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Construction of Short-Term Forecast Model of Eggs Market Price

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Abstract

China is the great power of poultry in the world, and its egg production ranks first in the world. With the transition of China's agricultural products market from the planned circulation system to the free flow circulation under the national macro-control, the cyclical fluctuations of eggs market price were increasingly frequent. The healthy development of China's eggs industry was related to how to filter the variable factors and establish econometric models that could realize timely and dynamic monitoring on short-term fluctuations of eggs market price, which also provided real-time market information and trends for farmers, enhancing their ability against market risk and increasing their income. According to the characteristics of poultry industry and the conditions of data acquisition, four correlation factors accessing to timely and comprehensive data were selected as independent variables. The short-term forecast model on eggs market price was constructed and tested with the validity. Also the forecast results of that model were evaluated. The significative exploration on short-term prediction market price of agricultural products was made in this paper.

Key words: eggs, market price, short-term forecast of market price, impact factor, econometric model, forecast

Eggs and their products, widely used all over the world, are the main kind of the traditional animal derived food. China is the great power of poultry in the world, and the numbers of poultry bred and eggs output are highest in the world. Since 1985, China has maintained the status of eggs production superpower for 25 years. China's eggs production was 27.027 million ton in 2008, and the share of global market surged to 44.5% from 10.07% in 1961. With the transition of China's agricultural products market from the planned circulation system to the free flow circulation under the national macro-control, market liberalization has also brought the cyclical fluctuations of market price eggs. This round of price fluctuations, beginning in June 2007, caused great concern in the community because of its big margin and high speed.

Therefore, it is significant that how to monitor duly and dynamically the main impact factors of short-term eggs market price fluctuations, and forecast accurate and timely fluctuation trend of short-term eggs market price. Because it is not only related to the healthy development of China's eggs industry, but also provides real-time

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market information and trends for farmers, enhancing their ability against market risk, improving market competitiveness and increasing their incomes.

1. Choice of Variable Factors

The fluctuations of eggs market price were a comprehensive reflection of the situation about the eggs production, circulation and distribution, which were effected not only by the typical factors such as eggs supply and demand, but also by the typical factors such as the market structure, expectations and speculation, location and quality. To forecast the factor model of short-term eggs market price, the variables were consisted fundamentally by the main factors that affected short-term eggs price. According to the characteristics of China's poultry industry, four correlation factors accessing to timely and comprehensive data were selected as independent variables, forecasting the factor model of short-term eggs market price.

1.1 Commercial Layers Market Price

As the main constitution affecting eggs supply and cost, the short-term eggs market price is influenced directly by commercial layers market price. In general, commercial layers and eggs prices are interactive. When eggs price increases continuously, it will drive up the commercial layers price and affect breeding layers, eggs supply and egg market price in the next season. For example, as the eggs price surged in 2007, the incubate businesses operated at full capacity, and commercial layers and eggs prices dropped in 2008. The sale of commercial layers was roughly estimated 20% less in 2008 than in 2007[9]. This also was a significant reason why eggs price rose in the first half of 2008.

1.2 Layer Feed Prices

Eggs as a kind of poultry product are the conversion of feed in essence. Farmers prepared their own feed in which corn and soybean meal respectively accounted for 60% to 65% and 20% to 25%. The enthusiasm of farmers in breeding was influenced by layer feed price, thus affecting eggs supply. on the other hand, it affected short-term eggs price directly. By the end of October 2007, the domestic feed price rose, causing the price of both commercial layers and parents layers prices dropped shapely. In that month, commercial layers and parents layers were obsolete about 25%.

1.3 Previous Price of Eggs

The study on short-term forecasts of eggs market price, of which the fluctuation was effected by the inertia of previous price, was a typical research of time series analysis. The previous price of eggs was brought into variable analysis when the forecast model on eggs price was established, achieving time trend affecting eggs price. In this study, first-order and second-order lag on eggs price were conducted as the independent variable, establishing the regression model of short-term eggs market price.

2. Establishing and testing short-term forecast model of eggs market price

Four predictor factors were selected previously, and monthly prices of each factor and eggs were analyzed and tested relevance and long-term stability. Based on the results, using Eviews analysis software, regression model was established. Finally, the validity and practicability of regression model were verified through the statistical test.

All the data in the research were monthly eggs, commercial layers and layer feed market prices from March 2000 to September 2009, sourcing from Animal Husbandry Division web site, Ministry of Agriculture.

2.1 Establishing Short-Term Forecast Model of Eggs Market Price

Short-term forecast model of eggs market price was established by four variables——first-order and second order lag of monthly eggs, commercial layers and layers feed market prices. Using EVIEWS analysis software, the model was ideal. The equation of short-term forecast model of eggs market price was expressed as follows:

$$QD=0.3043CL+0.4907SL+1.0433QD(-1)-0.2739QD(-2)$$
$$(11.15)\quad(-3.10)\quad(2.87)\quad(3.24)\quad(-0.999)$$
$$R^2=0.9592\quad DW=1.8571\quad s.e=0.220455\quad F=646.0767\quad T=115$$

In this equation, QD was on behalf of monthly eggs market price. CL represented monthly commercial layers market price. SL represented monthly layer feed market price. QD(-1) was in the name of first-order lag of monthly eggs market price. QD(-2) represented second-order lag of monthly eggs market price.

2.2 Validity Test of the Model

Through the simulation above, short-term forecast model of eggs market price was screened out. But the equation need to be tested and estimated that whether the model was consistent with theoretical assumptions and could make scientific forecast about the future price changes. If classical assumptions were violated, parameter estimates did not have the minimum variance, which was called the loss of validity. The violation of normality assumption would lead to t-statistic not obey the T distribution. Therefore this model could not forecast short-term market price accurately. Short-term forecast model of eggs market price was tested for normality, autocorrelation and heteroskedasticity, and the results were in line with theoretical assumptions. Therefore, the model was shown validity and could be used to forecast and analyze short-term change of eggs market price.

2.2.1 Normality Test

The results of normality test for short-term forecast model of eggs market price was shown in Figure 1. Compared the "Probability" of "Jarque-Bera" with the 5 percent significance level, if the result was greater than 0.05, the assumption that the random disturbance was normality was tenable. Otherwise, the normality assumption was not reasonable. The result here was 0.055898, greater than 0.05. It was concluded that random disturbance was normality, consistent with the forecast premise. The model passed the normality test.

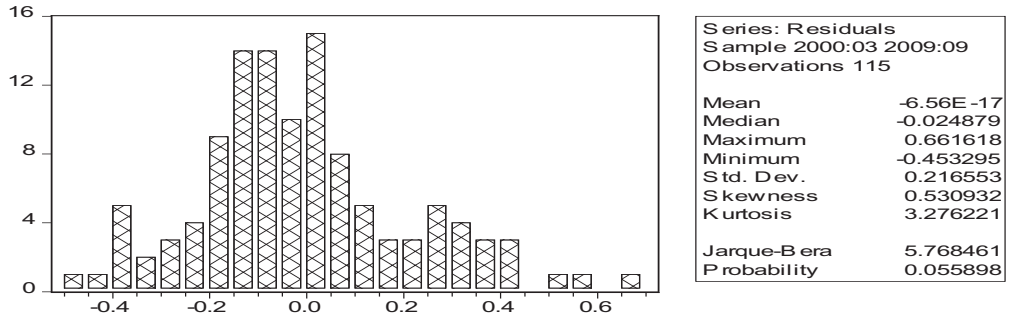

Figure 1 Normality Test on Short-Term Forecast Model of Eggs Market Price

2.2.2 LM Autocorrelation Test

In the LM autocorrelation test, the corresponding probability of the "Obs*R-squared" was compared with the 5 percent significance level. If it was greater than 0.05, the original hypothesis that there were no autocorrelation (the first-order, or N-order) was accepted. Otherwise, there was autocorrelation. In the LM autocorrelation test, the probability of first-order autocorrelation in the model was 0.079506, greater than 0.05, which indicated that there was no autocorrelation in short-term forecast model of eggs market price (Table 1).

Table 1 LM Autocorrelation Test Results of Short-Term Forecast Model of Eggs Market Price

F-statistic	2.994606	Probability	0.086372
Obs*R-squared	3.074966	Probability	0.079506

Test Equation: Dependent Variable: RESID
Method: Least Squares Date: 11/07/09 Time: 15:30
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
QD(-1)	-0.385368	0.241233	-1.597493	0.1131
QD(-2)	0.324232	0.206766	1.568113	0.1198
CJ	0.074851	0.113472	0.659647	0.5109
SL	0.140497	0.170691	0.823110	0.4122
C	-0.044585	0.149140	-0.298946	0.7656
RESID(-1)	0.432418	0.249882	1.730493	0.0864

R-squared	0.026739	Mean dependent var	-6.56E-17
Adjusted R-squared	-0.017906	S.D. dependent var	0.216553
S.E. of regression	0.218483	Akaike info criterion	-0.153454
Sum squared resid	5.203094	Schwarz criterion	-0.010240
Log likelihood	14.82359	F-statistic	0.598921
Durbin-Watson stat	1.908466	Prob(F-statistic)	0.700825

2.2.3 White Heteroskedasticity Test

In White heteroskedasticity test, the corresponding probability of the "Obs*R-squared" was compared with the 5 percent significance level. If it was greater than 0.05, the original hypothesis that there was homoskedasticity was accepted. In the White heteroskedasticity test, the value of its probability was 0.160419 in this model, greater than 0.05, indicating no heteroskedasticity (Table 2).

Table 2 White Heteroskedasticity Test of Short-Term Forecast Model of Eggs Market Price (With Cross-Term)

F-statistic	1.514819	Probability	0.160644
Obs*R-squared	11.79860	Probability	0.160419

Test Equation: White Heteroskedasticity Test Date: 11/06/09 Time: 10:57
Dependent Variable: RESID^2 Method: Least Squares
Sample: 2000:03 2009:09 Included observations: 115

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.710226	0.530968	-1.337606	0.1839
QD(-1)	0.258072	0.211710	1.218990	0.2256
QD(-1)^2	-0.019330	0.015895	-1.216056	0.2267
QD(-2)	-0.093934	0.195865	-0.479586	0.6325
QD(-2)^2	0.006106	0.014613	0.417842	0.6769
CJ	-0.008028	0.256270	-0.031326	0.9751
CJ^2	0.017394	0.053548	0.324836	0.7459

SL	0.177099	0.418841	0.422832	0.6733
SL^2	-0.039424	0.093907	-0.419821	0.6755

R-squared	0.102597	Mean dependent var	0.046487
Adjusted R-squared	0.034868	S.D. dependent var	0.070443
S.E. of regression	0.069204	Akaike info criterion	-2.428486
Sum squared resid	0.507655	Schwarz criterion	-2.213665
Log likelihood	148.6379	F-statistic	1.514819
Durbin-Watson stat	1.980940	Prob(F-statistic)	0.160644

2.3 The Result Analysis of Short-Term Forecast Model of Eggs Market Price

From the test results of the model above, the established short-term forecast model of eggs market price was effective, which could be used to forecast the future eggs market price. Actual values compared with the fitted values, the residuals basically fluctuated in 0.5 ranges (Figure 2).

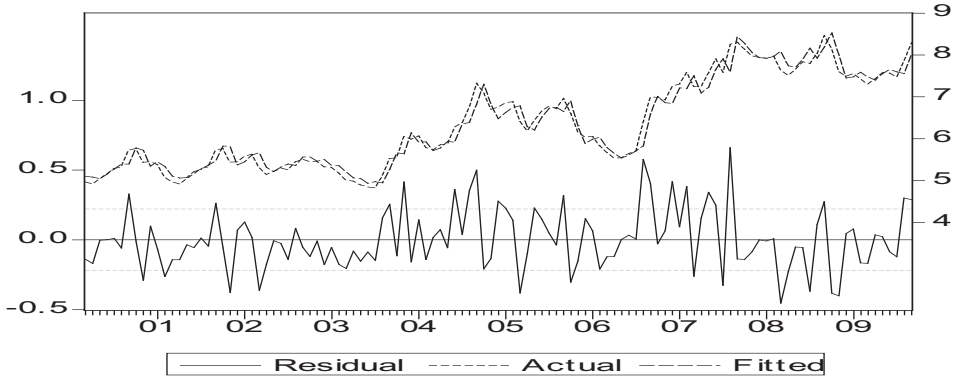

Figure 2 the Actual Value, Fitted Values and Residual Plots of Monthly Eggs Market Price

3. Discussion

Eggs market price was influenced by many factors. Theoretically, the more factors were considered in short-term forecast, the higher the reliability of forecast was. However, it was extremely complex relationship between various factors. Therefore in practice, considering data availability, all the variables could not be taken into account in a model. From a practical point of view, the real value of the model was not the complexity, but the accuracy of forecast. In this study, the impact factors of short-term model was selected as the result of a long-term tracking and monitoring analysis, combining a typical investigation and the data availability. The model established in this paper was used for short-term forecast, and the result of simulation forecast was good. But there was something to be improve, also which was further researches:

(1) Most results forecasted by short-term forecast model which was built in this study, could be achieved most the requirements. However, the forecast result of short-term price fluctuation, which caused by unexpected event (such as meteorological factors, quality and safety incidents, avian flu, etc.), was not always effective. Therefore, action mechanism of emergency need to be further studied.

(2) In the interpretative aspect of the result, factor model was better than time series prediction method. But the result of dependent variable depended on the accuracy of explanatory variables to a great extent. That is to say, in order to forecast independent variable, the trend of explanatory variable should be predicted firstly. In a way, the difficulty of short-term forecast was increased further.

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