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Study on the Impact of Sino-US Trade War on Chinese Agricultural Commodities Futures

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Abstract: The Sino-US trade war, which intensified fluctuations in the agricultural product futures market and affects everyone's normal life, would definitely has an impact on the agricultural product futures market under the exchange rate connection between two parties.

This paper uses corn and cotton as examples to analyze the impact of exchange rate. The results show that there is a two-way causal relationship between exchange rate and corn, while one-way between exchange rate and cotton.

In the long run, there is a balance between the exchange rate, corn and cotton. In the short term, the variance decomposition shows the exchange rate contributes to corn and cotton for 10.6% and 15.0% respectively, indicating that exchange rate fluctuations affect the prices of corn and cotton futures, and then will influence the spot prices of corn and cotton through the transmission mechanism.

Keywords: VAR model;trade war ;exchange rate fluctuates ;corn price fluctuation ;cotton price fluctuation

1. INTRODUCTION

In January 2018, the U.S. government imposed the highest tax rates on imported large-scale washing machines and photovoltaic products by 30% and 50% respectively. On March 22, the U.S. imposed a tariff of US$50 billion on Chinese goods due to intellectual property infringement and imposed investment restrictions. On April 4th, the White House imposed a tariff of 25% on 1,333 items worth 50 billion U.S. dollars on products imported from China. At the same time, China imposed a 25% tariff on 14 categories of 106 products such as soybeans, automobiles, and chemical products made in the United States. XueRongjiu(2009) believed that the increasing imbalance of economic development is the major trigger of the rise of new trade protectionism. Simon Evenett and Richard Bald-win(2010) pointed out that in a long term, protectionism not only fails to solve problems but also weakens a country's competitive capability, damages employment and national income and aggravates global economic recession. This war would do no good to both parties. Krzysztof Pelc and Christina Davis (2011) also said economic recession will result in larger protectionism and worse negative effect which would deteriorate economy. Chen Yongfu and He Xiurong (2001) discussed the impact of the agricultural trade war on China's trade and economy.

During the trade war, great changes have taken place in Chinese agricultural products futures. Qin Yan and Ni Yan (2013) proved the asymmetry between exchange rate and agricultural product prices. Based on the SVAR study, LvHuiming and Jiang Xiaoyan (2013) found that exchange rate changes have a major impact on domestic agricultural product prices. Corn is crucial to ensure national food security for it is the number 1 grain in China. Since 2009, China has transformed from a net corn exporter to a net corn importer, resulting in a major shift in the pattern of corn trade. Sun Mengyao and Liu Zhongqin (2014) pointed out that the real effective exchange rate of RMB plays a significantly positive role in China's corn imports, and it is stable in a long term.

DuanJuanjuan (2014) said there is a one-way price spillover effect between exchange rate and corn. Although China is the largest cotton producer in the world, due to the limited planting area and technology, a large part of the supply of cotton depends on the US import trade. Zhang Yibo (2016) pointed out that the high volatility of cotton prices is intensifying. In the short term, domestic cotton prices are mainly affected by the temporary purchase and storage policies, foreign cotton prices and exchange rate changes. After analyzing China's cotton price fluctuation and its influencing factors, Lu Guangmi and DuanDitao (2017) pointed out that there is a long-term balance between China's cotton price and exchange rate.

Based on the above research, this paper uses the VAR model to analyze the impact between USD/CNY exchange rate and corn and cotton futures prices, uses Granger causality test to analyze the long-term equilibrium relationship between variables, and uses impulse response analysis and Variance decomposition analyzes the dynamic dependency between variables and analyzes the conclusions and implications of the corresponding results.

2. SAMPLE SELECTION AND DATA PROCESSING

This article selects monthly changes in the US dollar-to -renminbi exchange rate (r), corn's consecutive futures closing price (y), and cotton's continuous futures closing price (m).

The data selected in this paper is from May 2009 to May 2018, including the exchange rate at the end of each month, the continuous futures closing price of corn and cotton which are divided into 109 groups of time series data. The VAR models were established separately for two sets of indicator data of exchange rate and corn price, exchange rate and cotton price and the data were from Great Wisdom 365 software.

3. EMPIRICAL RESEARCH RESULTS AND ANALYSIS

3.1 Data Stability Test

The VAR model needs to ensure that there is no heteroskedasticity and stability in the data.Take the logarithm of the U.S. dollar to RMB exchange rate (r),the corn price (y),and the cotton price (m),and take the logarithm then make the first difference, using dr,dy and dm to represent the variable after the change,that is:

$$dr_t = 100(\ln r_t - \ln r_{t-1}) \quad (1)$$

$$dy_t = 100(\ln y_t - \ln y_{t-1}) \quad (2)$$

$$dm_t = 100(\ln m_t - \ln m_{t-1}) \quad (3)$$

Table 1: Unit root ADF test

Variable	T statistics	Threshold at each significant level 1%	5%	10%	P value	test result
r	-1.5080	-3.4919	-2.8884	-2.5812	0.5259	not stable
y	-1.5314	-3.4919	-2.8884	-2.5812	0.5140	not stable
m	-1.9994	-3.4919	-2.8884	-2.5812	0.2868	not stable

dr	-8.4525	-3.4919	-2.8884	-2.5812	0.0000 stable
dy	-8.6444	-3.4919	-2.8884	-2.5812	0.0000 stable
dm	-8.2543	-3.4919	-2.8884	-2.5812	0.0000 stable

This paper mainly uses the ADF test method to test the stability of the data.The test results shown in Table 1 tells the t-test statistic of the raw data exchange rate, corn price and cotton price is larger than the critical value corresponding to a significant level of 10%, and the data is not stable. The ADF test results of the dr, dy, and dm data after the first-order difference shows that the t-test statistics of dr, dy, and dm were all smaller than at a significant level of 1% and the P value corresponding to the ADF is 0, so the dr, dy, and dm sequences are stable.

3.2 The Choice of Lag Order

To obtain the optimal lag order, Eviews was used to create VAR(2) for dr and dy, dr and dm respectively. The results show that the lag order with the largest lag order and the most "*" should be selected. The VAR model of dr vs. dy should select the second order, and the VAR model of dr vs. dm should choose the sixth order.

3.3 System Stability Test

The stability of the VAR model requires that all unit roots in the model fall into a unit circle with a radius of 1. Put the roots in the previously established VAR(2) model and the roots in the VAR(6) model into the unit circlet for testing. The results of the test are shown in Figures 1 and 2. With the four unit roots in the established VAR(2) model and the 12 unit roots in the VAR(6) model all fall in the middle of the unit circle, the model passes the stability test.

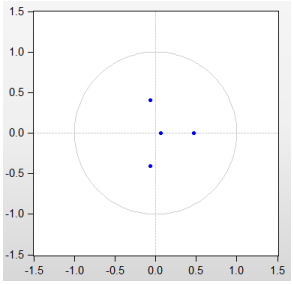

Figure 1: Stability test of VAR (2) model

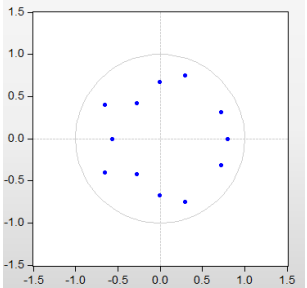

Figure 2: Stability test of VAR (6) model

3.4 Residual Analysis

From Figures 3 and 4,it can be seen that in the established VAR(2) and VAR(6) models,the residual is white noise,which is in line with the basic assumptions of the VAR model.

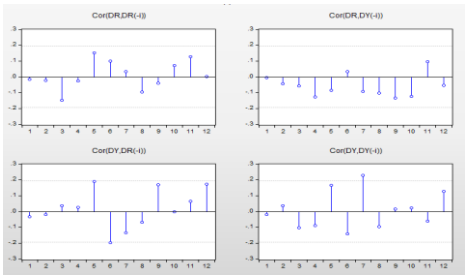

Figure 3: Analysis of corn residue residuals by exchange rate

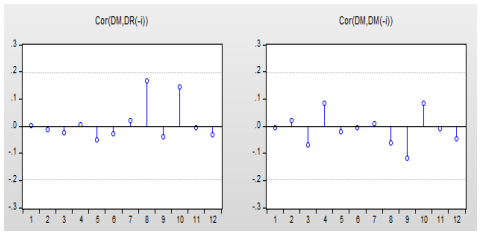

Figure 4: Analysis of cotton residuals by exchange rate

3.5 Granger Causality Test

After establishing the VAR model,the test results for the Granger causality between the variables dr and dy,dr and dm are shown in Table 2.Dy can cause dr change through Granger causality test.Its corresponding probability P is 0.0725.Dr can cause dy change through Granger causality test.Its corresponding probability P is 0.0030. According toGranger causality test, there is a two-way Granger relationship between dr and dy, indicating a long-term equilibrium relationship between exchange rate and corn. China's demand for corn has been very large in recent years.In 2017,the country's total corn import volume was 2.8254 million tons,and the import amount was US$602 million.In 2017, China's corn export volume was only 85,200 tons. Since the US has always been the major corn supplier for China, changes in exchange rates will naturally affect China's corn import costs.Secondly, since the introduction of the " Belt and Road" strategy in September 2013, China established a much closer connection with other countries. Maize has accounted formore than one-third of the output in global food crops,and has multiple uses: (1) Good feed for poultry and livestock,(2) An important industrial raw material,(3)In addition to being a food-related industrial raw material,corn is a new type of green energy raw material.Corn industry cooperation has become a major trend in the "Belt and Road" region.Due to more frequent and massive corn import and export,the price of corn will cause exchange rate fluctuations.

Dycan not pass dr Granger causality test, and the corresponding probability P is 0.5838. Dr can pass dm Granger causality test with the corresponding probability P is 0.0374. From Granger causality test results, there is a one-way Granger relationship between dr and dy. The later article mainly analyzes the impact of dr on dm and the impact of on dm itself. From 2002 to 2017,China's cotton imports increased by 25 times in 2017.In 2017,China's cotton imports amounted to 1.16 million tons,a year-on-year increase of 28.7%.China's cotton imports amounted to 2.19 billion US dollars,while China's cotton exports only amounted to 17,000 tons. Among countries that export cotton to China,the United States holds the largest share of the total,and more than half of the cotton in the United States is exported to China.Changes in the exchange rate between China and the United

States will cause significant changes in the price of Chinese cotton,but the effect of changes in cotton prices on exchange rates is not significant here.

Table 2: Granger causality test results

Dependent variable	Excluded	Chi-sq	df	Prob
dr	dy	5.248124	2	0.0725
dy	dr	11.65115	2	0.0030
dr	dm	4.692417	6	0.5838
dm	dr	13.38148	6	0.0374

3.6 Impulse Response Analysis

Impulse response means that in the regression variable,the impact of a shock on a variable in different periods is different.At the same time,if this effect tends to be stable in the long term,then it can be shown that the effect is basically unchanged.By analyzing the impulse response of the established VAR model,it is possible to obtain the degree and trend of the response of the variable to the impact.

From the impulse response analysis shown in Figures 5 and 6, the response of dr to dr showed a positive response in the first 10 phases,and it tended to be stable when it lags in the sixth phase.Its specific response trajectory are as follows. The effect of the first phase was 0.817627. After the rapid decline of the second and third period,the growth of the third period dr will increase dr 0.017690 percentage points.However,after a slight increase in the fourth period,it reached 0.058217,and then this effect began to gradually decline.By the sixth period,this positive effect was basically close to 0,tending to be stable. The impact of dy on dr was basically a negative impact except for the second period, but it did not immediately cause a shock effect. The effect was 0 in the first period and a slight positive impact in the second period reaching 0.020649.In the third period,the negative effect reached at its peak of -0.166564 which means that every 1 percentage point increase will bring dr 0.166564 percentage point drop.In the 4th period,the negative impact was reduced to -0.070824,and the impact was basically 0 in the 5th period and later, and it stabilized.

The impact of dr on dy was 0.561101 in the first period, and it quickly dropped to -1.555740 in the second period.After the third period it was -0.415110 and basically became 0 in the fourth period. The impact of dy on dy was mainly positive and strong. The effect in the first period is 3.808088, which means that every 1 percentage point increase will bring dy 3.808088% increase, the effect of the increase is great.In the second period,it changed to 0.873579.In the third period,it changed to a negative impact of-0.245269.In the fourth period and the fifth period,it turned into a positive impact,which was 0.114269 and0.134250respectively.Finally,in the sixth period and later,the effect turned to 0.

The impact of dr on dm was 0 in the first period,increasing to the maximum value of 0.136024 in the second period. and turning to zero after the oscillation of positive and negative impulses, basically in the tenth period. The impact of the dm on the dm was mainly positive,and the impact is very strong. In the first phase,it is

5.697547,which means that every 1 percentage point increase will bring dm5.697447 percentage points increase, and the effect of the increase is evident.In the second period,it became 1.232969,and then in the seventh period,it turned negative of -0.672272. Then in the 13th period, it gradually tended to be 0.

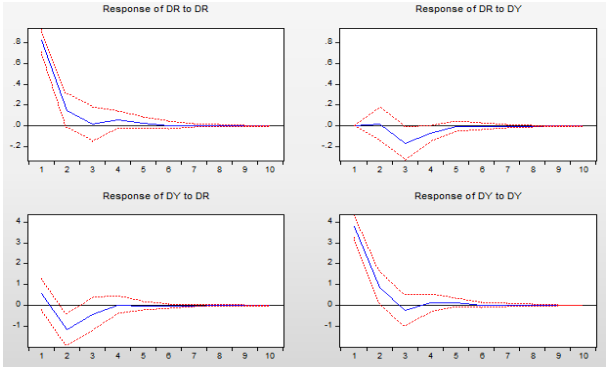

Figure 5: Analysis of the exchange rate to maize impulseresponse

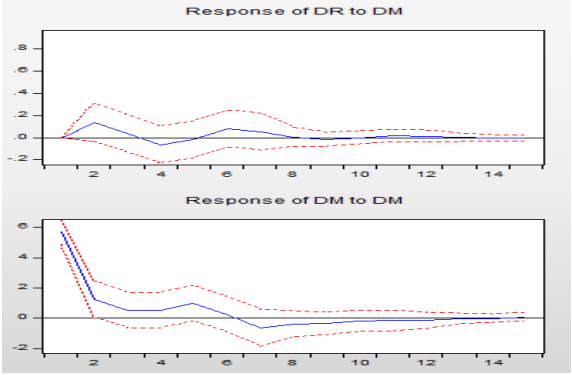

Figure 6: Analysis of the impulse response of exchange rate to cotton

3.7 Variance Decomposition Analysis

In this paper, there is a bidirectional causality relationship between dr and dy which is analyzed by variance decomposition.The result of variance analysis tends to be stable after the tenth periodwith the variance values of 0.853813 and 4.145332. And there is a one-way causal relationship between dr and dm.The result of variance analysis tended to be stable after the tenth period.The variance was 6.531211.The results are shown in Tables 3,4 and 5.

Table 3: Drvariance decomposition analysis

Period	S.E.	DR	DY
1	**0.817627**	**100.0000**	**0.000000**
2	**0.831524**	**99.93833**	**0.061668**
3	**0.848222**	**96.08574**	**3.914259**
4	**0.853162**	**95.44181**	**4.558187**
5	**0.853714**	**95.44358**	**4.556419**
6	**0.853764**	**95.43644**	**4.563559**
7	**0.853804**	**95.42897**	**4.571032**
8	**0.853812**	**95.42837**	**4.571631**
9	**0.853813**	**95.42834**	**4.571662**

10	**0.853813**	**95.42830**	**4.571701**

Table 4: Dy variance decomposition analysis

Period	S.E.	DR	DY
1	3.849204	2.124907	97.87509
2	4.112815	9.757883	90.24212
3	4.140981	10.63049	89.36951
4	4.142660	10.62686	89.37314
5	4.144996	10.62265	89.37735
6	4.145305	10.63479	89.36521
7	4.145318	10.63535	89.36465
8	4.145328	10.63531	89.36469
9	4.145331	10.63535	89.36465
10	4.145332	10.63537	89.36463

Table 5: Decomposition analysis of dm variance

Period	S.E.	DR	DM
1	5.805263	3.679923	96.32008
2	5.959438	4.318720	95.68128
3	5.982036	4.302264	95.69774
4	6.018212	4.745687	95.25431
5	6.114668	5.218783	94.78122
6	6.433334	14.26274	85.73726
7	6.501233	14.97498	85.02502
8	6.51436	14.9311	85.0688

	4	**6**	**4**
9	**6.52698**	**14.9636**	**85.0363**
	2	**3**	**7**
10	**6.53122**	**14.9929**	**85.0070**
	1	**5**	**5**

The analysis of variance shows that the change in the exchange rate of the US dollar against the RMB is mainly influenced by itself.In the first period,the change of the exchange rate itself reached 100%.After that, its contribution followed a downward trend with the delay of timeIt drops a little in the second period but a bit more in the third period to 96.08574%. Its contribution margin was close to 4%,but the decline rate in the later period was very small.After the 10th period,it was basically stable at about 95.4283%. In addition, the change rate was also affected by the change rateof corn price.The effect can be expressed as follows.In the second period,the change rate ofcorn price contributed to 0.061668% of the impact of exchange rate changes.The effect was relatively small. But as time went by,the degree of impact began to rise gradually.The third phase of this contribution directly rose to 3.914259%,until the impact of the exchange rate of the 10th corn increased to 4.571701%,tending to stable.

The change rate of corn price was also mainly affected by itself.In the first period,the influence was the mostsignificant,reaching 97.87509% and then a downward trend,with the largest decrease in the second period to 90.24212% and its contribution difference is close to 7.5%. But the decline rate in the later period is very small and the 10th period is basically stable at about 89.36463%. In addition,the corn price change rate is also affected by the exchange rate change rate. In the first period,the change rate of the exchange rate contributed to 2.124907% of the rate of change in the price of corn.By the second period,this contribution has risen directly to about 9.775883%.The difference with the contribution of the first period was close to 7.5%.The impact on the change rate of corn price was minimal until the 10thperiod,which rose to about 10.63537%,and the contribution gradually became stable.

The fluctuation of cotton price was mainly affected by itself.The influence in the first period was 96.32008%,and then it continued to decline.The difference between the fifth period and the sixth period was close to 9%,reaching85.73726%.Finally,it stabilized at 85.00705% in the tenth period.The exchange rate'scontribution to cotton has been rising.Similarly,the difference between the 5th and the 6th period is close to 9%,reaching 14.2617%.Finally,it became stable at 14.99255% in the 10th period.

From the above analysis,it can be seen that although the impact of changes of corn price on exchange rate is not stronger than exchange rate itself, it proves that changes in the corn price have a certain influence on the exchange rate change rate about 4.571701%. Similarly,the influence ofchange rate of exchange rate on corn and cotton priceis not as much as corn or cotton themselves,but it has largely proved that the exchange rate change rate has an important impact on the rate of change in the price of cotton and cotton.The degree of influence is close to 10.63753% and 14.99295% respectively,which also shows that there is a link between exchange rate fluctuations and the price fluctuations of corn and cotton.This connection can be explained by the fact that most of the corn and cotton planted in the United States are sold to China,and the exchange rate is the link between the two countries and the world.Changes in corn prices will affect the import and export of corn,and the international harvest of the affected countries.The positive and negative balance of the international balance of payments will in turn affect the exchange rate movement between the two countries.Similarly,when the exchange rate of the US dollar against the RMB changes,the cost of corn and cotton imported from China

will change,which will naturally affect the prices of China futures corn and cotton.

4. CONCLUSIONS

This paper studies the effect of exchange rate changes on the price fluctuations of corn and cotton price fluctuations through the VAR model,and draws the following conclusions: (1) There is a two-way Granger causal relationship between exchange rate changes and corn price volatility,and it is remarkable in a certain time. There is a one-way Granger causal relationship between exchange rate changes and cotton price fluctuations and the exchange rate is the Granger cause of cotton,and its effect is also significant. (2) The two-way effect of exchange rate changes and corn price fluctuations all have a certain lag,and the impact is mainly within the lag period of 10 periods.There is also a certain lag in the impact of exchange rate changes on cotton price volatility.After 15 periods of lag,the impact is almost 0. (3) In the long run,the variance contribution rate of exchange rate change to corn price change rate is about 10.6%,and the variance contribution rate of corn price change rate to exchange rate change is about 4.6%. And the variance contribution rate of the exchange rate change to the cotton price change rate is about 15.0%.The main factor of this effect is that a large part of China's corn and cotton are imported from the United States.

The following suggestions should be made on how to mitigate the price fluctuations of corn and cotton:(1)To timely adjust the planting structure of corn and cotton in China and readjust the planting area between corn,cotton and other crops reasonably. Control the production of corn and cotton to regulate their price. (2)The trade war intensifies the global economic recession,which is undoubtedly a disaster for both economies. Mutual benefit and win-win cooperation are the main themes of this time. (3)Further improve and promote the established mechanism for supplementing and separating corn and cotton prices,and directly adjust the prices of corn and cottoneffectively .

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