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Data Given:

- Brokers
- Commodity range
- Futures contracts information
- Daily Futures trading volume of each brokers (2019.3 - 2022.12)
- Futures daily price (2021.9 -2023.1)

Commodities Included:

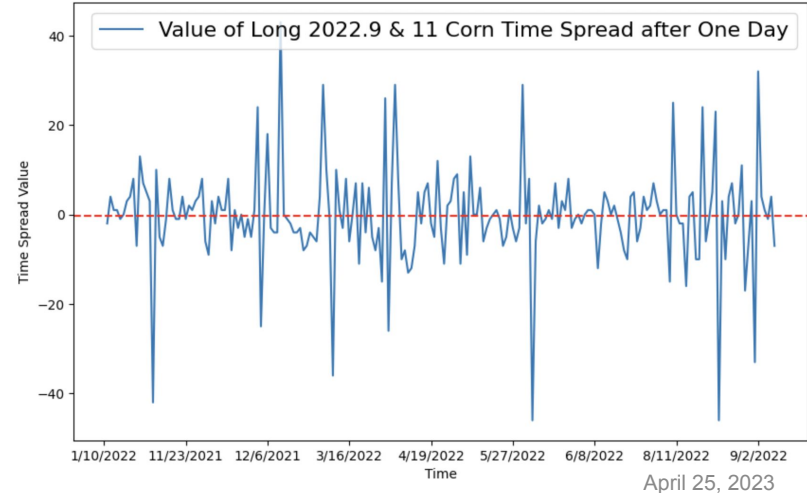
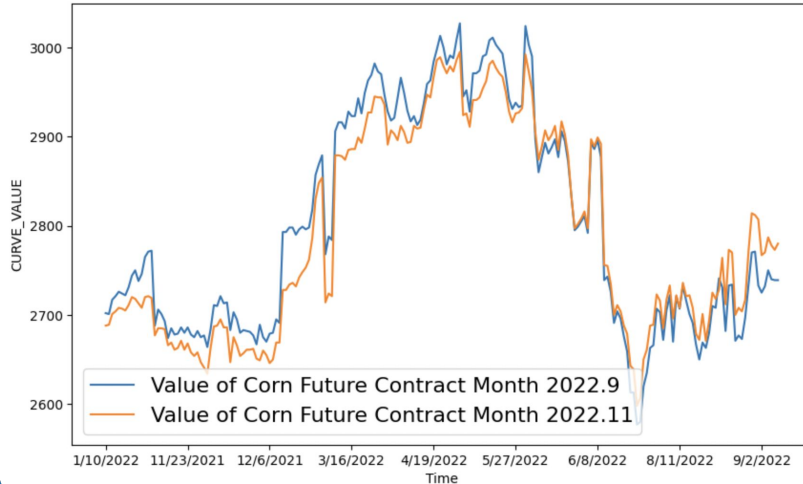
- ❑ Cs: Corn Starch Future
- ❑ C: Corn Future
- ❑ M: Soybean Meal Future (SBM)
- ❑ P: Palm Oil Future (PO)
- ❑ Y: Soybean Oil Future (SBO)

1) Spreads - Time Spread

a.) Understanding Time Spread

Time Spread: simultaneous purchase futures expiring on a particular date and sale another future on the same instrument expiring on another date

Profit Logic: When the profit from one future outweighs the loss from the other, the difference would be an overall profit for the investor



1) Spreads - Time Spread

b.) Types of Time Spread

Different Spread type:

- **Bull spread (In our study, we call this long the time spread):** When a trader **buys the nearby month** and **sells the deferred month** (e.g. Long the contract with contract date 2022.5 and Short the contract with contract date 2022.9).
- **Bear spread (In our study, we call this short the time spread):** When a trader **sells the nearby month** and **buys the deferred month** (e.g. Short the contract with contract date 2022.5 and Long the contract with contract date 2022.9).

Bear spread happens in cases of anticipated market volatility. Price swings are always higher in nearby months and tend to get stabilized around deferred months.

1) Spreads - Time Spread

c.) Recognize Time Spread Behavior

- Same commodity & broker & trading date
- Assume contract months are 1, 3, 5, 7, 8, 9, 11, 12. The two futures contract months farthest from the current date are not considered
- The amount of future contract we long > 500 lots
- The amount of future contract we short > 500 lots
- Difference between Long and Short < 100 lots
- The time spread operating amount is the **smaller absolute** value of long or short.
- The time spread trading direction is determined by the trading direction of the future with closer contract date

Example:

银河期货 **long** the Soybean Meal future time spread for **757 lots** if :

- 银河期货 **long** the future of Soybean Meal with contract date of **2020.May.1st** for **846 lots**
- 银河期货 **short** the future of Soybean Meal with contract date of **2020.Sep.1st** for **757 lots**

1) Spreads - Time Spread

d.) Filter Coincidental Situations

In the time range of 2019-2022, we identified 2480 times of time spread conducted by various brokers. But there are chances that the time spread just happened due to coincidence but not on purpose. So we add the criteria to further recognize true time spread behaviour carried out by brokers.

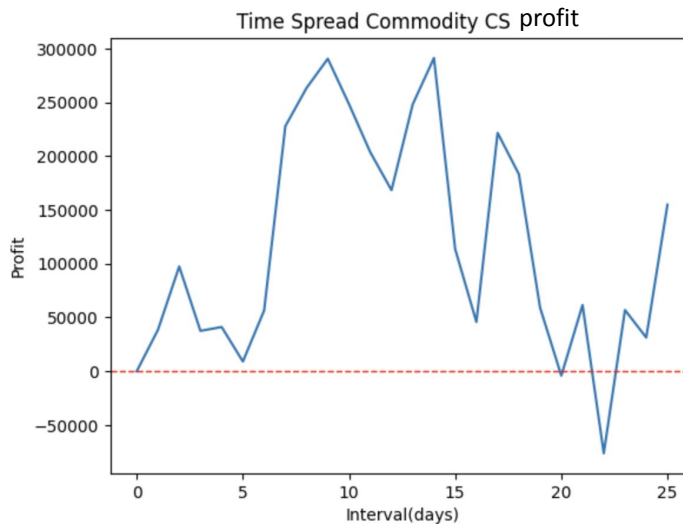
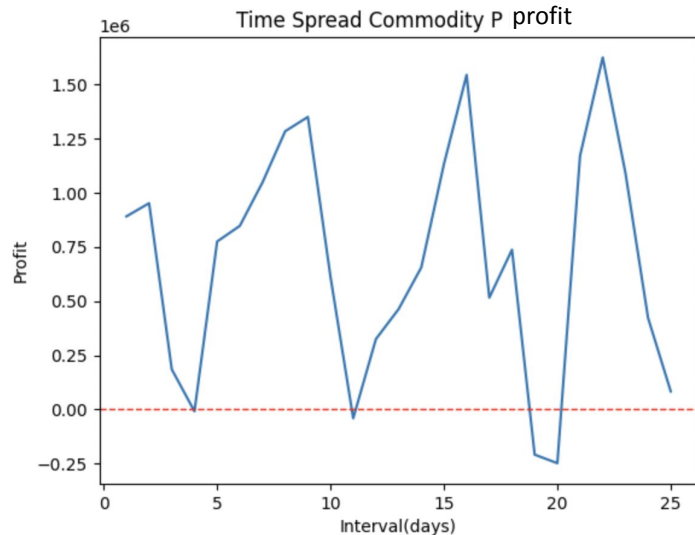
Criteria: Time Spread times > 10 in the time range of 2022.1-2023.1

brokerNameEN	Commodity	Short Contract Date	Long Contract Date	Trade Direction	Volume	Date	Trading Times
Galaxy Futures	m	9/1/2022	5/1/2022	Long	945	2/28/2022	21
Galaxy Futures	m	7/1/2022	8/1/2022	Short	1989	2/11/2022	21
Galaxy Futures	m	7/1/2022	8/1/2022	Short	2009	2/14/2022	21
GF Futures	y	9/1/2022	5/1/2022	Long	2176	3/21/2022	13
GF Futures	y	5/1/2022	9/1/2022	Short	822	2/15/2022	13
GF Futures	y	8/1/2022	9/1/2022	Short	909	2/15/2022	13

1) Spreads - Time Spread

e.) Profit Curves

There is no way to know the exit, so we assume the strategy would end days after

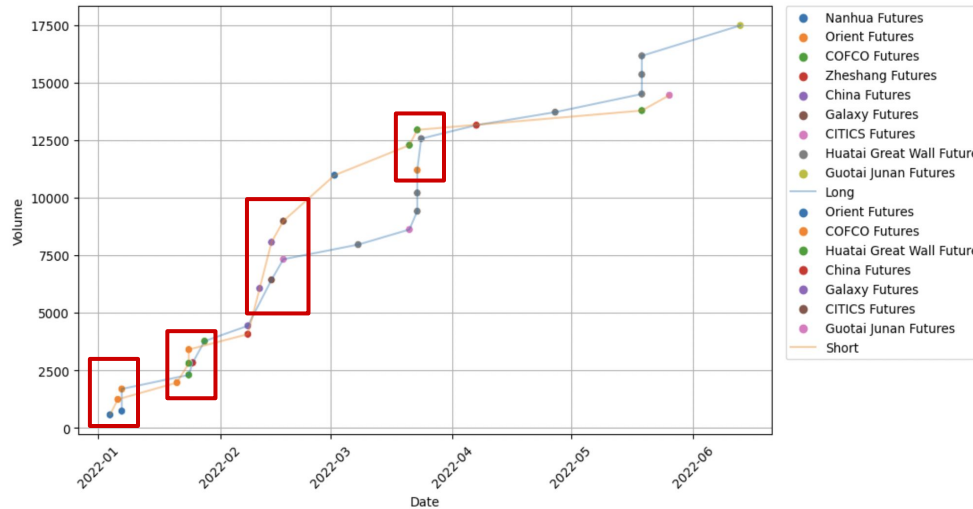


The sum of the initial cost of the time spreads are close to 0, so the profit the time spread strategy is great. The best time period to hold the spread is around 7 days.

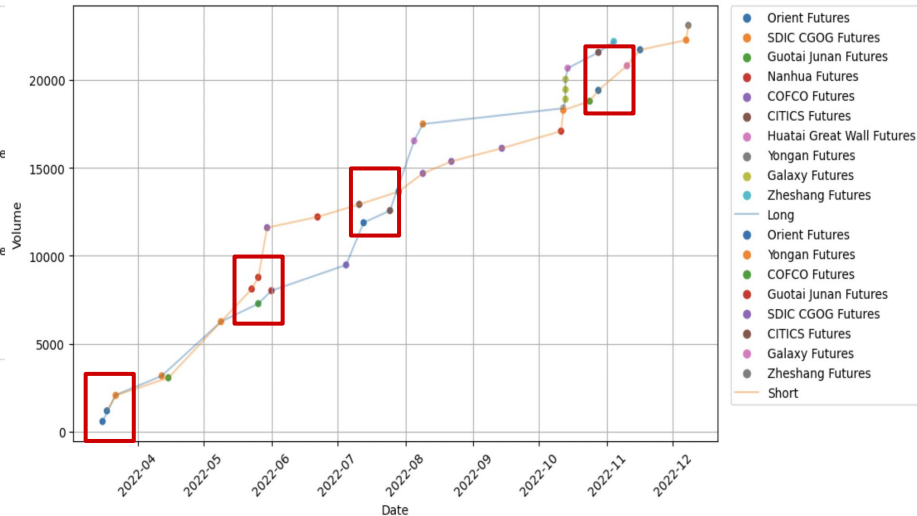
1) Spreads - Time Spread

f.) Long and Short Spread Patterns

Cumulative long and short of certain time spread of all brokers



Commodity: m Contract date: 2022-07

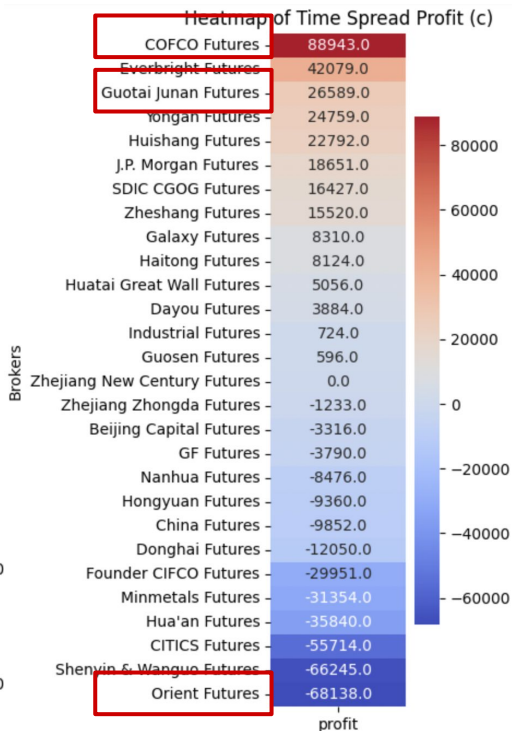
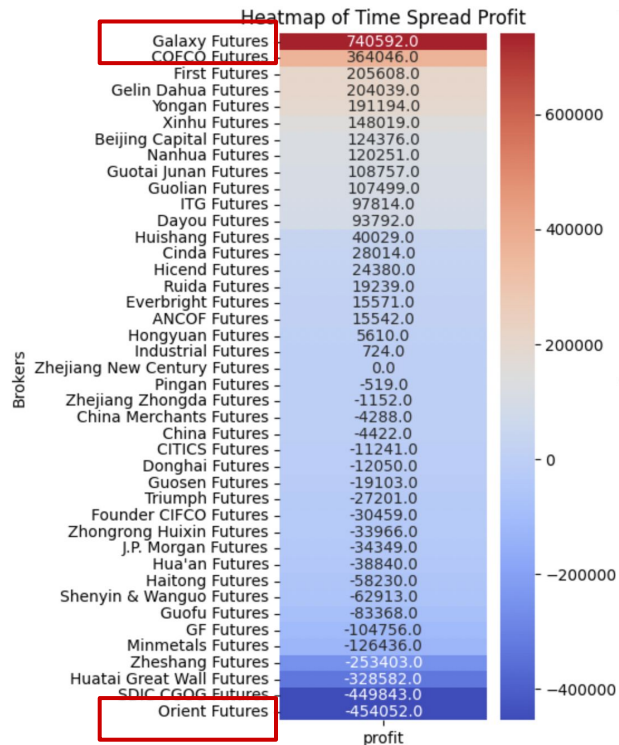


Commodity: m Contract date: 2023-01

- The buy and short behaviours of the brokers are similar → Buy & Sell in close days → Profit by short time volatility
- The long and short trends for the time spread of the same contract are also similar

1) Spreads - Time Spread

g.) Broker Profit out of Time Spread



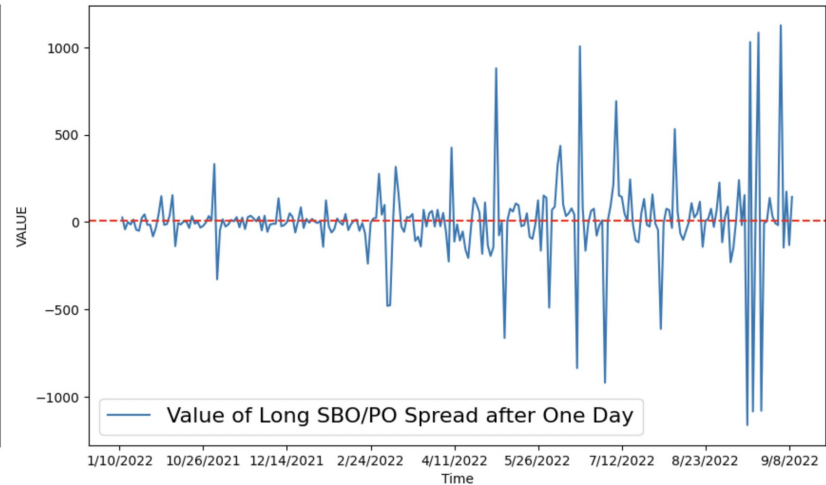
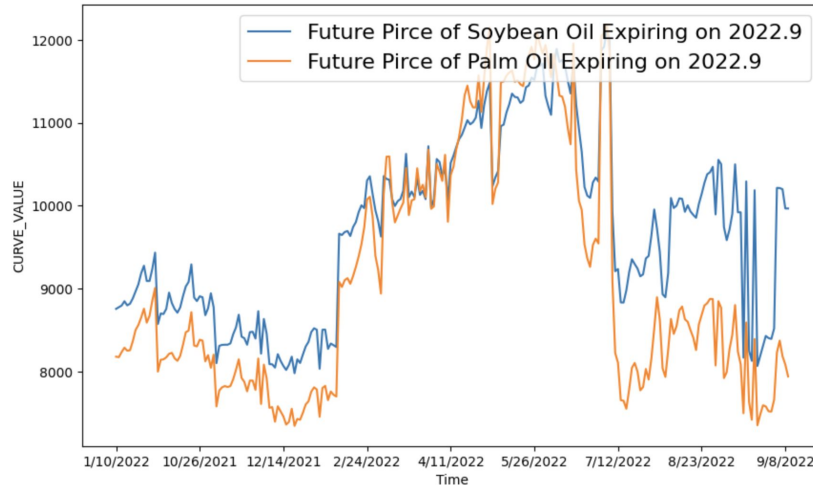
- In the year 2022, we can see that Galaxy Futures profited the most from time spread strategy; Orient Futures profited the least from time spread strategy.
- If we observe separately, COFCO and Guotai are usually showing great profitability, Orient usually is showing poor profitability.

1) Spreads - SBO/PO Spread

a.) Understand SBO/PO Spread

SBO/PO Spread: simultaneous purchase futures of SBO/PO and sell futures of PO/SBO expiring on the same date.

Profit Logic: When the profit from one future outweighs the loss from the other, the difference would be an overall profit for the investor



1) Spreads - SBO/PO Spread

b.) Recognise SBO/PO

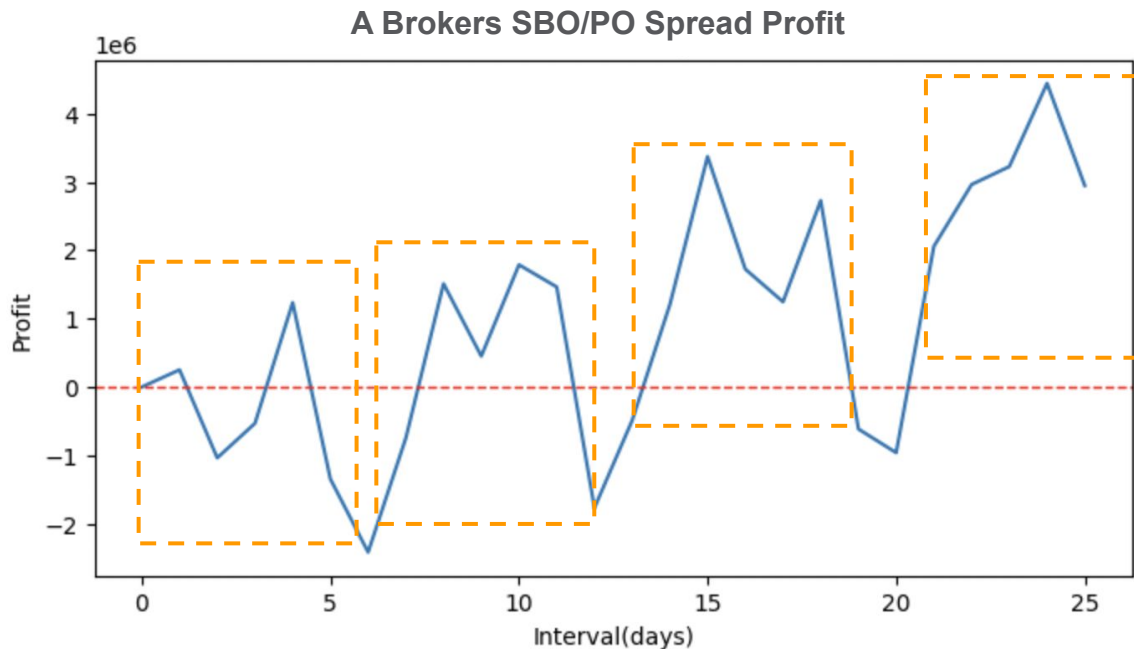
- Same expiring date & broker & trading date
- Difference between Long and Short < 100
 - Long SBO > 500, Short PO > 500 → buy SBO/PO Spread
 - Short SBO > 1000, Long PO > 1000 → sell SBO/PO Spread
- The SBO/PO spread operating amount is the **smaller absolute** value of long or short.
- The SBO/PO trading direction is determined by the trading direction of the SBO future

Criteria: Spread times > 5 after 2022-01-01

brokerNameEN	Contract_Month	Trade Direction	Volume	Date	Trading Times
SDIC CGOG Futures	5/1/2022	Long	516	12/23/2021	37
SDIC CGOG Futures	1/1/2023	Short	1236	10/26/2022	37
SDIC CGOG Futures	5/1/2022	Short	2320	1/14/2022	37
Shenyin & Wanguo Futures	9/1/2022	Long	561	4/11/2022	12
Shenyin & Wanguo Futures	5/1/2022	Short	1207	12/24/2021	12
Shenyin & Wanguo Futures	5/1/2022	Long	638	12/28/2021	12

1) Spreads - SBO/PO Spread

c.) Profit Curve of All Brokers

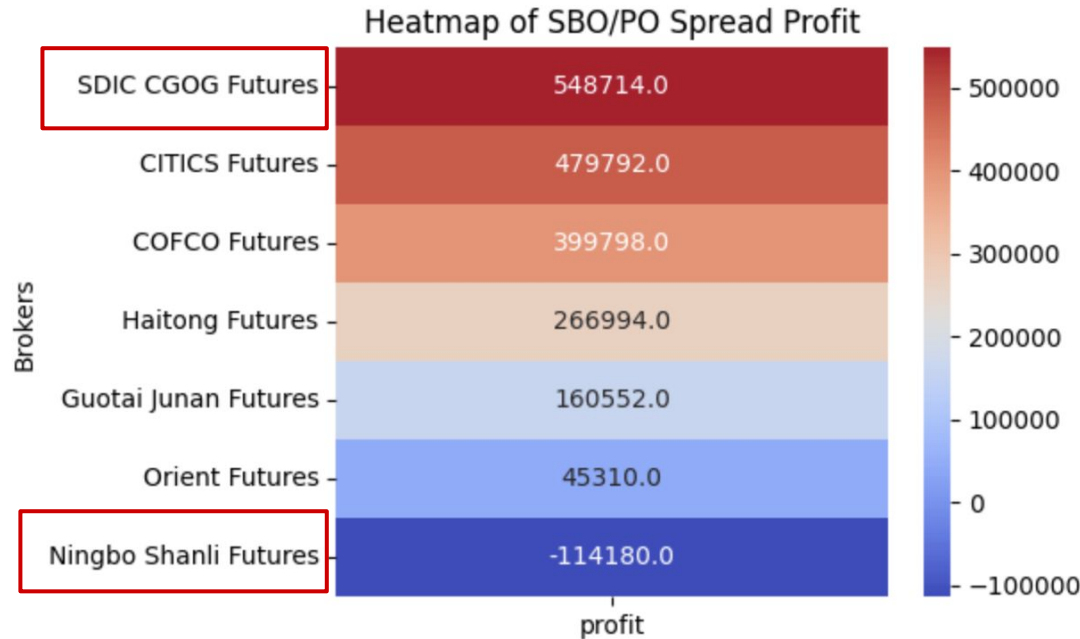


- Periodicity in profiting pattern (7 days), so the brokers may sell the spreads during high profit period
- most of the time the SBO/PO Spreads are profiting.

There is no way to know the exit, so we assume the strategy would end days after

1) Spreads - SBO/PO Spread

d.) Profit Curve of Separate Brokers



- The SDIC CGOG Futures is profiting the most from the SBO/PO Spread strategy;
- The Ningbo Shanli Futures is losing the most from the SBO/PO Spread strategy;
- Most of the brokers are earning money from the SBO/PO Spread strategy

1) Spreads - Crush Hedge

a.) Crush Hedge Behaviour

Soybeans are processed into soybean meal and soybean oil through a process known as crushing. **The crush spread is the difference between the value of soybeans and its byproducts**, and is considered a gauge of the potential profit margin for soybean processors.

- **Hedgers** balance the risk of taking a loss on the actual product sales by making money on the crush spread of the soybeans and processed soybeans.
- **Speculators** are looking for mispricing in the market and will use a crush spread to take advantage.

1) Spreads - Crush Hedge

b.) How to do Crush Hedge

In a crush spread Strategy:

- Long position in Soybean futures
- Short positions in Soybean Meal futures
- Short position in Soybean Oil futures

The ratio of soybean meal and soybean oil: The raw material is soybean, and the finished product is soybean meal and soybean oil. From the relationship between product quantity, 1 unit of soybean can extract 80% soybean meal, 18% soybean oil, and 2% loss. **The ratio is around 4.5, but we will use the data that LDC provided (4759 / 1162).**

1) Spreads - Crush Hedge

b.) Identify Crush Hedge Behavior

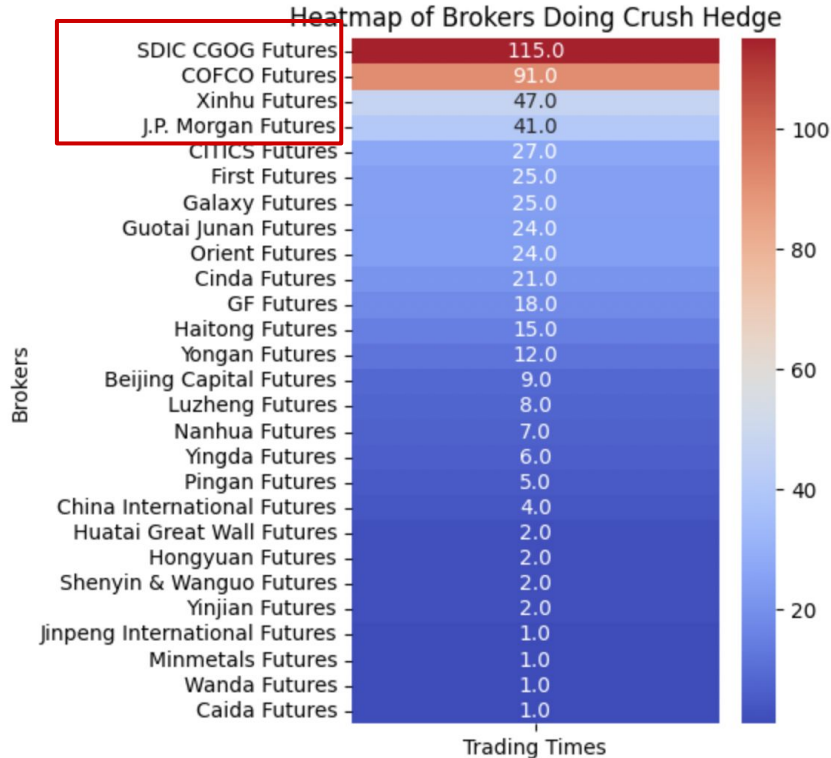
- Same Operating Date & Contract Date & Commodity is SBO and SBM
- Contract Date in Month 1/5/9
- Soybean Meal / Soybean Oil * 1162 / 4759 > 1
- Soybean Oil > 1000 lots
- Hedging Vessel = Soybean Oil / 1162

Filter Criteria: Crush Spread Times > 5 after 2022-01-01

Broker Name	Contract_Month	SBO Sold Volume	SBM Sold Volume	Hedging Vessel	Date
SDIC CGOG Futures	1/1/2023	2948	24978	2	8/23/2022
SDIC CGOG Futures	9/1/2022	1948	16221	1	3/31/2022
SDIC CGOG Futures	5/1/2022	5363	26554	4	1/18/2022
GF Futures	9/1/2022	1807	8507	1	4/20/2022
GF Futures	9/1/2022	4914	20909	4	3/30/2022
GF Futures	1/1/2023	2333	19571	2	10/14/2022

1) Spreads - Crush Hedge

c.) Brokers Activity Frequency in Last 4 years



- SDIC CGOG Futures, COFCO Futures, Xinhu Futures and J.P. Morgan Futures have the highest level of activity.
- Not many securities firms engage in Crush Hedging, but companies with intentions to do so have done it multiple times

2) Sentiment - Original Data

Categorical Method 1:

Find the broker that has the top 3 increments per day (for a single commodity and contract) and test if another broker happens to be in the top 3 the next day.

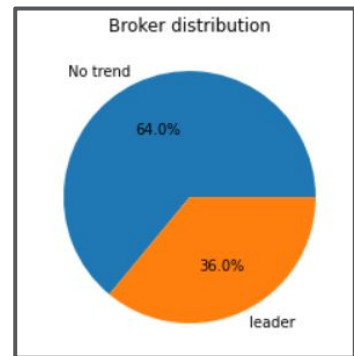
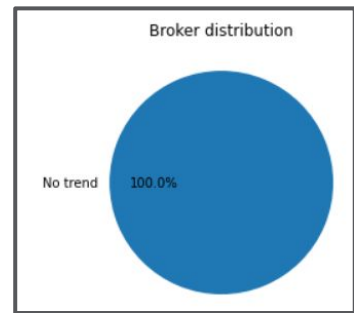
Criterion: This trend occurs more than 3 times per month.

Categorical Method 2:

Relax the criterion: search for the **top 5 brokers** and lower the frequency to **2 times per month**.

Limitations:

For brokers trading at high frequencies, they will frequently trigger the classification criteria and will be classified in both the leading and following groups.



2) Sentiment - Questions



If some broker has very large volume, and trade everyday, it will be considered as **both leader and follower (classified as leader)**.



Follower can also be identified as leader, there will always be **brokers that trades after**.



Real sentiments are already **reflected in the days or hours**, current data is limited.



Data was collected based on the value rank, therefore **only brokers with large absolute value can be recorded**, small potential follower or leader can not be captured.

2) Sentiment - Time Spread

Adjusted Method: We use the time spread data as new dataset for sentiment analysis.

Categorical Method 3 (General):

Sort the new dataset with 'Date', which is the actual date of the time spread trading.

Unnamed: 0	Broker Name	Commodity	Spread_Short	Spread_Long	Trade Direction	Volume	Date	brokerNameCN	brokerNameEN	
0	1121	瑞达期货	cs	2019-01-01	2019-05-01	Short	1111.0	2018-11-20	瑞达期货	Ruida Futures
1	978	东证期货	cs	2019-01-01	2019-05-01	Short	649.0	2018-11-22	东证期货	Orient Futures
2	1142	金元期货	cs	2019-01-01	2019-05-01	Short	803.0	2018-11-26	金元期货	Goldstate Futures
3	1083	东兴期货	cs	2019-09-01	2020-01-01	Short	700.0	2019-05-27	东兴期货	Dongxing Futures
4	977	东证期货	cs	2019-09-01	2020-01-01	Short	526.0	2019-08-14	东证期货	Orient Futures

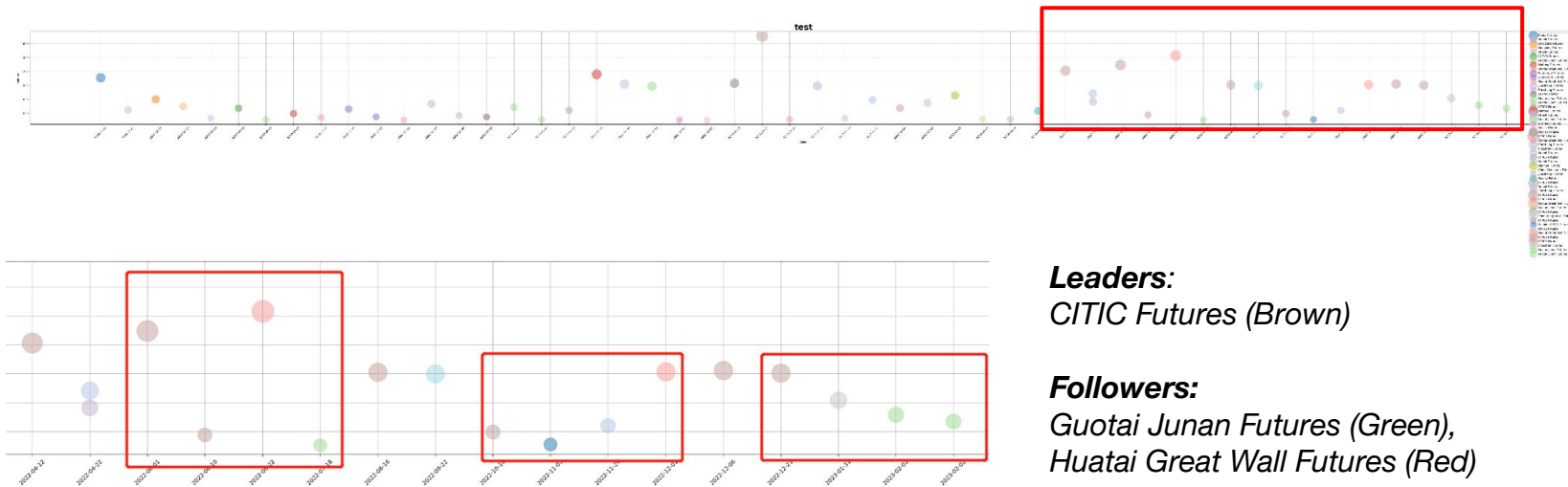
For the Column [Broker]:

- When Broker A completes a time spread transaction and Broker B appears within x rows of the dataset (which means that it follows A's transaction) y times, then we consider A to be the leader and B to be the follower.
- x and y are thresholds for this method, which can be set manually.

2) Sentiment - Time Spread

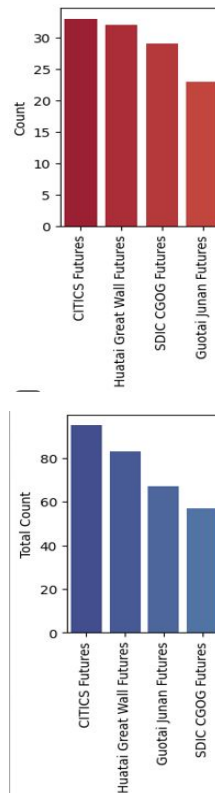
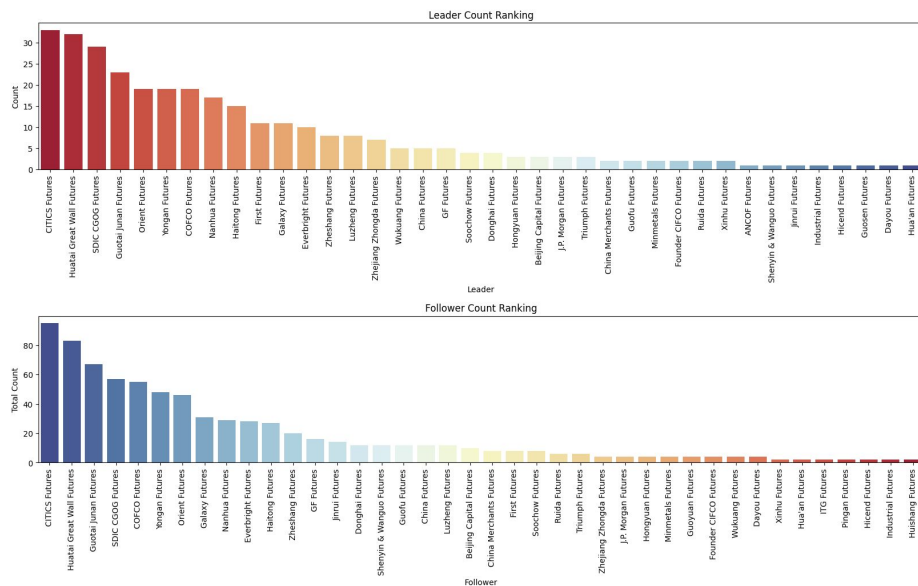
Categorical Method (For CS, Short):

When Broker A completes a time spread transaction and Broker B appears within 3 rows of the dataset (which means that it follows A's transaction) 2 times, then we consider A to be the leader and B to be the follower.



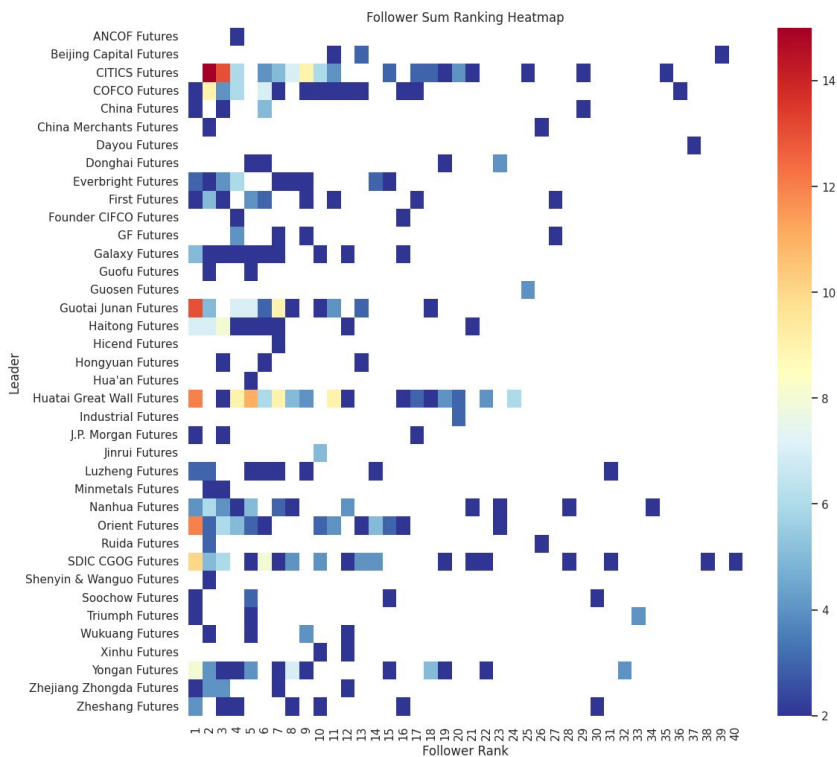
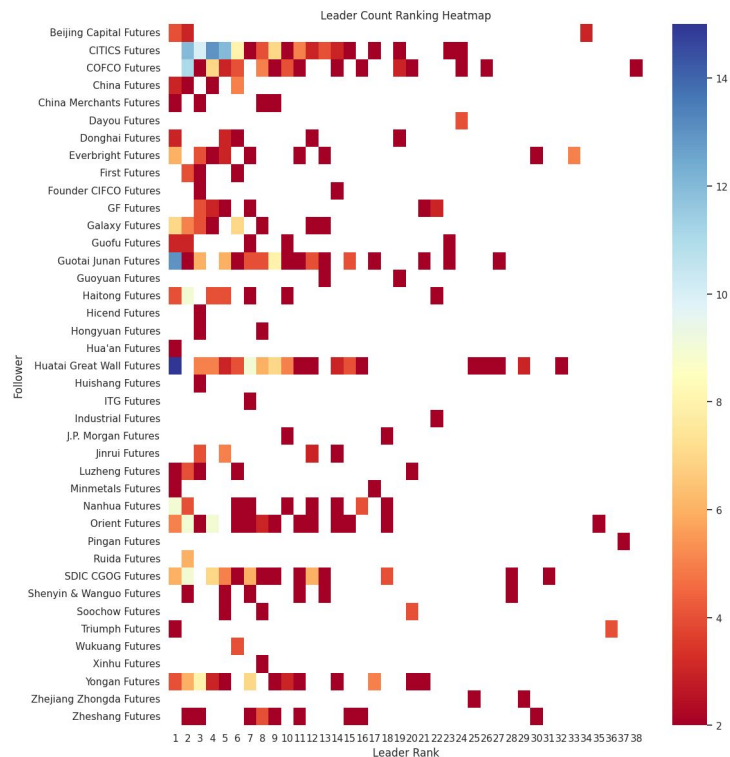
2) Sentiment - Time Spread

The combined sentiment (leaders & followers) results of all time spread data are as follows:



In all time spread based sentiment transactions, it is **often the larger brokers (CITICS, Huatai Great Wall, SDIC CGOG, Guotai Junan, etc.)** that are identified as leader and follower frequently.

2) Sentiment - Time Spread



3) Statistical Arbitrage - Pairs Trading

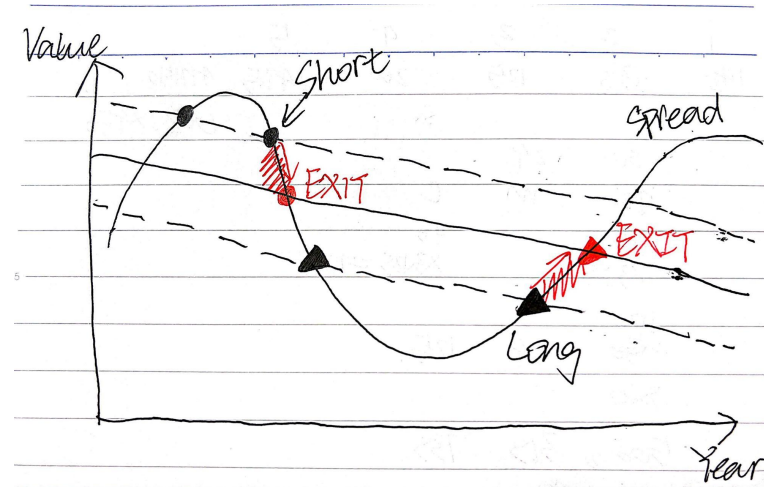
a.) Principle of Strategy

1. **Pairs trading** is an approach that takes advantage of the mispricing between two (or more) co-moving assets, by taking a long position in one(many) and shorting the other(s), betting that the relationship will hold and that prices will converge back to an equilibrium level
2. Pairs trading requires high **correlation** and **cointegration** between the assets
3. **ADF test** results: SBM & SBO spread is not stationary, SBO & PO spread and CS & C spread are stationary

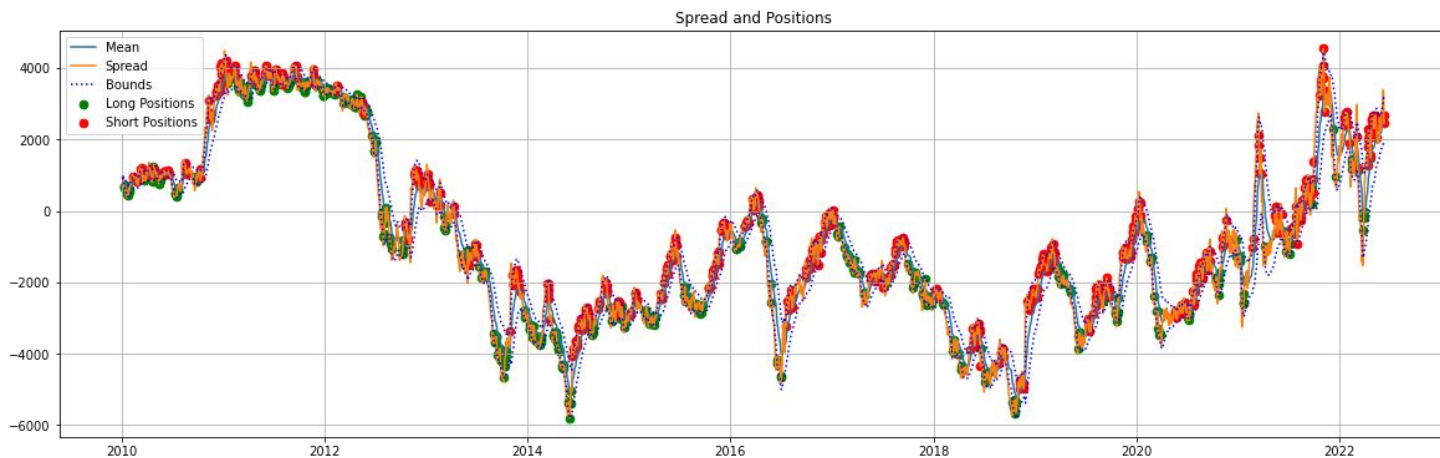
4. **Strategy**: we constructed a 10 days weighted moving average, and upper and lower boundaries with zscore=1 (1x SD), and generated trading signals from the relationship of the spread and three lines.

When the spread crosses the upper bound downward, and last time crosses the upper bound upward, signal=-1, **short**, when the spread reverts to the mean, signal=0, exit short;
When the spread crosses the lower bound upward, and last time crosses the lower bound downward, signal=1, **long**, when the spread reverts to the mean, signal=0, exit long;

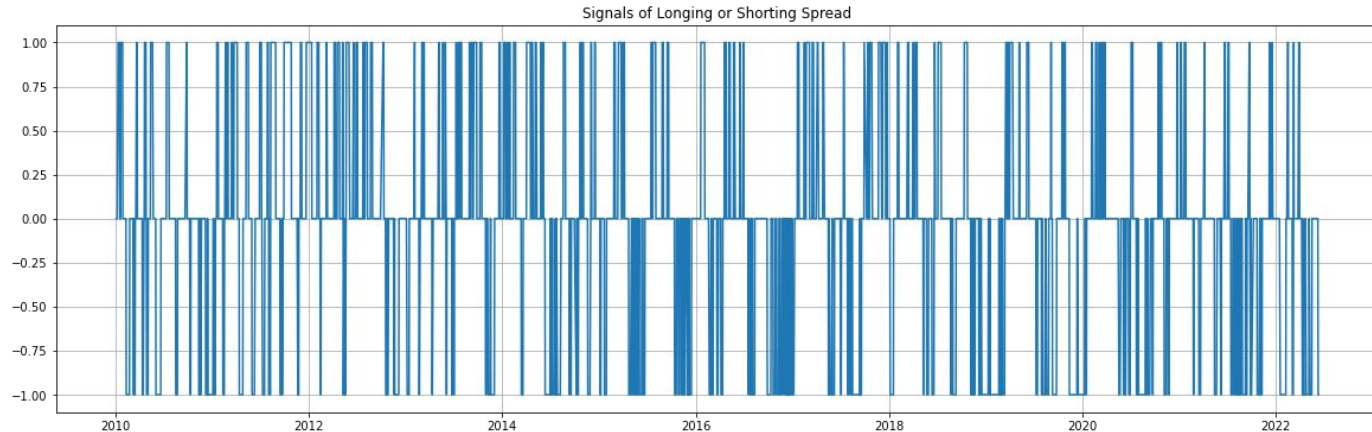
UCLA Also set a stop loss of 1%.



3) Statistical Arbitrage - Pairs Trading



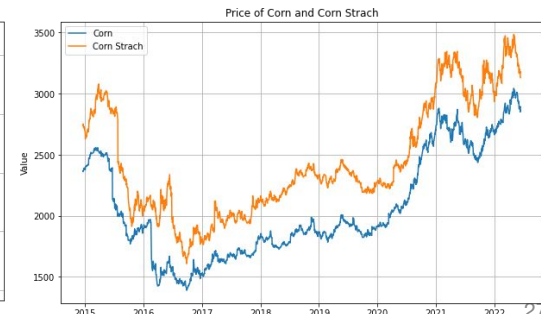
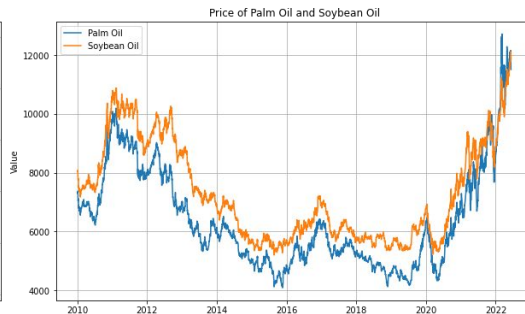
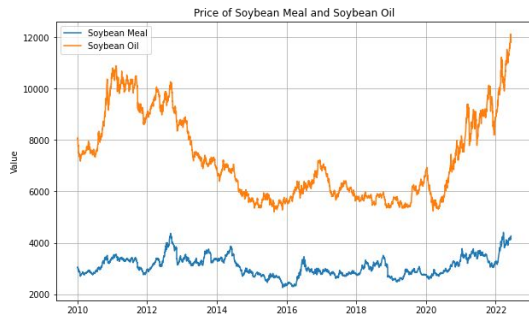
b) Positions & Signals
example:
SBM & SBO



3) Statistical Arbitrage - Pairs Trading

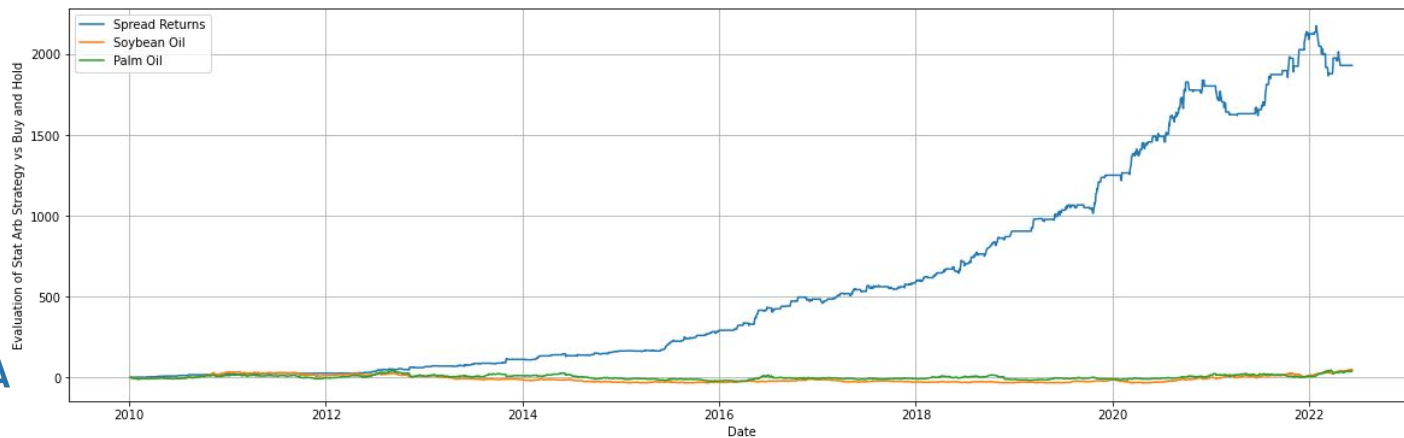
c) The Pair Trading strategy results of three different pairs

	SBM & SBO (5:2)	SBO & PO (1:1)	CS & C (1:1)
Absolute Return	116.86%	255.98%	53.65%
Annual Return	14.12%	30.94%	10.78%
Volatility	10.47%	14.86%	12.06%
Sharpe Ratio	1.35	2.08	0.89



3) Statistical Arbitrage - Pairs Trading

d) P&L and Return Comparison: SBO & PO



3) Statistical Arbitrage - Pairs Trading

e) Consideration



Pairs trading relies on the assets having a high statistical **correlation**. In most cases, we require a correlation of at least 0.80 which is very challenging to recognize.



The strategy trades and calculates returns without taking into account **commission fees**, **contract month changes**, **margin**, etc.. Frequent trading will result in high commission charges. The transactions are made in large quantities which shows the risk of filling the contract orders at the desired price when positions are open in a pair trading is high.



The strategy can only give rough entry and exit positions. There is a risk that the spread doesn't revert to the mean but go in the opposite direction. In this situation, we are at great **risk of losing capital**. So I set a stop loss of 1%.



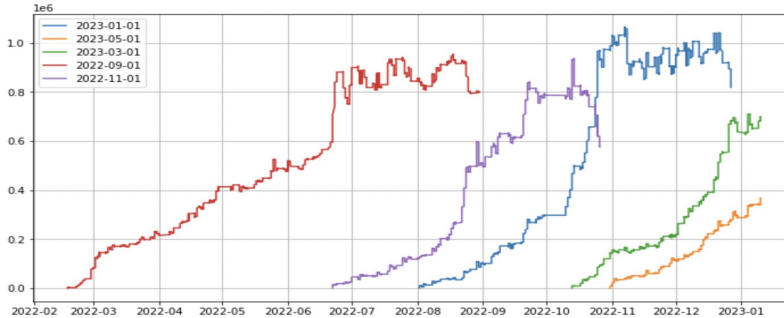
Traders may face **spot delivery issues**, but since Louis Dreyfus is a grain producer, this risk can be addressed.

4) Rolling of Price

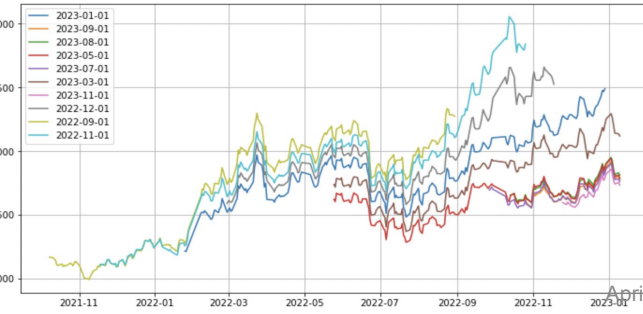
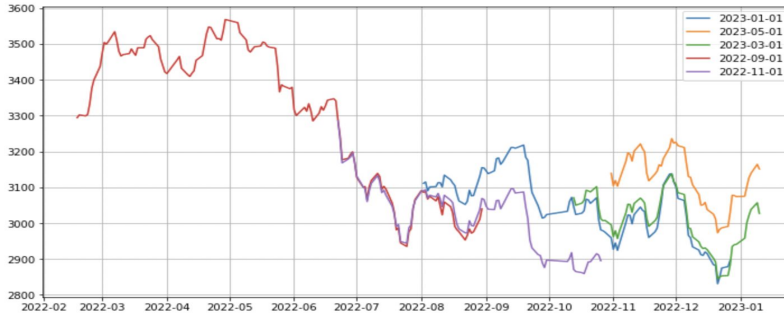
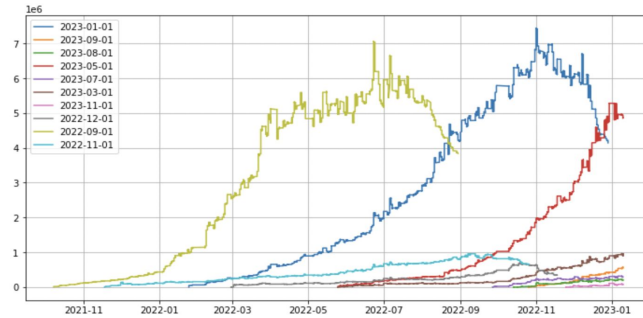
a.) Rolling of Price Pattern

Rolling of Price: Extending the expiration or maturity of a position forward by closing the initial contract and opening a new longer-term contract for the same underlying asset at the then-current market price.

CS
Futures



M
Futures



4) Rolling of Price

b.) Problem

We only have about one year of price data, so we can only explore one year of futures' rolling of price pattern.

One year price may be largely affected by outside world factors and may not be objective.

Main Issue - Data Restrictions

Spreads

- Data Lacking: The price data is limited in time period (We can only observe one year pattern, cannot work in cycle study) and the brokers data is limited in broker range (only the brokers that has high trading volume can be recorded into dataset).
- Data Frequency Problem: The data is daily, but the spread strategy is often used in high frequency trading scenario, we may fail to recognize large amount of high frequency trading.

Sentiment Analysis

- The outcome based on **daily average data** are only indicative (Since lead/follow behavior usually occurs within a few hours and is reflected in multiple transactions).
- Sentiment measurement cannot be set too restrictive (e.g., date, contract, location all fixed), and the set of images thus obtained, while certainly suitable for analysis, would further **amplify the problem** of missing data and lead to more inaccurate results.

Pairs Trading

- The strategy doesn't take **commission fees, contract month changes, margin**, etc. into account.

Conclusion

Spreads

- The brokers are doing Time Spreads, SBO/PO Spreads and Crush Hedge deliberately for the purpose of managing risk or profit from the market.
- The Time Spread and SBO/PO Spread are profitable for most brokers.
- Time Spread Strategy is more stable than SBO/PO Spread Strategy.

Sentiment Analysis

- We have derived a feasible set of measurements through several experiments and are able to adapt the criteria to the situation. Using additional data can alleviate the problem of misclassifying.

Pairs Trading

- For all three pairs of commodities we tested, SBO & PO spread has constant hedge ratio and the best trading performance, with an annual return 30.94% and sharpe ratio 2.08. SBM & SBO spread trading ranks second for profitable performance, but they are not cointegrated.

Thank You
