



A decomposition of the changes in seasonal concentration by tourist segment: an analysis of the Veneto region

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Received: 29 November 2024 / Accepted: 30 July 2025
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Abstract

Diversifying the tourist product by tourist segment is a strategy that local governments can use to counter seasonal concentration in tourist arrivals. The effectiveness of such a strategy can be assessed by using a statistical tool for analysing the changes in seasonal concentration by segment. Using a decomposition technique separating the roles of different tourist segments in changing the pattern and magnitude of seasonal concentration, this paper examines the changes in seasonal concentration in three popular tourist destinations in the Veneto region in the 2019–2022 period. Results show that the role played by each tourist segment in changing seasonal concentration varies according to the type of tourism of the destination considered.

Keywords Concentration · Seasonality · Segmentation · Tourist arrivals · Veneto

1 Introduction

A high concentration of tourist arrivals in a few months may imply some disadvantages for a tourism destination, such as an overuse of infrastructures in the peak season whereas they are underused in the off-peak season (Baum 1999; Butler 2001), higher prices for goods and services in the high season (Vergori 2012), a worsening of the quality of life for residents in the peak season (Koenig-Lewis and Bischoff 2005). Diversifying the tourist product by tourist segment is a strategy that can be used to counter seasonal concentration (Figini and Vici 2012; Koenig-Lewis and Bischoff 2010), and measuring the change in seasonal concentration is useful for assessing the impact of such a strategy. To diversify the tourist product effectively, local governments need to know the role that each tourist segment plays in determining the seasonal concentration and its changes. This appears particularly important for the regions that have very different destinations in terms of tourist product and, therefore, attract distinct tourist segments at different times of the year. The Veneto region has various tourist destinations offering different tourist experiences (e.g. art and cultural tourism, mountain tourism, sea and lake tourism, thermal tourism) that made it one of the

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most visited regions in Italy. In that scenario, distinct tourist segments (e.g. resident and non-resident tourists) may have different impacts on the pattern and magnitude of seasonality according to the tourist destination considered, therefore an analysis by segment may help to focus the initiatives to counter seasonality on the segments having a major role in seasonal concentration.

Various statistical indicators can be used to measure seasonal concentration (Fernández-Morales 2003; Fernández-Morales and Mayorga-Toledano 2008; Turrión-Prats and Duro 2017). Most of such indicators are well-known inequality indices used for measuring income inequality, like the Gini index (Ceriani and Verme 2024; Ciommi et al. 2024; Gini 1912) or the Theil index (Theil 1967). Fernández-Morales et al. (2016) used the Lerman and Yitzhaki (1985) decomposition of the Gini index to classify distinct tourist segments according to their propensity for seasonal concentration in each year of the 2007–2013 period in the United Kingdom. Koenig and Bischoff (2003) measured the seasonal concentration in overnight stays in Wales from 1994 to 2000 by using different measures (i.e. the Gini index, the coefficient of variation and the seasonal ratio) and compared their results. Duro (2018) used the Theil index to quantify the seasonal concentration in tourism revenues in Spain between 2005 and 2014. Vergori and Arima (2022) used the Gini index to measure the seasonal concentration in tourist arrivals in Italy from 1997 to 2017.

The above-mentioned indicators are appropriate to analyse seasonal concentration in a year but not to examine the changes in seasonal concentration between two years as they do not consider the shifts that may occur in the seasonal pattern, an essential feature of seasonality because it represents the scheme whereby seasonal fluctuations recur at the same times each year. Vergori (2017) pointed out that the seasonal pattern can change over time and that measuring its stability is needed to forecast tourist arrivals accurately. Grossi and Mussini (2021) obtained a measure of stability in the seasonal pattern by decomposing the change in seasonal concentration into two terms: a component tracking the change in the seasonal pattern, i.e. a seasonal stability component, and a component measuring the change in the magnitude of seasonality, i.e. a seasonal magnitude component.

Mussini (2025) showed that the seasonal stability and magnitude components can be broken down by tourist segment, when the tourism market is partitioned into segments by a segmentation variable (e.g. age, type of accommodation, transport mode, country of residence). The decomposition by segment measures how much each segment contributes to changes in the pattern and magnitude of seasonality. This decomposition is used to examine the changes in seasonal concentration by segment in three popular tourist destinations in the Veneto region between 2019 and 2022: the Dolomites, Jesolo-Eraclea and Venice. These popular tourist destinations are characterized by different tourist products and, therefore, by tourist arrivals that differ in terms of seasonal pattern and concentration. Results show that the role played by each tourist segment in changing seasonal concentration varies according to the tourist product of the destination considered. This information may help local policymakers to design segment-specific strategies to mitigate seasonal concentration in tourist arrivals in the three destinations.

The paper is organized as follows: Sect. 2 describes the components of the change in seasonal concentration; Sect. 3 briefly reviews the decomposition of each component by segment; Sect. 4 examines the changes in seasonal concentration in the Dolomites, Jesolo-Eraclea and Venice; Sect. 5 concludes.

2 The components of the change in seasonal concentration

This section briefly describes the seasonal stability and magnitude components that have been separated in the Grossi and Mussini (2021) decomposition of the change in seasonal concentration. Let Y stand for tourist arrivals in a destination and $y_{1,t}, \dots, y_{n,t}$ be the n observations of Y_t when year t is split into n periods (n equals 12 in case of a monthly series). The Gini index measuring the concentration of arrivals in year t is (Lerman and Yitzhaki 1985).

$$G(Y_t) = \frac{2cov[y_{i,t}, r(y_{i,t})]}{n\bar{y}_t}, \tag{1}$$

where \bar{y}_t is the average number of tourist arrivals per period in year t and $r(y_{i,t})$ is the rank of period i in the ranking of periods by tourist arrivals in year t .

After observing the distribution of tourist arrivals in year $t + k$, the change in seasonal concentration is measured by the difference between the Gini index in $t + k$ and that in t :

$$\begin{aligned} \Delta G &= G(Y_{t+k}) - G(Y_t) \\ \Delta G &= \frac{2cov[y_{i,t+k}, r(y_{i,t+k})]}{n\bar{y}_{t+k}} - \frac{2cov[y_{i,t}, r(y_{i,t})]}{n\bar{y}_t}. \end{aligned} \tag{2}$$

Grossi and Mussini (2021) broke down ΔG into two components:

$$\begin{aligned} \Delta G &= \left\{ \frac{2cov[y_{i,t+k}, r(y_{i,t+k})]}{n\bar{y}_{t+k}} - \frac{2cov[y_{i,t+k}, r(y_{i,t})]}{n\bar{y}_{t+k}} \right\} \\ &+ \left\{ \frac{2cov[y_{i,t+k}, r(y_{i,t})]}{n\bar{y}_{t+k}} - \frac{2cov[y_{i,t}, r(y_{i,t})]}{n\bar{y}_t} \right\} \\ \Delta G &= R + M. \end{aligned} \tag{3}$$

R measures the change in concentration because of changes in the ranking of periods by tourist arrivals from t to $t + k$. R ranges from 0 to $2 G(Y_{t+k})$ and tracks every change in the seasonal pattern. For this reason, Grossi and Mussini (2021) interpreted this component as a measure of seasonal stability. The larger R , “the more unstable the seasonal pattern” (Grossi and Mussini 2021).

M is the magnitude component indicating the extent to which arrivals in $t + k$ are more (or less) concentrated in the periods that are the peak periods in t (Grossi and Mussini 2021). A positive (negative) value of M indicates that the magnitude of seasonality has increased (decreased) with respect to the initial distribution of arrivals among periods.

3 Recent developments: a decomposition by tourist segment

Supposing that Y_t is the sum of arrivals from m different segments, $Y_t = X_{1,t} + \dots + X_{j,t} + \dots + X_{m,t}$, Mussini (2025) showed that R and M can be separated into m components measuring the contributions of the various segments to the stability of the seasonal pattern and to the magnitude of seasonal concentration. Such a decomposition by segment is obtained by using the Gini correlation (Lerman and Yitzhaki 1985; Schechtman and Yitzhaki 1987). The Gini correlation between variables $X_{j,t}$ and Y_t is defined as

$$\Gamma(X_{j,t}, Y_t) = \frac{cov[x_{ji,t}, r(y_{i,t})]}{cov[x_{ji,t}, r(x_{ji,t})]} \tag{4}$$

where $x_{ji,t}$ is the number of arrivals from segment j in period i in year t and $r(x_{ji,t})$ is the rank of period i in the ranking of periods according to arrivals from segment j in that year. $\Gamma(X_{j,t}, Y_t)$ ranges from -1 to 1 and measures the dependence between $X_{j,t}$ and Y_t , like the well-known Pearson correlation coefficient (Lerman and Yitzhaki 1984). Using the decomposition proposed by Lerman and Yitzhaki (1985), the Gini index of Y_t can be expressed as

$$G(Y_t) = \sum_{j=1}^m S_{j,t} G(X_{j,t}) \Gamma(X_{j,t}, Y_t), \tag{5}$$

where $S_{j,t} = n\bar{x}_{j,t}/n\bar{y}_t$ is the share of $X_{j,t}$ in Y_t , and $G(X_{j,t})$ is the Gini index of $X_{j,t}$. The Lerman and Yitzhaki decomposition in Eq. (5) was used in studies on tourism demand to classify its distinct segments depending on their aversion or propensity for seasonal concentration (Fernández-Morales et al. 2016; Cisneros-Martínez et al. 2023).

Given Eqs. (4) and (5), R is broken down into the sum of m terms (Mussini 2025):

$$\begin{aligned} R &= \frac{2cov[y_{i,t+k}, r(y_{i,t+k})]}{n\bar{y}_{t+k}} - \frac{2cov[y_{i,t}, r(y_{i,t})]}{n\bar{y}_{t+k}} \\ R &= \sum_{j=1}^m S_{j,t+k} G(X_{j,t+k}) \Gamma(X_{j,t+k}, Y_{t+k}) - \sum_{j=1}^m S_{j,t+k} G(X_{j,t+k}) \Gamma(X_{j,t+k}, Y_t) \\ R &= \sum_{j=1}^m S_{j,t+k} G(X_{j,t+k}) [\Gamma(X_{j,t+k}, Y_{t+k}) - \Gamma(X_{j,t+k}, Y_t)] \\ R &= \sum_{j=1}^m R_j. \end{aligned} \tag{6}$$

where $R_j = S_{j,t+k} G(X_{j,t+k}) [\Gamma(X_{j,t+k}, Y_{t+k}) - \Gamma(X_{j,t+k}, Y_t)]$ measures the contribution of segment j to the seasonal stability component. Unlike the seasonal stability component R , which is always non-negative, the contribution of segment j to R can be negative as one can notice by observing that the sign of R_j is linked to the difference between the Gini correlations $\Gamma(X_{j,t+k}, Y_{t+k})$ and $\Gamma(X_{j,t+k}, Y_t)$. R_j is negative if $X_{j,t+k}$ is more Gini-correlated to Y_t than to Y_{t+k} ; in other words, if the distribution of arrivals from tourist segment j among periods in year $t+k$ is more coherent with the seasonal pattern of total arrivals in year t . The interpretation of R_j is as follows: a negative (positive) value of R_j measures how much segment j contributes to the stability (instability) of the seasonal pattern over time; in line with the fact that the larger R , the more unstable the seasonal pattern.

The seasonal magnitude component is broken down into m terms:

$$\begin{aligned} M &= \frac{2cov[y_{i,t+k}, r(y_{i,t})]}{n\bar{y}_{t+k}} - \frac{2cov[y_{i,t}, r(y_{i,t})]}{n\bar{y}_t} \\ M &= \sum_{j=1}^m S_{j,t+k} G(X_{j,t+k}) \Gamma(X_{j,t+k}, Y_t) - \sum_{j=1}^m S_{j,t} G(X_{j,t}) \Gamma(X_{j,t}, Y_t) \\ M &= \sum_{j=1}^m M_j \end{aligned} \tag{7}$$

where $M_j = S_{j,t+k} G(X_{j,t+k}) \Gamma(X_{j,t+k}, Y_t) - S_{j,t} G(X_{j,t}) \Gamma(X_{j,t}, Y_t)$. M_j measures the contribution of segment j to the seasonal magnitude component. The interpretation of M_j

Table 1 Components of the change in seasonal concentration between 2019 and 2022

Destination	G ₂₀₁₉	G ₂₀₂₂	ΔG	R	M
Dolomites	0.37487	0.38739	0.01252	0.00415	0.00837
Jesolo-Eraclea	0.48249	0.53757	0.05508	0.00809	0.04699
Venice	0.16693	0.22074	0.05381	0.00857	0.04524

Source: own calculations on data from the tourism database of the Veneto region

is quite immediate: a positive (negative) value of M_j measures how much the distribution of arrivals from segment j in year $t + k$ increases (decreases) the magnitude of seasonal concentration in the distribution of total arrivals among periods.

4 The changes in seasonal concentration in the Veneto region

The decomposition is used to examine the changes in seasonal concentration of tourist arrivals in three popular tourist destinations in the Veneto region between 2019 and 2022: the Dolomites, Jesolo-Eraclea and Venice. Such destinations were chosen as they have distinct tourist products, thus analysing changes in seasonal concentration of tourist arrivals is particularly interesting as seasonality may be linked to the tourist product. The 2019 data were chosen because they are the last data before the COVID-19 pandemic, which severely affected the tourism sector in 2020 and 2021, causing a sharp decrease in non-resident tourist arrivals due to cross-border mobility restrictions. The tourism sector recovered only from 2022 when non-resident tourist arrivals almost returned to pre-pandemic levels, especially in the second semester.¹ Thus, the 2022 data are the first data that can be used for comparisons with the pre-pandemic situation in terms of seasonal concentration. Monthly data on tourist arrivals come from the database of the Veneto region (Regione Veneto 2025).² Tourists are divided into two segments according to that they reside in Italy or in a foreign country: resident and non-resident tourists.

Table 1 shows the Gini index in 2019 and 2022, the change in the index and its decomposition in the seasonal stability and magnitude components for each tourist destination. From Table 1 one can see that seasonal concentration generally increased over the 2019–2022 period, as the change in the Gini index is positive in every destination. Since the degree of seasonal concentration differs by destination, results are discussed for each tourist destination.

The Dolomites offer several attractive opportunities for mountain tourism, with a variety of experiences (e.g. skiing, trekking, climbing, natural landscapes) which can be tried in the winter and summer seasons especially. Monthly arrivals in the Dolomites in the two segments and in total in 2019 and 2022 are plotted in Fig. 1, where a two-peak seasonality is evident when looking at total arrivals. This seasonal pattern is the outcome of the mix between the monthly series of resident and non-resident tourist arrivals, the shapes of which are only partially overlapping. Figure 1 shows that the summer and winter peaks are more pronounced for resident tourists than for non-resident ones.

¹ The last COVID-related entry restrictions were removed from June 1, 2022 (the COVID-19 green certificate was no longer required to enter Italy since that date).

² Monthly data on tourist arrivals in the Veneto region are available at the website: https://statistica.regione.veneto.it/ENG/banche_dati_economia_turismo.jsp.

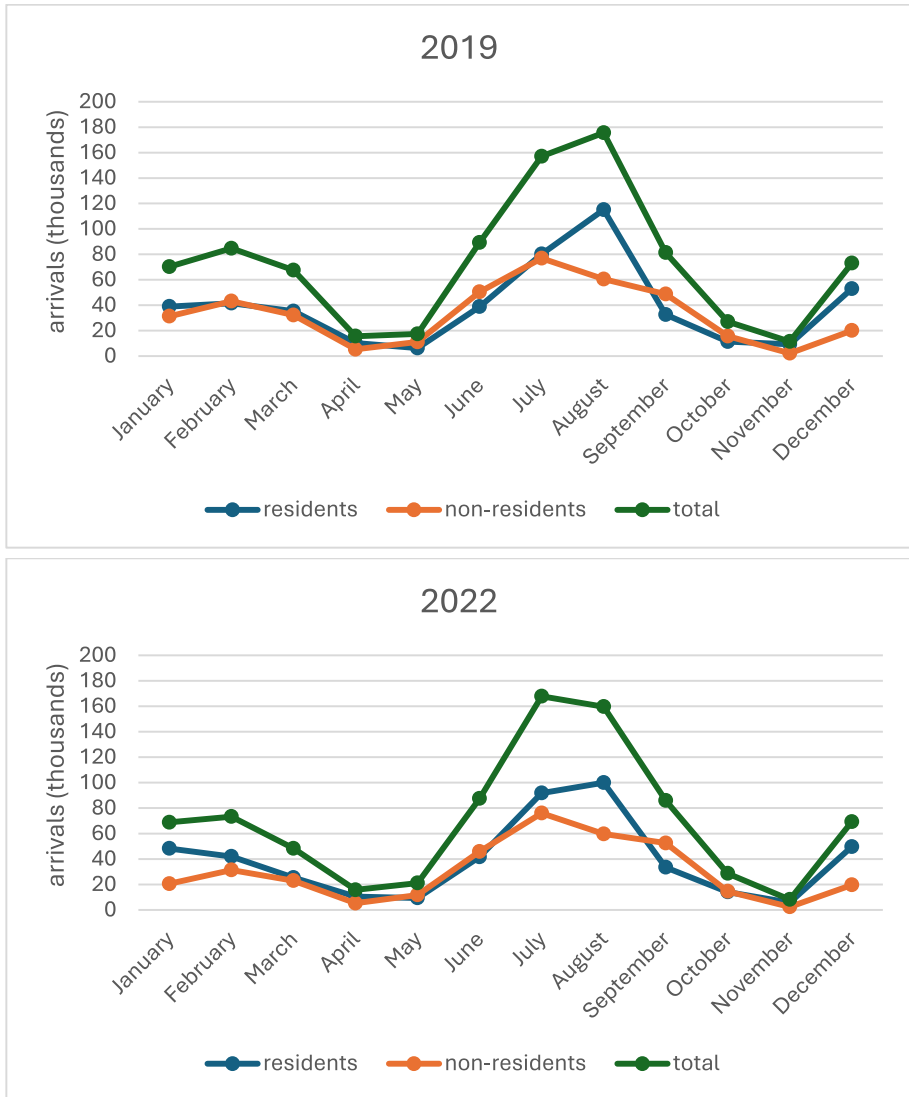


Fig. 1 Monthly tourist arrivals in the Dolomites in 2019 and 2022. Source: own elaborations on data from the tourism database of the Veneto region

Seasonal concentration was quite high in 2019, with a Gini index equal to 0.37487, and increased in 2022 (0.38739). The seasonal stability and magnitude components equal 0.00415 and 0.00837, respectively, indicating that there was a small increase in the magnitude of seasonality and the seasonal pattern changed slightly. Figure 2 shows the decomposition of the seasonal stability and magnitude components by segment. The contribution to R from the non-resident tourist segment is positive (0.00748), suggesting that the 2022 distribution of non-resident tourist arrivals is more consistent with the seasonal pattern of total arrivals in 2022 than in 2019. In other words, there was a slight shift in the seasonal pattern of total

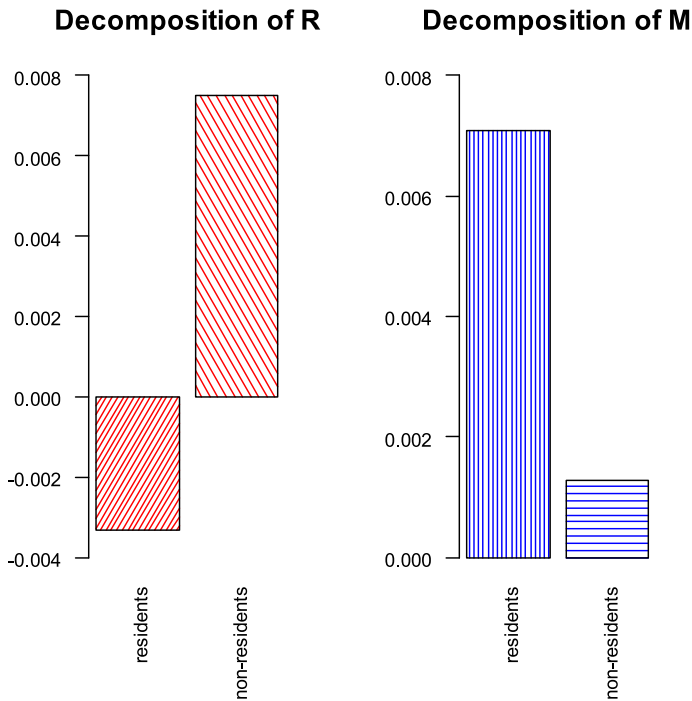


Fig. 2 Decomposition of the seasonal stability and magnitude components in the Dolomites. Source: own calculations on data from the tourism database of the Veneto region

arrivals towards the seasonal pattern shown by non-resident tourists in 2022. The contribution to M from non-resident tourists is positive but very small (0.00128), suggesting that the change in the relative distribution of non-resident tourists slightly increased the magnitude of seasonal concentration. The contribution to R from the resident tourist segment is negative (-0.00333), indicating that the resident tourist arrivals spread out among the months of 2022 in a way that preserved the initial seasonal pattern. The contribution to M from resident tourists is positive (0.00709), indicating that the change in their relative distribution among months increased the magnitude of seasonal concentration.

The above results point out that resident tourists played a major role in increasing the magnitude of seasonality and in keeping the seasonal pattern stable in the Dolomites. From a tourism policy point of view, a strategy to mitigate seasonality could be focused on the segment of resident tourists.

Figure 3 shows the monthly distributions of tourist arrivals in Jesolo-Eraclea in 2019 and 2022. Jesolo-Eraclea is a sun and beach tourism destination on the Adriatic Sea, characterized by a single-peak seasonality in the summer season. Both the resident and non-resident tourist arrivals were concentrated from June to August, with the shape of the monthly series of non-resident arrivals that appears more smoothed than that of resident arrivals in 2019.

Seasonal concentration was high in 2019, when the Gini index equals 0.48249, and increased in 2022 (0.53757). These results confirm that tourist arrivals are concentrated in the summer season whereas Jesolo-Eraclea attracts far fewer tourists in other seasons because of the characteristics of its tourist product. The seasonal stability and magnitude components equal 0.00809 and 0.04699, respectively, indicating that the change in the Gini

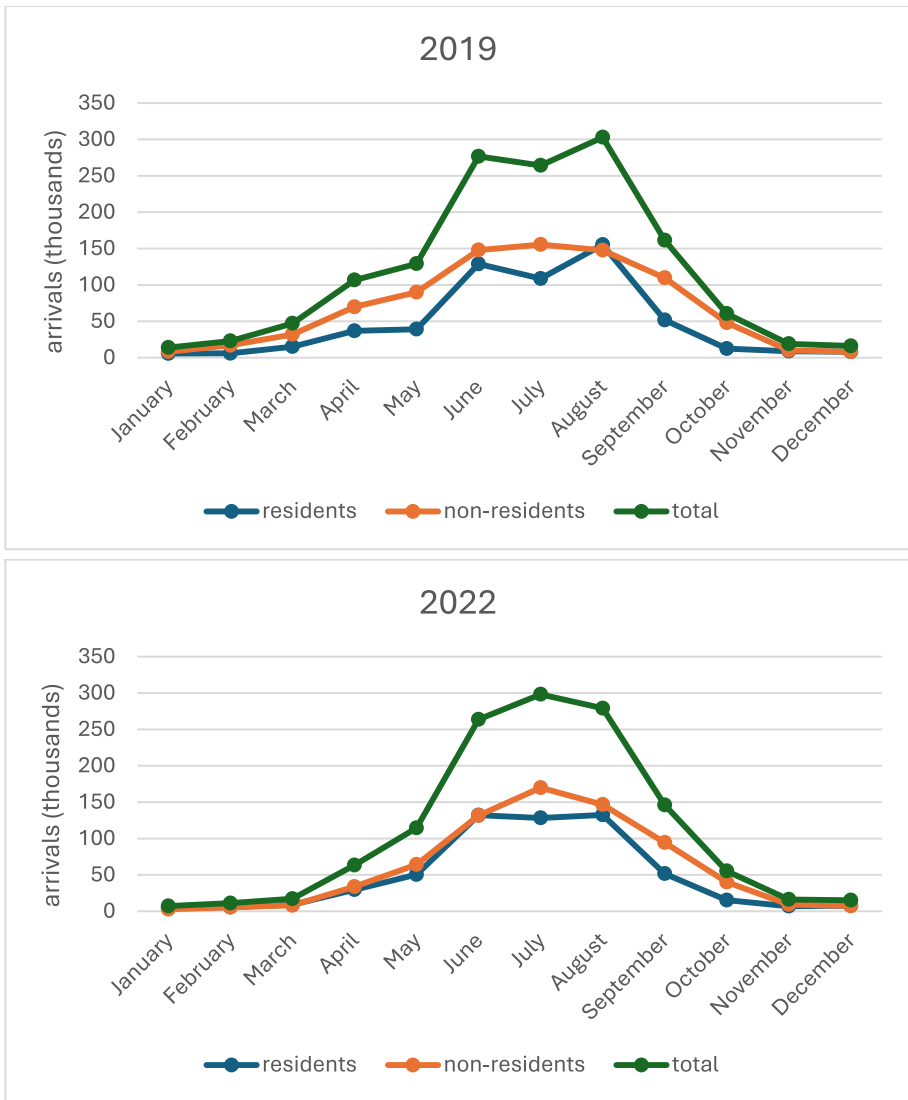


Fig. 3 Monthly tourist arrivals in Jesolo-Eraclea in 2019 and 2022. Source: own elaborations on data from the tourism database of the Veneto region

index was mainly due to an increase in the magnitude of seasonality while the seasonal pattern was more stable. Figure 4 shows the decomposition of the seasonal stability and magnitude components by segment. The contribution to R from the non-resident tourist segment is positive (0.00868), indicating that the 2022 distribution of non-resident tourist arrivals is more consistent with the seasonal pattern of total arrivals in 2022 than in 2019. This suggests that there was a shift in the seasonal pattern of total arrivals towards the seasonal pattern shown by non-resident tourists in 2022. The contribution to M from non-resident tourists is positive (0.02487), suggesting that the relative distribution of non-resident tourists changed in a way

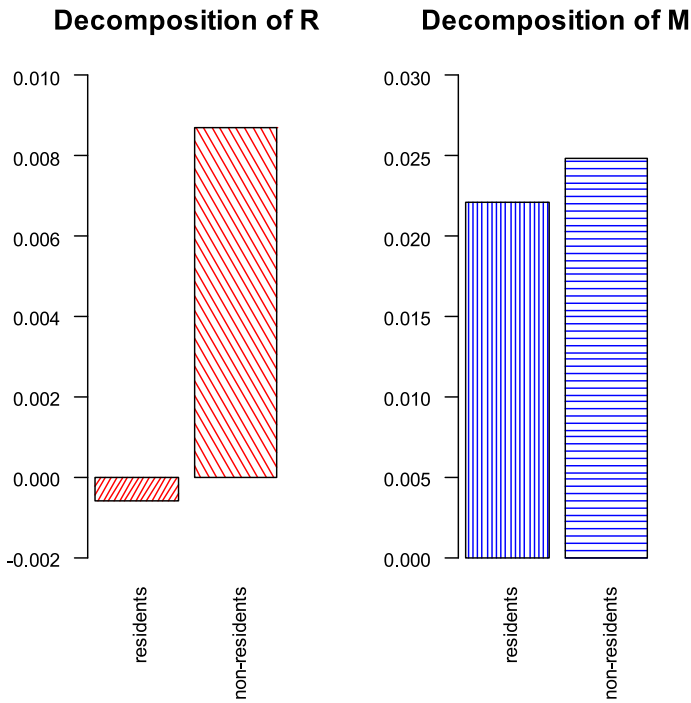


Fig. 4 Decomposition of the seasonal stability and magnitude components in Jesolo-Eraclea. Source: own calculations on data from the tourism database of the Veneto region

that increased the magnitude of seasonal concentration. The contribution to R from the resident tourist segment is negative and very small (-0.00059), indicating that the distribution of resident tourist arrivals among the months of 2022 was in line with the initial seasonal pattern. The contribution to M from resident tourists is positive (0.02212) and close to that of non-resident ones, suggesting that both the tourist segments contributed to increase the magnitude of seasonal concentration between 2019 and 2022.

The above results indicate that, while the seasonal pattern of total arrivals was almost stable, the magnitude of seasonality increased because both resident and non-resident tourist arrivals became more concentrated in the summer season. From a tourism policy perspective, a strategy to mitigate seasonality could be focused on diversifying the tourist product with the attempt to attract more tourists in the off-peak season.

Figure 5 shows the monthly distributions of tourist arrivals in Venice in 2019 and 2022. Venice is a famous art city (UNESCO 1987), with a tourist product differing from those of the Dolomites and Jesolo-Eraclea. Comparing the shapes of the monthly series of resident and non-resident tourist arrivals, one can see that seasonality is only shown by the segment of non-resident tourists. Since arrivals mainly are from the non-resident segment, the shape of the monthly series of total arrivals follows that of the monthly series of non-resident arrivals.

Seasonal concentration was equal to 0.16693 in 2019 and increased in 2022 (0.22074). These results indicate that seasonal concentration in Venice was much lower than in the other two destinations considered above. Such a difference may be explained by the Venice tourist product, which is not strongly dependent on season. The seasonal stability and magnitude components equal 0.00857 and 0.04524 , respectively, thus the increase in the Gini index

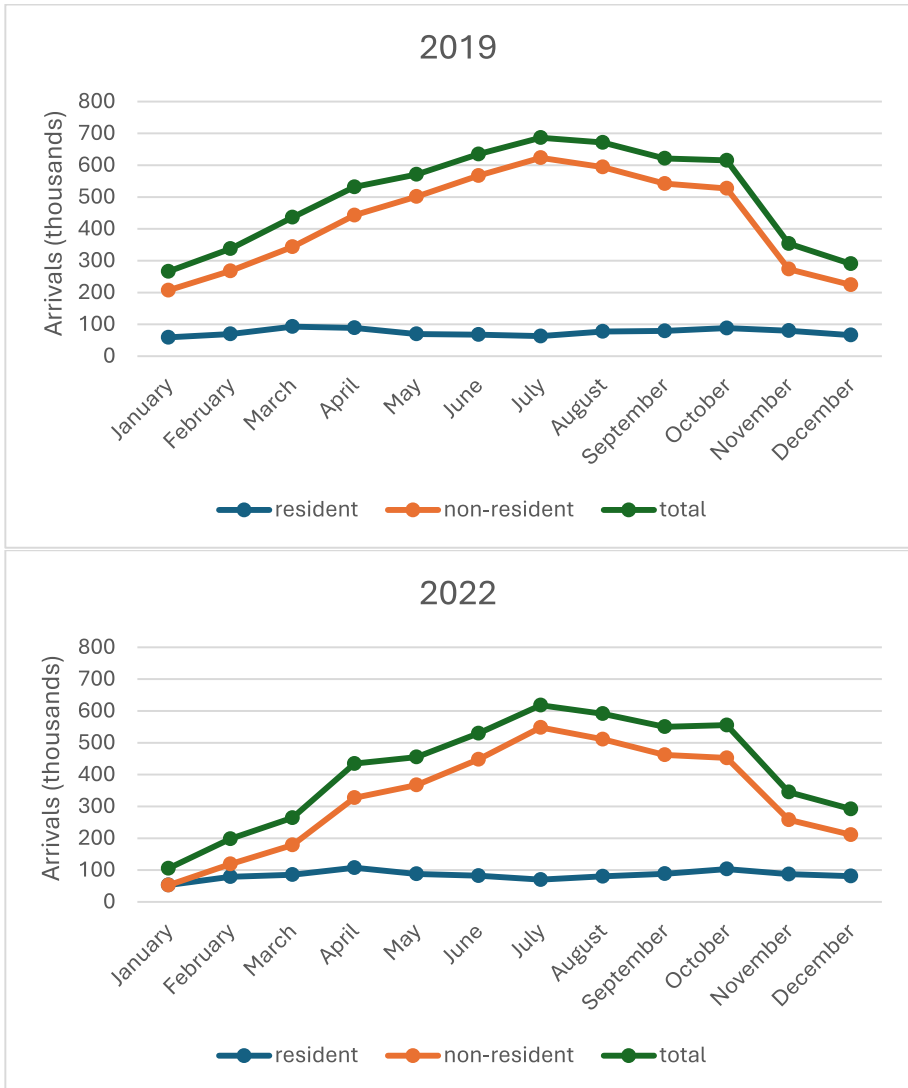


Fig. 5 Monthly tourist arrivals in Venice in 2019 and 2022. Source: own elaborations on data from the tourism database of the Veneto region

between 2019 and 2022 was mainly due to an increase in the magnitude of seasonality while the seasonal pattern was almost stable.

Figure 6 shows the decomposition of the seasonal stability and magnitude components by segment. The contribution to R from the non-resident tourist segment is positive (0.00718) and is much of the small shift in the overall seasonal pattern. This means that the small change in the seasonal pattern of total arrivals was driven by the seasonal pattern of non-resident tourist arrivals in 2022.

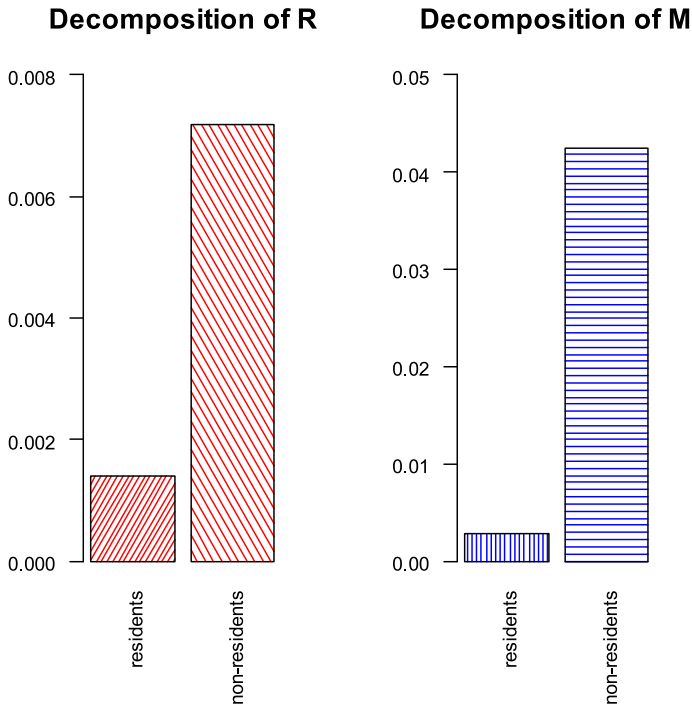


Fig. 6 Decomposition of the seasonal stability and magnitude components in Venice. Source: own calculations on data from the tourism database of the Veneto region

The contribution to M from non-resident tourists is positive (0.04247) and close to the value of M (0.04524), suggesting that the changes in the relative distribution of non-resident tourists explain the increase in the magnitude of seasonal concentration from 2019 to 2022. The contribution to R from the resident tourist segment is positive but very small (0.00139), indicating that the distribution of resident tourist arrivals among the months of 2022 did not modify the initial seasonal pattern. The contribution to M from resident tourists is positive but small (0.00277), suggesting that the resident tourist segment had an almost negligible role in increasing the magnitude of seasonal concentration.

The above results show that the change in seasonal concentration in Venice is essentially linked to non-resident tourist arrivals, which increased the magnitude of seasonality whereas the seasonal pattern remained substantially stable. From a tourism policy point of view, a strategy to reduce seasonal concentration should be focused on the segment of non-resident tourists as the impact of changes in resident tourist arrivals on the pattern and magnitude of seasonality was almost negligible.

5 Conclusion

The seasonal concentration in tourist arrivals is often analysed by observing total arrivals, without considering the roles of distinct tourist segments in changing the pattern and magnitude of seasonal concentration. In this paper, the impacts of different tourist segments on the pattern and magnitude of seasonal concentration have been examined by decomposing the changes in seasonal concentration in three popular tourist destinations like the Dolomites, Jesolo-Eraclea and Venice. Even though, these destinations belong to the same region (Veneto), they offer very different tourist experiences and have evident differences in tourist arrivals both in terms of pattern and magnitude of seasonality. The results of the analysis have shown some main points. First, seasonal concentration increased in the 2019–2022 period in each destination, although with differences in magnitude, while the seasonal pattern remained almost stable. The decomposition of the seasonal stability and magnitude components has pointed out that the segment of non-resident tourists had a major role in increasing the magnitude of seasonal concentration in Venice while the seasonal pattern was almost stable. On the contrary, the small increase in the magnitude of seasonal concentration in the Dolomites was driven by the segment of resident tourists. In Jesolo-Eraclea, where there was the largest increase in seasonal concentration, both the resident and non-resident tourist segments contributed to augment the magnitude of seasonal concentration, however resident tourists spread out among the months of 2022 in a way that preserved the seasonal pattern.

The above findings on the role played by each segment in changing seasonal concentration in the various destinations could be used to take specific initiatives to counter seasonality. In that scenario, decomposing the changes in seasonal concentration after that such initiatives have been implemented could provide indications on their effectiveness.

A natural direction for future research is the use of a statistical model for estimating the relationships between each component of the change in seasonal concentration and some explanatory variables. A further objective of future research is extending the analysis by using other segmentation variables, like the type of accommodation or the transport mode.

Acknowledgements I would like to thank two anonymous reviewers for their helpful comments on an earlier version of this manuscript.

Data availability The data that support the findings of this study are available at https://statistica.regione.veneto.it/ENG/banche_dati_economia_turismo.jsp.

Declarations

Conflict of interest The Author declares that there is no conflict of interest.

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