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Analyzing Seasonality in Cruise Tourism: The Seaports in Turkey*

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Abstract

Seasonality as a characteristic problem of tourism has a negative impact on the cruise industry. Therefore, analyzing the seasonality of cruise traffic is critically important. This paper examines the seasonal fluctuations in the cruise calls and passenger movements at the seaports in Turkey during 2019-2021 by using some measures, such as the seasonal index, cluster analysis, the seasonality indicator, the Gini coefficient, the Lorenz curve, and the coefficient of variation. The findings reveal that the cruise traffic at the sample seaports was significantly seasonal in the given period. It is also shown that the novel coronavirus disease has aggravated seasonality which is manifest from 2020 onwards. Moreover, the occupancy rates of these seaports were substantially poor. The global pandemic had a significant negative effect on port capacity utilization. Strategies for coping with seasonality in the sample seaports' cruise traffic should be created by considering the Eastern Mediterranean traffic and its characteristics.

Keywords: *Seasonality, Cruise Traffic, Cruise Tourism, Seaports, Turkey*

* This study is not included in the study group that requires TR Index Ethics Committee Approval.

1. Introduction

The modern cruise industry has been growing since the late 1960s (Li, Wang & Ducruet, 2021; Rodrigue & Notteboom, 2013; Rodrigue & Notteboom, 2012). Over more than fifty-year history, the industry is increasingly gaining popularity and becoming one of the important income-generating branches of the global tourism industry (Brida et al., 2014; Rodrigue & Notteboom, 2013; Li, Wang & Ducruet, 2021; Hung et al., 2019; Wang et al., 2016; Del Chiappa & Abbate, 2016). From only a few cruise lines to dozens of them, and millions of cruise passengers per year (CLIA, 2022a; CLIA, 2022b; Rodrigue & Notteboom, 2012). The cruise industry contributes billions of US dollars in annual revenue to the global economy (CLIA, 2022b).

Seasonality is a characteristic downside of the tourism industry and its subsectors that affects their sustainable growth (Butler, 1998; Bar-On, 1999; Esteve-Perez & Garcia-Sanchez, 2017; Turrion-Prats & Duro, 2019; Duro & Turrion-Prats, 2021). Although having some advantages, particularly in terms of ecological and sociocultural aspects (Butler, 2001; Butler, 1998; Koenig-Lewis & Bischoff, 2005; Cannas, 2012; Amelung, Nicholls & Viner, 2007), seasonality is generally recognized as a perennial problem and negative attribute of tourism (Flognfeldt, 2001; Butler, 2001; Butler, 1998; Bar-On, 1999). Baum and Lundtorp (2001) state that seasonality affects supply-side activities including marketing, the labor market, business finance, stakeholder management, and operations in tourism. Seasonality may bring about underutilization of organizational resources during off-seasons, and conversely, capacity shortages in high seasons, loss of revenue and profit potential, problems in managing revenue and costs, problems in attracting investment capital, difficulties in maintaining the supply chain and business networks, challenges in maintaining service and product quality standards, seasonal employment, underemployment, and unemployment of the labor force, higher prices during peak seasons, strains on the local environment, public services and infrastructure during peak seasons, negative influences on the quality of life, and so forth (Sutcliffe & Sinclair, 1980; Manning & Powers, 1984; Baum & Lundtorp, 2001; Koenig-Lewis & Bischoff, 2005; Cannas, 2012; Amelung, Nicholls & Viner, 2007; Jolliffe & Farnsworth, 2003). Most recently, tourism seasonality has been shown to impact high-growth firms negatively, such as capital underutilization, income instability, and high sensitivity to external shocks (Stojcic, Mikulic & Vizek, 2022).

To Esteve-Perez and Garcia-Sanchez (2017), seasonality has negative effects on both the demand and supply side of the cruise industry. They state that seasonality impacts source markets because of seasonal weather constraints in certain regions. On the supply side, it affects the main stakeholders that are involved in forming a cruise itinerary. Moreover, Fernandez-Morales and Cisneros-Martinez (2019) suggest that high levels of seasonal concentration in seaports can affect the satisfaction and loyalty of cruise passengers looking to flee from the masses.

Historically, analyzing temporal fluctuations in tourism demand has been a subject of common interest for many scholars. Some early studies by Bar-On (1975), Yacoumis (1980), Wanhill (1980), Bar-On (1999), and Lundtorp (2001) set out to analyze seasonal fluctuations in some tourist destinations around the world. Some other studies that analyzed seasonality in tourism include Lim (2001), Koenig and Bischoff (2003), Fernandez-Morales (2003), Nadal, Font and Rossello (2004), Andriotis (2005), Koc and Altinay (2007), Fernandez-Morales and Mayorga-Toledano (2008), Lim and McAleer (2008), Karamustafa and Ulama (2010), Bigovic (2011), Petrevska (2013), Duro (2016), Rossello and Sanso (2017), Turrion-Prats and Duro (2018), Ferrante, Magno and De Cantis (2018), Duro and Turrion-Prats (2019), Sainaghi, Mauri and d'Angella (2019), Duro and Turrion-Prats (2022), and Lau and Coo (2022).

There is also a growing interest in analyzing seasonality in cruise tourism over the last decade. For instance, Lukovic and Bozic (2011) investigated seasonality and its impact on the development and management of cruise tourism markets, such as North and Central America, Europe, Croatia, and the rest of the world. It was shown that the seasonality index of the North and Central American markets was not significant, whereas the European, Croatian, and some other cruise markets had notable indices. Sun, Wu and Feng (2015) analyzed seasonality in the North American market by using X-12 ARIMA and TRAMO-

SEATS. They found that the given market was moderately seasonal during the 2005-2011 period. They further showed that cruise tourism in North America was not significantly influenced by seasonal and irregular components. Cisneros-Martinez and Fernandez-Morales (2016) delved into the seasonality in the cruise traffic in the Mediterranean region by using the Gini coefficient. The authors identified six clusters comprising several seaports in different locations, yet with similar seasonal patterns. Esteve-Perez and Garcia-Sanchez (2017) analyzed seasonality in the cruise traffic at some seaports on the Spanish Mediterranean coast. They identified two clusters of seaports in the given period. Cluster one displayed one-peak seasonality, while the other had two peaks. Moreover, cluster one manifested a trend towards mitigating seasonality, while the other one displayed no signs of mitigation. Esteve-Perez, Garcia-Sanchez & Munoz-Paupie (2019) examined seasonality in the cruise traffic in the Western Mediterranean and the Adriatic Sea. They revealed that seaports in the region consisted of two clusters and the cruise traffic at these ports had a seasonal behavior. Esteve-Perez and Garcia-Sanchez (2019) analyzed seasonality in the main cruise ports' traffic in the northeast of the Atlantic Ocean to identify groups of ports with homogeneous seasonal patterns. Fernandez-Morales and Cisneros-Martinez (2019) analyzed the cruise tourism seasonality in Southern Europe. They found that the Western Mediterranean was the least seasonal region, while the Black Sea and the Adriatic regions displayed the highest levels of annual seasonality. Esteve-Perez and Garcia-Sanchez (2022) studied the cruise passenger movements among a group of harbors in the Atlantic Ocean and the Baltic Sea to identify seasonality patterns in the cruise traffic and their relationship between different regions. They showed that seasonality in cruise activity in a consolidated region was explained by own factors of the region and by seasonality induced by adjacent cruise regions.

Despite laudable efforts to analyze seasonality in the cruise industry, interest in such a topic has not proliferated much in Turkey. There is little research that examines seasonal concentration in cruise traffic at seaports in this country. For instance, Fernandez-Morales and Cisneros-Martinez (2019) included some seaports, such as Istanbul, Kuşadası, Bodrum, Antalya, and Alanya in their study. Even though Turkey is not one of the flagships in the cruise industry in Europe (see MedCruise, 2022), it is a destination involved in regional cruise traffic and has a high potential in terms of cruise tourism. Therefore, this paper intends to analyze seasonal fluctuations in cruise ship calls and passenger flows at the major seaports in the given country. It portrays how seasonal the cruise traffic was during the 2019-2021 period, as well as to what extent did the novel coronavirus disease affect this traffic and its seasonality.

The paper, addressing the above research gap, provides a detailed timely analysis and implications for those concerned with seasonality which is seen as a major downside of the industry. In addition, the paper uniquely substantiates the impact of the recent global health crisis on cruise tourism in the country. The findings of the study may contribute to a better understanding of the seasonality problem in the local and regional cruise industry.

The data and methods used for the analysis are described below. A statistical analysis of the cruise traffic in the country follows that section. The findings on seasonality in the sample seaports' cruise traffic are reported in the results section. Some concluding remarks and implications are given in the conclusion.

2. Methodology

The data and method of the study are explained in the following headings.

2.1. Data

The data used herein was obtained from the official annual cruise reports of the Department of Maritime Trade Development of the Bureau of Maritime Administration governed by the Ministry of Transportation and Infrastructure. Such data is gathered from seaport administration offices across the country (the Ministry of Transportation and Infrastructure, 2022). The data comprises available (no individual monthly records anent seaports are available before 2019) monthly records between 2019 and 2021 which is a suitable timespan to identify the level of seasonality in the cruise traffic. Since this work was only concerned with annual data, the semi-annual data from the year 2022 was not included in the analysis. The data comprised seaports, such as Antalya, Alanya, Bodrum, Bozcaada, Çanakkale, Çeşme, Dikili, Fethiye, Finike, Göcek, Istanbul, Kuşadası, Marmaris, and Yalova. However, we focused on analyzing the seasonality in the most frequented six ports as there was minor traffic at the others.

2.2. Methods

Seasonality of seaport traffic can be measured by using the number of passenger movements (see Sun, Wu & Feng, 2015; Cisneros-Martinez & Fernandez-Morales, 2016; Esteve-Perez & Garcia-Sanchez, 2017; Esteve-Perez, Garcia-Sanchez & Munoz-Paupie, 2019; Esteve-Perez & Garcia-Sanchez, 2019; Fernandez-Morales & Cisneros-Martinez, 2019; Esteve-Perez & Garcia-Sanchez, 2022), e.g. home in passengers, home out passengers, and transit passengers. We used the number of home in/out passengers, transit passengers and cruise ship calls to examine the seasonality in the sample seaports to a better extent.

Various methods can be used to measure seasonality in cruise traffic. We used some measures, such as the seasonal index, cluster analysis, the seasonality indicator, the Gini coefficient, the Lorenz curve, and the coefficient of variation.

The seasonal index is a figure representing seasonal variation in a particular time series, which reveals the way a month tends to deviate from what would be expected on the basis of the trend and cyclical variation in the time series (Mansfield, 1991). Seasonal variations denoted by S in the traditional time series model are most generally products of weather and man-made conventions, such as holidays (DeLurgio, 1998). A seasonal index is obtained by using the ratio to moving average method. The steps to obtain a seasonal index include computing a moving average of the monthly time series; centering the moving averages at the middle of each month by finding the average of two moving averages; calculating the actual value for each month as a ratio of the centered moving average; computing the median of the ratios for each month, and adjusting the sum of the seasonal indices to equal the number of months (DeLurgio, 1998; Mansfield, 1991). Since seasonal indices are purged from seasonal and irregular variations to the extent possible (DeLurgio, 1998; Mansfield, 1991), they were employed to identify clusters of seaports.

After computing seasonal indices for the cruise calls and passenger movements at the given seaports, a hierarchical cluster analysis was applied to form clusters of seaports. In doing so, one can identify groups of seaports with homogenous seasonal patterns (Fernandez-Morales & Cisneros-Martinez, 2019; Esteve-Perez, Garcia-Sanchez & Munoz-Paupie, 2019; Esteve-Perez & Garcia-Sanchez, 2017) Such a grouping also helps one infer which seaports may have close characteristics (e.g. cruise ship calls, passenger movements, itineraries, weather conditions and constraints, and such things that might affect the traffic at a seaport).

A cluster analysis "seeks to identify clusters of points in space" and "searches for hidden similarities and sorts items into abstract groups" (Edwards & Cavalli-Sforza, 1965). Clustering is mainly divided into two major categories which are partitioning methods and hierarchical methods (Leisch, 1999; Esteve-Perez, Garcia-Sanchez & Munoz-Paupie, 2019). Hierarchical clustering is useful when the conductor has not identified any certain number of clusters beforehand, while the other one is preferable when there are some clusters determined a priori, especially in terms of large data sets (Leisch, 1999; Kaufman & Rousseeuw, 1990). There is also a newer method called bagged clustering which combines partitioning and hierarchical methods (see Leisch, 1999).

Hierarchical clustering "produces a complete set of nested categories by sequentially pairing observations, clusters, or observations and clusters", and "it results in a hierarchical set of nested categories, the taxonomic dendrogram or tree-like graph" (Bridges, 1966). The dendrogram indicates a root that comprises the entire subsets and branches that refer to the single data points or observations (Leisch, 1999; Anderberg, 1973; Bridges, 1966). The branches' heights refer to the distances between the subsets (Leisch, 1999).

Hierarchical clustering consists of agglomerative clustering and divisive clustering approaches (Leisch, 1999; Anderberg, 1973; Kaufman & Rousseeuw, 1990). Agglomerative hierarchical clustering has been the dominant approach in clustering (Murtagh & Contreras, 2012; Sasirekha & Baby, 2013). There are two main steps that one should follow in agglomerative methods (Leisch, 1999; Murtagh & Contreras, 2012). Initially, one should use a measure of distance (usually adopting a dissimilarity approach), e.g. Euclidean, squared Euclidean, Manhattan, maximum, Mahalanobis, Hamming, and Levenshtein distances (Euclidean or squared Euclidean distances used widely) to compute distances between pairs of observations and determine which of those observations form a group or set (Sasirekha & Baby, 2013; Murtagh & Contreras, 2012; Leisch, 1999; Kaufman & Rousseeuw, 1990). Then, one should apply a linkage criterion to measure the distance between the closest two sets and link them to larger sets until they form a large single set (Sasirekha & Baby, 2013; Leisch, 1999; Kaufman & Rousseeuw, 1990; Bridges, 1966). Some common linkage criteria between two sets of observations are single linkage, complete linkage, average linkage, McQuitty's method, Centroid method, Gower's method, and Ward's method (Sasirekha & Baby, 2013; Murtagh & Contreras, 2012; Kaufman & Rousseeuw, 1990). An oft-preferred method for grouping observations hierarchically is Ward's method. This method helps one 'form hierarchical groups of mutually exclusive subsets based on their similarity with respect to specified characteristics' (Ward, 1963). Considering their functionality (see also Esteve-Perez & Garcia-Sanchez, 2017; Esteve-Perez, Garcia-Sanchez & Munoz-Paupie, 2019; Fernandez-Morales & Cisneros-Martinez, 2019), this paper adopted the agglomerative clustering approach by using the Euclidean and Ward's methods.

The seasonality indicator (ω) is another measure used in seasonality analyses, which is calculated as follows (Lundtorp, 2001; Bigovic, 2011):

$$\omega = \bar{y} / y_m ,$$

where $\bar{y}$ = the average number of passenger movements over n months,

and y_m = the highest number of passenger movements among all observations.

The ω coefficient can range from 1 / n to 1. With an equally distributed number of passenger movements per month, ω is equal to 1. In cases where all passenger movements belong to only one month and the rest of the months have zero movements in total, then, ω equals 1 / n. A value of 1, thus, would indicate that traffic at a given seaport is, actually, not seasonal during the period of n. This measure further represents the average occupancy rate at tourist accommodations (Lundtorp, 2001). Although such a measure is used to reveal hotel capacity utilization, it can also be useful in evaluating capacity utilization at cruise ships and seaports.

A more prevalent method for measuring seasonality in tourism is the Gini coefficient whose calculation is based on the Lorenz curve. These are two common methods used for indicating "inequality" among a number of observations. The Gini coefficient has several interpretations across the literature. One can preferably use the following formula to measure seasonality in a seaport's traffic (Yitzhaki & Lerman, 1991; Milanovic, 1997):

$$G = \frac{2\mathrm{Cov}[y, F(y)]}{\bar{y}} ,$$

where Cov[y, $F(y)$] is the covariance between passenger movements y and the cumulative distribution of y. The Gini coefficient can range between zero and one. In cases where the numbers of passenger movements are equally distributed throughout a given period, the Gini equals 0, which indicates no seasonality in the seaport's traffic (perfect equality). On the contrary, 1 denotes a complete seasonality (perfect inequality).

One can use the Lorenz curve to depict the magnitude of seasonality visually. The magnitude of seasonality is represented by the area between the Lorenz curve and the line of equality (Bigovic, 2011; Karamustafa & Ulama, 2010; Allison, 1978; Theil, 1967; Lorenz, 1905). The more the Lorenz curve approaches the line of equality, the lower the seasonality is.

The coefficient of variation (CV) is a measure of relative dispersion where the standard deviation is divided by the mean (Lovie, 2005; Brown, 1998). This measure is viewed as quite useful since it allows the comparison of variates free of scale effects (Brown, 1998). CV can be used to appraise G and ω values of passenger movements and cruise calls in terms of stability. CV values that approach 0 indicate minor seasonal variations and high stability, whereas values over 30 percent are deemed problematic and denote significant instability (Lundtorp, 2001; Brown, 1998).

3. Cruise traffic at seaports in Turkey during 2019-2021

Before analyzing seasonality at the sample seaports, it is worth overviewing and outlining the cruise traffic over the last three years statistically. Figure 1 illustrates cruise ship calls at the sample seaports during 2019-2021. The graph shows that cruise calls are highly fluctuating over the given period. There are significant changes in these calls year-over-year. For instance, cruise calls summit in 2019 with an amount of 353. However, one can observe a plunge from 2020 onwards, which is probably due to the ongoing pandemic—the novel coronavirus disease. There were only five cruise ship calls in that year, thus, it refers to an approximately 99 percent decrease. Calls tended to increase in 2021 though. However, this still pointed to a significant gap between 2021 and 2019 (around a -78% difference).

In a similar vein, passenger movements display high variations over the given period as shown in figure 2. There were over 35,2 thousand home-in passengers in 2019. However, one can observe a drastic fall in 2020 (around a 99.7 percent decrease compared to 2019). The number of home-in passengers tended to increase in 2021. Notwithstanding that, there is about a -94.5 percent difference as compared to 2019. Moreover, there were over 44,2 thousand home-out passengers in 2019. Contrariwise, there were no home-out passenger movements in 2020. The number of passengers tended to increase in 2021, albeit it lagged significantly as compared to 2019 (a -96.5 percent difference). As for transit passengers, there were more than 221,4 thousand passengers in 2019. However, one can also observe a plunge in the number of transit passengers in 2020. There were only around 1,7 thousand passengers in that year which refers to approximately a 99.2 percent decrease as compared to the previous year. Despite the conspicuous increase in the number of transit passengers in 2021, there is yet a significant difference compared to the number of transit passengers in 2019 (around -81 percent difference). It is also worth noting that transit passengers comprise approximately 76% of passenger movements over the given period, which suggests that the sample seaports mainly serve as ports of call or transit/destination ports (rather than being home/turnaround ports) in terms of cruise tourism.

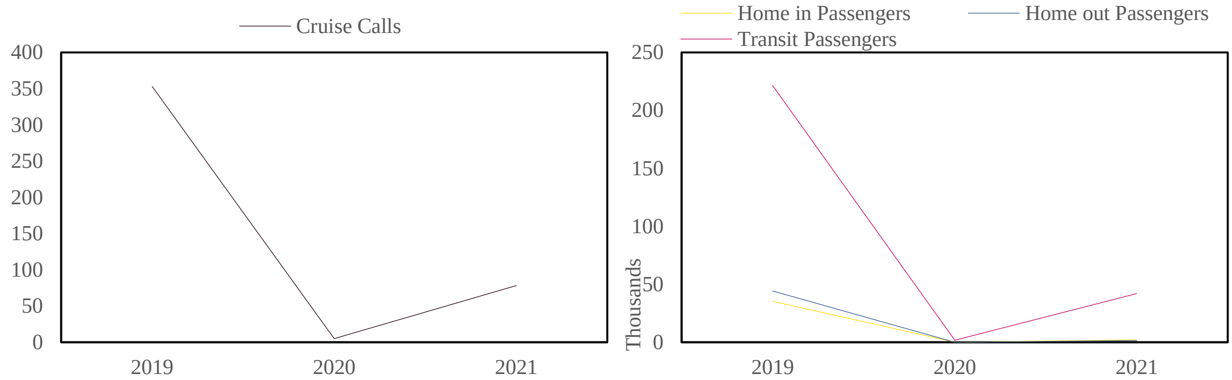


Figure 1-2. The cruise traffic at the sample seaports, 2019-2021

Shares of the seaports and their ranks according to the cruise traffic in the given period are exhibited in table 1. It is shown that Kuşadası was the most frequented seaport with about 52 percent cruise calls and about 55 percent passenger movements. However, Çeşme was the forefront seaport for turnaround (home-in/home-out) passengers with approximately 59 percent. Marmaris, Alanya, Istanbul, and Bodrum were some other highly frequented seaports among others. On the contrary, Yalova, Bozcaada, Fethiye, Finike, Dikili, Göcek, Antalya, and Çanakkale were seaports that had minor traffic (less than one percent of passenger movements). These ports constituted only 2 percent of the overall cruise traffic in the given period.

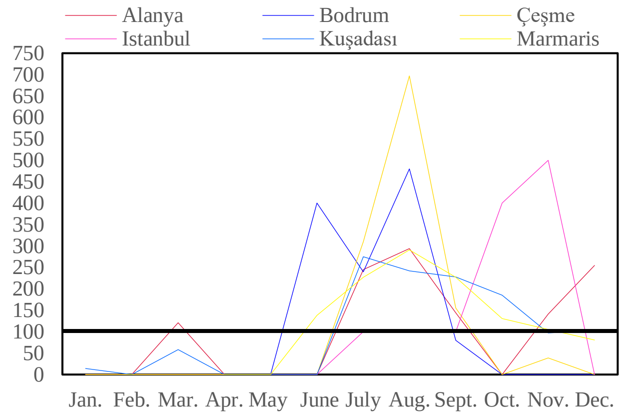
Table 1. Ranks of seaports according to the cruise traffic, 2019-2021

	Cruise Calls in Percentage	Rank by Cruise Calls	Home in/out Passengers in Percentage	Transit Passengers in Percentage	Rank by Passenger Movements
Alanya	6.42	4	0.11	5.85	4
Antalya	1.15	8	1.43	0.05	8
Bodrum	4.13	6	1.88	1.84	6
Bozcaada	0.23	11	0.00	0.02	13
Çanakkale	1.38	7	0.00	1.06	7
Çeşme	9.17	3	58.63	0.28	3
Dikili	0.92	9	0.00	0.29	10
Fethiye	0.46	10	0.00	0.08	12
Finike	0.46	10	0.00	0.23	11
Göcek	1.15	8	0.00	0.41	9
Istanbul	5.05	5	4.38	2.94	5
Kuşadası	52.06	1	33.52	61.89	1
Marmaris	17.20	2	0.03	25.06	2
Yalova	0.23	11	0.01	0.00	14

Moreover, seaports can be classified according to their sizes depending on yearly passenger movements (see Esteve-Perez, Garcia-Sanchez & Munoz-Paupie, 2019; MedCruise, 2016; Rodrigue, Comtois & Slack, 2013). For instance, Kuşadası was a medium-sized and category A port with over 181 thousand passenger movements in 2019. However, it became a small-size and category B port in 2020 and 2021 with less than 100 thousand passengers per year. All others were classified as small-scale seaports over the given period. Apart from that, depending on their passenger movements, it can be inferred that seaports, such as Kuşadası (85.5%), Marmaris (100%), Alanya (99.4%), Istanbul (68.2%), Bodrum (75.7%), Çanakkale (100%), Göcek (100%), Dikili (100%), Finike (100%), Fethiye (100%), and Bozcaada (100%) served majorly as ports of call (movements chiefly comprised of transit passengers), while Çeşme (98.5%), Antalya (90.5%), and Yalova (100%) primarily served as home ports (mainly turnaround passengers) over the given period.

4. Results

The results of the analysis of seasonality on the most frequented seaports are provided in this section. Figures 3 and 4 illustrate seasonal indices or smoothed seasonal variations in regard to the cruise calls and passenger movements at the main cruise ports between 2019 and 2021. Figure 3 reveals that the seasonal indices for cruise ship calls form highly fluctuating patterns. Similarly, one can observe significantly fluctuant patterns with respect to the passenger movements as shown in figure 4.



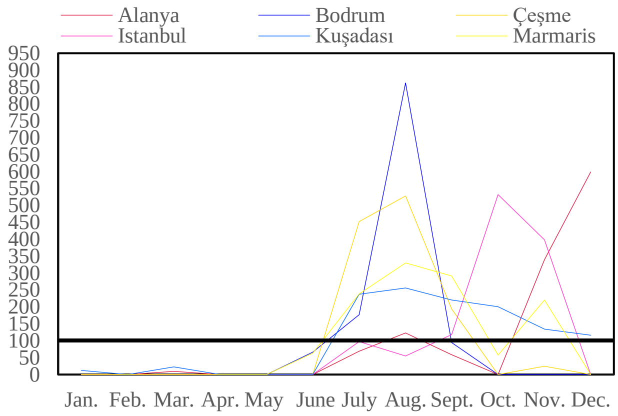
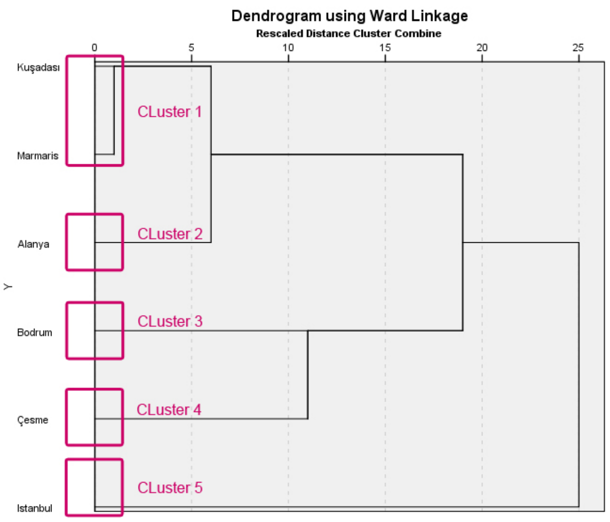


Figure 3-4. Seasonal indices for the cruise calls and passenger movements at the major seaports, 2019-2021

To see if the seaports have close characteristics and formed homogenous groups depending on the cruise traffic in the given period, seasonal indices were clustered using Ward's linkage method and the Euclidean distance measure. Figures 5 and 6 illustrate potential clusters of seaports based on cruise calls and passenger movements. The vertical axis in these figures spans the stages representing each given port, while the horizontal one refers to the distances between the clusters of seaports. The longer the distance the higher the heterogeneity or the lower the homogeneity would be. Therefore, the most likely groups or clusters for both cruise calls and passenger movements were spotted between points 0 and 5. There were five clusters identified at such a distance. Cluster 1 was comprised of the ports of Kuşadası and Marmaris. Other seaports were considered to form clusters on their own. These clusters were identified also considering the patterns in figures 3 and 4.

An alternative grouping at larger distances does not form groups of close patterns as indicated in figures 3 and 4. For instance, the seaports, such as Kuşadası, Marmaris, and Alanya form a group at distance 6 as shown in figure 5. However, looking at figure 3, it can be concluded that the pattern of the port of Alanya does not quite coincide with the patterns of the two other seaports. Such dissimilarities are also observable in other groupings. Moreover, the clusters in respect of the cruise calls do not correspond to the clusters with respect to the passenger movements at larger distances as shown in figures 5 and 6, which makes it hard enough to identify groups of seaports with close characteristics.

Figures 7 and 8 illustrate seasonal indices for cluster 1. Seasonal patterns for the other clusters remain unchanged as shown in figures 3 and 4. Figure 7 shows that the seasonal index for the cruise calls at the ports of Kuşadası and Marmaris culminates in July, which shows that cruise calls of this month are 253 percent of the amount expected on the basis of trend-cyclical variation (S_{Jul}= 2.53). Conversely, seasonal indices bottom in February, April, and May—all scoring zero. As for seasonal indices for the passenger movements at the given seaports, the highest value appears in August as shown in figure 8 (S_{Aug}= 2.60). It can be concluded that the cruise traffic at the given seaports has one-peak seasonality and the annual pattern for this cluster can be grouped into a low (January to June, and December), a middle (October and November), and a high season (July to September) with respect to the passenger movements.



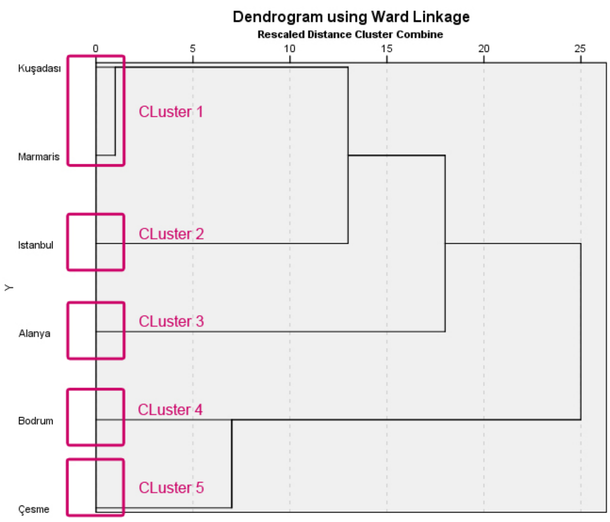


Figure 5-6. Dendrograms illustrating clusters of seaports with respect to cruise calls and passenger movements, 2019-2021

As for cluster 2, the highest seasonal index for cruise calls at the port of Alanya appears in August (S_{Aug}= 2.94). Along with that, December has also a significantly high value (S_{Dec}= 2.55) which tends to have a second peak as shown in figure 3. Moreover, March forms a quasi-peak pattern (S_{Mar}= 1.21). Contrariwise, the highest seasonal index for passenger flows appears in December (S_{Dec}= 5.99). Figure 4 reveals that the passenger movements at the port of Alanya have a one-peak pattern, although it tends to form a quasi-peak in August (S_{Aug}= 1.23). Considering these movements, the annual pattern for this port can be categorized into a low (January to July, September, and October), a middle (November), and a high season (December).

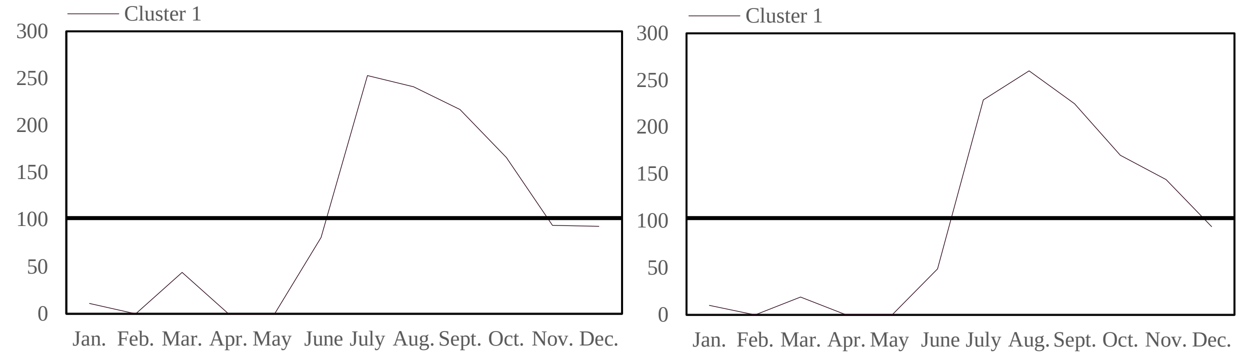


Figure 7-8. Seasonal indices for the cruise calls and passenger movements in cluster 1, 2019-2021

The cruise calls at the port of Bodrum in cluster 3 display a two-peak seasonality as the seasonal indices for this port culminate in August (S_{Aug}= 4.80) and in June (S_{June}= 4.00). However, passenger movements at this port have a sharp one-peak pattern with the highest seasonal index appearing in August (S_{Aug}= 8.62). Considering the passenger movements, the annual pattern for this port can be divided into a low (January to June, and September to December), a middle (July), and a high season (August).

The highest seasonal indices for the cruise calls and passenger movements at the port of Çeşme in cluster 4 appear in August (S_{Aug}= 6.97 and S_{Aug}= 5.28), suggesting that the cruise traffic at this port manifests one-peak seasonality. Conclusively, the annual pattern for the port can be grouped into a low (January to June, and October to December), a middle (July and September), and a high season (August) depending on passenger movements in the given period.

The seasonal index for the cruise calls at the port of Istanbul in cluster 5 culminates in November (S_{Nov}= 6.97)—referring to one-peak seasonality. However, the highest index for passenger movements appears in October (S_{Oct}= 5.32). Conclusively, this port has one-peak seasonality in respect of passenger flows and is divided into a low (January to August, and December), a middle (September and November), and a high season (October).

Table 2 exhibits the Gini indices and seasonality indicators for the cruise calls at the sample seaports between 2019 and 2021. Note that values for some ports are missing in 2020 and 2021. They could not be calculated as there was no traffic during these years. One can infer that the ports of Kuşadası and Marmaris in cluster 1 indicated a very high level of seasonality with respect to cruise ship calls, with a mean of around 0.67. These ports were highly seasonal before the outbreak of the global pandemic (*G*= 0.43). However, the Gini value for 2020 is extremely large (*G*= 0.94), which suggests that seasonality soared in that year. Seasonality tended to dwindle in 2021 (*G*= 0.63). Notwithstanding that, there was still around a 47 percent gap compared to the seasonality in 2019. Moreover, the indices indicate a significant level of variation. The CV value suggests that these indices are highly unstable (over 0.3 or 30 percent). Seasonality indicators suggest that the occupancy rate was 31 percent on average in the cluster 1 seaports. It is also worth noting that the indicators are significantly unstable (CV= 0.60).

Table 2. The Gini indices and seasonality indicators for the cruise calls, 2019-2021

	G						*ω*					
	2019	2020	2021	$\bar{X}$	*s*	CV	2019	2020	2021	$\bar{X}$	*s*	CV
Cluster 1	0.430	0.939	0.633	0.667	0.256	0.384	0.502	0.125	0.302	0.310	0.189	0.609
Kuşadası	0.419	0.939	0.811	0.723	0.271	0.375	0.497	0.125	0.205	0.276	0.196	0.710
Marmaris	0.508		0.677				0.407		0.287			
Cluster 2												
Alanya	0.622	1.000	1.000	0.874	0.218	0.250	0.361	0.083	0.083	0.176	0.161	0.914
Cluster 3												
Bodrum	0.794		0.939				0.208		0.125			
Cluster 4												
Çeşme	0.814						0.185					
Cluster 5												
Istanbul	0.748		0.919				0.217		0.150			

The port of Alanya has even higher Gini values that refer to significant seasonality in the given period. For instance, it manifested a very high level of seasonality in 2019 (*G*= 0.62). Furthermore, there was an absolute seasonality in 2020 and 2021 (*G*= 1.00). Also, note that the indices are rather unstable (CV= 0.25). Moreover, the seasonality indicators reveal that the average occupancy rate was only around 18 percent in the given period. There was a substantial decrease in port use in 2020 compared to the use in 2019 (-77%). It can be also inferred that the seasonality indicators for this port are extremely unstable (CV= 0.91).

In a similar vein, the seaports in clusters 3 and 5 are very seasonal with respect to cruise calls. For instance, these ports had significant Gini indices in 2019 as shown in the table. The port of Çeşme in cluster 4 points to an extreme level of seasonality (*G*= 0.81). Moreover, the occupancy rates were considerably low in these ports in the given period.

The Gini indices and seasonality indicators for the passenger movements at the sample seaports are exhibited in table 3. One can infer that the sample seaports were significantly seasonal in the given period with respect to passenger movements. For instance, the seaports in cluster 1 were highly seasonal in 2019 (*G*= 0.41). Seasonality in these ports increased significantly during the global pandemic (*G*= 0.90). However, their seasonality tended to decrease in 2021 (*G*= 0.67). Nevertheless, there is around a 63 percent gap between 2021 and 2019. The CV value suggests that the indices are highly unstable (CV= 0.37). Moreover, the occupancy rate was 32 percent on average. One can infer that there were significant oscillations in capacity utilization over the given period (CV= 0.53).

Table 3. The Gini indices and seasonality indicators for the passenger movements**,** 2019-2021

	G						ω					
	2019	2020	2021	$\bar{X}$	*s*	CV	2019	2020	2021	$\bar{X}$	*s*	CV
Cluster 1	0.413	0.909	0.672	0.665	0.248	0.373	0.502	0.166	0.293	0.320	0.170	0.530
Kuşadası	0.398	0.909	0.854	0.720	0.281	0.389	0.530	0.166	0.179	0.292	0.207	0.708
Marmaris	0.582		0.730				0.397		0.226			
Cluster 2												
Alanya	0.818	1.000	1.000	0.939	0.105	0.112	0.172	0.083	0.083	0.113	0.051	0.456
Cluster 3												
Bodrum	0.829		0.995				0.197		0.086			
Cluster 4												
Çeşme	0.777						0.258					
Cluster 5												
Istanbul	0.771		0.919				0.208		0.151			

As shown in table 3, the port of Alanya was extremely seasonal in the given period ($\bar{X}$= 0.94). For instance, the port had an absolute seasonality during 2020-2021. The Gini index for 2019 is also significant (*G*= 0.82). Along with that, the indices are unstable (CV= 0.11). Moreover, the occupancy rate was rather low ($\bar{X}$= 0.11). The CV value for the seasonality indicators is significant. The port of Bodrum was also extremely seasonal over the given period. The other seaports, such as Çeşme and Istanbul had a very high level of seasonality in 2019, which was even worse during the new normal. Looking at figures 9 to 13, one can observe how the passenger movements at the sample seaports pose "awkward" and notably unequal Lorenz curves over the given period.

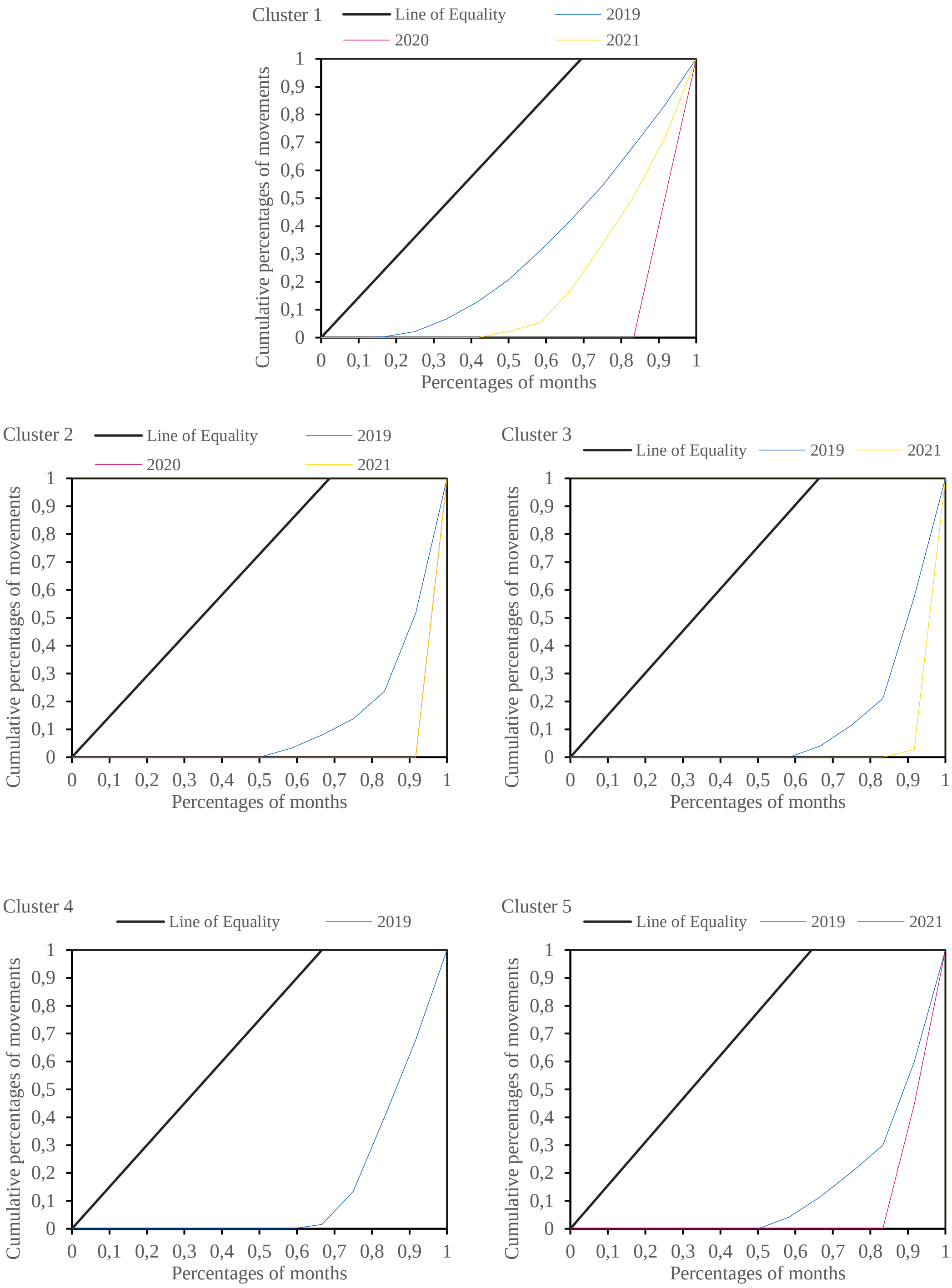


Figure 9-13. Lorenz curve charts of the passenger movements, 2019-2021

5. Conclusion

This paper analyzed seasonality in the cruise traffic at the major seaports in Turkey. The paper has several implications, specifically for practitioners, strategists, and policymakers. The cruise traffic at the sample seaports was highly fluctuant during 2019-2021. Moreover, there was a substantial shrink in this traffic over the given period. Both the cruise calls and the passenger flows have plunged from 2020 onwards. However, the demand tended to improve in 2021, with the caveat that it was still far lower than the demand in 2019.

The findings reveal that Kuşadası, Marmaris, Çeşme, Alanya, Istanbul, and Bodrum were highly frequented seaports over the given period. Contrariwise, Yalova, Bozcaada, Fethiye, Finike, Dikili, Göcek, Antalya, and Çanakkale were seaports of minor traffic. Moreover, all these ports were categorized as small-scale seaports for most of the period. Seaports, such as Kuşadası, Marmaris, Alanya, Istanbul, Bodrum, Çanakkale, Göcek, Dikili, Finike, Fethiye, and Bozcaada mainly served as ports of call, while Çeşme, Antalya, and Yalova served as home ports over the given period.

The sample seaports were grouped into five clusters with respect to cruise traffic. Kuşadası and Marmaris formed a single cluster, while the others were determined to be clusters on their own. These clusters of seaports had highly fluctuating seasonal patterns. Furthermore, the seaports in clusters 2 and 3 referred to two-peak seasonality, while the others had one-peak seasonality according to their cruise calls. However, all the clusters (except for Marmaris if taken individually) had one-peak seasonality according to their passenger movements. Seasonality in these ports was delineated by some sub-seasons, such as low, middle, and high. Each cluster had sub-seasons with distinctive characteristics (e.g., occupied different months and durations). All the clusters, however, had very short high seasons, while they had long low seasons, which indicates the severity of their seasonality on a temporal basis.

Another finding of this study is that the cruise traffic at the sample seaports was significantly seasonal. Both cruise ship calls and passenger movements had notable Gini indices. Furthermore, occupancy rates of the sample seaports were substantially poor. The results also show that the novel coronavirus disease has aggravated seasonality which is manifest from 2020 onwards. The global pandemic had a significant negative effect on the port occupancy rates. These findings suggest that large-scale crises impact cruise traffic and overall, the growth of cruise tourism negatively.

The paper has established the need for strategic action against the considerably seasonal traffic of the sample seaports. It can be inferred from the literature that one of the least understood aspects of seasonality in cruise tourism is designing effective strategies to manage such a widely recognized problem. Esteve-Perez, Garcia-Sanchez and Munoz-Paupie (2019) and Esteve-Perez and Garcia-Sanchez (2017) are among the few studies that have provided some strategies to address seasonal cruise traffic. Considering the findings above, efforts can arguably be centered around making arrangements with cruise lines and applying marketing campaigns to boost traffic outside the peak season. More research, however, should be conducted to identify specific strategies to manage seasonality efficiently. One should also consider post-pandemic transformations and trends to adopt stronger strategies as Lau, Yip and Kanrak (2022) stress that the global pandemic has changed the landscape of the cruise industry.

Cruise tourism is not the backbone of the tourism industry in Turkey. It requires much consideration in terms of itinerary design, infrastructure, investment, and marketing. It is suggested that cruise tourism should be considered in terms of itineraries rather than destinations (Rodrigue & Notteboom 2012; Rodrigue & Notteboom, 2013). Moreover, Esteve-Perez, Garcia-Sanchez and Munoz-Paupie (2019) suggest that seasonality in cruise traffic is associated with regions and not with ports in isolation. The seaports in Turkey are deemed a part of the Eastern Mediterranean cruise traffic. Therefore, strategies for coping with seasonality should unequivocally be created by considering the regional traffic and its characteristics. Collaboration with the stakeholders in the region is essential.

This study was limited to examining seasonality in a number of seaports and a specified length of time. Future studies can attempt to discover the seasonal patterns and other characteristics of cruise traffic on a regional scale. Interregional comparisons, where possible, can also allow one to see the broader picture of the subject. Aside from that, further research should be dedicated to identifying useful and practical strategies to reduce peaks and troughs in cruise traffic. Studies of consumer behavior considering seasonality may be quite helpful in developing effective marketing strategies to balance seasonal demand for cruise vacations.

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