Research on cruise pricing strategy based on Forecast

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Abstract. Based on the forecast of the cruise pricing strategy. Are first detected by using time sequence, gray prediction, divided into three equation model of the booking number prediction, it is concluded that the predicted results and error analysis. Sequence forecast every voyage each week booking price by time, and the relative error. Then, through the data fitting will reservation number, use the multiple linear regression models to obtain the average price of booking. The concept of reservation restriction, protection level, super sale and so on is introduced, and the maximum expected revenue model is established [1].

Introduction

With the rapid development of economy, the cruise tourism has become one of the most active and fast developing industries in modern tourism. Based on market segmentation, the appropriate products at the right price at the appropriate time to sell to the appropriate customer, in order to achieve cruise companies' profit maximization, and the development of reasonable pricing strategy is the core to realize maximum benefits. This paper in the cruise of 0 weeks before 14 weeks for a predetermined period and cruise, a total of 250 first-class accommodation, 450 a second-class cabin, under the premise of 500 third class accommodation, to solve the following problems:

1) At least by three kinds of prediction methods for every voyage each week to book all cabin seat or berth number, improve the voyage real weekly booking cumulative number of table;

2) To predict each voyage each week booking price, perfect every voyage booking price list;

3) According to the weekly predetermined price range and the number of voluntary booking per week, the Forecast Ltd is given the scheduled average price per week;

4) The establishment of a cruise ship each time the maximum expected ticket revenue model, and calculate the eighth times the expected ticket revenue;

Models

1)The actual number of weekly voyage booking forecast

The gray prediction[2] is characterized by the use of the model is not the original data sequence, but rather the generated data sequence. The core system is the grey model (GM), which is the method of modeling the approximate exponential law of the original data. Because of the known data is the voyage each week accumulated a predetermined number, so you can directly check out the known data.Select the 7 voyage data as the reference data, provided reference data for $x^{(0)} = (x^{(0)}(1), x^{(0)}(2), \text{L}\ , x^{(0)}(n))$, calculate the class ratio of series:

$$\lambda(k) = \frac{x^{(0)}(k-1)}{x^{(0)}(k)}, k = 2,3,\text{L}\ , n.$$

According to the calculation, all the levels of the $\lambda(k)$ are in the content of $\Theta = (e^{\frac{2}{n+1}}, e^{\frac{2}{n+2}})$, then the $x^{(0)}$ can be used as the data of the model GM (1,1).GM（1,1） model is established according to the formula $\frac{dx^{(1)}}{dt} + ax^{(1)}(t) = b.$, can get the predictive value:

$$\hat{x}^{(1)}(k+1) = (x^{(0)}(1) - \frac{\hat{b}}{\hat{a}})e^{-\hat{a}k} + \frac{\hat{b}}{\hat{a}}, k = 0,1,\text{L}\ , n-1,\text{L}\ ,$$

$$\hat{x}^{(0)}(k+1) = \hat{x}^{(1)}(k+1) - \hat{x}^{(1)}(k), k = 1,2,\text{L}\ , n-1,\text{L}$$

$$\varepsilon(k)=\frac{x^{(0)}(k)-\hat{x}^{(0)}(k)}{x^{(0)}(k)},k=0,1,\mathrm{L}\ 14$$

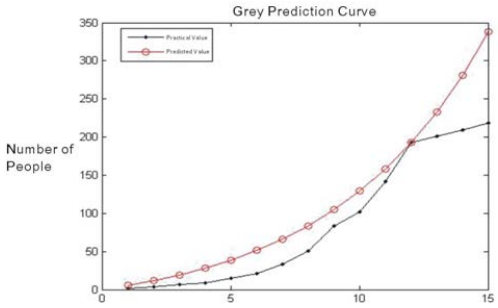

Fig.1 Grey Prediction Curve: Number of Weeks After Ticketing

2) The voyage booking price forecast

According to the analysis of the first question, it is concluded that AR[3] time series can be the booking number to better prediction effect. The second asked continue to use AR time series forecast of 5 ~ 10 cruises at a predetermined price.

Through the stationary test method, for all cruises that all the shipping space for stationarity test, can be drawn, every voyage booking price time series is stationary. The model can be established as follows: AR (2) model to predict the b_t:

$$y_t = c_1 y_{t-1} + c_2 y_{t-2} + \varepsilon_t$$

As shown in the following section, the full results are shown in Appendix sheet3. Through analysis, we can see that, the AR model of time series for the prediction of a predetermined price of the voyage of the weekly trend is ideal.

Fig.2 Average Price Prediction Curve: Number of Weeks After Ticketing

3) Forecast average price

When the change of demand is influenced by several factors, it is to choose several independent variables to establish multiple regression models. In reserve cruise weekly average price forecast, we assume a predetermined average price and price range of the maximum value, the minimum value and a week of each voyage volunteer reservation number satisfies a linear relationship, to establish multiple linear regression model. The model of multiple linear regression analysis is:

$$\begin{cases} y = c_1 x_1 + c_2 x_2 + c_3 x_3 + \varepsilon \\ \varepsilon \sim N(0, \sigma^2) \end{cases}$$

The following normal equations are arranged:

$$\begin{cases} c_1 \sum_{i=1}^{n} a_{i1} + c_2 \sum_{i=1}^{n} a_{i2} + \mathrm{L} + c_m \sum_{i=1}^{n} a_{im} = \sum_{i=1}^{n} b_i \\ c_1 \sum_{i=1}^{n} a_{i1}^2 + c_2 \sum_{i=1}^{n} a_{i1} a_{i2} + \mathrm{L} + c_m \sum_{i=1}^{n} a_{i1} a_{im} = \sum_{i=1}^{n} a_{i1} b_i \\ c_1 \sum_{i=1}^{n} a_{im} a_{i1} + \sum_{i=1}^{n} c_2 a_{im} a_{i1} + \mathrm{L} + c_m \sum_{i=1}^{n} a_{im}^2 = \sum_{i=1}^{n} a_{im} b_i \end{cases}$$

The average price of different space respectively, the actual value of the relative error analysis and predictive value, obtains the curve as shown below:

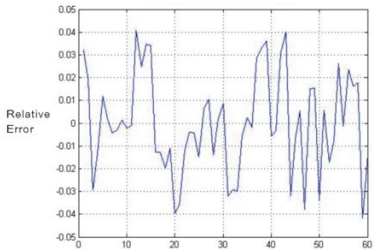

Fig.3 Sample of Relative Error

4)Maximum expected return model

The so-called overbooking refers to the cruise ship set sail before the sale of the number of seats over the cruise real in some capacity, in order to ease due to passengers cancel reservations, repeat booking, a refund and other reasons caused by the loss of vacancies. However, the sale may result in some of the holders of the full load and was refused to board. The cruise company had to pay high economic compensation. Research on overbooking is statistical analysis of various kinds of data analysis, make accurate predictions and calculated a can cruise benefit as large as possible, and can make the number of DB small optimal equilibrium point as far as possible, namely the best booking level. R (M) of the cruise ship's expectations:

$$R(M)=\sum_{Y=0}^{M}\binom{M}{Y}P^{Y}(1-P)^{M-Y}\left[M_p-F(Y,C)\right]$$

$$=M_p-(h+1)p\sum_{Y=C+1}^{M}\binom{M}{Y}P^{Y}(1-P)^{M-Y}(Y-C)$$

Assumptions do not account for the different cruises between the pricing influence, we ignore the influence of different space, and the different price be represented by the different space booking number and the corresponding price multiply and add, cruise company's total revenue can be obtained. According to the problem that: every cruise voyage the seating capacity of 1200C. By the voyage weekly actual predetermined number of non full cumulation table, combined with cruise per voyage weekly scheduled average price, obtained the cruise ticket price p=1226.8.

If a customer to votes arrived the probability p = 0.85; because of the ultra ticket was denied boarding compensation coefficient h is 0.6, which is an overloaded passengers to pay the compensation amount accounted for the proportion of the average price of the ticket is 0.6.Therefore, the results can be calculated as:

Maximum return R=1723255.6

Now the corresponding number of ticket M=1422; that is, the amount of m=222.

Conclusion

1) forecast of actual forecast: AR model, Grey Prediction GM (1,1) and differential equations of the three models are more commonly used to forecast data, but in the prediction of the voyage number AR model can good and fitting the original data and the original data can be ideal forecast; grey pre test and differential equation, the error is large, is not suitable for the prediction.

2) voyage booking price forecast: The AR time series model is ideal for a predetermined price each week to predict the trend of the voyage.

3) forecast average price: The average price of different space actual value and predictive value of relative error is analyzed, and get the actual value and the predicted values of the residual amount is very small. The results are ideal.

4) maximum expected ticket revenue model: For flight 8, the maximum income R=1723255.6 yuan, at this time the corresponding number of ticket M=1422; that is, the amount of m=222;

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