

Research on the Application of the "Insurance + Futures" Model for Agricultural Products in Addressing Price Fluctuations

Yiran Wang*

International Education School, Hebei University of Business and Economics, Shijiazhuang050000, China

Abstract. The price fluctuation of agricultural products has brought challenges to the stability of agricultural producers and related industrial chains. Traditional agricultural futures and price risk management tools have been unable to fully meet the needs of modern agricultural development. In recent years, "insurance + futures" model, as an innovative risk management tool, has gradually shown its unique advantages in coping with the price fluctuations of agricultural products. This paper takes "insurance + futures" model as the research object, discusses its application mechanism and effect in agricultural product price risk management. Firstly, this paper analyses the causes of price fluctuation of agricultural products and its impact on agricultural producers, and expounds the operation mechanism of "insurance + futures" model. Then, through case analysis, the actual effect of this model in stabilizing farmers' income and reducing the risk of price fluctuation is evaluated. Finally, some optimization suggestions are put forward for the existing problems of the model. The research shows that the "insurance + futures" model can effectively alleviate the negative impact of agricultural product price fluctuations, provide a new solution for agricultural risk management, and also provide theoretical support and practical reference for policy makers and market participants.

1 Introduction

The price fluctuation of agricultural products is one of the main risks faced by agricultural producers and related industrial chains. Because agricultural production is affected by many factors such as natural conditions, market supply and demand, and policy changes, the price of agricultural products often shows great uncertainty. Such price fluctuations not only affect the stability of farmers' income, but also may have a profound impact on food security and the sustainable development of the agricultural industry chain. Traditional price risk management tools, such as agricultural insurance and futures markets, can mitigate the risk of price fluctuations to a certain extent, but they have their own limitations. Agricultural insurance mainly aims at the output loss caused by natural disasters, but the coverage of market price risk is insufficient. Although the futures market can hedge the price risk, its

* Corresponding author: olivia18031287053@outlook.com

complex operation mechanism and high threshold make it difficult for many small and medium-sized farmers to participate effectively.

In recent years, the "insurance + futures" model, as an innovative risk management tool, has been gradually promoted and applied in the agricultural field. By combining agricultural insurance with futures market, this model not only plays the risk protection function of insurance, but also makes use of the price discovery and risk dispersion function of futures market, so as to provide a more comprehensive risk management solution for agricultural producers. Specifically, the "insurance + futures" model provides price insurance to farmers through insurance companies, and at the same time, insurance companies use the futures market to hedge their own risk exposure, so as to realize the secondary diversification of risks. This model can not only help farmers avoid the risk of price fluctuations, but also improve the stability and sustainability of agricultural production.

However, although the "insurance + futures" model shows significant advantages in practice, its application still faces many challenges. For example, problems such as insufficient market participation and limited policy support may affect the promotion effect of this model. Therefore, it is of great theoretical value and practical significance to deeply study the application mechanism, effect and optimization path of "insurance + futures" model in coping with the price fluctuations of agricultural products.

Around the "insurance + option" model, scholars have studied the respective roles of insurance and option and their interaction, providing theoretical and data support for the study of "insurance + futures" model. By studying corn and soybean options and loan rates, Kenyon et al., found that lower loan rates may increase volatility, thereby increasing the premium of options [1]. Gao and Liu selected the daily price data of Qingdao and Yantai and the price data of 36 major cities, and used the method of adding dummy variables in the GARCH model to study the impact of the marketization of apple futures on the spot price, research and development, and long-term use of apple futures is conducive to reducing the spot price of apple. It shows that the impact of futures on spot price is long-term and far-reaching. Bakst et al. noted that the U.S. Department of Agriculture's Economic Research Service (USDA) has identified five types of agricultural risks: (1) human and personal risks (such as human health), (2) institutional risks (regarding government actions), (3) financial risks (such as access to capital), (4) price or market risks, (5) production risks (such as weather and pests) [2]. Jiang conducted a study on apple "insurance + futures" in Fu County, Shaanxi Province, and found that a sharp drop in apple prices during the selling season led to a decrease in earnings, which was the worry of fruit farmers. To solve this problem, insurance and futures successively passed on the price risks borne by fruit farmers, and finally realized the diversification of risks and reduced the losses caused by one party taking risks [3].

This paper aims to explore the application of "insurance + futures" model in agricultural product price risk management, and analyze its operating mechanism, practical effects and challenges. Through the combination of theoretical analysis and case studies, this paper attempts to provide theoretical support and policy suggestions for improving the "insurance + futures" model, so as to promote its wide application in agricultural risk management, and then provide strong support for agricultural modernization and rural revitalization.

2 Analysis of price fluctuations of agricultural products

2.1 Causes of price fluctuation of agricultural products

Agricultural price fluctuations are caused by a range of factors, such as supply and demand, climate and natural disasters.

Firstly, the supply and demand relationship affects the price fluctuation of agricultural products. First of all, the growth cycle of agricultural products is related to seasonal changes. When the seasons change, the output of agricultural products will change, and the price of agricultural products will fluctuate accordingly. At the same time, changes in consumer demand will also affect the price of agricultural products. With the increase of population and income level, dietary habits will change, which will further affect the demand for agricultural products and lead to price fluctuations [4].

Secondly, climate and natural disasters will affect the price of agricultural products. Extreme weather such as droughts, floods, and earthquakes damage crops and reduce the supply of agricultural products, leading to higher prices. Long-term climate change will also affect planting conditions, altering yields and prices. For example, global warming leads to earlier maturation of agricultural products, increased production, and lower prices [5].

Thirdly, the cost of production will affect the price of agricultural products. Rising prices of seeds, fertilizers, pesticides, etc., will increase input costs and thus increase the price of agricultural products. Labour shortages or rising wages can also add to costs.

Fourthly, the market structure will affect the price of agricultural products. Market concentration has a big impact on prices, and when only a few large players control the market, it is possible to manipulate prices by manipulating supply. In addition, information asymmetry between farmers and consumers can also lead to price fluctuations.

The price fluctuation of agricultural products is the result of many factors. Observing and monitoring these factors will help to predict and manage the price change of agricultural products better.

2.2 Impact of price fluctuations on agricultural producers

Price volatility has a profound impact on agricultural producers, mainly in the form of income instability, distorted production decisions, cost transfer difficulties, and long-term investment constraints, which increase operational risks and can lead to poverty or labor loss. When prices fall, farmers' incomes decrease, making it difficult to cover their costs. You can't benefit if you don't have enough production. In addition, volatility can lead to blindly following the trend of planting or abandoning high-value crops, reducing agricultural efficiency. Responses include government interventions (e.g., price support, agricultural insurance), market tools (e.g., futures, contract farming), and producer self-help (e.g., purchase of agricultural insurance, cooperatives, extension of industrial chains) to enhance resilience and sustainability.

Price volatility is one of the core risks faced by agricultural producers, especially for small-scale farmers. Effective risk management requires a combination of policy support, market mechanisms and producers' own capacity building to enhance the resilience and sustainability of agricultural systems.

3 The operation mechanism of the "insurance + futures" model

3.1 Operation principle of "insurance + futures" mode

As an innovative model of agricultural product price insurance, the underlying principle of "insurance + futures" is as follows: the demand of the basic agricultural product producers of the insurance company involves the price insurance of agricultural products, and farmers or related enterprises can avoid price risks by purchasing insurance, so as to guarantee returns; By purchasing options, insurance companies can transfer the risk of agricultural product price insurance to avoid the risk of payment caused by the fluctuation of agricultural product price.

Futures companies hedge the risk of price fluctuations transferred to them by insurance companies by carrying out copy option operations in the futures market. Through the futures market, they transfer risks and divide risks to reduce losses [3].

As shown as figure 1, the main entities involved in the "insurance + futures" model include: farmers, insurance companies, futures companies, and the government. Futures exchanges, etc. Their mutual relationship mainly includes: farmers purchase insurance, and insurance companies settle claims for farmers; The government provides premium support to insurance companies. Insurance companies purchase options, and futures companies settle options for insurance companies. Futures exchanges provide project support to futures companies. Futures companies conduct risk hedging in the futures market. During this process, risks were transferred twice. First, farmers transferred to the insurance company, and then the insurance company transferred the risks to the futures market through the futures company, achieving the transfer and dispersion of risks [6].

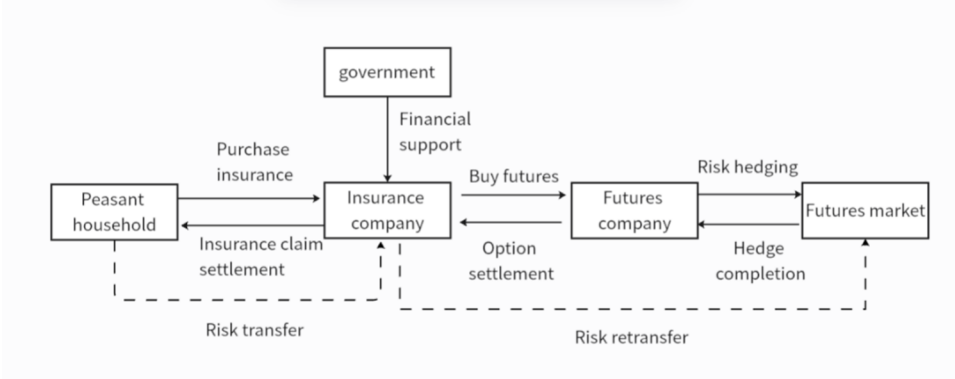


Fig. 1 Operation principle of "insurance + futures" mode

The "insurance + futures" model has three core functions, which are risk hedging, complementary advantages, and more reasonable pricing [7]. Firstly, "insurance + futures" mainly diversifies and hedges the price risks of agricultural products, thereby reducing farmers' losses. With the futures company to "reinsurance" the price, so that insurance companies in the past did not dare to insure the price risk of risk transfer. Insurance can spread the risk of natural disasters, and futures can spread the systemic risk of prices.

Secondly, the main advantages of insurance companies and futures companies complement each other, and improve the agricultural risk management system. "Insurance + futures" is to give full play to the respective advantages of insurance and futures markets, and jointly serve farmers and agriculture. Insurance is more popular, farmers are more familiar with agricultural insurance, and it is easier to understand and buy agricultural insurance, but there are still deficiencies in spreading price risks. Through the use of derivatives, futures companies can reasonably and effectively manage price risks and realize the function of price discovery, but for farmers, it is unknown and difficult to understand. The two combine with each other, give play to the advantages, make up for the shortcomings, and provide a double guarantee for the benefits of agriculture and farmers.

Thirdly, futures prices provide an important reference for insurance pricing, making insurance pricing more transparent and achieving the purpose of guaranteeing expected returns. "Insurance + futures" refers to the futures price as the basis for pricing and claims in the design of insurance products, breaking the traditional model of using spot price pricing for insurance products, and better reflects the characteristics of the future uncertainty of agricultural insurance. In 2011, the United States Federal Crop Insurance Corporation (FCIC) revised the General Agricultural Insurance Policy, making the income insurance of related crops based on futures prices as pricing reference standards. China also launched a pilot in

2021, and some provinces explicitly proposed that the price of corn income insurance refer to the futures price.

3.2 Features

Firstly, comprehensive risk management, through futures and insurance, risk management, to avoid the risk of price fluctuations. Secondly, the acceptability of financial products is high, because the popularity of agricultural insurance is stronger, farmers have higher trust in insurance and higher acceptance [6]. Thirdly, risk transfer can be carried out. Insurance can realize the transfer of natural disaster risks, while futures can realize the transfer of price risks, which plays an obvious role in the diversification and hedging of risks caused by natural disasters and agricultural market fluctuations [8]. Fourthly, the diversification of market participants, farmers buy insurance to transfer risks, the government subsidizes insurance, insurance companies and futures companies hedge risks. Fifthly, it has the flexibility to design diversified "insurance + futures" products according to the characteristics of agricultural products and the needs of farmers.

3.3 Status of risk management

At present, the scale of the "insurance + futures" model has expanded rapidly, the scope of risk management has gradually increased, and the management ability has gradually improved. In China, for example, the pilot program of "insurance + futures" was launched in 2015, and in the past ten years, the types of agricultural products involved have become increasingly rich and the scope has gradually expanded. By 2023, the "insurance + futures" model has provided services for 18 varieties such as natural rubber, corn, pigs, soybeans, and eggs, providing services for producers and suppliers of basic agricultural products, and promoting the improvement process of agricultural products market.

Since the first pilot project of "insurance + futures" was launched in 2015, the types of agricultural products involved have become increasingly rich, the scope has become wider and wider, and the scale has increased year by year. According to the report, by 2023, "insurance + futures" has invested 4.2 billion yuan in insurance premiums and paid nearly 3 billion yuan in compensation, with the loss rate of many projects exceeding 100%, which avoids price risks for farmers and enterprises and is conducive to the process of rural revitalization [6].

The variety of "insurance + futures" agricultural futures options is increasing, and by 2023, the "insurance + futures" model has been widely used in the agricultural markets of China and other countries. The variety of options involved in futures is also gradually increasing. The main varieties are corn, soybean, cotton, sugar, rubber and pig. China has gradually expanded from just corn and cotton in 2016 to 10 varieties. The United States set up a pilot model in 2000, opened in 2010, and gradually increased the variety of futures options.

The "insurance + futures" model has been widely used around the world to help farmers and agricultural enterprises avoid price risks and natural disaster risks, provide effective protection for farmers' income, reduce production costs, increase the income of farmers and enterprises, and promote economic development in rural areas.

4 Case study

Agricultural insurance and agricultural futures have different forces to alleviate the negative impact of agricultural product price fluctuations. Cooperation between the two can provide double protection for farmers and the agricultural product market, gradually reduce risks, and

strengthen cooperation and mutual assistance between markets, which is conducive to the long-term stable development of the agricultural product market, increase farmers' income and improve market liquidity.

4.1 Agricultural insurance: natural disaster risk management and popularization

Agricultural production is related to rainfall, temperature, humidity and other weather variables. Under extreme weather conditions, agricultural production will be affected and even suffer serious losses. Hazell and Hess recorded the extent of human losses caused by natural disasters. According to the report, between 1995 and 2015, more than 7,000 natural disasters occurred worldwide, affecting 4.3 billion people and causing an estimated loss of US \$2.3 trillion. In Africa, 1,145 natural disasters, including droughts, extreme heat, floods, storms, wildfires, earthquakes, tsunamis, mass movements, volcanic activity and landslides, occurred during this period affecting 308 million people. Agricultural insurance plays a positive role in alleviating these losses, enhancing the bargaining power of farmers and stabilizing the price of agricultural products. At the same time, the government reduces the burden of farmers by subsidizing agricultural insurance, enhances the ability of agriculture to resist risks, and indirectly stabilizes prices.

Changde, Hunan Province innovatively implemented the "insurance + futures" agricultural risk management model, with cotton and rice as the main pilot varieties. In the cotton project in 2021, the target price is set at 18,000 yuan/ton based on the futures price of Zhengshang Exchange, covering 5,000 acres of cotton fields in Lixian County and Anxiang County, with 70% premium subsidized by the government and 30% paid by farmers themselves. When the market price falls, the insurance company pays the difference and finally pays 1.2 million yuan to the farmers, effectively avoiding the risk of price fluctuations. In this model, insurance premiums are subsidized by the government and risks are hedged by financial institutions to effectively enhance the anti-risk ability of agriculture and help rural revitalization [9].

4.2 "Insurance + futures" model

Jiang Dehua studied the apple "insurance + futures" in Fuxian County, Shaanxi Province, and found that the sharp drop in apple prices during the selling season led to reduced earnings, which was a worry for fruit farmers. They are supported by subsidies from the government and the futures exchange, and farmers secure their rights by buying price insurance offered by the China Pacific Property Insurance Company. At the same time, the risk of falling apple price is transferred to the insurance company, and the insurance company passes the risk to the futures company by purchasing the over-the-counter options of the futures company and paying the royalty. The futures company receives royalties and replicates the put option within the futures market, passing the risk on to the participants in the futures market.

If the fall in the price of Apple futures triggers the insurance claim condition, the futures company can use the profits obtained from shorting the futures market to pay the insurance company. Through the three media of insurance products, over-the-counter options and futures contracts, the price decline insurance faced by fruit farmers is transferred to the futures market in the form of relay by insurance companies and futures companies, and futures market participants undertake and digest it, completing the closed loop of the whole process [3].

5 The deficiency of the "insurance + futures" model

First, global development is uneven, and developing countries have a low level of development, which is not conducive to model globalization. Considering that farms in developing countries are much smaller compared to countries such as the United States and Canada, traditional crop insurance products have higher administrative costs as a percentage of the total cost of insurance premiums. A portion of these costs relate to marketing and service-related (loss adjustment) insurance policies. Another part relates to the lack of farm-level data and cost-effective mechanisms to control moral hazard. These costs are even greater if rural infrastructure is inadequate (poor quality roads). In addition, the lack of a formal financial services network and legal record may increase the cost of premium collection and compensation.

Second, information asymmetry, compensation insurance is prone to serious information asymmetry problems, such as adverse selection and moral hazard [10].

Third, the burden of insurance costs is larger. On the one hand, the insurance products designed by insurance companies have higher cost, fewer insurance subsidies, and greater burden on the government and insurance companies. On the other hand, the high premium of some agricultural products leads to insufficient insurance coverage and low awareness of farmers to participate in insurance.

Fourth, the pilot coverage is small, the cooperation opportunities of insurance and futures companies are few, the maturity is not high, and inter-company cooperation still needs to be run-in and adapted [11].

6 Conclusion

This study focuses on the application of the "insurance + futures" model in coping with the price fluctuations of agricultural products, and draws three conclusions through theoretical analysis and case study. Firstly, the "insurance + futures" model can effectively deal with the risk of price fluctuations. This model combines the advantages of insurance and futures to provide price protection for farmers, reduce losses caused by price fluctuations, and stabilize income. Secondly, this model is helpful to improve the agricultural risk management system. Through the introduction of financial market tools, the means of risk management have been enriched, and the anti-risk ability of agriculture has been enhanced. Thirdly, the "insurance + futures" model still faces many challenges and a series of problems, including the lack of farmers' awareness and the need for introduction and promotion, the imperfect development of the futures market, the imperfect premium pricing mechanism, the insufficient financial support, the insufficient varieties of on-market options, and the limited capacity of the futures market.

In order to better develop and improve the "insurance + futures" model, the government, farmers, insurance companies and futures companies should work together to promote the development of "insurance + futures" model from all aspects.

At the government level, the government should strengthen financial support. In the operation chain of "insurance + futures", the cost of futures purchased by insurance companies directly comes from the cost of price insurance purchased by farmers from insurance companies. Therefore, when the futures price is too high, the premium supported by farmers will also increase, increasing the burden on farmers. Therefore, the government can increase financial support and subsidize premiums and futures costs to help farmers reduce the cost burden.

Farmers themselves: understand the change of concept, understand the "stop loss" role of agricultural insurance, can reduce costs through collective insurance, and incorporate insurance into the overall risk management system. With the improvement of the model, farmers can gradually move from passive acceptance to active use of this risk management tool.

Futures companies should improve the futures price mechanism, advance with The Times, and innovate to promote the listing of new varieties of agricultural products futures. At present, there are insufficient varieties of agricultural futures in the market, so it is necessary to accelerate the innovation of products. We can learn from the experience of the international futures market and design products according to the actual situation of the country [12].

Insurance companies need to continue to improve the premium subsidy system, expand the scope of pilot projects, increase the variety of insured agricultural products, strengthen publicity, and innovate the premium pricing mechanism according to the futures price.

Some suggestions for future research are put forward: to deepen the theoretical research, build a risk pricing model that conforms to the characteristics of agricultural products, and strengthen the development of basis risk management tools; Optimize product design, explore "insurance + futures + credit", "income insurance" and other extension models, expand the coverage of varieties and groups; Policy coordination innovation, promote cross-departmental regulatory coordination, explore "differentiated subsidies" and market-oriented reinsurance mechanisms.

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