ISSN (PRINT): 1994 - 7658 ISSN (ONLINE): 1314 - 0817

VARNA UNIVERSITY OF MANAGEMENT

European Journal of Tourism Research

http://ejtr.vumk.eu

Seasonality in the cruise industry: Activity, prices and regionality

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Abstract
The aim of this study is to analyse and compare the seasonal pattern of activity and prices in the cruise industry, both globally and regionally (in the Mediterranean), as well as the impact of this seasonality on the cruise industry and cruise destinations. Methodologically, seasonality indices for activity and prices are calculated based on available statistics and a database of 51,129 observations from 2019. The results show that there is activity and price seasonality worldwide, although it is higher in the Mediterranean region. This supports the idea that cruise lines face less variation in activity due to seasonality, as they can reposition their ships in different regions throughout the year. The seasonality of cruise destinations is more pronounced, due to natural and institutional factors, but also to these repositioning decisions by cruise lines. A comparison of activity and price seasonality shows that prices fluctuate more globally, while activity fluctuates more regionally. The cruise lines' strategies are reviewed in order to draw some theoretical and practical implications for understanding future trends in the industry. Suggestions are also made as to how destinations can deal with the inconveniences of seasonality in cruise destinations, such as overtourism.

Keywords: cruises; regional seasonality; seasonality of activity; seasonality of prices; worldwide seasonality

Citation: Espinet-Rius, J.M., García-Sánchez, A. and Gassiot-Melian, A. (2024). Seasonality in the cruise industry: Activity, prices and regionality. *European Journal of Tourism Research*, 38, 3810. https://doi.org/10.54055/ejtr.v38i.3481.

Publication history:
Received: 30/09/2023; Revised: 22/12/2023, 28/02/2024, 03/04/2024; Accepted: 22/04/2024; Published online: 01/08/2024; Volume date: 01/10/2024
Coordinating editor: Jessica Mei Pung

1. Introduction

Seasonality is defined as a temporal imbalance that recurs continuously over time (Butler, 1994). Seasonality and its effects have been extensively analysed in the literature (Butler & Mao, 1997; Koenig-Lewis & Bischoff, 2005), generally highlighting the negative impact on sales, profitability, investment, employment, social stability and the environment. Recently, the impact of overtourism has also been emphasised (Abbasian et al., 2020). Seasonality is thus a major concern for managers of companies operating in sectors that suffer from seasonal behaviour, who seek to overcome or at least mitigate some of the drawbacks of seasonality.

Tourism activities have different characteristics in terms of seasonality. This is true of the cruise industry, one of the sectors with the highest growth rates before COVID-19. According to the Cruise Lines International Association (CLIA, 2021), the number of ocean cruise passengers was 29.7 million in 2019, compared to 17.8 million in 2009, an increase of 66.8%. One of the characteristics of the cruise industry is that cruise lines can move their ships from one region to another in order to obtain better revenues and profits, which generally reduces the seasonality of these companies (Fernández-Morales & Cisneros-Martínez, 2019), but not the seasonality of the ports and destinations where cruise ships call (Esteve-Pérez & García-Sanchez, 2015). Cruise ships always sail where good navigational conditions are expected, and tend to spend more time in ports with temperate climates (Li *et al.*, 2021). While this is difficult to overcome in Northern Europe due to natural circumstances that make navigation difficult during part of the year, there are more opportunities in the Mediterranean and it is one of the main priorities of ports and destinations in the region (Pallis & Papachristou, 2021). Seasonality also has a negative impact on ports, as there is an under-utilisation of capacity in the off-season months, which in turn reduces the return on the deployed capital (Esteve-Pérez *et al.*, 2019). This is an important concern, given that the cruise industry currently requires specific terminals with first-class facilities and a high level of sophistication. Additionally, the larger size of some of the new cruise ships and the growing demand to provide newer and better services to ships and passengers in ports have increased the cost of investing in port infrastructure to adequately meet the demands of cruise tourism. Meanwhile, during peak seasons, ports struggle to recruit human resources, maintain service quality and keep their environmental impact down.

The aim of this study is to analyse and compare the seasonal pattern of activity and prices in the cruise industry, both globally and regionally, and the impact of this seasonality on the cruise industry and cruise destinations. Below are the four specific research questions that guided this research:

RQ1: What kind of activity seasonality is there in the cruise industry on a global scale?
RQ2: How does this global activity seasonality compare to regional activity seasonality?
RQ3: What kind of price seasonality is there in the cruise industry and how do global and regional patterns compare?
RQ4: What is the relationship between price seasonality and activity seasonality in the cruise industry?

The region analysed in this study is the Mediterranean, the second largest cruise region in terms of number of cruise tourists (CLIA, 2021). Comparing this region to the global context provides greater insight into changes in activity and prices due to seasonality and how these changes are related. This can lead to a better understanding of cruise lines' decisions to move to other regions and the impact of these decisions on activity and prices. Based on this, an explanation of how ships are positioned across regions with cruise activity is provided, and this can be used to anticipate changes in itineraries. The contributions of this study refer to both the global and regional context (in this case, the Mediterranean), resulting in some management recommendations for the benefit of cruise lines, destinations, ports and cruise passengers. Moreover, results of this study can help to propose measures to deal with overtourism in cruise destinations. To carry out this study, an extensive database of 51,129 observations

from 2019 is created to explore seasonality based on activity and prices. Methodologically, several seasonal indices are created following Esteve-Pérez and García-Sanchez (2019, 2022).

The rest of the paper is structured as follows. Section 2 provides a literature review, citing the main contributions. Section 3 presents the databases and methodology used in this study. Section 4 goes into our results and discusses them from a managerial point of view. Finally, Section 5 outlines our main conclusions.

2. Literature review

Seasonality in the tourism industry has been widely analysed. In production or activity, it implies a variation in output that recurs continuously over certain periods of time, resulting in high and low seasons. The temporal patterns of seasonality, the differences between high and low seasons, and the evolution of seasonality itself are other characteristics that have been analysed. Butler and Mao (1997), for instance, characterised seasonality patterns by the number of peaks recorded in the high and low seasons: 'one-peak', 'two-peak' or 'non-peak'. In the same way, price seasonality implies a variation in prices that is repeated over certain periods of time. Higher prices are recorded in one part of the period considered (e.g. year, month, etc.) and lower prices are recorded in the other. Literature comparing the seasonality of production or activity and the seasonality of prices in tourism is scarce (Mitra, 2020; Lozano *et al.*, 2021). This section includes a review of previous literature on seasonality in the cruise industry, an analysis of seasonality based on activity and prices, and a look at the relationship between the two in the cruise industry.

There may be several reasons for the paucity of research on seasonality in the cruise industry. First, although cruise tourism is growing rapidly, it is still a small part of the tourism and hospitality industry. Second, cruise activity consists of accommodation (ships) and itineraries (destinations and ports) and should therefore be treated differently. Third, data on cruise activity are difficult to collect. Most studies on seasonality in the cruise industry refer to the relationship between this phenomenon and the number of ships, itineraries or tourists, while only a few refer to the relationship between seasonality and prices. Furthermore, all empirical studies found have a local or regional focus. Thus, this study fills two gaps by analysing the relationship between activity and price seasonality in the cruise industry and by examining seasonality in the cruise industry at different levels (i.e. regional and global).

2.1. Seasonality and activity in the cruise industry

The review of the literature on seasonality in the cruise industry shows that researchers have focused their analyses mainly on the activity side and specific geographical areas. The literature review confirms that activity seasonality is prominent in the cruise industry, as studied in several destinations. For example, Marusic *et al.* (2012) compare cruise tourism in Dubrovnik with the rest of the Mediterranean; Bardolet and Sheldon (2008) analyse the Balearic Islands and Hawaii; Seidl *et al.* (2007) take Costa Rica as their study location; and others are located in Spain (Esteve-Pérez & García-Sánchez, 2017; Esteve-Pérez *et al.*, 2019; Fernández-Morales & Mayorga-Toledano, 2018; Lois Gonzalez *et al.*, 2022). Methodologically, most studies have explained seasonality through descriptive statistics of different indices, such as the Gini index or the number of passengers in cruise ports, so no major methodological advances in analytical tools have been used to explain it (Fernández-Morales & Mayorga-Toledano, 2018). Ito *et al.* (2023) measure the seasonality of the cruise industry by latitudinal distance in 2019, before COVID-19.

Apart from accepting that activity seasonality exists in the cruise industry, most published articles conclude that this seasonality has limited peaks, usually one or two. Rodrigue & Notteboom (2013) classify itineraries as perennial (Caribbean or Mediterranean), seasonal (Baltic) and repositioning (e.g. routes between the Caribbean and Mediterranean). The main reasons for seasonality studied in the cruise industry are natural, such as weather and navigational conditions. For example, the most important cruise

region, the Caribbean, is highly affected by the risk of hurricanes and tropical storms in the third quarter of the year (Wang *et al.*, 2018), which is why most cruise ships are repositioned to other regions or areas, such as the Mediterranean, during this period.

Li *et al.* (2021) note that the *Queen Elizabeth*'s itineraries are planned throughout the year to skip the winter seasons and follow the other climatological seasons continuously in both the northern and southern hemispheres. For similar reasons, more ships sail in the Mediterranean in summer and autumn, especially from May to October (CLIA, 2020). In this regard, Esteve-Pérez & García-Sánchez (2017) found a seasonality pattern in the Mediterranean, with a high season in the second and third quarters of the year and a low season from November to April.

In sum, there is a consensus that activity seasonality is a major challenge for all stakeholders in the cruise industry (Charlier & McCalla, 2006; Lukovic & Bözik, 2011; Pallis, 2015; Wang *et al.*, 2015). These challenges have increased in recent years due to the higher cost and capacity of new ships, which require cruise lines to ensure minimum occupancy levels, resulting in a higher number of cruise tourists. For example, Royal Caribbean International's *Wonder of the Seas*, the largest cruise ship in the world, cost nearly $1.35 billion to build and has a capacity of around 7,000 passengers and 2,300 crew members. Given the larger size of the new cruise ships and their growing needs, ports are also making greater efforts to invest in infrastructure for cruise activities. Likewise, cruise destinations (tourist hinterlands) have recently increased their investments in receiving and serving cruise ship tourists. Despite this, not all the three relevant stakeholders in the cruise industry have the same opportunities to mitigate the undesirable consequences of seasonality (Esteve-Pérez & García-Sánchez, 2017). As a direct consequence of ship repositioning by cruise lines, the variation in the number of ships between high and low seasons in a given region will be much greater than that observed at the global level.

2.2. Seasonality and prices in the cruise industry

Studies on price seasonality in tourism are not very common, and even less so in the cruise industry. Niavis & Tsiotas (2018) break down the price of the cruise product into tourism and transport attributes in the Mediterranean, considering four seasons and ultimately concluding that prices differ by trimester. In the same sense, Espinet *et al.* (2018, 2022) use the hedonic approach to isolate the effect of cruise package characteristics and attributes on prices and reveal the existence of price seasonality. Joo *et al.* (2020) analyse customer behaviour and prices between the date of booking and the date of consumption and identify several price seasonality dates. Thus, the literature provides evidence for the existence of price seasonality in the cruise industry, which is found in itineraries and consequently in ports and destinations, but also in companies.

Overall, the analysis of seasonality is common in the literature on tourism activity, but scarce when considering the cruise industry. Research on seasonality in the cruise industry has mainly been conducted with a regional focus and has primarily considered cruise activity. There is therefore a need to look at it globally and compare it with regional findings, and to consider the relationships between the seasonality of cruise activity and the seasonality of prices.

3. Materials and methods

3.1. Data collection

In the cruise industry, the most relevant global public data are provided by CLIA. However, these data are scarce, as they are only included in their specific reports, and they are usually not broken down by month. Monthly cruise industry data can be acquired from some private companies, but for a fee. It is also possible to collect data from specific websites, usually through web scrapping techniques. These were the techniques used to gather data from our main source, a leading American online travel agency (OTA). This database can be considered a complete database of cruises around the world for several

reasons. First, OTAs are one of the most common channels for booking cruises and prices do not vary between distribution channels (Joo *et al.*, 2020), so using data from a single OTA would not be a major limitation for this study. Second, the ships identified on this website have a capacity of 518,538 passengers, and the total capacity of the cruise industry, according to Cruise Market Watch (2019), is approximately 537,000, meaning that the sample in this study represents approximately 96.6% of the global capacity. Third, cruise lines do not have full occupancy rates until the last few days before departure (Joo *et al.*, 2020), and this study collects data and prices up to the day before departure.

Two types of data were obtained from this OTA: data on cruise activity, based on the identification of all available itineraries, and data on cruise prices paid by customers. Collecting price information is usually considered one of the main difficulties when trying to conduct studies on cruises (Papathanassis, 2017). However, we were able to collect all prices (in US dollars) paid by customers (including port taxes) for itineraries of up to 15 nights in 2019, departing and ending in the same CLIA region. These filters were applied because the aim of the study is to compare regional seasonality, which would not be possible if the ship were to be repositioned in another region (e.g. the study does not include world cruises or repositioning cruises). A total of 51,129 observations were considered, corresponding to 11,886 departures. The variables collected for each price are: itinerary identification, cabin type (i.e. inside, oceanview, balcony and suite), departure date, number of nights, port of departure and arrival, number of days at sea and ship characteristics (i.e. capacity, age and rating).

Regional data on activity were obtained from MedCruise (2020). MedCruise is the main association of Mediterranean cruise ports and regularly publishes statistics on the Mediterranean cruise market. For the purposes of this study, the total number of cruise passengers and the total number of cruise calls from 2015 to 2019 are considered. In addition, and similarly to what is done for the world, the seasonality of activity in the Mediterranean was estimated using the number of ships and their total capacity. Several years were considered in order to analyse whether the fluctuations in activity during the year are stable or have changed.

This study follows the cruise data collection and management process proposed by Espinet *et al.* (2022): (1) identifying the information needed according to the goals of the study; (2) downloading the data using an automated process (i.e. web scrapping techniques); and (3) analysing the quality of the data by, for example, identifying incomplete or incorrect pieces, which in this case led to the exclusion of some observations. After these steps, the data were clean and ready for analysis (Section 3.2).

Given the major impact of COVID-19 on the cruise industry and the fact that the sector is not expected to recover fully until 2023-2024 (CLIA, 2023), the authors thought it appropriate to use the activity and prices of 2019 for this analysis, thus offering insight into what can be considered the usual situation in the sector. Of course, it will be interesting to compare the seasonal evolution of activity and prices in 2024-2025, after the impact of COVID-19.

3.2. Data analysis

Data analysis was carried out in three steps: calculation and analysis of activity seasonality indices, calculation and analysis of price seasonality indices, and comparison of activity and price seasonality indices.

First, a specific analysis of the seasonality of cruise activity is conducted by constructing a seasonal index based on the number of cruise ships and their estimated capacity at both global and regional levels. For this purpose, the number of ships or their total capacity on a monthly average is calculated, followed by the standard deviation ('SD' in the tables), and finally the seasonal component is measured using the coefficient of variation (Duro, 2016; Duro & Turrión-Prats, 2022). This index, expressed as a percentage,

is obtained by multiplying the ratio of the standard deviation to the average by one hundred ('% SD/average' in the tables). It is particularly useful for understanding data variation, as it is independent of the unit in which it is measured. In this step, ranges and coefficients of variation in percentages are calculated in order to examine the existence, evolution and level of activity seasonality.

Second, a specific analysis of the seasonality of cruise prices is conducted by constructing a seasonal variation index based on the average price paid by customers and the hedonic coefficient –taking into account the characteristics of the cruise package that determine this price–, at both global and regional levels. The index is calculated in the same way as the seasonal activity indices, i.e. it is also based on the coefficient of variation. Ranges and coefficients of variation are calculated in percentage terms to examine the seasonality of prices.

From an economic point of view, the use of the real price paid by customers allows researchers to confirm that this is the equilibrium price obtained from the customers' willingness to pay, which can vary at any moment, and the price that the cruise line is willing to charge, which can also vary at any moment. This analysis is complemented by hedonic analyses, which have been widely used in tourism to compare seasonality (Coenders & Espinet, 2003; Saló *et al.*, 2012; Picazo & Moreno-Gil, 2018; Saló *et al.*, 2020; Casamatta *et al.*, 2022). This methodology allows researchers to disaggregate the impact of each price determinant on the overall price of the cruise package. A semi-logarithmic model is defined in which the dependent variable (i.e. ln price) is determined by several independent variables, which in this case refer to the attributes of the cruise package (i.e. number of nights in the itinerary, month of departure, cabin type, cruise line and ship capacity). As shown in the equations below, the cruise product can be defined as a vector of characteristics or attributes (Ci), where i = 1,..., n represents the ship and cim the value of each of its m attributes. All these characteristics have an impact on prices, so they are represented in the hedonic price function for each cruise (Pi). This functional form of P is assumed to be constant over time and across ships, although the weight or contribution of each attribute may change (lnPi), where P is the price, cm is each of the m attributes of the cruise, βn is the parameters to be estimated and εi is the error term of the regression:

(1) $\boldsymbol{C}i = (ci1, ..., cim)$,
(2) $\boldsymbol{P}i = f(ci1, ..., cim)$,
(3) $\ln Pi = f(ci1, ..., cim,, \beta n, \varepsilon i)$

Since the aim is to compare global and regional seasonality, two specifications are estimated: one for the Mediterranean and one for the world. The variables included, taken from Espinet *et al.* (2018), are the cruise package attributes mentioned above.

Finally, in order to compare activity seasonality and price seasonality, a correlation matrix is provided to explore the convergence of these indices.

4. Results and discussion

This section presents the results of the empirical analyses conducted to answer the four research questions of this study. The section is divided into three parts. The first part (4.1) presents and compares the nature and existence of seasonality in cruise activity from a global and regional (Mediterranean) perspective, thus addressing RQ1 and RQ2. The second part (4.2) analyses the existence of price seasonality in the cruise industry and compares regional and global patterns (i.e. RQ3 is analysed). The third part (4.3) compares the seasonality of cruise activity with the seasonality of prices, providing an analysis that addresses RQ4.

4.1. Seasonality of cruise industry activity

The results of our analysis of the seasonality of cruise industry activity globally (worldwide) and regionally (Mediterranean) are displayed in Table 1 and Appendix 1.

Table 1. Seasonality of cruise ships and cruise capacity by month for the world as a whole and the Mediterranean region

	WORLDWIDE				MEDITERRANEAN			
			SEASONAL VARIATION INDEX				SEASONAL VARIATION INDEX	
Month	**Number of ships**	**Estimated total ship capacity**	**Number of ships**	**Estimated total ship capacity**	**Number of ships**	**Estimated total ship capacity**	**Number of ships**	**Estimated total ship capacity**
January	187	415,599	91.0	92.3	5	15,584	12.7	18.9
February	194	426,055	94.4	94.6	6	16,514	15.2	20.0
March	192	436,525	93.4	97.0	15	42,810	38.0	51.9
April	197	439,145	95.9	97.5	47	90,673	119.0	109.9
May	217	471,146	105.6	104.6	63	123,325	159.5	149.5
June	226	480,825	110.0	106.8	52	106,907	131.6	129.6
July	222	476,334	108.0	105.8	52	109,041	131.6	132.1
August	224	476,109	109.0	105.8	54	107,811	136.7	130.7
September	210	462,053	102.2	102.6	63	133,808	159.5	162.2
October	198	437,326	96.4	97.1	68	137,118	172.2	166.2
November	196	440,718	95.4	97.9	40	87,357	101.3	105.9
December	203	440,739	98.8	97.9	9	19,233	22.8	23.3
Average	*205.5*	450,215	*100.0*	*100.0*	*39.5*	82,515	*100.0*	*100.0*
SD	*13.7*	21,963	*6.7*	*4.9*	*24.0*	46,440	*60.8*	*56.3*
% SD / Average	*6.7%*	*4.9%*	*6.7%*	*4.9%*	*60.8%*	*56.3%*	*60.8%*	*56.3%*
Min	187	415,599	91.0	92.3	5	15,584	12.7	18.9
Max	226	480,825	110.0	106.8	68	137,118	172.2	166.2
Range	39	65,226	19.0	14.5	63	121,534	159.5	147.3

4.1.1. Seasonality of cruise industry activity

The number of ships sailing around the world ranges from a minimum of 187 in January to a maximum of 226 in June, with a lower variation (6.7%). These differences of only 6.7% in cruise activity over the year can be explained by climatic, social, technical and economic factors (RQ1): the fact that most cruise destinations are located in the northern hemisphere, where the weather and sailing are more pleasant in spring and summer; the school and work schedules of the main source markets, which are also located in the northern hemisphere; the need for cruise lines to have some time off from sailing for ship maintenance, etc.

Seasonality based on total passenger capacity is lower than seasonality based on number of ships (4.9%), indicating that cruise lines are more interested in having their larger ships active throughout the year as they have a better revenue yield (Nguyen *et al.*, 2021). In addition, the other characteristics (i.e. the

average rate of the ships and the average year of ship construction or refurbishment) show little variation in seasonality patterns, suggesting homogeneous strategies among cruise lines in developing their annual strategy (Appendix 1). In particular, cruise lines worldwide prefer to keep the highest capacity ships in service all year round, and pay less attention to ship category or age (Appendix 1) when deciding which ships should be taken out of service during the low season.

4.1.2. Seasonality of activity in the Mediterranean

According to MedCruise (2020), whose report is estimated to cover around 80% of cruise calls and passenger movements, the number of cruise passengers in the Mediterranean increased by 18.8% between 2015 and 2019 (from 26.3 million to 31.2 million). Cruise passenger arrivals in the Mediterranean are seasonal (Appendix 2). There is a high season from April to October and a low season from November to March. The analysis of this five-year period shows that the seasonal patterns have hardly changed. In fact, the lowest index ranges from 24.2 (in 2016) to 29.0 (in 2018), both in February. The highest index ranges from 163.3 (in 2019) to 168.7 (in 2017), both in October. This is within a range that varies from 137.7 (in 2018) to 144.5 (in 2017). In sum, there is a high seasonality of activity in the Mediterranean, and this trend does not appear to be diminishing.

The results of the estimation of the seasonality of activity in the Mediterranean, measured by the number of cruise ships and their total capacity, are also shown in Table 1. The number of ships in operation ranges from 5 in January to 68 in October, which is a considerable difference (60.8%). October (68), September (63) and May (63) are the months with the highest number of cruises. Seasonality is also lower for total passenger capacity than for the number of ships (56.3%). This two-peak seasonality was also identified by Esteve-Pérez & García-Sánchez (2019). Seasonality is also present in the average capacity of ships (17.7%) and, to some extent, in their rating (4.9%), revealing a specific strategy for the Mediterranean (Appendix 1).

In fact, during the winter season, from January to March, when on average 82% of the industry's capacity is deployed worldwide, the Mediterranean represents only 3.0% of the deployment in January and 8.3% in March (in the Mediterranean's peak season, September and October, it represents around 26% of the deployment). During these winter months, most ships are in the Caribbean and warmer destinations such as South America, and in the Mediterranean, cruise lines deploy ships with a higher average capacity (Figure 1) and a lower rating (Figure 2). This specific strategy is the result of cruise lines' decisions to generate more revenue and profit, and could therefore define a specific cruise passenger profile for the Mediterranean for these dates (further research is needed on this topic).

The results show the same seasonality path for cruise tourism in the Mediterranean when we estimate seasonality with a supply variable such as the number of ships or their total capacity (Table 1 and Appendix 1) as when we estimate it with the number of cruise passengers (Appendix 2). These results confirm that there is little variation in the capacity occupied on cruise ships throughout the year (Charlier & MCallar, 2006; Joo *et al.*, 2020; Nguyen *et al.*, 2021).

The comparison of the seasonality of cruise activity worldwide and in the Mediterranean shows marked differences (RQ2). In terms of number of cruise ships, it is 6.7% worldwide compared to 60.8% in the Mediterranean, and in terms of estimated capacity it is 4.9% and 56.3% respectively. Thus, the seasonality of cruise activity is much more pronounced regionally, as cruise lines can reposition their ships between different regions in order to generate higher revenues and avoid significant drops in the occupancy rate of their ships. This practice reduces the seasonality faced by cruise companies. However, it creates greater activity seasonality for ports and tourist hinterlands.

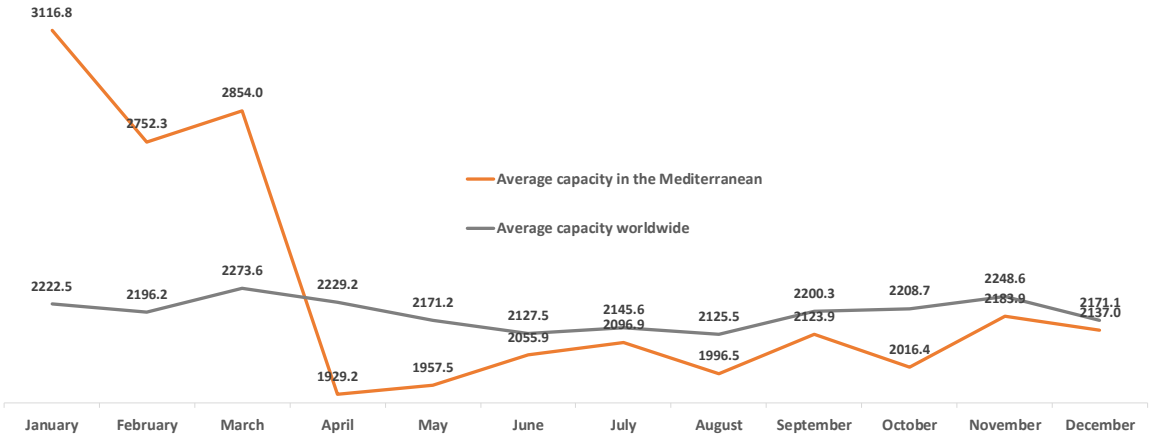

Figure 1. Average passenger capacity in the Mediterranean and worldwide

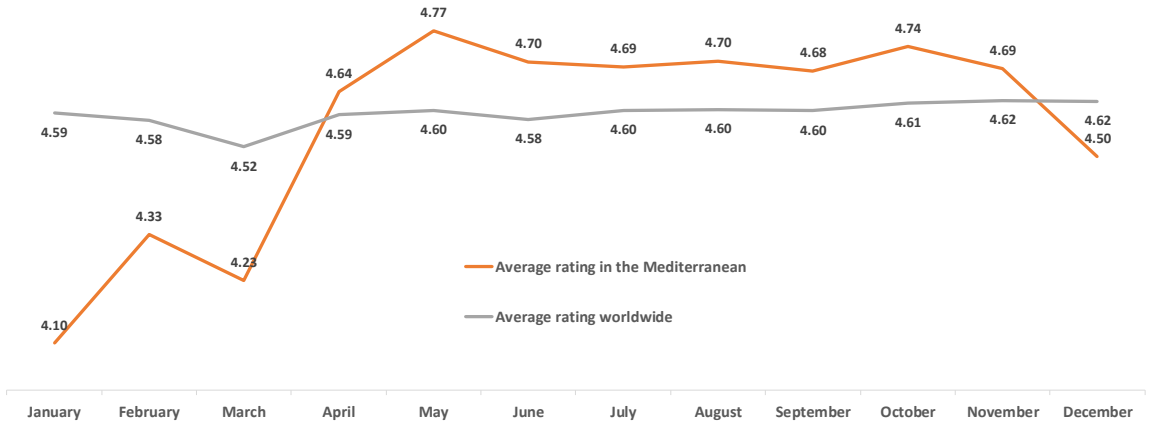

Figure 2. Average ship rating in the Mediterranean and worldwide

It is highly relevant to compare the seasonality of cruise arrivals with the seasonality of other tourist arrivals at the destination. For example, in Barcelona, the most important cruise port in the Mediterranean, the seasonality index for overnight hotel stays in 2019 was 15.8% and the seasonality index for cruise passengers was 50.7%. This shows that cruise lines may increase overtourism in some months of the high season in the Mediterranean, such as August, September and October.

4.2. Seasonality of prices in the cruise industry

To study the seasonality of prices, we first carried out a descriptive analysis of the average price per night paid by customers, both globally (Table 2) and by type of cabin (Appendix 3). We then analysed the seasonal variation index in terms of average prices and hedonic coefficients (Table 2).

The global analysis shows that the average price per night in 2019 was USD 240.9, ranging from USD 133.3 for inside cabins to USD 405.6 for suites. Analysis by month shows that average prices ranged from USD 209.3 in November to USD 283.5 in June, indicating some seasonality in prices.

In the Mediterranean, the average price per night in 2019 was USD 206.6, ranging from USD 120.3 for inside cabins to USD 335.0 for suites. Analysis by month shows that average prices ranged from USD 90.7 in January to USD 269.2 in August, indicating a high degree of seasonality in prices. Seasonal differences are higher for the cheapest cabin types (inside and oceanview) than for the most exclusive and selective (balcony and suite). This result is very common in the tourism industry, as the cheapest cabins are more price sensitive and customers tend to book later (Joo *et al.*, 2020).

In the rest of the world, the average price per night in 2019 was USD 245.9, ranging from USD 135.3 for inside cabins to USD 420.7 for suites. Analysis by month shows that average prices ranged from USD 212.8 in November to USD 292.3 in June. Again, seasonal differences are greater for the cheapest cabin types (inside and oceanview) than for the most exclusive and selective (balcony and suite).

Comparing the Mediterranean region with the rest of the world yields some interesting results (RQ3). On average, the Mediterranean region is cheaper than the rest of the world (16%). However, there are large differences between months. During the low season (January, February and March), the Mediterranean is clearly cheaper (46.3% on average). However, during the high season (from April, which included Easter in 2019, to July), the Mediterranean was on average only 9.3% cheaper than the rest of the world. Moreover, during some high season months (August and September), the Mediterranean was 4.2% more expensive than the rest of the world. October, November and December are on average 7.9% cheaper in the Mediterranean (Appendix 4).

These results help to estimate the minimum price per night, which could be an incentive for cruise lines to change regions. This price per night is on average USD 90.7 (USD 60.2 for inside cabins, USD 72.5 for oceanview cabins, USD 115.4 for balcony cabins and USD 174.0 for suites). It is important to note that before deciding to change regions, it is necessary to analyse the potential demand at the new region, the cost of moving the ship to that location and the weather conditions (Wang *et al.*, 2018). In this sense, seasonality in cruise tourism may be based more on supply than demand.

As indicated in Section 3, two seasonal price indices have been calculated. The first is based on the average price and the second on a hedonic approach, which has allowed us to isolate the effect of ship characteristics and attributes on prices. The results show a high adjusted R^2 (0.873 for the Mediterranean model and 0.865 for the rest of the world model). The specific results of the hedonic model are presented in Appendix 4 and the results of the seasonal indices are presented in Table 2. According to the average prices, price seasonality is moderate worldwide (10.9%), with November being the cheapest month and July the most expensive. In the Mediterranean, price seasonality is higher (27.4%), with January being the cheapest month and August the most expensive. According to the hedonic approach, which can be considered more accurate as it is adjusted for characteristics, price seasonality is moderate worldwide (14.6%), with November being the cheapest month and July the most expensive. Price seasonality is again higher in the Mediterranean (22.3%), with January being the cheapest month and August the most expensive. Although there are some differences between the results obtained using the average price and the hedonic approach, there is a high correlation between them (Pearson coefficient of 0.917 for the world and 0.969 for the Mediterranean). High regional differences have also been observed due to climate, such as in Northern Europe (Espinet *et al.*, 2018). As can be seen, the cheapest and most expensive months are different in the Mediterranean and in the rest of the world, confirming the fact that cruise lines move their ships to obtain higher revenues and profits. Thus, due to the high pricing opportunities identified in this study, cruise lines have a long way to go to improve their revenue

efficiency (Nguyen *et al.*, 2021), although these priorities may be the opposite of those of ports and destinations.

Table 2. Average price and seasonal price index

			SEASONAL VARIATION INDEX			
	Average price		Average price		Hedonic approach	
Month	**Worldwide**	**Mediterranean**	**Worldwide**	**Mediterranean**	**Worldwide**	**Mediterranean**
January	241.2	90.7	100.1	43.9	87.0	61.2
February	228.5	125.6	94.9	60.8	88.4	71.1
March	214.8	160.2	89.2	77.5	90.1	82.8
April	235.0	213.2	97.6	103.2	95.5	100.7
May	253.5	245.7	105.2	118.9	105.8	107.1
June	283.5	262.2	117.7	126.9	122.1	123.3
July	283.0	262.8	117.5	127.2	125.9	128.8
August	268.4	269.2	111.4	130.3	117.3	130.5
September	221.4	231.7	91.9	112.1	100.3	110.5
October	213.2	206.3	88.5	99.8	89.6	94.3
November	209.3	188.3	86.9	91.1	82.5	83.0
December	238.5	223.7	99.0	108.2	95.6	106.8
Average	240.9	206.6	*100.0*	*100.0*	*100.0*	*100.0*
SD	26.2	56.5	*10.9*	*27.4*	*14.6*	*22.3*
% SD / Average	*10.9%*	*27.4%*	*10.9%*	*27.4%*	*14.6%*	*22.3%*
Min	*209.3*	*90.7*	*86.9*	*43.9*	*82.5*	*61.2*
Max	*283.5*	*269.2*	*117.7*	*130.3*	*125.9*	*130.5*
Range	74.3	178.5	*30.8*	*86.4*	*43.3*	*69.4*

4.3. Comparison of activity seasonality and price seasonality

Finally, the degree of seasonality of activity and prices are compared both globally (the whole world) and regionally (the Mediterranean) (RQ4). This was done using Spearman's coefficient (Table 3), for which data were taken from Table 1 and Table 2. Correlations were calculated for the seasonal variation indices based on: ship activity, estimated ship capacity and average price.

In the world analysis, there is a clear correlation between the seasonal activity indices and the seasonal price indices. In fact, the minimum value of the correlation is 0.636 and the maximum value is 0.895. However, prices appear to be more seasonal than activity (14.6% compared to 4.9%). This can be explained by the fact that price variations are necessary to adapt to the greater changes in demand, with prices being lower when demand and supply are lower and higher during peak seasons when activity is also higher. The values obtained seem to be those with which the sector is comfortable and can be used as a measure of price elasticity.

In the Mediterranean region, a correlation between seasonal activity indices and seasonal price indices is also observed, although it is lower in some cases (with values around 0.63-0.64). However, prices appear to be less seasonal than activity (22.3% compared to 56.3%), as cruise companies can reposition their ships and demand does not fluctuate more than supply, as is the case worldwide. In the cruise

industry, the average minimum price (USD 90.4) could be interpreted as an incentive for cruise lines to reposition their ships outside the Mediterranean. Moreover, the repositioning of ships, by reducing the supply of ships in the low season and increasing it in the high season, significantly reduces the seasonality of prices in the region.

Table 3. Comparison of the seasonal index for demand and prices: the world versus the Mediterranean

	Seasonal index for ship activity	**Seasonal index for estimated ship capacity**	**Seasonal index for average price**	**Seasonal index for hedonic price**
World				
Seasonal index	6.7%	4.9%	10.9%	14.6%
Spearman's coefficient:				
- Seasonal index for ship activity		0.958	0.657	0.895
- Seasonal index for estimated ship capacity			0.636	0.881
- Seasonal index for average price				0.769
Mediterranean				
Seasonal index	60.8%	56.3%	27.4%	22.3%
Spearman's coefficient:				
- Seasonal index for ship activity		0.986	0.639	0.639
- Seasonal index for estimated ship capacity			0.629	0.636
- Seasonal index for average price				0.993
	Seasonal index for ship activity	**Seasonal index for estimated ship capacity**	**Seasonal index for average price**	**Seasonal index for hedonic price**
World				
Seasonal index	6.7%	4.9%	10.9%	14.6%
Spearman's coefficient:				
- Seasonal index for ship activity		0.958	0.657	0.895
- Seasonal index for estimated ship capacity			0.636	0.881
- Seasonal index for average price				0.769
Mediterranean				
Seasonal index	60.8%	56.3%	27.4%	22.3%
Spearman's coefficient:				
- Seasonal index for ship activity		0.986	0.639	0.639
- Seasonal index for estimated ship capacity			0.629	0.636
- Seasonal index for average price				0.993

5. Conclusions and discussion

Seasonality is usually a controversial issue in tourism, particularly due to its negative impact on areas such as sales, profitability, investment and employment. More recently, attention has also been drawn to its impact on sustainability and overtourism (Abbassian *et al.*, 2020). The aim of this study was to

analyse and compare seasonal activity and price patterns in the cruise industry, both globally (worldwide) and regionally (in the Mediterranean), and the impact of this seasonality on the cruise industry and cruise destinations.

Methodologically, this study has collected data from various sources, including a leading American OTA and several associations (e.g. CLIA and MedCruise), to create an extensive database of departures and prices for 2019. These prices were those actually paid by consumers, so the results of this study reflect actual market practice and are in no way theoretical simulations. For cruise activity, seasonal variation indices were constructed (Rey-Graña & Ramil-Díaz, 2007; Esteve-Pérez *et al.*, 2019). When considering prices, a hedonic approach was also used to obtain more accurate seasonal variation indices, as this is a well-established methodology in the field (Coenders & Espinet, 2003; Saló *et al.*, 2012; Picazo & Moreno-Gil, 2018; Casamatta *et al.*, 2022).

The results presented in response to RQ1 and RQ2 on the comparison of global and regional activity seasonality show that this seasonality (measured in terms of number of ships and deployed capacity) is low worldwide (6.7% and 4.9% respectively), but high in the Mediterranean (60.8% and 56.3% respectively). Seasonal patterns worldwide and in the Mediterranean are quite similar, although the high season in the Mediterranean is slightly longer than it is worldwide. Regarding price seasonality (RQ3), based on average and hedonic prices, the results also show that price seasonality is lower at the global market level (10.9% and 14.6% respectively) but higher at the regional level (27.4% and 22.3% respectively), which is to be expected as cruise lines adjust their combination of demand and prices in order to optimise their revenues, ship occupancy and profits. This study shows that the average minimum price per night, which could be an incentive for cruise lines to reposition their ships, in this case to or from the Mediterranean, is USD 90.7. All the price differences indicate the existence of seasonal price elasticities (Vives & Jacob, 2021).

Our comparative results show a high correlation between seasonality of activity and seasonality of prices (RQ4), reinforcing the idea that seasonality in terms of number of ships, itineraries or tourists and seasonality in terms of prices feed into each other. Globally, prices fluctuate more than activity throughout the year (14.6% compared to 4.9%), meaning that demand shifts more than supply in the cruise market throughout the year. This finding, together with the expected and current increase in tourist demand for cruises, explains the marked increase in cruise supply expected in the coming years, both in terms of the number of ships and their total capacity (CLIA, 2023). In the Mediterranean, prices are less seasonal than activity (22.3% compared to 56.3%), as cruise companies can reposition their ships to match supply and demand in order to generate higher revenues and/or profits.

This study demonstrates that seasonality in the cruise industry has different effects depending on the stakeholder considered. It allows researchers to comprehensively analyse the impact of seasonality on each stakeholder and, if necessary, propose measures to mitigate any negative effects. In this case, the analysis is divided into cruise lines and destinations, including port management and tourist hinterlands.

Cruise lines are private companies whose aim is to maximise their revenues and profits. They have some advantages in the cruise industry. For example, they are able to move their ships according to demand and thus benefit from the complementary nature of certain time profiles in different regions of the world. For this reason, the seasonality of activity is low for them (4.9% in terms of capacity). While the Mediterranean offers acceptable sailing and weather conditions throughout the year, cruise lines prefer to move to other destinations where they can improve their bottom line. This last point is particularly confirmed by a comparison of the seasonality of activity and the seasonality of prices. CLIA's reports

always highlight the annual impact, but never go into the monthly analysis and the impact on destinations.

Extrapolating from our results for the Mediterranean, destinations show a high degree of seasonality (56.3% in terms of capacity). This is due not only to natural and institutional factors, but also to the decisions taken by cruise lines to reposition their ships in order to improve their financial results, as explained above. This seasonality leads to an uneven distribution of income, turnover, employment, environmental impact and overtourism. In this sense, we believe that further research should be carried out on the impact of overtourism on destinations, especially during high season, which is perceived differently depending on the stakeholders and their characteristics (Del Chiappa *et al.*, 2019). In fact, there are now calls to reduce the impact of overtourism around the world. In terms of specific solutions for the cruise industry towards destinations, several measures have been taken and can be taken in the future:

- Limiting the number of ships in different ways, such as capping the actual number of ships, restricting their capacity, or requiring certain technical characteristics to make them more sustainable (Ito *et al.*, 2023).
- Adapting the time that cruise ships spend at each destination or finding alternatives in other nearby ports. This would be the case, for example, of Barcelona and Tarragona, between which there are approximately 100 km.
- Pricing strategies and port and city taxes are another way to reduce seasonality, as they have the potential to help destinations by reducing the number of arrivals during peak months and increasing the number of calls at other times of the year.
- Finally, the power of big data should be exploited to find solutions that benefit all stakeholders. For example, it would be interesting to know more about the traceability of cruise ships and what cruise passengers do in each destination to identify the real impact of seasonality. Cruise destinations should also choose cruise lines whose ships are more technically and strategically sustainable and whose passengers are more committed to sustainability through responsible and ethical behaviour.

Beyond these measures, another debate arises: is the cruise industry really to blame for overtourism? To answer this question, it is necessary to compare the seasonality of cruise arrivals with the seasonality of other arrivals at the destination. For example, in the case of Barcelona, the most important cruise port in the Mediterranean, cruise passengers accounted for 14.7% of overnight hotel stays in 2019, but the percentage ranges from 5.4% in December to 21.5% in September. Moreover, the seasonality caused by the cruise industry in destinations is known several years in advance, as itineraries are planned early on and solutions, which should be negotiated with stakeholders, could be found in a timely manner.

In summary, this study contributes to the literature in the following ways:

- It analyses the seasonality of cruise activity globally and in the Mediterranean region, and is therefore able to compare the two perspectives.
- It analyses the seasonality of cruise prices globally and in the Mediterranean region, and is therefore able to compare the two perspectives.
- It is the first study to look at the seasonality of cruise activity and prices at both global and regional levels, and to identify the relationships between these factors.

The results of this study provide a better understanding of the impact of cruise lines' decisions to reposition ships between regions. As private companies, they seek to maximise profits through a combination of seasonal activity and pricing. Is there an incentive for them to reduce the seasonality of cruise ports in order to mitigate its negative effects? Our analysis addresses the consequences of these strategies for other cruise industry stakeholders that cannot change location, such as ports and destinations. This provides a clearer picture of the impact of these companies' decisions on the seasonality of activity

and prices. Our results can be useful in redefining public policies and strategies aimed at reducing seasonality and optimising resource allocation to improve the competitiveness of both cruise lines and destinations, while providing scope for reducing the industry's environmental impact, including its impact on overtourism. There is a clear need for enhanced cooperation between all stakeholders for the benefit of all cruise industry stakeholders and society at large.

There are a number of limitations to this paper that, if overcome, could provide opportunities for new research. Firstly, the data used for the study are from 2019. Due to the heavy toll that COVID-19 took on the cruise industry, this has been taken as the reference year for comparing developments in this sector (CLIA, 2021, 2023). In addition, due to the availability and complexity of the data, prices were collected from a single year. Therefore, an interesting new line of study would be to compare seasonality patterns when the cruise industry has fully recovered (2023-2024 according to CLIA, 2023). Secondly, this study compares seasonality globally and in the Mediterranean region (looking at activity and prices), but it would be interesting to extend this research to other regions, such as the Caribbean, Northern Europe, Asia or Australia, so that different destination seasonality patterns could be identified and widely analysed. Thirdly, this study only considers one OTA, which is not a limitation per se (Joo *et al.*, 2020), as it provides a good starting point to compare these results with other OTAs or other booking channels. Studies in this vein would lead to more specific results on seasonality, not only from the perspective of regions or destinations (e.g. weather, sailing conditions), but also from the perspective of source markets (e.g. holidays).

This research opens up possibilities for further research, in addition to those mentioned above, such as:

- The relationship between activity-demand and prices. In the future, it would be interesting to analyse whether there are differences depending on the day of the week or other variables such as the number of nights or the quality of the cruise line, as is done in the accommodation industry (Lozano *et al.*, 2021).
- Given the strong interrelationships between price seasonality and activity seasonality, more research and publications should be devoted to both concepts together, for example by comparing the impact of seasonality of different types of tourism (i.e. hotels, campsites, apartments and cruises) in each destination.
- Studies could be conducted to establish a more precise relationship between seasonality, sustainability and overtourism. Overtourism can vary according to the size and number of calls made by the ship (Ito *et al.*, 2023) and according to whether the port is a home port, as it is possible that cruisers spend more time at the destination, or a port of call, as this overtourism is generally expressed in days and hours (Abbasian *et al.*, 2020). Overtourism in this sense is perceived differently by residents depending on their experience with cruise tourism and their relatives' dependence on this sector (Del Chiappa *et al.*, 2019).
- Finally, research could be done to define the specific profile of cruise passengers month by month in order to better understand the strategies of cruise companies and their impact on destinations.

Appendices

Appendix 1. Cruise ships by month around the world and the Mediterranean: number of ships, capacity, rating, antiquity and seasonal index

	ALL THE WORLD							
							SEASONAL INDEX	
Month	Number of ships	Average capacity of passengers per ship	Estimated capacity of ships	Average rating of the ships	% capacity over total	Average year of building / refurbishing	Number of ships	Estimated capacity of the ships
January	187	2222.5	415,599	4.59	80.2%	2009.1	91.0	92.3
February	194	2196.2	426,055	4.58	82.2%	2009.5	94.4	94.6
March	192	2273.6	436,525	4.52	84.2%	2009.2	93.4	97.0
April	197	2229.2	439,145	4.59	84.8%	2009.1	95.9	97.5
May	217	2171.2	471,146	4.60	90.9%	2009.4	105.6	104.6
June	226	2127.5	480,825	4.58	92.8%	2009.2	110.0	106.8
July	222	2145.6	476,334	4.60	91.9%	2009.2	108.0	105.8
August	224	2125.5	476,109	4.60	91.9%	2009.4	109.0	105.8
September	210	2200.3	462,053	4.60	89.2%	2009.7	102.2	102.6
October	198	2208.7	437,326	4.61	84.4%	2009.7	96.4	97.1
November	196	2248.6	440,718	4.62	85.1%	2009.7	95.4	97.9
December	203	2171.1	440,739	4.62	85.1%	2009.5	98.8	97.9
Average	*205.5*	*2193.3*	450,215	*4.59*	87.0%	*2009.4*	*100.0*	*100.0*
SD	*13.7*	*46.8*	21,963	*0.0*	*0.0*	*0.2*	*6.7*	*4.9*
% SD / average	*6.7%*	*2.1%*	*4.9%*	*0.6%*	*4.9%*	*0.0%*	*6.7%*	*4.9%*
Min	187	2125.5	415,599	4.52	80.2%	2009.1	91.0	92.3
Max	226	2273.6	480,825	4.62	92.8%	2009.7	110.0	106.8
Range	39	148.1	65,226	0.10	12.6%	0.7	19.0	14.5

	MEDITERRANEAN							
							SEASONAL INDEX	
Month	Number of ships	Average capacity of passengers	Estimated capacity of ships	Average rating of the ships	% capacity over total	Average year of building / refurbishing	Number of ships	Estimated capacity of the ships
January	5	3116.8	15,584	4.10	3.0%	2011.0	12.7	18.9
February	6	2752.3	16,514	4.33	3.2%	2012.3	15.2	20.0
March	15	2854.0	42,810	4.23	8.3%	2009.4	38.0	51.9
April	47	1929.2	90,673	4.64	17.5%	2010.1	119.0	109.9
May	63	1957.5	123,325	4.77	23.8%	2010.7	159.5	149.5
June	52	2055.9	106,907	4.70	20.6%	2009.9	131.6	129.6
July	52	2096.9	109,041	4.69	21.0%	2009.2	131.6	132.1
August	54	1996.5	107,811	4.70	20.8%	2009.3	136.7	130.7
September	63	2123.9	133,808	4.68	25.8%	2009.4	159.5	162.2
October	68	2016.4	137,118	4.74	26.5%	2010.4	172.2	166.2
November	40	2183.9	87,357	4.69	16.9%	2010.1	101.3	105.9
December	9	2137.0	19,233	4.50	3.7%	2008.3	22.8	23.3
Average	*39.5*	*2268.4*	82,515	*4.56*	*0.2*	*2010.0*	*100.0*	*100.0*
SD	*24.0*	*400.7*	46,440	*0.2*	*0.1*	*1.0*	*60.8*	*56.3*
% SD / average	*60.8%*	*17.7%*	*56.3%*	*4.9%*	*56.3%*	*0.1%*	*60.8%*	*56.3%*
Min	5	1929.2	15,584	4.1	3.0%	2008.3	12.7	18.9
Max	68	3116.8	137,118	4.8	26.5%	2012.3	172.2	166.2
Range	63	1187.6	121,534	0.7	23.5%	4.0	159.5	147.3

Appendix 2. Seasonality of demand by year: cruise passengers and seasonal index

	Year 2019			Year 2018			Year 2017			Year 2016			Year 2015		
Month	**Total cruise pax**	**%**	**Index base 100**	**Total cruise pax**	**%**	**Index base 100**	**Total cruise pax**	**%**	**Index base 100**	**Total cruise pax**	**%**	**Index base 100**	**Total cruise pax**	**%**	**Index base 100**
January	753,879	2.4%	29.0	760,001	2.7%	32.5	585,842	2.3%	27.1	618,681	2.3%	27.1	614,385	2.3%	28.1
February	647,632	2.1%	24.9	676,502	2.4%	29.0	522,749	2.0%	24.2	599,426	2.2%	26.2	543,428	2.1%	24.8
March	1,075,125	3.4%	41.3	962,240	3.4%	41.2	740,719	2.9%	34.3	1,002,070	3.7%	43.8	743,948	2.8%	34.0
April	2,690,232	8.6%	103.4	2,743,717	9.8%	117.4	2,308,613	8.9%	106.9	2,198,321	8.0%	96.1	2,049,595	7.8%	93.6
May	3,567,655	11.4%	137.2	3,047,518	10.9%	130.4	2,905,156	11.2%	134.5	3,018,321	11.0%	132.0	2,979,908	11.3%	136.1
June	3,518,994	11.3%	135.3	2,950,601	10.5%	126.3	2,763,468	10.7%	128.0	2,959,161	10.8%	129.4	2,971,605	11.3%	135.8
July	3,742,912	12.0%	143.9	3,312,071	11.8%	141.8	3,126,904	12.1%	144.8	3,492,826	12.7%	152.7	3,281,594	12.5%	149.9
August	3,925,410	12.6%	150.9	3,251,336	11.6%	139.2	3,201,749	12.4%	148.3	3,545,682	12.9%	155.0	3,515,396	13.4%	160.6
September	3,766,442	12.1%	144.8	3,475,831	12.4%	148.8	3,351,555	12.9%	155.2	3,570,017	13.0%	156.1	3,499,428	13.3%	159.9
October	4,246,474	13.6%	163.3	3,893,059	13.9%	166.6	3,644,332	14.1%	168.7	3,804,591	13.9%	166.3	3,631,925	13.8%	165.9
November	2,292,651	7.3%	88.1	2,009,079	7.2%	86.0	1,799,593	6.9%	83.3	1,810,276	6.6%	79.2	1,785,280	6.8%	81.6
December	983,346	3.2%	37.8	956,581	3.4%	40.9	964,893	3.7%	44.7	826,326	3.0%	36.1	650,377	2.5%	29.7
TOTAL YEAR	31,210,752	100.0%		28,038,536	100.0%		25,915,573	100.0%		27,445,698	100.0%		26,266,869	100.0%	
Annual % change:	11.3%			8.2%			-5.6%			4.5%					
Average	2,600,896		100.0	2,336,545		100.0	2,159,631		100.0	2,287,142		100.0	2,188,906		100.0
SD	1,387,497		53.3	1,194,648		51.1	1,179,977		54.6	1,265,812		55.3	1,272,636		58.1
% SD / average	53.3%		53.3%	51.1%		51.1%	54.6%		54.6%	55.3%		55.3%	58.1%		58.1%
Min:	647,632		24.9	676,502		29.0	522,749		24.2	599,426		26.2	543,428		24.8
Max:	4,246,474		163.3	3,893,059		166.6	3,644,332		168.7	3,804,591		166.3	3,631,925		165.9
Range:	3,598,842		138.4	3,216,557		137.7	3,121,583		144.5	3,205,165		140.1	3,088,497		141.1

Source: Authors' own work, based on MedCruise (2020).

Appendix 3. Price per night by month

	All the world					Mediterranean					Rest of the world					Comparative Med. With the Rest of the world				
Month	**Inside**	**Ocean**	**Balcony**	**Suite**	**Average**	**Inside**	**Ocean**	**Balcony**	**Suite**	**Average**	**Inside**	**Ocean**	**Balcony**	**Suite**	**Average**	**Inside**	**Ocean**	**Balcony**	**Suite**	**Average**
January	109.0	196.7	275.9	424.7	241.2	60.2	72.5	115.4	174.0	90.7	114.3	207.7	289.5	444.1	254.0	*52.7%*	*34.9%*	*39.9%*	*39.2%*	*35.7%*
February	117.5	183.6	250.2	391.8	228.5	69.6	84.0	147.3	252.3	125.6	122.0	190.9	259.0	402.9	236.6	*57.0%*	*44.0%*	*56.9%*	*62.6%*	*53.1%*
March	119.9	177.7	227.3	357.1	214.8	95.7	101.9	195.6	277.2	160.2	123.5	186.4	231.8	367.7	222.0	*77.5%*	*54.7%*	*84.4%*	*75.4%*	*72.2%*
April	126.8	188.2	251.6	398.0	235.0	117.8	160.6	232.4	337.3	213.2	129.8	197.7	261.0	424.5	243.9	*90.8%*	*81.2%*	*89.0%*	*79.4%*	*87.4%*
May	137.7	196.8	269.4	434.1	253.5	132.7	195.5	256.7	394.9	245.7	139.6	197.4	275.7	453.8	257.1	*95.0%*	*99.0%*	*93.1%*	*87.0%*	*95.6%*
June	167.4	234.9	295.7	462.4	283.5	154.3	215.9	274.8	414.8	262.2	172.5	242.4	304.6	482.8	292.3	*89.4%*	*89.0%*	*90.2%*	*85.9%*	*89.7%*
July	171.3	219.4	311.2	466.0	283.0	160.5	212.9	280.9	407.3	262.8	175.9	222.1	324.7	492.5	291.8	*91.2%*	*95.9%*	*86.5%*	*82.7%*	*90.0%*
August	161.6	208.6	290.2	440.3	268.4	171.8	228.9	273.7	411.5	269.2	157.0	199.2	297.8	454.2	268.0	*109.4%*	*114.9%*	*91.9%*	*90.6%*	*100.5%*
September	129.8	176.8	240.1	369.5	221.4	135.5	185.3	248.4	374.1	231.7	126.3	171.4	234.6	366.6	214.9	*107.3%*	*108.1%*	*105.9%*	*102.1%*	*107.8%*
October	115.9	161.8	236.0	360.9	213.2	114.0	158.3	225.3	331.0	206.3	117.2	164.3	244.7	383.8	218.4	*97.2%*	*96.4%*	*92.1%*	*86.2%*	*94.5%*
November	112.0	159.0	226.0	356.6	209.3	97.1	145.0	204.6	297.5	188.3	114.3	161.2	229.9	366.6	212.8	*85.0%*	*89.9%*	*89.0%*	*81.2%*	*88.5%*
December	131.3	191.7	244.2	405.2	238.5	134.7	200.4	216.1	348.4	223.7	131.1	191.2	245.9	408.4	239.3	*102.7%*	*104.8%*	*87.9%*	*85.3%*	*93.5%*
Average	133.3	191.3	259.8	405.6	240.9	120.3	163.4	222.6	335.0	206.6	135.3	194.3	266.6	420.7	245.9	*87.9%*	*84.4%*	*83.9%*	*79.8%*	*84.0%*
SD	21.9	22.2	28.2	39.9	26.2	34.9	53.2	51.3	74.0	56.5	21.7	23.2	31.6	45.0	27.7	*17.9%*	*26.0%*	*17.8%*	*15.8%*	*20.7%*
% SD / average	*16.4%*	*11.6%*	*10.9%*	*9.9%*	*10.9%*	*29.0%*	*32.5%*	*23.0%*	*22.1%*	*27.4%*	*16.0%*	*11.9%*	*11.9%*	*10.7%*	*11.3%*	*20.4%*	*30.8%*	*21.2%*	*19.8%*	*24.6%*
Max.	171.3	234.9	311.2	466.0	283.5	171.8	228.9	280.9	414.8	269.2	175.9	242.4	324.7	492.5	292.3	*109.4%*	*114.9%*	*105.9%*	*102.1%*	*107.8%*
Min.	109.0	159.0	226.0	356.6	209.3	60.2	72.5	115.4	174.0	90.7	114.3	161.2	229.9	366.6	212.8	*52.7%*	*34.9%*	*39.9%*	*39.2%*	*35.7%*
Range	62.3	75.9	85.2	109.4	74.3	111.6	156.4	165.5	240.8	178.5	61.6	81.2	94.8	125.9	79.5	*56.8%*	*80.0%*	*66.0%*	*62.9%*	*72.1%*

Appendix 4. Results of the hedonic models

		GLOBAL MODEL				MEDITERRANEAN				REST OF THE WORLD			
		B	% Var.	Sig.	VIF	B	% Var.	Sig.	VIF	B	% Var.	Sig.	VIF
	Constant	7.220		0.000		6.596		0.000		7.231		0.000	
	Number of nights	0.122	12.2%	0.000	1.444	0.113	11.3%	0.000	1.430	0.125	12.5%	0.000	1.542
Type of cabin	Cheapest	-0.110	-10.4%	0.000	1.706	-0.128	-12.0%	0.000	1.734	-0.105	-9.9%	0.000	1.699
	inside	-0.189	-17.2%	0.000	1.599	-0.204	-18.5%	0.000	1.612	-0.181	-16.5%	0.000	1.596
	Balcony	0.299	34.9%	0.000	1.654	0.233	26.2%	0.000	1.700	0.323	38.2%	0.000	1.641
	Suite	0.653	92.2%	0.000	1.639	0.566	76.1%	0.000	1.683	0.684	98.1%	0.000	1.627
Month	January	-0.370	-30.9%	0.000	1.526	-0.745	-52.5%	0.000	1.159	-0.315	-27.0%	0.000	1.697
	February	-0.353	-29.8%	0.000	1.587	-0.595	-44.8%	0.000	1.163	-0.312	-26.8%	0.000	1.778
	March	-0.335	-28.4%	0.000	1.660	-0.442	-35.7%	0.000	1.296	-0.303	-26.1%	0.000	1.834
	April	-0.276	-24.1%	0.000	1.622	-0.247	-21.9%	0.000	1.601	-0.288	-25.0%	0.000	1.648
	May	-0.173	-15.9%	0.000	1.740	-0.185	-16.8%	0.000	1.737	-0.175	-16.0%	0.000	1.748
	June	-0.030	-3.0%	0.000	1.842	-0.044	-4.3%	0.000	1.775	-0.026	-2.5%	0.001	1.873
	August	-0.070	-6.8%	0.000	1.837	0.013	1.3%	0.144	1.822	-0.112	-10.6%	0.000	1.842
	September	-0.227	-20.3%	0.000	1.744	-0.153	-14.2%	0.000	1.883	-0.287	-25.0%	0.000	1.676
	October	-0.340	-28.8%	0.000	1.685	-0.313	-26.8%	0.000	1.882	-0.377	-31.4%	0.000	1.593
	November	-0.422	-34.4%	0.000	1.600	-0.440	-35.6%	0.000	1.296	-0.408	-33.5%	0.000	1.740
	December	-0.275	-24.0%	0.000	1.692	-0.187	-17.1%	0.000	1.153	-0.261	-23.0%	0.000	1.923
Capacity in passengers	From 501 to 1,000	-0.505	-39.6%	0.000	5.512	-0.153	-14.2%	0.000	8.503	-0.511	-40.0%	0.000	5.490
	From 1,001 to 2,000	-1.125	-67.5%	0.000	5.498	-0.221	-19.8%	0.000	23.902	-1.145	-68.2%	0.000	5.045
	More than 2,000	-1.127	-67.6%	0.000	13.211	-0.150	-13.9%	0.001	63.272	-1.190	-69.6%	0.000	11.733
Cruise Company	Azamara Club Cruises	0.366	44.2%	0.000	1.702	0.761	114.1%	0.000	4.385	0.283	32.8%	0.000	1.452
	Blount Small Ship Adventures	-0.054	-5.3%	0.383	1.043		0.0%			-0.103	-9.8%	0.107	1.048
	Carnival	-0.257	-22.7%	0.000	1.937		0.0%			-0.232	-20.7%	0.000	1.898
	Celebrity	0.438	54.9%	0.000	1.804	0.256	29.2%	0.000	1.585	0.411	50.8%	0.000	1.893
	Costa Cruises	0.072	7.4%	0.000	1.631	-0.152	-14.1%	0.000	5.959	-0.004	-0.4%	0.664	1.275
	Cruise & Maritime Voyages	0.002	0.2%	0.898	1.346		0.0%			-0.024	-2.4%	0.148	1.454
	Crystal	0.542	72.0%	0.000	1.421	1.124	207.7%	0.000	3.267	0.443	55.8%	0.000	1.325
	Cunard	0.449	56.7%	0.000	1.074		0.0%			0.460	58.4%	0.000	1.082
	Disney	0.831	129.5%	0.000	1.171	0.754	112.5%	0.000	1.069	0.851	134.2%	0.000	1.173
	Holland America	0.017	1.7%	0.069	1.770	-0.165	-15.2%	0.000	1.412	0.001	0.1%	0.917	1.934
	Hurtigruten	0.313	36.7%	0.000	6.628	0.718	105.0%	0.000	1.176	0.278	32.1%	0.000	7.475
	MSC Cruises	0.043	4.4%	0.000	1.937	-0.171	-15.7%	0.000	7.051	-0.021	-2.1%	0.011	1.438
	Norwegian	0.166	18.0%	0.000	1.480	-0.002	-0.2%	0.918	2.129	0.164	17.9%	0.000	1.424
	Oceania Cruises	0.520	68.2%	0.000	1.440	0.736	108.7%	0.000	2.466	0.459	58.2%	0.000	1.353
	P&O Cruises	0.182	19.9%	0.000	1.231	-0.007	-0.7%	0.698	1.584	0.161	17.5%	0.000	1.208
	Paul Gauguin Cruises	0.437	54.9%	0.000	1.221		0.0%			0.384	46.9%	0.000	1.247
	Ponant	0.518	67.9%	0.000	1.802	1.065	189.9%	0.000	6.274	0.531	70.1%	0.000	1.638
	Princess	0.056	5.7%	0.000	1.490	0.061	6.2%	0.004	1.511	0.047	4.8%	0.000	1.492
	Pullmantur	-0.409	-33.5%	0.000	1.263	-0.667	-48.7%	0.000	2.391	-0.340	-28.8%	0.000	1.137
	Quark Expeditions	0.964	162.2%	0.000	1.178		0.0%			0.900	146.1%	0.000	1.200
	Regent	0.753	112.4%	0.000	1.455	1.280	259.6%	0.000	2.967	0.625	86.9%	0.000	1.316
	SeaDream Yacht Club	0.519	68.1%	0.000	1.332	1.184	226.6%	0.000	4.408	0.479	61.5%	0.000	1.206
	Seabourn	0.196	21.7%	0.000	1.546	0.919	150.7%	0.000	4.457	0.023	2.3%	0.364	1.387
	Silversea	0.577	78.0%	0.000	1.841	1.106	202.3%	0.000	4.089	0.542	71.9%	0.000	1.791
	Star Clippers	-0.370	-30.9%	0.000	1.751	0.338	40.2%	0.000	8.257	-0.433	-35.1%	0.000	1.482
	Viking Cruises	0.756	112.9%	0.000	1.909	1.261	253.1%	0.000	4.266	0.652	92.0%	0.000	1.711
	Voyages to Antiquity	-0.275	-24.1%	0.000	1.151	0.493	63.8%	0.000	3.604	-0.508	-39.8%	0.000	1.039
	Windstar	-0.222	-19.9%	0.000	2.184	0.785	119.1%	0.000	8.681	-0.404	-33.2%	0.000	1.950
	Observations	*51,129*				*12,565*				*38,564*			
	Adjusted R^2	*0.858*				*0.873*				*0.865*			
	Maximum VIF	*13.211*				*63.272*				*11.733*			
	Average VIF	*2.097*				*4.966*				*2.037*			
	p-value	*0.000*				*0.000*				*0.000*			

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