



# The Role and Performance of Hog Futures in China

Yifan Li<sup>1,\*</sup>, Xiangyu Shi<sup>2</sup>, Ling Zhang<sup>3</sup>, Mutian Guo<sup>4</sup>, Michael Ka Chun Lai<sup>5</sup>

<sup>1</sup>College of Business and Economics, Australian National University, Canberra, 2600, Australia

<sup>2</sup>School of Aviation, University of New South Wales, Sydney, 2052, Australia

<sup>3</sup>Qingdao No.9 High School, Qingdao, 266432, China

<sup>4</sup>School of Art and Science, University of Colorado Boulder, Boulder, 80309, United States

<sup>5</sup>Dickinson College, Carlisle, 17013, United States

791380978@qq.com, 1076946320@qq.com,  
zhanglin20051127@outlook.com, Mugu2297@colorado.edu,  
laim@dickinson.edu

**Abstract.** Pork is the largest meat product in China, but the hog market is deeply affected by the hog cycle. In order to stabilize hog prices and to protect hog breeding enterprises, the Dailian hog futures was launched. We compare the volatility of pork cash prices before and after the release of hog futures, and we found that hog future did not reduce the price volatility, even worse. The article searches for problems faced by the Chinese hog market by comparing it with the U.S. hog market, such as the number of large farms and the participation in the futures market. We also discuss the dilemmas faced by some Chinese hog futures rule makers.

**Keywords:** Hog cycle, Hog futures, Cash price volatility

## 1. Introduction

China is the world's largest producer of hogs, accounting for nearly half of the world's total percentage of hogs [1]. The sale of hogs typically increases as people's incomes increase. Hogs are one of the most important agricultural commodities in China. Stabilizing hog prices is essential since the hog sector is critical to maintaining the stability of people's lives. In addition, it plays a crucial role in improving the efficiency of the production.

The term "hog cycle" is defined as "the periodic hog price variations during the 4-y period. This would result in more erratic price swings. The hog market cycle has six phases: the growth phase, the peak phase, the decline phase, the recession phase, the trough phase, and the recovery phase [2]. China has had many hog cycles up to this point, with about four years passing with each complete cycle. In China, there have been four hog cycles documented, spanning May 2006 to the present. The cobweb phenomenon is also one of the primary causes of the hog cycle. Hogs will become less available and more expensive as hog production declines, despite consumer demand for the meat remaining constant. The farmers would then realize that it was profitable

to rear the hogs, so they would likely increase the number of sows to bear young. As a result, the quantity of hogs entering the market reduces, causing the demand for hogs higher than the supply, as well as the price of hogs. The number of hogs will increase when these hoglets are old enough to be sold, making the supply of pork greater than the demand, which would result in a decrease in hog prices. This chain effect could cause producers to reduce the number of sows and piglets. Ultimately, demand will be greater than supply, and the price of hogs will rise again and enter the cycle again [3]. The launch of hog futures might avoid the blindly expansion or reduction of production capacity for hogs, promoting the healthy and orderly development of the industry, as well as preventing the extreme situation of rushing up and scattering. In the context of the extremely obvious hog cycle effect in China, the launch of hog futures is of importance. Our study aims to verify whether the launch of hog futures acted as a price stabilizer. Still, the listing time of China's hog futures is January 8, 2021, which is less than four years, so it has not played a significant role in stabilizing the volatility of the hog spot. The article analyzes the reasons behind the fluctuations in pork prices and discusses the possible solutions to the problem.

## 2. Literature Review

For storable commodities, such as corn, coffee, and sugar, forward markets are seen as trusted expectations in cash markets. However, commodities that cannot be stored, such as hog, are less predictive in forward markets [4]. The cost of storage activity acts as a link between cash and forward prices, but in commodities like goods that cannot be stored, the link is broken because the inventory does not play a role. When using the traditional forward price calculation formula to calculate commodities that cannot be stored, the model's R-square appears to be zero.

Hog futures at the Chicago Trading Center are important commodity futures that cannot be stored [5]. Most of the hog farmers in the United States are now using hog futures hedging, the hog industry in the United States has undergone drastic changes, especially since 1980, horizontal and vertical industrial chain integration has made the hog industry a collection of fewer, but larger scale companies. Because of the evolution of the U.S. hog market structure, the role of United States' hog futures has become more and more significant. One study found that suppliers utilizing futures delivery accounted for 80% in 2001 [6].

Often, agricultural producers or other industry participants use forward prices to help them guide decisions [7]. If the predictive power of futures is not high, decisions made based on them can be counterproductive. However, the buyer of the future can guarantee their profit due to futures. Still, it is particularly important for consumers to understand whether the predictive power of hog futures can provide participants with accurate information of the market outlook. Although some research suggested that the prediction ability of hog futures on cash is ambiguous, after the re-integration of the industrial structure and the optimization of the futures trading system itself, the situation may be different in the present. Based on a study of data from the Chicago Trading Center from 1998 to 2004, hog futures prices were found to have reliable forecasts for

cash prices [5]. Moreover, the standard deviation of the Chicago hog cash market fell by 4 percentage points after the launch of hog futures, indicating that the futures market function is in play [8].

### 3. Data Analysis

In order to understand whether Chinese hog futures are effective and can positively influence the cash price stability on the market, we found the average cash unit price of hogs from September 2011 to May 2022 from Wind database and used the market volatility of the monthly yield to represent the situation of the futures contract launching to make the participants' investment income change. We calculated the standard deviation to compare the fluctuations in yields between the two samples before (from 08/30/2019 to 12/31/2020) and after (from 01/01/2021 to 05/31/2022) the launch of hog futures. The volatility of yield data was calculated by EXCEL, and the standard deviation before the release of hog futures was 1.82, while the standard deviation after the listing of hog futures was 3.18, as it is shown in Table 1 below.

**Table 1.** Hog Spot Price Statistics

<b>Descriptive Statistics</b>	<b><i>Before</i></b>	<b><i>After</i></b>
Mean	16.9753	8.9547
Standard Error	0.4422	0.7718
Median	17.1700	8.0500
Mode	#N/A	6.2100
<b>Standard Deviation</b>	<b>1.8231</b>	<b>3.1824</b>
<b>Sample Variance</b>	<b>3.3237</b>	<b>10.1274</b>
<b>Kurtosis</b>	-0.5492	1.5467
<b>Skewness</b>	0.1146	1.4755
<b>Range</b>	6.6400	11.6800
<b>Minimum</b>	14.0500	5.4000
<b>Maximum</b>	20.6900	17.0800
<b>Sum</b>	288.5800	152.2300
<b>Count</b>	17.0000	17.0000
Maximum	20.6900	17.0800
Minimum	14.0500	5.4000
<b>Confidence Level (95.0%)</b>	0.9374	1.6362

source: Wind

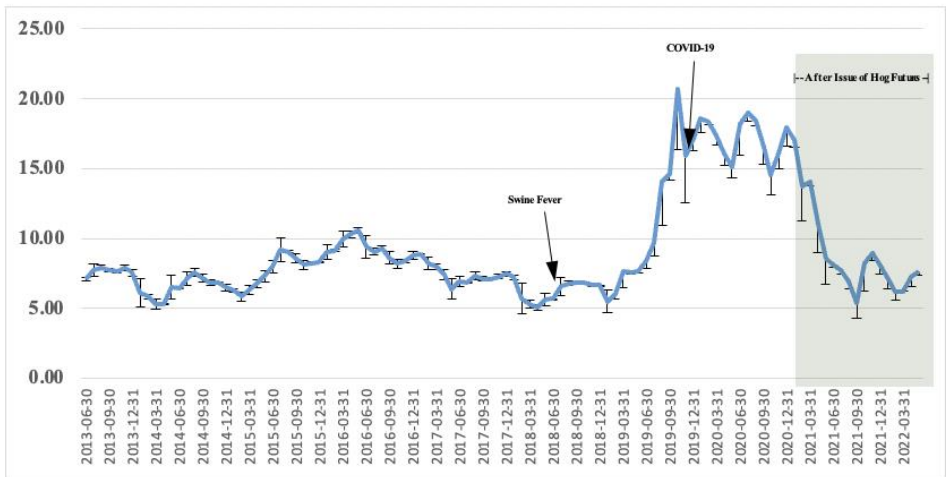
Moreover, in the Figure 1 below, we can see the variation of the cash price is higher after the issue of hog future than before. However, the right skewness and the outlier might trigger the variation upward biased.



source: Wind

**Fig. 1.** Variation of Hog Spot Price Before and After the Issue of Hog Futures

If we look at the longer-term volatility curve below in the Figure.2. The price has raised sharply under the joint effects of Swine fever and Covid-19. Then, after the introduction of hog futures, the price was pulled to its normal level around ¥7.6 as production was gradually restored. In this sense, the futures did recover the hog price, but it did not reduce the price volatility by its nature, however more data are needed to bring a more concrete result in the future.



Source: Wind

**Fig. 2.** Volatility of Hog Spot Price

#### 4. Discussions

With more study and research, we believe that there are three main reasons why the futures market has not played its full role.

1. To truly play the role of the futures market, most producers and consumers need to participate in the future market. Hog futures, which have only been running for more than a year, are far from reaching the scale of "centralized trading". Data from the Dalian Commodity Exchange shows that as of January 7, 2022, the cumulative trading volume of Hog futures was 6.1669 million lots, with a turnover of 1.74 trillion yuan. The average daily position is 60,800 lots, which is only equivalent to more than 8 million hogs. The average number of hogs produced in China in normal years is about 700 million per year, and the proportion of the futures market is still very small.

2. There are more abnormal events in the industry, such as the epidemic, which caused the price to fluctuate greatly. Due to the recurrence of the COVID-19 epidemic, there has been a shortage of supply for feed enterprises, and the prices of feed and raw materials have increased to varying degrees. Moreover, the traffic restrictions caused by the epidemic and the lack of capacity of transport companies have caused a sharp increase in freight rates. These costs will be passed on to the hog farm, resulting in an increase of the production cost. The epidemic has led to poor pork sales, an increase in live hogs, and an increase in feeding density, and this results in a decline in feed remuneration and an increase in breeding costs.

3. Compared to developed markets, the proportion of large-scale farms in China is low. In the 1980s, there were about 670,000 hog farms in the United States, which were greatly reduced to about 65,000 in 2008, which is also a process of large-scale breeding to replace retail farming, during which "super hog farms" were born. In 2008, the top twenty hog farmers provided more than 50 percent of the U.S. market's supply, while the top-ranked companies accounted for 18 percent of the nation's supply share. In China, the proportion of producers involved in futures trading is also far from enough, and by the end of 2021, all 2600 or so unit customers will participate in Hog futures trading. In the same period, there were more than 19 million breeding units in the country, including 180,000 large-scale enterprises. Even if the 2600-unit customers of large commercial firms are all large-scale breeding enterprises, it only accounts for 1.44% of all large-scale enterprises. The market principle of futures must fully focus on supply and demand in order to truly reflect market changes and guide future production. If the proportion of the futures market is too small, it will not play a role in price discovery and guidance in the future, and it will be difficult to achieve the effect of hedging and passing on unnecessary risks. Secondly, the relatively high proportion of small-scale farms managed to convince retail investors to blindly conform to the others, resulting in a vicious circle of increased price fluctuations due to herd effect.

## 5. Outlook

The trading quality of China's hog futures is affected by the national territory, which is prone to regional issues. This is mainly manifested in the decline in hog quality caused by long-distance transportation, and large regional price difference.

Hog as one of the most important agricultural commodities in China, a considerable part of hog futures will be delivered physically. Since inspection takes place when picking up, transportation loss plays a role. The delivery of live hogs that met the quality

standards shall be completed by loading the live hogs into the transport vehicles and providing the animal quarantine certificate to the pick-up customer. After the delivery is completed, the picking customer shall transport the goods by themselves, and the risk of live hog damage and loss (after the delivery of future hogs) will be borne by the picking customer, which is called transportation loss.

This is mainly affected by such factors as the water intake before the hog is released from the market and the excretion consumption during the transportation [9]. Although requiring the breeding enterprises to cut off food and water in advance can reduce most of the transportation losses, the environmental temperature and the hog density in the carriage still cause inevitable losses. The extremely short and long transportation distance will cause higher losses than the medium distance transportation [10]. The benchmark delivery place of China's hog futures is Henan Province, and the rest are distributed in Shandong Province, Jiangsu Province, Hubei Province, Anhui Province, Zhejiang Province and other parts of the country. However, according to the diversity of hog varieties and the difference in the demand for different types of pork in different parts of the country, the transportation distance is either too long or too short, resulting in a higher risk of transportation loss.

China has a vast territory, where different regions can develop different agriculture industries that corresponds to their regional advantages. The places which are close to raw material production areas have cost advantages; and the places that are close to pork consumption areas have sales advantages. Generally, the northern region with more abundant production resources has a certain cost advantage. The local supply exceeds the demand, so the pork price is lower than that in the south. At the same time, the formation of regional price differences is also related to the investment choice of capital, the breeding layout of enterprises, the trade flow and breeding structure, and the supply-demand balance of the market.

As shown below (Fig.3), taking central China as the reference system, the northwest, northeast and North China belong to low price areas, while the southwest, East and South China belong to relatively high price areas, with the situation that the north is weak and the south is strong. However, before the occurrence of African swine fever, the southwest region was the leading region in terms of hog price. After the occurrence of African swine fever, South China became the leading region in terms of price. The price in the southwest region was even lower than that in Central China in the past two years. There was a relative disadvantage in the breeding in the southwest region.

	North-west China	North-east China	North China	Central China	South-west China	East China	South China
2017	14.39	14.31	14.34	14.55	14.98	14.74	14.37
2018	12.98	11.66	12.15	12.56	13.71	13.27	13.22
2019	19.39	20.77	20.86	21.77	21.57	22.77	21.94
2020	31.91	32.31	32.8	34.64	34.85	35.17	37.1
2021	19.21	18.97	19.5	20.31	20.14	20.71	22.15
2022	12.98	13.06	13.62	14.26	13.76	14.5	15.31

<Data source: National Grain and Oil Information Center, CSC Futures>

**Fig. 3.** Hog prices in various regions of China (yuan / kg)

A live hog contract size will be 110 to 140 pigs, approximately 16 tons per lot [11]. Tiny difference in hogs' unit-price from different regions can create giant gap between

varied hog contracts, which is indicated in Figure 4. A value difference of more than 30,000 yuan is generated in two single contracts from North and South China.

	North part of China	Central China	South part of China
Average Hog Unit-price in Different China Regions (2017-2022)	18.62	19.68	20.24
Average Hog Contract Price in Different China Region (2017-2022)	297964.44	314906.67	323786.67

**Fig. 4.** Average Hog Unit-Price and Hog Contract Price in Different Regions in China (yuan)

Therefore, from the perspective of development, China can set up multiple hog futures contracts parameters according to regional differences. Otherwise, the long-distance physical delivery should be considered as over-resource-consuming, which deserves a tax collection. Providing policy support, improving the information system, expanding information release channels, and establishing an ideal hog quotation system based on detailed statistical data can be achieved in China.

## 6. Conclusion

It will still take time for China's hog futures to play its role in the hog market. As of now, whether it is stabilizing producer profits or stabilizing market prices, more efforts are needed other than the hog futures. Hog future simply acts as a switch, market can react accordingly by itself. However, the risks posed by the Chinese hog cycle remains imminent, and futures are one of the means of the market, but not all of them. From the government's point of view, in the future, it is also necessary to create a better business environment, such as the establishment of a smoother supply and demand information release channel, such as a comprehensive concentration of agricultural products trading, etc., to establish a better market operation mechanism, and play the role of the market in order to optimize the allocation of resources.

## Acknowledgment

Yifan Li, Xiangyu Shi, Ling Zhang, Mutian Guo and Michael Ka Chun Lai contributed equally to this work and should be considered co-first authors.

## References

1. Liu, H., Sun, D. (2010) Three development trends of China's pig industry and pork consumption outlook. *China Gaomu magazine*, 46: 12.
2. Liu, Y. (2007) Reflections on the increasing cyclical fluctuation of hog price in recent years. *Market Modernization*, 155: 164.
3. Zhang, X. (2010) Pig futures to control pig prices substantially of action of wave. *Market modernization*, 46: 12.
4. Tomek, W. (1997) Commodity Futures Prices as Forecasts. *Review of Agricultural Economics*, 19(1):23.

5. Carter, C., Mohapatra, S. (2008) How Reliable Are Hog Futures as Forecasts?. *American Journal of Agricultural Economics*, 90(2):367-378.
6. Barkema, A., Drabentstott, M., Novack, N. (2001) The new U.S. meat industry. *Economic Review*, 86:33-56.
7. Gardner, B. (1976) Futures Prices in Supply Analysis. *American Journal of Agricultural Economics*, 58(1):81-84.
8. Wang, K. (2012) Research on the necessity and feasibility of hog futures launch in China. <https://d.wanfangdata.com.cn/thesis/D297254>.
9. Wang, L., Cui, D., Zhang, D., Yu, Y. (2021) Cash Industry Foundation of Hog Futures. *China Futures*, 29-36.
10. Dewey, C., Haley, C., Poljak, Z., Friendship, B., Widowski, T. (2009) Transport Losses in Finishing Hogs. <https://www.thehogsite.com/articles/transport-losses-in-finishing-hogs> .
11. Chow, E. (2020) China's hog futures set to make debut, but face big challenges. <https://www.reuters.com/article/us-china-futures-hogs-analysis-idUKKCN2500H3>.

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

