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COMMODITIES

CBOT Soybeans vs. DCE Soybean Meal and Soybean Oil – Crush Spread

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CBOT SOYBEANS VS. DCE SOYBEAN MEAL AND SOYBEAN OIL – CRUSH SPREAD

A key component in the soybean market is what is known as the "crush" spread. Soybeans are processed into two products – soybean meal and soybean oil, and this process is known as "crushing." The crush spread is the difference between the combined value of the products and the value of the soybeans. It is a measurement of the profit margin for the soybean processor. The soybean processor will be interested in the crush spread as part of its hedging strategy, and the speculator will look at the crush spread for trading opportunities. This strategy paper will walk you through how different types of crush spreads work using a range of pricing examples.

In a crush spread, the trader takes a long position in soybean futures against short positions in soybean meal futures and soybean oil futures. The spread's value represents the gross processing margin from crushing soybeans.

Generally each 60-pound bushel of soybeans produces approximately 11 pounds of oil, 48 pounds of 44% protein meal and 1 pound of waste. Dalian Commodity Exchange (DCE)'s Soybean Meal contract specifies 43% or higher protein content, which suggests the meal output includes the hulls. (This crush is different from CBOT "Board" Crush, in which 44 lbs of 48% protein meal and 5 lbs of hulls and waste are produced.) Also, oil yields vary depending upon growing conditions. This would also affect the crush ratio.) In percentage terms, 1 unit of soybeans produces 80% meal, 18.3% oil and 1.7% waste. To determine the crush margin on a unit of soybeans, we take the % value of the products and subtract the value of the soybeans:

Crush Margin =
Soybean Meal x 80% + Soybean Oil x 18.3% - Soybeans

(Some market participants have been known to use 20% for the oil share to make calculations easier.)

CRUSH MARGIN

We would apply the same formula to determine the crush margin using products sold in China and soybeans purchased in the US. However, the products are quoted in Chinese yuan per metric ton (CNY/mt), while the soybeans are quoted in U.S. dollars per bushel. When calculating the crush, we will convert the soybeans to a CNY/mt price. At the time of this writing, the exchange rate between the two currencies was 1 CNY = $0.1611. We will use that rate in our examples, reserving to topic of managing currency risk to another publication. To convert the current price of soybeans from $/bu to CNY/mt, we use the following formula:

Soybean price ($/bu) x 36.7437 bu per mt / 0.1611 =
Soybean price (CNY/mt)

Using this formula we determine that cash soybeans trading at $9.15/bushel in the U.S. equate to CNY 2087/mt.

With cash soybean meal in China trading at 2575 and soybean oil at 5765, the crush margin would be:

2575 * 0.8 + 5765 * 0.1830 – 2087 = CNY 1028/mt.

Please note that transportation costs have not been subtracted from this margin. It merely reflects the difference between the selling price of the products in China and the purchase price of the soybeans in the US.

SIZE DIFFERENCE BETWEEN CBOT AND DCE CONTRACTS

The CBOT Soybean contract consists of 5,000 bushels, which is equivalent to approximately 136.1 metric tons. The DCE Soybean Meal and Soybean Oil contracts are 10 metric tons each. Using the percentage formulas above, 136.1 mt of soybeans would yield 108.9 mt of soybean meal and 24.9 mt of soybean oil. Therefore, to do the crush on an approximate equivalent volume basis, for each contract of soybeans they purchased at the CBOT, the trader would have to sell 11 contracts of meal (a total of 110 mt) and 2 contracts of oil (20 mt). This would leave the crusher slightly over-hedged on the meal and under-hedged on the oil.

A more accurate estimate of the crush margin would be if the trader used 2 contracts of Soybeans at CBOT (272.2 mt) and 22 contracts of Soybean Meal (220 mt) and 5 contracts of Soybean Oil (50 mt) at the DCE. Physically crushing 272.2 mt of soybeans should produce 217.7 mt of soybean meal and 49.9 mt of soybean oil.

Of the two, the second version more accurately reflects the actual crush ratio. However, trading a spread that size requires more margin than many traders are willing to undertake, and the total dollar risk could be higher. The larger trade can be useful for larger trader, while smaller traders might find that the smaller version better suits their needs.

Furthermore, the ratios used here do not necessarily reflect the "ideal" hedge for any particular firm. These are merely examples based on typical crush margins. Hedgers would do well to adjust the quantities to meet their own particular needs.

Table 1. Soybean Crush Comparison

Ratio	Position	Attributes	Trader Profile
1:11:02	Long 1 CBOT Soybean	Less Accuracy	Smaller Market
	Short 11 DCE Soybean Meal		Participants
	Short 2 DCE Soybean Oil		
2:22:05	Long 2 CBOT Soybeans	More Accuracy	Larger Market
	Short 22 DCE Soybean Meal		Participants
	Short 5 DCE Soybean Oli		

CBOT-DCE SOYBEAN CRUSH HEDGE

We will consider the November Soybean Crush, in which the November CBOT Soybean contract is paired with January DCE Soybean Meal and January DCE Soybean Oil. This allows approximately one month for shipping and one month for crushing.

Table2. Soybean and Product Futures Prices

November CBOT Soybeans	$9.60/bushel = CNY 2190/mt
January DCE Soybean Meal	CNY 2677/mt
January DCE Soybean Oil	CNY 5878/mt

In this scenario, a soybean crusher in China wishes to protect himself against reduction in his hedge margin over the ensuing 5-7 months, when he expects to crush a certain amount of soybeans. They are planning to import soybeans from the U.S. in October and sell the products in China in December. As protection against a reduction in this margin, the crusher could consider putting on a crush by buying November CBOT Soybeans and selling January DCE Soybean Meal and Soybean Oil. They will initiate the hedge in May, lift the CBOT Soybean portion of it in October when they price the Soybeans in the US, and lift the DCE product potion in December, when they sell the Soybean Meal and Soybean Oil.

USING THE 1:11:2 CRUSH RATIO AS A HEDGE

We will start by considering the 1:11:2 Crush Ratio. Let us first examine what would happen if the crush narrows. In these examples, for illustrative purposes we make the unrealistic assumptions that basis and the $/CNY exchange rate remain steady.

Table 3. Soybean Crush Hedge, Narrowing Margin, 1:11;2 Ratio
Strategy: Buy 1 Soybean futures at CBOT, sell 11 Soybean Meal and 2 Soybean Oil futures at DCE

May	**Cash**	**Futures**	
Soybeans (US)	$9.15/bu (CNY 2087/mt)	Buy 1 Nov CBOT at $9.60/bu	
Soybean Meal (China)	CNY 2575/mt	Sell 11 Jan DCE at CNY 2677/mt	
Soybean Oil (China)	CNY 5765/mt	Selll 2 Jan DCE at CNY 5878/mt	
Crush	CNY 1028/mt		
October	**Cash**	**Futures**	
Soybeans (US)	$11.15/bu (CNY 2543/mt)	Sell 1 Nov CBOT at $11.60/bu	
December	**Cash**	**Futures**	
Soybean Meal (China)	CNY 2815/mt	Buy 11 Jan DCE at CNY 2917/mt	
Soybean Oli (China)	CNY 6246/mt	Buy 2 Jan DCE at CNY 6359/mt	
Crush	CNY 852/mt		
Change	**Cash Position**	**Futures Position (per unit)**	**Total:**
	– CNY 176/mt or	CBOT Soybeans: +$2:.00/bu	CNY 62,073
	– CNY 23,954 per 136.1 mt	DCE Soybean Meal: – CNY 240/mt	– CNY 26,400
	(1 contract at CBOT)	DCE Soybean Oil: – CNY 481/mt	– CNY 9,620
		Net per CBOT soybean contract (136.1 mt) Net per mt	CNY 26,053 CNY 191
		Unhedged Crush Margin **Hedged Crush Margin**	**CNY 852** **CNY 1,043**

In this example, the soybean and product prices increased from when the hedge was started to when it was exited, but because the soybean price gained more than the combined values of the soybean meal and soybean oil, the crush margin declined. Between May and December the crushing operation saw their processing margin fall by CNY 176 per metric ton, which amounts to a net loss of CNY 23,594 per 136.1 metric tons (the equivalent of one Soybean futures contract at CBOT). However, by entering the hedge, the crusher saw a net gain of CNY 26,053 in their futures positions, the equivalent of CNY 191/mt.

Note that the gain in the futures is slightly larger than the loss in the cash market. This was largely due to the imprecision in the contract sizes. This hedge covered 20 mt of oil, which was only 80% of the crusher's cash position exposure of 24.9 mt. The market conditions – prices rising – meant that the long side of the hedge, in this case the soybean position, saw a gain while the short side of the hedge, the meal and products, saw a decline. Because the hedge was 100% covered on the soybeans, the hedger actually benefited from this. As we

shall see in the next example, if prices were falling instead, the hedger could find the imprecision of the hedge working to his disadvantage. The hedge's performance will follow the cash market more closely with a larger hedge, such as the 2:22:5 ratio shown in Table 1.

Now let's look at the same hedge in a situation where the margin is widening over the same time frame:

Table 4. Soybean Crush Hedge, Widening Margin, 1:11:2 Ratio
Strategy: Buy 1 Soybean futures at CBOT, sell 11 Soybean Meal and 2 Soybean Oil futures at DCE

May	**Cash**	**Futures**	
Soybeans (US)	$9.15/bu (CNY 2087/mt)	Buy 1 Nov CBOT at $9.60/bu	
Soybean Meal (China)	CNY 2575/mt	Sell 11 Jan DCE at CNY 2677/mt	
Soybean Oil (China)	CNY 5765/mt	Selll 2 Jan DCE at CNY 5878/mt	
Crush	CNY 1028/mt		
October	**Cash**	**Futures**	
Soybeans (US)	$7.15/bu (CNY 1631/mt)	Sell 1 Nov CBOT at $7.60/bu	
December	**Cash**	**Futures**	
Soybean Meal (China)	CNY 2335/mt	Buy 11 Jan DCE at CNY 2437/mt	
Soybean Oli (China)	CNY 5284/mt	Buy 2 Jan DCE at CNY 5397/mt	
Crush	CNY 1204/mt		
Change	**Cash Position**	**Futures Position (per unit)**	**Total:**
	+ CNY 176/mt or	CBOT Soybeans: –$2:.00/bu	– CNY 62,073
	+ CNY 23,954 per 136.1 mt	DCE Soybean Meal: + CNY 240/mt	CNY 26,400
	(1 contract at CBOT)	DCE Soybean Oil: + CNY 481/mt	CNY 9,620
		Net per CBOT soybean contract (136.1 mt) Net per mt	– CNY 26,053 – CNY 191
		Unhedged Crush Margin **Hedged Crush Margin**	**CNY 1,204** **CNY 1,013**

In this example soybean prices and the product prices decreased from when the hedge was started to when it was exited, but because the soybean price fell more than the combined values of the soybean meal and soybean oil that was produced, the crush margin improved. Between May and December the crushing operation saw their processing margin increase by CNY 176 per metric ton, which amounts to a net gain of CNY 23,594 per 136.1 metric tons (the equivalent of one soybean futures contract at CME). However, by entering the hedge, the crusher saw a net loss of CNY 26,053 in their futures positions, which equates to a CNY 191 decline in the crush margin.

Note that the loss in the futures is slightly larger than the gain in the cash market. As in the first example, this was mainly because the soybean oil futures position covered only 80% of the cash position, a limitation brought on by the size of the hedge.

As we have noted, there are limitations in using this hedge against a "real life" crushing situation. The hedge of using one (5,000 bu. or 136.1 mt) CBOT Soybean contract against 11 (10 metric ton) DCE Soybean Meal contracts and two (10 mt) DCE Soybean Oil contracts is an approximation of a crush ratio that produces 108.9 mt of 44% protein soybean meal and 24.9 mt soybean oil from 5,000 bushels of soybeans. It is also important to note that no hedging vehicle is perfect. Other factors not considered here, such as basis and currency risk, could also affect the success using the crush hedge.

USING THE 2:22:5 CRUSH RATIO AS A HEDGE

Now let's look at a larger, more accurate crush, such as buying 2 contracts of Soybeans at CBOT and selling 22 contracts of Soybean Meal and 5 contracts of Soybean Oil at DCE. This hedge covers crushing operations on 10,000 bushels or 272.2 metric tons at a time.

First let us consider a Narrowing Margin:

Table 5. Soybean Crush Hedge, Narrowing Margin, 2:22;5 Ratio
Strategy: Buy 2 Soybean futures at CBOT, sell 22 Soybean Meal and 5 Soybean Oil futures at DCE

May	**Cash**	**Futures**	
Soybeans (US)	$9.15/bu (CNY 2905/mt	Buy 2 Nov CBOT at $9.60/bu	
Soybean Meal (China)	CNY 2575/mt	Sell 22 Jan DCE at CNY 2677/mt	
Soybean Oil (China)	CNY 5765/mt	Sell 5 Jan DCE at CNY 5878/mt	
Crush	CNY 1028/mt		
October	**Cash**	**Futures**	
Soybeans (US)	$11.15/bu (CNY 2543/mt)	Sell 2 Nov CBOT at $11.60/bu	
December	**Cash**	**Futures**	
Soybean Meal (China)	CNY 2815/mt	Buy 22 Jan DCE at CNY 2917/mt	
Soybean Oli (China)	CNY 6246/mt	Buy 5 Jan DCE at CNY 6359/mt	
Crush	CNY 852/mt		
Change	**Cash Position**	**Futures Position (per unit)**	**Total:**
	– CNY 176/mt or	CBOT Soybeans: +$2.00/bu	CNY 124,146
	– CNY 47,907 per 272.2 mt	DCE Soybean Meal: – CNY 240/mt	– CNY 52,800
	(2 contracts at CBOT)	DCE Soybean Oil: – CNY 481/mt	– CNY 24,050
		Net per CBOT soybean contract (272.2 mt) Net per MT	CNY 47,296 CNY 174
		Unhedged Crush Margin **Hedged Crush Margin**	**CNY 852** **CNY 1,026**

In this example, the crushing operation saw their processing margin fall by CNY 176 per metric ton, which amounts to a net loss of CNY 47,907 per 272.2 metric tons (the equivalent of two soybean futures contract at CBOT). However, by entering the hedge, the crusher saw a net gain of CNY 174/mt or CNY 47,296 in their futures positions.

In this case, the offset in the futures is much closer to the loss on the cash side than it was for the 1:11:2 Crush Ratio. This means that the hedged margin is much closer to what the original cash margin was on the day the hedge was established.

Now let us consider a widening margin:

Table 6. Soybean Crush Hedge, Widening Margin, 2:22;5 Ratio
Strategy: Buy 2 Soybean futures at CBOT, sell 22 Soybean Meal and 5 Soybean Oil futures at DCE

May	**Cash**	**Futures**	
Soybeans (US)	$9.15/bu (CNY 2905/mt	Buy 1 Nov CBOT at $9.60/bu	
Soybean Meal (China)	CNY 2575/mt	Sell 11 Jan DCE at CNY 2677/mt	
Soybean Oil (China)	CNY 5765/mtt	Sell 2 Jan DCE at CNY 5878/mt	
Crush	CNY 1028/mt		
October	**Cash**	**Futures**	
Soybeans (US)	$7.15/bu (CNY 1631/mt)	Sell 1 Nov CBOT at $7.60/bu	
December	**Cash**	**Futures**	
Soybean Meal (China)	CNY 2335/mt	Buy 11 Jan DCE at CNY 2437/mt	
Soybean Oli (China)	CNY 5284/mt	Buy 2 Jan DCE at CNY 5397/mt	
Crush	CNY 1204/mt		
Change	**Cash Position**	**Futures Position (per unit)**	**Total:**
	+ CNY 176/mt or	CBOT Soybeans: –$2.00/bu	– CNY 124,146
	+ CNY 47,907 per 272.2 mt	DCE Soybean Meal: + CNY 240/mt	CNY 52,800
	(2 contracts at CBOT)	DCE Soybean Oil: + CNY 481/mt	CNY 24,050
		Net per CBOT soybean contract (136.1 mt) Net per MT	– CNY 47,296 – CNY 174
		Unhedged Crush Margin **Hedged Crush Margin**	**CNY 1,204** **CNY 1,030**

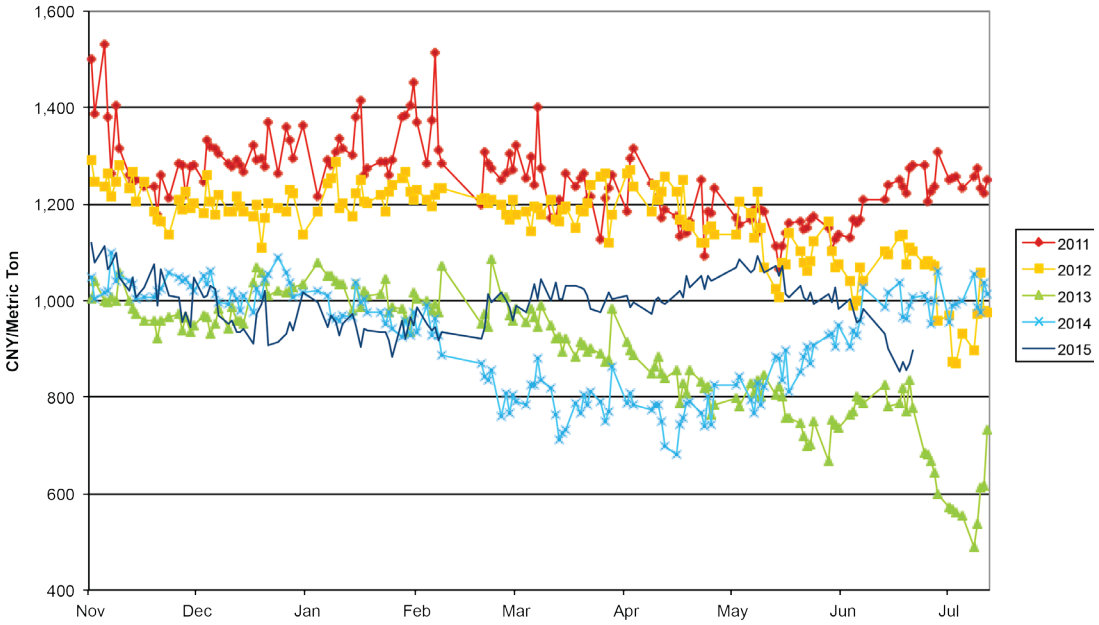
In this example, the cash position of the crusher increased by CNY 47,907, which is offset by a loss of CNY 47,296 in the futures. Because of the larger number of contracts traded, the hedge more closely mirrors the cash market position than in the case of the 1:11:2 hedge.

CRUSH CHARTS

How has the crush behaved in recent years? The following charts show the values of the July CBOT Soybean/September DCE Product and the November CBOT Soybean/January DCE Product crush spreads over the past 5 years:

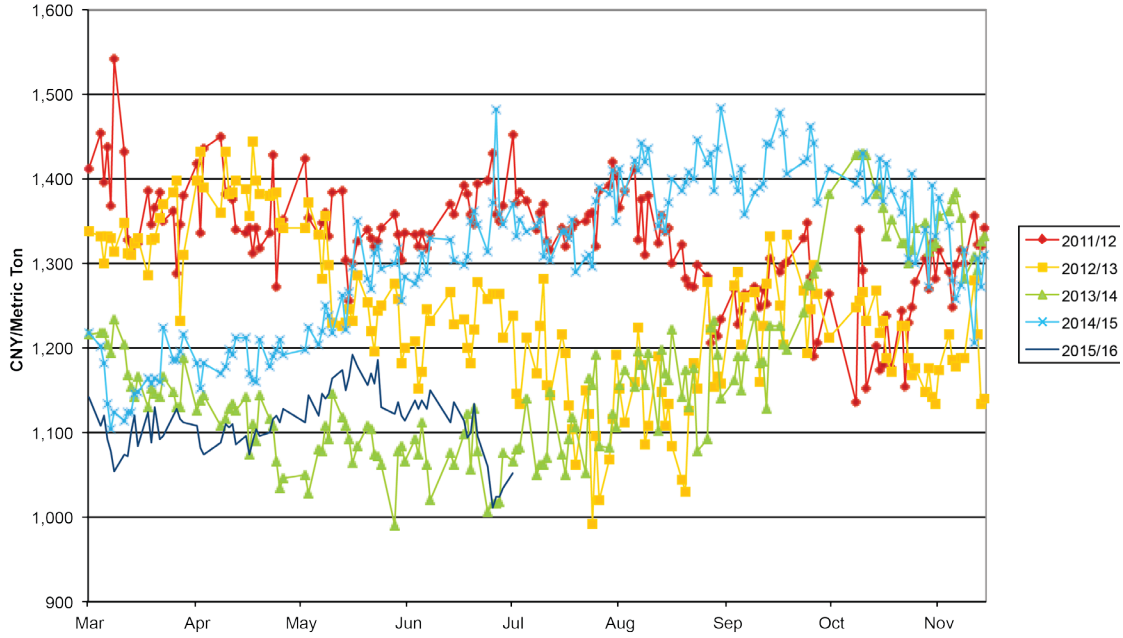
Soybean Crush: July CBOT Soybeans/Sep DCE Products

22 Sep DCE Soybean Meal + 5 Sep DCE Soybean Oil -2 July CBOT Soybeans



Soybean Crush: Nov CBOT Soybeans/Jan DCE Products

22 Jan DCE Soybean Meal + 5 Jan DCE Soybean Oil -2 Nov CBOT Soybeans



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