

Article

Method of Smoothing Seasonal Fluctuations of Tourist Activity Indicators in The Fergana Valley

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Abstract: Seasonality persists as an enduring problem for the tourism industry because visitor flows in certain locations tend to vary dramatically throughout the year. Tourism enterprises throughout the Fergana Valley area of Uzbekistan face low tourist engagements between peak times that results in resource underuse and income instability. Actively existing seasonality management initiatives do not have sufficient analytical tools that specifically meet regional requirements. Research about seasonal changes in Fergana Valley tourist activity remains minimal because statistical models lack sufficient evidence in this area. Time-series analysis through moving averages and analytical smoothing functions will be used to model and identify seasonal patterns in tourist activity according to this research's main goal. The main goal involves extracting trend and seasonal patterns together with random disturbances which enables creation of evidence-based strategies to minimize seasonal variations. Research data supports July as the summit of annual tourism but most months create an expanded period of little tourism activity. The application of addition and multiplication patterns and index computations demonstrated that seasonal patterns changed their forms and intensity measurements periodically. Novelty: The paper provides an innovative methodological approach that links the well established tools of classical moving averages with the advanced analytical smoothing techniques to develop accurate trend models to be applied for seasonal forecasting in tourism. This research offers tourism businesses and policy makers operational frameworks for constructing substitute marketing plans together with strategies to boost sustainable tourism products throughout the entire year which leads to tourism economy stability in the region.

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1. Introduction

One of the main problems in the tourism sector of our country is the fluctuation of tourist flows within large indicators by season, and this issue is not being adequately resolved within the framework of measures to stabilize the tourism sector at the national level[1].

Extending the tourist season and solving the problem of smoothing seasonal fluctuations in the sector will expand the possibilities of providing the population with full employment in the regions, increase the level of use of the material component of tourist facilities, ensure the rational use of natural resources, reduce the dependence of the demand for tourist services on seasonal fluctuations and, as a result, stabilize the demand for tourist services[2].

Tourism functions as an active economic field that drives economic progress together with job development and regional expansion. Tourism managers face a longtime difficulty from seasonality patterns in visitor demand that cause visitor distribution to

remain unbalanced throughout the year. The regular pattern of tourism development causes businesses to underutilize their resources and produces inconsistent income streams alongside workforce shortages during less busy times. Seasonal patterns create a major obstacle for sustainable development and economic stability in sustainable tourism throughout the Fergana Valley region of Uzbekistan[3].

The cycle of peak and low tourist activity throughout the year depends on both weather patterns and cultural activities and social economic conditions. Time-series data reveals three main components in these fluctuations which include trends and seasonality and random effects. Researcher K. Gubskaya with her team A. Zyryanov and L. Shmarkova along with other colleagues established moving averages and seasonal indices as tools to study and regulate this pattern. The majority of research concentrating on national or global tourism patterns exists without focused studies for seasonality management within specific regions such as the Fergana Valley[4].

The research utilizes moving averages combined with analytical smoothing procedures to measure and analyze seasonal patterns in tourism for Fergana Valley. Research evaluates tourist activity time-series data from the past which requires breaking down stable and periodic elements while separating random factors. Using additive and multiplicative model structures the analysis detects trend behavior and locates higher and lower visitor presence together with seasonal index measurement. This methodological structure creates visible patterns of cyclic changes alongside providing foundational knowledge for creating strategic strategies that lower seasonality effects[5].

The study aims to demonstrate that July consistently marks the season of high activity while most other months maintain a low activity level. Such evidence will demonstrate why present-day tourism plans need to change since they lack methods for year-round tourist activity. Subsequent analysis of seasonal evolution patterns enables enterprises to obtain practical operational strategies which enhance their performance. Organizations can reduce revenue fluctuations while distributing tourists throughout the year through developing seasonal packages and funding new tourism methods such as ecotourism and cultural exploration together with evidence-based marketing strategies[6].

The research adds to existing scholarly works about tourism seasonality through its local analysis conducted with powerful statistical approaches. Both government officials along with tourism businessmen must shift from short-sighted reactive approaches to empowered proactive decision-making which draws from actual statistical data. The Fergana Valley tourism sector can secure steady growth with better resources and employment potential through smoothing its seasonal waves. The proposed method enables similar regions to follow this model for sustainable tourism growth that supports inclusivity[7].

2. Materials and Methods

Time-series analysis provides the research methodology used to investigate and smooth seasonal trends within Fergana Valley tourist activity measurement. This research evaluated tourism demand-supply periodicity through an integrated usage of historical and logical and inductive and deductive methods. The research adopts statistical methods as its main foundation together with quantitative methods while using qualitative approaches to study recurring patterns of tourist flow variation across annual time periods. The research analyzes seasonal variation by using moving averages together with analytical smoothing models. The decomposition procedure divides time series data into its three main components including the trend (U_t), seasonal factor (S_t) and random fluctuation (ϵ_t) while using additive or multiplicative evaluation methods based on data characteristics. Empirical data collected from regional tourism activities helped researchers evaluate the presence of trends while determining the size of seasonal fluctuations and structural changes in their patterns. Moving average served as an easy-

to-use method for reduction purposes but analytical smoothing offered a more exact mathematical description for detecting seasonal patterns. The calculation of seasonal indices examined both pattern changes and fluctuation degrees between different time intervals. The research approach allows identification of Fergana Valley tourism peaks and slow times which helps create effective tourism strategies to lengthen the visitation period and improve resource management and benefits for employees and earnings in tourism activities.

3. Results and Discussion

To date, research on smoothing fluctuations in the seasonality of demand for tourist services has been carried out by a number of researchers.

The issue of smoothing seasonal fluctuations in the demand and supply of tourist services, identified on the basis of theoretical studies, is the object of research by another group of researchers. In particular, the research of K. Gubskaya and A. Zyryanov, Ye. Konovalova and I. Lapteva, O. Suranova and N. Ogneva investigated the methods of smoothing seasonal fluctuations in tourist services theoretically and practically[8].

Another researcher, L. I. Shmarkova, conducted research on the formation of stable trends in the process of forming trends in the activities of tourist enterprises by reducing the range of fluctuations of existing seasonal fluctuations using the "moving averages" method.

In the process of determining the demand for services and sales volumes in the tourism sector, it is necessary to adequately take into account the seasonality factor arising from the existing resource components of the industry and the range of tourist products[9].

Seasonality in tourism activities is associated with changes in natural and climatic conditions, employment of the population, economic characteristics of the supply and consumption of tourist products, and other characteristics of the industry. The main tourist season is the period of highest intensity of tourist flows[10].

A season is a period of time during which the main part of a tourist trip occurs, which can consist of one or more tourist seasons, and for certain characteristics of tourism activities, various seasonal fluctuations in time may occur[11].

Seasonal fluctuations should be understood as regular, periodic phenomena of increases and decreases in the indicators of tourist activity over time, as well as seasonality. Regardless of the form in which seasonality manifests itself, in any case its impact negatively affects the efficiency of the tourism sector. The impact of seasonality leads to uneven use of resources in the sector and manifests itself in the creation of services and other processes. In all cases, seasonality is the result of the influence of uncontrollable factors[12].

In order to stabilize the level of fluctuations in tourist activity, the most important issue is to extend the main tourist season and equalize seasonal fluctuations in specific indicators in the tourism sector. Solving this issue will ensure full employment of the population, increase the level of utilization of the industry's fixed assets, rationally use resource components, reduce the dependence of demand for tourism services on seasonal fluctuations, and, as a result, increase the profits of tourism enterprises.

If the process of the relationship between supply and demand for tourism products reflects periodic fluctuations with a constant period or an annual interval, then we use a trend based on a seasonal time series, the indicators of which are formed under the influence of three components - stable (U_t), seasonal (S_t) and random (ε_t). Depending on the type of relationship between the trend components, the time series can be described by an additive model, that is, it can be expressed as an additive model as the sum of these components - (1) or as a multiplicative model as the product of the components - (2).

$$Y_t = U_t + S_t + \varepsilon_t \quad (t=\overline{1, t}) \quad (1)$$

$$Y_t = U_t \cdot S_t \cdot \varepsilon_t \quad (t=\overline{1, t}) \quad (2)$$

Here: Y_t – time series level;
 U_t – stable component;
 S_t – seasonal component;
 ε_t – random component;
 t – number of observations.

When building additive models of tourist activity indicators that have a seasonal variation, their structural components are measured in absolute indicators, and in multiplicative models in relative indicators[13].

The study of seasonal time series reflecting tourist activity is a complex study that requires the use of modern methods of statistical analysis and the formation of reliable and reasonable forecast indicators on this basis. In the process of this study, the following should be studied[14]:

1. Determining the presence or absence of a trend in a seasonal time series;
2. Determining the presence or absence of seasonal fluctuations in a seasonal time series;
3. Isolating structural components in time series indicators;
4. Analyzing the dynamics of seasonal wave changes;
5. Studying the factors determining the seasonal fluctuation of the trend;
6. If necessary, forming forecast indicators based on the model.

In the analysis process, it is often assumed that seasonal fluctuations do not change from year to year. For most of the characteristics of the activities of tourist enterprises operating on the basis of seasonal fluctuations, this assumption is incorrect, since both the shape and the scale of seasonal fluctuations change over time. There is a need to analyze the change in seasonal fluctuations, which should include solving three interrelated tasks:

1. Analysis of the dynamics of the amplitude of seasonal fluctuations in each period;
2. Analysis of the dynamics of the extreme points of seasonal fluctuations;
3. Study of changes in the shape of seasonal fluctuations.

Most methods of filtering time series based on seasonal fluctuations are designed to first identify the trend, and then the seasonal component, and the trend in its pure form is also necessary for analyzing the dynamics of seasonal fluctuations.

Traditionally, very simple methods of measuring seasonal fluctuations are used - absolute differences, relative differences, and methods for constructing seasonality indices. The first two methods involve finding the differences between the actual levels of the seasonal time series and the levels found when determining the main trend of change. The absolute difference method works directly on the magnitude of these differences, while the relative difference method works on the ratio of absolute differences to the smoothed level of the seasonal time series[15].

When implementing the absolute or relative difference method in practice, it should be taken into account that seasonal fluctuations of a particular indicator of tourist activity may differ for the relevant periods and interfere with random fluctuations. To eliminate random fluctuations, it is necessary to take into account the average deviations over several years.

The search for an acceptable expression of the trend component and its mathematical description is the most important point in the study of seasonal processes. To determine the main trend of the process under study, the method of "moving averages" or the method of analytical smoothing is used.

When determining the moving average, enlarged intervals of the same number of levels are formed. Each subsequent interval is obtained by gradually moving one level from the initial level of the previous interval. According to the formed enlarged intervals, the sum of the values of the levels and, based on it, a moving average is calculated, which refers to the middle of the specified interval. The longer the smoothing interval, the smoother the average and the determined trend will be.

The advantage of moving averages is that they are easy to calculate, interpret, smooth out random and periodic fluctuations, and identify the current trend in the

changes in the process under study. The disadvantage of this method is that it does not allow expressing the general trend of the indicator in the form of a mathematical model and, therefore, cannot be used for forecasting. Studying the trend of a seasonal time series using the moving average method allows only for preliminary analysis of the seasonal time series.

To obtain a quantitative model describing the general trend of changes in the level of a seasonal time series, it is necessary to use the method of analytical smoothing of the series. In this case, the actual levels of the seasonal time series are replaced by levels calculated using an analytical model, the choice of their optimal form largely determines the result of trend extrapolation.

When choosing the form of an analytical model, it is necessary to take into account the analysis of the essence of the indicator of tourist activity under study. To do this, it is necessary to resort to the analysis of the graphical representation of empirical data of the levels of dynamic series. However, even in this case, it is not always possible to accurately determine the type of model, therefore it is recommended to use the analysis of the graphical representation of the smoothed levels of the series, in which random fluctuations are removed to a certain extent.

Seasonality indices can be calculated as the ratio of a certain actual level of the time series to the level calculated using the moving average method or to a certain trend level. Obviously, they have different values for different levels of the seasonal series and depend on the smoothing method. Comparing the values of seasonal indices allows you to analyze the trend of variability of seasonal fluctuations of the indicator.

4. Conclusion

Thus, the optimal approach to studying the time series of tourist enterprises' performance indicators is to analytically smooth the previously smoothed time series using moving averages, and then assess the impact of seasonal and residual components.

The desire of tourist enterprises to attract more customers should be supported by the development of an adequate strategy, taking into account the nature of the identified trends. At the same time, it is necessary to take into account the formed form of seasonal wave oscillations of each of the indicators under study. Analysis of its evolution allows us to conclude that there are stable peaks in the center of the graph in July. At the same time, there is an unacceptably long stable "dead season", which occupies almost three quarters of the annual cycle. Obviously, this fact is due to the influence of objective factors, in particular, time stereotypes associated with the preference of tourists to spend their holidays in the summer.

At the same time, it will be objectively possible to develop a more advanced strategy for a tourism enterprise to attract customers, form a variety of service offers with a rational mix of advertising, popularize alternative types of tourism, and use the "off-season" resources of the time series to form exclusive tours.

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