Backwardation Has Its Price

A key component of the strategy that hurt the Metallgesellschaft (MG) futures trading team was the expectation of backwardation in the crude oil market. Historically, crude nearby is typically in backwardation. MG was long spot futures against its forward physical sales, and counted on beings able to roll these futures into the nearby at a backwardation premium. However, markets do not always behave in the same way. When energy prices began falling and the market flipped from backwardation to contango, MG lost big money on the roll.

Intermonth spreads are priced through a combination of cost-of-carry and expectations for future price action. These spreads have a set of natural floors corresponding to the levels where cash-and-carry arbitrage is profitable for those willing and able to take delivery of the prompt month. Using the simple arbitrage relationship

$$M_2 = M_1 * (1+r)^t + \text{physical storage costs,}$$

where M2 represents the forward month, M1 the spot month, and (1+r)t the costs of capital over the intervening period, we can derive quickly the floor level for riskless arbitrage if we know the physical costs of storage. In practice, the levels at which this spread can trade in a contango describe a stairstep pattern as incrementally higher-cost storage facilities are demanded.

Unless there are severe inventory overhangs in a market, riskless arbitrage opportunities are rare, especially for those who pay the marginal costs of storage. Moreover, there are certain conveniences for commercial interests to hold inventories at non-arbitrage levels. This "convenience yield" on a commodity can be inferred by measuring the difference between the prevailing intermonth spread and the arbitrage spread level, as in the example below for May and July 1994 Chicago wheat:

May wheat	$3.31
July wheat	$3.24
Storage	$0.10
Capital	$0.02
May arbitrage level	$3.12
Excess	$0.19
Convenience yield	5.67%

Using a physical storage cost of $0.048/bushel/month and a 4% cost of capital, we find the price of May wheat would have to fall to $3.12, $0.12 below July, to allow for riskless arbitrage. But instead of May trading at a discount, it is trading at a $0.07 premium. This $0.19 excess represents an annualized yield of 5.67% over the two-month storage period.

Backwardation

As many traders have learned the hard way, there is no theoretical limit to this convenience yield. In a phenomenon first named by John Maynard Keynes, the normal carrying curve can invert (become "backwardated," in his terminology) when sellers are risk-averse regarding the back months, and when buyers are willing to price their purchases as close to the delivery date as possible.

If supplies for prompt delivery become scarce, the ownership of physical inventory becomes very "convenient" indeed. Consider the plight in the example above of the flour miller who hasn't covered his wheat requirements between May and July delivery. He either has to pay the prevailing spot price for May wheat and remain unhedged against the risk of buying during a price spike, or he can sell July wheat forward and guarantee a direct loss of $0.07 per bushel.

On the other hand, anyone who owns physical wheat inventories during this May-July period is in a position to sell cash wheat at any premium to the July contract, thereby calling the backwardated spread away from the market at his option. The essential equivalence between ownership of the intermonth spread and a nearby call option can be demonstrated in the table below.

	Futures expiry	Options expiry	Price		Spread		ATM Call
May	19-May-94		$	3.31			
Jul	20-Jul-94	17-Jun-94	$	3.24	$	(0.07)	$0.12750
Sep	21-Sep-94	19-Aug-94	$	3.26	$	0.02	$0.11625

	Volatility		Time From 5/19/94	From 9/21/94
Jul	19.62%	Jul Call	66	
Sep	17.59%	Sep Call	129	99

The current prompt/nearby spread, May-July, is trading at a $0.07 premium. The second nearby at-the-money call, the September $3.30, is trading at $0.11625. This call will lose value in two ways by expiration of July futures on July 20th, even with no expected change in either price or volatility levels: time decay and a shift from present levels of backwardation in May-July to the discount prevailing in July-September. Taking both these factors into account, the expected value of the September $3.30 call on July 20 will be $0.08, well within the envelope of arbitrage transaction costs.

If a functional equivalence exists between owning the front month in an intermonth spread and a second nearby call option, then the spread should exhibit the asymmetric distribution of an option position. This distribution should be characterized by a small mode at lower levels representing the constraint of arbitrage cash-and-carry levels, by a large central node representing random distribution of the spread, and a long, thin, right-hand tail representing the open-ended returns of a call option/intermonth spread. This distribution exists in financial markets as well as in physical markets, as demonstrated in the chart below of the June/September 1994 Eurodollar spread.

Distribution of Jun / Sep 1994 Eurodollar Spread
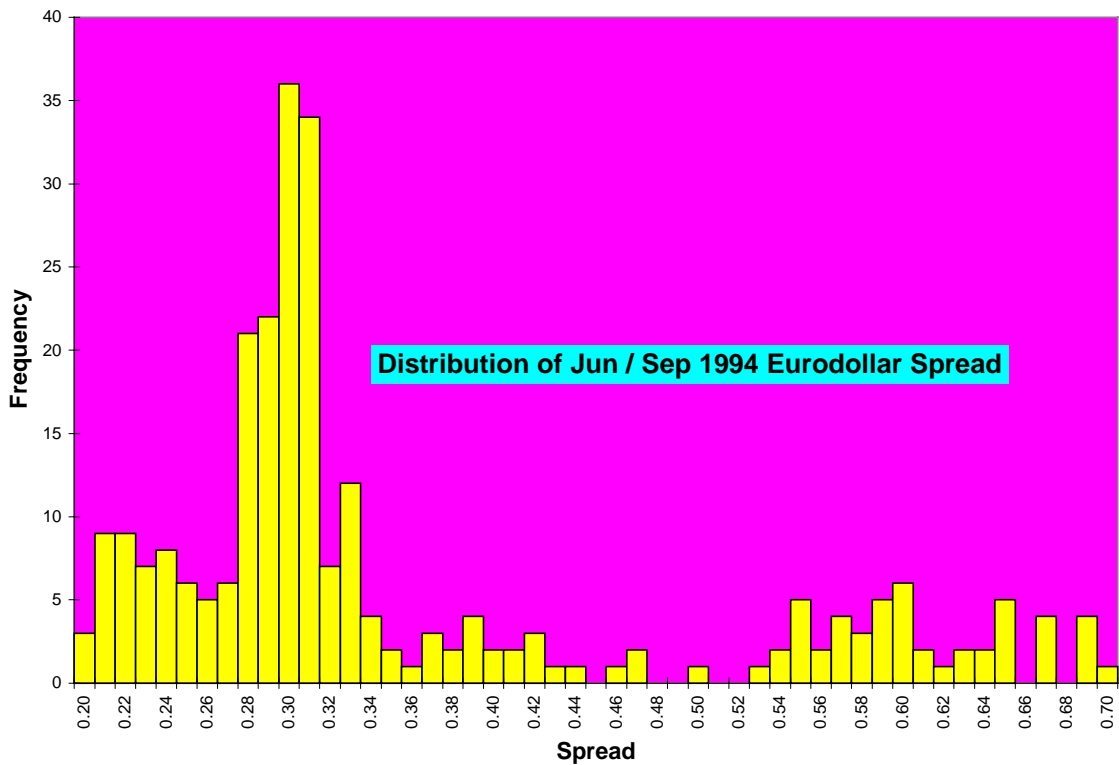
Countertrend Trading Strategies
This distribution suggests a "fade-the-extremes" trading strategy can be used for intermonth spreads. At the one extreme, should a physical market fall into a deep contango that approaches the riskless arbitrage level, and the physical inventory overhang is not sufficient to cause a shift

down to the next level, the trade of buying the front month and selling the nearby is equivalent to buying a call option in a market that has already fallen sharply. Knowledge of each successively higher level of storage costs is crucial in this trading strategy, because this is what determines the downside risk of the trade.

The opposite trade, selling backwardation, is quite a bit riskier as it is akin to selling a naked call option. Sharp increases in backwardation often are associated with severe natural supply disruptions, such as the spike in January 1990 heating oil that occurred in December 1989; with policy-caused supply disruptions such as the spotted owl effects on the lumber market; with market squeezes, such as the December 1987 copper contract; or with the natural unease that occurs in markets trading at unnaturally high levels, such as the crude oil market during the fall of 1990.

In any instance, knowledge of underlying fundamentals is essential; there's no way for a technical trading system to be aware of the underlying physical conditions that produce either successively deeper contangos or of the physical disruptions that can produce runaway backwardation.

Some protection against runaway backwardation can be afforded by purchasing a delta-unitary call position against the short intermonth spread, using the equivalence relationship discussed above. In the case of the September $3.30 wheat call, which has a delta of .47, (1/.47), slightly more than two calls can be purchased against every long May / short July spread. The degree of protection afforded is impossible to ascertain at initiation for several reasons. First, although both the price level of wheat in all months and the volatility of the options purchased are likely to increase in a higher backwardation environment, there is no guarantee that either condition will apply. Second, in a true supply disruption, the gains of the spot month against the nearby will disconnect from the rest of the forward curve, rendering call option protection ineffective.

Third, and perhaps most important is the behavioral inequality involved: Because sellers face treble damages if they cannot deliver against a short contract, they are likely to be the more anxious party.

No protection is afforded by the converse trade of selling call options against a short intermonth spread for one reason in particular: The price of the call cannot go below zero. Furthermore, a market's contango can deepen in a rising market; this situation was seen in the crude oil market throughout much of 1992 and 1993, and is largely attributable to the actions of swap market intermediaries rolling positions prior to expiration.

The upshot of countertrend trading strategies for time spreads: purchasing spot against nearby at levels approaching arbitrage is a low-risk strategy provided inventory levels do not threaten collapse to the next level. Selling a backwardation spike while backwardation is increasing can be covered to some extent by the purchase of call options, but is a poor way of expressing your opinion with your money. If you are willing and able to take delivery of the physical commodity at an arbitrage level, either directly or by "legging into" the position, you gain an economic benefit equivalent to an at-the-money call option in the second nearby month.

Trend Trading Strategies

The tendency of intermonth spreads to regress toward their random median often produces tradable trends once the spread leaves the extremes or once a spread "breaks out" of a congestion zone. Consider the path of the June-September Eurodollar spread, shown immediately below, whose frequency distribution is shown in the previous graph.

June/September 1994 Eurodollar Spread
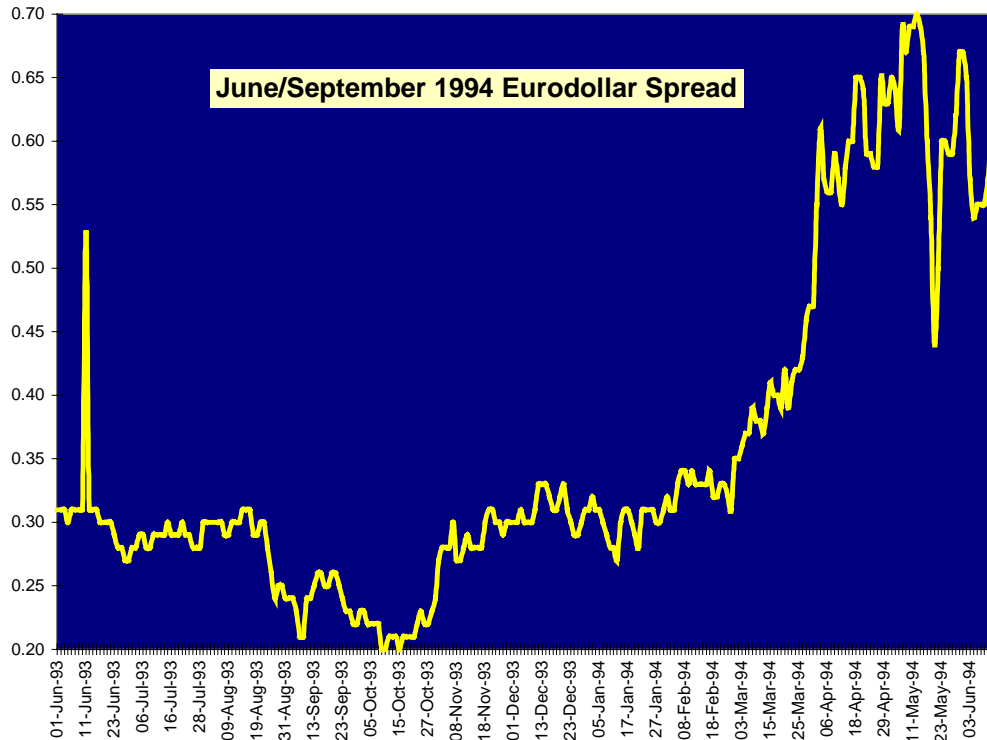
This spread moved in a fairly narrow range while U.S. monetary policy was on hold throughout the winter of 1993-1994. Once the Federal Reserve tightened on February 4, 1994, the spreads widened in anticipation of further interest rate hikes. Because the limits of how wide this spread can get are a function of market expectations of Federal Reserve action, this spread can continue to widen if the market fears further rate hikes.

Sometimes trends appear in both directions. Consider the chart of the May/June unleaded gasoline spread over the May 1993-April 1994 period, shown below. As the oil market weakened and both prompt and expected supplies of gasoline were perceived to be plentiful, the spread fell into a discount that approached, but did not reach, the arbitrage storage level. Later, as the market bottomed and the contracts became more active, the spread narrowed back to more normal random levels.

May/June Unleaded Gasoline Spread
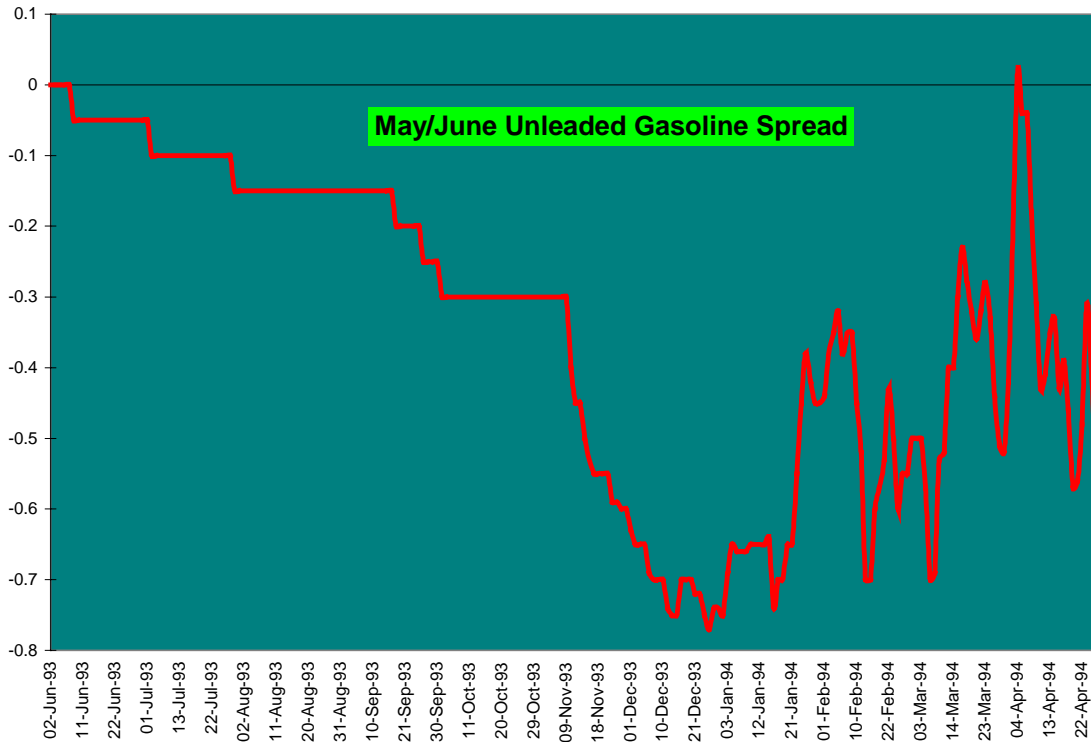
These spreads can be traded on a trend basis once they either move from an extreme or emerge from the random zone using the most rudimentary technical models; a simple moving average crossover system can work. Several notes of caution are in order: the biggest moves in backwardation occur inside the delivery notice period. Unless you are willing to hold a long position during this period, you are likely to miss the biggest moves. Unless you are certain a contango will deepen to the next storage level, there is little to be gained from remaining short the prompt month once the first arbitrage level is approached. Breakouts from the random zone have a significant probability of being false. Strict risk control parameters are suggested.

While there are both trend and countertrend ways of trading intermonth spreads profitably, the biggest rewards from these strategies will always devolve to the commercial player who is willing and able to make and take delivery of the underlying physical commodity. Patience is a virtue for time spread players; the long periods of randomness and the significant transaction costs relative to the move of the underlying spread work against making a lot of money in such a venture.

For those speculators who are willing to remain long during the delivery notice period and who are willing to take delivery of the underlying commodity, significant gains equal to a "free call" are possible.