

Step On A Crack

Perhaps nowhere in economics does the phrase, "You have to play the cards you are dealt" apply more than for basic natural resources. Consider silicon: It is quite literally as cheap as sand, and yet the worlds of microelectronics and fiber optics depend on it completely. Or, at the opposite end of the spectrum, platinum: It is found only in minute quantities in a handful of deposits, yet it is so useful that more than one-fifth of all industrial goods involve it at some point in their manufacture.

Crude oil, too, is replete with irony. Two things have held true since the first commercial drilling of the late 19th century. First, everyone thinks we are running out of it sometime in the near future. Second, its price is so subject to crashing below the marginal cost of production that a cartel manager such as the Texas Railroad Commission or OPEC must intervene to restrict supply. But the greatest irony is just how useless this gooey and foul-smelling mixture, too often found in the most inhospitable corners of the globe, is until it is refined.

Just as the price of crude oil itself is capable of wild swings both higher and lower, so are the margins realized by refiners. These margins often are referred to as "crack" spreads, in recognition of the process by which long hydrocarbon chains are cracked apart to produce more of the lighter molecules used in gasoline. There is no standard cracking yield; the actual conversion of crude oil into refined products depends on the type of crude oil used, the class of refinery used and the seasonal configuration of those refineries.

Moreover, most U.S. refineries are located on the coasts, far away from the pipeline market at Cushing, Oklahoma, that is the basis for the NYMEX crude oil contract. Most crude oil imported into the U.S. is high-sulfur or "sour" crude oil, incompatible with the low-sulfur or "sweet" grade specified in the NYMEX contract. Wholesale refined product markets are scattered throughout the country and bear little logistical connection to the New York harbor market that forms the basis of the NYMEX heating oil and gasoline contracts.

Still, even with all of these considerations and caveats, the crack spreads commonly traded with NYMEX futures contracts mirror the broad conditions of the cash market reasonably well. The two most common crack spread trades are:

- The 2/1/1, which involves the purchase/sale of two crude oil futures and the sale/purchase of one contract each of heating oil and gasoline; and
- The 3/2/1, which involves the purchase/sale of three crude oil futures and the sale/purchase of two gasoline contracts and one heating oil contract

To complicate things a little further, crude oil is priced in dollars per 42-gallon barrel, while both heating oil and gasoline are priced cents per gallon, and the crack spread is quoted as the margin on a barrel of crude oil. Let's work through an example using July 16, 2004 prices of September 2004 contracts. On that day, crude oil closed at \$41.30, heating oil at 110.67¢ and gasoline at 127.34¢.

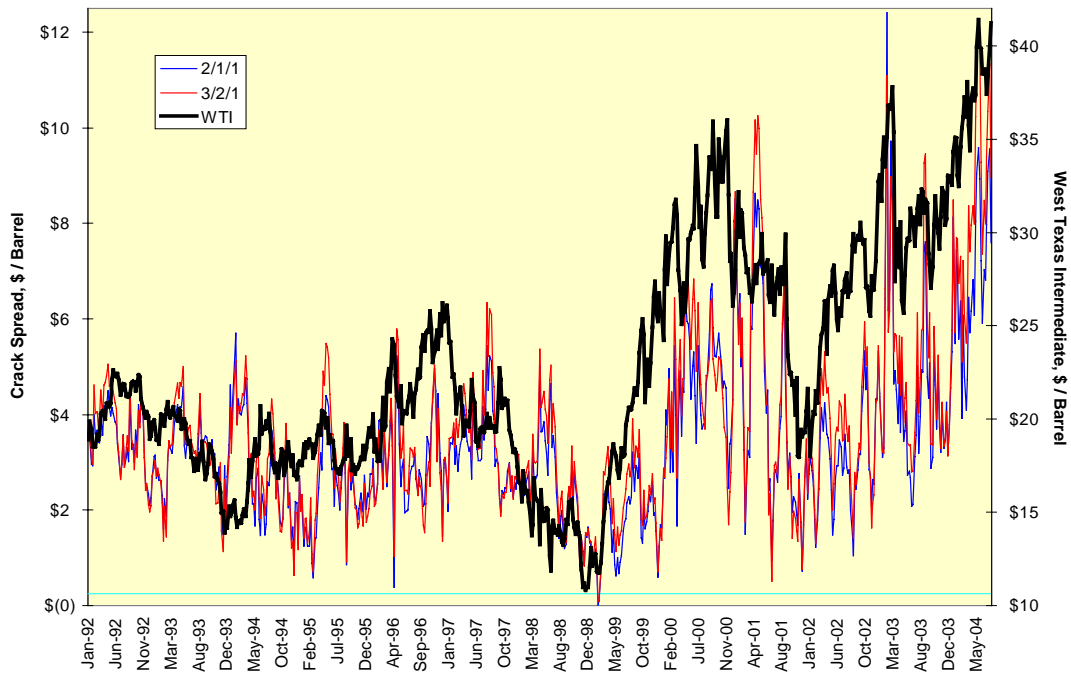
The 2/1/1 crack would be $((.42 * 110.67 + .42 * 127.34) - 2 * 41.30) / 2$, or \$8.68.

The 3/2/1 crack would be $((.42 * 110.67 + .84 * 127.34) - 3 * 41.30) / 3$, or \$9.85.

Margins And Prices

How do these spread values rank historically? If we use cash market series based on West Texas Intermediate, the NYMEX' marker grade of crude oil, and Gulf Coast refined products, we can see that current vales are quite high. This, and the rather obvious fact that crude oil prices have been moving higher in advance of crack spreads, stands counter both to pre-1990s experience and to economic theory.

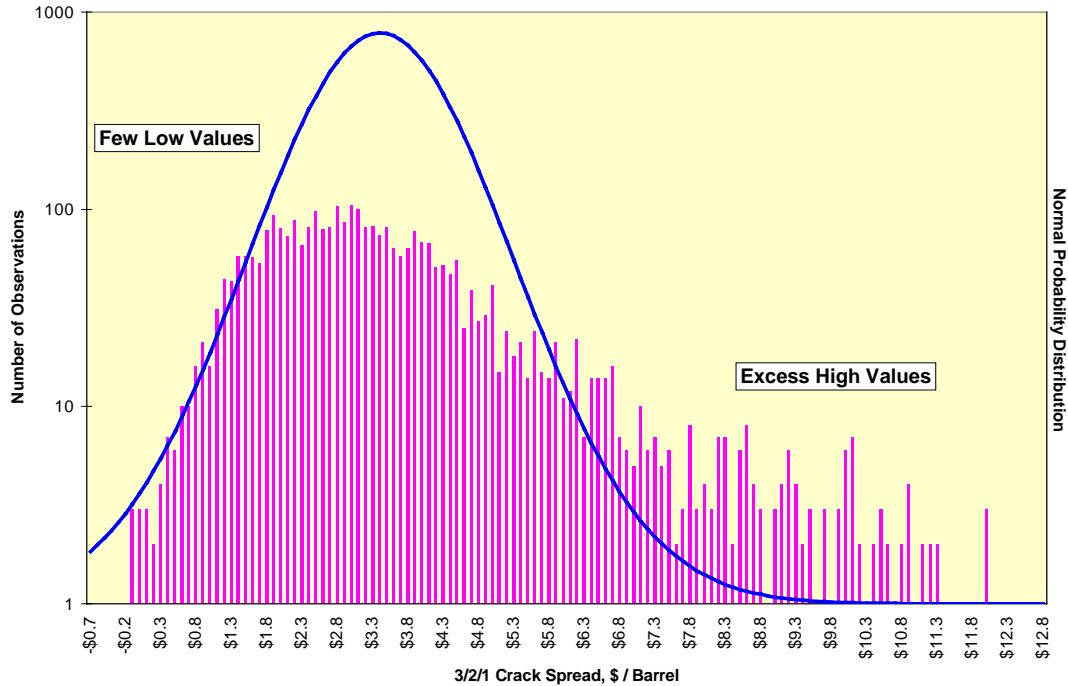
Crude Oil Prices Have Been Leading Margins



We should expect high crack spread values to encourage refiners to bid the price of crude oil higher, and we should then expect these higher feedstock costs to squeeze refiners' profits. That this has not been the case stands as evidence that refinery capacity is a very scarce resource. Refiners are able to pass on their higher costs to you, the consumer, because they need not worry about new entrants into the market: The environmental restrictions on refineries are such that no new refinery may ever be built in the U.S. again.

The scarcity of refining capacity has important implications for crack spread traders as well. If margins are weak, refiners can close down their less efficient units to raise their overall profitability. In addition, price spikes in the refined products, such as those for heating oil during cold winters or for gasoline in late spring, can propel crack spreads higher quickly. The asymmetric profit profile resembles that of a call option - limited downside, unlimited upside - and refineries can in fact be valued on the basis of this embedded option. All a trader needs to do is look at the distribution of 3/2/1 crack values below and decide whether being short this spread has the same risk as being long.

The Crack Spread As An Embedded Option

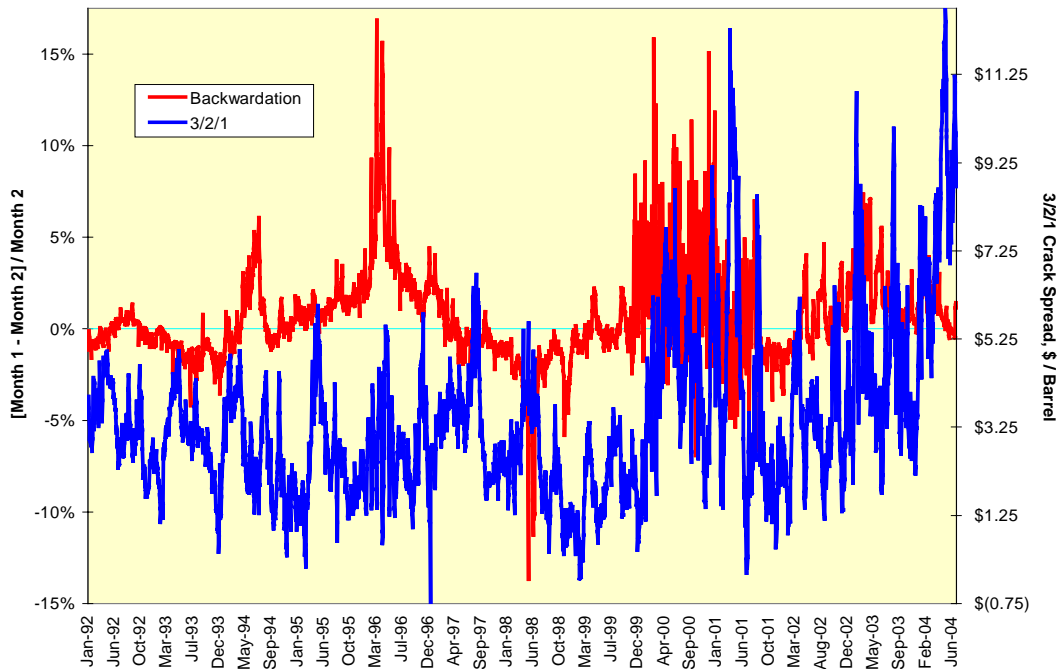


Throw 'Em A Forward Curve

As anyone who has traded the energy markets can attest, they are highly seasonal and are given to wide swings in their intermonth spreads. Energy commodities are given to bursts of backwardation, or the front month futures trading well over their back month counterparts, and to contango as well. They have all of the attributes required for backwardation: The cheapest place to store them is with the producer, they are subject to both transportation bottlenecks and demand surges, and most important a gnawing sense that price surges are unsustainable.

It used to be axiomatic that high prices for crude oil were accompanied by high backwardation. As the price for spot month crude oil was squeezed higher, crack spreads fell. This, too, changed with the disappearance of slack refining capacity in the 1990s and with the recent and gradual acceptance of the notion that high crude oil prices may be with us for several years at least.

The Intermonth - Intermarket Relationship

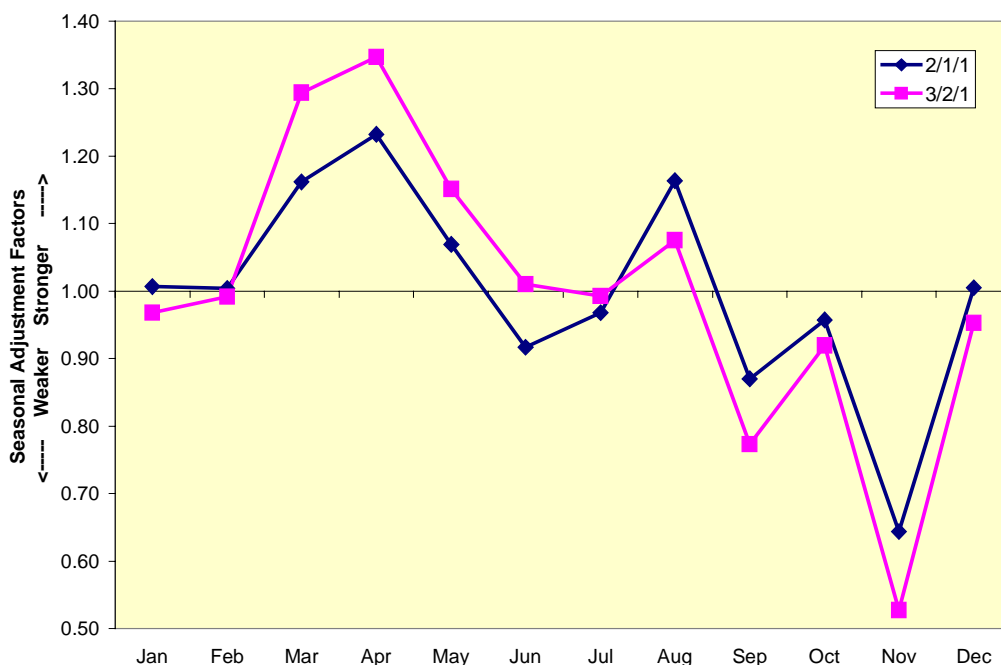


The acceptance of the high price regime has, in contravention of historic trend, led to declining levels of backwardation in 2004. The lower price premium for spot month crude oil is one of the factors permitting high crack spreads to coexist with high prices.

Seasonality

The annual switchover in refinery configurations to produce more gasoline in the summer and more heating oil in the winter produces an identifiable seasonality in the crack spreads. Ignore it at your peril. If we run crack spread values through a seasonal adjustment program and extract the average monthly factors, we can see just how much stronger the crack spreads are in the spring than they are in the fall. Refiners typically do their annual maintenance programs during the late winter, which reduces output. Conversely, refiners typically run near capacity during the fall to assure heating oil supplies for the winter months.

Seasons Matter



Putting It All Together

The successful analysis of energy market spreads requires understanding the individual markets, the spreads and the relationships between them. That is the cost. The benefit is you can trade these spreads with a very high ratio of signal to noise. Anyone who has traded individual energy commodities - and we have not even discussed the wildest of them all, natural gas - knows they are extremely volatile and news-driven. Yes, some can claim to trade them fundamentally, but really, whom are they kidding?

As the same peripatetic news items affect all legs of a spread equally, the effects get offset. And, most importantly, the underlying fundamentals move fairly slowly. As noted above, the scarcity of U.S. refining capacity has been a problem in the making for more than a decade, and it cannot change tomorrow or next week.

All of the factors can be combined into a simple and robust trading matrix, as seen below in a screenshot from the Simons Research, Inc., daily energy report for July 16, 2004.

Technical Data Bank: Spread Positions

Spread	Value	N-Day Stochastic	Quadratic Detrending	Stochastic Signal
Sep. CL-BR	3.30	83.1%	1.16	None.
Sep. HO-CL	5.18	51.1%	-2.18	None.
Sep. HU-CL	12.18	68.0%	-0.08	None.
Sep. 2/1/1	8.68	67.4%	-0.94	None.
Sep. 3/2/1	9.85	67.6%	-0.56	None.
Sep. HU-HO	16.67	66.7%	0.95	None.

A total of six intermarket spreads are examined. These include the NYMEX-International Petroleum Exchange crude oil spreads, the heating oil and gasoline cracks, the 2/1/1 and 3/2/1 cracks and the spread between gasoline and heating oil.

The screen values are adjusted for both the effects of each commodity's forward curve and for the seasonal factors involved in each of the spread markets; these adjustments are not shown in the table above. Each spread is then placed into an unsmoothed fast stochastic (%K) over the N-day Adaptive Moving Average period; the derivation of N is not discussed here. This stochastic produces a trend-following indicator.

A countertrending indicator is provided by the Quadratic Detrending value; these are the normalized residuals of the adjusted spread against a time sequence and the time sequence squared. The presence of a countertrending indicator is required by the embedded call option structure seen in the crack spreads: You need some governor to prevent you from buying a runaway market or to provide an exit from same.

The location of the current spread point on the Student's T-distribution defines whether the spread is overbought or oversold at present. Using a one-tailed 97.5% T-test, these values generally will be greater or less than ± 2 . While the Stochastic column defines a trend, the Quadratic Detrending column defines a countertrend.

It all comes down to the action contained in the Stochastic Signal column. A buy signal is generated when the stochastic is greater than 84% and the T-distribution inverse is less than .975. A sell signal is generated when the stochastic is less than 16% and the T-distribution inverse is greater than 0.025.

A long position in the spread means buying the first item and selling the second, and vice-versa for a short. For multiple-commodity spreads such as the crack, a long position means buying the refined products and selling the crude oil, and vice-versa for short positions.