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Research on the Benign Development of China's Hog Futures Market

--Comparison Between China and the USA

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Abstract: Hog futures are a type of financial contract that allow participants to buy or sell hogs at a predetermined price for delivery at a specified date in the future. These futures serve as a risk management tool for hog producers, processors, and speculators over pork value. This research paper aims to cover the uses of hog futures, and provides a detailed comparison with the well-established live hog spot and futures markets in the United States as compared with the newer hog futures market in China. We would also briefly explain China's live hog industry hog chain and highlight its unique characteristics. Then we cover the design of live hog futures and explore the potenti,al impact of the contextual disparities between China and the United States. Lastly a detailed analysis will be conducted on how these futures can effectively change the complexities of industry and price cycles in China drive the development of the spot market, taking into consideration the complexities of industry and price cycles.

Keywords: Hog futures, hog industry, insurance, options

1. Introduction

As of 2023, pork holds the distinction of being the most widely consumed meat worldwide, accounting for a staggering 36% of all meat consumption quadrupling its amount since 1961. This remarkable surge in demand for swine meat has led to an unprecedented increase in pig production, prompting the adoption of new techniques to meet this growing demand. One essential tool used to evaluate the growth of the swine industry is through the implementation of hog futures.

In 1966, live hog futures made their debut on the Chicago Mercantile Exchange in the United States. Fast forward to 2021, China's live hog futures were introduced on the Dalian Commodity Exchange. The global commodity futures market has witnessed a significant surge in use of the live

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hog futures, making it one of the most sought-after futures contracts worldwide. With China being the world's largest consumer of pork, hog futures ought to play a crucial role in shaping the market dynamics. Compared to the nearly 60-year development history of the pork futures market in the United States, Chinese pork futures is still in its early stages.

The United States used Vertical integration to mass industrialize the production of pigs. This breeding style differs to Chinese's industrial pork production enterprises, correlating to the spot value of pigs.

Hence The following analysis will provide a detailed comparison between the mature market in the United States and the emerging market in China. It covers various aspects of the upstream feed industry, the midstream breeding sector, the downstream industry, and other relevant factors. In addition to the necessary improvements required in the entire industry chain, there are also specific factors unique to China's national conditions.

2. Analysis of hog spot market

2.1. Comparison of the hog industry in China and the United States(As shown in Table 1)

Table 1: Comparison of the Pig Industry Chain between China and the United States

Covered Areas	China	United States
Hog Production	Driven by feed factories: In China, farming enterprises have stronger bargaining power due to a preference for fresh meat and regional pig supply distribution.	Driven by slaughterhouses: The US has a more integrated downstream market, leading to greater bargaining power for slaughter and processing companies.
Hog Breeding Practices	In China, pig farming enterprises tend to handle breeding internally, maintaining their own breeding pigs. This means that there are many small, separated breeding facilities.	Pig farmers often outsource commercial pig breeding to specialized breeding companies like PIC, Newsham, and Danbred.
Feed Resource	In China, feed production is often allocated significant resources, but the results are limited due to the lack of specialization and technological advancements	In the US. feed production operates mainly under a contract system, leading to significant economies of scale for large integrated companies.
Hog Fattening Process	Fattening is outsourced by corporations and farmers, or self-breeding and fattening is common.	Fattening is done professionally by farmers with specialized farming practices promoting improved production efficiency.
Fluctuation of price and interest	High interest rates for rural borrowing, affecting the capital needs for rural economic development (We would explain later)	Mature agricultural loan systems with long-term loans and low-interest rates for family farms.

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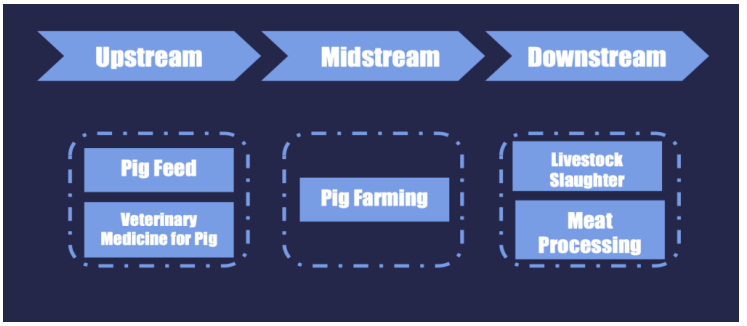

Figure 1: Pig Breeding Industry Chain (Source: Perspective Industry Research Institute)

Figure 1 is a comprehensive picture of pig breeding industry chain in order to help people understand the paper better.

2.2. A Key Introduction the Cost of Agricultural Funds in China and the United States

Due to the focus on the financial aspect, so we focus on analyzing it.
Funding and Interest Rates: Low funding costs for farmers in the United States, high interest rates for private borrowing in China. The reasons and facts are as below.

United States: Mature agricultural loan system

Commercial banks and rural credit cooperatives are the main sources of agricultural financing in the United States, accounting for around 80% of funds. Family farms have diversified sources of loans, with long terms and low interest rates. Loan terms range from 1 to 5 years for short-term loans and can extend up to 40 years for long-term loans, with interest rates typically below 5%.

China: High interest rates for rural borrowing

The government's support for rural finance is insufficient, with limited contributions from government financial investments in the agricultural financing system. From 2001 to 2012, although rural investments in China increased from 721B yuan to 4.3T yuan, their proportion in total social fixed asset investment decreased from 19.38% to 11.48%. The investments in agriculture, forestry, animal husbandry, and fisheries in urban fixed assets also declined from 1.64% to 0.81%, fluctuating significantly. Financial institutions' credit investment in agriculture has weakened over the years, failing to meet the capital needs for rural economic development. From 1995 to 2012, the proportion of loans to rural areas in the total national bank loan balance decreased from 11.27% to 4.71%, with an average annual decline of 0.5 percentage points. In 2012, the total balance of all loans from financial institutions in the country was 67 trillion yuan, and agricultural loans accounted for only 5.09%. (Source: Sina finance) Additionally, in recent years, the net outflow of rural funds through financial and postal savings channels has reached approximately 400 billion yuan annually. (He Guang Wen,2004). This situation severely affects the development potential of agriculture.

Family Farms: Financial institution loans have short terms, high interest rates, and small amounts; interest rates for private borrowing are excessively high. Reference to the interest rates for loans to small and medium-sized enterprises at 6%-8%, the interest rates for farm household loans are even higher, and the loan terms (average 1-3 years) are generally shorter than what family farms actually need. Even if they can choose longer loan terms than their actual loan needs, farmers have to bear a heavier interest burden, which affects reinvestment and development of family farms. In most rural areas of China, farmers often lack sufficient assets for collateral, resulting in small loan amounts, and they are often limited to personal credit loans, which are also not substantial. At the same time, interest rates for private borrowing in rural areas are excessively high, with some reaching above 12%, and even up to 30%.

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Large Advantageous Enterprises: Abundant financing channels, multiple choices for fund terms, and relatively lower funding costs. Advantageous enterprises can finance through various means, such as issuing bonds, stocks, credit loans, and mortgages. Due to their good credit and strong debt-servicing ability, they can obtain funds at much lower costs compared to family farms. For instance, Wenshi Foodstuff Group issued two corporate bonds in 2017, totaling 2.5 billion yuan, with a 5-year term and a weighted interest rate of 4.82%.(Source:Wenshi Food Group Co., Ltd. 2017 Corporate Bond (Phase 1) Entrusted Management Affairs Report (2019))

2.3. Research on Feed Cost Represented by Soybean Meal

In hog production, corn and soybean meal, as the main feed, are the Committed step to analyze production costs.

Because of this, in addition to spot goods, there is also a strong correlation between hog futures, corn futures, and soybean meal futures. The emergence of hog futures in the United States is linked to the early use of futures in commodities such as corn and soybean. The highly developed agriculture in the U.S. led to large-scale cultivation of crops like corn, wheat, and soybeans in the 19th century. The livestock feed aspect of these crops was fully utilized, enabling localized livestock farming to achieve minimal feed costs and maximum efficiency. This contributed significantly to the appearance and global leadership of the hog futures market. In the trading market, cross breed arbitrage orders are often used to lock in the prices of corn and soybean meal futures, in order to achieve the goal of stabilizing hog futures or spot prices, or to hedge the risk of unilateral trading of one of these three futures varieties. And around the above introduction to the level of agricultural development in the United States, we will mainly focus on the cost advantage of soybean meal futures in the United States compared to China. From 2010 to 2018, the total cost of soybeans in China surpassed that of the United States and showed an increasing trend. The material and service costs in the United States have steadily increased, while labor costs have remained almost unchanged; However, China has experienced drastic changes in labor and land costs. As shown in Figure 2.

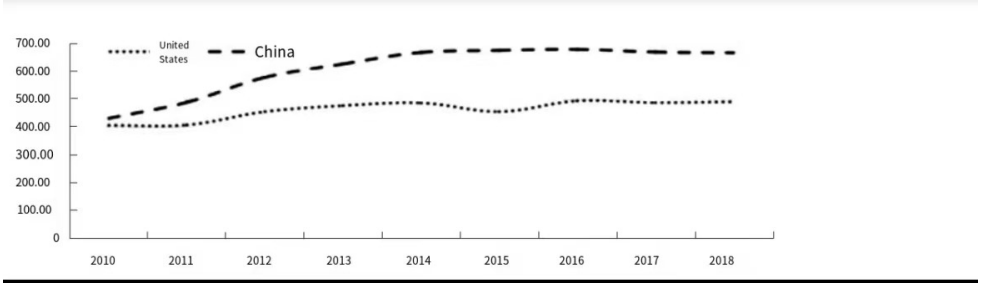

Figure 2: 2010-2018 Total cost of soybeans in China and the USA (yuan/mu)

It can be seen that the main reason for the increase in the total cost of soybeans in China is the significant increase in labor costs and land costs, with a net increase of 88.96 and 107.24 yuan/mu, respectively, an increase of 77.15% and 77.11%, respectively. In contrast, among the three costs in the United States, the most significant increase is the net increase in material and service expenses and land costs was 44.33 and 35.48 yuan/mu, respectively, with growth rates of 16.96% and 28.85%. [1].

In the 1940s, Chicago quickly developed into a grain distribution center due to its proximity to the Great Lakes and the fertile farmlands in the Midwest. To stabilize market management, traders established the Chicago Board of Trade (CBOT), and soybean futures trading began. As trading volumes expanded, Chinese factories and South American farms gradually adopted the pricing model of CBOT. Today, 100% of the world's soybean prices are based on CBOT. The large-scale cultivation

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of genetically modified soybeans and highly mechanized agricultural production in the U.S. significantly reduced the production costs of soybeans. Additionally, the developed transportation conditions in the U.S. have lowered soybean transportation costs, resulting in lower soybean prices on the CBOT compared to those on the Dalian Commodity Exchange.

Overall, the pig industry chains in China and the United States exhibit different patterns due to the variations in consumption habits, bargaining power, and information transparency. Each country can learn from the strengths of the other and explore opportunities for collaboration to improve their respective pig farming sectors.

Fluctuations in pork prices, sudden large-scale uncontrollable epidemics, major food safety incidents, systemic risks in the macroeconomic system, extreme climate disasters leading to significant crop reduction and pushing up grain prices, and listed companies being affected by African swine fever.

3. Analysis on the Cyclical Fluctuations of Price in the hog Market

3.1. US

The creation of the initial buffer in pork processing, which involved increasing production before COVID-19 disruptions affected packing plants, was driven by two main factors. First, it was influenced by the past trends in price movements observed in the futures market. Second, it was supported by a stable condition in the cash market for pork; the stability of the cash market refers to the degree in which the amplitude and frequency of price fluctuations are low, and the state of the market's economic order remains stable. However, news of the COVID-19 pandemic's impact on the United States caused concerns among futures market participants about possible supply disruptions and demand impacts, leading to a decline in futures prices.

The Chicago Mercantile Exchange (CME) lean hogs futures contract pricing for April 2020 showed a decline from the mid $70s in January to $45.60 per cwt(centum weight)on April 15, reflecting the impact of the pandemic on the futures market. As shown in Figure 3.

Figure 3: Daily lean hog futures prices for the April 2020 contract

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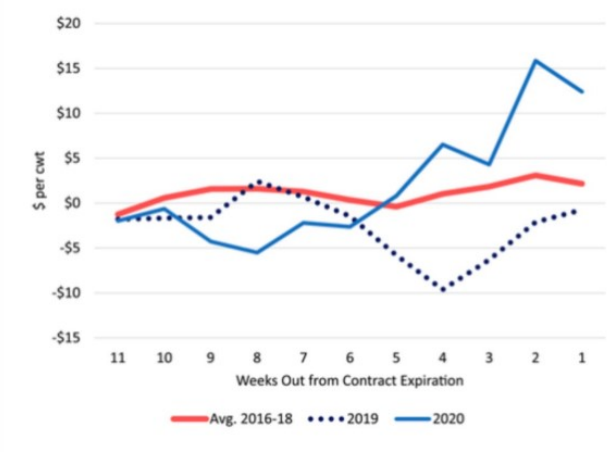

Figure 4: Weekly lean hog basis, April contract

During the same period, the cash market remained relatively firm, as indicated by the weighted average weekly producer sold for all purchase types of hog price. The basis which represents the difference between cash market prices and futures contract prices, showed deviations in 2020 compared to 2019 and the 2016–2018 average. While lean hog futures prices slumped, the basis held within historical norms, except for a temporary drop from the second week of February to the first week of March. As shown in Figure 4.

As the downturn in the April futures contract accelerated in late March and early April, the cash market remained strong, resulting in a large positive basis. Four weeks out from contract expiration, the basis was over $6 per cwt, and it jumped to over $15 per cwt two weeks before expiration. This strong basis served as a signal to producers to market hogs and take advantage of the positive basis, especially for those who had hedged by selling futures contracts. On the other hand, a weak basis, like in 2019, signals a need to delay marketings, with the expectation that the basis will return to a more normal level.

Overall, the analysis highlights the impact of the COVID-19 pandemic on the pork futures and cash markets, the role of basis in creating a processing buffer, and the importance of monitoring market signals for timely decision-making by producers.

3.2. China

In 2019, the Chinese pork market experienced cycles of short-term supply surplus and tightness mainly due to the outbreak of African Swine Fever (ASF). ASF, a highly contagious pig disease, had a significant impact on China's pork production and supply. However, the duration and intensity of supply surplus and tightness varied in different regions and over time due to the ongoing and complex nature of the ASF outbreak.

Supply Surplus Cycle:

ASF resulted in the mass culling of pigs, leading to short-term supply surplus in some areas. Implementing control measures and culling plans caused a sharp decline in pig populations in certain regions, resulting in temporary supply surplus.

Supply Tightness Cycle:

On the other hand, continuous ASF outbreaks in certain areas led to pork supply tightness. The unpredictable spread of ASF kept pig populations low in some regions, causing supply shortages and short-term tightness.

The duration of supply surplus and tightness cycles in the Chinese pork market in 2019 was relatively short, typically lasting several months to a year. However, the uncertainty of the ASF

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outbreak could lead to variations in supply fluctuations in different regions and timeframes. It is essential to note that the outbreak and spread of ASF could have lasting effects on the market, prolonging the duration of supply fluctuations until the outbreak is fully controlled and recovery is achieved.

The increase in production capacity and the subsequent decline in prices were other contributing factors. The recovery of pig production capacity led to a rapid increase in domestically produced pork supply. Additionally, high pig weights, coupled with increased imports of pork, led to a substantial oversupply of pork in the domestic market. The combination of oversupply and price decline resulted in severe losses for pork producers.

Furthermore, some pork producers faced significant losses due to excessive expansion during price peaks, leading to overcapacity and a lack of cost considerations. As pork prices started to decline, these producers were forced to accept losses.

In contrast to the opinion of some analysts, the significant decline in pork prices was not solely due to blind expansion by pork producers, but rather, it was influenced by the culling of sows during the ASF outbreak. This direct impact on sow numbers contributed to the downward pressure on pork prices.

Overall, the Chinese pork market faced challenges in 2019, with fluctuating supply and declining prices driven by the ASF outbreak and its complex effects on pig populations. The situation differed across regions and timeframes, leading to varying degrees of supply surplus and tightness. Additionally, other factors, such as production capacity, import volumes, and pricing strategies, influenced the profitability of pork producers in the market.

4. Research on the Functions of hog Futures

As a kind of financial derivatives, hog futures have various functions to the spot market. First of all, hog futures have price discovery and guidance function to the spot market. Secondly, hog futures are an important tool for enterprises to hedge, therefore, it is of great significance to play the function of hog futures for the spot market of hogs. From the development trajectory and practice of foreign futures markets, the listing of new futures varieties to the effective play of futures price discovery and risk control function takes three to five years, from the law of development, the development of China's hog futures is still in the "cultivation period".

4.1. The Birth of Pig Futures and Underlying Asset Design - A Comparison of China and the United States

According to the chart compiled by the BBC, we can observe:

In 1995, China's pig slaughter volume was 406 million heads; in 2005, it increased to 552 million heads; and in 2014, it reached 735 million heads. (Source: Ministry of Agriculture and Rural Affairs of China) China and the United States have completely different directions in the utilization of pork. China has a long-standing preference for pork, and pork dishes are popular in various provinces across the country, such as Beijing's braised and stir-fried liver, Guangdong's pig stomach with chicken... On the other hand, in the United States, apart from the beloved fried pork chops, grilled pork ribs, and bacon, much of the other valuable parts of the pig are abandoned.

However, in the United States, "pork financialization" has been taken to the extreme. The Chicago Mercantile Exchange (CME) launched the world's first pork futures. US pig farms have separate rooms for dead pigs, with air conditioning to prevent rapid decomposition. Even to prevent swine fever, vehicles within and outside the pig farms do not cross transport. The feed system is fully automated, with preset weighing information, and it automatically sends messages to the feed factory to ensure smooth supply of feed.

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According to relevant statistics, over the 50 years since the launch of pork futures, the number of pig farms in the United States has decreased by 96%, but the average stock has increased by 17.42 times.[2]. Small-scale pig farms are almost non-existent as pork futures become a booster for industry consolidation.

In 2018, Dalian Commodity Exchange attempted to launch pork futures but was interrupted due to the impact of African swine fever. In 2019, domestic pork prices soared, and Dalian Commodity Exchange accelerated the listing process of pork futures, which was officially launched in 2021.

The essence of futures is a contract, and its design revolves around the aspects of the underlying, quality, quantity, delivery time, and place in the contract.

The choice of underlying assets for futures is critical. In the global futures trading market, there are two types of cattle products: "Live Cattle" and "Feeder Cattle." But for pigs, there is only one type, called "Lean Hogs." Feeder cattle refer to calves raised to become larger cattle, while live cattle are used for meat, milk, and hide. For cattle, the growth cycle is one year, compared to pigs, which only take 4-5 months, posing higher risks. Moreover, Europeans and Americans have always favored high-protein beef, and the fluctuations in pork are not as sensitive as in China. Therefore, in the European and American markets, the risk of cattle is more sensitive, leading to phased beef futures. However, although there is only one type of pork futures, its underlying assets have changed. With the improvement of standardized pig farming, the development of logistics distribution technology and transportation systems, and the improvement of warehousing facilities, the spot transaction pricing of pigs has shifted from live pig pricing to lean pork carcass rate pricing. To meet the needs of the spot market development, the CME's pork futures contract has also been adjusted accordingly, changing from live hogs' futures to lean hogs' futures contract, with the underlying being carcass pigs that meet the lean meat rate and weight standards. At the same time, the delivery method has changed from physical delivery to cash settlement, with the settlement price determined by CME's Lean Hogs Index. In addition, with continuous improvements to the lean hogs' futures contract, its trading volume has been increasing. In 2001, CME added a May lean hogs' futures contract, adjusted the index for final settlement price in 2002, and adopted open outcry and electronic trading. Furthermore, in 2003, the contract's underlying asset's lean meat rate was raised to 54%.[3] It can be said that regardless of how the futures contract is designed and changed, its development must be based on the spot market and adapt to the spot market, providing a means for the spot market to hedge price risks.

4.2. Market Functions of Hog Futures

4.2.1. Price discovery function of hog futures

The phenomenon of "hog cycle" has been a typical feature of hog price fluctuations, while the market lacks effective forward price guidance. The risk of price fluctuations in hog farming is deeply troubling for all business entities in the hog enterprise chain. Therefore, hog price fluctuations have become the most critical factor in determining the profitability of hog farming. Effective forward price guidance in the market is an important way to maintain the smooth development of the hog industry.

With the launching of hog futures on the Dalian Commodity Exchange in 2021, risk management tools in the market are further improved. The expected price of the future market generated through the open bidding of multiple participants in the futures market, with the function of price discovery.

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Figure 5: Trends in China's hog futures and spot prices (Source: wind)

The trend of China's hog futures and spot prices from January 8, 2021 to July 25, 2023 is illustrated in Figure 1.

However, the price discovery function of futures needs time to be improved. As indicated by the chart, the price of hog futures in China does not fluctuate in line with the spot price of hogs in the early stage of listing. Hog futures prices are showing a slight upward trend, while hog spot market prices are way down. But after a period of development, although the futures price and spot price still exist deviation, from a general point of view, China's hog futures period spot price from the hog futures listed at the beginning of the brief deviation to later price fluctuations tend to be consistent. Although the market is still in its infancy, and there is still a long way to go to maturity, the discovery function of China's hog futures on spot prices is gradually increasing, and the effect of the futures market's anticipation of the future price of the hog spot market has begun to appear. The trends in China's hog futures and spot prices are shown in Figure 5.

4.2.2. Hog futures hedging

The listing of agricultural futures mainly stems from the use of hedging and thus avoiding the risk of agricultural spot market. Hog futures are the earliest live delivery varieties in China, and hog farming enterprises can utilize the price discovery function of hog futures to adjust the scale of farming in a timely manner, thus realizing the smooth change of hog and pork market prices.

Overview of Hedging Theory

Risk-averse individuals buy and sell similar commodities in the futures and spot markets, respectively, thereby establishing a hedge between the risks in the futures and spot markets. Market participants use hedging to reduce losses from price fluctuations and to realize the use of gains in the futures market to compensate for losses in the spot market, and risk averse individuals will choose commodity futures for hedging in order to minimize losses.

Hedging according to buy and sell contracts are divided into two categories: one is to buy futures that is long hedging, the second is to sell the spot as short hedging. Who does what?

As the main seller of hogs in the spot market, hog farming enterprises will sell hogs strictly according to the current market price. In order to avoid the loss caused by the fall of hogs' price in the spot market in the future, the farming enterprises will choose to short hedge in the futures market, i.e., to agree on the price of the future transaction to sell futures, so as to prevent the price from falling sharply and bring about a significant loss.

The necessity for farming enterprises to utilize hog futures to protect their value

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It is necessary for farming enterprises to utilize hog futures to protect value. China hogs are mainly distributed in Sichuan, Henan, Hunan, Shandong, and these provinces are the main set of hog futures delivery depot. China large-scale hog farming enterprises are Wens Foodstuff Group, Muyuan Foods Co, Zhangbang Technology, etc., these enterprises are characterized by the huge scale of farming, of which there are nearly a dozen listed companies, the market value of the scale of close to one trillion yuan. Due to the 2018 hog cycle, and the effects of swine fever, less than 30% of businesses are profitable according to their FY2021 financial statements [4]. If the farming enterprise in advance of the hedge operation, in the event of a decline in the price of hogs can be in accordance with the price of the futures contract for delivery, the general delivery contract price will be higher than the spot market price, the futures market profits will be partially offset by the loss of the spot market price decline, thus ensuring the liquidity of the enterprise funds.

4.3. The use of hog futures for risk

4.3.1. The Future + Insurance Model

At present, hog futures play a larger role in hedging the risk of spot price, enterprises through futures and over-the-counter options to protect the price of hogs, is one of the important ways. The insurance company takes the futures price of agricultural products listed in the futures market as the underlying, and establishes the corresponding agricultural product price insurance; the farmer or agricultural enterprise manages the price risk by purchasing the agricultural product price insurance, and reduces or suppresses the impact of the fluctuation of the agricultural product price on its own production and operation; the insurance company hedges its own payout risk by purchasing over-the-counter (OTC) options provided by futures risk management company. The insurance company hedges its own payout risk by purchasing over-the-counter options provided by the company's risk management company to achieve the purpose; the futures company risk management company carries out hedging transactions in the futures market according to the corresponding model, replicates the put options, and transfers the risk of price fluctuations to the futures market.

Advantages

1. If insurance companies provide insurance services for farmers alone, they may face huge compensation, and if futures companies carry out customer development alone, there are problems such as low professional level of farmers and small trading volume. The model involves external synergies, and the cooperation between insurance companies and futures companies makes full use of the core functions of price discovery and risk transfer in the futures market, and also gives full play to the advantages of the sinking of the agricultural insurance service network and the high degree of acceptance by farmers.

2. In this process, the government can provide subsidies to farmers through premium subsidies and other means to reduce the cost of insurance and promote the enthusiasm of farmers to insure, which belongs to one of the new types of agricultural subsidies, which are more direct, more operational and more conducive to safeguarding the interests of farmers than the traditional transport and planting subsidies.

Example[5]

Figure 6 shows a detailed process of Insurance + Future project

1. One of project that China Government support is in Gucheng County, Xiang yang City, Hubei Province. The hog insurance + futures project is manipulated by two companies, which are Yangtze River and Hubei Ping An Property Insurance. As mentioned before, the price of hog futures continually decreases. To solve this issue, the insurance effectively increases the price of hog futures. Meanwhile, Hubei Ping An Property Insurance has completed the compensation payment.

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In the project, farmers purchased hog price's insurance from Ping An Property Insurance, and the insurance company purchased live pig off-market options from Changjiang Industrial Financial Services (Wuhan) Co., LTD., a subsidiary of Changjiang Futures, and carried out risk hedging through the futures market, transferring the price risk to the futures market, and realizing effective risk management of live pig price decline.

According to Security Daily, the total compensation of the project is more than 1.46 million yuan, and the loss rate is as high as 146%. The smooth development of the project not only effectively avoided the risk of falling pig prices for local farmers in Hubei Province, but also improved the awareness and understanding of the hedging function of the insurance + futures project and derivative instruments such as option futures to a certain extent.

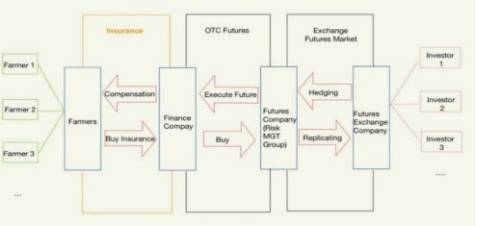

Figure 6: Detailed Process of Insurance + Future project

This project is also one of the decentralized pilot projects of the "Dashangsuo Agricultural Insurance Plan", which lasts for 1 month, and guarantees a total of 11,300 pigs for 4 farmers, with a total premium of 1 million yuan, which guarantees the income of farmers while stabilizing the price of the pig industry.

According to the market price of hog in China, the hog price from November 2022 to December 2022 continually decrease. The hog price drop from 25.60 yuan to 22.00 yuan. If the hog insurance does not exist in the market, the potential loss is at least 2 million yuan.

4.3.2. Utilization of options

Off exchange options refer to non-standard financial option contracts conducted in non-centralized trading venues. They are financial derivatives that are self-designed and traded according to the needs of both parties through negotiations between off exchange parties or matchmaking by intermediaries. The nature of the options trading is basically not different from that conducted on the exchange, and the fundamental difference between the two lies in whether the option contracts are standardized. Development of over-the-counter options in China: In 2013, over-the-counter options were introduced in China, allowing qualified institutions to participate in over-the-counter option trading. Domestic commercial banks and qualified large fund companies became the first buyers of over-the-counter option trading. In 2017, various third-party trading channels were established, and the over-the-counter option business rapidly improved. Individuals can participate in off market option trading through various channels, mainly through asset management channels and private equity fund channels.

The frequent introduction of new asset management regulations in 2018 restricted the feasibility of new asset management plans connecting with over-the-counter option trading. Securities firms and private equity institutions received window guidance from regulatory authorities, marking the standardization of the over-the-counter option market. Since 2020, the regulatory system and regulations have basically taken shape, and the over-the-counter option business has entered a high-speed development stage (data source: Abama). The latest data from the China Securities Association shows that as of May 2021, the scale of over-the-counter derivatives has approached 1.5 trillion yuan. In May, the over-the-counter financial derivatives business added an initial nominal principal of

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566.506 billion yuan, a decrease of 51.759 billion yuan compared to the previous period, and a decrease of 8.37% month on month; As of the end of this period, the outstanding initial nominal principal was 1481.388 billion yuan, an increase of 51.522 billion yuan compared to the previous period, or 3.6% month on month (data source: China Securities Association). Companies providing OTC option trading services in China include GF Securities, Guotai Jun'an, Huatai Securities, CICC, China Merchants Securities, etc.

Looking purely at the derivatives themselves, options provide beneficial support to the futures market. In well-developed financial markets, option trading can reduce price volatility in futures contracts. From a broader perspective, options trading enriches trading strategies and fills certain gaps. It enhances the liquidity of less active contracts and increases market capital. Regarding the Chinese pig futures market, the strategy of options plus OTC options is not widespread. However, the strength of OTC options will be highlighted in the following section, emphasizing their positive significance in achieving a stable futures pricing mechanism. Additionally, it will explore how to safeguard the interests of small and medium-sized enterprises and individual farmers in the futures market, promoting the co-healthy development of leading enterprises and SMEs(small and medium-size enterprises).

One typical case is the period since August 2018 when the African Swine Fever led to a rapid decline in China's pig inventory and a significant increase in pig prices. Starting in 2020, China's pig inventory and output gradually recovered, and pig prices reentered a downward cycle in the first half of 2021. Faced with drastic price fluctuations in pig prices, pig farmers struggled to cope, resulting in significant losses, diminished confidence, and a large number of individual farmers permanently exiting the market. Company A, a professional agricultural and animal husbandry enterprise engaged in feed production, sales, and pig farming, slaughtered approximately 6,500 tons of pigs in 2021, mainly purchasing piglets for fattening externally.(Source: New Hope Liuhe 2022 annual report) Throughout the years of pig farming, they endured the cyclical challenges with limited capacity to address them, relying on limited and lagging market information to adjust the farming volume in response to risks, often missing the peak prices and selling at low points. After the launch of pig futures, the company made small-scale attempts to hedge using pig futures but lacked the expertise and capital to actively manage risks in the futures market. Consequently, they preferred to choose more suitable tools available in the market to match risks, aiming to stabilize the exit prices while maintaining the farming scale.

In early 2022, as the inventory of sows declined to the normal holding level, pig prices continued to fall, and the September contract price of futures stabilized near the break-even line for small and medium-sized pig farmers. During contact with Huatai Futures Chengdu Branch, the company expressed that by the end of February, they purchased 4,500 piglets (weighing approximately 500 tons) for fattening, with a bullish outlook on future pig prices. However, they also worried about significant losses during the sales period if consumption declined upon pig maturity. Engaging in a short futures hedge would entail additional margin calls and erode the profits from rising spot prices. To address these concerns, Huatai Futures collaborated with its subsidiary Huatai Great Wall Capital to provide options-related training to the company and customized an OTC option product to optimize pig exit profits. The company was also invited to participate in the 2022 Dalian Commodity Exchange "Enterprise Risk Management Program." From a futures and options perspective, tailored hedging advice was provided. For the 500 tons of pigs the company planned to exit in the future, if they used futures hedging, the estimated initial margin for selling in February would be approximately 1.7 million yuan. In the case of a futures price increase, additional margin calls would exert significant financial pressure, without the possibility of profiting from a price rise. Alternatively, by purchasing a put option, they could hedge against the risk of price decline. If the spot price continued to rise, they could enjoy additional profits without facing margin pressures. However, they would need to pay the

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option premium. Additionally, the plan introduced a bear market spread structure, expected to reduce 40-50% of the option premium. However, the company chose not to select it due to concerns about extreme risk events.

On February 24, the company bought put options at a strike price of 17,100 yuan/ton, paying a premium of 1,826 yuan/ton for 500 tons of pigs, hedging for a six-month period until August 30. As the market unfolded, the reduced supply of fattened pigs caused by the decline in sow inventory appeared, leading to continuous pig price increases. As of the settlement date, August 30, the settlement price rose to 22,160 yuan/ton, exceeding the exercise price, resulting in a total loss of 913,000 yuan for the premium. However, in the spot market, the company's pig selling price at the time of entry was 11,400 yuan/ton. As the deadline approached, the company sold a total of 16 batches of pigs, totaling 4,575 heads with an average weight of 110 kilograms, resulting in an average selling price of 22,047 yuan/ton, increasing the sales price by 10,647 yuan/ton. The spot value appreciated by 5.32 million yuan. Overall, the project's integrated futures and spot earnings amounted to 4.41 million yuan, with profits mainly derived from the spot price increase far exceeding the option premium loss. If futures hedging were used, according to a 20% margin rate, the highest margin utilization during the period would be 2.329 million yuan (the highest price in the interval being 23,290 yuan/ton). At the contract's expiration, liquidating the futures at a price of 22,160 yuan/ton would result in a loss of 5,060 yuan/ton, totaling 2.53 million yuan in losses. After combining futures and spot, the overall profit would be 2.7935 million yuan, significantly lower than the total profit from options hedging. The main source of profit in futures hedging was a substantial change in the basis, with the basis changing from -5,700 yuan/ton at the beginning to -113 yuan/ton at the end, resulting in a basis profit of 5,587 yuan/ton. The specific change of the contract is shown in Figure 7.

Figure 7: DCE IH2209 Contract Price Trend (Source: Wind Stock Market)

Compared to linear profit and loss patterns of futures, options offer a more flexible and diverse approach, providing a higher level of risk management product that better caters to individual trader preferences. In this case, even though the company incurred the maximum loss of 913,000 yuan on the options side, the spot market profits far exceeded expectations, with spot profits being more than five times the option losses. The non-linear profit and loss characteristics of options were vividly demonstrated, making the use of options hedging a crucial factor for the project's success. Another critical factor contributing to the success of the project was the company's recognition of the significance of aligning futures with spot positions. By prioritizing long-term option products that correspond to the pig's growth cycle, the company managed to achieve more comprehensive protection, despite incurring higher costs. Currently, the market and government entities are exploring mechanisms for long-term hedging to address the issues of short-term and small-scale hedging.

The derivatives market poses a higher entry barrier, and small to medium-scale pig farmers may struggle with limited financial resources, lack of expertise in derivatives, and weaker risk control capabilities, which makes their direct participation in the futures market riskier. However, these farmers still account for a significant portion of China's pig farming industry. The absence of these

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participants in the futures market creates a structural gap among market participants, hindering the efficient functioning of the futures market's price discovery mechanism. Through the "Enterprise Risk Management Program" offered by the Dalian Commodity Exchange, small and medium-scale pig farmers can participate in the futures market, effectively transferring the risks of price fluctuations and expanding the futures market's capacity while encouraging qualified investors to strengthen the market.

Since the introduction of pig futures in January 2021, Company A, one of Shandong's leading slaughter companies, and Company B, a prominent frozen meat trader in Tianjin, have been continuously exploring the pig futures and over the counter (OTC) options markets.(Source: DCE Futures Daily) In 2021, the two companies utilized frozen pork as the underlying asset for spot trading and pig OTC options as the underlying asset for options trading, successfully conducting a pig futures and options trade that yielded favorable comprehensive economic benefits.

As a pig farming enterprise, Company A's operating model involves slaughtering pigs into fresh meat for sale in major agricultural markets. When same-day sales are not feasible, the meat is frozen for future sale to frozen meat traders when market conditions are favorable. On the other hand, Company B primarily engages in frozen pork trading, serving downstream processing plants and end retailers. The two companies collaborated on the pig futures and options trade, with Company A acting as the supplier and Company B as the demander. Company A had already engaged in pig hedging in recent years, acquiring experience in derivatives hedging and suitable management systems. Facilitated by Guotai Junan Futures, the two companies decided to utilize frozen pork as the underlying asset for the pig futures and options trade. They aimed to enhance their understanding of the pig futures market, accumulate successful experiences, explore pig futures basis trading, and establish a robust corporate risk management system. Using OTC options, they sought to hedge against price risks and prevent sharp price declines after the Mid-Autumn Festival, as domestic pork prices typically do not peak at this time, and often decline after the festival due to reduced demand. Before the Mid-Autumn Festival in 2021, Company A analyzed the market and predicted a post-festival price decline. However, to maintain operational continuity and ensure the ability to supply downstream companies under any market conditions, the company needed to maintain a certain inventory level. The goal was to achieve normal shipments while maintaining pork prices at levels acceptable to downstream companies. Company B had already signed long-term supply contracts with several local catering companies and food processing plants, requiring them to supply 1,000 tons of segmented hind leg meat after the festival. To ensure a stable supply of products, the two companies signed a pig futures and options trade contract. Company A aimed to avoid the risk of a sharp decline in pork prices and supply disruptions after the festival, while Company B sought to secure sources in advance and ensure that Company A had enough frozen hind leg meat to meet the needs of downstream enterprises. Based on the intentions of both parties, Company B provided a pricing method that combined spot and options. Subsequently, the two companies signed the trade contract, specifying that if the closing price of LH2201 futures on September 22, 2021, was not higher than 14,325 yuan/ton, Company B would purchase spot pork from Company A at 12,100 yuan/ton. If the closing price was higher than 14,325 yuan/ton, Company B would purchase spot pork at the closing price minus 2,500 yuan/ton. Before signing the contract, the two parties estimated the price difference based on the previous 20 days, ultimately setting the basis at 2,500 yuan/ton. On September 15, 2021, the contract was signed, and on September 17, Company B purchased put options with LH2201 futures contracts as the underlying asset from Guotai Junan Futures, transferring the risk of spot trading.LH2201 is shown in Figure 8.

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Figure 8: DCE LH2201 Contract Price Trend (Source: Wind Stock Market)

As a result, on September 22, 2021, the futures price was 13,772.5 yuan/ton, lower than 14,325 yuan/ton. Therefore, Company B purchased spot pork from Company A at 12,100 yuan/ton, totaling 880 tons. For upstream Company A, the pig futures and options trade provided them with the right to "follow the rise and avoid the fall," locking in the minimum selling price of 12,100 yuan/ton while retaining the profit potential from price increases. For Company B, after the project's completion, they received compensation of 810,900 yuan from Guotai Junan Risk Management Company, with an additional profit of 220,800 yuan after deducting the premium from the OTC option. This hedging strategy successfully protected their positions and transferred the risk.

5. Suggestions and Prospects

5.1. Utilization

In the future, the Chinese Government will consider adding Future + Insurance project in the policy insurance. Based on the government subsidy rate, financial subsidies will reduce the self-insurance ratio of farmers, thereby increasing their participation enthusiasm. In the long run, the comprehensive operation of the project relies on government support. On this basis, the future may be included in the scope of policy insurance, like traditional pig insurance. The high subsidies from the government can encourage farmers to participate and maintain the healthy development of the pig farming industry.

In the future, may continue to receive support from the government and the futures market. Government support is self-evident. In recent years, the futures market has responded to national policies to assist in poverty alleviation for farmers, making significant contributions. Additionally, the futures market in the country lacks sufficient vitality, with issues such as limited internal trading and a lack of futures varieties. The futures hedging aspect can effectively increase the internal vitality of the futures market. Given external and internal factors, the futures market has reasons to continue supporting the project.

5.2. Utilization of OTC options

Overall, the utilization of over-the-counter options for weighted trading in the pig industry has yielded favorable outcomes. Despite declining pig prices, the bearish positions in the OTC options effectively hedged the risk of slaughterhouse sales prices, assisting enterprises in securing their supply sources and mitigating default risks in unfavorable price scenarios, resulting in positive returns. This trading approach demonstrates three key characteristics: first, it expands the application of OTC options beyond pig-related trades, introducing a novel trading model for frozen pork. Second, it explores innovative risk management methods, as both parties hedged risks while further refining internal risk management strategies, accumulating valuable experience in combining futures and spot transactions. Third, it enhances the cohesion of upstream and downstream enterprises within the pig industry chain.

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Throughout this option-weighted trading process, derivatives and spot trading are harmoniously integrated, transforming options into spot pricing methods, thereby increasing spot trading profits and enriching risk management tools.

In the future, leveraging the option-weighted trading model may effectively highlight the role of OTC options and significantly elevate the risk management level of the entire pig industry chain. Moreover, it will provide increased opportunities for small and medium-sized enterprises lacking funds and risk management capabilities to participate in the market fairly, thus avoiding structural issues in the participation of futures market participants. The introduction of options also impacts the futures market in two significant ways: firstly, the asymmetry of option returns highly appeals to spot enterprises, offering unlimited profit potential and limiting losses to option premiums well below futures margins. Secondly, option exercises enhance futures market liquidity. Option trading encourages futures exchanges to adopt market maker systems, where market makers provide quotes and execute trades in options while simultaneously hedging risks by opening positions on corresponding futures contracts. For instance, the trading volume of pig futures contracts from November to January significantly surpasses other months, yet spot enterprises have continuous production, whereas futures exhibit cyclicality, resulting in a contradiction between spot continuity and futures periodicity. However, with options listed and market makers participating, the trading volume of less active contracts witnesses a substantial increase in the short term, enhancing liquidity.

In conclusion, continuous optimization of the futures trading system is imperative to better align with international futures markets, facilitating more efficient operation of both futures and options markets to serve the real economy more effectively. This will undoubtedly contribute to the improved service and performance of the Chinese pig futures market.

6. Conclusion

(1) Based on the comprehensive analysis provided, several key conclusions can be drawn:

(2) China has significant potential for improvement in various aspects of the pig farming industry, including feed production, farming practices, breeding systems, sow management, fattening efficiency, and cost management. In comparison to the United States, where these aspects are highly specialized and commercialized, China's pig industry chain exhibits relatively lower efficiency and higher costs.

(3) The changes in the underlying assets and delivery mechanisms of pig futures highlight the accelerated standardization and market integration of the Chinese pig futures market. Moreover, China demonstrates higher potential in terms of pork demand and utilization, presenting substantial opportunities and challenges for global commodity futures markets and market participants.

(4) Pig futures continue to enhance their functionality in the spot market, becoming a crucial tool for hedging and risk management. They hold significant importance in stabilizing commodity prices and promoting the sustainability of financial markets. However, compared to the U.S. pig futures market, China still faces challenges in stabilizing forward profits and effectively serving the spot and real sectors. Speculative and profit-driven behaviors remain common, indicating that China's pig futures market still has a long way to go.

(5) The emerging new models of "insurance + futures" and "futures + over-the-counter options" are crucial for fully leveraging the stabilizing mechanism of futures prices. They also contribute to optimizing the structure of futures market participants, promoting social fairness, and breaking information barriers. China has taken a bold step in the new model of swine breeding and domestication. The improvement of policies and regulations provides strong support for China's unique social structure. The country is making significant progress towards a mature market phase with individual characteristics. From both the industrial and financial perspectives, a promising

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development of the Chinese pig futures market can be foreseen. It also signifies the establishment and enhancement of the world's financial system and a new financial order.

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