The analysis of the multivariate linear regression model of

soybean future influencing factors

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Abstract: China's soybean futures market is not mature, and there is a large space for development. In this paper, by using data statistics, on March 10, 2017 - March 21, 2018, during the 253 session of soybean (mainly is to use yellow soybeans futures close no. 1 and the relationship between the closing price of soybean meal, soybean oil were analyzed, and found that soybean futures price fluctuation is short time severe problems. In the face of this situation, government departments should be prepared to monitor the full risk of the supply of soybean stocks, and the market participants should be prepared to respond to market risks.

Key words: soybean futures; The closing price. The correlation

1. Introduction

As soybean in China's largest consumer, its development situation is not optimistic, represented by harsh natural conditions of force majeure factors and is difficult to prevent market risks to seriously hindered the development of soybean industry in China. On the other hand, there are endless examples of "valley farmers". At present, the existence of the leverage in the futures market and the investors' ability to deal with the market information ability need to be improved, which makes the futures market more volatile. In addition, China's futures market existence of herding effect significant effects on the market, combined with Chinese "buy or not to buy up" psychological, soybean futures market, single movements for a short period of time, increased market risk.

2. Model setting and inspection

(1) Source of data.

In order to analyze the relationship between the fluctuation of soybean futures price and the change of soybean meal and soybean oil futures price,the settlement price of soybean, soybean meal and soybean oil on March 21, 2017 will be selected. Select "soybean settlement price" (unit/yuan) as the explanatory variable (expressed in Y); Select "soybean meal settlement price" (unit/yuan) as explanatory variable (X_1), and "soybean oil settlement price" (unit/yuan) as explanatory variable (X_2).

In order to analyze the influence of soybean meal futures price (X_1) and soybean oil futures price (X_2) on soybean futures price (Y), the computer software Eviews was used to do econometrics analysis.

(2) Model setting.

In order to show the relationship between P1 (soybean meal settlement price), X2 (soybean oil settlement price) and Y (soybean settlement price) intuitively. Make a line graph with the date as the

x-coordinate, with the price (unit/yuan) as the ordinate, as shown in figure 1 (the change line chart of Y and X1 and X2 in September 2016):
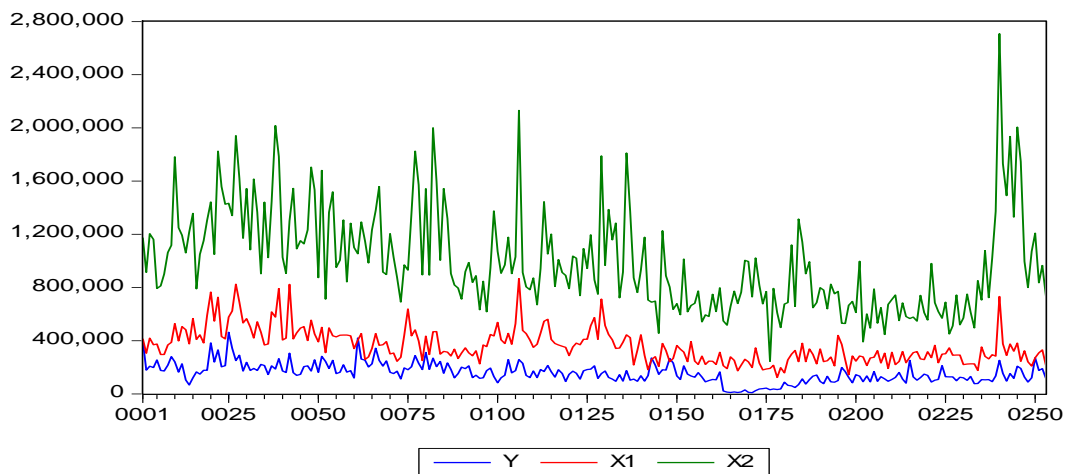

FIG. 1 change line graph of Y and X1 and X2

On the whole, the price of soybean meal has been fluctuating regularly; The price of soybean oil declined at the end of the year. The change of price of two explanatory variables is consistent with the change of soybean price. Judgment of the soybean futures price and the differences between various influencing factors, it changes direction, there may be some correlations between each other, exploring to set the model for the linear regression model form:

$$Y_{ii} = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \mu_i$$

Eviews estimation model parameters are shown as below:

Dependent Variable: Y
Method: Least Squares
Date: 03/26/18   Time: 10:03
Sample: 0001 0253
Included observations: 253

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	27124.16	11730.81	2.312216	0.0216
X1	0.247963	0.039062	6.347953	0.0000
X2	0.040743	0.013376	3.045889	0.0026

R-squared	0.356250	Mean dependent var	157349.9
Adjusted R-squared	0.351100	S.D. dependent var	74021.88
S.E. of regression	59627.84	Akaike info criterion	24.84142
Sum squared resid	8.89E+11	Schwarz criterion	24.88332
Log likelihood	-3139.440	Hannan-Quinn criter.	24.85828
F-statistic	69.17469	Durbin-Watson stat	1.059049
Prob(F-statistic)	0.000000		

FIG. 2 regression results of the model

According to the data in FIG. 2 (regression result), the result of the model estimation is written:

$$\hat{Y}_i = 27124.16 + 0.2479 X_1 + 0.0407 X_2$$

$$(11730.81)(0.0396)(0.0134)$$

$$t = (2.3122)(6.3479)(3.0459)$$

$$R_2 = 0.3523 \quad \bar{R}_2 = 0.3511 \quad F = 69.1747 \quad n = 253$$

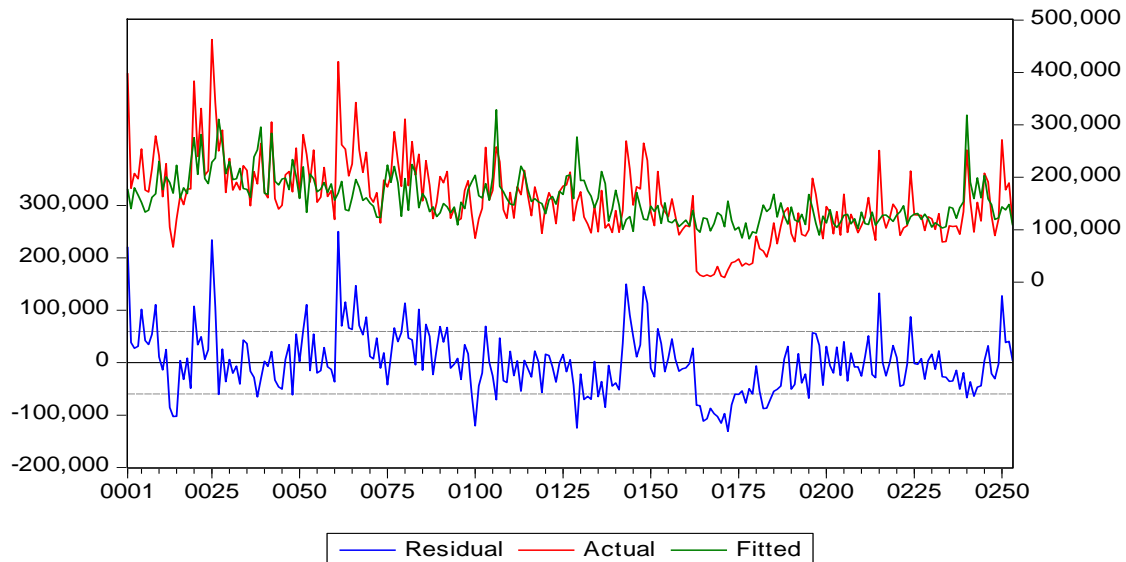The regression results are shown graphically:

FIG .3   Residual value, actual value, fit value graph

(3) Model Test.
1. Economic significance test.

According to the model estimation results, the estimated parameters $\hat{\beta}_0 = 27124.16$, $\hat{\beta}_1 = 0.2479$, $\hat{\beta}_2 = 0.0407$, indicating that the price of soybean meal increases by 1 yuan when the price of soybean meal increases by 1 yuan, and the average soybean price increases by 0.2479 yuan. Soybean oil price increases by 1 yuan, the average soybean price increases by 0.0407 yuan.

This is consistent with theoretical analysis and empirical judgment.

2. Statistical test.

F inspection: in view of the H: $\beta_0 = \beta_1 = \beta_2 = 0$, for a given level of significance $\partial = 0.05$, found among Eviews degrees of freedom for k - 1 = 2 and n - k = 251 threshold $F_\partial (2, 251) = 3.0315$, due to the F≥ 69.1747, should reject H0: $\beta_0 = \beta_1 = \beta_2 = 0$, shows that the regression equation, namely each explanatory variables in regression equations "price of soybean meal and settlement" and "soybean oil settled" variables together significant influence on "soybean settlement price".

T test: for $\beta_j = 0 (j = 0,1,2)$, respectively, for a given level of significance $\partial = 0.05$, in the Eviews finds out the critical value of degrees of freedom for n - k = 251, $\hat{\beta}_0, \hat{\beta}_1, \hat{\beta}_2$, at this time, the corresponding T

statistic were 2.3122, 3.3479 and 3.0459, and its absolute value is greater than, this shows the significance level, respectively, should be rejected. Regression equation that is to say, the effect is remarkable, the regression equations of each variable "soymeal settled" (X_1) and "soybean oil settled" (X_2) variable combined influence on "settled" soybean significantly.

(4) Regression Prediction.

Estimated by using soybean settlement price impact model, through the corresponding yields, "price of soybean meal and settlement" (X_1) and "soybean oil settled" (X_2) forecasting data, to "price of soybeans and settlement" (Y) and interval prediction.

1. Point prediction

If the settlement price of soybean meal is 600000, the settlement price of soybean oil is 1800000, and the estimated price of soybean futures can be predicted by using the estimated model. The calculation formula of point prediction is as follows:

$$Yf==27124.16+0.2479\times600000+0.0407\times1800000=249124.16$$

2. Interval prediction

In order to forecast period average E (Yf) interval prediction, take confidence level of the average prediction interval analysis point prediction Yf and forecast period average E (Yf), the relationship between and analysis of the properties of probability distribution:

$$\hat{Y}_f - t_{\frac{\partial}{2}}\,\hat{\delta}\sqrt{X_f(X'X)^{-1}X'_f} \le E(Y_f) \le \hat{Y}_f + t_{\frac{\partial}{2}}\,\hat{\delta}\sqrt{X_f(X'X)^{-1}X'_f}$$

The confidence interval of Yf average E (Y_f) is obtained：

$$215829.67\le E\,(Y_f)\le361857.21$$

In other words, when the settlement price of soybean meal is RMB 600000 and soybean oil futures price is RMB 1800000, the prediction interval of the average confidence level of soybean futures price Y_f is (215829.67, 361857.21).

	Y	X1	X2
Mean	157349.9	361439.4	996550.8
Median	152106.0	341018.0	913516.0
Maximum	462692.0	865902.0	2708168.
Minimum	8690.000	123602.0	244470.0
Std. Dev.	74021.88	130071.9	379838.2
Skewness	0.724755	1.192175	1.055660
Kurtosis	4.519867	4.937680	4.344442
Jarque-Bera	46.50005	99.51043	66.04565
Probability	0.000000	0.000000	0.000000
Sum	39809526	91444176	2.52E+08
Sum Sq. Dev.	1.38E+12	4.26E+12	3.64E+13
Observations	253	253	253

FIG. 4. Statistical results of the description of X_1, X_2 and Y.

In the Eviews software, the figure of predictive value and standard error is displayed, as shown in the figure below:
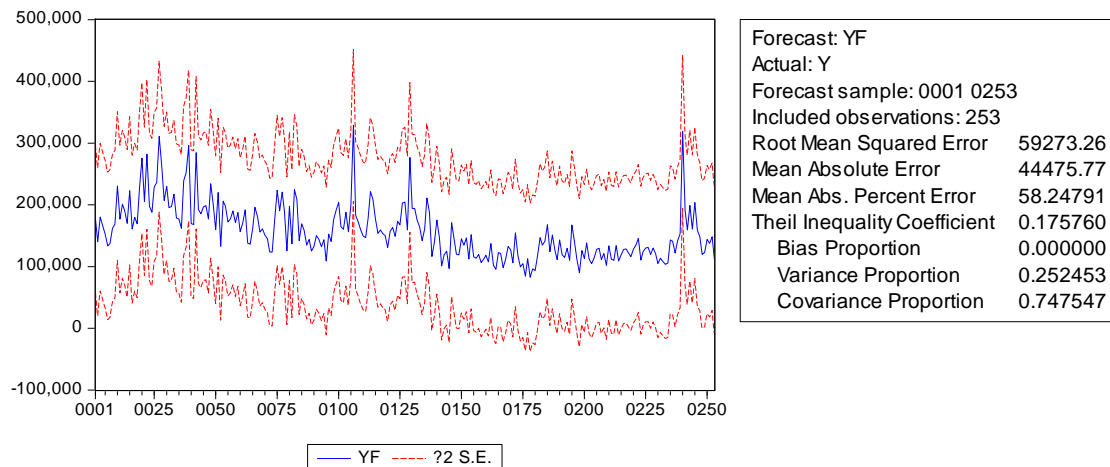
FIG. 5 Prediction and standard error.

3. Conclusions and recommendations.

(1) Conclusion

1. The price fluctuation of soybean futures is regular, and soybean futures price has a high correlation with soybean meal and soybean oil price. Therefore, we should pay attention to the price fluctuation of soybean meal and soybean oil as well as the effect of price fluctuation of soybean meal.

2. The fluctuation of soybean price has the characteristics of clustering, which has the following characteristics: after a large fluctuation, there is a small fluctuation, which reflects the time variability of soybean price. The clustering of soybean futures price changes also shows the positive correlation and positive feedback effect of price fluctuation.

(2) Suggestions

1. Strengthen the soybean futures market risk monitoring, due to price fluctuations shows the cluster effect, in the short term the price volatility, volatility increases obviously, and with small fluctuations in last longer. Therefore, it is necessary to strengthen the regulation function of the risk of continuous market fluctuation, and be ready to monitor the market continuously.

2. Increase the spot reserve of soybean properly, because the price of soybean futures will increase sharply in a short time, which leads to the obvious increase of soybean futures risk. The government appropriately increase soybean spot is one of effective means to manage market risk, when the market risk is large. The use of reserves of soy in and out of the market to regulate market risk.

3. In addition, other market participants in the market, risk management, also should consider to soybean futures price volatility risk, considering the characteristic of risk in the market, to market risk at any time.

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