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Empirical analysis of palm oil futures price volatility based on EGARCH model

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Abstract: In this paper, the research object is the palm oil futures daily closing price, time: 2012-1-4 to 2012-1-4, the yield of palm oil futures daily volatility clustering, establish a GARCH model and EGARCH model, results show that the EGARCH model is better than GARCH model reflects the yield of palm oil futures volatility clustering, different response to the positive impact and negative impact.

Keywords: palm oil, the futures price, the yield, EGARCH

I. Introduction

Palm oil as one of the three big vegetable oil in the world, China in this play an important role, embodied in the main of the world's biggest palm oil importer, China on October 29, 2007 in zhengzhou Commodity Exchange listed the palm oil futures. In food and industrial demand growth, driven by palm oil demand is still growing, with the development of economy, the demand for palm oil in the future for a long period of time may increase, this may form a driving force to keep its prices. Therefore, the description of palm oil price fluctuation is of great significance to hedging and avoiding risks of various participants. In the stock market, a lot of time series data model, the conditional variance is constantly changing, and a cluster, in order to accurately depict the heteroscedasticity, the ARCH model and GARCH model is put forward, the two models under certain conditions of financial assets yield variance prediction more successful. However, the distribution of stock returns has two characteristics: skewness and peak thickness. Although asymmetric GARCH model can well deal with the issue of heteroscedasticity, and can effectively eliminate the influence of yield distribution peak thick tail, but it is difficult to handle well the distribution of the yield are biased, and the model of coefficient of nonnegative constraint is too strong, thus put forward the EGARCH, this model can be a very good solution to the distribution of the yield two features and different variance problem. For the stock and stock index earnings sequence, due to its own inertia and lag effect. Tend to present a different degree of serial correlation, in view of the stock yield sequence correlation, heteroscedasticity, biased and rush fat-tailed features, this paper argues that if the GARCH model is established first, and then re-use EGARCH model dealing with different variance, then it can well solve the palm oil yield fluctuation characteristics, obtain ideal fitting effect.

II. Literature Review

There is a study on thepalm oil.PANG Z Y (2013) studied the product price fluctuated frequently in China, and the current literature. for the theoretical and empirical research whether spot price volatility of agricutual product can be smoothed by future trading are in lack ,and data processing method is simple and coarse, future price and spot price data are denoised, decomposed and reconstructed by using discrete wavelet transform method, and VECM-BEKK-GARCH model is adopted in our empirical study. then GARCH model with dummy variables is constucted to investigate the influencedirectionof listed future contracts to its spot price

fluctuation. the results of empirical study show that spot price fluctuation can be stabilized by listed future contracts, the influence of future contracts is persistent and the influence are different for different varieties.LIU S，TANG T F(2014) measures the returns and volatility spillover effects in China's palm，soybean andrapeseed oil futures markets and American soybean oil future market and Canadian canola future marketby using VAR(1)-GARCH(1，1)-BEKK modelsFurthermore，co-integration test and error correction model are applied to analyze the information transmission within oil futures markets．The results revealthat there is an unidirectional returns spillover effect from American soybean oil future market and Canadian canola future market to the three oil futures markets of China; as for China's three oil futures markets，returns spillover effects from soybean oil to palm oil and from palm oil to rapeseed oil have beenfound; there are bidirectional volatility spillover effects among all the markets except for the effect fromChina's soybean，palm oil markets to rapeseed oil futures market，which is one-way; All markets share astable co-integration relationship and have the same information transmission efficiency． In conclusion，the main finding of this study is that Chicago soybean oil futures market and Canadian canola futures market function as world's soybean oil and rapeseed oil pricing center respectively while Dalian futures market is the pricing center of China's domestic oil product．WANG H,SONG F,CAO F Y,CHEN W J,ZHAO S L(2017)introduces the fatty acid composition and nutrient content of palm oil, and provides a theoretical basis for improving our understanding of palm oil and the market promotion.LIU R J ，WANG C L (2017) analyzed the interaction between palm oil supply and prices of major domestic vegetable oils, and supply reaction of palm oil under positive and negative shocks of prices was studied， as to provide theoretical references for palm oil import management. The interaction between supply and price was assessed un-der the framework of co-integration-GARCH and error correction-GARCH models using monthly palm oil imports ， spotprices of palm oil ， soybean oil and rapeseed oil ， and spot price of Malaysian palm oil. Linear and nonlinear Granger testwas conducted for robustness check. Chinese palm oil processing manufacturers and traders preferred to rely onvariance information accumulated in the past log period（ ARCH effect ）， rather than a prediction variance （GARCH effect）. Compared to rapeseed oil ， soybean oil had much stronger adjusting force on palm oil. The shock of palm oil supplyweakly affected the prices. The signal of price changes with two lags had asymmetric impact on supply of palm oil. There existed no Granger causal relation between supply and price of palm oil. Palm oil import management， marketingbuilding and inventory monitor should be enhance ， and researches on international pricing mechanism of palm oil need tobe deepened.ZHOU L(2018).studied Cross — market Arbitrage Based on Extreme Fluctuation The daily data of rebar futures and spot from the beginning of January 2016 to the end of Sep-tember 2017 are selected． The ratio of arbitrage is determined by cointegration model and GARCH mod-el． The volatility variables for statistical arbitrage are constructed，and compared the arbitrage result withthat of the arbitrage standard deviation and GARCH variance． The results show that: the winning per-centage of the range fluctuation arbitrage sample is 100%，which is much higher than that of GARCH arbitrage and covariance standard deviation arbitrage; the annualized yield reached 123. 37%，slightlyhigher than the GARCH arbitrage 112. 68% and far higher than the covariance standard deviation of15. 93%． On the whole，the use of extreme volatility to carry out arbitrage can achieve excellent results，but the combination of palm oil and methanol is arbitrarily further testing，arbitrage volatility arbitrage overall effect is slightly less than GARCH arbitrage．

III. Empirical Analysis

3.1. Introduction to the GARCH class model

3.11 The ARCH model

Conditional heteroscedasticity model can be divided into two types. The second type is described by stochastic equation, such as stochastic volatility model. ARCH model is called autoregressive conditional heteroscedasticity model, which was developed by Engel (1982). The ARCH (q) model can be expressed as follows:

$$\varepsilon_t = Z_t \sigma_t \quad Z_t \sim i.i.d.D(0,1)$$

$$\sigma_t^2 = w + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-1}^2 \qquad (1)$$

Where, D (.) represents probability density function with unit variance of zero mean.

3.12 The GARCH model

GARCH model is to solve the ARCH lag period and estimate the parameters of the problem and the introduction of a new prediction model, GARCH model with a handful of conditional variances of lag values instead of random perturbation terms lag value of the lot. For the convenience of observation, this paper using GARCH (1, 1) model for palm oil futures price fluctuation law research, GARCH (1, 1) model (1, 1) the order of the number of 1 autoregressive (GARCH) and lag order of 1 squared residuals (ARCH), the standard GARCH (1, 1) model as shown below:

$$\sigma_t^2 = w + \alpha\sigma_{t-1}^2 + \beta\varepsilon_{t-1}^2 \qquad (2)$$

(2) is called the conditional variance equation, the style showed that moment t condition variance depends on the condition of t - 1 case of residual square on the size of the item (i.e., the ARCH) and a period of variance prediction (GARCH).

3.13 The EGARCH model

In order to overcome some weaknesses of the GARCH model in dealing with financial time series, Nelson (1991) proposed the exponential GARCH (EGARCH) model, and Bollerslev and Mikkelsen (1996) re-expressed the EGARCH model.

The simple EGARCH (1,1) model is shown below:

$$\sigma_t = c + c\frac{|\varepsilon_{t-}|}{\sqrt{\sigma_{t-}}} + c\frac{\varepsilon_{t-}}{\sqrt{\sigma_{t-}}} + c\ \sigma_{t-} \qquad (3)$$

3.2. The empirical analysis

Based on the dalian Commodity Exchange of palm oil daily closing price data as sample, time to choose from the date of the palm oil futures listed on January 4, 2012 to May 28, 2018, a total of 1553 days, fry a software data from big wisdom.The broken line graph of the data is shown in figure 1

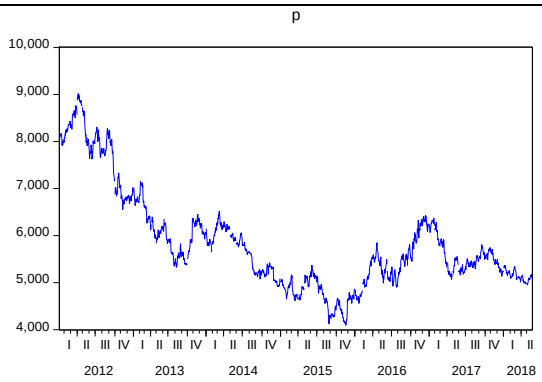

Chart -1 daily closing price of palm oil futures

3.21 Data selection and model preprocessing

By the diagram you can see a before 2015, palm oil prices is the decline of Ming, early in 2015 to the middle of the first quarter of 2017 is obviously rising trend, in the middle of the first quarter of 2017 to early 2017 showed a trend of steady. The application condition data of GRACH model is stable, so the stability of data needs to be tested.

Table 1 stability test of original data

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.109751	0.2409
Test critical values:	1% level		-3.434357	
	5% level		-2.863197	
	10% level		-2.567700	
*MacKinnon (1996) one-sided p-values.				

The display data is non-stationary, and the original data needs to be processed. After logarithm is taken, the difference is:

$$r_t = 100 * (\ln p_t - \ln p_{t-1})$$

Represents the daily yield of palm oil futures, as shown in figure 3 below

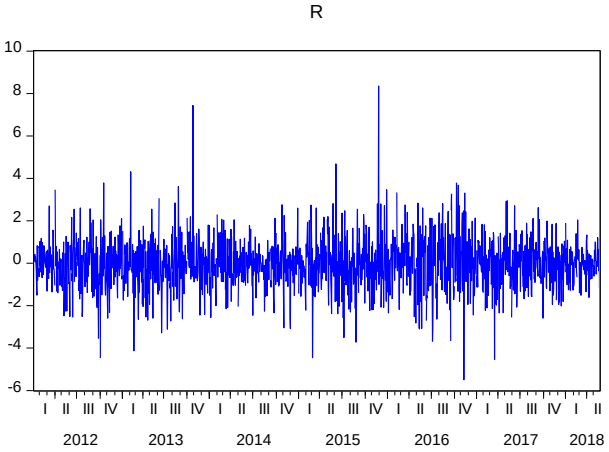

Figure 2 daily yield of palm oil futures

Can be seen from the figure 2 the yield of palm oil futures daily volatility clustering, may have to establish a GARCH model, to ensure smooth data, yield data stationarity test in the following table, the table 2 test results show that the yield data smoothly.

Table 2 stability test of yield rate

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-38.65245	0.0000
Test critical values:	1% level	-3.434360	
	5% level	-2.863198	
	10% level	-2.567701	

*MacKinnon (1996) one-sided p-values.

3.22 Model building

We use conditional maximum likelihood method to estimate GARCH model. The maximum likelihood method must make assumptions about the distribution of residual error. We first assume that residual error follows gaussian distribution, i.e. The GARCH and EGARCH models were estimated respectively, and the order of the model was determined by AIC. The estimated results are shown in table 3.Results show that the GARCH and EGARCH model coefficient is significant in 1% significant level, but the EGARCH model better reflects the yield of palm oil futures volatility clustering, the impact on the positive impact and negative reaction.

Table 3 fitting results

参数	GARCH	EGARCH
C	0.016238	-0.037046
α	0.018343	
β	0.971025	
C(2)		0.059149
C(3)		0.015730
C(4)		0.981766
ARCH TEST	0.9939	0.9776
AIC	3.189318	

IV. Conclusions

Based on the above empirical analysis, we can draw the following conclusions:

(1) By the diagram you can see a before 2015, palm oil prices is the decline of Ming, early in 2015 to the middle of the first quarter of 2017 is obviously rising trend, in the middle of the first quarter of 2017 to early 2017 showed a trend of steady.

(2) In this paper, data of daily closing prices of palm oil futures in recent 7 years were selected. Through analysis of Eviews10.0 statistical software, it was concluded that palm oil futures prices showed obvious variability and volatility aggregation. This also proves that the application of GARCH model can eliminate the

variability and aggregation, which can effectively reflect the palm oil futures price volatility change rule, namely the GARCH model can depict the palm oil futures price volatility. However, the EGARCH model is better than the GARCH model to reflect the volatility and aggregation of palm oil futures yields, and has different positive and negative impact responses.

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