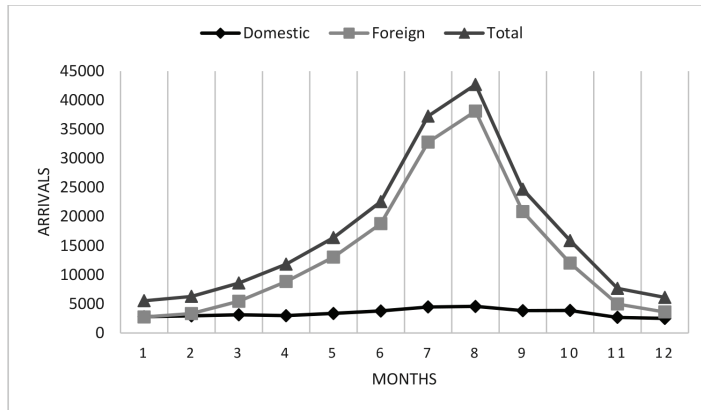


Figure 1 Tourist arrivals in Rijeka in 2016, by month

Source: Croatian Bureau of Statistics, First Release – Tourist Arrivals and Overnights in 2016, 53 (4.3.1.), February 2017

The following figure clearly demonstrates the seasonal effect on total tourist-arrival numbers in Rijeka in the observed period and indicates a gentle downward trend in tourist arrivals from 2011. Given the fact that the seasonality of Rijeka’s tourism demand is the result of foreign tourist flows, the upcoming section separately examines domestic and foreign tourist arrivals. Therefore, figure 3 and 4 present the number of domestic and foreign tourist arrivals in Rijeka in the period from 1<sup>st</sup> quarter of 2007 to 4<sup>th</sup> quarter of 2016, together with the trend component and seasonal component.

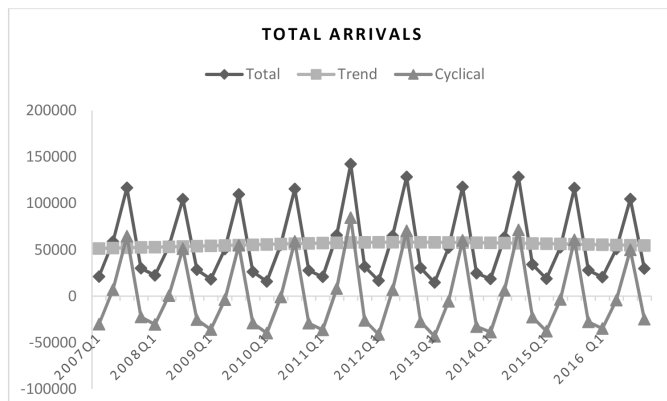


Figure 2 Total tourist arrivals in Rijeka from 1<sup>st</sup> Q 2007 to 4<sup>th</sup> Q 2016 - Hodrick-Prescott filter,  $\lambda = 1600$ .

Source: Croatian Bureau of Statistics, First Release – Tourism, 2008 – 2017



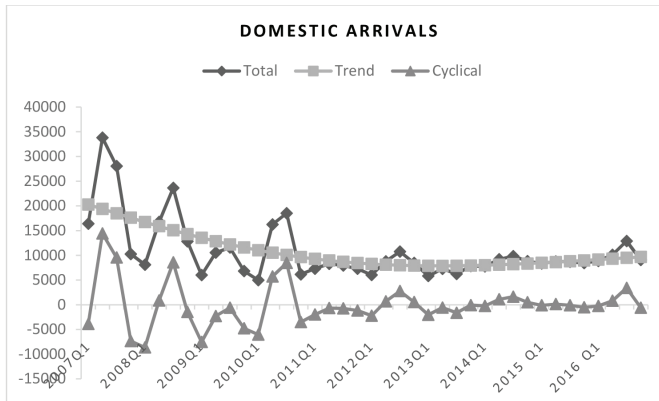


Figure 3 Domestic tourist arrivals in Rijeka from 1<sup>st</sup> Q 2007 to 4<sup>th</sup> Q 2016 - Hodrick-Prescott filter,  $\lambda = 1600$ .

Source: Croatian Bureau of Statistics, First Release – Tourism, 2008 – 2017

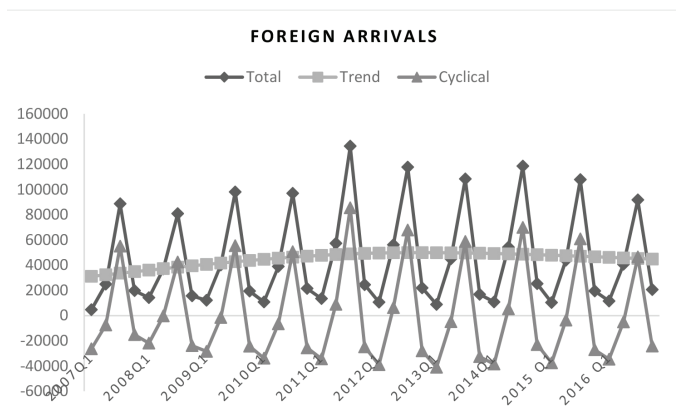


Figure 4 Foreign tourist arrivals in Rijeka from 1<sup>st</sup> Q 2007 to 4<sup>th</sup> Q 2016 - Hodrick-Prescott filter,  $\lambda = 1600$ .

Source: Croatian Bureau of Statistics, First Release – Tourism, 2008 – 2017

The smallest number of domestic tourist arrivals (4.982) was recorded in the 2<sup>nd</sup> quarter of 2010, and the largest (33.802) in the 2<sup>nd</sup> quarter of 2007. The number of foreign tourist arrivals was the lowest (4.709) in the 1<sup>st</sup> quarter of 2007 and the highest (134.370) in the 3<sup>rd</sup> quarter of 2010.

A downward trend in tourist arrivals is evident in the case of domestic tourists in the observed period, while foreign tourist arrival numbers are characterised by an upward trend. However, foreign tourism demand in Rijeka displays pronounced seasonality in comparison with domestic tourism demand.

## 4.2. Forecasting tourism demand in Rijeka

The study generated forecasts of the total number of tourist arrivals in Rijeka, as well as separate forecasts of domestic and foreign tourist arrivals for the period between 2016 to 2020. Forecasted values are presented in Table 2.

Table 2  
Forecasted tourist arrivals in Rijeka from 2016 to 2020

Year	Arrivals	Number	Share (%)	Index
2020	Domestic	37.564	20,96	101,87
	Foreign	141.627	79,04	93,86
	TOTAL	179.191	100,00	95,43
2019	Domestic	36.875	19,64	101,90
	Foreign	150.892	80,36	95,35
	TOTAL	187.767	100,00	96,57
2018	Domestic	36.187	18,61	101,94
	Foreign	158.255	81,39	93,41
	TOTAL	194.442	100,00	94,88
2017	Domestic	35.498	17,32	101,98
	Foreign	169.419	82,68	94,82
	TOTAL	204.917	100,00	95,98
2016	Domestic	34.810	16,30	/
	Foreign	178.682	83,70	/
	TOTAL	213.492	100,00	/

Source: authors' research

Figure 5 shows the forecast of the overall number of tourist arrivals. The results indicate a continuous downward trend in total tourist arrivals in the period from 2016 to 2020. More specifically, in comparison to the actual data for 2016, predicted tourist arrivals in 2020 will decrease by 12,80%. Also, the prevalence of foreign tourism demand, together with the powerful effect of the seasonal component, continue to be present in the forecasting period.

As evident from Figure 6, which displays the forecasted values for domestic and foreign tourist arrivals, the predicted fall in total tourist arrivals is largely driven by a significant drop in foreign tourist arrivals. Namely, in comparison to the actual data for 2016, predicted foreign tourist arrivals in 2020 will decrease by 13,93%.

On the other side, domestic tourist arrivals indicate a continuous upward trend in the entire forecasted period. As in the previous period, future foreign tourist flow will continue to be affected by seasonality, unlike domestic tourist flow.

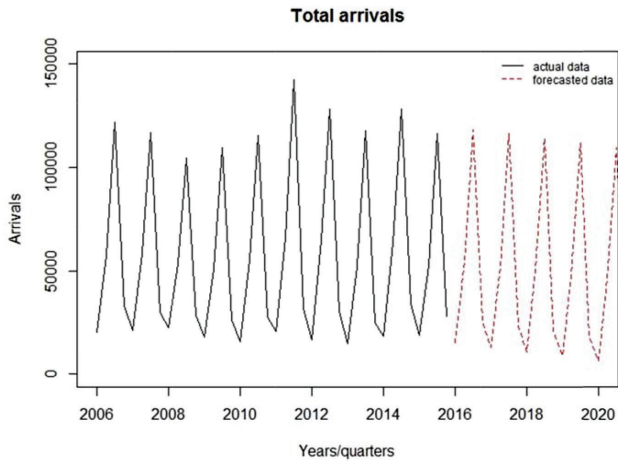


Figure 5 Forecasted total tourist arrivals in Rijeka from 1<sup>st</sup> Q 2016 to 4<sup>th</sup> Q 2020

*Source: authors' research*

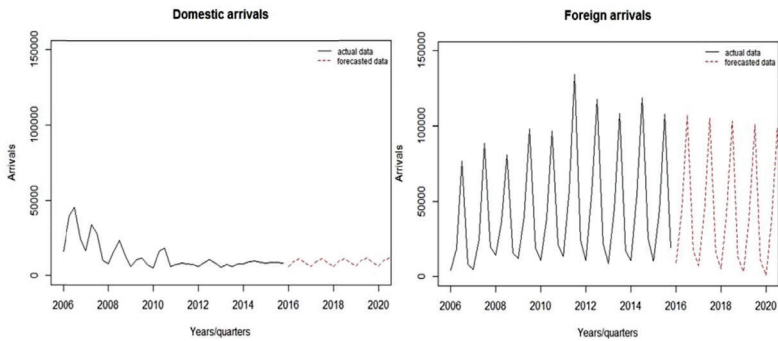


Figure 6 Forecasted domestic and foreign tourist arrivals in Rijeka from 1<sup>st</sup> Q 2016 to 4<sup>th</sup> Q 2020

*Source: authors' research*

After modelling and forecasting the number of tourist arrivals, the forecast values were compared with the actual number of tourist arrivals in Rijeka for the year 2016 - a period for which the latest statistical data at the annual level are available.

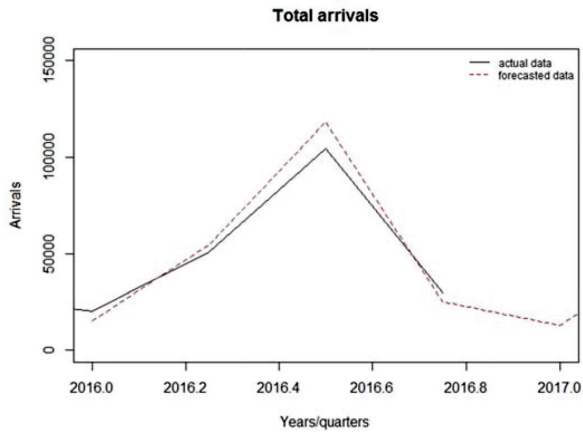


Figure 7 Actual and forecasted total tourist arrivals from 1<sup>st</sup> Q 2016 to 4<sup>th</sup> Q 2016

Source: authors' research

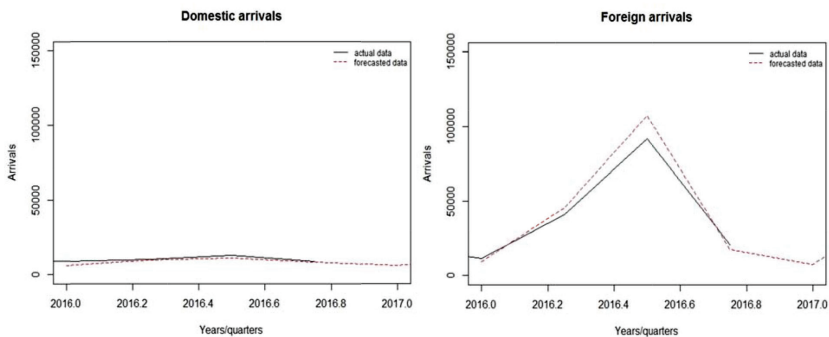


Figure 8 Actual and forecasted domestic and foreign tourist arrivals from 1<sup>st</sup> Q 2016 to 4<sup>th</sup> Q 2016

Source: authors' research

The above figures demonstrate that tourism demand forecasts are in line with the trend of time series; in other words, the forecasts are in alignment with the actual data. This is also confirmed by MAPE values:

- Total arrivals forecast - MAPE 15.03322
- Domestic tourist arrivals forecast – MAPE 15.31565
- Foreign tourist arrivals forecast – MAPE 15.25278.

Given the MAPE values calculated, the forecast of future tourist flows is considered to be good (<20).

## 5. CONCLUSION

The study attempted to examine the trend in tourist arrivals in Rijeka over the last ten-year period and to forecast tourist arrivals in the near future. The time series analysis method was used to this end. The Hodrick-Prescott filter was applied to detrend the time series in the modelling process. Based on the identified characteristics of tourism demand in Rijeka over the observed period, the Holt-Winters triple exponential smoothing model was used for the short-term forecasting of tourist arrivals.

Research results indicate a significant prevalence of foreign tourism demand as well as a strong seasonal influence on the total number of tourist arrivals in Rijeka in the period from 2007 to 2016. A separate analysis of domestic and foreign tourist arrivals showed a considerable downward trend in domestic tourist arrivals in the observed period, contrary to an upward growth trend in the number of foreign tourist arrivals. Also, unlike domestic tourism demand in Rijeka, foreign tourism demand is especially affected by seasonality.

Forecasting analysis indicate a continuous downward trend in total tourist arrivals in the period from 2016 to 2020. More specifically, in comparison to the actual data for 2016, predicted tourist arrivals in 2020 will decrease by 12,80%. The predicted fall in total tourist arrivals is largely driven by a significant drop in foreign tourist arrivals. Namely, in comparison to the actual data for 2016, the predicted foreign tourist arrivals in 2020 will decrease by 13,93%. On the other side, domestic tourist arrivals are characterised by a continuous upward trend in the entire forecasted period.

The forecasted values of tourism demand from the first to the last quarter of 2016 - a period for which the latest statistical data at the annual level are available, match the time series trend, that is, they are in alignment with actual data. The MAPE values obtained indicate that the forecasting accuracy of the proposed model is good.

The study findings enable researchers to better understand tourism demand forecasting as a factor of efficient tourism planning. In this sense, the study also provides practical implications for destination management organisations and other tourism forecasters or policy makers.

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