The Empirical Analysis of the Dynamic Prices Relationship between Cotton Spot Market and Futures Market in Xinjiang

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Abstract The thesis analyzes the causal relationship between the cotton spot, and the tendency and impact of prices of futures markets in Xinjiang by using ADF test, co-integration analysis, Granger causality test and other econometric methods in order to discuss the interacted relationship between futures market prices of cotton and spot market prices since the futures of cotton in Xinjiang go public. The results of empirical analysis show that the spot market prices of cotton and the futures market prices in Xinjiang fluctuate prominently in the short run and tend to counterpoise in the long run; the futures market of cotton plays the role of leading the spot market prices of cotton in Xinjiang, while the spot market prices of cotton in Xinjiang impacts little on the futures market prices. The corresponding countermeasures are put forward. The government should continuously perfect the construction of the futures market of cotton in Xinjiang, so as to exert the function of price discovery and the function of hedging, and promote the development of cotton industry in Xinjiang.

Key words Cotton Price, Spot Market, Futures Market, Granger causality test, China

Xinjiang, as the biggest production base of commodity cotton in China, is one of the largest cotton-production bases. The cotton, one of the cash crops with the biggest scale advantage in Xinjiang, is significant to Xinjiang's socio-economic development and income-increase of farmer and herdsman. However, Xinjiang has not yet transformed the resources advantage to economic advantage since a long time, and reason is as follows: firstly, before the reform of cotton circulation system prior to the year 1999, the market had not yet played the role of basic adjustment in production, purchase, processing and circulation of cotton; secondly, the production of cotton has a long period and the typical characteristic of season. The price expectancy behavior of cotton producers and their decision-making conform to spider network model, resulting in the frequent fluctuation of the area of cotton cultivation and production. In order to promote the healthy development of cotton industry in Xinjiang, fully exerting the function of the price finding of futures market and hedging is significant in reality for the dynamic research of the price relationship between futures market and spot market of cotton in Xinjiang. Based on this, I adopt the econometric methods, such as ADF test, co-integration analysis, Granger causality test and so on; conduct the empirical analysis on the dynamic price relationship between futures market of cotton and spot market of cotton in Xinjiang; demonstrate the problem of validity of two functions of cotton futures market in cotton spot market in Xinjiang so as to promote the healthy and sustainable development of cotton industry in Xinjiang.

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1 Data sources and research methods

1.1 Data sources and processing The price data of futures market of cotton is from China's cotton information network[1]. We select the closing prices of 1005 dominant future of NO. 1 futures of Zheng cotton from January 1, 2007 to December 31, 2009. The data of the spot market price of Xinjiang cotton is the Xinjiang cotton-production area price of CC Index328, and there are 750 data in the aggregate. After arrangement, in order to elimination the big fluctuation, we take the mathematical mean value of the price every month as the futures price and spot price of Xinjiang cotton, so as to generate time sequences of $\{QH_t\}$ and $\{XH_t\}$. QH_t is the average price of months of cotton futures market, and XH_t is average price of months of Xinjiang cotton spot market.

1.2 Research Method Prior to quantitative and empirical analysis of cotton prices in spot market and futures market in Xinjiang, qualitative analysis on the price trend of the two markets is conducted. Proper quantitative analysis method is selected, according to the result of the qualitative analysis. According to the quantitative analytical results, the appropriate quantitative analytical method is selected.

In methods of empirical analysis regarding random time series, the co-integration test is often used to verify whether there is a long-term and stationary relationship between the two variables. While Granger causality test is used to verify whether there is causal relationship between the two variables.

Normally, when conducting co-integration and Granger causality test, stationarity test is conducted beforehand to avoid "spurious regression" problem in the data of time series. If the price series are non-stationary, the use of traditional least square method to check unbiasedness is invalid[2]. So only the stationary time series can be applicable to co-integration and

Granger causality tests, then the test results are meaningful.

2 Results and analysis

2.1 Qualitative analytical results Draw the broken line figure of trend comparison between $\{QH_t\}$ and $\{XH_t\}$ (Fig. 1).

Fig. 1 shows that, from 2007 to 2009, cotton prices of futures and spot market were between 10 thousand yuan/t and 16 thousand yuan/ t, and mainly between 13 thousand yuan/ t and 15 thousand yuan/ t. The two curves are with same trend in long run, though they may cross or reverse in a short period. So co-integration method can be used to further research their relationship.

2.2 The empirical analysis

2.2.1 Stationarity test. ADF test is adopted[3]. By using Eeviews5.1 software, we select ADF test method including intercept terms and including no trend terms to conduct unit root test on $\{QH_t\}$ and $\{XH_t\}$, and the test results can be seen in Table 1.

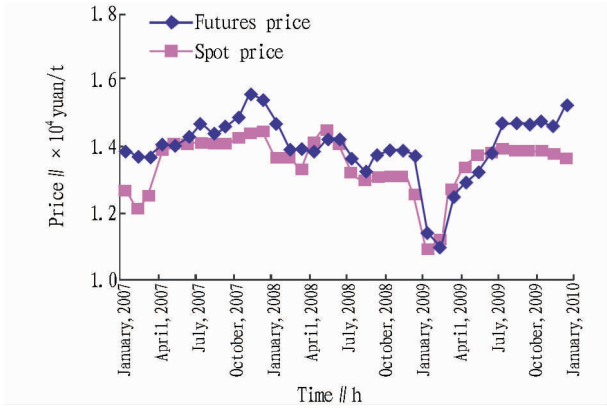

Fig. 1 The comparison of the prices trend of cotton spot-futures markets in Xinjiang from 2007 to 2009

Table 1 ADF test results of $\{QH_t\}$ and $\{XH_t\}$

Variable	*ADF* value	1% *ADF* critical value	5% *ADF* critical value	10% *ADF* critical value	Test results
XH_t	−2.364 828	−3.635 3	−2.949 9	−2.613 3	Non-stationary
QH_t	−2.400 005				Non-stationary
ΔXH_t	−3.833 700	−3.642 2	−2.952 7	−2.614 8	Stationary
ΔQH_t	−4.968 095				Stationary

Note: Δ is first-order differentiation

From Table 1, we know that as for sequence $\{QH_t\}$ and sequence $\{XH_t\}$, under 1%, 5% or 10% level of significance, the ADF value is no smaller than the critical value, indicating that the data of futures market price and spot market price are non-stationary time sequences; after first-order differentiation, the ADF value of sequence $\{\Delta QH_t\}$ and sequence $\{\Delta XH_t\}$ is bigger than the critical value under 1%, 5% or 10% level of significance, indicating that after first-order differentiation, they are stationary sequences. $\{QH_t\}$ and $\{XH_t\}$ are all first-order single time sequences, namely XH_t and QH_t conform to I(1).

2.2.2 Co-integration test. The time sequences of XH_t and QH_t conform to I(1), but it does not mean that there is long-term balanced relationship between XH_t and QH_t, namely the co-integration relationship[4]. We must conduct co-integration test to circumvent the problem of "fake regression". By using Johansen Co-integration Test of Eviews5.1 software, we test the terms including intercept and the terms including no trend. Generally, on the premise of ensuring the irrelevancy of residual terms, AIC guide line and SC guide line are used at the same time in order to be the standard of optimum time lag. The lag length is the optimum lag length when the value of the two is smallest[5]. According to AIC guide line and SC guide line, we select the optimum lag order of co-integration test of XH_t and QH_t as 1 (the lag period of one month), and the Johansen test results can be seen in Table 2.

Table 2 Johansen test results of $\{QH_t\}$ and $\{XH_t\}$

0 hypothesis	Eigenvalue	Trace statistic	5% level of significance	*P* value
Without co-integration	0.480 939	32.838 23	15.494 71	0.000 1
At least one co-integration	0.287 777	3.199 04	3.841 466	0.000 8

The second line of Table 2 is to test whether there is no co-integration relationship, namely the former assumption is that there is no long-term balanced relationship among sequences. We can find that under 5% level of significance, the trace statistic 32.838 23 > 15.494 71. The former assumption "there is no co-integration" is refused, indicating that there is co-integration relationship between the two variables; the former assumption of the third line of Table 2 is that there is one co-integration vector at least among sequences, and the trace statistic 3.199 04 < 3.3.841 466. The former assumption cannot be refused, indicating that there is one co-integration relation at least between sequence XH_t and sequence QH_t, namely there is long-term balanced relationship between the spot market price and futures market price of Xinjiang cotton.

2.2.3 Granger causality test. In order to test the guiding relationship between futures market price and spot market price of Xinjiang cotton, we conduct Granger causality test on sequence XH_t and sequence QH_t. From the foregoing test analysis, we know that there is co-integration relationship between sequence XH_t and sequence QH_t, which can be used by Granger causality test. In the meanwhile, in order to eliminate heteroscedasticity and make the data smooth, we conduct Granger causality test by substituting $\ln XH_t$ for XH_t, and substituting $\ln QH_t$ for QH_t. The test results can be seen in Table 3.

Table 3 Granger test results of $\ln QH_t$ and $\ln XH_t$

Null Hypothesis	Lag phase	*F* statistic	Probability
$\ln XH_t$ is not Granger cause of $\ln QH_t$	1	0.085 05	0.772 44
$\ln QH_t$ is not Granger cause of $\ln XH_t$		3.296 68	0.078 80
$\ln XH_t$ is not Granger cause of $\ln QH_t$	2	0.974 13	0.389 53
$\ln QH_t$ is not Granger cause of $\ln XH_t$		1.433 01	0.254 99
$\ln XH_t$ is not Granger cause of lnQH	3	0.479 43	0.699 39
$\ln QH_t$ is not Granger cause of $\ln XH_t$		1.336 21	0.284 14
$\ln XH_t$ is not Granger cause of $\ln QH_t$	4	0.513 40	0.726 53
$\ln QH_t$ is not Granger cause of $\ln XH_t$		0.758 20	0.563 05
$\ln XH_t$ is not Granger cause of $\ln QH_t$	5	0.958 83	0.465 92
$\ln QH_t$ is not Granger cause of $\ln XH_t$		0.504 48	0.769 38

From Table 3, under 5% level of significance, when the lagged difference is 1, the probability of $\ln XH_t$ being not the reason of $\ln QH_t$ is 0.772 4; the probability of $\ln Q_t$ being not the reason of $\ln XH_t$ is 0.078 80. It indicates that the futures market price $\ln QH_t$ is the reason of variation of spot market price $\ln XH_t$ of Xinjiang cotton; since the cotton futures are listed, it begins to play the role of guiding spot market price of Xinjiang cotton, while the spot market price of Xinjiang cotton is not the reason of variation of futures market price, indicating that the spot market price of Xinjiang cotton hardly impacts futures market price of Zheng cotton; when the lagged difference is 2, 3, 4 or 5, there is no causal relationship between futures market price and spot market price.

2.3 The empirical conclusion and analysis of reason

2.3.1 The empirical conclusion. First, the spot market price of Xinjiang cotton and futures market price of Zheng cotton fluctuate in the short run, but the long-term tendency of both is identical and there is a long-term balanced relationship.

Second, the futures market price of Zheng cotton is the reason of the variation of the spot market price of Xinjiang cotton, which plays the role in guiding the spot market price of Xinjiang cotton; while the spot market price of Xinjiang cotton hardly impacts the futures market price of Zheng cotton.

2.3.2 The analysis of reason. The two functions of price finding and hedging of the futures market of Zheng cotton begin to work in the spot market of Xinjiang. The main body of market, such as cotton growers and enterprises, has begun to use the tendency of futures market price to direct the planting, production and sales of cotton, and they begin to use the futures market to exert the function of hedging and avoid risk. This is the internal reason of the two tending to be identical, but the main body of spot market of Xinjiang cotton is insensitive to the information of futures market, and there is time lag, resulting in the ineluctable short-term fluctuation and time difference of price reaction. But the spot market of Xinjiang cotton hardly impacts the futures market of Zheng cotton, indicating that the hedging amount is smaller of the main body of market, such as the cotton growers and managers of cotton, which is not enough to guide the formation of the futures market price of Zheng cotton. In the mean time, it indicates that the futures market of Xinjiang cotton develops imperfectly, and its operating efficiency is low, which underlies why Xinjiang, as the biggest cotton-production area and commodity cotton production base in China, has no pricing power in cotton market. The other way around, if the futures market of Xinjiang cotton develops perfectly, and operates effectively, which will impose great impact on the futures market price of Zheng cotton, then Xinjiang cotton can lead the tendency of market price, and have the pricing power. There are many reasons responsible for the generation of these problems, but it can be embodied in the following 2 aspects.

2.3.2.1 The spot market of Xinjiang cotton is not perfect. First, the spot market of cotton main includes 4 markets of growing, purchasing, processing and circulating. Due to the short-period opening up of cotton circulation system, the system is not normalized on the whole. Second, the behavior of the main body of the cotton market transaction is not normalized and they speculate excessively; some farms purchase the cotton growers' cotton coercively and intensively, which imposes negative impact on the fostering of cotton market. Third, the infrastructure of Xinjiang cotton market is outdated, and the closed transportation facilities cause the obstructed cotton circulation in Xinjiang or obstructed cotton circulation between Xinjiang and other places, which makes it difficult to form high-efficiency unified market.

2.3.2.2 The futures market of Xinjiang cotton is not perfect. Firstly, the transaction variety of futures market is single. Now what Zheng cotton transacts mainly is NO. 1 cotton futures contract. The delivered NO. 2, designed for Xinjiang cotton, has not been listed in Xinjiang, which brings inconvenience, such as high transportation fee and transaction fee, to the production and management of Xinjiang cotton, and the hedging and delivery of textile enterprises. Secondly, the cognitive ability of the main body of market transaction is limited, lacking the awareness of circumventing risk. I have surveyed some cotton growers and cotton managers, and they have little knowledge about the futures of cotton, let alone direct the planting area of cotton, management and participation in hedging according to futures market price of Zheng cotton. Some managers who have knowledge of cotton futures market, are inactive to participate in hedging due to various reasons, which causes the low proportion of participating in futures market of Xinjiang cotton. According to my survey on the Aksu Sales Department of Tianli Futures Brokerage Corporation of Xinjiang, at the end of 2009, there were only 100 cotton-related enterprises approximately in Xinjiang opening an account to transact in futures firms, while there were only no more than twenty accounts transacting actively. Thirdly, the futures market of cotton is not developed. Primarily, the cotton futures were listed not long ago. The futures brokerage firms participating in the management of cotton futures are scanty. The firms have a small scale, single business, scanty capital amount, few personnel, and small transaction amount. The firms with large scale are Tianli Futures Brokerage Corporation of Xinjiang, Jinshi Futures Corporation

of Xinjiang, Urumchi Sales Department of Wanda Futures Corporation and Hongyuan Futures Corporation. Secondly, the information network infrastructure of cotton is poor; the market information is imperfect; the market legal system construction is not sound; the normalization of market transaction is poor. Finally, the cotton market of Xinjiang lacks critically the high-quality talents of cotton futures transaction, which has been the bottleneck of the development of futures market of cotton in Xinjiang.

3 Countermeasures and suggestions

3.1 Promote the development of futures market of the cotton in Xinjiang Firstly, we should propel the NO.2 futures contract regarding the cotton of Xinjiang to be listed as soon as possible; establish delivery warehouse in the concentrated cotton-production areas of the south and the north of Xinjiang; increase the transaction proportion of Xinjiang cotton in futures market. Secondly, we should perfect the futures transaction system of cotton; strengthen the governmental supervision; normalize the main body of transaction in futures market; encourage maintaining value; prevent the excessive speculation, and even the illegal behaviors of breach of contract and cheating. Thirdly, in terms of tax preference and deposit, the government and bank should offer support. Fourthly, we should foster the futures brokerage firms of cotton, and cultivate and introduce more high-quality talents of futures transaction.

3.2 Establish normalized the futures market of cotton Firstly, we should establish and expand a batch of wholesale markets with great capacity and strong attraction in the concentrated production areas and distribution areas of Xinjiang cotton, so as to form the sound cotton wholesale market connecting city and village. Secondly, we should perfect the quality test system of cotton in the spot market, so as to make its standard correspond with the test standard of futures market, and form an organic market system connecting futures market and spot market. Thirdly, we should reinforce the governmental supervision on the spot market of cotton; adjust effectively the spot market by using the means of reserving in order to make the market play the basic role in supplying and demanding cotton of market and avoid the market chaos.

3.3 Establish the service system of the cotton industry in Xinjiang We should establish the information service network of cotton, and increase the input in the construction of the supply and demand information network of Xinjiang cotton and marketing organization, so as to release the products information, supply and demand information and price tendency of cotton market for cotton growers, cotton franchisers and cotton textile enterprises; we should guide the cotton growers reasonably to adjust the variety of cotton, planting area, cotton production, cotton sales, and hedging[6]. We should establish the promotion institutions of cotton futures market; establish the service institutions where the local cotton association and government are dominant; make propagation and training regarding the futures knowledge for cotton growers, franchisers, cotton textile enterprises and so on, and guide them to conduct price judgment and decision-making by using the flotation function of the futures market prices and the function of hedging to circumvent risk.

3.4 Foster the cotton growers as the main body of futures market transaction According to the statistics, 19% – 25% of farmers in the USA use the futures market directly, and 28% – 35% of farmers indirectly use the futures market to circumvent risk by signing the long – term contract with the cooperatives, while in Xinjiang, due to the shortage of knowledge and skills regarding participation in futures transaction, as well as small and scattered production management model, one contract is about 5 t/lots in the futures market, and the cotton produced by small household growers is difficult to meet the need of contract. So, we should foster the cotton growers as the main body of futures market transaction. In addition to the promotion of futures knowledge and operation skills training, promoting the industrialization of Xinjiang cotton is very important. The local government uses multifarious forms, such as the contract farming of " enterprise + base + cotton growers" , the cotton growers' cooperatives, " association + cotton growers" , " futures + order" , " professional market + cotton growers" , " futures brokage firms + cotton growers" and so on, to promote the development of cotton industrialization, and foster the cotton growers as the main body of futures market transaction so as to make cotton growers as the beneficiary of the unification of spot market and futures market" , promote the sustainable development of Xinjiang cotton, and transform the resources advantage of cotton into economic advantage.

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