Tourism Management and Technology Economy (2021) 4: 21-26
Clausius Scientific Press, Canada
DOI: 10.23977/tmte.2021.040204
ISSN 2616-2199

Research on the Tourism Industry Impact of the National Games Based on Grayscale Models

Yulu Yang, Wanli Cheng

College of Water Resources and Architectural Engineering, Northwest A & F University, Yangling, Shaanxi, 712100

Keywords: Gray prediction, GM(1,1), LagRange interpolation theory

Abstract: In this paper, gray prediction is used to predict the later development data of the year without the participation of the National Games, which is compared with the real value of the later year. Then fit all provinces with tourism data in China with the data in Shaanxi Province, and select the better fitting provinces Jiangxi, Shanxi and Yunnan as the standard to test the gray prediction results. For the area substitution error in gray prediction, Lagrange interpolation is used to calculate a new background value for optimization. Finally, the map line of tourism development growth rate is drawn, and the impact of the National Games on Shaanxi tourism is -15%.

1. Introduction

National Games is generally the National Games of the People's Republic of China, referred to as "National Games". The competition of the National Games is basically the same as the Olympics outside the martial arts. Its original intention is to exercise new people for the country's Olympic strategy. Every four years, the National Games is generally held before and after the Olympics. The first ninth National National Games was held by Beijing, Shanghai and Guangdong. At the beginning of 2001, there is no longer restricted place. In 2021, China's 14th National Games will be held in Xi'an. The National Games held in the west of the West, and Xi'an has held its largest national events since recent years. Throughout Tianjin, Shenyang, Jinan and other central cities, their economic trends have a large change. At the end of 2015, Shaanxi Xi'an declaration has become the 14th National National Games, in September 2021, the National Games expected will be held here. In order to this national sports meeting, the province has made a large number of layout measures. Xi'an has conducted a new planning and construction in all aspects, the road to repair, the increase in the green space, the construction of the sports venue, which is undoubtedly in the city and even Shaanxi Province. Economic changes have played an irreparable role, so quantifying the influence of the whole mightseeing is critical to the province.

2. Model Establishment and Solving

2.1 Model establishment

By simple judgment on data, it can be seen that the data rendering index type increases, that is, grayscale prediction method, using GM (1, 1) model analysis.

Set known columns A:$x^{(0)}$=($x^{(0)}(1)$,$x^{(0)}(2)$,…$x^{(0)}(n)$), 1 time accumulated sequence: $x^{(1)}$ = ($x^{(1)}(1), x^{(1)}(2)$, …$x^{(1)}(n)$) = ($x^{(0)}(1)$, $x^{(0)}(1)+$ $x^{(0)}(2)$,…, $x^{(0)}(1)+$ …$x^{(0)}(n)$), where $x^{(1)}(i) = \sum_{j=0}^{i} x^{(0)}(i)$, i=1,…,n. $x^{(1)}$ generated sequence $C^{(1)} = (C^{(1)}(2), C^{(1)}(3), \ldots, n))$, where $C^{(1)}(i) = 0.5x^{(1)}(i) + 0.5x^{(1)}(i-1), i = 2,3\ \ldots$, n.

Establish ash differential equation $x^{0}(k) + aC^{(1)}(k) = b$ $, i = 2,3,$ …n, and the corresponding white-filled differential equation is $\frac{dx^{(1)}}{dt} + ax^{(1)}(t) = b$.

Let c=$[a, b]^{T}, Y = [x^{(0)}(2), x^{(0)}(3),\ \ldots x^{(0)}(n)]^{\mathrm{T}}$, constructing data matrix B= $\begin{bmatrix} -z^{(1)}(2) & 1 \\ \vdots & \vdots \\ -z^{(1)}(n) & 1 \end{bmatrix}$.

Calculate c= $[a, b]^{T}$=$(B^{T}B)^{-1}B^{T}Y$ by the least squares method, it can draw the prediction data equation $x^{(1)}(i+1) = (x^{(0)}(1) - \frac{b}{a}$.

2.2 Model solving

2.2.1 Prediction model of the initial grayscale prediction model of the number of tourists in Shaanxi Province

Establish symbol variables: development factor a and gray dosage b, c=$[a, b]^{T}$. Set original sequence A = [353,418,504,607,767,984,1324,1713,2135,2521,3006].

Use the least squares method available: $c = [-0.2505, 337.19]^{T}$.

Since the prediction data equation, G = [353,483.68,621.37,798.26,1025.51,1317.45,1692.49, 2174.32,2793.29,3588.49,4610.07,5922.46,7608.46,9774.43,12557.01].

For this grayscale model, the evaluation is as follows: relative residual $Q = 0.0379$, variance ratio $C_{fc} = 0.0751$, small error probability $p = 1$.

2.2.2 Initial grayscale prediction model of total tourism income in Shaanxi Province

Establish symbol variables: development factor a and gray dosage b, c=$[a, b]^{T}$. Set original sequence A = [6081,7056,8138,9182,11555,14566,18406,23276,28514,33219,38567].

Use the least squares method available: $c = [-0.1953, 5073.60]^{T}$.

Since the prediction data equation, G = [6081,6914.39,8405.62,10218.45,12422.26,15101.35, 18358.25,22317.56,27130.77,32982.03,40095.24,48742.54,59254.80,72034.23,87569.79].

For this grayscale model, the evaluation is as follows: relative residual $Q = 0.0726$, variance ratio $C_{fc} = 0.1048$, small error probability $p = 1$.

2.2.3 The number of tourists and total income of various provinces

Drawing the tourism data from the provinces of 1997-2019 using the PLOT function, compared with Shaanxi tourism data. It can find three provinces close to Shaanxi data: Yunnan, Jiangxi, Shanxi. The test of the grayscale model is again made.

2.3 Model Optimization-LagRange interpolation theory

The three provinces data on the results test analysis of the grayscale model, according to the three provinces of data, change the background value.

The initial setting background value is: $C^{(1)}(i) = 0.5x^{(1)}(i) + 0.5x^{(1)}(i-1), i = 2,3\ \ldots$, n, i.e. $S(k \times x^{(1)}(k+1)(k+1)$.

As the surface of the curved trapezoidal area corresponding to the area approximately an alternate $x^{(1)}(t)$. However, in the case where the index continues to grow, the data sequence has exacerbated changes, which will directly affect the accuracy of the forecast results. As shown in Figure 1 below.

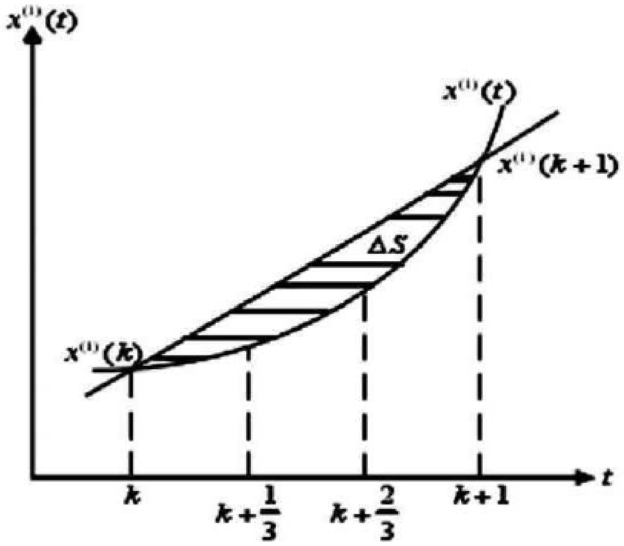

Figure 1: Gray model prediction deviation diagram [3]

In order to reduce this part of the error generated, the LagRANGE interpolation is optimized. Constructed interpolation: integrates to whitening differential equations:

$$\frac{dx^{(1)}}{dt} + ax^{(1)}(t) = b \tag{1}$$

$$\int_k^{k+1} \frac{dx^{(1)}}{dt} dt + a \int_k^{k+1} x^{(1)} dt = b \tag{2}$$

$$x^{(1)}(k+1) - x^{(1)}(k) + a \int_k^{k+1} x^{(1)} dt = b \tag{3}$$

$$x^{(0)}(k+1) + a \int_k^{k+1} x^{(1)} dt = b \tag{4}$$

New background value:

$$z^{(1)}(k+1) = \int_k^{k+1} x^{(1)} dt \tag{5}$$

Reclusion on background value $z^{(1)}(k+1)$:

Take k, k + 1, k + 2 as an interpolation node, the Lagrang Nuclear $p_k(t)$ of $x^{(1)}(t)$ is:

$$\begin{aligned} p_k(t) = x^{(1)}(k) \frac{(t-k-1)(t-k-2)}{(-1)(-2)} + x^{(1)}(k+1) \frac{(t-k)(t-k-2)}{1 \cdot (-1)} \\ + x^{(1)}(k+2) \frac{(t-k)(t-k-1)}{1 \cdot 2} \end{aligned} \tag{6}$$

Calculated new background values by Simpson formula:

$$z^{(1)}(k+1) = \int_{k}^{k+1} p_k(t)dt$$
$$= \frac{5}{12}x^{(1)}(k) + \frac{2}{3}x^{(1)}(k+1) - \frac{1}{12}x^{(1)}(k+2) \quad (7)$$

The final equation of the background value C is reconstructed by the lagrange interpolation theory.

$$C^{(1)}(i) = 23/54x^{(1)}(i) + 31/54x^{(1)}(i-1), i = 2,3 \ \ldots, n \quad (8)$$

Corrected grayscale predictions and three travel data fitted with better provinces, as shown in Figure 2.

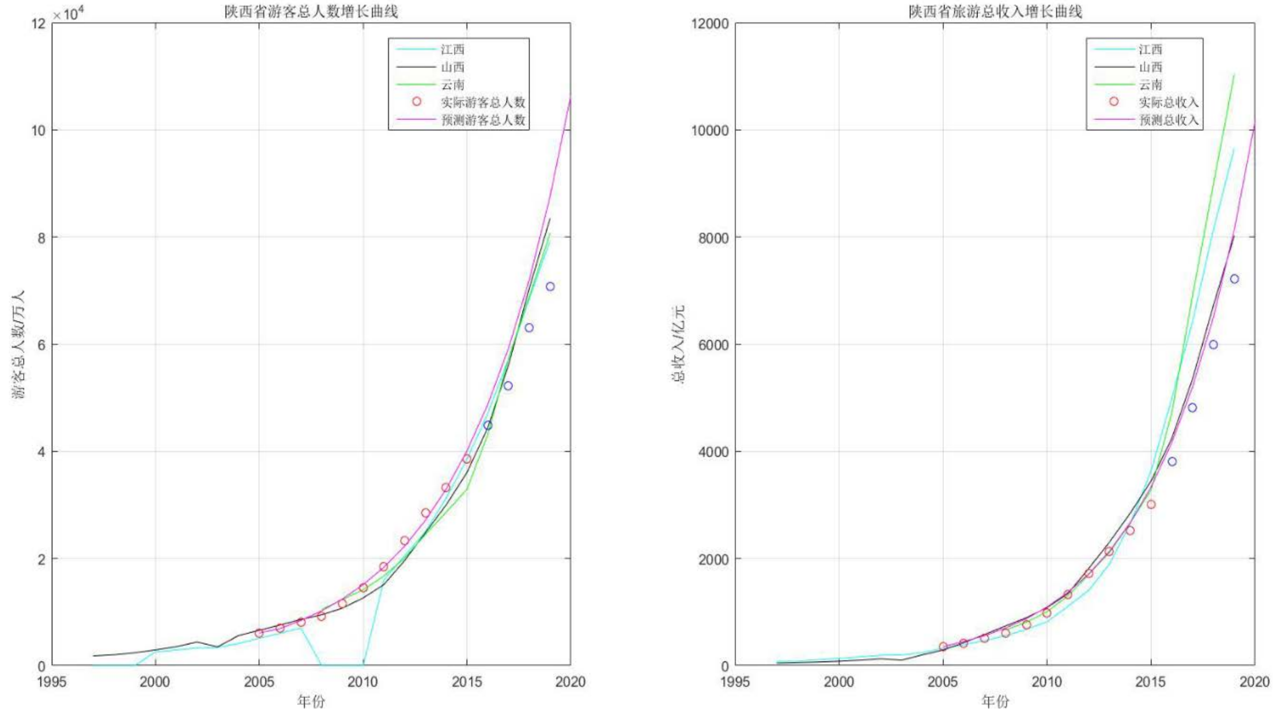

Figure 2: Correction alignment image (Jiangxi Province image mutation is zero is the data loss)

2.4 Model results and analysis

For the quantitative assessment of influence, the analysis growth rate, the use of better Jiangxi province data is used, and the total income of Shaanxi Province is 15% higher than the actual total income, as shown in Figure 3 below.

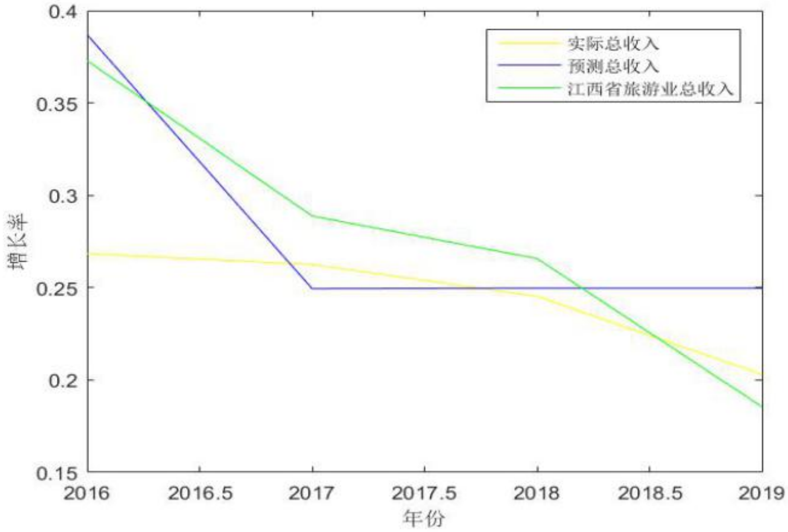

Figure 3: Growth rate statistical analysis

By establishing and analyzing the above model, whether it is the initial fit value, or after the correction test value of other provinces, Shaanxi Province has more tourism data under the participation of the National Games, which is greater than the real data involved in the National Games. Out, the National Games is a promising trend for travel data in Shaanxi Province. Refer to the influence of large-scale sports activities to organize urban tourism, there are many trends in the first reduction, so during 2016-2019, the National Games has little effect on tourism, analyzing the reasons, there may be the following aspect:

(1) During the National Games, there are too many sports constructions, and the good operation of the tourism project cannot be taking into account the good operation of the tourism project, so the number of tourists has not increased significantly. There is no improvement of tourism facilities. Tourists have not much contribution to the tourism economy. Tourism income has no greater increase.

(2) During the National Games, it is necessary to ensure a smooth route. In the preparatory stage, there should be a large number of traffic conditions in the province, and must have a certain blockade maintenance on the road, because the road is not convenient to have a negative impact on recent tourism.

(3) In 2016, the 13th Five-Year Plan period, other provinces have a large amount of economic development in the 13th Five-Year Plan, and other provincial data is used in the optimization of Shaanxi data.

3. Model Evaluation

3.1 Advantages of the model

1. The grayscale model is used in the index type data, while simply statistically analyzing travel data, also conforms to the exponential growth, so the degree of fit is higher.

2. The optimization method of the grayscale model is more, and the background value can be adjusted to fix the actual curve to achieve a good forecast..

3.2 Disadvantages of the model

The quantization index of this model is not easy to determine, and the average of the growth rate is conclusively, and the accuracy of judgment conclusions is affected. In the later stage, if the data collection is complete, increase the index coefficient, you can build more specific quantization functions, use this to determine the influence value.

References

[1] Si Shoukui. Sun Zhaoliang. Mathematical modeling algorithms and applications. Beijing: National Defense Industry Press. 2015.

[2] Yan Zefan, Wang Chongyang, Wang Yonghao. Quantitative evaluation of the influence of Tangshan Expo based on grey prediction model [J]. Information Recording Materials, 2018, 19(05): 217-218.

[3] Tian Zichen, Ji Gang, Liu Miao. Analysis and prediction of Xinjiang's total population based on improved grey GM(1,1) model [J]. Mathematics in Practice and Knowledge, 2021, 51(05): 258-264.

[4] Wang Dan. Quantitative assessment of the impact of major events on the host city's GDP [J]. Science & Technology Economic Guide, 2020, 28(17): 8-9.