

Chapter 6

Agricultural Market Risk Management Strategy

Agriculture risk management is a possibility that occurs in the process and circulation of agricultural products, because of the influence of various factors that can't anticipate in advance, make the agriculture producer's border income and expectation revenue deviate negatively, then suffer economic loss. Under the condition of market economy, the agriculture producer should be engaged in earning products, there is a risk chaperonage earnings, all the items of product management have the possibility that make money or compensate for loss and this is so-called risk management. Especially when the risk directly comes from the market prices fluctuation, which makes the use of the market to manage risk becomes more convenient. It is combined with people's market speculation more closely, resulting in the risk product operations management study.

The sale strategy for agricultural production and business risks management mainly discusses the influence that can be made by changing input product factors and inputs prices, the change of consumer hobby and variety of market trade condition etc. effect the agriculture management. The strategies usually be used for decreasing or scattering the sales risks of agricultural product and in circulation, which usually have support and ceiling prices, futures market hedging performance, sales strategies, contract farming, industrializing management, material purchase and product for sale in advance, to and strengthen the logistics and information management measures etc.

What need to explain in this chapter, we will mainly discuss about agricultural product futures bargain, research the problems of hedging performance for agricultural product futures, study the mechanism and application value made by agricultural product futures market, which is a kind of high hierarchy market in avoiding the price risk of the agricultural product market and newly development in China.

6.1 The Futures Exchange of Agricultural Products

The futures market is a place where the futures and a total variety of the futures trade relation are to be exchanged. It is not only the extension of spot market but also a production which the market economy develops to a higher stage. Futures market is a market form which is developed from the spot market of highly organized and the high norm, according to the principle of “public, fair, justice”.

The development histories of futures market have been more than 100 years in the world. The first grain futures in Japan in the seventeenth century, the Japanese in order to overcome the instability in spot trading, the excess food to Osaka or Tokyo, if necessary, re-sale store. The establishment of modern futures market is developing since the second half of the nineteenth century in the United States futures, obvious sign is well-established and trading system and the system of commodity exchanges.

The futures is opposite to stock on hand, futures trade is a contract business which is in the particular place, according to the particular rule and procedure, carrying on a kind of format and contents which have been already standardized, committing that at a particular time and place in the future, according to the standard and quantity which have been prescribed, completing a business transaction with merchandise or financial bill. According to the differences between the purposes of merchandise exchange, objects of trade, manners of trade, guarantees of performance, manners of session, places of trade, scopes of merchandise and the degree of the market norm, the forward contract can be seen as a kind of spot transactions, the different characteristics between the time bargain and the spot transactions can be described in Table 6.1.

Table 6.1 *Characteristics between Time Bargain and the Spot Transactions.*

Item	Spot transactions		Future exchange
	Spot exchange	Forward contract	
Purpose	Obtaining object	Getting profit by obtaining object or transferring contract	Getting profit by obviating price risks or Venture Capital
Object	Merchandise	Standard contract	Standard futures contract
Manner	Haggling	Public sale or negotiate about	Open-door and just competition
Guarantees of performance	No worry	Worry about (notarization + “law of contract”)	Cash security system
Cession	Cannot	Inconvenient endorse	Hedging manner, convenient
Payment	100% of exchange quantum	Foreign account for 20-30% of Complete a business quantum	Bail account for 5-18% of exchange quantum
Places of trade	Absoluteness	Absoluteness	exchange
Barter	Exchange with money	Subscribe a contract nonce and Complete a business later	Complete a business with practicality only accounts for 1-4%, and the manner was fixed
Scopes of merchandise	All the merchandises which enter into circulation		Varieties in trading are limited

Source: Wang Guomin. “China Agricultural Risk Protection System Construction”, Sichuan University Press, 1997^[64].

In fact, the real purpose of futures trade lies in avoiding the risks of price undulate or carrying on venture capital investment by making use of price undulate. Two basic economic functions of it are transferring price risk and price discovery. A normative futures market offers lots of convenience to the production about agriculture and industry. But there are different opinions about the functions of the futures market. In general, there are eight functions of future markets: (i) Formation fair price; (ii) Provide price basis towards trade; (iii) Provide advance index on economy; (iv) Avoid the business risks got around price undulate; (v) Regulate supply and demand; (vi) Decelerate prices fluctuations; (vii) Attract speculation capital; (viii) function of resources reasonably locating for agricultural producers most directly, transferring the risks of foodstuff’s price fluctuation to the speculator who would like to undertake it by making use of future markets. It can avoid loss caused by the price drop of agricultural products benefit.

6.1.1 The Basic Operation Procedure of Futures Markets

As the forward contract, future contract is an agreement that two opponents make sure that purchase or sell capital at a certain time and with a certain price in the future. Different from forward contract, future contracts usually trades in the normative exchange. In order to promote the trade, exchange has made detailed standardization items of the future contracts. Because both sides of the future contracts may not be acquainted with each other, the exchange also provides the assurance of these future contracts in the meantime^[65].

According to the purpose of participating in the futures trade, the participant basically can be divided into hedger and speculator. The purpose of the former is carrying out to keep the trade value, which making use of the future markets in order to decrease the risks caused by price fluctuation and insured the normal profits of production and management. The hedgers usually are producer, trader or consumer. The latter also be called risk investor, their purpose of attending futures trade is opposite to the hedger, they would like to undertake the risks of price fluctuation so that can get more profit by less capital. The way of speculation is varied and more complex than hedging. In the futures market, if there are not speculators to participate, the two functions of evasion risk and discovering price will fail. The speculator attend to trade can increase the fluid of market as lubricant. The customers or members could attend the real trading process when they accepted the futures theories, had been familiar with basic future instructions and operation techniques.

I. Get into a Futures Market

First, clients should choose an agent company and broker when they getting into a futures market. The agent company is a corporation act for customers to carry on futures trade and provide trade service concerning the futures. The brokers of Agent Company carry on trade using the funds account of them. To agent and broker whose capital is abundant, good credit standing, means of

communication are advanced, service quality is high in order to offer various detailed information about market to the customer actively in time. And broker should be honest, steady careful and actively introduce beneficial trade opportunity to customer. The agent company has good business image and also offers a special and reasonable discount for taking the performance bail and the commission.

Secondly, the customer should have a condition of opening an account and carry on operation according to the procedure of opening an account. Customer should at least have the following condition: (i) Having complete civil case behavior ability; (ii) Having funds or other property suit for carrying on futures trade, can undertake risk of futures trade; (iii) Having fixed residence; (iv) Accord with the relevant provision about nation and industry.

The concrete procedure of opening an account is: (i) The client provide relevant documents and proof material; (ii) The company should explain the basic rule and risk of time bargain towards the customer futures trade and submit the risk announce and rule about the time bargain. After the client accurately comprehend the rule of time bargain, they will stamp and signing on the risk announcement; (iii) Futures broker and the client both parties sign for the client entrust on a contract book in order to nail down the relation between the right and obligation; (iv) Futures agent offer specialized account of funds contacting for client. This account must be separated from funds account that belong to the futures agent, but when the client book order they have to contain the security bail on its account. ^[66]

Last, the client should doing various preparation work before going into the market to trade such as necessary mental preparation with undertaking the risk which may be met about price fluctuation and the futures operation, necessary knowledge preparation for controlling the basic knowledge and basic techniques of time bargain, understanding regulation of commodity exchange, exactly

making trade instruction known to lower levels, Overall market information preparation in order to control a market information in time, accurately, completely, win in the free competition, study out a plan of time bargain, carefully be engaged in trade and obey behavior standard so that make trade loss minimum, the earnings be the maximum.

II. The Futures Transaction Business Process

The basic operation procedure of futures trading is the organic connection of the four parts of the futures exchange, the clearing house, the Broker's Firm and the trader. First, customers choose a futures broker's firm, the broker's firm to open an account. After the formal establishment of the relationship between the client and the broker's firm, it will be issued to the broker's firm in accordance with the requirements of the transaction instruction. Upon receipt of a customer's transaction, the broker's firm shall immediately notify the company's representative, commission broker, on behalf of the company's stock exchange and write down the contents of the order and give it to the company. The deputy of the market on behalf of the customer's instructions for the sale and purchase transactions.

China is currently the general use of computer automatically set the transaction way, after the daily settlement, in writing to notify the broker's firm. Broker's firm also provides a clearing list to customers. In the request of the customer, the deputy on behalf of closing out a position, the broker's firm will be open after the report to the customers. Customers if not exit, the implementation of the daily marking to market system, according to the same day price settlement, book profit of brokerage firms should be supplementary payment of profit margin to the customer. When the book loss, the client shall pay the loss of balance, until the customer is close, then the actual settlement of the actual profit and loss.

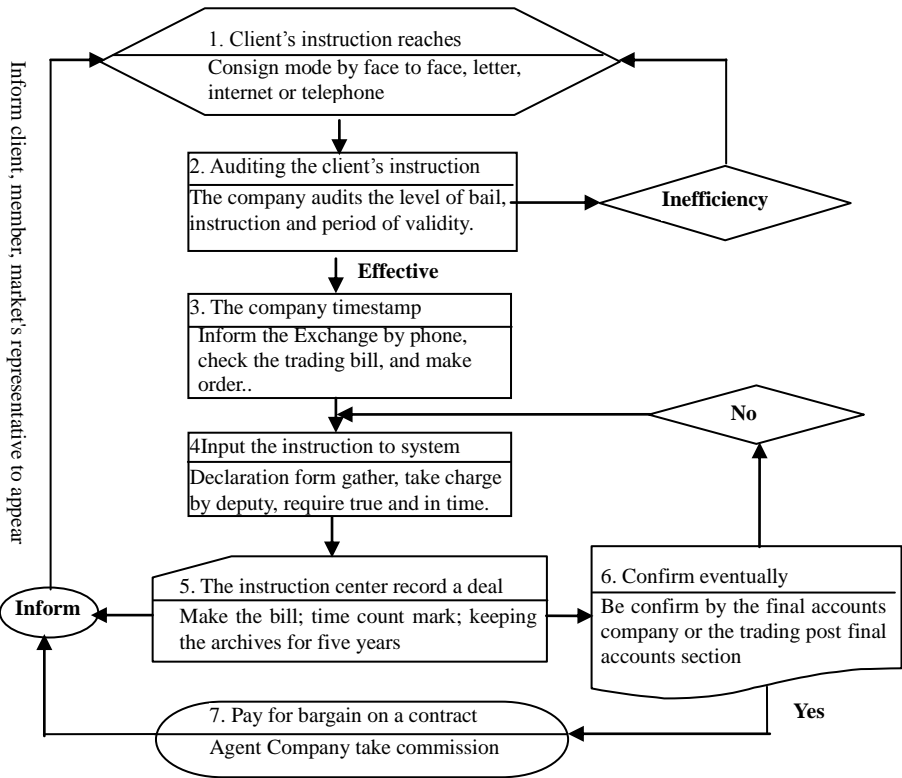


Figure 6.1 Business Processes That the Futures Trade in the Computer.

The formation method of futures price mainly includes oral communication to call price and computer bring together two kinds of methods [67]. The oral communication calls the price method divide into two kinds again, namely continuous the price system and one section one price system. Computer matching transactions is according to the principle of publicly oral price method to design a kind of trade way. This kind of bargain has accuracy and continuity characteristics. The calculator of futures trade process is illustrated in Figure 6.1.

After enters the futures market, the agricultural production operator as the client of the futures company, when carries on the prompt sale must store certain amount of money in the honor of an agreement, as the financial resource

guarantee on the both sides of an honor agreement, its specified amount usually for about 5-10% of the contract. When the contract becomes due, it will arrange material object exchange by the member through the exchange. Besides the price, the futures contract has the unification stipulation in all aspects, like China's wheat prompt sale quality standard, the delivery procedure and the time of delivery, the place of delivery and so on. Take the example of Zhengzhou commodity futures exchange wheat future contract are shown above in Table 6.2.

Table 6.2 *Zhengzhou Commodity Exchange Wheat Futures Contracts Guarantee.*

Exchange species	Wheat	Transaction Time	Per Monday to Friday 9:00--11:30 am, 1:30--3:00 pm
Trade code	WT	Trade poundage	2 Yuan/lot (contain risk reserve)
Trade unit	10 ton/pound	Trade bail	About the 5% of the contract
Quoting units	Yuan/ton	Exchange date	The first trade day to the last trade day of the exchange month
Exchange Month	1, 3, 5, 7, 9, 11	Exchange grade	Standard: second class winter white wheat; Accord GB 1351-1999, Substitute: first, third class winter white wheat Accord GB 1351-1999
Least changing price	1Yuan/ton	Exchange place	The warehouse is appointed by ZCE
The largest limit of price fluctuation p.d	Don't exceed a trade day balance of accounts, for $\pm 3\%$ of the price	Exchange manner	Physical delivery
The last trade day	The countdown seventh trading day of the contract delivery month.	Exchange Listed	Zhengzhou Commodity Exchange (ZCE)

Source: <http://czce.com.cn> ^[68].

6.1.2 Analysis of Agricultural Products Futures Transaction

In the futures market, someone who has the commodity and thinks that market price be expected to fall, sells the stock to occupy the short position, someone who has the currency thinks that the market price has stronger tendency, buys up the stock to occupy long position. Among the futures trader, the position of hedger is quite fixed and long in the futures market. The sales man who has the agricultural products sells the futures in order to prevent the damage of the price falls,

simultaneously, the people who will buy up the agricultural product, the human will be in order to prevent the damage of price rising will only then buy the futures.

The speculator who carries on the risk investment is to seek the profit directly as the goal; he hoped that has some option position in the market. Speculator's position in futures market is changeable and short. They occupy the short position are hoped that after the futures is sold the price will fall unceasingly, in order to buys up the futures in the suitable moment by the low price, and then becomes the long position. They may in "short position-long position-short position", which the position transforms unceasingly, sells in the low price using the high price to buy up, or the low price buys up the high price to sell in order to obtain the profit.

The mature futures market is equal to one kind of complete competitive market is the most ideal market form in the economics. The hedger and the speculator these two kinds of investment main body coexist in the identical market, plays respective role, although their goal and behavior ways are different, but we can still analysis them with the available approximately same model.

I. The Analysis of Profit, the Loss and the Breakeven

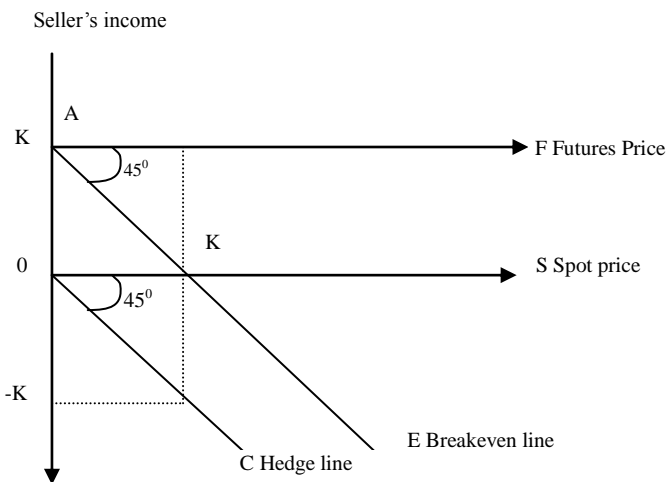


Figure 6.2 *Futures Seller's Breakeven.*

The profit, loss and the breakeven through the graph which the futures, option transaction, elementary operations are available may analyze, through geometrical analysis method when prompt sale of the round turn occurs, but when operates complex may carry on the basic geometric figure of the inter combination. Then obtain it from the following hedge analysis, which they can averse the agricultural market risk management effectively ^[69].

As shown in Figure 6.2, because the anticipated farm price will reduce, the farmer might occupy the short position by using the hedge method. In the figure K0 is the seller's revenue, AF is the futures price of business, axis OS is the spot price, the KE is breakeven line, axis OC is the line of flushes, and both the latter have 45 degrees angles with the abscissa axis.. First, when the producer forecast that the market price of agricultural product will fall, they will carry on the dead end transaction, first oversell futures by high price OK in order to hedge. In the process which is expected to fall, it also can make up futures in a low price according to the situation that the agricultural product market price will lower. In the AK section the distributor obtains the profit obviously from the profit and loss line AE, but in the KE section model of domestic virtue is the loss.

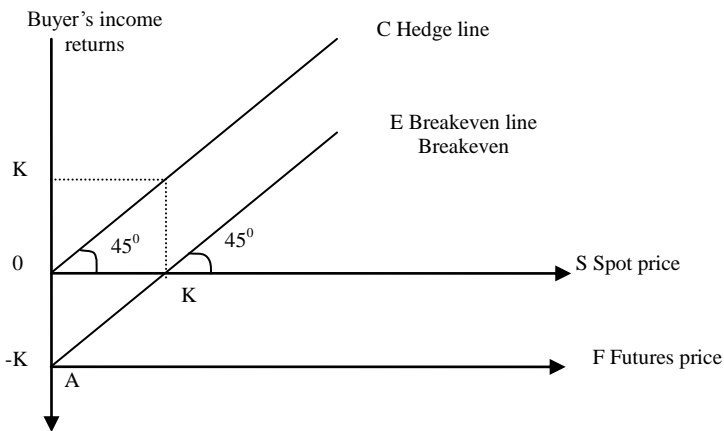


Figure 6.3 *Futures Buyer's Breakeven.*

If it can forecast that agricultural products market price will rise in the future, the operator will carry on long position transactions. They will buy up the futures first, then sell them when price rise again. This buyer transaction analysis can be explained available in Figure 6.3. By now, revenue and cost just right opposite to seller, and profit loss line also corresponds with the seller's profit and loss line. In the figure the agricultural product buyer's futures contract market price (or the price on-hand merchandise finalizes) is on the behalf of abscissa axis OS, among it K is the business price of the futures buys up by the people who are in the long position. In stipulation date, according to the contract, no matter how the market does change, the buyer must pay K Yuan as cost to buy up on-hand merchandise.

The ordinate axis rear axle expressed buyer's income or the profit, the negative axis expressed the cost expense or loss. AF expressed the buyer needs to flush in the futures market, sells the price of futures business, which are the same quantity on due date. It can use straight line OC to express the situation of flushes when the stock is sold. OC is similarly has 45 degrees angles with the abscissa axis, the dead end obtains revenue S basis to the flushes, the OC line plus AF line may obtain the buyer loss line AE. The profit and loss line had demonstrated instinctively the influence that when after buys up the futures to carry on to flushes to the long position, if the buyer is in order to guarantee the price, then AE is the on-line expression profit and loss may reverse mutually with the stock market in profit and loss. If the buyer is for congenial, buys up the futures in front of the price rises to K can occupy the long position and becomes the short position if sells surpasses K, spot price KS section can make the speculator obtains the profit when becomes short position. Looked from profit and loss line AE, he will obtain the profit in a point on KE section, but it will sustain a loss when the price accident fall to the AK section.

The analysis of the above graph indicates, the reason of why the prompt sale has the functions of shift risk and hedge the firm fixed price, is that the trader has simultaneously used the stock and on-hand merchandise two markets in this process, and according to the trend of the forward price and the spot price of homogeneous commodity can basically maintain the same and may has the possibility to hasten with the axiom when the time of finalizing arrivals. Simultaneously, buying up or selling the agricultural product in front either in after from the stock market, and selling or buying up certain quantity commodity stock contract in the futures market, which enables the trader to establish a mechanism between two markets, which one kind flushes mutually arrives, thus the trader can achieve to guarantee the price goal.

In fact, after both sides finalize a deal, finalizes and criticizes must carry on the price which is stipulated according to the contract in forward, “in the actual prompt sale market, the due finalizes on-hand merchandise to be rare, only accounts for the contract total about 1%, and the general common procedure is the business level ^[64], which causes to finalize the process only according to the price difference of buys up and sells to finalize the settlement. Therefore, at final of exchange, “forward price is restrained in spot price” ^[65], this enables prompt sale to become the effective methods of avoiding the price risk, carrying on the risk management and the congenial profit.

II. Prompt Sale Base Difference Analysis

According to the viewpoint of Keynes (Keynes 1923) and Hicks (Hicks 1946), the hedge makes the change of the spot price counterbalanced by the reverse direction change of the futures market. The hedge needs to follow four principles: Quantity equal, the time same or close, the direction opposite, and the variety same. However, it is not easy to achieve the goal of both counterbalances in the actual operation. Under the mature market economy

condition, whether the hedge can be carried on successfully and decided to a great extent by the assurance of basis and the hedge ratio. In the hedge situation, the definition of the base difference is: The base (B) = The spot prices of hedge property (S) - Futures prices of futures contracts (F) ^[65].

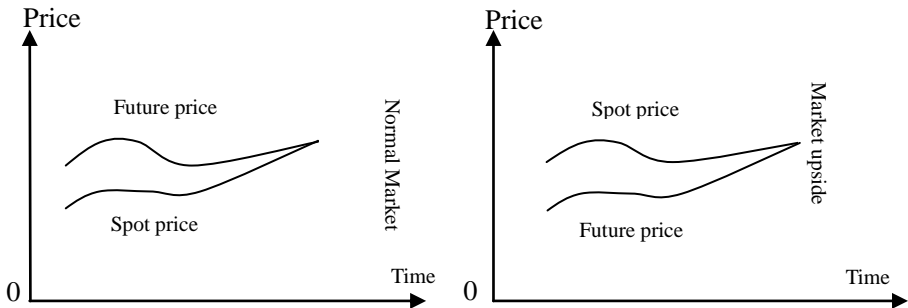


Figure 6.4 Spot and Futures Price on Delivery Month Is Approached.

Base value may be positive, negative or zero, which relates directly whether the hedge can succeed. If $S < F$, $B < 0$, it is called the forward premium; Otherwise, then called the agio. In normal condition, spot price and forward price change along with the time, and no matter in the normal market or hangs upside down market (Backward market), the basis along with finalizes date approaching to is supposed to draw close in the zero as shown in Figure 6.4.

Generally speaking, the production and business of agricultural product has the seasonal characteristic, its price trend often drops in the harvest season, rise in other time. Supposes the spot price of some agricultural product in the t_1 time is S_1 , the forward price is F_1 . If the operator thought spot price of this time is ideal in order to avoid the losses caused by the farm price falling in the future, the operator decided to do sell the hedge transaction. Supposes that he sells the hedge in the t_2 time conclusion the spot price and the forward price respectively is S_2 and F_2 , then the base difference in the time of t_1 , t_2 respectively is $B_1=S_1-F_1$, $B_2=S_2-F_2$. If the quantity of the hedge product that the operator needs is Q , then after the two markets arrived at breakeven the net profit and loss are:

$$\begin{aligned} E &= Q (F_1 - F_2) - Q (S_1 - S_2) = Q [(S_2 - F_2) - (S_1 - F_1)] \\ &= Q (B_2 - B_1) = Q \Delta B \end{aligned}$$

The analysis of the change ΔB between two basis indicate that, regarding the hedge which sells, if strengthening of the basis, the hedge effect is the profit, if weakening of the basis, the hedge effect is the loss, if the basis is invariable, the hedge effect is impartial.

Similarly, it may push that the relations between buys up the effect of hedge and the basis change is $E = -Q \cdot \Delta B$. This indicated that, regarding to the hedger who buys up the hedge, if strengthening of the basis, the hedge effect is the loss, if weakening of the basis, the hedge effect is the profit, if the basis is invariable, and the hedge effect is impartial.

As shown in the above analysis, regardless of buying up the hedge transaction or selling the hedge transaction, its effect is decided by the basis change, while has no relation with the quotation actual trend. After the hedger transforms the spot price to the change of basis, in the essence the hedging risk has been transformed into the basis risk, when the basis is not equal zero, the hedging possibly to succeed also possibly to defeated, therefore always hoped the basis' change is equal to the zero or the smaller, the better. When establishment and conclusion the hedge transaction, the relative change of two time basis is extremely important to influence the effect of hedge transaction, it decides the degree which is finally shifted the hedger.

So-called the basis risk is the risk which brings by the basis change in hedge process, is closely correlated with the anticipation of B_2 in the formula. However, the basis very little maintains invariably, any declension element of certainty which can influence spot price and the forward price can cause the basis risk. The factor which influence basis risk are both many and complex, mainly has the following several aspects.

First of all, the key is the futures contract that hedging has chosen, including the chosen futures contract's subject assets and the delivery day. It usually needs to review whether there is highly positive pertinence between the futures price and the spots price or the price of the related assets. If the pertinence level is high, the probability of the difference between the futures price and spots price is small, and so is the hedging person's basis risk and vice versa, the basis risk is high. Meanwhile, the bigger the difference between the expiry date of hedging and the month of delivery, the longer the remaining period, the bigger the probability of the deviation between the futures price and the spots price, and the higher the basis risk—that is the remaining period of the futures contract and the basis risk is positively pertinent.

Secondly, cost of carry of the spots and related assets. Cost of carry including the storage cost pluses interests paid by buying financing assets and then subtracts profits of assets ^[65]. For agricultural products, that is “the storage fee + the insurance + the interests occupied by spots assets”. If cost of carry of the spots or the related assets rises, the probability of basis change increases inclined to enlarge the basis risk, and vice versa, it inclined to reduce the basis risk. It needs to point out, that basis of the agricultural products is not wholly equal to cost of carry (the storage fee), it is also affected by the season and supply and demand of the market, but the change of basis is enslaved to cost of carry ^[70].

Thirdly, the demand and supply factors of spots market can change the basis. The deviation of spots demand and supply will directly affect spots price and then indirectly affects futures price and the basis change. In the meantime, trader's anticipation of the futures price and the spots price is also very important. If people anticipate the futures price will change heavily, the basis risk will increase and vice versa, the basis risk will reduce.

The difference of the spots price and the futures price will make the person hedging face the basis risk. Generally speaking, the basis risk of futures is lower than the price risk of spots or related assets and also lower than that of futures. But when the pertinence between the futures price and the spots price is low, hedging will increase the price risk instead ^[71].

That means, a person hedging must pay close attention to the different manifestations of basis. Basis can be positive or negative. When basis is positive, it states that spots prices greater than future prices. Supply and demand shows futures shortage, the cost of ownership will disappear or even contrary, the holder of a negative cost, at this time the current market priorities and no attention in the future, resulting in the spot and futures contracts recent high prices. In such circumstances, the stock market holder or commodity producers that, if the current holders or producers of goods sold, the market is willing to give higher price, which is the difference or the two-month futures the spread without a certain ceiling, since the current shortage is likely to result in spot prices or longer period of the recent futures prices higher than the futures price a lot. Only practical measures adopted mitigation and the elimination of the phenomenon of the cash shortage was the poor will be gradually narrowed.

As for the negative basis, there is a limit that their absolute value cannot exceed the cost of ownership. If holders of more than absolute cost differential will induce inventory increase, which led to the spot to reduce the supply, because the purchase would happen to be stored in the spot phenomenon to the increased demand for cash, then the spot prices rise. On the other hand, the increase of the inventory which makes the sale of the commodity futures to hedge, futures prices fall which makes down the price spread between the cash price and the futures price, finally to the extent that a considerable price differences narrow or closer to a cost.

Holders of futures prices reflect the cost of spot prices and the nature of the relationship between basic characteristics of different varieties of futures composition, because its cost of ownership is different, but generally the cost of ownership is proportional to the duration. Worse by the futures prices and spot prices between changes in the actual decision, such a change is often as holders of costs arising from the changes. Poor base running in the futures market is an important dynamic indicator. Theoretically, futures prices reasonably expected for the long-term spot prices, in this sense, the establishment of relations often are as follows ^[66].

Theoretical futures prices (F) = spot prices (S) + cost of ownership (C_S) + transport costs (C_T). When the delivery is at the same location, transportation costs can be neglected. Therefore, Theoretical futures prices (F) = spot prices (S) + cost of ownership (C_S). Basis (B) = theoretical futures price (F) - Spot prices (S) = cost of ownership (C_S). The absolute number changes of Basis is impacted by spot prices and futures prices change, when the spot price at the beginning of hedging less than futures prices, the difference of change and the profit and loss hedging relationship can be summarized as follows in Table 6.3.

Table 6.3 *The Relations between Hedging and Basis.*

Price		Basis change of absolute amount	When the hedge starts the spot price to be smaller than in the forward price situation overall profit is (+) or loss is (-)	
Spot price	Futures price		Bear hedging	Long hedging
Fall	Fall the same amount	No change	0	0
Fall	Fall the less amount	Augment	-	+
Fall	Fall the more amount	Contract	+	-
Rise	Rise the same amount	No change	0	0
Rise	Rise the less amount	Contract	+	-
Rise	Rise the more amount	Augment	-	+
Fall	Rise	Augment	-	+
Rise	Fall	Contract	+	-

Source: Zhengzhou Commodity Exchange, Annual Report, 1994-2001. www.cngrain.com, Food Network News ^[67]

6.2 The Price Discovery Function of the Futures Market

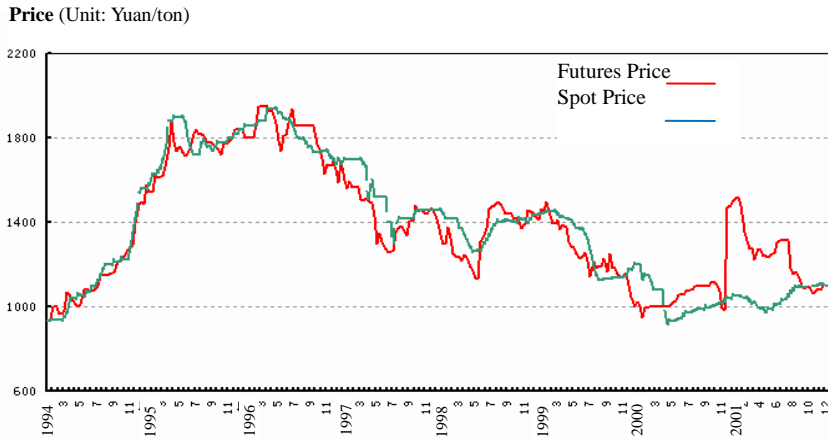
The price discovery function has become an important function of the futures' market since its existence. Some business people make business decisions based on this function even though they don't invest in futures. This is because in an open, fair, efficient and competitive futures market where the price is formed by centralized trading, price is featured with better authenticity, predictability and continuity. It can reflect the future trends of the market.

Modern market system includes spots market and futures market. Spots market tells current situation of supply and demand, forming spots' price. While futures market tells future market situation and reflect the price trends. Two markets have different features and functions, and they play different roles in price forming. They are mutually complementary. In agro futures market, price renews when suppliers and demands bargain and compete until forming the convincible and worldwide price. This future real price, which is formed by the futures market, can reduce the blindness and volatility in agricultural production. And forming of the fair price in the grain market needs many conditions which just can be satisfied by the futures market. Therefore, futures market can become the price center, and form the Benchmark Price. That's why futures market has the price discovery function.

6.2.1 Analysis of Correlation

Current, futures market in China has experienced over 20 years of development. So far it should be said that futures market has become more mature and prosper. We can use econometric models to analyze the futures market, because, in order to get a real price, the study on the price discovery function has been an important part of futures strategy research. Many scholars like to carry the study on the problem by correlation, causation and basic statistical method. However, as a young market, indeed it would have a price

discovery function. For example combine with practice in China market, and the futures principle has proved it effective. We ever got the real data that offered by ZCE from 1994 to 2002 for decade wheat futures development. Historically, as Figure 6.5 is shown in actual market, the wheat spot and the futures prices variations, as well as their long-term trend.



Note: Wheat futures were for delivery month in every ten days average price; the spot price was the car plate delivery wholesale price.

Figure 6.5 ZCE the Wheat Spot and Futures Markets Prices and Long-Term Trend^[67].

As shown in the Figure 6.5, wheat spots price and futures price change in a similar way in long term, which tell us that wheat futures price can reflect the spots market supply and demand, serving as barometer. According to the similarity between spots market and futures market, we can hypothesis that there is a liner relation between the two. Therefore, based on the price data in the two markets, econometric model can be used to establish a liner regression model, and carry on the correlation analysis by their dependent relationship. Suppose, two prices have the following relationship^{[65] [72]}:

$$F_t = \beta_0 + \beta_1 S_t + \mu_t.$$

Where, F_t represents future’s price; S_t represents spot’s price in the same time; β_0 is a constant term; β_t is the regression coefficient; μ_t is stochastic disturbance term.

Based on the 276 data in Figure 6.5, regression is carried to get the regression coefficient, R square and F, as shown in the following Table 6.4

Table 6.4 *The Regression Result Summary Output.*

Multiple R	Standard error	R Square	Adjusted R Square		Observed value	
0.937995	96.86184	0.879834	0.879396		276	
ANNOVA						
	Df	SS	MS	F	Significance F	
Regression analysis	1	18822471	18822471	2006.186	4.4E-128	
Residual	274	2570727	9382.217			
Overall	275	21393199				
Regression equation	Coefficient	Standard error	t Stat.	P-value	Lower 95%	Upper 95%
β_0	56.32284	30.37481	1.854262	0.064776	-3.47484	116.1205
β_t	0.944615	0.02109	44.79047	4.4E-128	0.903097	0.986134

Therefore, the regression function is $F_t=56.32+0.94S_t$; $R=0.94$, $F=2006.19$. As shown in the output, the spots price and the futures price of the wheat in Zhengzhou Commodity Exchange are highly liner related, with the $R=0.94$ (very close to 1) and $t_{0.025}(275)=1.96 \ll 44.79$, which has proved that the spots price of the wheat has predictability.

6.2.2 Analysis of Causation

By using analysis of causation (Granger 1987) ^{[73] [74] [75]}, we can further reveal that, as for spots’ price and futures’ price, which one is the dependent variable and which is the independent variable. This can be used to analyze the guidance of the futures’ price to the spots’ price and judge whether futures’ price can contribute to spots’ price. Usually the following model is established to analyze.

$$S_t = a_0 + a_{t-1}S_{t-1} + b_{t-1}F_{t-1} + \varepsilon_t$$

Where s_t is spots' price; s_{t-1} is spot's price in previous period; F_{t-1} is futures' price in previous period; a_0 , a_{t-1} , b_{t-1} are respectively the regression coefficients; ε_t is random disturbance. The regression result is shown as Table 6.5.

Table 6.5 Regression Result Analysis Based on the "SUMMARY OUTPUT".

Multiple R		Adjusted R Square	R Square	standard error	Observed value	
0.994437		0.988823	0.988909	28.81542	275	
VAR analysis	Df	SS	MS	F	Significance F	
Regression	2	20129346	10064673	12121.31	1.4E-266	
Residual error	272	225849.4	830.3285			
Overall	274	20355195				
Parameter estimation	Coefficient	Stand error	t Stat	P-value	Lower 95%	Upper 95%
a_0	12.77312	9.202413	1.388019	0.166267	-5.34389	30.89014
a_{t-1}	0.922153	0.01889	48.81616	1.4E-136	0.884963	0.959343
b_{t-1}	0.070834	0.018321	3.866173	0.000138	0.034764	0.106904
Regression equation: $S_t = 12.77 + 0.92S_{t-1} + 0.07F_{t-1}$; $R = 0.99$, $F = 12121.31$.						

When $\alpha=0.05$, $F_{0.05}(2,274)=3 \ll 11489.48$, which means futures' price in the third previous period is of good predictability to spots' price. And the Correlation coefficient is 0.99. further analysis has shown that $t_{0.025}(273)=1.96 < 3.87$ and 48.82, which means both futures' price and the spots' price in the third previous period, as independent variables, are of great predictability to the spots' price. Therefore, as for the wheat futures in Zhengzhou Commodity Exchange, we can use wheat future's price to guide the spot's price. This is essential to risk-avoidance in agro producers and traders.

6.2.3 The Basic Analysis

The Basis consists of transportation expense and storage expense. It tends to be convergence when the delivery time comes; the change of Basis is smaller than the changes of the spot's price, which is a precondition of hedging. The Basis can be used to analyze the relation between futures' price and spots' price. Because the variance of the futures is usually smaller than that of the spots, the smaller the variance of futures is, the better hedging effectiveness (HE) will be. To prove this relation, we define the variance of futures as $\sigma^2(B)$.

Since the Basis changes with time, we use B_t to represent the Basis in the t period, S_t to represent the spots' price in the t period, F_t to represent the future's price in the t period. Therefore, $B_t = S_t - F_t$. the stability of the Basis change degree can be defined as ^[72]:

$$\sigma^2(B) = \frac{1}{n-1} \sum_{t=1}^n (B_t - \bar{B})^2$$

Where n : the number of the sample; \bar{B} is the average of the Basis.

The hedging effectiveness is determined by the variance of gains and losses due to maturity resulted by the changes of the price both in spots' market and futures' market. The function was shown by L. Johnson in 1960 ^{[72][76]}:

$$HE = 1 - \sigma^2(B) / \sigma^2(S)$$

Where $\sigma^2(S)$: non-hedging risks (in the spots market); $\sigma^2(B)$: hedging risks (in futures' market).

By calculating the variance of the wheat spot's price and future' price in ZCE, we can see that $\sigma^2(B) = 9099.81$; $\sigma^2(S) = 74881.04$. Therefore, the Hedging Effectiveness (HE) is 0.88, which means the HE of wheat future is good, and the price discovery function is good too.

The analysis above has shown that: wheat future price fluctuate widely recently, so some people think that it has been speculated too much. They worry that domestic futures market does not go have the same trend with overseas futures market. According to our survey and study, because of the new international standard of wheat, spots market has inertia and futures market has price inquire process. As a result, prices in these two markets diverge greatly (such as the futures' price trend in the first six month of 2001 shown in Figure 6.5), but the wheat futures' price will be amended soon.

6.3 The Strategy of Hedge and Its Application

The study of basis is not only related to the futures market could perform its true price discovery function or not, but also to the hedging rate and optimal effect of hedging. The definition of hedging rate is the ratio between the cash in your futures contracts and the risk assets. Different hedging rate determines different hedging positions, but there is an optimum hedging rate, which uses fewest cash to achieve best effect. Following are the research of optimum hedging rate and hedging strategy.

6.3.1 Optimum Hedging Rate

In general, the hedging rate is always considered to be a fixed number as 1. However, John C. Hull once pointed out, if the purpose of hedging is to minimize the risk, the hedging ratio of 1.0 is not always the best ^[65]. To illustrate this point, we have to determine the best hedge ratio in agricultural futures market, because it determines how much cash in futures market will makes the profit and loss on the futures market; offset the profit and loss on the spot market in the hedging with minimum risk. Assumptions: ΔS is the change of spot price in hedging time, $\sigma(\Delta S)$ is the standard deviation for the ΔS . ΔF is the change of futures price in hedging time, $\sigma(\Delta F)$ is the standard deviation for the ΔF . ρ is the correlation coefficient between ΔS and ΔF . H is the

hedging rate. As time changes, the prices of futures and stock on hand will change. Suppose the income during the hedging time is E, the values of the income for short-seller and many are different. The formulas are as follows.

For the short-seller, the variety of cash is, $E=(S_2-S_1)-(F_2-F_1)$, $H=\Delta S-H\Delta F$;

For many, the variety of cash is: $E=(F_2-F_1)H-(S_2-S_1)=-\Delta S+H\Delta F$.

So under the above two cases, the VaR of E is:

$$VarE = \sigma^2(\Delta S) + H^2\sigma^2(\Delta F) - 2H\rho\sigma(\Delta S)\sigma(\Delta F).$$

To get the hedging rate with minimum risk (h), then let

$$\frac{\partial VarE}{\partial H} = 2H\sigma^2(\Delta F) - 2\rho\sigma(\Delta S)\sigma(\Delta F) = 0.$$

We get $h = \rho\sigma(\Delta S) / \sigma(\Delta F)$.

Different hedging rates decide different quantity of cash and $\rho = 1$ and $\sigma(\Delta S) = 2\sigma(\Delta F)$, uses fewest cash to achieve the best effect. If $\rho = 1$ and $\sigma(\Delta S) = \sigma(\Delta F)$, then the optimum hedging rate (h) is 1.0. It means the price of futures reflects the spot price completely. That is to say the number of cash in futures market must equal to it in spot market and its direction must opposite. There shall be a full hedging. If $\rho = 1$ and $\sigma(\Delta S) = 2\sigma(\Delta F)$, then the optimum hedging rate(h) is 0.5, which means that the change of futures price is always as twice as the spot price changes. Thus in order to hedge for the purpose of minimizing risks, as long as the number of cash in futures market is only half as it is in the spot market and its direction is opposite. That is the best way to minimize the risk.

Example of wheat futures in Zhengzhou Commodity Exchange is taken to explain optimum hedging rate of wheat on the first three months in 2000. By the

data of futures prices and spot prices of wheat in the first quarter of 2000 we can find, $\sigma(\Delta S)=34.42$, $\sigma(\Delta F)=22.25$, $\rho=0.56$. So that, we find

$$h = \rho\sigma(\Delta S) / \sigma(\Delta F) = 0.56 \times 34.42 / 22.25 = 0.79$$

Based on the above analysis, if the purpose of wheat hedging is to minimize the risk in Zhengzhou commodity exchanges, the hedging rate of 1.0 is not perfect. According to the best hedge rate, if one wants to hedge wheat in the March 1 to buy 1,000 tons on May 1 expiration of wheat contracts, the average purchase contract positions should be 79 lots and not 100 lots.

6.3.2 The Strategy of Hedge when Basis Changes

In fact, futures prices and spot prices of wheat is always changing, sometimes up, sometimes decline, special time changes may occur in the opposite direction. If the rise range and fall range are the same, the basis is unchanged. As long as the basis is unchanged, buying and selling hedging can be fully realized.

When the spot price increases greater than the increase in futures prices, that is the variance of spot price greater than the variance of futures prices in the last example, the extend of the basis makes the loss in spot market higher than the profit in the futures market because of higher prices to sell futures contracts, only after the realization of reduced losses hedge against inflation.

When the stock on hand and futures prices increased but not decreased, longs profit in the cash market, loss in the futures market. But as long as basis expands, the profit in the spot market cannot make up for the futures market losses, but will show a net loss. On the contrary, when basis expands, and if the spot market and futures market prices are not decreased but increased, dealers profit in the spot market, loss in the futures market, the profit in spot market cannot fully make up for the loss in futures market, then longs hedge will continue to be a net loss.

If the prices in spot and futures markets is fall, but the prices decline in the spot markets greater than the futures markets, sold hedging can only be to achieve reduction losses.

If spot prices and futures prices both rise, but the increase rate in the spot price is less than in the futures market, the loss because of buying in spot market will less than the profit in the futures market because of selling futures contract when price raises.

If spot prices and futures prices both drop, dealers profits in the spot market, loss in the futures market, the profit in spot market not only make up for all the losses, but as long as the basis narrowing, long buy hedging will continue to be net profit.

According to the analysis, buying (longs) hedging hope that the basis will narrowing, and sell (short-seller) hedging expect to expand the basis. Contact years of Zhengzhou Mercantile Exchange wheat futures in Zhengzhou Mercantile Exchange, wheat hedging effect, in accordance with the basis change, the hedging strategy of wheat are shown below in Table 6.6.

Table 6.6 *Following the Basis Changes of Wheat Hedging Strategy.*

Basis change	Buying (longs) hedging	Sell(short-seller) hedging
Basis unchanged	Profit and loss balance out (Breakeven point)	Profit and loss balance out
Basis narrowing	Profit greater than loss completely hedging	Profit makes up part of loss Partly protect
Basis extend	Profit makes up part of loss Partly protect	Profit greater than loss completely hedging

6.3.3 The Open Type Hedging Strategy

In order to avoid failure, to establish scientific and rational hedging strategy is very important. “Open-hedging” is a standard of the hedging strategy. Its immediate purpose is to use one market’s profit to make up for another market’s losses. Other strategies such as the “physical delivery of hedging” and “delivery + open-hedging” are for the purpose of making money through different time.

According to the research and objectives of this chapter, we only give a briefing about open-hedging a most advanced form of hedging ^[67]. For example, on October 18, 2001 by wheat futures prices are 1080 Yuan/ton in Zhengzhou Commodities Exchange, a flour mills wants to buy wheat in the future at this price, but worried about future inflation, then hedging in the futures market against inflation, then there are two situations, such as in Table 6.7 and Table 6.8.

I. The Results of Both the Spot and Futures Prices Are Rising

Table 6.7 The Results of both the Spot and Futures Prices Raise.

Transaction date	Spot market	Futures market
October 18	Wheat price 1080 Yuan/ton (hope buy in future at 1080 Yuan/ton)	Buy 10 lots 201wheat contract; Price: 1100 Yuan/ton
December 8 (Both spot and futures prices raise)	Buy: 100-tons wheat Price: 1120 Yuan/ton	Average:10 lots 201 wheat contract: Price:1140 Yuan/ton
Result of hedging	Cost raise 40 Yuan/ton Real cost 1080 Yuan/ton	Payoff 40Yuan/ton

Source: <http://czce.com.cn> ^[68].

When futures prices and spot prices are rising, the wheat price on October 18 is 1080 Yuan/ton on spot market, December 8 is 1120 Yuan/ton, raising the cost of 40 Yuan/ton. In futures markets the price to buy on October 18 is 1100 Yuan/ton, December 8 sold price is 1140 Yuan/ton, and the final profit is 40 Yuan/ton.

II. Both the Spot and Futures Prices Fall

Analysis of this case, the results are shown as follows in Table 6.8.

Table 6.8 *The Results of both the Spot and Futures Prices Fall.*

Transaction Date	Spot market	Futures market
October 18	Wheat price 1080 Yuan/ton (hope buy into in future at 1080 Yuan/ton)	Buy:10 hand 201wheat contract; Price:1060 Yuan/ton
December 8 (Both spot and futures prices fall)	Buy:100 ton wheat Price:1040 Yuan/ton	Average: 10 hand 201 wheat contract; Price:1060 Yuan/ton
Result of hedging	Cost fall 40 Yuan/ton Real cost 1080 Yuan/ton	Payoff 40Yuan/ton

Source: <http://czce.com.cn> ^[68].

Hedging strategy mainly transferred the risks brought about by the adverse changes in price and gave up the profit might be brought about by a favorable price changes. This is very suitable for agricultural production operators who expect hedging to keep normal profits, or slightly surplus (deficit). This is a strategy to abandon risk of profit. The surplus in the futures market is to compensate the loss in the spot market, rather than investment profits. The cash wheat holder's hedging likes property insurance in the insurance company. His surpluses in the futures market like compensation for property damage, the losses in the futures market like his pay for the insurance companies. These changes can only be counted as cost, and not counted as investment earnings. Therefore, hedging is an effective measure to avoid risks brought about by price changes, especially in China. Because of China insurance business about some agricultural operational risks hasn't been carried out. Organizing agricultural hedging to prevent the production and operation risks is the most effective marketing strategy.

Summary

This chapter focused on market instrument which can solve operational risk in production. Futures market in China is still a new thing although it has existed in foreign countries for more than a hundred years. In order to obtain the first-hand materials, we visited Zhengzhou Commodity Exchange which is the

earliest market that can carry on agricultural product futures trade. Therefore, this chapter studied and discussed the basic procedure of agricultural product futures trade, basic trade analysis, the base difference analysis, the rolling hedge strategy and the price discovery function in futures market, etc. Hedging strategy is an effective measure to avoid risks in sales of agricultural products. We have given a systematic discussion of the agricultural futures markets and hedging strategy combined with wheat futures market research in Zhengzhou Mercantile Exchange. We studied the main function of agricultural futures market and the effects of hedging. The statistical methods, such as correlation analysis, regression analysis, ANOVA, causal analysis and basis analysis are found that wheat futures prices and spot prices have high linear relationship, the correlation coefficient as high as 0.94. To illustrate the delayed three months futures prices can forecast the spot prices, we used Engle and Granger factors analysis, and based on the analysis, we obtained the hedging effects $HE = 0.88$. Empirical research shows that wheat futures market run well in Zhengzhou Mercantile Exchange. It is a typical model for China's entry into the WTO to avoid risks in agricultural prices changes.

