Research on cruise pricing strategy based on Forecast

Bin Wang

North China Electric Power University, Beijing, 100041, China

Keywords: cruise pricing strategy, forecast, GARCH model

Abstract. Based on the analysis of the cruise booking and price data, this paper studies the problem of the cruise pricing based on the forecast. This paper builds on the voyage each week booking GARCH, accommodation was predicted, and achieved ideal effect.

1 Problem repeating

The booking of a cruise ship is conducted in advance booking, before 0 to 14 weeks for a predetermined period. Cruise Company in order to obtain each voyage of the ticket income is expected, I hope through historical data prediction every voyage 0 weeks to 14 weeks the number of booking, booking accommodation prices. In order to ensure the stability of price, need to limit the same voyage two weeks between adjacent floating price ratios. Intend to book a number of people (The number of fill in the information table is not paid) into the actual number of people (Fill in the information table and the payment number) and the price is closely related to the pricing plan.

Known as a cruise company has a cruise aboard a 1200 space, space is divided into three, 250 first-class accommodation, 450 a second-class cabin, 500 three space. The weekly round trip cruise voyage, with a price of two weeks between adjacent floating ratio should not exceed 20%. The problem is: the number of forecast each week booking of every voyage.

2 Model hypotheses

（1）Assuming that the observation data is true and reliable

（2）In the short term, there is no large natural disasters, such as earthquakes, tsunamis and typhoons.

（3）Assuming a week each space booking price distribution from the uniform price range in oral

（4）When the price remains unchanged, can rise to the senior class, visitors will upgrade to 1

（5）If tourists on board, if the expectations are consistent with the actual situation, they won't require upgrades, which will upgrade to 0；On the contrary, probably because of congestion, service quality and other reasons temporarily change his mind and upgrades.

3 GARCH Forecasting model

The large value of time series may cause greater instability (i.e., large variance), which often occurs in time series, and is called (condition) of different variance. For this case, the GARCH method can be used to process. Bollerslev (1986) introduced the generalized autoregressive conditional (GARCH) model by introducing the ARCH model to Engle (1982). Its structure is as follows:

$$\begin{cases} x_t = f(\mathrm{t}, \mathrm{x}_{t-1}, \mathrm{x}_{t-2}, \cdots) + \varepsilon_t \\ \varepsilon_t = \sqrt{h_t} e_t \\ h_t = \omega + \sum_{t=1}^{p} \eta_i h_{t-i} + \sum_{j=1}^{q} \lambda_j \varepsilon_{t-j}^2 \end{cases}$$

GARCH model is based on the ARCH model, which is based on the P model, which is

considered to be an effective method for the long memory.

4 Model order and parameter estimation

The choice of model order can be determined by the following 3 methods: ACF and PACF method, AIC method and BIC method. Among them, ACF and PACF are more commonly used, the AIC criterion is higher than the order of BIC. The estimation method of GARCH model parameters is mainly conditional maximum likelihood estimation, Whittle estimation and minimum absolute deviation estimation. The first method is the benchmark estimate, which is widely used in banking. Finally, a class of methods is required to model a heavy tailed error. In fact, when the extent of the heavy tail is increased, the performance of the Gauss maximum likelihood estimation is poor. However, this is not always the case in terms of the minimum absolute deviation estimate, because it is stable relative to the heavy tail.

The prediction of the model is based on the observation data including the present and the past, and the observation data of the exogenous variable, and the value of the future time is estimated. So, how to use the existing data to get the best prediction results is a key step in the method.

5 GARCH model

Based on the applicability of the GARCH model, when the time series data has a significant trend or a decrease, it is considered that the sequence is suitable for GARCH model. Figure 1-6 for the first - second times the average price of the first class of the first class, two class, three class average price of the original sequence diagram.

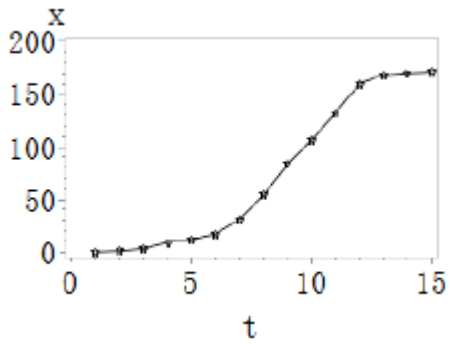

Figure 1 First first class cabin

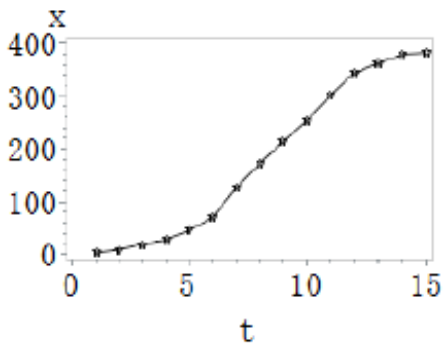

Figure 2 First second class cabin

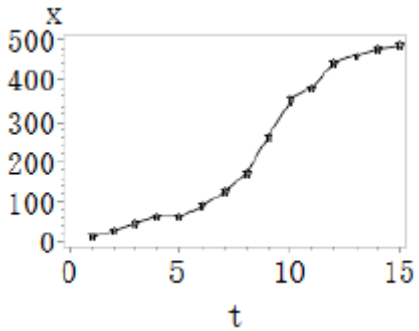

Figure 3 First third class cabin

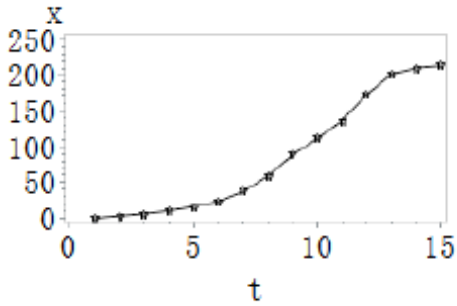

Figure 4 Second first class cabin

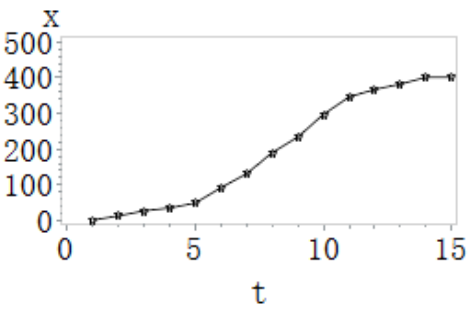

Figure 5 Second second class cabin

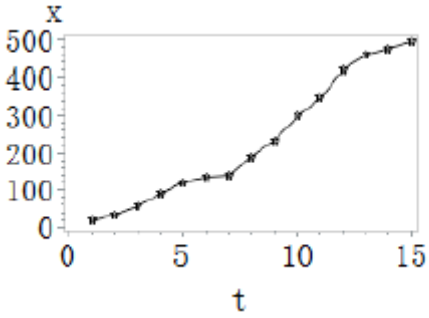

Figure 6 Second third class cabin

Time sequence diagram shows that the sequence has a significant linear trend, and the fluctuation amplitude increases with time, so the linear regression model of the time series is established by using AUTOREG process, and the autocorrelation of the residual sequence and the variance of the residuals are tested. If the test results show that the residual sequence has significant autocorrelation, the establishment of the residual regression model; if the residual sequence has a significant difference, then to establish the conditional model of different variance.

In view of the great flexibility of the GARCH model, the order of the model is adopted in order to get the most reasonable model. According to the results of time series test, the autocorrelation of the residual sequence is shown, and the number of feasible steps is estimated, and the model is diagnosed, and the model set is selected. If the model of the whole model is high, and the normality test is not significant, it can be considered that the model fitting effect is very good, and the parameters of the GARCH model of the data sample are estimated as table 1.

Table1 GARCH model parameter estimation

	1 头等	2 头等	3 头等	4 头等	1 二等	2 二等	3 二等	4 二等	1 三等
Intercept	-5.9697	-16.1098			-27.5140	-30.1334	-37.2234	-33.8223	-24.6195
t	10.1374	15.0333	13.5435	11.7604	27.3414	29.1084	26.2489	29.9967	33.3168
AR1	-1.7677	-0.9337	-0.9510		-0.8930	-0.8750	-0.9211	-0.9062	-0.8895
AR2	0.9313	101.3192							
ARCH0	27.4993	0.004393	108.4356		259.6045	277.0162	221.7639	407.7466	595.5515
ARCH1		0.1205	0.1708				0.5719	0.2601	0.1021
GARCH1		-16.1098							
MSE	27.97880	115.93333	131.32542	70.70868	262.17567	335.35387	613.14459	561.27341	669.93416
正态性检验	0.4370	0.6185	0.5387		0.4673	0.7405	0.3953	0.4580	0.4251
R^2	0.9939	0.9815	0.9944	0.9905	0.9871	0.9854	0.9792	0.9817	0.9789

Parametric test results show that more than 12 model 2 R are as high as 0.9, and the normal test was not significant (P > 0.05). This and it is assumed that the GARCH residuals function obey normal distribution coincide, so that more than 12 model successfully fitted

6.Conclusions

In this paper, the GARCH method is established for the prediction of the voyage booking, and the ideal results are obtained. Based on these models, we establish the optimization model. As a result, we get the maximum expected return ticket model, so that the expected maximums return

ticket for the company to develop the upgrade plan.

References

[1]Pinson P，Kariniotakis G N．Wind Power Forecasting Using Fuzzy Neural Networks Enhanced with On-line Prediction Risk Assessment [A]. In: Power Tech Conference Proceedings 2003 IEEE[C]. Bologna: 2003.

[2]Damousis I G，Dokopoulos P. A Fuzzy Expert System for the Forecasting of Wind Speed and Power Generation in Wind Farms[J]. Power Industry Computer Applications，2001,(4)：63-69．

[3]Wang P，Billinton R ．Time-sequential Simulation Technique for Rural Distribution System Reliability Cost/worth Evaluation Including Wind Generation as Alternative Supply[J]．IEEE Proceedings on Gener, Transm,and Distrib, 2001，148(4)：355-360．