ISSN 2959-6130

Analysis of the Impact of the Covid-19 on Agricultural Product Futures and Prospect

Yichen Sun[1,*]

[1] Nottingham University Business School China, University of Nottingham Ningbo China, Ningbo, China
Corresponding author: biyys54@nottingham.edu.cn

Abstract:

Although COVID-19 has come to an end for a few years, the impact that it has on the economic market cannot be ignored. This paper analyzes the effect of COVID-19 on agricultural product futures in the United States market. And mainly analyze the price changes of agricultural product futures and the correlation between the different futures during and after the pandemic. In addition, this paper also discusses how to reduce risk with the hedging method. Moreover, the article also explores future research directions, including deepening research on hedging strategies. From the analysis, it seems that the pandemic enhanced the volatility of the price of agricultural product futures. And affected the price correlation between each two futures contracts. After analyzing various data on agricultural product futures, there is an opportunity for investors to hedge risk hedging. However, A good commodity price hedging strategy needs to be fully analyzed and timely adjusted according to market conditions to achieve the goal of better risk control and maximization of returns.

Keywords: COVID-19; Futures; Agricultural product futures; Price correlation.

1. Introduction

The COVID-19 pandemic has had a great impact on the global financial market. With the operation of the pandemic, most countries have successively introduced a series of control policies for epidemic prevention. It is true that these policies to a certain extent prevent the continued dissemination of the pandemic, the policies could lead to the stagnation of production activities, disruption of the supply chain, and various economic fluctuations. In addition, the pandemic and the lockdown order had caused public panic of lack food supply. Moreover, the remarks of some scholars have led to the lunacy purchase of some agricultural products as they mentioned these agricultural products can protect people from COVID-19 or may alleviate the patient's symptoms. These matters mentioned above primarily caused significant fluctuations in the agricultural futures market during the pandemic. As agricultural futures are a more reasonable means of ensuring income for farmers, the fluctuations in the futures market may let the futures become the reason for the loss.

Against the backdrop of the global pandemic, the global economy is facing unprecedented challenges. The impact of the COVID-19 epidemic on the global commodity market is more significant. As the largest derivatives market, the significant fluctuations in US commodity futures prices are bound to have a great impact on the global economy.

As a global sudden and highly contagious epidemic, COVID-19 has had a great impact on the economic market. Due to the huge influence that is caused by it, many scholars have conducted relevant research on it. Consumer spending in agriculture has fallen sharply due to COVID-19, however, as the sustenance is inelastic it needs time to reflect the price change [1]. The impact of COVID-19 on China's agricultural futures market is on the production, processing, sales, transportation, demand, and other aspects under a certain environment, which is interrelated and mutually supportive, namely a structural impact on the entire agricultural futures market [2]. The COVID-19 pandemic has had a significant but different impact on the multifractal characteristics and sustained levels of agricultural futures markets [3].

Some scholars have analyzed specific agricultural futures and reached relevant conclusions. The COVID-19 pandemic has affected the price of wheat as its operation has let some countries published lockdown policies and the demand for wheat sharp decline, also it affected the difference between the farm-gate cash price and corresponding futures prices of major commodities in farms [4]. It analyzed two listed (NCDEX) benchmark agricultural futures indices in India which showed that the prices of two futures fluctuate greatly and display instability [5]. The COVID-19 pandemic has caused the depth of soy-

bean outright futures to drop by half, the sharp increase in bid-ask spread, the decrease in its market's liquidity, and increasing its hedging costs [6].

Besides the direct effect that came from the general environment of COVID-19, some related futures markets that suffer from COVID-19 could also have an impact on the agricultural futures market. One of the important factors that affect the fluctuation of commodity prices is the spillover effect, the COVID-19 enhanced return spillovers in the crude oil market and agricultural product market [7]. Using the network analysis with PMFG find out that the metals and grain industries were less relevant during both the financial crisis and COVID-19 and global commodity futures markets are more connected during COVID-19 than during the economic crisis due to the tight connections between networks [8].

By analyzing the coefficient estimates for the specification, they found that hedging efficiency declined during COVID-19 compared to the pre-pandemic period for the entire Brazilian futures market, even accounting for a range of real economic and financial controls [9]. As agricultural futures are the main investment products, people still may invest in them during special periods like COVID-19. According to the research, during the COVID-19 pandemic, investors can invest in soybean oil and rice in tranquil periods and soybean and rice in crisis periods to reduce the risk, as they occupy a high proportion in the minimum variance portfolio and soybeans have a low variance and high average correlation [10]. This research may provide advice to investors.

Through literature review, the paper comprehensively reviews the theoretical basis and previous research results of agricultural product futures price analysis during the epidemic, providing solid theoretical support for subsequent data analysis and research.

2. Analysis

2.1 Method

To analyze the influence of COVID-19 on agricultural product futures, this paper adopts diversified research methods and detailed data analysis to ensure the comprehensiveness and depth of the research. This paper selected seven futures (soybean, soybean meal, corn, wheat, orange juice, cocoa, and wood) as samples and selected data during and after the pandemic for analysis. This article strives to ensure the rigor and credibility of the research. The data collected mainly comes from authoritative channels such as the US Commodity Exchange, Futures Exchange, and financial institutions. These official sources of data are not only true and reliable, but also highly authoritative, providing a solid foundation for subsequent analysis. To ensure the integrity and accuracy of the data, outliers and missing values were removed, ensuring the purity of the data and eliminating interfering factors for subsequent analysis. With the help of Excel, using average, stander deviation, covariance formulas, and some basic computational functions to calculate the correlation rate of the price of each two futures and find out the degree of correlation between the two futures.

2.2 Price Analysis of Changes in Futures of Different Agricultural Products

The price of agricultural product futures could directly show the impact of COVID-19. According to the graph "Price of the futures during the COVID-19", it shows that during the COVID-19 period, most futures' starting prices and ending prices are basically at the same level (Fig. 1).

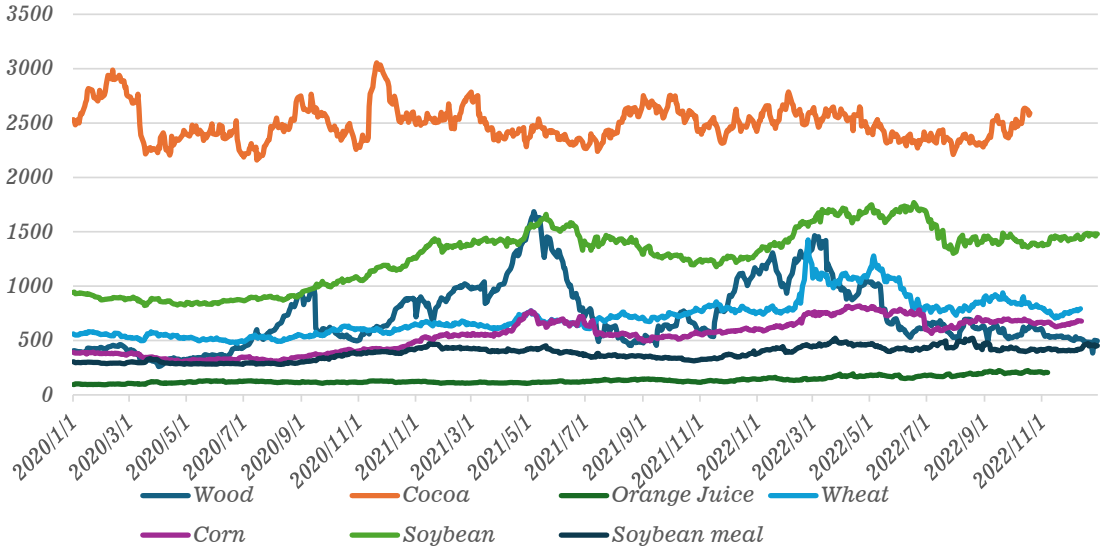

Fig. 1 Price of the futures during the COVID-19

The price of corn futures, wheat futures, and cocoa futures had a light-increasing trend. And soybean future price had a significant growth. Moreover, the prices of orange juice future and soybean meal future maintain stability. Among these futures, wood futures had the most obvious price fluctuations. During the pandemic period, it had four price fluctuations with significant price differences. Its price had increased rapidly from April to May in 2021 and then a sharp decrease from May to July and the D-value is more than a thousand. It also had price fluctuations in the later period with a large price difference. In this group of futures, cocoa's future price is the most unstable. Its price continues to fluctuate slightly. During the pandemic, most futures had relatively significant price fluctuations from February to August in 2022 (Table 1).

Table 1. Information table of the futures prices during the pandemic

	Soybean	Corn	Wheat	Soybean Meal	Orange Juice	Cocoa	Wood
Standard deviation	268.50	145.83	164.82	61.33	29.47	160.65	300.10
Average price	1265.87	534.24	704.46	376.03	134.59	2493.47	724.08
Maximum price difference	947.25	515.5	101.25	66.9	130.5	894	1426.2

The primary factor of the impact of COVID-19 lies in the imbalance between supply and demand. As COVID-19 has strong infectivity which causes the situation of lack of labor to produce and transport the products, it may cause a short-term shortage of product supply. The publication of compulsory home quarantine caused people to buy a large amount of food in the short term. Moreover, the epidemic has new situations every day, people become sensitive and suspicious in this crisis, and they may be more concerned about relevant news and make decisions more immediately. Under the impact of the epidemic, investor confidence has been severely damaged, and risk appetite has decreased. Some countries have implemented measures such as export controls and trade restrictions to protect their own industries and market stability. These measures not only directly affect the supply and demand relationship of commodities, but also indirectly affect the formation and fluctuation of prices. These uncertain factors let the volatility of the futures price increase (Fig. 2).

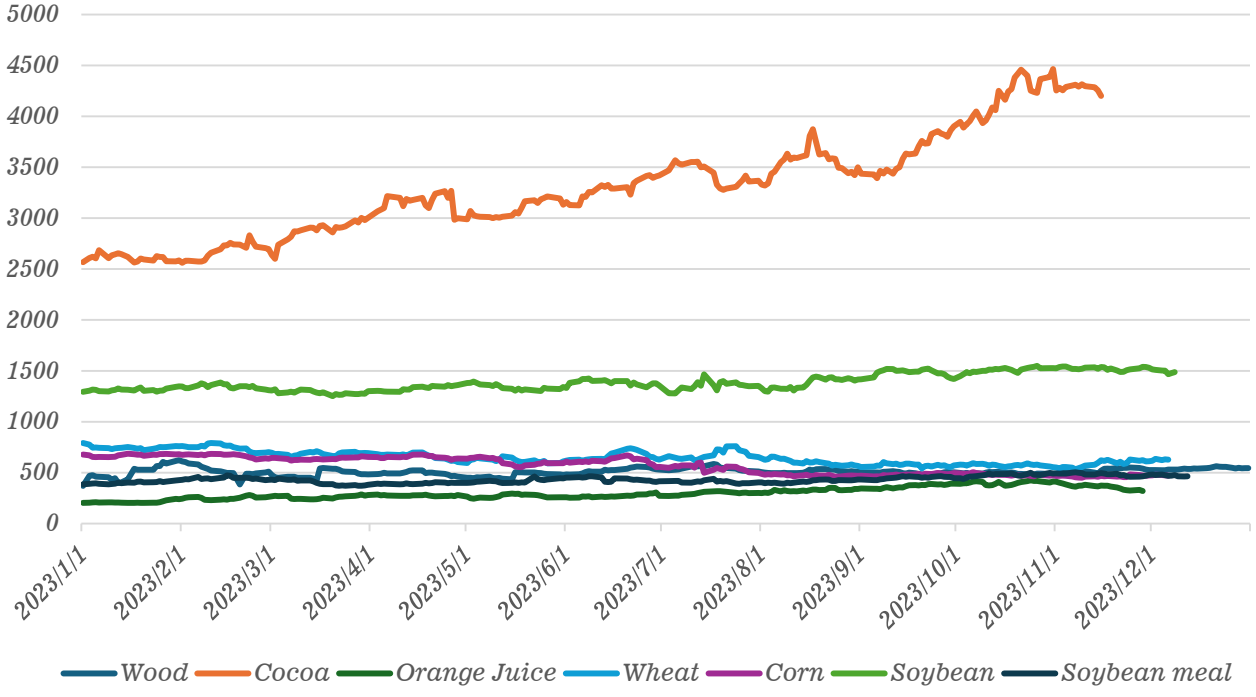

Fig. 2 Price of the futures after the COVID-19

As the pandemic has come to an end, some price-influencing factors have disappeared and most futures prices are gradually returning to normal levels. The graph "Price of the futures after COVID-19" showed that most prices

of the futures remained stable. The price of cocoa futures increased sharply. The price of soybeans had a slightly increasing trend (Table 2).

Table 2. Information table of the futures prices after the pandemic

	Wood	Cocoa	Orange Juice	Wheat	Corn	Soybean	Soybean Meal
Standard deviation	35.33	511.35	59.12	65.95	84.08	85.02	33.20
Average price	511.20	3324.67	302.73	643.05	561.99	1389.34	431.73
Maximum price difference	222.5	1904	222.8	257.75	235.5	296.25	132.3

Compared with the two graphs, most futures had a high volatility during the COVID-19. It seems that after the end of the epidemic, all futures prices have rebounded, and cocoa futures are the ones with the fastest price recovery. According to the two sheets above, they directly showed that the standard deviation of these futures had sharply decreased from the pandemic period to the after-pandemic period. And the maximum price difference of these futures is at the same level in the after period. As the prices of agricultural product futures are influenced by many aspects and COVID-19 has affected several areas of the whole society, these made the prices of the futures more unstable during the COVID-19 period. After COVID-19, the factors that caused the impact decreased, and the prices of the futures became stable and gradually returned to normal levels.

2.3 Correlation Analysis of Changes in Futures of Different Agricultural Products

The graph of the price correlation of the futures during COVID-19 showed that soybeans and corn had the strongest correlation during the pandemic (Fig. 3). Then is the correlation between wheat and corn. For most futures, cocoa has a negative correlation with them.

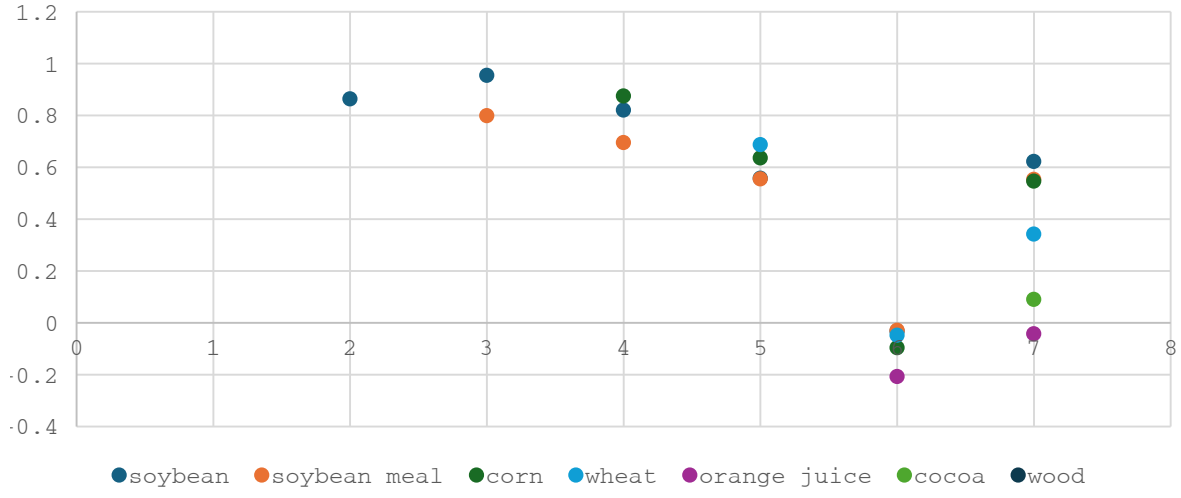

Fig. 3 Price correlation of the futures during the COVID-19

The graph of the price correlation of the futures showed that orange juice and cocoa had the strongest price correlation, and then soybean and soybean meal. Most futures had a negative price correlation with orange or cocoa (Fig. 4).

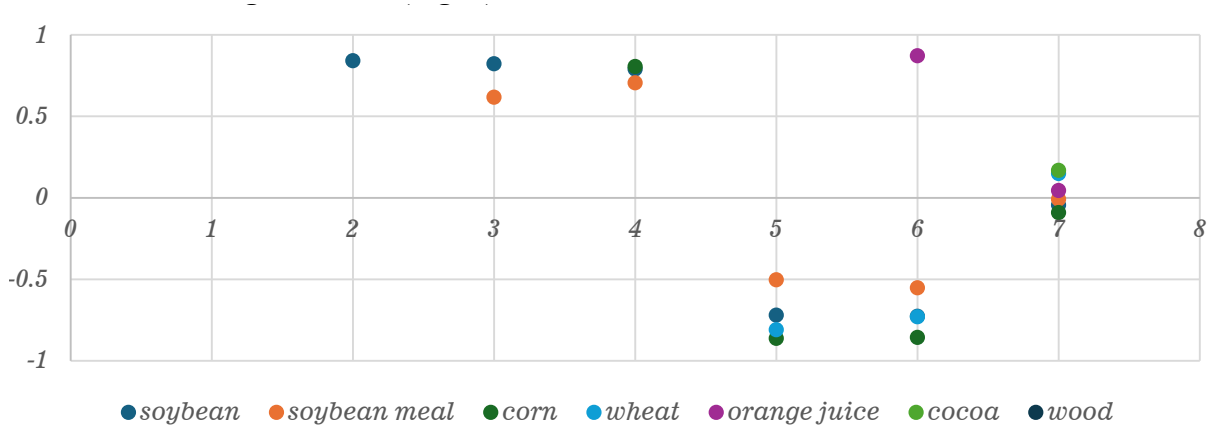

Fig. 4 Price correlation of the futures after the COVID-19

Compared with the two periods, most of the price correlation between each two futures had decreased after COVID-19, especially the price correlation between cash crops and grain crops. The negative correlation between the prices of most futures and cocoa futures has increased.

2.4 Theoretical Basis of Hedging Strategy and Example Analysis

The basic principle of hedging strategy is to utilize the correlation between different asset prices and eliminate or reduce some risk by constructing opposite positions. This article mainly explores cross variety of statistical arbitrage strategies, using mathematical models and algorithms to construct opposite investment positions through statistical analysis of historical data. The core of this strategy is to leverage the price relationships between different commodities and achieve arbitrage returns by long-selling relatively undervalued varieties and short-selling relatively overvalued varieties.

To reduce the risk during the investing of futures, many investors use the hedging method. Here take soybean future and corn future during the COVID-19 for the first hedge portfolio and cocoa future and orange future during the COVID-19 for the second hedge portfolio as examples to analyze how to use hedging methods to reduce risk during the COVID-19 pandemic. For the first portfolio, the correlation rate is about 0.875 which showed that the two futures had a strong positive correlation on price. After the hypothesis test, it showed that the first portfolio had a chance to use the hedging method. According to the graph of the difference of the first portfolio, it showed that the price difference between two futures fluctuates around the average of the difference (Fig. 5). When the price difference is higher than the average, there is a chance to gain profit through the hedging method. Considering the cost of futures trading and the impact of the market on trading prices, it seemed that it was possible to make short selling of the future which had a higher price, and long the future which had a lower price.

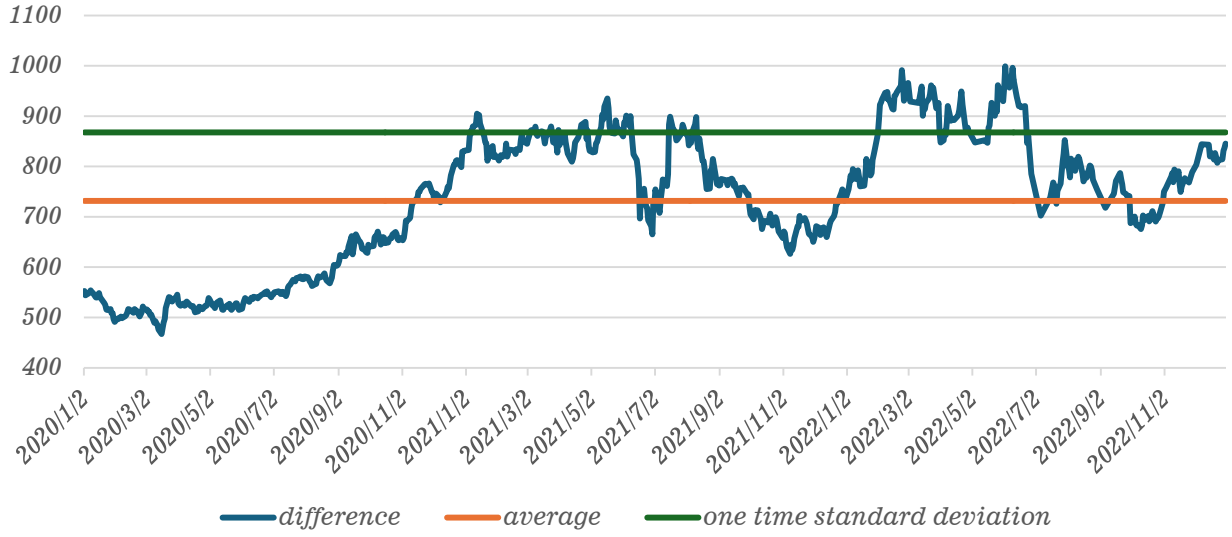

Fig. 5 Difference of first portfolio

For the second portfolio, the correlation rate is about -0.207 which showed that cocoa future and orange juice future had a relatively strong negative correlation on price during the COVID-19 (Fig. 6). After the hypothesis test, it showed that the second portfolio had a chance to use the hedging method. The graph of the difference of the second portfolio showed that the price difference between the two futures fluctuates around the average of the difference. There was a chance to reduce the risk using the hedging method when the price difference was higher than the average. As the issues that were considered in the previous portfolio still need to be considered, it seems that it is possible to reduce risk by doing a long on one future while also going long on another.

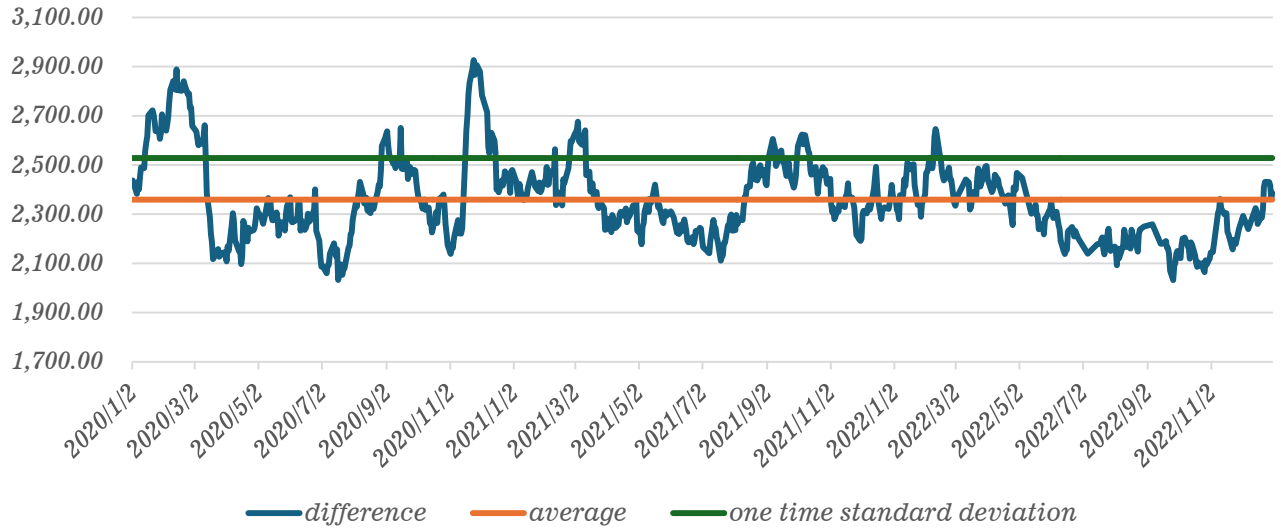

Fig. 6 Difference of second portfolio

3. Conclusion

According to the analysis above, it seems that the COVID-19 pandemic has had an impact on agricultural product futures prices to a certain extent and has a significant impact on the price correlation between agricultural futures. During the COVID-19 pandemic, the volatility of most agricultural product futures prices has increased, especially wood futures. For the correlation of the futures' price, most grain crops futures have a strong positive correlation with each other, and most cash crops have a strong positive correlation with each other. Most grain crop futures have a negative correlation with cash crop futures. The COVID-19 pandemic has strengthened the price linkage between the futures. Although unexpected situations like COVID-19 cannot be avoided, investors can use hedging methods to reduce the risk. During the epidemic, the impact of the global economic downturn has led to a significant increase in price fluctuations, and the correlation between commodity varieties has also increased in response. At this time, the established hedging strategy may not necessarily adapt to all economic environments, so timely adjustments to the hedging strategy are needed. Liquidity risk is also a challenge that cannot be ignored in the implementation of hedging strategies. During the epidemic, market liquidity may be severely affected, leading to obstacles in the execution of hedging strategies, which may greatly reduce hedging effectiveness and even greater risks.

3.1 Some Suggestions for the Investing of Agricultural Product Futures

From the analysis, it seems that during the COVID-19 pandemic, the futures market was more complex and uncertain, and investors faced more risk in that period. For investors, investing the situations like COVID-19, they need good stress resistance, a well-informed source of information, and a method of offsetting risks. When facing a situation like COVID-19, investors can reduce the risk of losing money by hedging. However, before hedging, investors need to fully analyze the relevance of the futures they want. The formulation and implementation of commodity futures price hedging strategies are not achieved overnight. It requires an in-depth exploration of the gradual development of the global economy, changes in market supply and demand relationships, trend changes in price differentials, and the correlation between price changes. In practical operation, strategies should be flexibly adjusted according to market conditions to achieve risk control and maximize returns. As agricultural product investment has a relationship with agricultural product spot prices, its price will not change much in normal times. It seems that agricultural product futures are ideal investment products for investors who are unwilling to take on too much risk.

3.2 Further Research Direction Exploration

It is worth noting that the study of commodity futures price fluctuations and arbitrage is a complex problem involving multiple disciplines, which requires the comprehensive application of theories and methods from multiple disciplines such as economics, finance, and behavioral science. At both theoretical and practical levels, it is expected that more significant progress can be made through the continuous deepening and expansion of research on hedging strategies.

References

[1] Elleby, C., Domínguez, I.P., Adenauer, M. and Genovese, G. Impacts of the COVID-19 Pandemic on the Global Agricultural Markets. Environ Resource Econ 76. 2020. pp.1067–1079.

[2] Zhang, Z., Ma, S., and Wang, J. The structural impact and short-term impact of the COVID-19 on the risk of China's agricultural futures market. China Securities and Futures. 2022. Issue2.

[3] Aslam, F., Ferreira, P., Ali, H. Analysis of the Impact of COVID-19 Pandemic on the Intraday Efficiency of Agricultural Futures Markets. J. Risk Financial Manag. 2022, 15, 607.

[4] Vercammen, J. Information-rich wheat markets in the early days of COVID-19. 2020 Special Issue: COVID-19 and the Canadian agriculture and food sectors: Thoughts from the pandemic onset. 2020. 68, 2. pp.177-184.

[5] Sidhu, A. and Katoch, R. A Causal Nexus Of Indian Agricultural Futures Market In Pre- And Post-COVID19 Outburst: A Case Of India's First Tradable Agri-Futures Index. 2022. 19, 2.

[6] Peng, K., Hu, Z., Robe, M. A. and Adjemian, M. Canary in the Coal Mine: COVID-19 and Soybean Futures Market Liquidity. 2021.

[7] Hung, T. N. Oil prices and agricultural commodity markets: Evidence from pre and during COVID-19 outbreak. Resources Policy. 2021. 73.

[8] Kamal, M., Roca, E., Li, B., Lin, C. and Reza, R. Interconnectedness of the Global Commodities Futures Markets: COVID-19 Pandemic vs. the Global Financial Crisis. 2021.

[9] Magalhães, L. A., Silva T. C. and Tabak, B. M. Hedging commodities in times of distress: The case of COVID-19. The Journal of Futures Markets. 2022. 42(10). pp.1941-1959.

[10] ŽIVKOV, D., BALABAN, S. and JOKSIMOVIĆ, M. Making a Markowitz portfolio with agricultural commodity futures. Agric. Econ. - Czech, 2022. 68, 219-29.