CRUISE TOURISM DEMAND FORECASTING – THE CASE OF DUBROVNIK

Review

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Abstract
The purpose – Cruising is nowadays a mass phenomenon since an increasing number of passengers worldwide have been taking part in this form of tourism. Therefore the purpose of this paper is to forecast cruise tourism demand at the level of micro destination.
Design/Methodology/Approach – Dubrovnik has become one of the most important and most frequently visited destinations for cruise tourism in the Mediterranean. The rapidly increasing number of passengers on cruise voyages has put Dubrovnik among the leading cruise destinations in the Mediterranean. Dubrovnik is now facing the problem of concentration of a large number of ships and passengers in a short period of time. Consequently, this paper aims at forecasting the number of passengers from cruise ships within the next five year period in order to highlight eventual consequences and the necessity for implementation of a different management policy in accepting cruise ships and passengers at the destination to satisfy the requirements of both the passengers from cruisers and stationary tourists on one side and on the other side to improve the living standards of the local community. For this purpose the seasonal ARIMA model has been used which incorporates both seasonal autoregressive and moving average factor in the modelling process.
Findings – With application of the above mentioned model and having in mind that forecasting was carried out under assumption that there will be no significant changes in the existing conditions it is to be concluded the cruise ship passenger arrivals in Dubrovnik area in 2015 will reach 1.294.316 making an increase of 31% in comparison with the year 2011 at an average growth rate of 7.06%.
Originality of the research – Research was carried out to indicate the necessity for implementation of the new model of management for passengers from cruise ships by tourism destination management.
Keywords cruise tourism, tourism demand, forecasting, Dubrovnik

INTRODUCTION

Cruise tourism has been a globally expanding phenomenon in the last thirty years. The increase in demand for cruise tourism that is being registered on all markets worldwide confirms that the cruise market is on the upward trend. The demand for this specific form of tourism has almost doubled in comparison with the number of international arrivals and according to the relevant forecasts it is going to have an increasing share in the global, European and Mediterranean tourism (Study Integrated Management 2011, 4). Today the Mediterranean is the leading European cruising region, second destination in the world after the Caribbean islands. At the cruise market the Mediterranean has assumed the position of a region offering a wide cultural and natural diversity on a relatively small area. The increasing role of the Mediterranean as the cruise region is manifested in the development of home ports and ports of call that are today, in terms of passenger traffic, among the leading world ports. Dubrovnik is one of the leading ports for cruisers in the Mediterranean and the leading port in Croatia with 985.398 passengers in 2011 (Dubrovnik Port Authority, 2011). The present state and prospect of the cruising tourism in Dubrovnik should be contemplated in a wider context, i.e. the context of the whole Mediterranean region and global cruise market trends. In the recent years an increased growth in demand for cruise tourism in the Mediterranean has been noted on all markets worldwide, in particular on the European market, which without doubt influences the tourism trends in the region. Due to its positive effect on the city economies, cruising tourism is a major factor in the tourism development strategy in the Mediterranean countries. The increase in demand for Mediterranean cruises and an almost continuous increase in the number and capacity of ships have already created issues in accepting the passengers and ships in many Mediterranean countries. These issues can only develop if the increase is not followed by development of the city infrastructure and all complementary services on one hand and implementation of the new approach to cruise ship passenger management at a destination on the other. It is therefore the main objective of this paper to apply the selected forecasting methods in order to foresee the future trends in cruise ship passengers calling Dubrovnik in the future period. Having in mind that with the present number of passengers the problems are evident, this paper shall indicate the need for implementation of a new integrated approach to cruise ship and passenger management in Dubrovnik. Forecasting the demand in cruising tourism ensures better planning, more efficient preparation at the destination for future changes and it is the basis for elaboration of future development plans with particular emphasis on sustainability.

THEORETICAL BACKGROUND AND OVERVIEW

Sea cruises have been instituted as a special form of tourism relatively late in relation to other forms of tourism. Ships have plied the waters of the world for centuries but the concept of cruising, as a tourist activity, started in the 1880s. The cruise industry continued to grow and by the early 1900s the White Star Line, P&O and the Hamburg America Line were offering regular cruises. The growth was gradual. The decades following the late 1960s saw an impressive growth in the cruise line industry with increased versatility in itineraries and the types of cruises offered (Cartwright and Baird 1999, 23). Sea cruises as a form of package tours were developed in the 1960s. The first ship built exclusively for cruising (in the North America), m/v Oceanic, was launched in 1965 and some chroniclers consider it as the beginning of modern cruising Wood, 2004). Alternatively the start date for this form of tourism is considered to be December 1966 when the company Norwegian Caribbean Line offered the first annual cruise schedule on board the m/v Sunward (the first voyage with 540 passengers) (Dowling 2006, 170). This kind of leisure tourism can be traced back to the early 1970s when the first modern cruises began to operate in the Caribbean with North American tourists (Marquez, 2006). In the 1990s, the cruise phenomenon reached UK and then the rest of Europe and Asia and the Pacific (Kester 2002, 340). Globally, both "experiential" forms of tourism (including ecotourism) and cruise tourism are growing rapidly (CESD, 2006).

The growth rate of sea cruises in the 1980s surpassed considerably the average growth rate of other forms of tourism and it is starting to show mass qualities. In the 1990s cruising took the mass character. The analysis of global demand for cruising in the period 1990 – 2011 indicates an extremely high average growth rate of 8,02% per annum. Over ten years from 2001 to 2011 demand for cruising worldwide has doubled from 9,91 million passengers to 20,6 million with 6,88% growth achieved in 2011 (European Cruise Council, 2012). The North American countries are traditionally the leading cruise destinations participating 55,8% in the total demand worldwide. However, the analysis of demand for these cruise destinations in the period 2001 – 2011 indicates that in 2001 the share was as high as 70%. This means that although this area is still dominant in cruise industry, it has been recording somewhat lower average annual growth rates (4,74%). In the same period European share in the industry increased from 21,6% in 2001 to 30% in 2011 at an average annual growth rate of 10,12% (European Cruise Council, 2012). This indicates the importance of Europe as a cruise destination. In Europe the Mediterranean region is nowadays the leading cruise region, being the second most visited region in the world after the Caribbean islands. It has taken its position as the region offering cultural and natural variety in a relatively small area. Due to the large number of ports of call, the Mediterranean cruises offer something for every passenger providing a multicultural experience (Perucic 2009, 10). In 2011 the share of the Mediterranean in the global demand for this form of tourism was 19,8%, and the share of Europe 66,2%. In 2011 cruise ships were active in Mediterranean with a capacity of 221,419 lower berths with the 4,08 million passengers on 2.958 cruises (European Cruise Council, 2012). Recent changes on tourism market have caused the increasingly complex tourism demand to require an increasing number of elements and forms from tourism supply (Vlahović 2003, 20).

The sudden growth in demand for cruising points to numerous impacts arising from its accelerated development. Many authors sort the impacts of cruise tourism development onto destinations in different ways, e.g. Carwright and Baird mention the social, technological, economic, political and environmental impacts (Carwright and Baird 1999, 23). Brida and Zapata elaborate on economic, political, socio-cultural and environmental impacts (Brida and Zapata, 2010). At the same time, economic impacts are the main topic of numerous research work (Dwyer and Forsyth 1998, Mancini 2000, Henthorne 2000, Braun 2002, Kester 2002, Chase and McKee 2003, Seidl 2006, Brida, Aguire 2009), while the other impacts of cruising tourism onto destinations have only recently become the subject of many research.

Dwyer and Forsyth (1998) developed a framework for assessing the economic impact of cruise tourism for a nation and its sub regions. Economic contribution of cruise industry depends on the category of the port: home port or port of call. A home port is a destination from which ships begin and end their voyages, while a port of call is just an intermediate stop. Normally, a cruise passenger spends less than ten hours in a port of call (Dwyer and Forsyth 1998, 398). Cruise voyages may turn into a propelling force of economic and social development in a tourism destination provided economic entities and local community work in co-operation to adjust the total supply to the highly valued demand in cruise tourism (Breskovic and Novakovic 2002, 65). Ships calling ports for one day does not only mean increased port traffic but also increased traffic and consumption in the region.

Cruise tourism expenditure has direct, indirect and induced impacts on the economy of each region that participates in this form of tourism. The direct impact is on a supplier who sells goods and services directly to cruise vessels, cruise passengers and crew. Indirect impact results from the purchases of direct suppliers of cruise activity (Brida and Zapata 2010, 214). Induced impact is shown because the expenditures of the cruise industry to some extent become income of the affected local firms. This impact is manifested in multiplicative function of this form of tourism since there is a need to create a new and to innovate the existing supply at the local and regional level. Numerous issues occur when measuring economic impacts. According to Braun one of the main difficulties lies in the fact that many cruise lines sail under flags of convenience and employ worldwide crews (Braun et. al. 2002, 282). The cruise industry has the potential to provide economic benefits to a port state. These economic benefits arise from spending by cruise passengers and crew, then from the shore side staffing by the cruise lines for their headquarters, marketing and tour operations; from expenditures of the cruise lines for goods and services necessary for cruise operations; from spending by the cruise lines for fort services and also from expenditures by cruise lines for the maintenance (Brida and Zapata 2009, 111).

Economic issues surrounding the cruise ship industry include direct and potential impacts on the port authorities and port communities, hidden environmental impacts on marine and costal eco-systems, development alternatives to cruise ships for port communities, distributional impacts and cultural implications of cruise tourism development and socio-economic impact of disembarking crew members, in addition to the typically tracked tourist expenditures (Seidl, Guiliano and Pratt 2006, 2016).

There are only few studies on social impacts of cruise tourism (Wood 2000, WTO 2003, Jaakson 2004, Loper 2005, Gibson & Bently 2007, Brida & Zapata Aguire 2010). Interactions between residents and cruise passengers can have also positive effects offering residents the possibility to learn about the world and to explore new life perspective. At the same time, increasing cruise activities restrict the space of residents and sometimes push them to adopt different moral conduct (Brida and Zapata 2009, 114).

The negative impacts, in particular the environmental impacts, have recently become the subject of many research works (Johnson 2002, Butt 2007, Bresson & Logossah 2008, Hritz & Cecil 2008, CRS 2008, Diedrich 2010, Carić 2010, Brida & Zapata 2010). Uncontrolled development of cruising tourism may have a negative impact on stationary tourism and local residents' quality of life due to large concentrations of mega ships in a short period of time. This is in particular manifested in smaller places that are at the same time attractive destinations that must be seen and giving an extra value to the cruise. There may also be air and sea pollution as well as negative impacts onto the ecosystem, but also degradation of the destination image (Perucic 2009, 5).

Cruise ship impacts not only the local environment but also the local community. Economic and employment gains are positive for community, whilst degradation and additional burden on a community's infrastructure have negative impacts on the environment. If both sides are taken into consideration, there is a need to ask whether positive gains compensate sufficiently for the added burden and environmental degradation that local area may suffer (Butt 2007, 595). Public attention to environmental impacts of the maritime industry has been especially focused on the cruise industry, in part because its ships are highly visible and in part because of the industry's desire to promote positive impacts. However, cruise ships generate a number of waste streams that can results in discharges into the maritime environment, including sewage, grey water, hazardous wastes, oil bilge water, ballast waters and solid waste. They also emit air pollutant into the air and water. These wastes are not properly treated and disposed of. Therefore, it is important to keep these discharges in some perspective, because cruise ships represent a small although highly visible portion of the entire international shipping industry (CRS 2008, 3).

The potential rapid increase of cruise tourism resulting from agreements necessitates due attention to understanding the potential implications from environmental and socio-economic perspectives and also in the terms of how it might affect the current overnight tourism market. The lack of planning that allows confronting the massive arrivals of cruise tourism is the guarantee of multiple negative impacts in destination wherever this segment exists or is under consideration as an option for its economic growth (Brida 2009, 116). It is of utmost importance for local authorities to forecast the future trends in crew ship passenger flows in order to use the advantages to the best, but also as an extremely important and often neglected fact in the long run, to reduce the negative effects onto the tourism destination. In the western economies forecasting of tourism demand trends has been in the centre of attention for a long time and all their efforts are concentrated on making the forecasting methods and models as simple as possible from the scientific theoretical level onto the destination level and business unit levels.

Forecasting methods can be divided into two groups – qualitative and quantitative. Studies of forecasting in the past have shown that there are two main techniques of quantitative forecasting. First is time series model and second is multivariate regression model. Time series techniques use the pass values of particular variable in order to project it into the future (Schwartz and Hiemstra 1997, Wong 1997, Chu 1998, Kim 1999, Lim and McAleer 2000, Cho 2001, Turner and Witt 2001, Gustavsson and Nordstorm 2001, Greenidge 2001, Louvieris 2002, Kulendran and Witt 2003, Coshall 2005, Suhartono and Lee 2011). On the other side econometric model use economic phenomenon to identify theoretical models that relate the scope of influence of underlying factors to a particular variable in order to generate future values (Rossello 2001, 366.) Econometric models have been the most commonly used method of forecasting tourist arrivals (Witt, Witt and Wilson 1994, Kulendran and King 1997, Lathiras and Siriopoulos 1998, Turner, Reisinger and Witt 1998, Rosello 2001, Song, Witt and Li 2004, Kulendran and Wong 2005, Wong 2007, Onafowora and Owoye 2012). In tourism demand forecasting, tourist arrivals variable is most popular measure of the tourism demand (Wong et. al., 2007). Previous studies have revealed that time series model often outperform econometrics models with the respect to the forecasting performance.

When forecasting is the aim of the time series analyses the available historical data are taken as the basis to constitute and evaluate the time series model, which is then applied to forecast the future trends in the series while a series of statistical tests are used to evaluate the model applicability. In case forecasting is applied on non-stationary series it is necessary on the basis of monthly or quarterly data to identify the presence of the seasonal component appearing along with the trend and accidental component. The oldest method analysing seasonal time series is the standard decomposition method. Along with this standard method the smoothing methods may be applied; Winters linear and seasonal exponential smoothing model. Linear stochastic models can also be applied onto non-stationary series if non-stationary property is filtered from them. The appearance of autoregressive models is attributed to Yule 1926 and generalisation of AR model to Walker in 1931. MA models were first applied by Slutzky in 1937. Theoretical grounds for ARMA were first given by Wold in 1938. Nowadays ARMA models from 1970 are being most frequently applied by Box and Jenkins who successfully integrated all the former experience and developed the analysis and forecasting of time series procedure by ARMA model. Chu in his work ascertained that ARIMA model is adequate for forecasting tourism demand (Chu, 1998). Because the concept associated with ARIMA is derived from a solid foundation of mathematics, statistics, and classical probability, an appropriate ARIMA model should produce an optimal univariate forecast. (Chen, Chang and Chang 2009, 127) Forecasting of tourism demand by application of the time series model ARIMA has been used in many scientific works. (Chu 1998, Kim and Song 1998, Kulendran and Witt 2003, Lim and McAleer 2000, Kim and Moosa 2005, Coshal 2005, Gustavsson and Nordstorm 2001, Chen, Chang and Chang 2009, Suhartono et. al. 2010, Suhartono and Lee 2011, Suhartono 2011).

Consequently, in this paper the seasonal autoregressive model ARMA (p, d, q) is being used to forecast future cruise passenger trends through application of the methodology used by Chen, Chang and Chang in their work in 2009.

CRUISE TOURISM IN DUBROVNIK

In accordance with the global growth in the number of cruise voyages and cruise passengers, and the growth in the Mediterranean region, Croatia has recently been recording a significant growth in the number of cruisers calling Croatian ports. This growth is particularly shown in the number of cruise passengers that has more than doubled in the last five years. Croatian coast is very attractive for navigation due to many islands and coastal places and towns with rich history, sights and other attractions that appeal to tourists. Cruise ships mostly call the ports and towns that offer facilities for their calls, but are also attractive to visitors (Dubrovnik, Split, Zadar). The largest ships usually call only Dubrovnik, but there are many smaller cruise ships that call several Croatian ports/destinations in one cruise.

Dubrovnik is the leading Croatian destination for cruise ships, generating approximately 75% of the total cruise traffic (Statistical Yearbook, 2011). Owing to its tourism potential stemming from the cultural-historical and natural resources, as well as the geographic position that makes it the most favourable stop between Venice and Greek ports, Dubrovnik has become an important destination in cruise itineraries for cruise ships in the Eastern Mediterranean. According to European Cruise council statistics 2011, with its over 958 thousand passengers Dubrovnik takes the 7th place right behind Naples in the Mediterranean and 8th position in the European market behind Southampton. According to the ports of call analysis made by European Cruise Council, Dubrovnik takes the second position behind Naples both on the Mediterranean and European cruise markets (European Cruise Council 2012, 13-14).

As a leading cruise destination in the Croatian part of the Adriatic Dubrovnik is experiencing progressive growth, in which phase the large tourism resources potential is confronted with the challenges of proper development as opposed to the danger of losing control over excessive commercialisation and devastation of the location.

Dubrovnik has two physically and organisationally separate locations for cruise ships. Consequently, one of the major issues is organisation of distribution of the burden between those two locations. Study of Sustainable Development of Cruising Tourism in Croatia (Study, Institute for Tourism 2006, 149), elaborated by the Institute for Tourism Zagreb in co-operation with the Faculty of Maritime Studies Rijeka, has promoted the already existing standpoint that the Old City of Dubrovnik should be profiled as a destination for luxury yachts and smaller crafts (up to 1000 passengers), while the port of Gruž should be oriented to accepting large and mega cruisers. This principle of traffic distribution is supported by the Study on Selection of Anchoring Site for Cruise Ships in Dubrovnik waters which offers similar arguments with respect to safety of accommodation, environmental protection as well as other consequences that may have a negative impact on the quality of life and quality of tourism supply.

Application of measures to regulate anchoring near the Old City and distribution of acceptance of cruise ships between two ports is in line with the strategic goals of the Port of Dubrovnik within the Project for Modernisation of the Passenger Port as the main infrastructural object in Dubrovnik for acceptance of large and mega cruisers, which will in future be supported with various port and passenger facilities. According to the Project for Modernisation of the Passenger Port, which has largely been implemented or is under construction, Gruž becomes the central point of cruise tourism in Dubrovnik, a port centre with corresponding dock capable of accepting/berthing several mega ships at the same time, and offering to the passengers/crews/ships various facilities/services.

Moreover, the need for a unique approach to organisation of acceptance of cruise ships in Dubrovnik by application of a unique booking system, common tariff policy and uniform procedures, especially as far as documentation is concerned, must be pointed out.

Table 1: **Comparison of cruise ship and passenger traffic between the Port of Dubrovnik and Old City Anchorage**

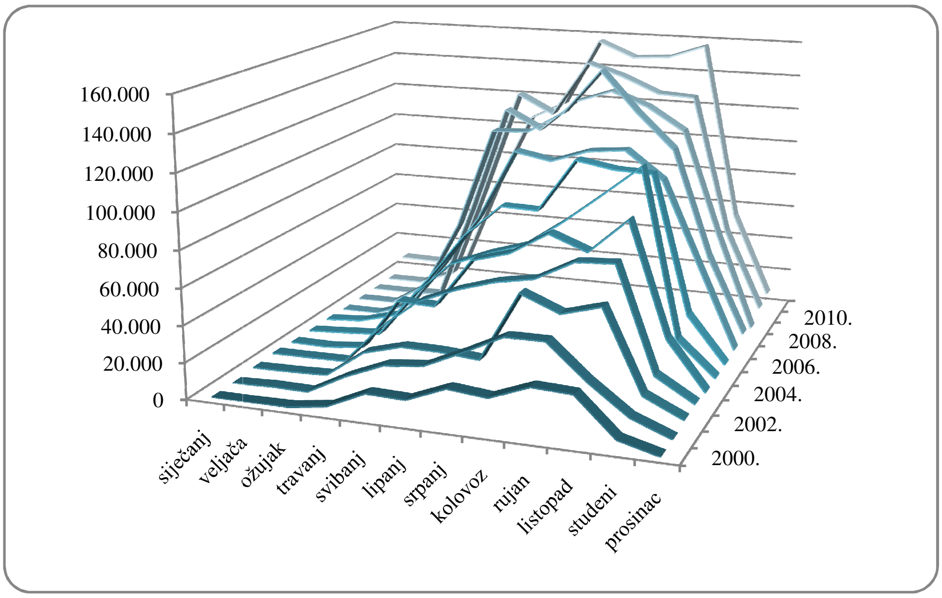
Year	Number of calls			Number of passengers		
	GRUŽ	OLD CITY	TOTAL	GRUŽ	OLD CITY	TOTAL
1998	118	28	146	59.331	30.449	89.780
1999	28	4	32	13.808	1.359	15.167
2000	107	61	168	61.591	65.250	126.841
2001	178	101	279	95.031	110.064	205.095
2002	221	122	343	114.952	149.950	264.902
2003	361	119	480	259.705	135.637	395.342
2004	357	147	504	260.801	196.533	457.334
2005	382	171	553	297.466	213.175	510.641
2006	394	180	574	367.321	235.726	603.047
2007	429	177	606	435.489	242.280	677.769
2008	502	197	699	569.020	281.360	850.380
2009	448	185	633	573.742	272.292	846.034
2010	526	179	705	611.756	259.879	871.635
2011	484	197	681	704.725	280.673	985.398

Source: Data processed from data base of the Dubrovnik Port Authority; statistical data on cruise ship and passenger traffic in Dubrovnik 1998 – 2011

In the observed period there was an increase of the number of passengers both in Gruž and the Old City, in Gruž of 1.204% at an average growth rate of 21,84% and in the Old City of 822% at an average growth rate of 18,63%. The shown cruise passenger dynamics indicates that 85% is realised from May to October.

Calls of large and mega cruisers, short stays at destination are characteristic for Dubrovnik, as well as the fact that for most itineraries it is the only destination in Croatia. This is a direct consequence of the definition of competitive surrounding which puts Dubrovnik among the most frequent destinations included in mega cruiser tours. These tour packages are characterised by mass character, short stay at destination, extremely rich facilities on board and period of usually seven days. The type of package or the size of ship and length of call at destination determine the type of demand at destination. Thus the passengers visiting smaller cities on the Adriatic coast on smaller ships stay longer at those destinations and are more prone to various forms of expenditure. Visitors on mega cruisers, whose main destination is Dubrovnik, stay only for several hours and have little time to spend their money. Their visits are mostly focused on organised trips. Dubrovnik as a destination is mostly oriented on transit passengers, while as an official port of embarkation/disembarkation it does not exist in cruise itineraries.

Graph 1: **Cruise passenger traffic in Dubrovnik per month from 2000 till 2011**



Source: Statistical data from the Port Authority Dubrovnik

In Dubrovnik as a tourism destination there is a mesh of customs and cultures of various categories of people, namely local residents, visitors, stationary tourists and cruise passengers. A large concentration of passengers, as a result of the crowds disturbing everyday activities, fosters negative opinion of the local population on tourism. In July and August approximately 4.040 cruise passengers per day (Port Authority Dubrovnik) visit Dubrovnik, which along with 3.500 stationary tourists and 3.000 visitors (Dubrovnik Tourist Board) reaches the number of more than 10.000 passengers per day. This number does not include the local population and day visitors. Consequently the need to forecast the future flow of cruise ship passengers in the Dubrovnik region is more than evident in order to avoid unwanted effects of its further and uncontrolled development.

DATA AND METHODOLOGY

Chronologically arranged series of values from past arrivals is the starting point when forecasting arrivals of cruise ship passengers in Dubrovnik (Old City) due to the fact that 90% cruise passengers visit the Dubrovnik Old City. The Old Since the analysis of cruise ship passenger arrivals per month indicated the existence of a periodical phenomenon with one year cycle it is to be concluded that there is a pronounced seasonality. Statistical analysis is directed to numerical expression of the size of seasonal influence and as the foundation the additive and multiplicative models based on the standard decomposition of time indications are used. The main characteristics of seasonality are extreme regularity and prediction of trends at an annual pattern, so that the difference in deviation between the annual values is equal to zero when trend and accidental components are removed.

Forecasting of cruise ship passenger flows in Dubrovnik will serve to process the data on previous flows in order to determine the trends in the flows over a period of time. Forecasting procedures relying on time series are mostly related to standard decomposition of time series. To forecast the tourism flows some time series models will be used according to models applied by Chen, Chang and Chang in 2009.

First of all HEGY test must be used to test seasonal unit roots and is based on result on the decomposition of polynomials. HEGY provide tests for unit roots at the zero and each seasonal frequency, within the overall null hypothesis that seasonal (or annual) differencing is required to induce stationarity in a quarterly time series. Unit root test examines whether time series is stationary, whether this series contains unit root. If the HEGY test shows that series contains unit root it has to be transformed into stationary series by removing the unit root. For the unit root in this paper Augmented Dickey-Fuller (ADF) test is applied which is the most notable method. The Augmented Dickey-Fuller (ADF) test is a test for a unit root in a time series sample. This test is a version of the Dickey-Fuller (DF) test for a larger and more complicated set of time series models. ADF statistic, used in the test, is a negative number. The more negative it is, the stronger the rejections of the hypothesis that there are a unit root at some level of confidence. ADF test can be written as (Chen, Chang and Chang 2009, 128):

$$\Delta y_t = \alpha y_{t-1} + \sum_{i=1}^{n} \beta_i \Delta_{yt-1} + \lambda_t + \gamma + \mu_t \qquad \mu_t = IID(0, \sigma^2) \tag{1}$$

y_t is the natural logarithm at t, α, β_t, λ_t and γ are parameters for estimating, and μ is the error. H0: $\alpha = 0$ and the alternative hypothesis is H1: $\alpha < 0$.
In case of seasonality, a time series achieving stationarity after taking d non-seasonal differences and D seasonal difference is denoted as $I(d,D)$.
For monthly series, the HEGY test is based on the following auxiliary regression.

$$y_{13_t} \sum_{k=1}^{12} \pi_k x_{k,t-1} + r_0 t + r_1 + \sum_{k=2}^{12} r_k S_{kt} + \varepsilon_t \tag{2}$$

$y_{13_t} = (1-B^{12})x_t$ and $x_{k,\,t-1}$ are linear transformations of y_{t-1}, y_{t-2}… y_{t-12}; k is determined to mimic a white noise process. The null hypothesis representing that the time series follows an $I(0, 1)$ process. It is tested using an *F-type* statistic, denoted as $F_{1\text{-}12}$. If it is rejected that indicates that time series follows *(1, 0)*. *F*-type statistic is conducted and denoted as $F_{2\text{-}12}$. If the hypotheses are rejected, that indicates that time series follows the process *I(0, 0)*.

The ARIMA model can be used when the time series is stationary and there are no missing data in time series. Analysis in ARIMA model is based on observation to a time series for generating a good model that shows process-generating mechanism precisely. This technique includes identification, estimation and diagnostic checking. The generalisation of ARIMA model to the SARIMA model occurs when the series contains both seasonal and non-seasonal features. In fact, time series of tourism demand often display periodic patterns for example- seasonality. A seasonal time series contains periodical behaviour and is no stationary. Therefore the ARIMA model is used to accommodate the seasonality with model SARIMA. This behaviour of the series makes the ARIMA model inefficient to be applied to the series. This is because it may not be able to capture the feature along the seasonal part of the series and therefore may mislead to a wrong order selection for non-seasonal component. The seasonal ARIMA (p,d,q) is one of the ARIMA models (p,d,q) which residuals ε_t may further be modelled by an ARIMA (P,D,Q) structure with linear operators (P,D,Q) that are functions of B^s operator. B is operator of backward shift operator while s represents the seasonal moving average. SARIMA i.e. ARIMA(p,d,q)(P,D,Q)$_s$ model is defined as:(Brockwell and Davis, 2002)

$$\phi(B)\Phi(B^s)(1-B)^d(1-B^s)^D y_t = \theta(B)\Theta(B^s)\varepsilon_t \tag{3}$$

where B is backward shift operator, Φ i Θ is seasonal operator of moving average (MA) and autoregressive (AR) polynomial queue (P) and (Q) in variable B^s:

$$\Phi(B^s) = 1 - \Phi_1 B^s - \Phi B^{2s} - \ldots - \Phi_p B^{PS} \tag{4}$$

$$\Theta(B^s) = 1 + \Theta_1 B^s + \Theta B^{2s} + \ldots + \Theta_Q B^{QS} \tag{5}$$

ϕ and θ are standard moving average *(MA)* and autoregressive *(AR)* polynomial queue p and q in variable *B:*

$$\phi(B) = 1 - \phi_1 B - \phi_2 B^2 - \ldots - \phi_p B^p \tag{6}$$

$$\theta(B) = 1 + \theta_1 B + \theta_2 B^2 + \ldots + \theta_q B^q \tag{7}$$

p, d and *q* are the order of non-seasonal AR, differencing and MA respectively.
P, D and *Q* represent the order of seasonal AR, differencing and MA respectively.
yt represent observable time series data at period *t*.
ε_t represent white noise error (random shock) at period *t*.
s is seasonal order.

RESULTS

In the stage of the model identification, it is assumed that possible SARIMA models that best fit data under consideration. Before searching for the potential model for the data on cruise demand in Dubrovnik, that data must fulfil the first condition and that is condition of stationarity. Stationary time line has a constant median value, constant variance and constant auto-correlation. This model proposes differencing of non-stationary series once or multiple times in order to achieve stationarity before fitting this model to the cruise tourism demand in Dubrovnik. Logarithmic transformation is applied to the series to capture the multiplicative effect in the level of cruise tourism demand. The ADF test for unit root is applied for the logarithmic cruise tourism demand to Dubrovnik. This test allows a parametric correction for the higher order serial correlation. The results of ADF test are shown in next table.

Table 2: **Results of ADF test for the series cruise tourism demand (CTD)**

Null Hypothesis: D (CTD) has a unit root

		t-statistic
Augmented Dickey-Fuller test statistic		-1.5610
Test critical values:	1% level	-2.0510
	5% level	-1.9452
	10% level	-1.6283

Augmented Dickey-Fuller Test Equation
Dependent Variable D (CTD, 2)
Method: Least Squares
Sample (adjusted): 2000 M1 2011 M12
Included observation 144 after adjustment

Variable	Coefficient	t-statistic
CTD-1	-0.1336	-1.5610
D(CTD (-1))	0.4043	5.0033
D(CTD(-2))	0.1188	1.3202

In the first differencing series the value of ADF test unit is -1.5610 and it is higher than the critical values of ADF test that read -2.0510 for significance of 1%, -1.9452 for significance of 5% and -1.6238 for significance of 10%. Since the test on the presence of unit root is actually the test for the bottom value, the test result indicates that the null hypothesis on non-stationarity with the usual level of significance can be accepted which confirms the conclusion on non-stationarity of the phenomenon.

In order to reach the conclusion on non-stationarity of the phenomenon the HEGY test will be applied as well. The results of the HEGY test are shown in the table 3.

Table 3: **HEGY seasonal unit root test for monthly cruise tourism demand in Dubrovnik before seasonal adjustment and after seasonal adjustment (2000:1 to 2011:12)**

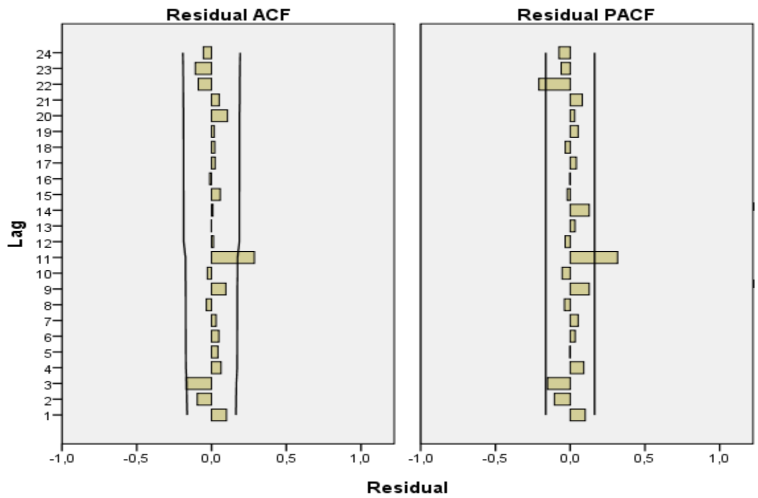
Variable	t-statistic
π_1	0.2564
π_2	1.6234
π_3	0.7100
π_4	0.8395
π_5	-1.7763*
π_6	2.0293
π_7	1.6288
π_8	2.4391
π_9	1.5072
π_{10}	-0.4901*
π_{11}	-0.2006*
π_{12}	-0.5682*
	F-statistic
π_3, π_4	0.2365
π_5, π_6	0.3845
π_7, π_8	0.4018
π_9, π_{10}	0.3501
π_{11}, π_{12}	0.4871
$\pi_1, \ldots \pi_{12}$	0.2793
$\pi_2, \ldots \pi_{12}$	0.1536

Variable	t-statistic
π_1	0.8961
π_2	-3.3468*
π_3	-1.3017*
π_4	-0.8419*
π_5	-3.6297*
π_6	-5.1607*
π_7	-0.0820*
π_8	-0.0796*
π_9	-1.5730*
π_{10}	-2.6152*
π_{11}	-0.2414*
π_{12}	-0.8049*
	F-statistic
π_3, π_4	3.0714
π_5, π_6	3.0652
π_7, π_8	3.1041
π_9, π_{10}	3.1125
π_{11}, π_{12}	3.1182
$\pi_1, \ldots \pi_{12}$	1.9051
$\pi_2, \ldots \pi_{12}$	1.8867

The null hypothesis of a unit root test is based on t-statistic using simulated critical values. The test involves the use of t-test for the 12 hypotheses and an F-test for the last six hypotheses. The results of a seasonal unit root test show that almost all the parameters are not significant at 5% levels in the table before seasonal adjustment of the cruise tourism demand in Dubrovnik. That means that we can accept null hypothesis of the existence of a seasonal unit root. Logarithmic transformations are used to capture multiplicative effect in the level of the variable and are applied to the monthly number of cruise tourism demand and HEGY test in table after seasonal adjustment shoves that eleven of twelve parameters are significant at 5% level and it can be concluded that after logarithmic transformations null hypothesis can be rejected and then that this time series can be treated as the variable of interest as seasonal stationary.

After confirming and then removing the seasonality by applying logarithmic transformation in the next stage it is necessary to determine the order (p and Q) of the autoregressive unit in the moving average. The p i q value is determined by auto-correlation coefficients and partial correlation coefficients that behave differently in AR and MA models. The partial auto-correlation coefficients react in the opposite way. It is necessary to obtain data on both groups of coefficients. The coefficients behave differently and thus forming a conclusion may be complicated. Oscillation of coefficients around the abscissa and their gradual closing towards zero indicates a negative sign in denoting parameters, and if both groups of coefficients are closing towards zero the SARIMA model is chosen where the order is defined by evaluation and comparison on the basis of the parameters given. From the data shown in the graph below the ACH has an exponential decay starting from non-seasonal lag 1 and seasonal lag 12. After comparing 20 different models using their information criterion the most appropriate model was selected and that is the model with the lowest value of AIC and BIC SARIMA $(1,0,0)(0,0,1)_{12}$.

Graph 2: **Value of residual ACF and PACF**



After estimating parameters of the model, the chosen model must be tested to determine whether it satisfies all the assumptions of seasonal ARIMA model. The residuals of the model must follow a white noise process. Residuals should have zero mean, constant variance and also be uncorrelated. Graph 2 displays the ACF of the residuals of selected SARIMA models. Since the residuals on the graph are random chosen the model is suitable. Consequently, the next phase of forecasting of cruise tourism demand in Dubrovnik area with application of the SARIMA model $(1,0,0)(0,0,1)_{12}$ is justified. The monthly data for the period 2012 – 2015 are in the forecast.

Table 4: **Cruise tourism demand forecasting in Dubrovnik from 2012 to 2015**

Month	*Number of cruise tourists*	*Month*	*Number of cruise tourists*
Jan 2012	13.663	*Jan 2013*	20.134
Feb 2012	13.967	*Feb 2013*	20.438
Mar 2012	16.938	*Mar 2013*	23.409
Apr 2012	69.018	*Apr 2013*	75.489
May 2012	112.714	*May 2013*	119.185
Jun 2012	123.514	*Jun 2013*	129.986

Month	***Number of cruise tourists***	***Month***	***Number of cruise tourists***
Jul 2012	162.989	*Jul 2013*	169.460
Aug 2012	154.380	*Aug 2013*	160.851
Sep 2012	155.675	*Sep 2013*	162.146
Oct 2012	163.179	*Oct 2013*	169.650
Nov 2012	61.181	*Nov 2013*	67.652
Dec 2012	14.139	*Dec 2013*	20.610
Jan 2014	26.605	*Jan 2015*	33.076
Feb 2014	26.909	*Feb 2015*	33.380
Mar 2014	29.880	*Mar 2015*	36.351
Apr 2014	81.960	*Apr 2015*	88.431
May 2014	125.656	*May 2015*	132.127
Jun 2014	136.457	*Jun 2015*	142.928
Jul 2014	175.931	*Jul 2015*	182.402
Aug 2014	167.322	*Aug 2015*	173.793
Sep 2014	168.617	*Sep 2015*	175.088
Oct 2014	176.121	*Oct 2015*	182.592
Nov 2014	74.123	*Nov 2015*	80.594
Dec 2014	27.081	*Dec 2015*	33.552

With application of the SARIMA model and having in mind that forecasting was carried out under assumption that there will be no significant changes in the existing conditions it is to be concluded the cruise ship passenger arrivals in Dubrovnik area in 2015 will reach 1.294.316 making an increase of 31% in comparison with the year 2011 at an average growth rate of 7.06%. If the initial starting period is taken into consideration, i.e. 1998, the number of passengers on cruise ships will increase by 1.341% by 2015 at an average growth rate of 17%. The data obtained indicate that the dynamics of cruise ship passenger flows as well as their time distribution is the same as in other groups of visitors to Dubrovnik, which is primarily due to limitations of receptive capacities and, which is no less important, due to flaws in destination management organisation. The problem is even more pronounced in the light of the records showing that cultural and natural attractions in the County reach approximately one million of visits per annum. The existing number of cruise ship passengers could be received if the future trends are forecast provided sustainability and attractiveness of the destination are preserved to the satisfaction of the local population and all categories of visitors and only if the demand is more evenly distributed throughout the year along with the application of an adequate model of the visitor flow management at the destination.

CONCLUSION

The adequacy of a forecasting method of tourism demand is imperative for a successful tourism development policy for public and private sector. Therefore the paper analyses the possibility of choosing an adequate SARIMA forecasting model and its usefulness as a forecasting mechanism for cruise tourism demand in Dubrovnik. The SARIMA forecasting frame has been identified encompassing collection of data, determining the order of integration, model identification, validation and estimation of forecasting performances. The Box-Jenkins forecasting model has been adopted known as the SARIMA model since the basis for strategic planning of development of cruising tourism in Dubrovnik is sustainability and demand management. Univariated methodology is applied with some modification. The paper performed the analysis on monthly inflow of cruise demand covering the period from 2000:1 to 2011:12. Using monthly date paper forecast the period 2012:1 to 2014:12. In this study, HEGY seasonal unit root test is applied to examine the logarithms of monthly cruise tourism demand to Dubrovnik. The use of such procedures improves the validity of SARIMA model construction. After comparing 20 different models using their information criterion the most appropriate model was selected and that is the model with the lowest value of AIC and BIC SARIMA $(1,0,0)(0,0,1)_{12}$. The data obtained indicate that the dynamics of cruise ship passenger flows as well as their time distribution is the same as in other groups of visitors to Dubrovnik. Although there are positive trends in distribution of demand per month and per week days, they cannot compensate for the problems arising due to the concentration of cruise passengers in the first half of the day, short stay in port and limited receptive area capacities. Due to the specific situation, foreseen growth in demand and sustainable/acceptable capacities much more attention should be dedicated to the problem of cruise ships and passengers management.

In planning the future development of tourism in Dubrovnik it is necessary to keep forecasting the passenger flows. This would give necessary guidelines for due action to be taken to meet the passengers' requirements in a more efficient manner and thus achieve certain competitiveness at the tourism market in this segment of tourism supply. On the other hand, forecasting of tourism flows and passenger flows enables a more accurate planning and more efficient preparation for the forthcoming changes at the destination. If the extreme elasticity of passengers' demand is taken into consideration it is almost impossible to make accurate forecasts, but such a procedure could significantly assist to reduce the uncertainty in the near future. Consequently, in order to avoid the negative aspects arising from tourism development in a destination in the future the applications of different forecasting models are unavoidable.

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