

Forecasting Method of Camp Demand for Tourist Highway Service Facilities

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Abstract: In order to meet the travel needs of the demanders after the planning of the tourist road camp, the method of camp demand prediction is proposed. The forecast method of camp demand is based on the analysis of demand characteristics of camp service facilities, the forecast index system is established through factor correlation analysis, and the multiple regression and GM (1,N) model are used as the forecast methods; the empirical part uses the two methods to predict the total camp demand of Jilin Province in the future 2030 by using the multiple regression model. Through the research, it provides the method to control the total demand of future camp planning.

1. Introduction

Since 2015, the state has issued several documents, such as "opinions on further promoting tourism investment and consumption", "opinions on promoting the development of self driving recreational vehicle(RV) tourism", and proposed to encourage and guide social capital to build 1000 self driving RV camps by 2020. According to China self driving travel development daily (2016-2017)[1], the number of self driving tourists in China reached 2.64 billion, an increase of 12.8% over the last year, accounting for 59.5% of the total number of Chinese tourists. Self driving on holiday has been the first choice of car owners for holiday and leisure, and RV has gradually entered the vision of Chinese people. Car camping, a kind of recreational activity which is in line with the new concept of personalized and leisure vacation tourism in modern society, has quietly risen, showing us the development direction of leisure activities in China in the future[2]. In order to meet the needs of this part of self driving tourists, better experience the natural scenery and in-depth experience of the beautiful scenery, the original traffic function of the road has not met the needs of the growing part of tourists, while the original national and provincial trunk road service facilities are very scarce, seriously lacking the half way rest, moderate leisure and relaxation facilities. The tourist road camp is a leisure and vacation place with self driving tourists as the main body, relying on waterfront, forest and grassland scenic spots or beautiful natural landscape areas along the existing tourist road, which can provide self driving tourists with accommodation, catering, entertainment and leisure,

and special theme activities. In order to better promote the construction of tourist road camps to serve the growing self driving tourists, it is necessary to predict the total demand of tourist road camps for a reasonable number of layout.

The self driving RV camp originated in the United States in 1860, and the international camping association was established in the Netherlands in 1932, marking the promotion of camping activities and camp development to the global scale[3-4]. At present, there are nearly 50,000 car camps in Europe and more than 20,000 in the United States. Overseas researches on campsites mainly focus on the concept, location, planning, construction, operation and management of campsites[5]. In the 1990s, scholars gradually paid attention to the relevant research of campers. Edward et al.[6-7] studied the safety management system and composition of campsites. Brooker et al.[8-10] proposed that new products, market positioning and personalized experience are the important trends of campsite development in the future. However, the theoretical research on camps in China is relatively lagging behind and has few achievements, mainly focusing on concept discrimination[11-12], planning and design[13], macro layout[14], case study[15] and sustainable development[16].

Based on the investigation and analysis of the demand characteristics of campsite service facilities, this paper establishes the corresponding campsite service facilities demand forecasting index system, and then constructs the multivariate regression model and GM (1, N) model as the forecasting basis. By comparing the prediction error and accuracy of the two methods, the optimal model is selected to predict the camp demand of Jilin Province in 2030. The research can provide guidance for the camp demand prediction of tourism highway service facilities, and control the total demand for the future camp planning and layout.

2. Analysis on Demand Characteristics of Camp Service Facilities

2.1. The Rise of Leisure Experience Tour

In 2015, the comprehensive contribution of tourism to the national economy reached 10.8%; domestic tourism, inbound tourism and outbound tourism developed in an all-round way, and China became the world's largest domestic tourism market, the world's largest international tourism consumer and the world's fourth largest tourism destination country. With the development of tourism industry and economic growth, relevant research shows that when the per capita income is between 2000-3000 US dollars, people's demand for scenic spot tourism changes, while the per capita income of all residents in China (see Figure 1) has broken the boundary of 3000 US dollars as early as 2013. In the new era, more high knowledge talents and youth groups tend to enjoy leisure experience tour. Driven by this economic factor, the future camp leisure tour under self driving travel will usher in new development opportunities.

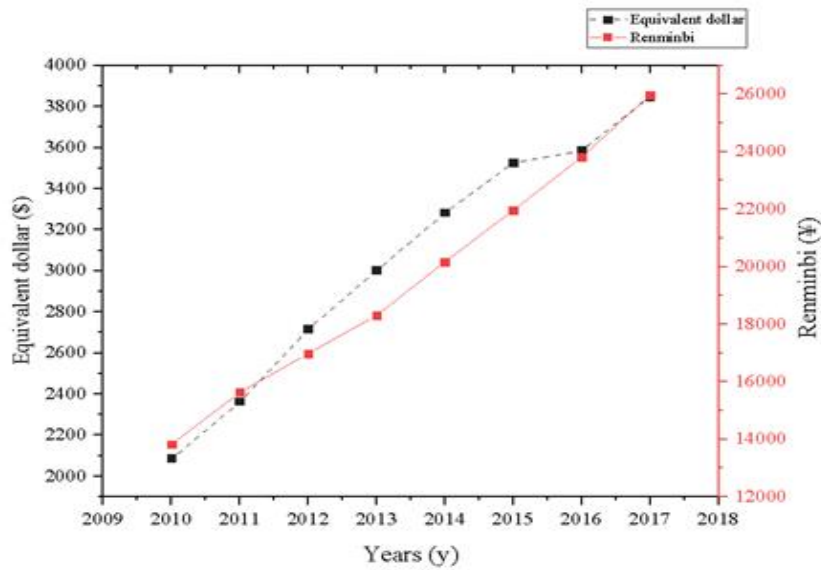


Figure 1: Per capita income of all residents.

2.2. Vehicle Ownership

The National Bureau of Statistics recently released a series of reports on the achievements of economic and social development in the 70th anniversary of the founding of the people's Republic of China. Taking automobile consumption as an example, the report said that the average annual growth rate in the past 20 years was nearly 30%. At the end of 2018, the number of civil vehicles in China exceeded 240 million (see Figure 2 for details). Private car ownership group holiday travel destinations are now more inclined to scenic spots, but as people's long cherished wish for a better life is stronger and stronger, people's destinations will change to more leisure and semi self-service facilities, and the functional orientation of the camp is very good to meet this demand. The group with motor vehicles is bound to become the main source of tourists in the camp. The total demand for planning and layout of the camp in the future should be controlled and closely combined with the number of civil motor vehicles.

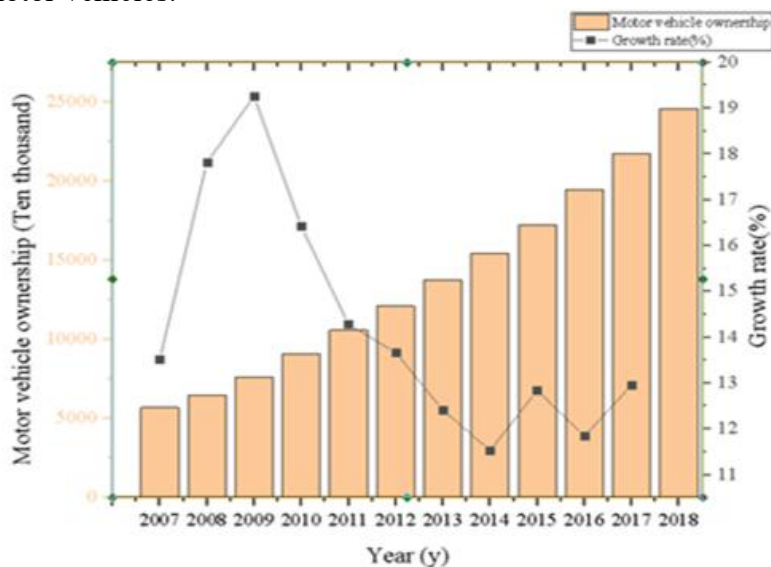


Figure 2: The quantity of civil motor vehicles.

2.3. Analysis of Potential Customers

According to the latest Ma beehive data, since 2015, the number of tourist groups aged 19-50 in China's scenic spots has remained at about 80%. In the future, with the improvement of road service facilities such as camps and post stations, the travel of these customers will be transformed into camp demanders. When such a large number of potential customers choose to travel on holidays with road service facilities, it is very important to ensure that the supply of service facilities can meet their needs. Therefore, it is necessary to consider the future situation of the corresponding main customer groups for the forecast of camp demand, and the future number of population as an age group is clear, which is more conducive to the accuracy of demand forecast.

3. Demand Forecast Index System and Model

3.1. Establishment of Prediction Index System

In this era of massive information, it is also more difficult for us to predict a new thing. How to find useful information from massive data is very important. As a new thing, the data of demand status of tourist road camp is scarce. After consulting many documents and demand prediction methods, the author thinks that there are two aspects to grasp the demand of camp. First, reference the development data of foreign camp for comparative reference. Second, the total number of tourists is taken as the starting point to establish the total demand forecasting framework.

Therefore, based on the historical data correlation analysis of the total number of tourists per year and tourism income, GDP, consumption level of all residents, number of civil motor vehicles, fixed asset investment, number of potential customers in the camp, the prediction index system is determined as shown in Figure 3. On this basis, the model is selected to predict the total number of tourists per year and then take the data of the total number of tourists and the total number of campsite trips in the United States as reference. Finally determine the total demand of the camp.

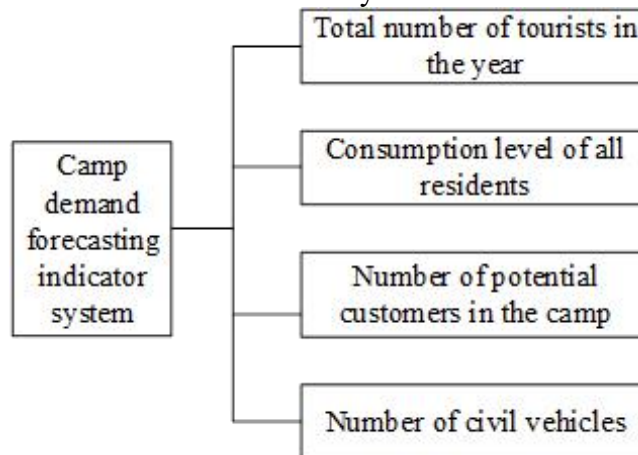


Figure 3: Camp demand forecast index system.

3.2. Demand Forecasting Model

3.2.1. Multiple Regression Model

For practical problems, one thing is often associated with many influencing factors. When we predict its future change trend, we need to select multiple variables to describe together. For a problem that can't find an effective mechanism to find the law to predict, people tend to choose a

large number of data regression analysis to express the correlation between them. Generally, it can be divided into linear regression and curve regression. The general model formula of linear multiple regression is as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k + \varepsilon \quad (1)$$

We call β_0 regression parameters. On the basis of the regression population model, we make some basic assumptions about the regression model and data, estimate the corresponding parameters, get the estimated value in the actual problem, and then get the sample regression function. The basic form is as follows:

$$\hat{Y} = \hat{\beta}_0 + \hat{\beta}_1 X_1 + \hat{\beta}_2 X_2 + \dots + \hat{\beta}_k X_k \quad (2)$$

3.2.2. GM (1,N) Model

In grey theory, discrete random numbers are used, and the generated randomness is weakened to reflect certain regular generated numbers, and then the change process can be described for a long time, so as to establish the model of differential equation form. Grey GM (1, n) model is used to describe the relations and changes among n related variables, among which one variable is the main object (dependent variable) and the other variables are the driving factors (independent variable). The change and development trend of the investigated variables are based on the driving factors, and the dependent variables are expressed as the exponential function of the independent variables, so as to realize the prediction of the investigated objects[17,18]. The specific calculation formula of the time corresponding function model (see 3); the original sequence prediction model (see 4) can be obtained by accumulating and restoring it.

$$\hat{x}_1^{(1)}(k+1) = \left[x_1^{(0)}(1) - \frac{1}{\hat{a}} \sum_{i=2}^n \hat{b}_{i-1} x_i^{(1)}(k+1) \right] e^{-\hat{a}k} + \frac{1}{\hat{a}} \sum_{i=2}^n \hat{b}_{i-1} x_i^{(1)}(k+1) \quad (3)$$

$$\hat{x}_1^{(0)}(k+1) = \hat{x}_1^{(1)}(k+1) - x_1^{(1)}(k) \quad (4)$$

4. Case Study

4.1.Data Sources

According to the demand prediction index system established above, four variables are selected, which are the total number of tourists per year, the consumption level of all residents, the number of civil vehicles, and the number of potential customers in the camp. The above data mainly come from the official data of Jilin statistical yearbook and Jilin census data. The first three variables are from the statistical yearbook, and the last one is calculated according to the number of people of all ages in the census.

4.2.Multiple Regression Model Prediction

Through the establishment of the total number of tourists, the consumption level of all residents, the number of civil motor vehicles and the number of potential customers in the camp between 2005

and 2015, the multiple regression analysis was carried out by SPSS17.0 software. The dependent variable is set as the total number of tourists per year, and the independent variable is the other three items. The results show that the first variable is the number of potential customers, the second is the number of civil vehicles, and the third is the consumption level of all residents, and no variable is excluded. Model fitting shows that the complex correlation coefficient (R) is 0.998, the judgment coefficient (R Square) is 0.997, the adjusted R square is 0.996, and the Durbin Watson test statistic is 2.262, indicating that the residual is independent.

The results of F-test show that the observation value of statistics is 996.926, and the introduction P is 0.00, indicating that under the significance level of 0.05, it can be considered that there is a linear relationship between the total number of annual tourists and the number of potential customers in the camp, the number of civil motor vehicles and the consumption level of all residents, and the corresponding model coefficient test is shown in Table 1.

Table 1: Multiple regression fitting coefficient results.

| Model | Unstandardized | Standardized | T | Sig. | Collinearity | |
|---------------------------------|----------------|--------------|--------|-------|--------------|------|
| | Coefficients | Coefficients | | | Statistics | |
| | B | Beta | | | Tolerance | VIF |
| 1 (Conatant) | 2.505E8 | | 3.069 | 0.013 | | |
| Number of civil vehicles | 55.511 | 1.098 | 8.489 | 0.000 | 0.020 | 50.2 |
| Consumption level of residents | -584.893 | -0.039 | -0.256 | 0.804 | 0.014 | 70.8 |
| Potential customers in the camp | -17.893 | -0.138 | -2.99 | 0.015 | 0.157 | 6.37 |

The maximum eigenvalue of the second model is 3.852, and the rest of them decrease rapidly. The maximum absolute value of the residual statistical standard residual is 1.345, which is less than the default value of 3.00. No singularity is found. The histogram of standard deviation is normal, and the P-P diagram shows that the residual distribution of observed value is close to the assumed normal distribution (see Figure 4-5 for details).

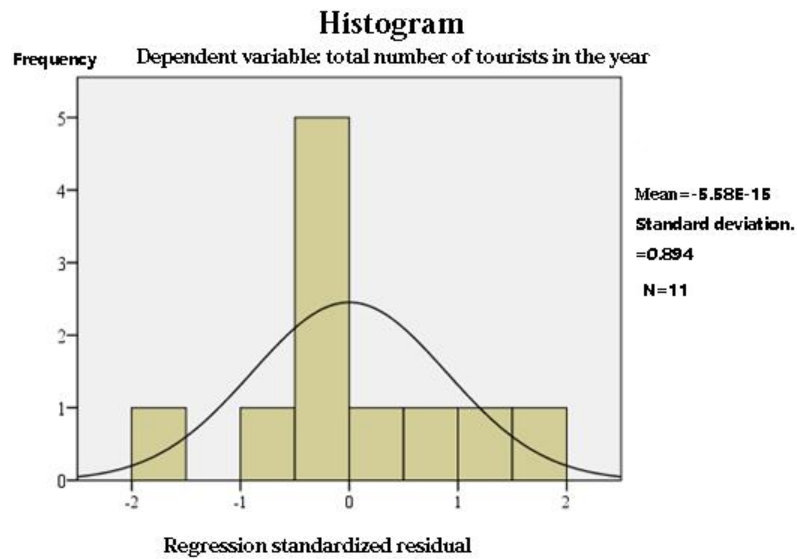


Figure 4: Regression residual histogram.

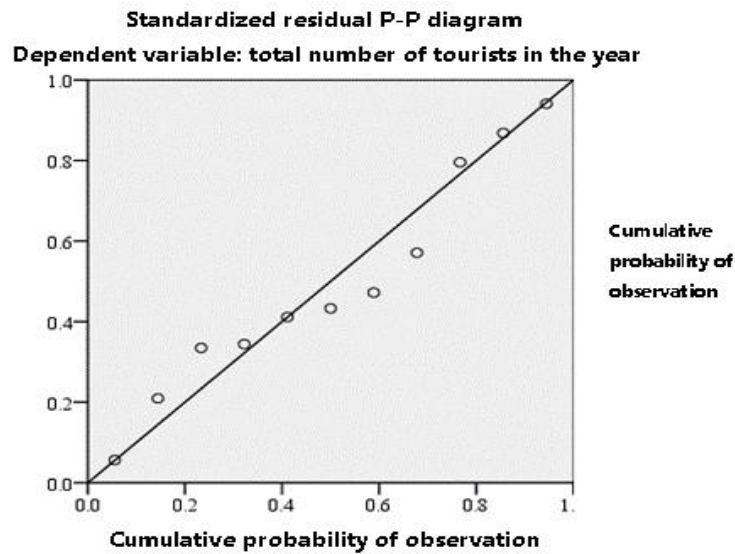


Figure 5: Regression standardized residual P-P chart.

Therefore, the prediction formula (5) of the corresponding multiple regression analysis is established as follows:

$$Y = 250500000 + 55.511X_1 - 584.893X_2 - 17.893X_3 \quad (5)$$

4.3.GM (1, n) Model Prediction

There are three main variables to be considered in the prediction of the total number of tourists in Jilin Province, which are the consumption level of all residents, the number of civil vehicles and the number of potential customers in the camp. As there is a gap in the order of magnitude between the statistical data, we first take the logarithm of the data, and then build GM (1,3) model to predict the

total number of tourists in the future, and get the corresponding forecast situation, and then calculate the power of e to get the data of the same magnitude of the original data.

Using DPS data system to calculate GM (1,3) model to get parameters $\hat{a} = 2.28393$, $\hat{b}_1 = 2.78663$, $\hat{b}_2 = 0.77550$; the response formula of the total number of tourists per year is as follows (6):

$$\hat{X}_1(t+1) = (7.96841 - 1.2201X_2 - 0.33955X_3)e^{-2.284t} + 1.2201X_2 \quad (6)$$

See Figure 6 for the prediction value of the error of the original data and the value of the original observation value.

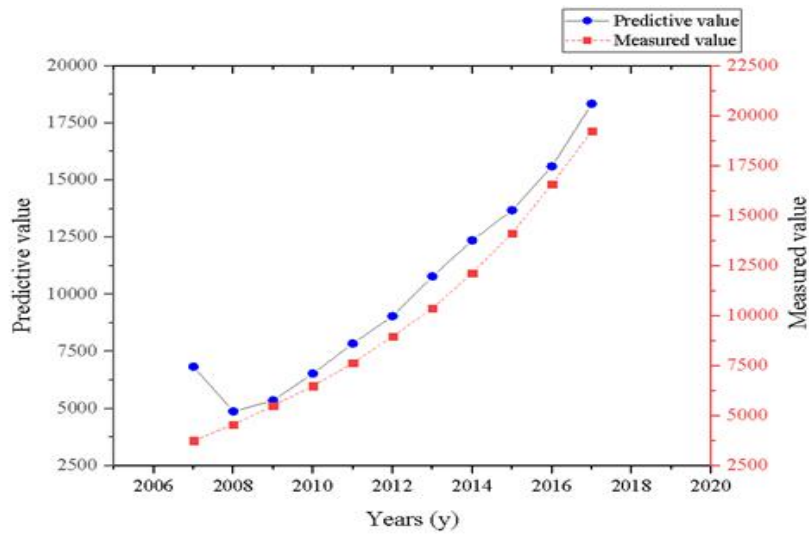


Figure 6: Fitting results of GM (1, n) model.

4.4. Comparative Analysis of Models

Through multiple regression analysis and GM (1, n) model prediction, the total number of tourists in Jilin Province in the future is obtained. The error and accuracy of the specific model need to be evaluated in order to be able to grasp the total amount of camp construction demand in the future more accurately. According to the model formula of multiple regression analysis and GM (1, n) model formula, the predicted value and actual value in 2013-2017 are shown in Table 2.

Table 2: Error analysis of prediction results of two models.

| Years | Measured value | GM(1,N) Predictive value | Multiple Regression Predictive value | GM (1, N) Error (%) | Multiple Regression Error (%) |
|-------|----------------|--------------------------|--------------------------------------|---------------------|-------------------------------|
| 2013 | 103694000 | 107880800 | 104461000 | 4.04 | 0.74 |
| 2014 | 121417000 | 123641600 | 125715600 | 1.83 | 3.54 |
| 2015 | 141314000 | 136796200 | 142716000 | -3.19 | 0.99 |
| 2016 | 165719000 | 155991400 | 167367400 | -5.91 | 0.95 |
| 2017 | 192414000 | 183352300 | 188374400 | -4.71 | -2.10 |

Through Table 2, it can be seen that the prediction results obtained by multiple regression analysis are more accurate. Therefore, the total number of annual tourists in Jilin Province will reach 863.2547 million in 2030 by multiple regression. Compared with the consumption level of all residents and the number of motor vehicles in the same period, we are equivalent to the development of the camps in the United States in 2000. According to the relationship between the total number of tourists and the total number of tourists in the camps in 2000, the annual number of tourists in the camps in the United States accounted for 4.26% of the total number of tourists in 2000. Therefore, the total demand of the camps in Jilin Province in 2030 is 36.775 million.

5. Conclusions

When people's life style changes, they will naturally have demand for new things and things with more independent choices. The functional orientation of the camp is to meet the potential needs of this kind of people. Based on the analysis of the current situation of the camp demand sources, this paper shows that the future camp market in China has broad prospects. On this basis, it explores and puts forward the forecast index and model of the camp, and takes Jilin Province as an empirical demonstration, selects multiple regression model to forecast the camp demand in the future 2030. At present, domestic tourism has gradually become an important source of financial revenue for each province. How to ensure the development of tourism is more attractive and dynamic? The planning and layout of the camp can be an important part of it. The total demand forecasting method proposed in this paper fills in the blank of the corresponding research, and provides the basis for the overall control of the planning and layout of the camp in the future.

Acknowledgments

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