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SPATIAL DISPARITIES IN TOURISM SEASONALITY: A MULTI-INDICATOR APPROACH TO DOMESTIC AND INTERNATIONAL ARRIVALS

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ABSTRACT

Seasonality in tourism affects the economy at all levels-national, regional, and local level. This study analyzes seasonality in North Macedonia using a NUTS 3 approach at the regional level. Using a comprehensive dataset of 1440 observations covering a period of 15 years (2010–2024), the research explicitly distinguishes differences between domestic and international tourist arrivals. To determine the level of seasonality and variability of tourist flows, a robust multi-indicator methodology is applied, encompassing the Seasonality ratio (SR), Seasonal range (SRA), Coefficient of seasonal variation (SV), and the Gini coefficient. The results of the analysis show pronounced regional disparities. The Southeastern and Southwestern regions record the highest seasonality, with over 40% of tourists visiting for two months period. The Skopje Region experiences the lowest seasonality. Research also shows that domestic tourists have the highest number of visits in the summer months (July and August), whereas foreign tourists do not demonstrate peak season. The pandemic period (2020–2021) represents a statistical anomaly that caused distortions in typical seasonal patterns. The multi-indicator approach identifies a winter peak in the Polog Region, providing an opportunity to develop strategies to mitigate seasonal fluctuations, regional development, and address challenges associated with the peak.

Key words: tourism, seasonality, NUTS 3 regions, North Macedonia, multi-indicator approach

INTRODUCTION AND LITERATURE REVIEW

Seasonality is a universally recognized phenomenon in global tourism (BarOn, 1972, Baum and Hagen, 1999, Baum and Lundtorp, 2001, Allcock, 1989). It is an

important feature in the tourist arrivals time series and requires careful handling to improve the accuracy of seasonal tourism demand forecasts (Kulendran and King, 1997, Lim, 1998, McEniff, 1992). Seasonality implies cyclical variations in the movement of a phenomenon, or the repetition of an identical or similar pattern every calendar year at approximately the same time (Kožić, 2013). Biedermann (Biederman and Lai, 2008) stated that seasonality is a prevalent characteristic of travel and tourism, characterized by sharp variations in demand across the year. Seasonality also is defined as the irregularity in tourism, as reflected in visitor numbers, consumption, overnight stays, and transportation, which directly affects the creation of supply and demand at the tourist destination (Butler, 1994, Butler, 2001). Although tourism seasonality is considered a universal problem whose intensity varies across countries (Yacoumis, 1980), destinations with an established tourism industry have proven to be the most successful in mitigating it (Butler and Mao, 1997). Hylleberg (Hylleberg, 1992) grouped the basic causes of seasonality into three categories: weather variables (e.g., temperature, sunlight hours), calendar effects (e.g., the timing of religious festivals such as Christmas and Easter), and timing decisions (e.g., school holidays, industry shutdowns, dividend and bonus payout dates).

According to BarOn (BarOn, 1975), seasonality in tourism is driven by two basic elements, one 'natural' and the other 'institutionalized' (which, in some cases, are linked). The first concerns regular temporal variations in natural phenomena, particularly those associated with climate (e.g., temperature, rainfall, snow, and sunlight). Institutional seasonality results from human decisions and is shaped by religious, cultural, ethnic, and social factors. Seasonality in tourism driven by natural factors is generally stable over longer periods and is therefore largely predictable. Butler (Butler, 1994) defines five main reasons for seasonality: regular temporal variations in natural phenomena, human decision factors - the institutionalized seasonality, social pressure and fashion, sporting season, inertia and tradition. Hartmann (Hartmann, 1986) suggests that these differences indicate that tourist regions possess varying seasonal potentials and resources, resulting in distinct seasonal characteristics. Natural factors influencing these are beyond the control of decision-makers (Cuccia and Rizzo, 2011). There are minor differences in seasonal patterns between international and domestic tourists, conditioned by domestic tourists' greater sensitivity to weather (Agnew and Viner, 2001) and by fixed periods of school and work holidays that dictate the intensity of the summer peak (Murphy, 2013, Rosselló and Sansó, 2017).

Domestic tourists tend to respond more quickly to changes in the weather. After a period of sunshine, when rain sets in, they often leave the destination earlier, and the number of new domestic arrivals declines rapidly. In contrast, international tourists usually plan their trips well in advance and are less likely to alter their plans because of sudden weather changes; they typically arrive and stay according to their original schedule regardless of weather conditions. Just as the causes of seasonality are diverse and complex, so are its impacts (Koenig and Bischoff, 2004). Unsurprisingly, most researchers have noted that seasonal variation is an

uncontrolled factor that leads to several adverse effects (Chung, 2009) and with the growth of mass tourism, the impacts of tourism seasonality have become greater (Yan and Wall, 2003). According to Koening-Lewis and Bischoff (Koenig and Bischoff, 2004), the consequences of tourism seasonality are generally categorized into three main groups: economic, ecological, and sociocultural. The economic impact is most evident during off-peak periods, primarily through reduced profits from underused resources and facilities (Sutcliffe and Sinclair, 1980, Williams and Shaw, 1988). Variations in demand can lead to hotel shortages during peak seasons and to underutilization of tourism facilities in the off-season (Murphy, 2013, Butler, 1994, Koenig and Bischoff, 2004, Chung, 2009). Ecological impacts are associated with peak seasons, marked by adverse effects from the concentration of visitors at a destination during these periods. These include air pollution, sewage disposal problems, litter, noise, and reduced quality of life for the local population (Bender et al., 2005, Chung, 2009). Socio-cultural impacts extend not only to seasonal fluctuations in the host community but also to visitors (Koenig and Bischoff, 2004). Negative implications for residents arise from dramatic population increases during the summer months, which strain existing infrastructure and services. These include congestion, crowded streets, slower traffic, lack of parking, higher service prices, significant increases in the costs of community services, and overcrowding at attractions (Koenig and Bischoff, 2004, Commons and Page, 2001, Krakover, 2000). There are two primary perspectives to consider when examining the impact of seasonality on employment in tourism-dependent destinations. The most commonly expressed view is that the seasonal nature of tourism poses challenges for employers, making it difficult to recruit and retain full-time staff (Krakover, 2000, Pearce, 1989, Yacoumis, 1980, Mathieson and Wall, 1982). Nevertheless, the characteristics and measures of tourism seasonality, when compared across regions, remain poorly understood. Problem analysis and the search for solutions in competition among tourist regions are becoming more prevalent, but thus far only at the regional level (Bender et al., 2005).

Fluctuations in visitor numbers and revenues are widely regarded as a problem by the tourism industry, which invests considerable time, money, and effort to modify these patterns by developing and the implementing strategies to extend "shoulder seasons" or create "all-season" destinations (Corluka, 2019). To overcome seasonality, several approaches include launching additional seasons, diversifying markets, reducing prices, and offering off-season activities (Baum and Hagen, 1999). A destination may have one peak season, two peak seasons, or no distinct peak (Butler and Mao, 1997). The one peak seasons are typically divided into off-season (January-February, November-December), shoulder season (March–June and October), and peak season (July–September). Ćorluka (Corluka, 2019) further categorized the seasons as low (January, February, November, December), mid (March, April, May, October), and high (June–September). Two-peak destinations combine winter and summer tourism, often by promoting outdoor activities and events. Non-seasonal patterns are rare and typically found in tropical or urban destinations with a steady year-round flow of visitors.

Despite extensive research on tourism seasonality, few studies combine long-term data, regional (NUTS 3) resolution, and a multi-indicator framework while explicitly distinguishing domestic and international tourist flows in small transition economies.

The primary objective of this study is to analyze tourism seasonality in North Macedonia using a spatially approach at the NUTS 3 level. It uses a multi-indicator framework to examine various aspects of seasonal concentration, based on monthly tourist arrival data from 2010 to 2024. Special focus is placed on distinguishing between domestic and international arrivals to uncover variations in seasonal trends and regional responses. The study specifically explores the following research questions:

- What are the main characteristics of tourism seasonality in North Macedonia, and how does it vary across the eight statistical regions?
- Which regional differences can be observed in the seasonal patterns of domestic and international arrivals during the analyzed fifteen-year period?
- How well do the selected methods (Seasonal Ratio, Coefficient of seasonal variation, Seasonality Range, and Gini) reflect the complexity of seasonal concentration within Macedonian tourism industry?

Since the measures selected directly affect analytical accuracy, the methodology employs a multi-indicator approach to simultaneously assess the intensity, capacity, and inequality of tourist arrivals. This approach helps clarify seasonal fluctuations, which vary notably between domestic and international arrivals across various NUTS 3 regions in the country.

METHODOLOGY

To measure and analyze seasonality patterns in Macedonian tourism, this study employs a set of complementary statistical approaches. As Koenig-Lewis and Bischoff (Koenig and Bischoff, 2004) note, the choice of measures depends on the specific research questions and the level of detail required for the analysis. Our objective is to analyze and quantify seasonality in Macedonian tourism, including at the NUTS 3 level, and to examine seasonal disparities in arrivals of domestic and international tourists. To accomplish this, we selected several key indicators as the most appropriate measures: the seasonality ratio, the seasonal range, the coefficient of seasonal variation, and the Gini coefficient. As outlined at the beginning of this paper, the primary unit of analysis remains the monthly number of arrivals, which enables comparison with findings from other researchers (Bigović, 2012, Commons and Page, 2001, Cuccia and Rizzo, 2011). Karamustafa and Ulama (Karamustafa and Ulama, 2010) compared methods for measuring seasonality and analyzed their advantages and weaknesses. They explained that the seasonality ratio assesses the intensity of seasonal fluctuations, but the main drawback is that distributional skewness is influenced by extreme values, and focuses on data from a single year. In contrast, the Gini coefficient offers a more comprehensive evaluation by analyzing

the entire period and facilitating monthly comparisons. Fernandez-Morales and Mayorga-Toledano (Fernández-Morales and Mayorga-Toledano, 2008) noted that the Gini coefficient is more stable than earlier methods, as it is less affected by extreme values and more responsive to changes outside the peak period. Yacoumis (Yacoumis, 1980) uses two measures to demonstrate the importance of seasonality. The first is the coefficient of seasonal variation, defined as the standard deviation of the seasonal indices; a value of 100 indicates that the standard deviation equals the mean monthly visitors. This coefficient shows how visitor numbers fluctuate throughout the year and provides a simple way to quantify these changes. However, interpreting this coefficient can be challenging because, although it is derived from statistical calculations, seasonality itself is not a random variable within the year. The second measure is the seasonality ratio, a straightforward metric that highlights peak-season impact by taking the maximum in the numerator.
The following section presents a more detailed examination of the selected methods:

Seasonality ratio (SR):

The seasonality ratio is calculated as the highest monthly arrivals divided by the average number of arrivals per month. It ranges from 1 to 12. A ratio of 1 indicates that the number of visitors remains constant each month (no seasonality). Conversely, a ratio of 12 indicates the highest level of seasonality, with visitors concentrated in a single month (Karamustafa and Ulama, 2010). The annual average refers to the arithmetic mean of the twelve-monthly arrival values in year t.

$$v_{sum} = \sum_{i=1}^{12} v_i \qquad \bar{v} = \frac{v_{sum}}{12} \qquad SR = \frac{v_h}{\bar{v}} \tag{1}$$

Seasonal range (SRA):

The seasonal range (SRA) is the difference between the highest and lowest monthly indices (Koenig and Bischoff, 2004), with an index of 100 representing the average monthly number of arrivals. In our case study, if *Imax* is the highest monthly index in year *t* and *Imin* is the lowest monthly index in year *t*, the average of 100 indicates that the monthly average number of arrivals serves as the base index. The SRA for tourism in year *t* can be calculated as follows:

$$SRA = I_max\ (average = 100) - I_min\ (average = 100) \tag{2}$$

This measure can take theoretical values between 0 and 1200. With the same number of arrivals each month, the seasonal range is 0. If all visitors arrive at the regional level every month, the seasonal range is 1200.

Coefficient of seasonal variation (SV):

The coefficient of seasonal variation (SV) is equal to the standard deviation of the seasonal indices, where index = 100 is the average number of arrivals per month

(Baum and Lundtorp, 2001). Concretely, if *Ii* is a seasonal index, where *i* refers to the related month (i.e., 1 ≤ i ≤ 12), and $\bar{I}$ is the mean of seasonal indices (i.e., 100), then the coefficient of seasonal variation *s* related to tourism in the year *t* can 12 ∑ be calculated as follows:

$$S_t = \sqrt{\frac{\sum_{i=1}^{12}(Ii - \bar{I})^2}{12 - 1}} \quad (3)$$

The quantity (*Ii* – $\bar{I}$)in the previous formula refers to the deviation of *Ii* from the mean $\bar{I}$. A smaller coefficient *s* indicates less regional seasonality (both domestic and international arrivals). In comparison, a larger value of s signifies greater seasonality in the destination.

Gini coefficient (G):

The Gini coefficient is one of the most commonly used metrics for measuring revenue inequality induced by temporary disturbances. It is derived from the Lorenz curve (Baum and Lundtorp, 2001), which illustrates inequality, while the Gini coefficient provides a numerical measure of that inequality (Bigović, 2012). When the Gini coefficient equals 0, the number of visitors remains constant throughout the year. If *G* equals 1, this indicates complete inequality in the concentration of monthly visitors and arrivals (Kulendran and Wong, 2005). In tourism, a Gini coefficient of 1 indicates extreme seasonality, meaning the entire annual volume of arrivals occurs in a single month, with the remaining eleven months recording zero activity. Conversely, a value of 0 indicates a perfectly even distribution, with arrivals identical across all twelve months of the year. The more unequal the seasonal distribution of arrivals, the larger area between the Lorenz curve and the line of equality. The Gini coefficient is calculated as the area between the curve and the 45-degree equality line divided by the entire area below the 45-degree line.

$$G = \frac{2}{n}\sum_{i=1}^{n}(x_i - y_i) \quad (4)$$

n = ratio value (in the case of this study, number of months = 12),
xi = ratio order (i.e. 1/12, 2/12, …, 12/12); and,
yi = cumulative actual ratios in the Lorenz curve.

DATA

To quantify and understand the seasonality patterns in Macedonian tourism, a historical dataset from the State Statistical Office (Office, 2024) was used. It includes monthly tourist arrivals for each NUTS 3 region and national level, from January 2010 to December 2024. This yields 180 observations, with fifteen annual data values per month. These data are calculated for each of the eight regions, yielding a total of 1440 observations, or 2880 when both categories — domestic and international tourist arrivals — are considered.

The 15 year analyzed period, reached the highest annual tourists' arrivals in 2024 (1260425), the lowest annual arrivals reached in 2020 (467514), while the average arrivals was 859130 tourists per year. The peak of arrivals (113285) was recorded in August 2024, with international tourists accounting for 57% and domestic tourists for 43%. Annual averages by region were as follows: Vardar (20682), Eastern (23535), Southwestern (330891), Southeastern (125577), Pelagonia (61434), Polog (33902), Northeastern (7985), Skopje (256140).

During the period under analysis, the number of arrivals shows a positive trend (Figure 1), except in the pandemic year (2020). This is particularly evident among international tourists, with a 217% increase.

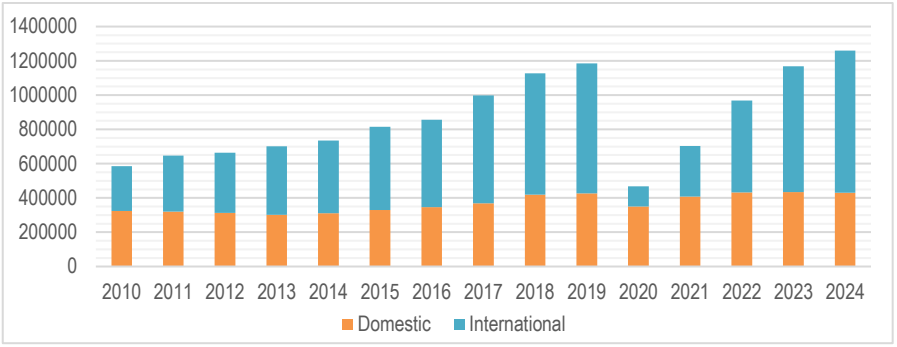


Figure 1. Domestic and international tourist arrivals in North Macedonia (2010 – 2024)

The Figure 2 shows that tourism in North Macedonia peaks in July and August, indicating that these are the main seasons. The shoulder seasons occur in May, June, and September. The remaining months—January, February, March, April, October, November, and December—are considered the off-peak season for tourism in North Macedonia. Domestic tourist arrivals are mostly concentrated in July and August, in contrast international tourist arrivals differences are minor and less pronounced.

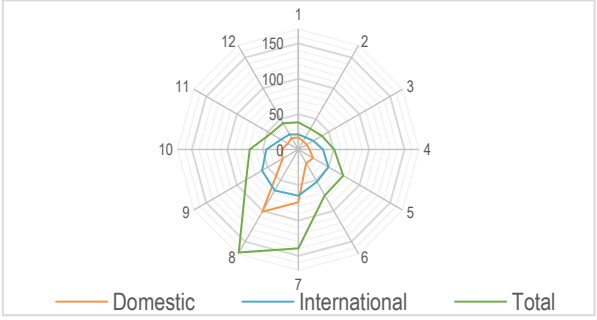


Figure 4. Monthly average domestic and international arrivals in thousands (2010 – 2024)

At the regional level, the two most visited months are grouped into three clusters (Figure 3), as follows: July and August (Northeastern, Southeastern, Vardar, Pelagonia, and Southwestern), August and September (Skopje and Eastern) and January and February (Polog). This national trend of high concentration in August aligns with previous studies for Ohrid-Struga subregion, where August also record the highest average number of arrivals (Dimeska Trajkova and Zlatanoski, 2025, Petrevska and Nikolovski, 2018).

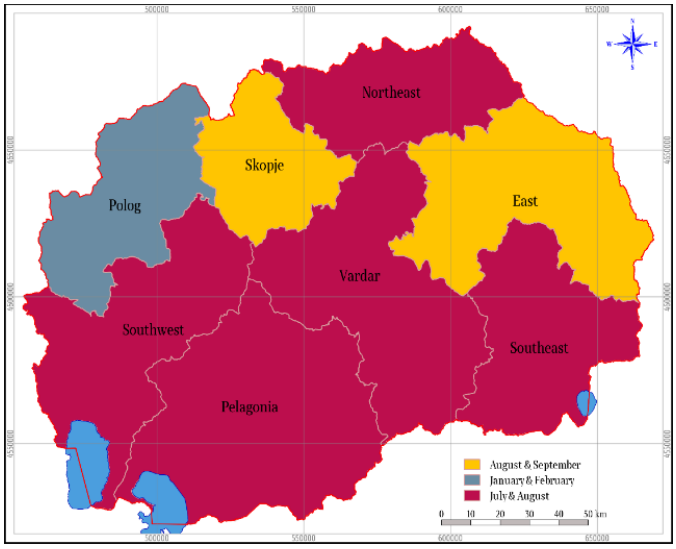


Figure 3. The top two visited months at the NUTS 3 regional level

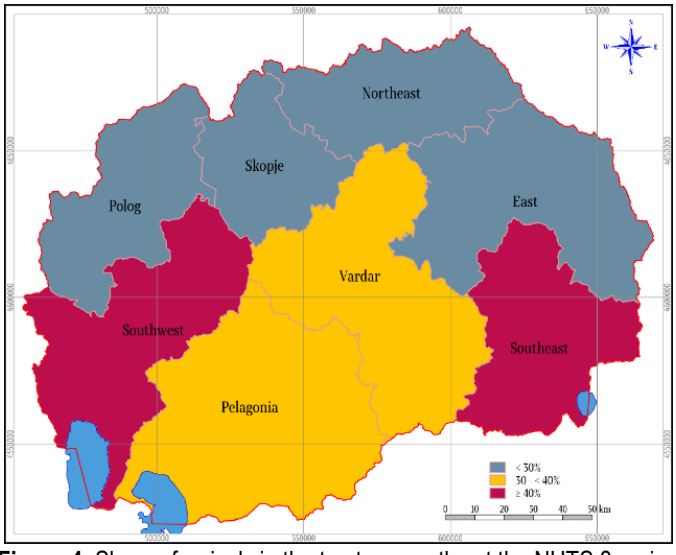


Figure 4. Share of arrivals in the top two months at the NUTS 3 regional level

Based on the analyzed data (Figure 4), the concentration of tourists in the two most-visited months is divided into three groups: under 30% of the total arrivals (Polog, Skopje, Northeastern, Eastern), from 30% to 40% of the total number of tourists (Vardar and Pelagonia), and over 40% of the total number of tourists (Southeastern and Southwestern). It can be concluded that the Southeastern and Southwestern regions exhibit the highest seasonality, followed by Vardar and Pelagonia, while the remaining regions show less pronounced seasonality.

RESULTS

Seasonality Ratio (SR)

Figures 5 and 6 present seasonality ratio results. The analysis shows that the Southeastern Region had the highest SR for domestic arrivals in 2019 (Figure 5), reaching SR of 6.2, while the Skopje Region recorded the lowest value of 1.17 in 2016.

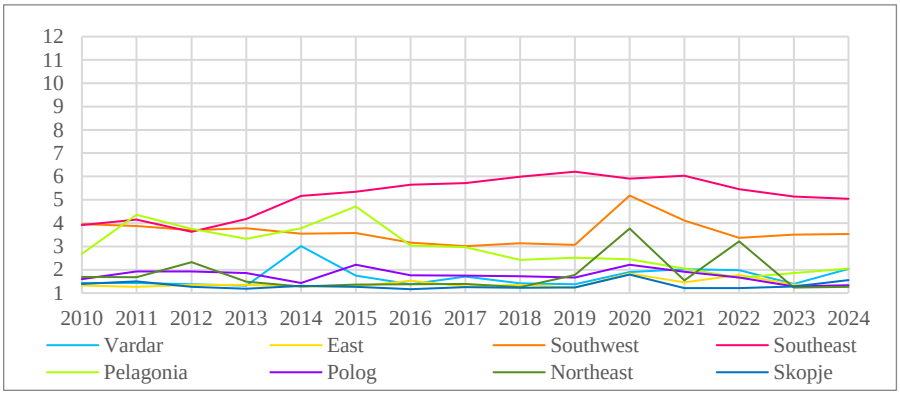


Figure 5. Seasonality ratio of domestic arrivals at the NUTS 3 regional level

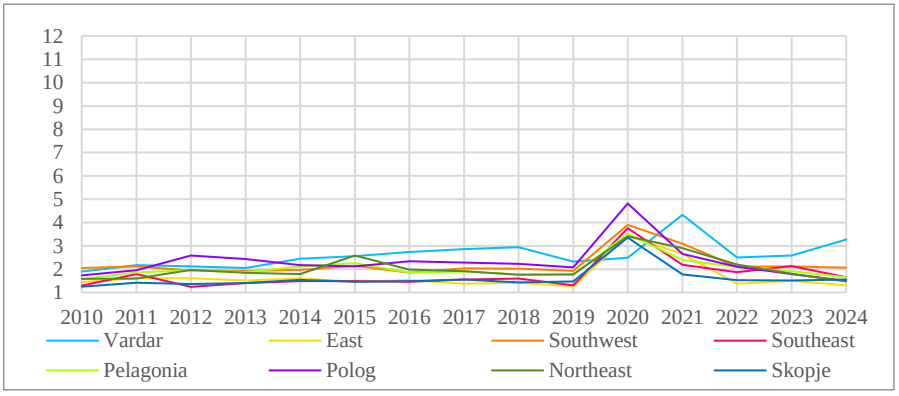


Figure 6. Seasonality ratio of international arrivals

The data indicate that the highest SR for international arrivals (Figure 6) was recorded in the Polog Region in 2020 (4.82) and the Vardar Region in 2021 (4.33). Conversely, a minimum value of 1.24 was registered in the Southeastern Region in 2012. The observed variations between domestic and international market segments underscore the complexity of seasonal demand. This distinction aligns with findings by Koenig & Bischoff (Koenig and Bischoff, 2004), who emphasizes that domestic and international arrivals often exhibit divergent seasonal patterns due to differing sensitivities to institutional and natural factors.

Seasonal range (SRA)

The calculated seasonal ranges are presented in Tables 1 and 2. Among domestic arrivals (Table 1), the highest SRA was recorded in the Southeastern Region in 2019 (594), while the lowest was observed in the Eastern Region in 2011 (37). Among international arrivals (Table 2), the highest SR was recorded in Polog Region in 2020 (482). The lowest SRA was recorded in the Southeastern Region in 2012 (37).

Table 1. Seasonal range of domestic arrivals

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
1	103	81	87	71	248	117	81	106	70	77	189	153	138	71	143
2	65	37	75	53	48	61	78	48	56	45	184	78	111	68	49
3	379	370	359	363	338	345	297	280	292	282	517	392	307	329	323
4	340	368	323	376	478	504	530	542	575	594	588	587	522	492	478
5	235	409	335	300	338	429	255	251	190	204	244	172	110	124	145
6	108	132	140	134	75	171	120	114	106	94	221	148	123	60	66
7	115	97	183	92	67	76	73	70	55	108	377	114	263	51	71
8	78	101	58	56	73	65	42	52	49	42	171	44	54	52	79

Note: Numbers 1–8 correspond to the following regions: 1 – Vardar; 2 – Eastern; 3 – Southwestern; 4 – Southeastern; 5 – Pelagonia; 6 – Polog; 7 – Northeastern; 8 – Skopje.

Table 2. Seasonal range of international arrivals

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
1	162	188	190	179	212	225	242	258	269	208	248	423	224	240	306
2	90	107	108	102	112	89	88	91	84	62	343	233	81	92	73
3	183	196	184	184	186	200	168	186	185	179	390	292	195	195	192
4	58	117	37	64	73	73	73	84	86	51	367	184	136	155	98
5	99	153	152	132	170	184	137	143	132	138	351	221	174	152	130
6	113	147	214	206	167	163	187	185	170	159	482	234	173	123	93
7	98	114	153	140	131	219	147	161	127	137	341	268	200	145	102
8	68	91	81	92	113	104	98	107	93	101	335	138	115	107	109

Note: Numbers 1–8 correspond to the following regions: 1 – Vardar; 2 – Eastern; 3 – Southwestern; 4 – Southeastern; 5 – Pelagonia; 6 – Polog; 7 – Northeastern; 8 – Skopje.

Coefficient of Seasonal Variation (SV)

All calculated seasonal variation values are presented in Figure 7. The data indicate that the lowest SV for domestic arrivals was recorded in the Skopje Region in 2021, with a value of 11.74 and the highest SV was recorded in the Southeastern Region

in 2021 (173.15). Among international arrivals, the lowest number was recorded in 2012 in the Southeastern at 10.57. The highest value was recorded during the pandemic in 2020 in Polog (149.27), and in 2021 in the Vardar Region (123.62) .

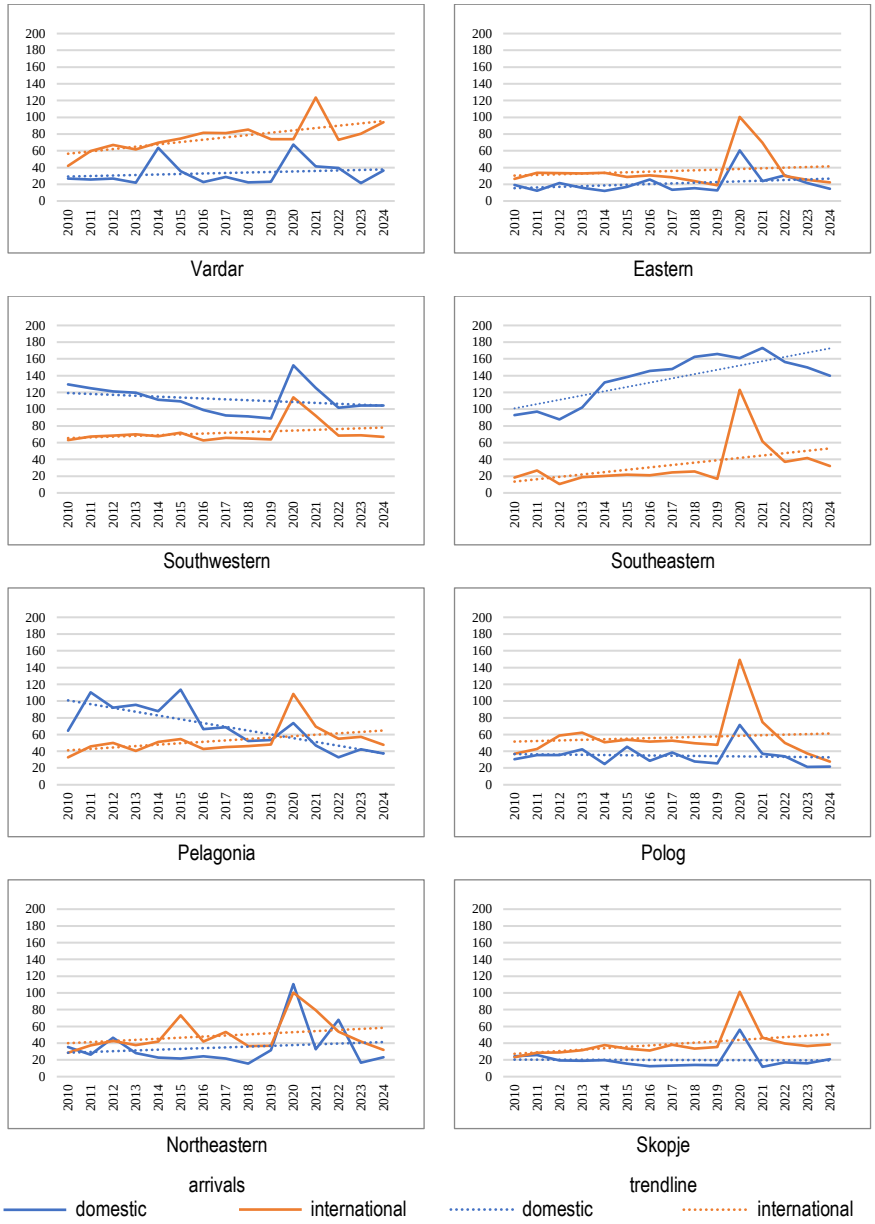


Figure 7. Coefficient of seasonal variation of domestic and international arrivals

Based on the data, regions in North Macedonia demonstrate stable seasonality trends among domestic tourists, with the Southwestern and Pelagonia regions

experiencing negative growth. Unlike the other regions, only the Southeastern Region has a high seasonality trend. On the other hand, foreign tourist trends are generally positive. This growth is most noticeable in the Vardar and Southeastern regions, followed by the Northeastern, Skopje, and Pelagonia region. Stagnant or mild growth trends characterize the region of Polog, Eastern, and Southwestern.

Gini coefficient

Seasonality in domestic arrivals is highest in the Southwestern and Southeastern regions, whereas for international arrivals it peaks in the Southwestern and Vardar regions. The lowest seasonality in domestic arrivals is observed in Skopje, Eastern, and the Vardar Region. In contrast, among international tourists, the lowest seasonality is observed in the Southeastern and Eastern region. The most significant seasonal differences are observed in the Vardar Region (international arrivals) and the Southeastern Region (domestic arrivals). Conversely, the smallest differences are observed in the Pelagonia and Southwestern regions (Figures 8, 9, and 10).

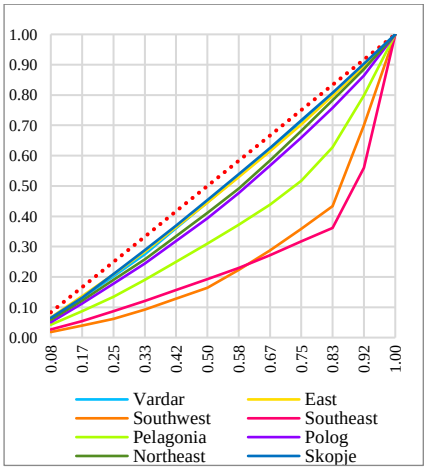


Figure 8. Lorenz curve of domestic arrivals

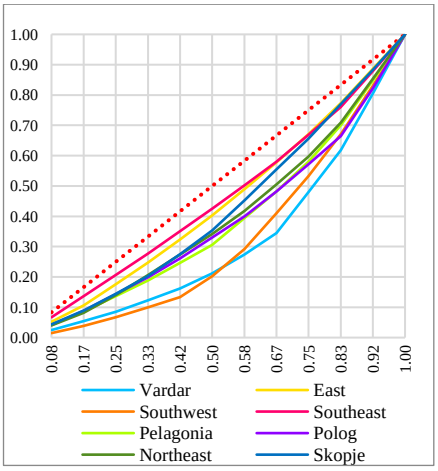


Figure 9. Lorenz curve of international arrivals

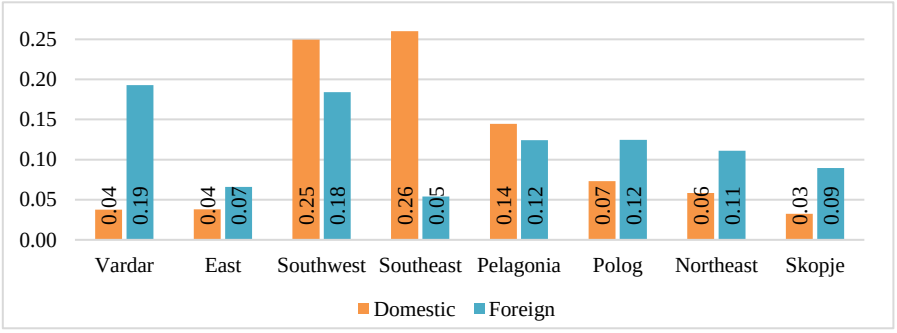


Figure 10. Gini index of domestic and international arrivals

DISCUSSION AND CONCLUSION

Analysis of tourist seasonality across the eight NUTS 3 regions of North Macedonia reveals notable spatial disparities and distinct behavioral patterns among domestic and international visitors. This section summarizes key findings aligned with the three main research questions:

Spatial disparities in seasonality: The study confirms that seasonality is disproportionately distributed across researched area. The Southeastern and the Southwestern regions experience highest tourist concentrations during specific months, with over 40% of annual arrivals occurring in just two months. Elevated SR values in the Southeastern Region, reaching up to 6.2 among domestic tourists highlights the prominence of lake tourism and summer cultural events. Conversely, Skopje, as the administrative center, demonstrates the lowest seasonal sensitivity.

Differences between domestic and international tourists arrivals (2010–2024): Domestic travelers peak sharply in July and August, while international visitors show a more balanced distribution year-round. However, the 15-year data reveal that the pandemic years 2020-2021 created artificially high seasonal peaks in international arrivals, notably in Polog Region (SR = 4.82) and Vardar Region (SR = 4.33), due to uneven market recovery. Similar findings were observed in the nearby Serbian tourism market (Trajkov et al., 2022, Pavlović et al., 2022). This pattern aligns with evidence from the mountain regions of Serbia and other inland destinations, where the seasonal nature of tourism is shaped by snow-dependent activities rather than summer recreation.

Evaluating the effectiveness of quantitative indicators: Employing a multi-indicator approach using SR, SRA, SV, and the Gini coefficient was vital for a comprehensive understanding. While SR highlights extreme peaks, the Gini coefficient offers a more stable view of overall distributional inequality across all 12 months. This methodological approach enabled precise identification of specific patterns, such as the winter peak in Polog Region (January-February), which is often missed when relying on a single indicator.

The lower seasonality in the Skopje Region is attributed to its dominant urban and administrative functions, whereas the stability observed in the Eastern and Vardar regions is driven by tourism products less sensitive to climatic variables. This includes cultural, wine, rural, and transit tourism, which operate independently of traditional seasonal cycles.

In summary, the study finds that regions such as Skopje, Eastern, and Vardar are less affected by seasonal changes, whereas regions such as Southeastern, Southwestern, and Polog experience significant seasonality. High seasonality can lead to inefficiencies, including underused infrastructure during off-peak seasons and overcrowding during peak periods, thereby hindering sustainable tourism development. These comparisons suggest that, although the country follows broader European seasonal patterns in tourism, its small size and limited diversification intensify seasonal concentration, underscoring the need for regional tourism strategies.

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