The Application of ARIMA Model in the Prediction of the Electricity Consumption of Jiangsu Province

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Abstract. Forecasts of electricity can play a rational allocation of resources and avoid wasting. It is an important guiding significance to the regional economic development. Based on the annual electricity consumption data of Jiangsu Province, the ARIMA model of Jiangsu Province's electricity is established and make prediction.

Keywords: The Electricity Consumption ARIMA model prediction.

There is important guiding significance about the accurate prediction of electricity consumption to the production management, planning and construction of power systems. It can provide a basis for electric power enterprise for the enterprise goals, the development planning and the business strategy. As the power consumption affected by the level of economic development, industrial structure changes and people's income levels. It is difficult to adopt factor analysis by the changes of randomness and relevance of the factors, and the predictions are also inaccurate. This paper will adopt model ARIMA to recognize the nature and structure of time series to get the optimal prediction.

1 Introduction

ARIMA model is a common and effective method as one of kind of time series prediction method. The variable $Y_t$ is explained with the lag variable $Y_{t-d}$ and random error terms, rather than the k-exogenous variables $X_1, X_2, X_3,..., X_k$ in a general regression model. The ARIMA method can find a suitable model of study data in the case of unknowing the date model, so it has been widely applied in the financial and economic fields. Its specific form can be expressed as ARIMA $(p, d, q)$, Where $p$ represent the order of autoregressive process, $d$ represent the order of difference, $q$ represent the order of moving average process. If the data sequence is non-stationary, we need to make d-order difference to smoothing it and then establish the ARIMA model. Otherwise, there is no need to differential it. We can directly fitting it with the ARMA() model or the ARIM$(p, 0, q)$ model.

ARIMA process can be expressed as a general model:

$$Y_t = \theta + \alpha Y_{t-1} + \alpha_2 Y_{t-2} + \ldots + \alpha_k Y_{t-k} + \beta \mu_{t-1} + \beta_2 \mu_{t-2} + \ldots + \beta_q \mu_{t-q}$$
The use of ARIMA (p, d, q) model to fit the time series is just to use the combination of a different order of the autoregression, the differential, and the moving average to express a variety of information of the time series. So if you can select an appropriate order for the ARIMA model, it can become an effective method of economic analysis and forecasting.

2 Application

DL is recorded as the variables of the total annual electricity consumption of Jiangsu Province and the Empirical Analysis bases on the date of the annual electricity consumption of Jiangsu Province from 1980 to 2008 (Data are from Statistical Yearbook of Jiangsu Province). The following analysis is achieved with Eviews6 statistical software.

2.1 Model Identification

First of all, the data must be stable when we use the b-j method to establish the ARIMA model. From Figure 1, we can see that the Observed values of consumption has not fluctuated around but increases over time. In order to get a smooth time series, we made the natural logarithm transformation to the original sequence and the new sequence is recorded Ldl. Differentiate the new sequence and then conduct the unit root test for the sequence using ADF method. The results are shown in Table 1.

![Fig. 1. The electricity consumption (1980-2008)](image)

<table>
<thead>
<tr>
<th>order</th>
<th>ADF</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-2.92</td>
<td>0.0554</td>
</tr>
<tr>
<td>2</td>
<td>-5.33</td>
<td>0.0002</td>
</tr>
</tbody>
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The unit root test results indicate that non-stationary series Ldl become stable by second-order difference. Therefore, we can determine d = 2. Namely, we can establish the arma(p,q) model based on the second-order difference stationary series.