You And Your Strike

The fourth Big Lie is "I'm not trading to make a lot of money quickly." Or some variation thereof: The leverage afforded in this business is such that it inevitably lures traders into low-probability, high-return situations. This is where the action is, and who ever really rooted for the tortoise to beat the hare anyway?

The question of which strike to employ in an option trading strategy is related directly to the level of risk a trader is willing to accept. We can illustrate this by examining a single option-based hedging application, a flour miller's capping of his wheat costs through the purchase of call options. On December 31, 1998, March wheat settled at $2.7625, and there were 51 days remaining to the expiration of March options. Key data for the March call options are presented below.

March 1999 CBOT Wheat Call Options
December 31, 1998

Strike	Premium	Delta	1/Delta	Cost	Gamma	Volatility	Z-Value	Probability Fut > Strk	Expected Return
$2.4	$0.3625	0.97	1.03	$0.3745	0.30	19.87%	-1.89	97.09%	$0.00
$2.5	$0.2675	0.92	1.09	$0.2904	0.71	18.88%	-1.41	92.14%	$0.00
$2.6	$0.1838	0.80	1.25	$0.2291	1.35	19.55%	-0.83	79.66%	-$0.01
$2.7	$0.1200	0.63	1.60	$0.1920	1.73	21.09%	-0.29	61.42%	-$0.05
$2.8	$0.0788	0.45	2.21	$0.1738	1.64	23.35%	0.15	43.86%	-$0.12
$2.9	$0.0500	0.32	3.17	$0.1587	1.38	24.89%	0.52	30.08%	-$0.21
$3.0	$0.0325	0.22	4.61	$0.1498	1.07	26.62%	0.83	20.36%	-$0.31
$3.1	$0.0213	0.15	6.76	$0.1436	0.79	28.18%	1.09	13.69%	-$0.42
$3.2	$0.0138	0.10	10.00	$0.1375	0.58	29.47%	1.33	9.10%	-$0.52

Columns are included for (1/Delta), which determines the number of call options we will need to cover our risk, and for the Total Cost, which is premium/delta. When we purchase a call option for the purposes of offsetting a purchase risk, we are most interested in the option's delta, its hedge ratio. The more delta we buy per option, the more each option will move to protect the underlying asset, and the fewer options will be needed. However, we will need to risk more capital due to the greater initial cost of in-the-money (ITM) options, and this starts to defeat the whole concept of using options instead of futures as a hedge instrument. If we purchase a larger number of out-of-the-money (OTM) options, each option will move far less in response to the underlying asset, and so despite their lower cost, they will be an ineffective hedge for all except the most extreme price movements.

We also need to consider the probability of the futures price settling at or above the call option's strike price by expiration. We can calculate the number of standard deviations away from the mean each strike price is by using the range formula:

$$Z = \ln(Strike / 2.7625) / (\sqrt{51/365} * Volatility)$$

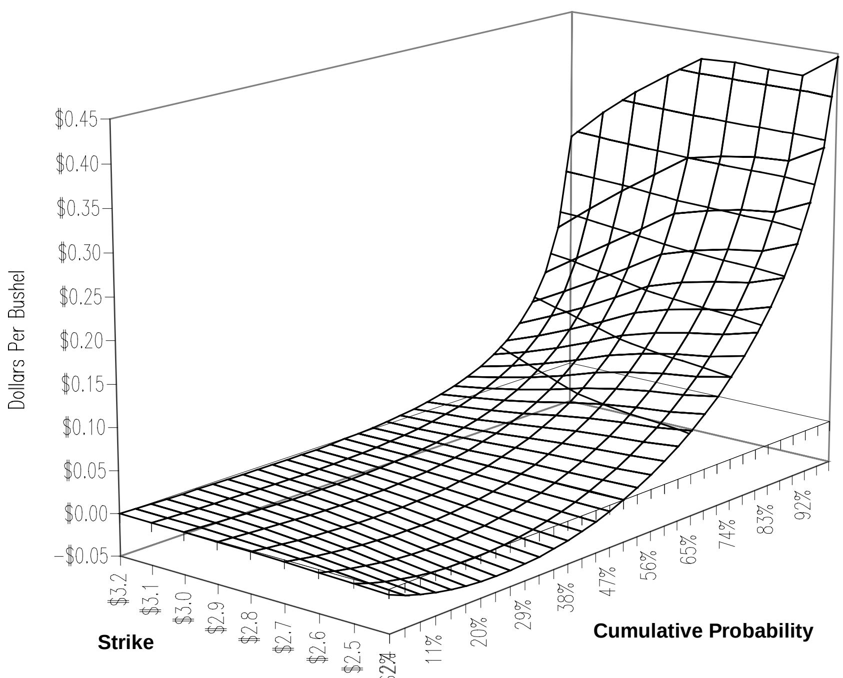
This number of standard deviations, Z, corresponds to a probability of the price of March wheat equaling or exceeding the strike price at expiration. These probabilities then can be used to determine an expected return, E, for our flour miller at that particular strike price, which is the worst-case scenario for any option-based hedge:

$$E = (1 - \Pr ob.) * (2.7625 - Strike - Cost)$$

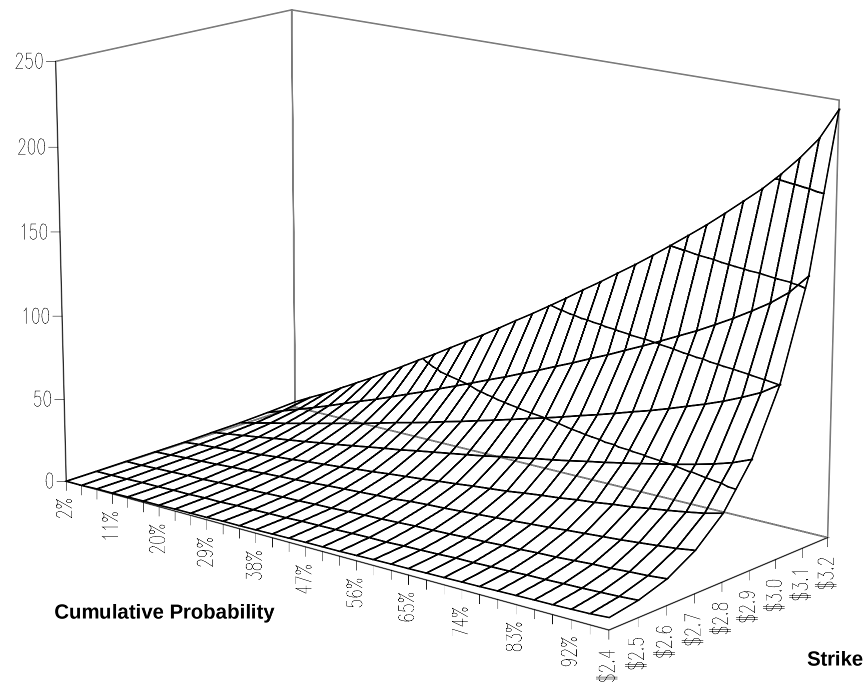
The OTM options, while cheap, are almost wholly ineffective at capping the costs of the raw material, while the ITM options, while expensive, provide an adequate hedge. The tradeoff is that in a low-probability, high-return price increase, the OTM options will be able to provide a larger return, a “home run” trade. This is one of the many paradoxes of option-based hedging: A truly risk-averse trader must be willing to risk additional capital to an ITM instrument, while a risk-seeking trader – the supposed antithesis of a hedger – is risking less capital on his OTM instruments. Only when the complete hedge, the probability-weighted cash-plus-options return, is examined does the risk-seeking nature of the OTM option hedge become apparent.

The nature of the strike tradeoff can be illustrated by viewing the absolute expected return per strike, which favors the ITM option, and the multiple of the initial option cost received, which favors the OTM option.

Absolute Expected Return Per Strike



Multiple Of Initial Investment Received



Striking A Balance

The resolution of this tradeoff is offered by the options themselves, and we can verbalize it: We want to buy the most delta possible so that we may have the most favorable worst-case for our hedge, and this favors the ITM options as illustrated above. We want this delta to expand as rapidly as possible in price movements favorable to the option so that we may sell it back to the market, and this suggests maximizing gamma, and that occurs near the at-the-money (ATM) strike. Finally, we want this option to retain as much of its value as possible in price movements unfavorable to the option so that we will retain as much time value as possible for as long as possible, and this minimization of time decay favors the ITM options at the expense of the ATM options. The desired attributes of options for a hedger are summarized below.

Hedger's Option Wish List

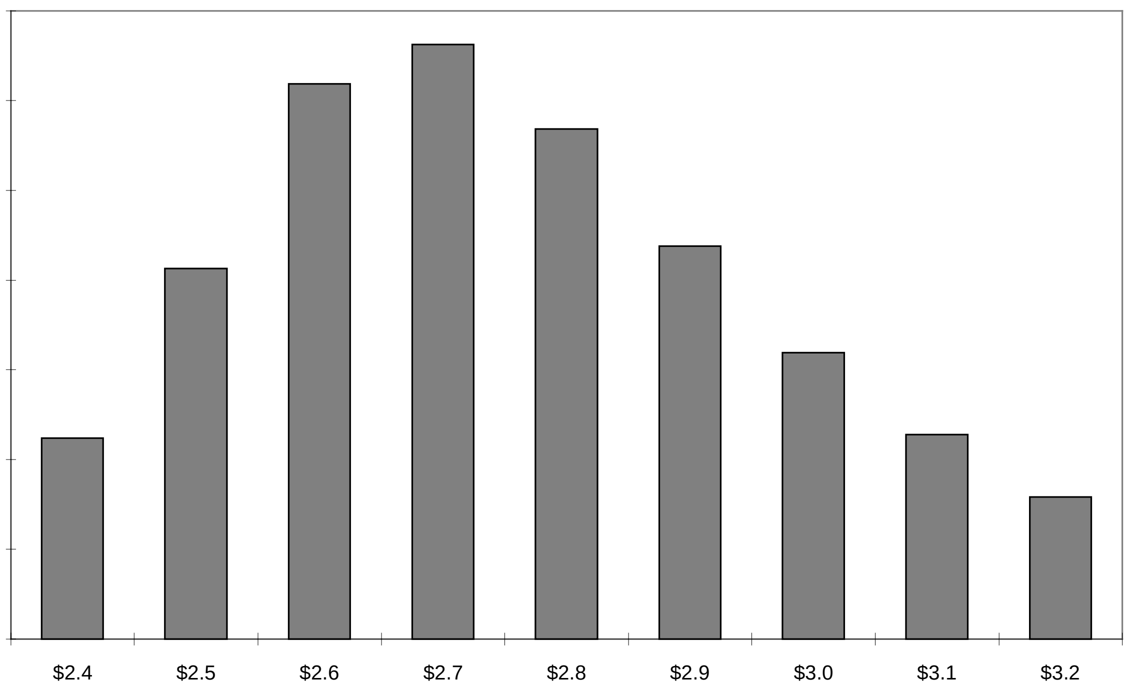
1. Be a buyer of insurance; maintain positive gamma
2. Make the calendar work for you; minimize time decay exposure
3. Make accidents work in your favor
4. Minimize capital commitments
5. Leverage potential gains
6. Sell forward months in carry markets
7. Buy forward months in backwardated markets
8. Minimize net borrowing and maximize net lending

Points 2, 6, and 7 apply to hedge instruments involving intermonth spreads, and will not be discussed further. Points 4 and 5 have been discussed above. Points 1 and 3 go straight to the nature of hedging itself, which is buying insurance against unknowable adverse events. In the case of our flour miller, this translates into converting his short cash market profit profile into that of a synthetic put option by buying a call option; the miller now knows his worst-case.

Point 8 relates to the nature of options themselves. An option price can be decomposed into intrinsic value, in this case the maximum of ($2.7625 - Strike, 0), and time premium. The buyer of the call option is borrowing this time premium; the loan will be repaid through time decay. Since all OTM options, by definition, have an intrinsic value of zero, they represent a loan to the buyer to buy an asset with only a probability, represented by volatility, of being worth something at expiration. The cost of this loan increases with volatility, with time to expiration, and with the underlying interest rate. Unlike a conventional loan, however, the cost cannot exceed the value of the underlying asset for a call option or the present value of the strike for a put option. The more an option is in the money, the greater the ratio of intrinsic value to time premium becomes.

All of these factors can be combined into a selection algorithm, which shall remain proprietary. The output, displayed below, selects the $2.70 strike as the optimal call option for our flour miller to purchase. Had there been additional time premium from any of the three factors listed above, the algorithm would have selected the $2.60 strike.

Call Option Selection



The end result of this selection is viewed by many hedgers as a speculative risk of the $0.192 total premium paid; this quite common response ignores the comparative risks of adverse movement in the cash market and of the expected returns on other strikes, especially the apparently cheaper OTM instruments.

What About Selling?

Can a hedger cover a forward purchase commitment with an instrument other than the long $2.70 call option selected above? Even though we may have satisfied all of our trading objectives by selecting this strike, buying any call option involves the simultaneous purchase of insurance and borrowing of money, and these are not joyous occasions for most traders.

Let’s say we wished to defray some of the initial expenditure by converting our long $2.70 call option into a bull call spread, one involving the purchase of an ATM call, and the sale of an OTM call. Which strike should we sell? Ideally, we would like to sell this call option right at a resistance level, or the highest price level we would expect to see for whatever reason. In the particular example of our wheat hedge, the strike selected by a parallel DOSS algorithm will be the $3.20.

We are trading off premium received from this strike, a mere $0.01375, against the likelihood that the buyer will wish to exercise this call option, only 9.1%.

However, we also impose two fundamental, and largely unwelcome, changes to the nature of our hedge. The net delta of this bull call spread is the difference between the deltas of the two strikes, .45 - .10, or .35. This necessitates that we buy (1/.35) of these spreads for a net expenditure of ($0.07875 - $.01375)/.35, or $0.1841, which is hardly a savings from the $0.192 cost of the $2.70 call position. Second, the bull call spread becomes self-liquidating at higher prices as the delta of the short $3.20 call rises. This is seen in the "Advantage" chart below.

Advantage of $2.70 Call To $2.80 / $3.20 Bull Call At Expiration