



An integrated methodological framework to measure tourism seasonality across short-stay accommodations offered via online platforms and hotels

Marco metodológico integrado para medir la estacionalidad del turismo a partir de alojamientos de corta estancia ofrecidos en plataformas en línea y de hoteles

José David Cisneros-Martínez 

Universidad de Málaga, Facultad de Turismo, Departamento de Economía Aplicada (Estadística y Econometría), Instituto Andaluz de Investigación e Innovación en Turismo, España, davidcisneros@uma.es

Antonio Fernández-Morales 

Universidad de Málaga, Facultad de Ciencias Económicas y Empresariales, Departamento de Economía Aplicada (Estadística y Econometría), Instituto Andaluz de Investigación e Innovación en Turismo, España, afdez@uma.es

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Abstract

This article proposes an integrated methodological framework to measure tourism seasonality that combines overnight stays in hotels and short-stay accommodations offered on digital platforms (including short-term rental properties). The methodology is applied in four phases: (i) seasonal factors to profile the monthly distribution, (ii) max/min ratio and Gini index to quantify annual concentration, (iii) additive decomposition of the Gini index to estimate relative marginal effects by market, and (iv) double decomposition of the Gini index by accommodation type and travellers' origin. The empirical application to six Andalusian destinations shows that the max/min ratio and the Gini index offer similar results. The proposed framework constitutes a flexible methodology that can be applied at different levels: the max/min ratio is ideal for public reports and dashboards, while the Gini index and its simple and double decomposition are more suitable for comparative analysis, policy evaluation, and designing strategies to reduce seasonality, which makes it easier to identify markets with greater deseasonalisation potential.

Keywords: Tourism seasonality, Gini index decomposition, Market segmentation, Tourism demand analysis, Short-term rental properties.

Resumen

Este artículo propone un marco metodológico integrado para medir la estacionalidad turística que combina las pernoctaciones en hoteles y en alojamientos de corta estancia ofrecidos en plataformas digitales (incluidas las viviendas de uso turístico). La metodología se aplica en cuatro fases: (i) factores estacionales para perfilar la distribución mensual, (ii) ratio máximo/mínimo e índice de Gini para cuantificar la concentración anual, (iii) descomposición aditiva del índice de Gini para estimar los efectos marginales relativos por mercado, y (iv) descomposición doble del índice de Gini según el tipo de alojamiento y el origen de los viajeros. La aplicación empírica a seis destinos andaluces muestra que el ratio máximo/mínimo y el índice de Gini ofrecen resultados similares. El marco propuesto constituye una metodología flexible que puede aplicarse a distintos niveles: el ratio máximo/mínimo es ideal para informes públicos y paneles de control, mientras que el índice de Gini y sus descomposiciones simple y doble son más adecuados para el análisis comparativo, la evaluación de políticas y el diseño de estrategias para reducir la estacionalidad, ya que facilita la identificación de mercados con mayor potencial de desestacionalización.

Palabras clave: Estacionalidad turística, Índice de descomposición de Gini, Segmentación de mercados, Análisis de demanda turística, Alquiler de corto plazo.

1. Introduction

Tourism seasonality refers to the tendency for tourist flows to concentrate in relatively short periods of the year, thereby creating an imbalance between supply and demand in a destination (Baum, 1999, p. 45). This phenomenon remains a major structural challenge for the tourism industry, as it contributes to an uneven concentration of demand flows, which in turn affects both the financial viability of businesses (Alvarez, Bahja, & Fyall, 2022) and the sustainability of destinations (Grossi & Mussini, 2021). Seasonality is one of the most persistent constraints on the economic, social, and environmental sustainability of tourism (Butler, 2021); it hinders effective destination planning, generates unemployment in tourism-dependent economies (Ashworth and Thomas, 1999), jeopardises the financial stability of businesses, and causes an imbalance in the structure of revenues and costs (Butler, 2001). These combined impacts explain why tourism seasonality remains a strategic challenge for destinations, as it undermines long-term planning, financial resilience, employment stability, and the sustainable use of resources.

The causes and effects of seasonality have been analysed extensively in other studies (Duro, 2016; Koenig-Lewis & Bischoff, 2005). Among the main consequences are the underutilisation of businesses and services during the low season, together with the saturation of destinations in the high season due to the high temporary concentration of tourists. This pattern leads to irregular use of available resources and hinders efficient capacity planning (Baum & Lundtorp, 2001), thus generating negative economic and social effects such as job instability and the inefficient use of infrastructure (Jang, 2004).



Seasonality should not be overlooked by destination managers, who must design and implement appropriate policies and strategies to mitigate its effects. The complexity of the phenomenon lies in its multiple factors, such as climatic, cultural, institutional and structural, that condition demand behaviour (De Cantis, Ferrante, & Vaccina, 2011). Other economic variables that alter interannual demand, such as purchasing power and prices, also exert an influence (Rosselló, Riera, & Sansó, 2004), making it difficult to control. Reducing tourism seasonality is a priority for destination managers, and it is key to establish marketing strategies based on the behaviour of the different markets that constitute demand (Spencer & Holecek, 2007).

The main strategies to reduce seasonality can be classified as product diversification, market targeting, and pricing policies (Turrión-Prats & Duro, 2018). The design of policies aimed at reducing seasonality should avoid inefficiencies in resource utilisation, as well as poorly targeted marketing strategies (Koenig-Lewis & Bischoff, 2010). In this regard, tourism planning should be geared towards deseasonalisation by attracting less seasonal markets, which allows for a more balanced distribution of visitor flows throughout the year. To achieve this, it is essential to use a method, such as the one proposed in this study, that analyses the seasonal behaviour of the different markets and identifies their contribution to the overall seasonal concentration. In this regard, previous research shows that analysing off-peak visitor profiles can support the management of seasonality imbalances in coastal destinations (Lukoseviciute & Pereira, 2021).

In Spain, studies on tourism seasonality have traditionally been based on hotel overnight-stay figures (Martínez-García & Raya, 2008; Rosselló-Nadal, Riera Font, & Sansó Rosselló, 2004), due to the availability and homogeneity of data from the Spanish National Institute of Statistics (INE). However, recent research (Cardona et al., 2021; Méndez Gutiérrez del Valle, & Monteserín Abella, 2023) and several Spanish tourism observatories (Tourism Observatory of the Canary Islands, 2022; Tourism Observatory of Málaga, 2023) have begun to integrate overnight stays in tourist apartments within apartment establishments. By contrast, overnight stays in short-term rental properties and other short-term accommodation were excluded from these analyses. Therefore, these studies are limited because they do not reflect the actual accommodation demand.

Since 2020, the European Statistical Office (Eurostat) has had a collaboration agreement with the main digital accommodation platforms (Airbnb, Booking, Expedia Group, and Tripadvisor), and in this context, having new data available from these digital accommodation platforms gives us the opportunity to measure tourism demand more accurately. With this agreement, the platforms provide municipal-level information on various demand variables, including the number of overnight stays by travellers' origin; specifically, these are overnight stays in various types of accommodation, including tourist apartments, regardless of whether they are included in apartment establishments, tourist hostels, rural houses, and short-term rental properties, whose growth in recent years is linked to the collaborative economy and the rise of these platforms (INE, 2025a).

The INE receives aggregate information from the four platforms via Eurostat and has been publishing data since 2018 under the title "Estimation of occupancy in tourist accommodation based on data from digital platforms" (INE, 2025b). Eurostat refers to these overnight stays as "Short-stay accommodation offered via online collaborative economy platforms" (Eurostat, 2025), and in this study, we hereafter refer to them as "short-stay accommodation". These overnight stays, which for the first time include overnight stays in short-term rental properties, complement the information from the INE's traditional Tourist Apartments Survey (2025d), which previously only collected data on tourist apartments within apartment establishments distributed in furnished units (apartments, chalets, villas, bungalows, etc.).

In this study, overnight stays in hotels are combined with those registered in short-stay accommodation for a joint analysis of the seasonality of tourist demand. The proposed method consists of several techniques that can be used at various levels depending on the target audience. In the first phase, seasonal factors are calculated to identify the peak months for each demand segment (hereinafter, markets). In the second phase, the max/min ratio or the Gini index can be used as indicators of annual seasonal concentration. The results obtained with both indicators in this study are very similar, although the Gini index yields smoother profiles because it incorporates all monthly values for each year and produces more stable trajectories. In public reports, websites, or dashboards aimed at a less specialised general audience, the first and second phases can be implemented with the max/min ratio.

In a third stage, the additive decomposition of the Gini index is used to determine which markets contribute to a deseasonalising effect on the total demand. In a fourth and final phase, the two-level decomposition of the Gini index is used to identify less seasonal demand markets in more complex classifications such as the one used in this study, where demand is segmented by accommodation type and travellers' origin. The complete method, using the Gini index in the second phase, is suitable for more detailed analysis aimed at more specialised audiences.

In the region of Andalusia, the choice of destinations analysed to apply the proposed methodology is based both on their tourist relevance and their marked seasonality. Coastal destinations, which often depend on sun and sand tourism, are particularly affected by seasonality, as their activity is strongly conditioned by climate and peak demand cycles (Martín Martín & Salinas Fernández, 2022). In highly seasonal destinations, businesses and destination managers must design strategies aimed at stimulating demand



in the low season (Gil-Alana, Gil-López, & San Román, 2021). To achieve this, it is essential that destinations adopt strategies and policies aimed at promoting less seasonal markets, such as the foreign market geared towards cultural tourism, which has been shown to have a deseasonalising effect in Italy (Vergori & Arima, 2020) and in coastal destinations in Andalusia (Cisneros-Martínez & Fernández-Morales, 2015).

However, the effectiveness of strategies against seasonality is limited, particularly at the local or municipal level, due to the scarcity of disaggregated data and the lack of adequate comparative methodologies. Recent studies have used additive Gini index decomposition to estimate the contribution of each demand segment to the overall seasonality of a destination (Fernández-Morales, Cisneros-Martínez, & McCabe, 2016), revealing significant differences between domestic and international markets (Perles-Ribes, Ramón-Rodríguez, Sevilla-Jiménez, & Moreno-Izquierdo, 2018). However, there are still gaps in our knowledge of how these markets interact at the local level or across accommodation types.

The method applied in this study combines Gini index decompositions with digital platforms data sources to constitute an innovative analytical framework for assessing tourism seasonality with greater precision in established destinations. This approach helps identify differences in the intensity and temporal distribution of each market, and it offers a useful tool for sustainable tourism planning by identifying less seasonal markets. The results highlight the need for a comprehensive approach that captures the real structure of tourism seasonality. This methodological approach can serve as a basis for the design of more accurate and sustainable deseasonalisation policies.

2. Literature review

Tourism seasonality is one of the most serious problems for the sustainability of tourism in high-affluence destinations (Duro & Turrión-Prats, 2021). In recent decades, research into tourism demand has evolved from a purely temporal conception to a more complex and multidimensional view, encompassing economic, social, and territorial dimensions (Ćorluka, 2019). Recent studies confirm that seasonality varies not only in intensity but also in structure, and its analysis must incorporate factors such as origin, type of accommodation, and geographical scale (Viera-González & Hernández-Martín, 2025).

Traditional methods for measuring seasonality, such as coefficients of variation or seasonal factors, provide a basic description of the seasonal concentration of demand but have limitations as they do not consider the complete distribution of tourist flows throughout the year or enable the decomposition of seasonality. In this context, inequality indices and particularly the Gini index, have become more robust and comparable tools to quantify seasonality (Duro & Turrión-Prats, 2019). The Gini index summarises monthly variability into a single indicator and supports decompositions that make it easier to analyse the contribution of different markets. Its main advantage lies in its stability when faced with extreme values (Fernández-Morales et al., 2016).

Other simple indicators have also been used in the literature, such as the seasonal ratio, which compares the month with the highest number of overnight stays to the lowest in the same year (De Cantis et al., 2011). This measure provides an intuitive approximation of the magnitude of seasonal fluctuations and is particularly useful in descriptive studies or public reports, as it is easy to interpret. However, it is limited by its focus on the two extreme months of the annual cycle: those with the highest and the lowest demand. Although more recent research has tended to incorporate measures of inequality such as the Gini index, which considers all months of the year for its calculation, few studies systematically compare results between the Gini index and the seasonal ratio.

Several concentration indices, such as the Gini, Theil, and coefficient of variation can be used to quantify the annual level of tourism seasonality. Among these, the Gini index is particularly advantageous due to its intuitive interpretation, robustness against extreme values, and its suitability for additive decomposition as proposed by Lerman and Yitzhaki (1985), which makes it easier to identify the contribution of each market to the overall seasonal concentration (Fernández-Morales et al., 2016) and enables the identification of compensatory effects between regions (Viera-González & Hernández-Marín, 2025). The use of the Gini index in the analysis of tourism seasonality has undergone significant methodological development. Fernández-Morales and Mayorga-Toledano (2008) were among the first to apply the previously mentioned Gini index decomposition to identify the contribution of different source markets to the seasonal concentration of a tourist destination, proving its usefulness in detecting less seasonal demand segments. Since then, this approach has been employed in several studies to estimate the contribution of each demand segment, classified by the origin of travellers, to the overall seasonality observed at regional, provincial, and national levels (Fernández-Morales, 2021).

Recent literature has paid particular attention to measuring seasonality from a quantitative and comparative perspective (Ferrante, Lo Magno, & De Cantis, 2018). Among the most current approaches, the tourism seasonality index proposed by Lo Magno, Ferrante, and De Cantis (2017) stands out, introducing an approach based on the decomposition of temporal components. Duro and Turrión-Prats (2022) used three approaches to decompose tourism demand based on the method proposed by Lerman and Yitzhaki (1985), Shorrocks (1980), and Shapley (1953), and concluded that the results obtained were broadly consistent across the methods.



However, these authors highlighted that the Lerman and Yitzhaki method is more useful, as we can quantify the specific contribution of each market to the overall seasonality of a destination. Likewise, Cisneros-Martínez, McCabe, and Fernández-Morales (2023) combined the method of Lerman and Yitzhaki with the additive decomposition of the Gini index proposed by Podder and Chatterjee (2002), thereby explaining whether seasonal variations in segment demand are due to increases in their relative share or to changes in their level of concentration.

The decomposition of the Gini index using the Lerman and Yitzhaki proposal is considered the most widely applied in the field of tourism (Fernández-Morales & Cisneros-Martínez, 2019; Lau & Kau, 2022; Rosselló & Sansó, 2017; Vergori & Arima, 2022). This decomposition has been used in these studies to identify less seasonal segments and assess their seasonal impact on the overall seasonality of a destination. Given its usefulness, it has been included in the method proposed in this study, as it is one of its objectives. Lau and Koo (2017) expanded its application to capture the internal structure of tourism demand more accurately through a two-level decomposition of the Gini index, which allows for a hierarchical analysis of two simultaneous levels of segmentation. This methodological extension complements the original model by decomposing the overall seasonal concentration into subcomponents associated with specific market combinations and provides a more detailed view of how seasonality is distributed within each main group. Its key contribution is the introduction of the concept of sub-RME (sub-Relative Marginal Effect), which measures the marginal effect of each submarket on the overall seasonality of the destination.

The rise of digital accommodation platforms has introduced new structural elements into the configuration of tourism demand. Despite the growing relevance of these platforms, their inclusion in seasonality studies remains limited. As Wang et al. (2024) notes, the heterogeneity of data sources and their limited temporal granularity pose major challenges to accurately measure platform-based short-term rentals and incorporate them into seasonality models. The agreement reached between Eurostat and the main digital platforms has made it possible to access data on overnight stays in short-term rental properties and other short-stay accommodation, thus significantly expanding the available sources. Recent research suggests that the expansion of short-stay accommodation may have contributed to extending the high season in certain urban destinations by incorporating new markets that are less dependent on the summer months (Cardona, 2021). On the other hand, Sainaghi and Baggio (2020) studied the synchronisation between hotels and Airbnb daily occupancy rates in Milan, finding a partial synchronisation only in holidays and weekends. However, there is still a research gap in studies that simultaneously combine hotel and short-stay accommodation to perform two-level decompositions by accommodation type and origin of travellers, a gap this study helps to fill.

Most of the institutional plans take an essentially descriptive approach without incorporating advanced statistical tools that would allow for the quantification of seasonal concentration or the identification of less seasonal markets. This limitation highlights the need to address seasonality using easily understandable seasonal analysis techniques.

3. Methodology

3.1. Data sources and variables

In most studies and reports analysing tourism seasonality, tourists, or overnight stays, are commonly employed as the basic unit of measurement, and the frequency of the variables analysed is usually monthly or quarterly. There are various variables associated with tourism demand that enable the analysis of seasonality in tourist destinations. This study uses monthly data from the Hotel Occupancy Survey (2025c) and from the estimation of occupancy in tourist accommodation based on data from digital platforms (2025b) given that the combined analysis reflects more accurately the accommodation demand and, consequently, the seasonal behaviour of the different markets.

The combined results from both datasets are highly innovative, as studies of seasonality have traditionally been based on overnight stays in hotel establishments. The demand variable selected to assess the seasonality of accommodation demand in the destinations analysed, common to both data sources, is the number of overnight stays, and they were differentiated between those made by the national and international markets. Data on overnight stays in short-stay accommodation have been available since 2018 through the estimation of occupancy in tourist accommodation based on data from digital platforms. Therefore, to carry out a joint analysis of overnight stays in both types of accommodation, this study took 2018 as its starting point and also included data for 2024, the most recent year available, in order to perform a comparative analysis between the two years.

Seasonality levels vary across destinations due to differences in market patterns and depending on whether tourists are domestic or foreign (Perles-Ribes et al., 2018). In this study, a quantitative approach based on the use of the Gini index and its two-level decomposition is adopted to analyse tourism demand across various destinations. This approach allows the degree of seasonal concentration in demand to be measured and decomposed into its structural components, and thereby to identify the specific contribution of each market according to the accommodation type and travellers' origin.



Eurostat provides data for eleven cities of Andalusia, both coastal and inland. To apply the proposed method, this study focuses on the six Andalusian cities with the highest volume of overnight stays. Specifically, two inland provincial capitals (Sevilla and Granada), three coastal cities (Benalmádena, Torremolinos, and Marbella) and one coastal provincial capital (Málaga). These cities have records of both hotel overnight stays and short-stay accommodation, which enables a joint analysis of the demand for accommodation in the cities analysed. As far as we know, this is the first study to jointly analyse overnight stays in hotels, tourist apartments, and short-term rental properties, as well as other smaller-scale stays recorded in tourist hostels and rural guesthouses. This approach is key for a more comprehensive analysis of accommodation demand and seasonal concentration in destinations.

3.2. Analysis techniques

Seasonality analysis was conducted using various statistical metrics. The temporal evolution of the selected variables reveals the underlying structure of the seasonal patterns of each market. To accurately define these patterns, techniques are needed to quantify the average level of demand in each month of the year. Specifically, to analyse the distribution of tourist flows throughout the year, a method based on obtaining seasonal factors is used, which allows the identification of the seasonal patterns of each variable analysed. Seasonal factors were obtained as the average relative frequencies of each month in relation to the annual monthly mean, averaged across the entire study period. Months with values exceeding 100% were considered indicative of the high season, while those below 100% correspond to the low season. For a set of monthly data of T years, the seasonal factor of month i is calculated as

$$F_i = \sum_{t=1}^T \frac{y_{i,t}}{T}, \quad i = 1, 2, \dots, 12; \quad t = 1, \dots, T \quad (1)$$

Additionally, the max/min ratio is used to assess the degree of annual seasonal concentration. This indicator captures the magnitude of variation between the months with the highest and lowest levels of demand within a given year. De Cantis et al. (2011) refer to this measure as the 'seasonal ratio'. However, in this study, we adopted the term max/min ratio to avoid confusion with Yacoumis's (1980) seasonality ratio, which compares the maximum and average monthly values of the same year. The max/min ratio is calculated by dividing the value of the variable in the month with the highest observation by that in the month with the lowest observation within the same year, providing a clear measure of the magnitude of seasonal variation. Considering a time series of 12 monthly observations, $y = (y_1, y_2, \dots, y_{12})$, the max/min ratio, according to the expression:

$$\max/\min \text{ ratio} = \frac{\max_i(y_i)}{\min_i(y_i)}, \quad i = 1, 2, \dots, 12 \quad (2)$$

Considering that the $\max/\min \text{ ratio} \geq 1$, values closer to 1 indicate lower levels of seasonality in a given year. Conversely, values increasingly distant from 1 indicate stronger seasonality. This indicator enables one to examine annual changes in tourism demand seasonality and its distribution across markets (De Cantis et al. 2011). This measure has the advantage, compared with others, of being very easy to interpret and is therefore particularly suitable for reports and works aimed at a general audience.

As an alternative to the max/min ratio, the Gini concentration index was also employed to measure seasonal concentration. Since Wanhill's (1980) work, it has been widely used in tourism research Grossi & Mussini, 2021; Viera-González & Hernández-Marín, 2025; Yabancı, 2024). This index enables several useful decompositions, some of which are applied in this study. The Gini concentration index, G , can be obtained with different specifications, the most convenient for decompositions being covariance-based (Yitzhaki & Schechtman, 2013, p.17):

$$G = 2 \frac{\text{Cov}(y, F)}{\mu} \quad (3)$$

Where μ and F are the mean and the distribution function of y , respectively.

Following Lerman and Yitzhaki (1985), the Gini index can be additively decomposed, offering direct applications to analyse the contribution of different markets to total seasonal concentration (Derrouiche & Mebirouk, 2015; Goh, Li, & Zhang; 2015; Lau & Koo 2017; Šegota & Mihalič, 2018; Vergori & Arima, 2020). If the total demand y is comprised of K markets or segments, $y = y_1 + y_2 + \dots, y_K$, the Gini concentration ratio of y can be decomposed as

$$G = \sum_{i=1}^K S_i R_i G_i \quad (4)$$



Where G_i , S_i and R_i are, respectively, the Gini concentration index, the market share, and the Gini correlation index of the market i with the whole market.

The decomposition in (4) allows the estimation of the Relative Marginal Effects (RME) of each market. The *RME* of market i quantifies the proportional change in the overall Gini index induced by a small increase in this market, given that the remaining markets do not change. The *RME* of market i can be expressed as:

$$RME_i = \frac{S_i R_i G_i}{G} - S_i \quad (5)$$

The estimation of *RME* is a powerful tool to analyse which markets can contribute to reducing the seasonal concentration in a destination. Those markets with negative *RME* are the most interesting to reduce seasonality.

The above method can be extended to multilevel decompositions. In this study, we applied the two-level decomposition introduced by Lau and Koo (2017), considering two dimensions of tourism demand: accommodation type ($i=1, 2, \dots, I$) and travellers' origin ($j=1, 2, \dots, J$).

$$G = \sum_{i=1}^I \sum_{j=1}^J S_{ij} R_{ij} G_{ij} \quad (6)$$

Where G_{ij} , S_{ij} and R_{ij} are, respectively, the Gini concentration index, the market share, and the Gini correlation index of the market ij , representing the combined demand from accommodation type i with travellers' origin j .

This two-level decomposition generates *sub-RME*:

$$\text{sub-RME}_{ij} = \frac{S_{ij} R_{ij} G_{ij}}{G} - S_{ij} \quad (7)$$

Sub-RME are additive:

$$RME_i = \sum_{j=1}^J \text{sub-RME}_{ij} \quad (8)$$

Each *sub-RME* _{ij} measures the effect on over the overall G of a proportional increment of the market combination of accommodation type i and travellers' origin j . The sum of the *sub-RME* of all travel purposes and one country of origin combinations equals the *RME* of that total market of country of origin over G .

The multilevel decomposition could be applied to more than two levels, as in the work of Zhu *et al.* (2023) who performed a three-level decomposition of the tourism spatial dispersal by country of origin, purpose of travel, and airport of entry.

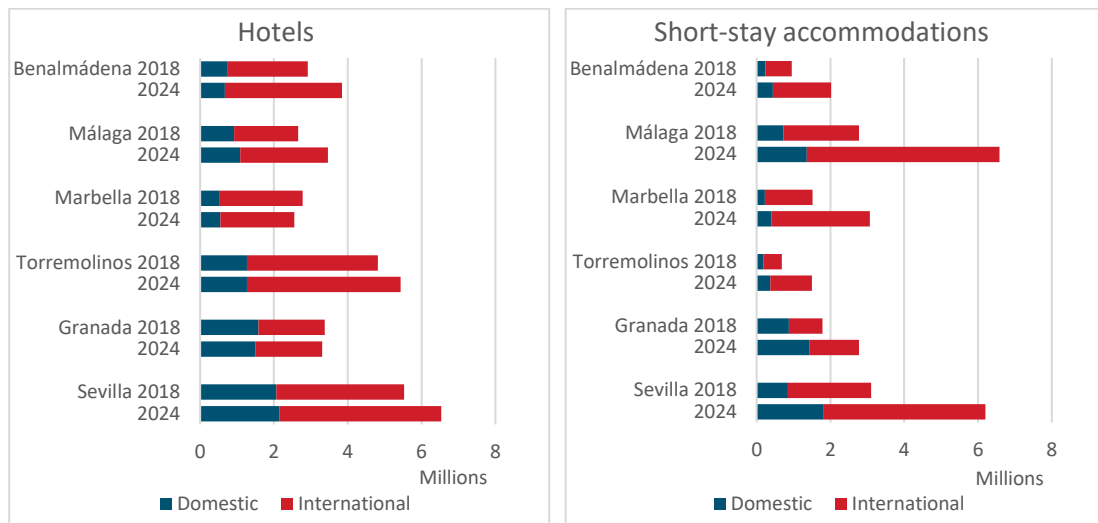
4. Results

Across the six destinations analysed, the number of overnight stays recorded in 2024, including hotels and short-stay accommodations, exceeded 5 million. These figures indicate that, overall, all destinations have surpassed their pre-pandemic level of 2018. However, in the hotel accommodation market (Figure 1, left panel), two destinations recorded slightly lower figures in 2024 compared to 2018. This decline is more than offset by the growth in the short-stay accommodation market (right panel of Figure 1). Moreover, the data show that the increase experienced in short-stay accommodations is significantly greater in all destinations than that corresponding to hotels.

The distribution by market of origin, domestic and international, shows significant differences between the destinations analysed. Although they are all in the same geographical region, there are coastal destinations such as Marbella, Torremolinos, and Benalmádena with an international share of over 75% in both hotels and short-stay accommodations. In contrast, the inland destinations in this study, which are provincial capitals, have a lower international share, with values between 55% and 67% in hotel accommodation and between 48% and 71% in short-stay accommodations, with Granada showing the most significant domestic market, with 52% in hotels and 45% in short-stay accommodation. Finally, Málaga, which is a coastal destination but also a provincial capital, like Granada and Sevilla, has an international market that accounts for 80% of overnight stays in short-stay accommodations, but only 69% in hotels. The figures shown in the graphs in Figure 1 are also useful for verifying that within each destination, in 2024, there are no major differences between the distribution of the domestic and international markets, between the hotel accommodation market and the short-stay accommodation market, with differences ranging from 1 to 11 points.



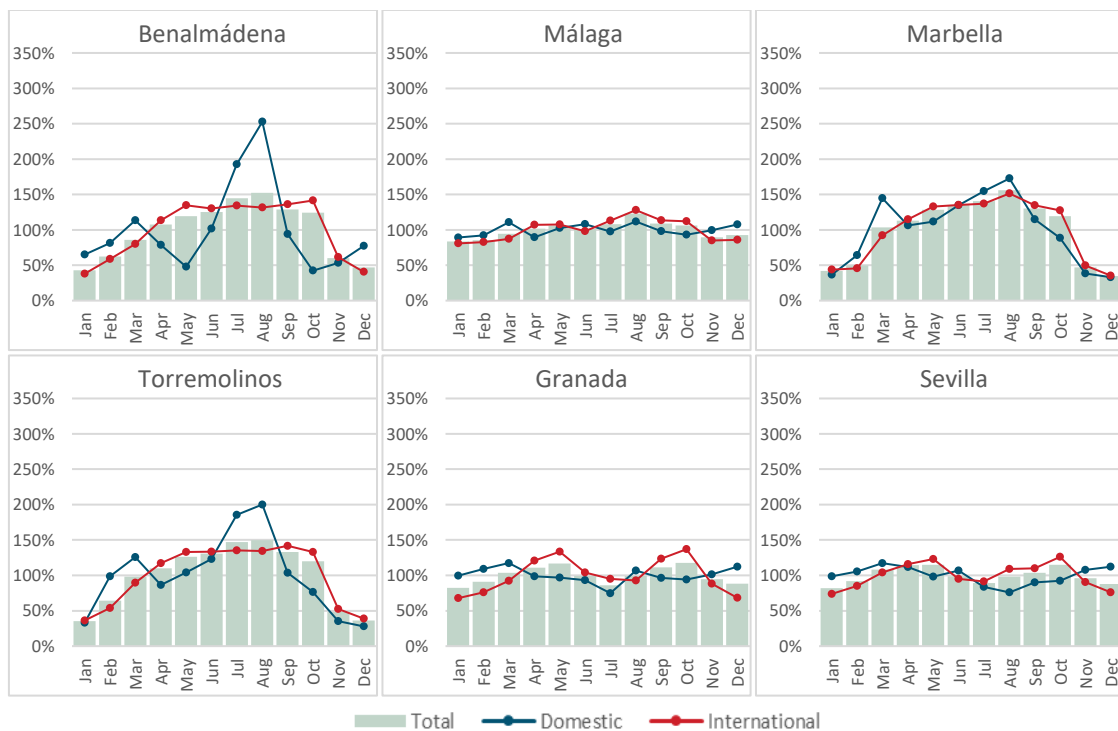
Figure 1. Overnight stays in hotels and short-stay accommodations by market



Source: Authors' elaboration based on INE (2025b; 2025c).

To analyse the distribution of demand throughout the year, Figures 2 and 3 show the seasonal factors for the last available year, 2024. In the hotel accommodation sector, in Figure 2, the three coastal destinations Benalmádena, Marbella, and Torremolinos display a typical monthly pattern for sun and beach destinations, with a significant concentration in the summer months. The domestic market in all three is more concentrated in summer than the international market, although they have secondary peaks during holidays such as Easter in all three cases and during Christmas only in Benalmádena. In these locations, the overall pattern is more similar to that of the international market due to its very high share.

Figure 2. Seasonal factors of overnight stays in hotels by travellers' origin (2024)



Source: Authors' elaboration based on INE (2025c).

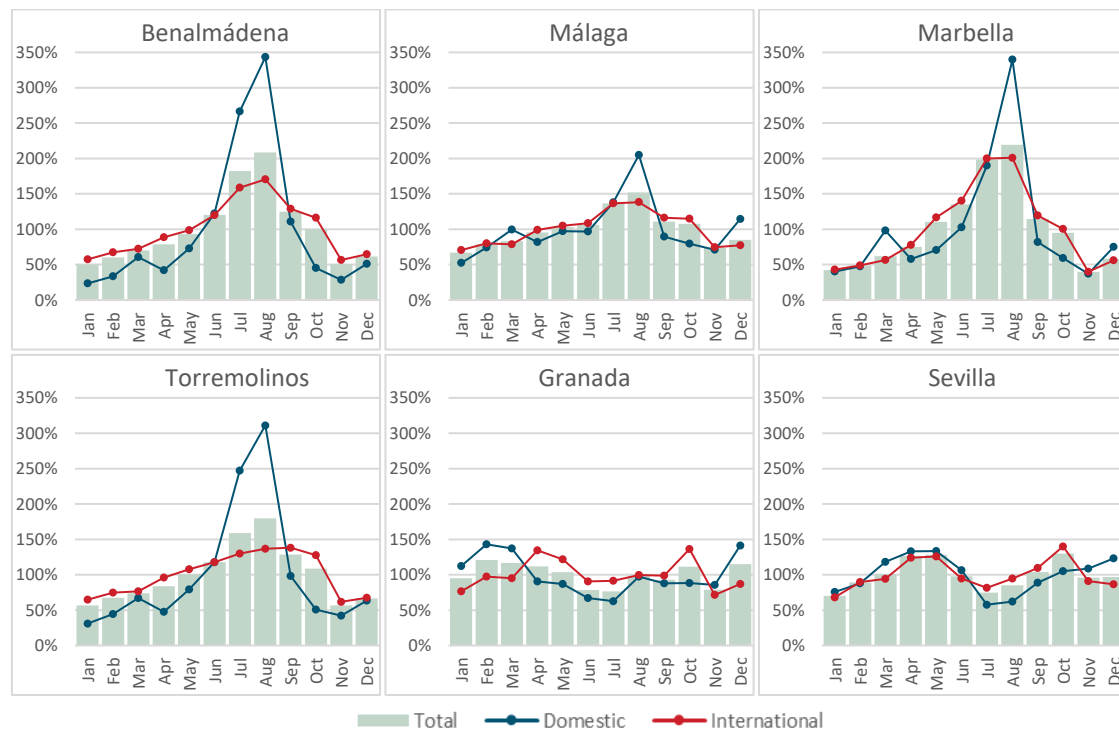
Provincial capitals included in our study (Granada, Málaga, and Sevilla) show a much more balanced monthly distribution than coastal cities. The seasonal peak in the summer months is only slightly noticeable in Málaga in the international market. Moreover, in Granada and Sevilla, seasonal peaks occur in spring and autumn and are more intense in the international market. In the specific



case of Sevilla, the seasonal peaks of the domestic and international markets occur in different months, so that the overall seasonal pattern is less concentrated than that of each market separately due to a compensating effect between them.

Regarding the short-stay accommodation market, Figure 3 shows that, in general, the three coastal destinations of Benalmádena, Marbella, and Torremolinos have a similar monthly pattern to that of the hotels in Figure 2. In this sector, the domestic market also shows a seasonal pattern that is more concentrated in the summer period than the international market, and in a more pronounced way than in the hotel sector. As to the three provincial capitals, we find that while Sevilla and Granada show seasonal patterns with peaks in spring and autumn, both in the domestic and international markets, Málaga shows a seasonal pattern with peaks in the summer months, more similar to a sun and beach destination, but with much lower levels of concentration.

Figure 3. Seasonal factors of overnight stays in short-stay accommodations by travellers' origin (2024)



Source: Authors' elaboration based on INE (2025b).

As mentioned in the Methods section, to quantify the degree of annual seasonal concentration, we first estimated the max/min ratios (see Figure 4, left panel). Regarding hotel accommodation in 2024, the two inland tourist destinations (Sevilla and Granada), together with Málaga, have concentration indicators that are clearly lower than those of the other destinations analysed, all of which are coastal destinations. These coastal destinations with the highest ratios correspond to coastal locations with a tourist product closely linked to sun and beach. In this type of accommodation, the difference between domestic and international markets is more pronounced in the three coastal destinations, with a greater seasonal concentration in the domestic market than in the international one. In contrast, in the three large cities, the international market has slightly higher max/min ratios than those corresponding to the domestic market. It is worth noting that the ratio of the total distribution of nights does not necessarily have to be an average of the domestic and international ones. Indeed, in Granada and Sevilla, it is lower than that of the domestic and international markets. This is because both distributions have different seasonal patterns, which partially compensate each other.

Focusing now on short-stay accommodation, we can see that, in most cases, the max/min ratios are higher than those of the distribution of overnight stays in hotel accommodation. The two groups of destinations identified for hotel accommodation are the same in this type of accommodation: a group of three coastal destinations with the highest seasonal concentration, Benalmádena, Marbella, and Torremolinos, and another group of three destinations that includes the provincial capitals of Granada, Málaga, and Sevilla. However, the annual seasonal concentration of the domestic market is higher in all six destinations than that recorded for the international market, unlike what was observed in the hotel sector.

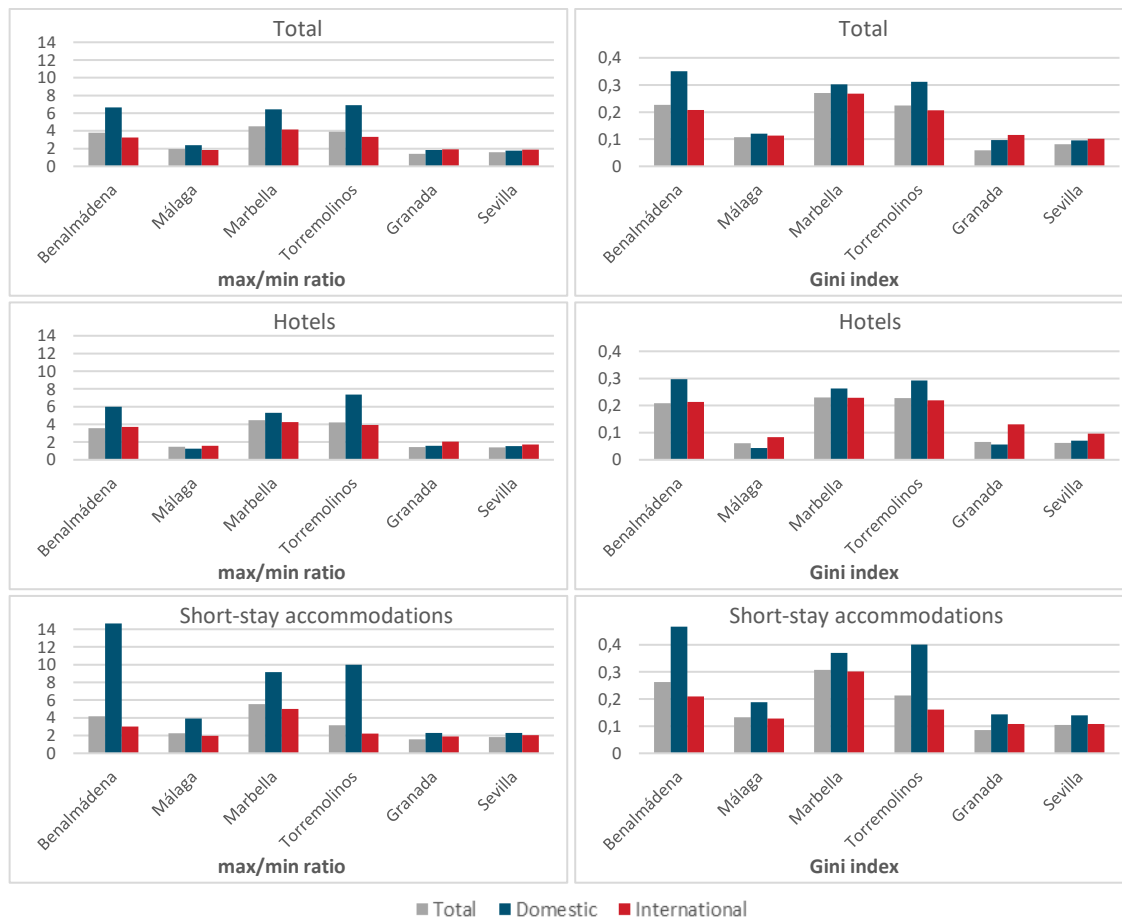
Figure 4 also includes the max/min ratios of the distribution of the sum of overnight stays in hotels and short-stay accommodations. The results of this metric applied to the total again show two clearly differentiated groups of destinations in terms of seasonal concentration. The first consists of the three coastal destinations with high ratios, where the domestic market shows higher levels of concentration than the international market. The second group, comprising the three provincial capitals, has lower levels of



seasonal concentration than the first group, and in the two inland cities, the domestic market shows lower concentration than the international market, while in Málaga, the opposite is true. This pattern reflects the role of short-stay accommodation. This is mainly because in Málaga, short-stay accommodations already outnumber hotel nights, and in the short-stay accommodation sector, all metrics yield higher figures for the domestic market in the destinations in our study, including Málaga.

The estimations of the second metric used in this paper, the Gini index, are shown in the right panel of Figure 4. Although this metric has a different range than the max/min ratio, the results in comparative terms are very similar.

Figure 4. Seasonal concentration metrics by accommodation markets (2024)

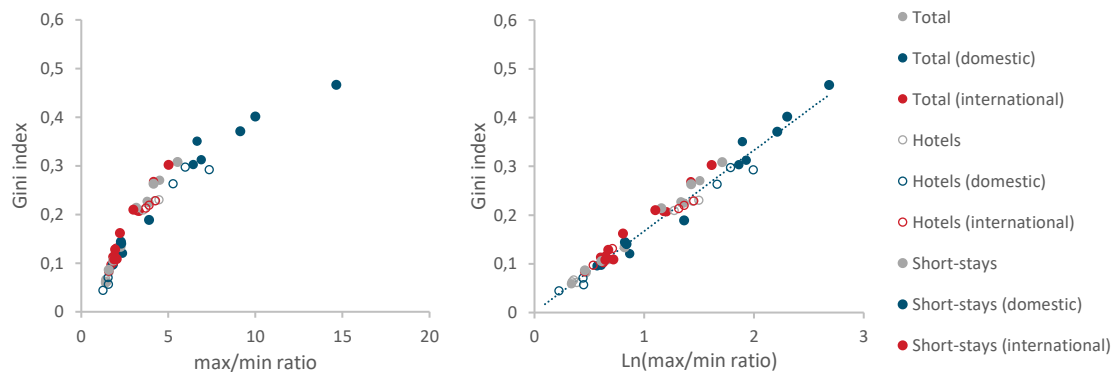


Source: Authors' elaboration based on INE (2025b; 2025c).

To have a preliminary assessment of the relative similarity between the two indicators, the left panel of Figure 5 includes for 2024 the ratios and Gini indexes for all combinations of destination, type of accommodation, and market of origin used in this study. Although there is no exact mathematical relationship between the two metrics, that can be easily deduced from the Methods section, there is a very clear empirical relationship, which is particularly strong in cases of lower seasonal concentration. Given that the visual depiction of the plot in the left panel of Figure 5 suggests that the relationship between the two indicators is non-linear, a graph with the max/min ratio r variable on a logarithmic scale has been included in the right panel. This case shows there is a very close linear correlation between the two variables, $\ln(r)$ and G (with an estimated correlation coefficient $r=0.987$). Thus, it can be deduced that, in general, higher ratios are clearly associated with higher G ; and vice versa. This does not mean that both metrics are perfectly substitutable for each other, but rather that, at least in our case, seasonal concentration can be evaluated with the max/min ratios in a preliminary study, and the Gini index can be used for more in-depth analysis and decomposition. As an indication of the consistency of this result, the linear correlation coefficients between $\ln(R)$ and G have also been calculated separately for hotels ($r=0.995$), short stay accommodations ($r=0.988$) and total (0.989), yielding very similar figures. Therefore, our proposal seems valid for both types of markets as well as for the combined set of data. Additionally, in order to have an initial assessment of the robustness of these results regarding the time period, the same coefficients obtained for 2018 are 0.983, 0.985, and 0.989 for hotels, short-stay accommodations, and total, respectively, which are also very similar to those of 2024.



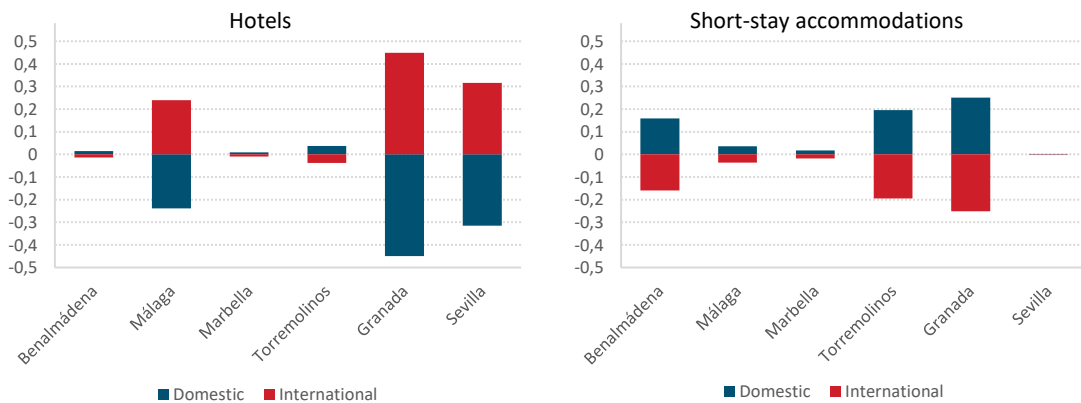
Figure 5. Comparison of seasonal concentration metrics (2024)



Source: Authors' elaboration based on INE (2025b; 2025c).

To better understand the effects that different markets have on the overall level of seasonal concentration, this study uses the decomposition of the Gini index, described in the Method section. To do this, we focused on the estimates of the Relative Marginal Effect (RME). Figure 6 shows the RME obtained from the decomposition of the Gini indices for the hotel accommodation and the short-stay accommodation sectors separately. We see that in the coastal destinations, excluding Málaga, the international market has a negative RME in both hotels and short-stay accommodations. It is a favourable market for reducing the level of annual concentration while maintaining its seasonal structure. In contrast, in the big cities, the international market also has a negative RME in short-stay accommodations, but in hotels, it has a positive RME. This reveals that both the domestic and international markets have different impacts depending on the type of accommodation in some destinations due to the different compositions and monthly distributions in each destination or group of destinations. On the other hand, it is worth mentioning that the higher RME values in Granada, Sevilla, and Málaga for hotels need to be interpreted with caution, as the Gini indices on which they impact are very low, less than 0.07, and proportional increases in these low G values also result in low values in absolute terms. At the opposite end of the spectrum is the case of short-stay accommodation in Sevilla, which has very low RME mainly because both markets, domestic and international, show very similar seasonal patterns and have low seasonal concentration.

Figure 6. Relative marginal effects (2024)



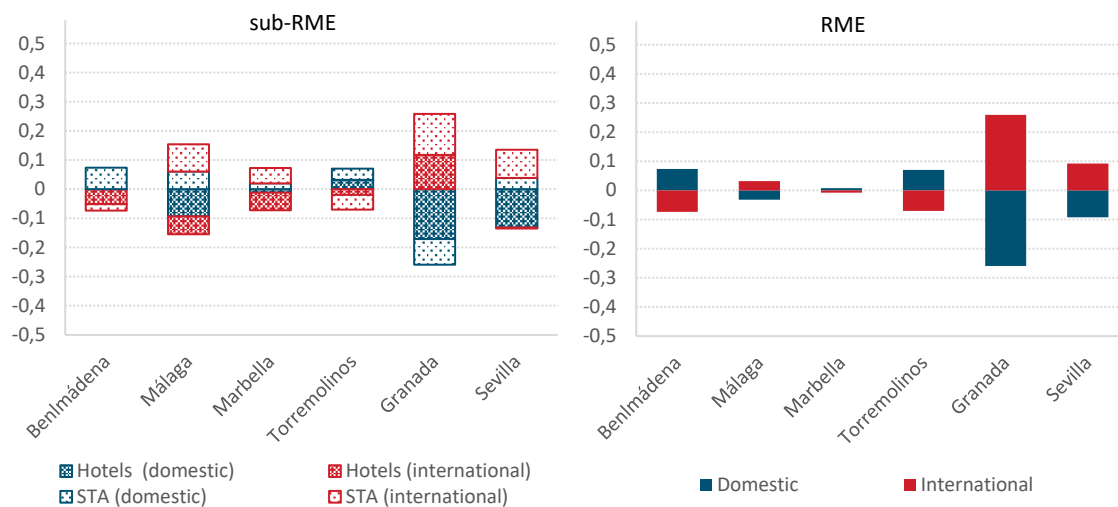
Source: Authors' elaboration based on INE (2025b; 2025c).

The effects the different markets have on seasonal concentration, considering the total demand, i.e. combining the two types of accommodation investigated in this study, can be complex. To better understand how the RME of the domestic and international markets interact in both types of accommodation, for the total demand, double decomposition can be used, whose RME and sub-RME are shown in Figure 7. The RME (sums of the sub-RME) indicate that, in general, in the three capital cities, the domestic market shows negative values and can be a target market to reduce seasonality. In the other three coastal destinations, the opposite situation occurs, with the international market showing negative RME. However, this general assessment must be studied thoroughly, given that the markets for hotel and short-term accommodations are not homogeneous in all cases, as we have seen above. To this end, we can deepen the analysis with the estimated values of the sub-RME. In both Málaga and Sevilla, two of the largest cities, the signs of the sub-RME replicate those obtained in the simple decompositions of both types of accommodation, although their magnitudes are modified, especially in Sevilla. However, in Granada, the sub-RME of short-stay accommodations reverses its sign with respect to the simple decomposition. Thus, in Granada, the markets that have a negative relative marginal



effect on the total concentration index are the international market in hotel accommodation and the same market in short-stay accommodation. This shows that the use of decomposition reveals aspects that cannot be appreciated through simple decompositions. On the other hand, in coastal destinations, excluding Málaga, the RME of the international market as a whole is all negative, indicating at first glance that they may be a target for the deseasonalisation of the destination. However, once again, when we break down the data by accommodation type, we find very different situations. On the one hand, in Torremolinos, according to the sub-RME, the international markets in hotels and short-stay accommodations are both negative, indicating that both types of accommodation are favourable for deseasonalisation. In contrast, in Marbella, the situation is quite different since, when we break it down to the double decomposition level, it is estimated that the markets with negative sub-RME are the international and domestic markets in hotels, so that the two short-stay accommodation markets, national and international, have positive sub-RME on the total. This would have gone unnoticed with a simple decomposition. Finally, Benalmádena has a distribution more similar to Torremolinos than to Marbella, although the effect of the domestic market in hotels, while negative, is very small.

Figure 7. Relative and sub-relative marginal effects calculated on total demand (2024)



Source: Authors' elaboration based on INE (2025b; 2025c).

5. Discussion

The results of this study confirm the usefulness of integrating traditional indicators with inequality measures to analyse tourism seasonality. Both the max/min ratio and the Gini index offer similar patterns, suggesting that the two techniques interpret seasonal variations consistently. This finding reinforces the validity of simple indicators as practical approximations when advanced analytical tools are not available. However, the Gini index demonstrates greater sensitivity to inter-monthly variations and stronger temporal stability, thus making it a more suitable instrument for longitudinal monitoring and comparison between destinations (Duro, 2016).

The two-level decomposition of the Gini index has made it possible to disaggregate seasonality by accommodation type and travellers' origin, which provides a more accurate view of the demand structure. This approach has revealed that seasonal patterns are not homogeneous: accommodations offered through digital platforms show, in general, more seasonal concentration than hotel establishments, while international travellers tend to distribute their demand more evenly throughout the year. The results will depend on the destination, since, for example, Benítez-Aurioles (2021) analyses peer-to-peer accommodation in Mallorca by estimating the demand with the number of reviews and finds that it exhibits lower seasonal concentration than the traditional hotel market; and Gutiérrez-Taño et al. (2023) show that the collaborative accommodation sector tends to attract different market segments with more stable travel patterns throughout the year. These results extend the methodological proposal of Lau and Koo (2017) and are consistent with recent studies highlighting the usefulness of hierarchical analysis of the Gini index to analyse the relative contributions of different markets to the total concentration of the destination (Turrión-Prats & Duro, 2018).

In addition to the consistency between the max/min ratio and the Gini index, the results show a nearly linear correlation between the Gini index and the natural logarithm of the max/min ratio ($\ln R$). This relationship reinforces the use of the max/min ratio as a suitable indicator for informative reports, while the Gini index is positioned as the preferred measure in comparative studies that require disaggregation and estimations of marginal contributions from the different markets analysed. In this sense, the Gini index decomposition applied is particularly effective to quantify the contribution of each market to the total seasonality of the destination, as also evidenced in previous research in regional and local tourism contexts (Cisneros-Martínez & Fernández-Morales,



2015; Koenig-Lewis & Bischoff, 2010). A relevant finding of the analysis is the possible compensatory effect between markets of origin, since when seasonal peaks of domestic and international demand do not coincide, the overall concentration of the destination tends to be smoothed out. This behaviour explains why inland cities such as Granada or Sevilla exhibit a more moderate total seasonality in contrast to coastal destinations, which are more dependent on international tourism.

The application of the methodology in this study reveals clear structural differences between urban and coastal types. Málaga shows a more balanced annual pattern throughout the year compared with coastal destinations, suggesting a process of demand diversification linked to cultural and urban tourism.

The discussion of the results confirms that the proposed methodology not only allows one to quantify the overall seasonality, but it also provides insight into its internal composition by identifying the segments and combinations of segments that contribute the most to reducing the temporal concentration of demand. This multidimensional approach is a significant advance over traditional models that focus exclusively on a single dimension of analysis.

5.1 Theoretical Implications

This study contributes to advancing the theoretical understanding of tourism seasonality by integrating traditional measures of seasonal concentration with inequality approaches within a single methodological framework. By combining simple indicators such as the max/min ratio with more elaborate metrics like the Gini index and its additive decomposition, the research shows how simple and more sophisticated metrics can coexist as complementary analytical tools for studying the seasonal concentration of tourism demand. This integration provides a conceptual connection between classical descriptive approaches and more recent analytical approaches that aim to represent the internal structure and dynamic behaviour of tourism demand.

Furthermore, the application of the two-level decomposition of the Gini index introduces another theoretical dimension by simultaneously analysing the influence of the accommodation type and the travellers' origin, providing a more accurate representation of the internal structure of the tourism demand. In this way, the study contributes to refining the concept of segmented seasonality, showing that seasonal concentration is not uniform across demand segments, but rather the result of interactions between various dimensions of demand.

This multidimensional approach allows one to identify the specific contribution of each segment and helps determine whether seasonal variations arise from changes in market share or from internal concentration effects. In this sense, this study expands on the methodological contributions of Duro and Turrión-Prats (2022) by showing how the combination of different decompositions can be used to formulate and test hypotheses about the relative contribution of each segment to the reduction of seasonality.

The inclusion of short-stay accommodation expands the theoretical limits of traditional seasonality models, which have focused almost exclusively on hotel establishments. This incorporation promotes a more holistic understanding of the phenomenon, consistent with the current reality of tourist accommodation in the collaborative economy context and contributes to creating updated theoretical frameworks that reflect the growing diversification of the current accommodation offer.

5.2 Practical Implications

The results obtained in this study confirm the practical value of combining traditional indicators and inequality measures to analyse tourism seasonality. The max/min ratio and the Gini index offer similar patterns, suggesting that both techniques consistently interpret seasonal variations across markets. This reinforces the validity of simple indicators as accessible approximations when advanced analytical tools are not available. However, the Gini index shows greater sensitivity to inter-monthly variations and stronger temporal stability, making it a more suitable instrument for longitudinal monitoring and comparison between destinations (Duro, 2016).

The two-level decomposition and the use of sub-RME provide additional analytical value for tourism planning, as they allow for the comparison of the relative contribution of different markets in terms of accommodation type and travellers' origin and for assessing which markets have the greatest potential for deseasonalisation. A practical implication, derived from the two-level decomposition of the Gini index, is the possibility of designing differentiated strategies by accommodation type. For instance, if hotels attract fewer seasonal markets but collaborative accommodations show higher concentration, regulatory, fiscal, or promotional incentives could be targeted specifically at encouraging off-season bookings in the latter. The technique makes it easier to identify structural differences between destinations that might initially appear homogeneous, such as coastal or inland destinations, but which in reality have more complex seasonal behaviours. A significant example is Málaga, a coastal destination that, due to its urban character, behaves more similarly to other inland cities included in the study. Likewise, the two-level decomposition allows one to detect internal variations within destinations that, from a simplified perspective, could be considered homogeneous or classified into similar categories but, when analysed thoroughly, reveal different patterns and distinct mechanisms of seasonality generation.



This phenomenon can be observed in the three coastal destinations of Marbella, Benalmádena, and Torremolinos, where the submarkets have different weights and give rise to different seasonal patterns.

The results of this study provide practical guidance for public managers, tourism observatories, and private operators. One specific example is that the identification of markets with a negative RME can help prioritise promotional efforts toward segments that naturally mitigate seasonality. This may translate into targeted campaigns in countries with more evenly distributed travel patterns. The RME are an essential complement to the proposed methodology, as they allow interpretation of the marginal effect that a small percentage increase in the volume of overnight stays in a given market would have on the total Gini index, while maintaining the monthly distribution of that market and the other markets considered (*ceteris paribus*). The RME help to estimate the potential effects of attracting greater demand from a specific market without changing its distribution throughout the year. In this way, the RME become a useful tool to identify which markets are most favourable for deseasonalisation without requiring a seasonal structure change.

The RME help to identify opportunities to reduce seasonality in the short term by increasing demand from markets with less seasonal behaviour, while policies aimed at modifying seasonal patterns should be evaluated using metrics such as the max/min ratio or the Gini index, which allow one to measure their long-term effectiveness. Likewise, markets with a positive RME indicate that, if demand continues to grow with the current structure, they will contribute to increasing seasonal concentration. Therefore, these markets should not be disregarded but rather considered a priority to develop specific strategies aimed at modifying their seasonal structure. Consequently, the RME provide a solid empirical basis to identify markets with the greatest potential to improve their seasonal structure.

The proposed methodology constitutes an effective evaluation tool to assess the degree of success of the deseasonalisation policies and plans already implemented, allowing for precise observation of whether the implemented interventions adopted have had a measurable effect on the temporal redistribution of demand. Overall, this methodological framework offers destination managers a flexible, understandable, and scalable tool to analyse seasonality at different levels of detail, adapting to both institutional contexts and applied research environments. The methodology can also serve as a tourism intelligence tool for digital platforms and hotel chains, helping them adjust prices or segment campaigns dynamically, thereby reducing costs linked to underutilisation or seasonal saturation.

5.3 Limitations and future research

This study presents certain limitations while also opening up relevant opportunities for future research. The methodology has been applied to a set of six Andalusian destinations selected for their tourism relevance and data availability. Although this provides a solid basis for empirical validation, future research could extend the geographical scope to other Spanish or European destinations with different market structures to test the stability and generalisation of the model. The availability and homogeneity of data constitute a limitation of this study, as they are not available for all European destinations but only for those with the highest tourist demand.

The two-level decomposition approach could be expanded to incorporate additional analytical dimensions of analysis, such as the purpose of the trip, the marketing channel, or the category of accommodation, giving rise to a multi-decomposition model capable of capturing the increasing complexity of today's tourism market. These lines of research would contribute to establishing a more comprehensive analytical framework to understand and manage tourism seasonality in different territorial contexts.

6. Conclusions

This study presents and validates an integrated methodological framework to measure tourism seasonality that combines simple and easily interpretable indicators with advanced analytical tools based on the Gini index and its decompositions. The joint application of the max/min ratio, the Gini index, and the two-level decomposition offers a complementary perspective that allows the phenomenon of seasonality to be addressed from different levels of analytical depth and practical utility.

The results confirm that the max/min ratio is an effective and easily interpretable measure for monitoring and publicly communicating seasonality, while the Gini index and its two-level decomposition provide a more solid basis for comparative analysis and policy formulation. This methodological complementarity makes it easier to design analytical tools adaptable to different audiences, from institutional managers to specialised researchers, therefore facilitating the analysis of the evolution of seasonal patterns at different levels of detail.

The incorporation of marginal relative effects, RME and sub-RME, makes it possible to identify the markets or sub-markets with the greatest potential for reducing seasonality without necessarily altering their seasonal structure. This analytical capability provides destination managers with a practical tool for prioritising target markets and designing differentiated demand capture strategies based on each market's marginal contribution to overall seasonal concentration. As it has been demonstrated, demand



segments identified as less seasonal through RME can play an important role in maintaining economic activity and employment during the low season.

The integration of data from short-stay accommodation, which includes short-term rental properties offered via online platforms, is a significant advance in measuring actual demand for accommodation. Combining this with traditional data from hotel establishments has provided a more comprehensive and up-to-date view of seasonal behaviour, highlighting the importance of incorporating new accommodation typologies into destination planning.

The results confirm that the proposed method is capable of identifying less seasonal demand segments and detecting structural differences between urban and coastal destinations. The cases analysed show that destinations with more balanced demand structures, such as Málaga, demonstrate greater capacity to adapt and diversify, while others, with high seasonal concentration, present greater challenges in reducing seasonality in the long term. These findings have direct implications for the management of seasonality as they provide a tool that can be used both to design deseasonalisation strategies and to evaluate the effectiveness of policies already implemented.

The proposed methodological framework contributes to strengthening the analytical basis of tourism seasonality studies, providing a comprehensive and replicable approach that combines interpretative simplicity with statistical rigour. Its application across diverse contexts can help advance towards more balanced and sustainable tourism planning.

Credit author statement

All authors have contributed equally.

Declaration of competing interest: None

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