The Impact of the Global Grain Problem Caused by the Russia-Ukraine Conflict on Chinese Grain Market

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Abstract. This paper examines the impact on the Chinese grain market of the global food problem caused by the Russian-Ukrainian conflict. It is conducted in two main aspects. First, the Russia-Ukraine conflict was found to have caused a global food problem. In turn, the impact of Chinese food was examined. Hypothesis testing was used to explain the impact on the Chinese grain market. It was found that after the Russia-Ukraine conflict, grain futures prices in China increased significantly compared to the pre-conflict period. Then, the regression model is applied to examine changes in the grain stocks of leading Chinese companies in the context of the grain futures that have been studied. In turn, the impact of global food issues on the stock prices of grain companies in the Chinese stock market is explained. It is then found that the AAR and CAAR data are obtained by averaging the AR and CAR data for the eight companies. Therefore, it can be concluded that the Russian-Ukrainian conflict started to have an impact on the entire Chinese grain market ten days after it occurred and that it also had a different effect on the leading Chinese grain companies.

Keywords: Russia-Ukraine Conflict · Grain Futures · Stocks · Empirical Analysis · Hypothesis Testing · Linear Regression

1 Introduction

The conflict between Russia and Ukraine on February 24th has caused many global problems, one of which is the food issue. It has seriously affected food prices, such as; according to the CBOT in August 2022, soybean futures closing price of 1422.75 cents, an improvement of 6.2% compared to 2021 [1]. Meanwhile, Russia and Ukraine are both major exporters of grain in the world. The rise in food prices and the demand for raw materials for food production has affected the share prices of leading food companies in the Chinese stock market to some extent. From the macro level, due

to the COIVED-19, the Fed's raises interest rate led to a global economic downturn, and inflation became faster. And global economic growth will drop by more than one percentage point this year due to the conflict, and already high inflation could rise by an additional 2.5 percentage points globally [2]. The subsequent increase in prices of food, oil, gas, and other supplies, coupled with the military conflict between Russia and Ukraine and the mutual sanctions between the West and Russia, have led to significant increases in the prices of many commodities. The outbreak of the Russia-Ukraine conflict has led to increased international transportation costs, increased volatility in global food prices, and shocks to food supplies [3]. Subsequently, China is a country with a large population, so its food consumption is huge, and therefore its demand is also huge. This makes imports a very critical aspect, and the stocks need to be ensured to be adequate and not to run short. However, today, due to the impact of food exports, the increasing number of countries (more than 20) with policies that restrict food exports [1]. And the high demand for raw food materials from companies, this puts enormous pressure and challenges on food companies because if this problem is not solved, it may lead to a severe shortage of supply, company performance does not meet the target, and a decrease in profits, which will eventually have a volatile impact on the share price of the Company.

2   Literature Review

Some studies have shown that international military crises have an impact on the stock market [4, 5]. Gourio found that because stock markets are sensitive to changes in disaster risk, they are bound to react accordingly [6]. To quantify effects of international conflicts on stock prices, Goldstein has constructed a scale to code conflictive versus cooperative events that can be used to assess the impacts of war risk [7]. Ozili studied the extent to which the stock market of a country was affected by wars and conflicts from the distance from the country where conflicts occurred [8].

Recently, financial markets have suffered several shocks caused by the Russia-Ukraine conflict. The financial market reaction to this international conflict has generated a great deal of interest in finance [9–11]. The literature on the impact of the international energy stock market during the Russia-Ukraine conflict is growing [12]. Hui, L. & Yu Z pointed out that geopolitical conflicts would cause food market disorder and drastic price fluctuations. China mainly relies on Ukraine for imports of grain, oil, and meal [13]. China mainly imports fish and crab, sunflower, canola, soybean oil, and potash from Russia. If the impact of the war continues, the import volume of wheat and corn to China will decrease, as well as the supply of rapeseed meal and sunflower seed meal, which will indirectly drive up the spot price of related domestic agricultural products [14].

In short, many types of research have been written about the impact of the conflict between Russia and Ukraine [15, 16]. However, little research has been done on the impact of the Russia-Ukraine conflict on food stock markets. Therefore, this topic mainly studies the impact of the conflict between Russia and Ukraine on Chinese grain market.

3 Data and Research Methodology

3.1 Data Description

On the one hand, to perform a hypothesis test, this work needs to select the object, let's say H_0, calculate the statistic and plug it in and determine if the statistic is wrong. This work adopted February 24, 2022, as the start date of the Russia-Ukraine conflict. Since the interest rate hike of the Federal Reserve in June 2022 will affect the decline of futures prices, to reduce the influence of other factors, this work choose three months before and after the Russia-Ukraine conflict as the period for analysis and select six futures about grain.

As for Chinese futures, there are mainly the following three commodity futures. Firstly, about rapeseed meal futures, rapeseed meal of China is mainly used for domestic consumption. Affected by domestic demand continuously increasing, the export volume is decreasing constantly. In February 2022, a sharp rise in futures prices can be seen. Although the consumption of rapeseed meals has a seasonal impact. From February to April every year, the stock of domestic rapeseed meals in China is relatively small, and the price of rapeseed meals generally rises. However, the increase is more obvious in February this year due to the influence of the conflict between Russia and Ukraine. Regarding palm oil futures, in January 2022, affected by the production cut of Malaysian palm oil, the outer oil market rose strongly, and domestic palm oil rose with the price. Then, in February 2022, there is a large increase in futures prices due to the Russia-Ukraine conflict. Moreover, soybean meal, soybean oil, and japonica rice futures, In February 2022, were both driven higher by the Russia-Ukraine conflict.

At the same time, this work also analyzed some other kinds of futures. Regarding rap oil future, Russia supplies less than 1% of Chinese rapeseed oil, so the Russian side has little influence on domestic rapeseed oil. Regarding wheat's future, The price fluctuation of wheat affects social stability, the country does not allow a large rise or fall, so its futures price has risen but fluctuated little. And because the trading volume of wheat futures has not been high, the delivery months of futures contracts are many, so this work did not choose it.

In conclusion, this work mainly selected rapeseed meal, palm, soybean oil, and japonica rice as the research objects from the aspect of grain futures. Their futures ticker symbol is RM9999, p9999, m9999, y9999, rr9999, b9999. After that, this work collected data and tested the hypothesis by the daily closing prices of these six-grain futures.

On the other hand, to perform the event study, this work needs to define the event, event date and event window. Since the war has never been formally declared this work use 24th February 2022 as a breakout date of the Russian Ukraine conflict. Because of the lack of awareness of the intensity, duration and far-reaching impact of the war when it first broke out, the share price was relatively slower to react to the event. In addition, Chinese grain-listed companies are predominantly state-owned, and the nature of state-owned companies also leads to slower reactions to information. Therefore, this work expands the event window. The event window consists of 61 days from t-30 to t + 30 days. This work also investigated the Shanghai lockdown, which occurred at a similar time. The first district to be lock downed was reportedly on 1 April. At this time the social atmosphere was not yet tense until the city-wide lockdown in the teens

of April. So the event window this work have set does not overlap with the Shanghai lockdown. The estimation window is of 1206 days from t-1236 to t-31 days. This work only considers trading days in the analysis.

This work selected leading companies whose main business includes soybean meal, rapeseed meal, palm oil, soybean oil and rapeseed oil respectively for analysis. As the main business of grain and oil companies generally include both soybean oil and rapeseed oil, these two agricultural products share the data of the same group of leading companies for analysis; as China relies on nearly 100% of palm oil imports, mainly from Indonesia and Malaysia, and lacks local palm oil processing enterprises, the instant noodle companies at the downstream of the palm oil chain were chosen for the study; Soybean meal and rapeseed meal are both used in feed processing, but rapeseed meal is particularly important in aquafeed, so the representative companies for soybean meal were chosen from leading feed companies, while the representative companies for rapeseed meal were chosen from companies specializing in aquafeed. In China, the soybean meal is mainly produced by crushing soybean. In recent years, China only imports a little soybean meal from Denmark. When it comes to soybeans, Brazil and the US are the primary channels for China to import soybeans, accounting for 93.73%. Russia ranks fourth in exporters, but only constituting 1%. Additionally, China imports around 90% rapeseed meal from Canada. As a result, Chinese soybean meal and rapeseed meal industries do not rely on both Russia and Ukraine too much.

Based on the market model, this work uses the SZI and HSI share returns to represent the market returns. Because the selected companies are listed on the Shenzhen and Hongkong Stock Exchange. This work calculated them through the daily closing price of SZI and HSI shares. This work uses the stock returns of Chinese 10 leading companies representing the segmented industries of soybean oil, rapeseed oil, palm oil, soybean meal and rapeseed meal as explanatory variables. This work calculated them from the future compounded closing prices of these stocks.

4 Methodology

This work applys a hypothesis test. Let's first determine the null hypothesis and alternative hypothesis. H0 is supposed correct.

Hypotheses:

$$H0 : \mu\_difference = 0$$

$$H1 : \mu\_difference > 0 \tag{1}$$

μ_difference: population mean of (After the Russian-Ukrainian co - Before the Russian-Ukrainian co)

Test statistic:
And then they are plugged in to get the T-Value and P-Value.

$$T = \frac{\overline{X} - \mu}{\sqrt{\frac{\sigma 2}{N}}} \tag{2}$$

If the P > 0.05, H0 fails to be rejected.
If the P < 0.05, H0 is rejected.

5   Conclusion

This work determines whether the value of the statistic is within the 95% confidence interval. Finally, the conclusion is drawn to see whether the conflict between Russia and Ukraine has an impact on Chinese grain futures prices.

The normal returns are calculated using the data of the estimation window, a time period before the event window.

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon \tag{3}$$

where, Rit is the daily return of the sample company on day t; Rmt is the daily return of the stock market segment in which the sample company is located on day t; αi is the intercept of the equation; βi is the regression coefficient of the equation, ε is the random error term is a random error term.

The normal/expected return can be calculated using below given formula.

$$NR_{it} = \alpha_i + \beta_i R_{mt} \tag{4}$$

Secondly, the abnormal return (AR) in the event window period [-30, 30] can be calculated using below given formula.

$$AR_{it} = R_{it} - NR_{it} \tag{5}$$

Finally, the cumulative abnormal return (CARs) is calculated for index i over the event window from day r1 to r2

$$CAR_t(r_1, r_2) = \sum_{t=r_1}^{r_2} AR_{it} \tag{6}$$

Average Abnormal Return (AAR) is the average of abnormal returns. In order to remove the impact of disturbing events on the abnormal return of individual stocks, the abnormal returns of all samples are averaged out, thus reducing the impact of disturbing events on stock returns. Finally, the average abnormal return is calculated

$$AAR_t = \frac{1}{N} \sum_{i=1} AR_{it} \tag{7}$$

where, N is the number of sample companies. Finally, this work use AAR to calculate the cumulative average abnormal returns (CAARs) for the event window.

6   Results

6.1   Part 1

Through the analysis, six-grain futures have been selected as the research objects. Then, hypothesis testing was applied to test the results of this analysis. First, this work calculated the mean and variance of the data samples to compare the data before and after the Russia-Ukraine conflict. And the mean and variance increased after the Russia-Ukraine conflict. Second, a hypothesis test was conducted. This work set the null hypothesis that the population means difference before and after the Russia-Ukraine conflict is 0 and the alternative hypothesis that their difference is greater than 0. And by calculations, the following results were obtained: the mean (1,047), Standard Deviation (699), SE mean (285), and the 95% Lower Bound for the difference (472). Then, the T-value (3.67), P-value (0.007) which was less than 0.05 was calculated. Therefore, the null hypothesis was rejected. So, the Russia-Ukraine conflict caused the price of Chinese grain futures to rise.

6.2   Part 2

The results of the regression analysis are shown in the form below, including intercept, slope, r squared and P value. The r-squared and p-values are all at reasonable values and the p-values are all less than 0.01, indicating the regression model is significant. It implies that the explanatory variable, Rmt, affects response variable, Rit, positively or negatively (Table 1).

Table 1. Some values for ten companies [Owner-draw].

Stock code	α	β	r^2	$P > |t|$
000019	-0.0004266	0.7660945	16.68%	0.000
000505	-0.0000768	0.7146955	10.80%	0.000
000639	-0.0006561	0.8811094	22.22%	0.000
000702	-0.0008533	0.7748868	17.78%	0.000
000876	0.0007067	0.7298657	16.01%	0.000
002311	0.0012987	0.730222	20.59%	0.000
002696	-0.0005783	0.8075773	15.75%	0.000
002714	0.0021151	0.8812737	16.18%	0.000
0322.HK	0.0007195	0.5875123	9.02%	0.000
0220.HK	0.0009528	0.624949	10.72%	0.000

Fig. 1. Confidence intervals for grain and oil companies [Owner-draw].

Firstly, Fig. 1 shows the CAR and proportion of grain and oil companies. The grain and oil processing businesses of three firms account for 87.76%, 91.74% and 49.64% respectively. The charts illustrate that the CAR of three selected companies began to increase on the 16th days. Finally, they all exceed the confidence interval, which means that the Russia-Ukraine conflict has had a certain impact on the stock returns of grain and oil market. After that, the CAR of two companies with more grain and oil businesses still fluctuated while the impact of the event on the company with lowest proportion was diminishing. It proves that firms with higher proportion of the related business are influenced more deeply.

Secondly, as the background introduced before, it can be predicted that the increasing soybeans' prices caused by the conflict between Russia and Ukraine may not have a deep negative impact on Chinese soybean meal market. The Fig. 2 show that CAR of the picked companies are all significant at 95%. Only the CAR of 000702 is over the confidence interval at 90% after the twenty-second day. The reason may be that this company sell the soybean meal at a higher price and get more profits after the event happened. 000876 is also a soybean meal company. At the same day, the CAR reached the highest point. The event did not have an obvious negative effect on the stock price of 002714 which is a livestock breeding company, relying on the soybean meal as feeds. To sum up, the above prediction is correct.

Thirdly, the rapeseed meal industry in China is similar to the soybean meal. As a result, the event will not influence the Chinese rapeseed industry. However, the CAR of two companies show different trends in Fig. 3. Feed production makes up over 80% of the main business in 002311. From November to March in next year is the off-season for aquaculture, the rapeseed meal enters the off-season of consumption throughout the whole year, which is the reason for the decrease in CAR. In another company, 002696, feed production only hits 53%. In off-season, this company can depend on other business to gain profits.
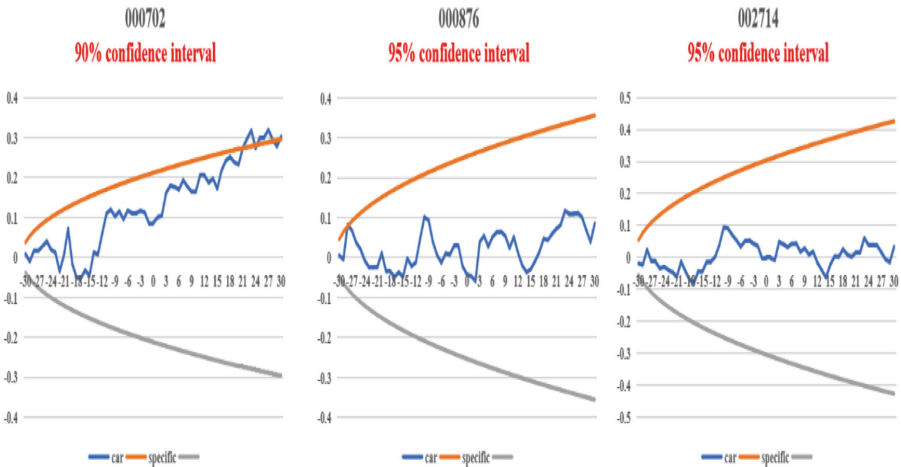
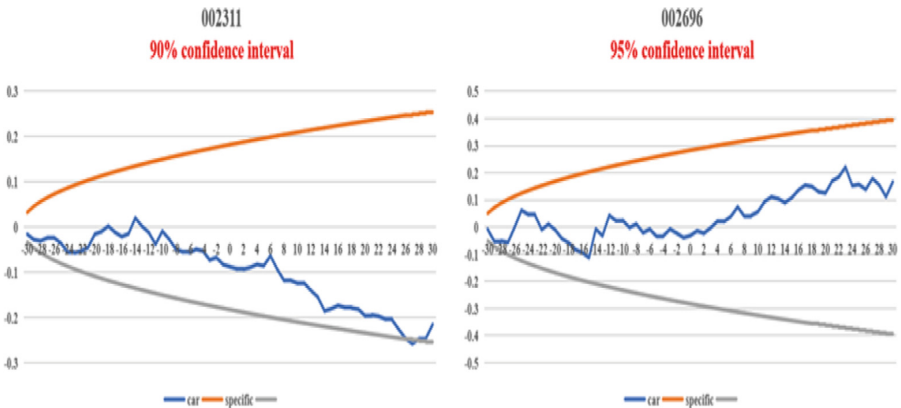**Fig. 2.** Confidence intervals for soybean meal companies. [Owner-draw]

Fig. 3. Confidence intervals for rapeseed meal companies [Owner-draw].

Fourthly, the stock returns of two Chinese instant noodle companies, Tingyi and Uni-president are demonstrated in Fig. 4, whose CAR trends are different. The CAR of Tingyi only reduced for several days after the outbreak of the conflict and then reverted to a normal level. During the event window, the CAR did not exceed the confidence interval, suggesting that the event did not have a significant impact on Tingyi. In contrast to Tingyi, Uni-president was impacted by the event negatively. The CAR kept going down after the event happened and even exceeded the confidence interval. The proportions of the instant noodles of two companies are the same. The different impacts of the same incident on these companies could be explained by variable palm oil suppliers. According to past disclosures, Tingyi's palm oil is entirely supplied by domestic grain and oil companies, whose price is more stable, while the Uni-President purchase palm
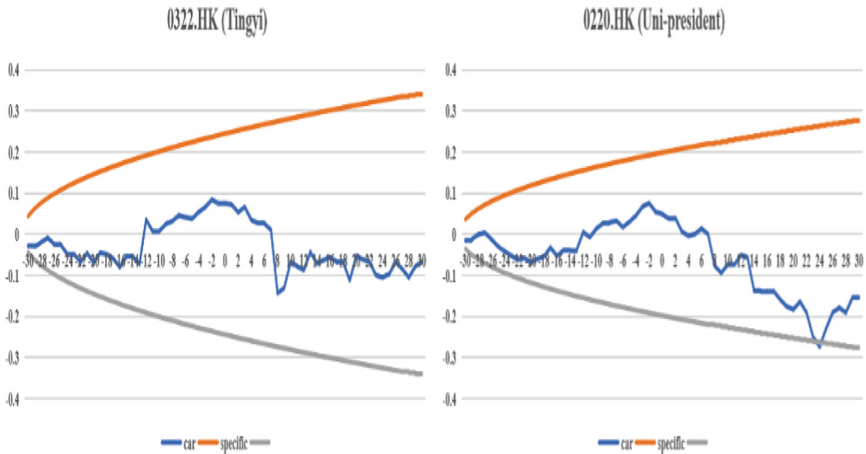
Fig. 4. Confidence intervals for palm oil companies [Owner-draw].

Table 2. Some values for different event window [Owner-draw].

event window	CAAR	t value	p value	event window	CAAR	t value	p value
[-1,30]	0.2369	3.69716	0.00768	[-30,30]	0.28757298	3.99944	0.00519
event window	CAAR	t value	p value	event window	CAAR	t value	p value
[-1,20]	0.15861	3.19592	0.01515	[-20,20]	0.20956661	5.24231	0.0012
event window	CAAR	t value	p value	event window	CAAR	t value	p value
[-1,10]	0.02365	1.65875	0.14113	[-10,10]	0.03446437	1.48169	0.18198

oil with a higher price from a Vietnamese palm oil company price. The difference is due to Chinese grain price protection policy.

Finally, this work develops an analysis of the extent to which the overall grain market has been affected by the events. As instant noodle companies are listed on the HKSE, only the AR and CAR data for the eight companies listed on the SZSE are averaged and AAR and CAAR are obtained. This work has adjusted the event window to obtain a different CAAR, and the results show that the CAAR is significant about 15 days after the event, representing a significant impact on the Chinese grain market 15 days after the outbreak of the conflict between Russia and Ukraine. (Table 2).

Figure 5 is a line graph of the CAAR within the event window, which can be found to match the results of the significance test of the CAAR just now. The CAAR began to rise abruptly 15 days after the event, when the impact of the Russian-Ukrainian conflict was reflected in the share price, and then around 25 days after the event, the impact of the event began to dissipate and so the CAAR began to decrease.
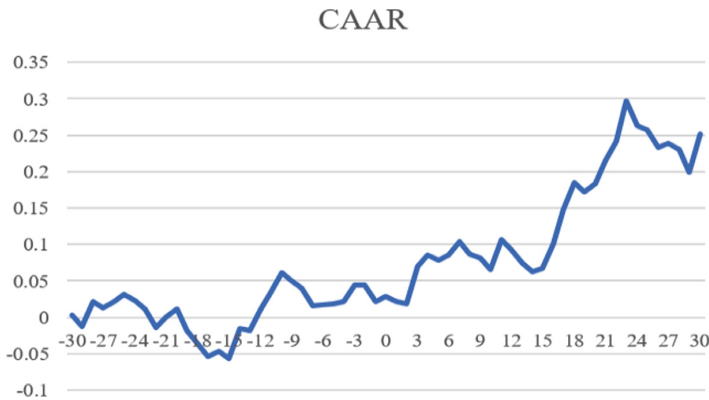
Fig. 5. CAAR within the event window [Owner-draw].

7   Conclusion

The purpose of this research is to inspect the influence of the conflict between Russia and Ukraine on Chinese grain stock market. The first part is about the grain futures, where this work apply hypothesis testing and obtain significant results, meaning that the conflict fully affect the price of the Chinese grain. The event study, including estimate window and event window, and the model of AR and CAR are adopted when studying the stock return of the leading grain firms in China. The result is that the soybean oil and rapeseed oil companies are affected deeply and positively while less impact is on the industries of the soybean meal and rapeseed meal. In terms of the palm oil companies, the price protection policies in China weaken the influence from the increasing price in the international market. The research indicates that the positive impact on grain and oil companies in China is beneficial to the investors. However, because of the unfavorable situation of the international grain market, investors in other fields, including soybean meal, rapeseed meal and palm oil, still need to wait and see for a while. In view of the different trends of the VAR of variable companies under the same external environment, this work can conclude that national protection policies, business diversity and seasonal changes in demand for products are vital to the development of firms, which can also be considered by the investors to make predictions and select the stocks. There are still some shortcomings in this study, for example, more kinds of grains and companies should be selected for research.

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