Research on Dynamic Distribution and Prediction of Inbound Tourists in China

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(Work-in-progress)

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ABSTRACT
Based on the 1997-2016 inbound tourism data, this paper establishes a second exponential smoothing prediction model, predicts the number of inbound tourists in the next five years, and explores the dynamic changes and trends of inbound tourists in China, and analyzes this trend. The study found that the distribution of inbound tourists in the six regions of China has shown a relatively stable trend.

Keywords: inbound tourists, second exponential smoothing prediction, tourist number forecast.

*Corresponding author

INTRODUCTION
Inbound tourism is an important part of China's tourism industry. In 2017, China received 1,984.24 million inbound tourists, a year-on-year increase of 0.80%, and the total volume reached a record high. China has a vast territory and abundant tourism resources. However, the tourism environment, tourism culture and tourism services in different regions are different. The number of inbound tourists in each region is also very different. Understand and grasp the spatial distribution pattern of inbound tourists in China, explore the dynamic changes and trends of inbound tourists in China, and have important reference significance for formulating targeted regional tourism development strategies and promoting coordinated development of regional tourism.

Inbound tourist flow is one of the most important subjects involved in inbound tourism activities. Domestic and foreign research is mainly based on inbound tourist flow. The research content mainly focuses on the spatial distribution of inbound tourism flow (Jin-Feng et al., 2010; Xing-Zhu et al., 2014, 2011; Jing-Feng et al., 2015, 2010; Yong-Ming et al., 2011), and agglomeration (You-Yin et al., 2009, 2011; Hongying, L et al., 2008). Liu Fajian and others combined network analysis with tourism flow to obtain: China's inbound tourism scale is strong in the east, the west and northeast are strong, and the central part is weak. The overall structure is loose and uneven, and there is a certain cluster phenomenon in the spatial structure (LIU, F et al., 2010). Chen Gangqiang and Li Yinghui used spatial analysis techniques to explore the spatial structure and changes of regional tourism scale in China. The results show that the spatial differences between the eastern, central and western regions are obvious, but the spatial gap between regions and within them is shrinking (CHEN, G et al., 2011). Shen Jinghong et al. used the Gini coefficient and its decomposition method to calculate the income difference of China's inbound tourism regions, and also found that the income difference in inbound tourism regions is shrinking (Jing-Hong et al., 2013). Shi Zhuoyi selected Canada as the research object, based on the statistics of Canadian inbound tourists from 31 provinces and cities and some major cities in the mainland, using standard deviation, coefficient of variation, Gini coefficient, Herfindahl index and other methods to enter Canada's mainland China tourism flow. Analysis of spatial distribution characteristics and differences, and found that Canada's inbound tourism flows have obvious regional differences. The above research explores the spatial structure and dynamic changes of China's inbound tourism regional differences from a macro level.

In order to more accurately grasp the changing trend of inbound tourists, this paper starts from the six major regions and establishes a second exponential smoothing prediction model to predict the number of inbound tourists in China and the proportion of inbound tourists in different regions in the next five years, so as to explore the distribution of inbound tourists in China. Dynamic changes and trends.

DATA SOURCE AND DESCRIPTION
The data comes from the 1997-2016 China Tourism Statistics Yearbook. The data includes the number of overnight visitors from international tourists to China's six major regions and provincial regions. The “inbound overnight visitors” refers to the total number of foreign tourists, Hong Kong and Macao tourists and Taiwanese tourists.

This paper uses China's geographical division criteria to divide the Chinese mainland into six regions: North China, East China, Central South, Southwest, Northwest, and Northeast, as shown in Table 1.

<table>
<thead>
<tr>
<th>Region</th>
<th>Province</th>
<th>Region</th>
<th>Province</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern China</td>
<td>Beijing</td>
<td>Central</td>
<td>Henan</td>
</tr>
<tr>
<td></td>
<td>Tianjin</td>
<td>Southern</td>
<td>Hubei</td>
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</tbody>
</table>

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The distribution of inbound tourists in the Chinese region is measured by the proportion. The ratio of the inbound tourists of region \( i \) is \( A_i \):

\[
A_i = N_i / \sum_{i=1}^{7} N_i, \quad i = 1, 2, ..., 7
\]

(1)

\( N_i \) is the number of inbound tourists received by the region \( i \).

This paper will establish an exponential smoothing prediction model to predict the inbound tourists. Exponential smoothing is a common method used for trend analysis and prediction. The method can weaken the influence of short-term random fluctuations on time series, show the variation law of sequence, and has the advantages of simple calculation, less sample quantity, strong adaptability and stable prediction results. The exponential smoothing method is a weighted moving average method. In the moving average method, all historical observations are given the same importance, and in actual random events, recent results have a greater impact on the present. Therefore, in the exponential smoothing method, the weight of the observations in each period is exponentially attenuated with the increase of the time interval, and the earlier the observation weight is smaller, so as to reflect this feature.

Taking a region as an example, a simple exponential smoothing method is expressed as follows:

\[
\tilde{x}_t = \alpha x_t + \alpha(1-\alpha)x_{t-1} + \alpha(1-\alpha)^2x_{t-2} + ... + \alpha(1-\alpha)^{t-1}x_1 + (1-\alpha)^t\tilde{x}_0
\]

(2)

\( \tilde{x}_t \) is the smoothing value of \( t \) period; \( \alpha \) represents the smoothing coefficient that provides the weight, which satisfies \( 0<\alpha<1 \); \( \tilde{x}_0 \) is the initial smoothing value, which is generally the mean of the first three samples, because:

\[
\tilde{x}_{t-1} = \alpha x_{t-1} + \alpha(1-\alpha)x_{t-2} + \alpha(1-\alpha)^2x_{t-3} + ... + \alpha(1-\alpha)^{t-2}x_1 + (1-\alpha)^{t-1}\tilde{x}_0
\]

(3)

So, \( \tilde{x}_t \) equals,

\[
\tilde{x}_t = \alpha x_t + (1-\alpha)\tilde{x}_{t-1}
\]

(4)

\( \tilde{x}_t \) is the predicted value of the inbound passenger flow for the \( t+1 \) period; \( x_t \) is the actual value of the inbound passenger flow for the \( t \) period.

The overall prediction error is expressed by the mean square error, and the smoothing coefficient \( \alpha \) takes the value of the minimum mean square error. The overall mean square error \( \lambda_{MSE} \) of the \( t \)-stage sample can be calculated from the following equation.

\[
\lambda_{MSE} = \frac{1}{t} \sum_{i=1}^{t} (\tilde{x}_{i-1} - x_i)^2
\]

(5)

The obvious shortcoming of the one-time smoothing index method is the hysteresis of the prediction, and it is more suitable for the stationary time series. It is impossible to predict the time series of the trend, and the purpose of the inbound passenger flow forecast is whether it has a rising or falling trend. Here, the Holt two-parameter exponential smoothing method in the second exponential smoothing method is used.

### PREDICTION MODEL

<table>
<thead>
<tr>
<th>Northeast China</th>
<th>China</th>
<th>Westsouth China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hebei</td>
<td>Hunan</td>
<td>Chongqing</td>
</tr>
<tr>
<td>Shanxi</td>
<td>Guangdong</td>
<td>Sichuan</td>
</tr>
<tr>
<td>Inner Mongolia</td>
<td>Guangxi</td>
<td>Guizhou</td>
</tr>
<tr>
<td>Heilongjiang</td>
<td>Hainan</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eastern China</th>
<th>Westnorth China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liaoning</td>
<td>Chongqing</td>
</tr>
<tr>
<td>Jilin</td>
<td>Sichuan</td>
</tr>
<tr>
<td>Heilongjiang</td>
<td>Guizhou</td>
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<tr>
<td>Shanghai</td>
<td>Yunnan</td>
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<tr>
<td>Jiangsu</td>
<td>Tibet</td>
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<td>Zhejiang</td>
<td>Shaanxi</td>
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<tr>
<td>Anhui</td>
<td>Gansu</td>
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<td>Fujian</td>
<td>Qinghai</td>
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<tr>
<td>Jiangxi</td>
<td>Ningxia</td>
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<tr>
<td>Shandong</td>
<td>Xinjiang</td>
</tr>
</tbody>
</table>
The quadratic exponential smoothing increases the parameters reflecting the trend compared to the one exponential smoothing, and performs better in the short- and medium-term forecasting. Its formula is:

$$s_t = \alpha x_t + (1 - \alpha)(s_{t-1} + b_{t-1})$$

(6)

$s_t$ is the second exponential smoothing value, and is also the predicted value of the inbound passenger flow in the $t$ period. $x_t$ is the actual value of the inbound passenger flow in the $t$ period. $\alpha$ is the smoothing coefficient, which satisfies $0<\alpha<1$. $b_{t-1}$ is the trend of the $t-1$ period. The initial value $s_0$ is the average value of the inbound passenger flow in the first three periods. Under the influence of random factors, the increment or decrement value of each period in the time series will also fluctuate with time, so the trend sequence is a random sequence, and it is smoothed once, then the formula of $b_t$ is:

$$b_t = \gamma(s_t - s_{t-1}) + (1 - \gamma)b_{t-1}$$

(7)

$\gamma$ is the trend smoothing coefficient and satisfies $0<\gamma<1$. The initial value is $b_0=\frac{x_0-x_1}{1-\gamma}$. In the quadratic exponential smoothing algorithm, the influence weights of recent data are represented by two smoothing coefficients $\alpha$ and $\gamma$. And the method of taking the smoothing coefficients also takes the value when the mean square error is the smallest. Here, the trial algorithm is adopted, taking the initial value $\alpha=0.5, \gamma=0.5$, taking the step length 0.05 to calculate the increment and decrement respectively, and calculating the mean square error $\lambda_{MSE}$ no longer decreases, so as to obtain the parameter value of $\alpha$ and $\gamma$ (Saputra et al., 2017).

Using Holt's two-parameter exponential smoothing method, the predicted model of the forward $l$-stage predicted value is expressed as follows:

$$\hat{A}_{t+l} = s_t + lb_t$$

(8)

$\hat{A}_{t+l}$ indicates the predicted value of inbound passenger traffic for the $t + l$ period.

**FORECAST RESULTS OF INBOUND TOURISTS**

Based on the annual data of inbound tourists received in the unit area from 1997 to 2016, this paper first establishes an exponential smoothing prediction model, predicts the number of inbound tourists received in the unit area from 2017 to 2023, and then calculates and predicts the ratio of tourists to each region and province. The results are shown in Figure 1 and Figure 2. Figure 1 shows the number of inbound tourists and the predicted results. The red color is the predicted value. Figure 2 shows the proportion of inbound tourists and the forecast results. The red mark is the predicted value, and the forecast error is 0.0526-0.0911.

As can be seen from Figure 1, after 2014, the Central and South China region has the largest number of inbound tourists, followed by Central South, East China, Southwest China, North China, Northeast China and Northwest China. Overall, the number of inbound tourists in China is on the rise. Except for the inflowing tourists in North China and Northeast China, the trend of decline is stable after 2012. The rest of the regions have shown a trend of decline after the first decline. As can be seen from Figure 2, the inbound tourists are in a trend of decreasing proportion in Central, Northeast and North China. They have been in a stable trend in the northwest, rising in East China and Southwest China, and the most influx of inbound tourists in East China, and tourists in the Southwest. The increase in the proportion is second, thanks to the development of the western region and the positive promotion of inbound tourism to the west. It can be seen that the distribution of inbound tourists in the six major regions of China has shown a relatively stable trend.

The analysis shows that the changing trend of Chinese inbound tourists has the following characteristics: First, the implementation of a series of facilitation policies such as transit visa exemption and departure tax rebate, it is expected to continue to expand the development space of China's inbound tourism and improve the quality of development; Visitors will get more convenient travel services and higher travel experience, which will become the focus of China's inbound tourism in the next stage of full participation in international competition. Third, the current development model of China's inbound tourism has changed from the closed mode of the past team reception to more Diversified and more open.
CONCLUSION

China has a vast territory and rich tourism resources. Geographical zoning divides the Chinese region into six regions with certain characteristics of tourism flow. According to the research results of this paper, the distribution of overseas tourists in China's six major regions has shown a relatively stable trend. The proportion of East China and Southwest China is increasing, while the proportion of northern regions is decreasing. It is recommended that the northern region improve inbound tourism. The attraction effect, while the state can consider implementing an integrated development strategy for inbound tourism regions, and coordinate the development of inbound tourism in various regions, with a view to the long-term sustainable development of China's inbound tourism industry.

REFERENCES


