DIGGING DEEPER INTO THE VOLATILITY ASPECTS OF AGRICULTURAL OPTIONS

This article is a part of a series published by R.J. O'Brien & Associates Inc. on risk management topics for commercial grain and oilseed traders.

In previous articles in our risk management series we have stressed the importance of understanding the volatility aspects of option positions. This is crucial not only for speculators that are explicitly trading volatility, but also for hedgers that are implicitly taking volatility positions when using options. We have also previously illustrated the distinct seasonal patterns of volatility in most agricultural options and introduced the concept of skew. In this article we dig deeper into the issues of seasonality and skew and introduce some important considerations that are often overlooked.

Note: For more background on volatility trading please refer to our articles *Volatility Trading in Agricultural Options* and *Delta Neutral Trading in Agricultural Options.* R.J. O'Brien also publishes a daily summary of implied volatility that is available to its commercial grain and oilseeds clientele.

I. SEASONALITY

Not surprisingly, grains and oilseeds exhibit a high degree of seasonality in implied volatility. This typically goes hand-in-hand with the key production periods for each crop. For example, as shown in Figure 1, implied volatility in corn options rises sharply in the July/August period as the crop enters its critical pollination period and then drops off sharply in September. Remember that uncertainty is the key driver of higher implied volatility levels. Even during the 1988 drought, corn implied volatility dropped off sharply in September once the market was able to quantify the reduction in yields.

Figure 1.
Corn Seasonal Implied Volatility Based on Nearby ATM Calls (1992 to 1999 Average)

While charts like Figure 1 give us some important insight into the seasonality of implied volatility, they require careful interpretation since they're usually based on a nearby implied volatility series (as is Figure 1). The problem with this is that even though the chart shows a 15% average increase in implied volatility from April to July, you often can't capture this move since it's already factored into the market. For example, September corn volatility may already be trading at 10% higher than May, so most of the usual seasonal move is already built into the market. This is similar to the problem of analyzing spreads using a continuous nearby series (which is why we built SpreadMaster© to analyze spreads on a contract-specific basis).

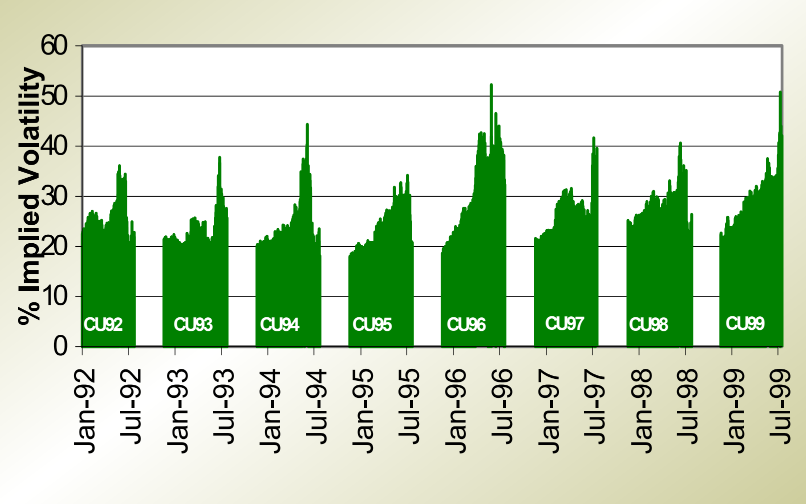
What we really want to know is, how does July or September (rather than nearby) volatility behave on a seasonal basis for corn? In order to isolate the seasonal moves in volatility for the grains, we have used CBOT option premium data and reconstructed an implied volatility data series on a contract-by-contract basis. This gives us a much better idea of what we can actually trade in terms of a volatility play.

Figures 2 and 3 show the historical implied volatility and seasonality of *September* at-the-money corn calls for the 1992 to 1999 contracts. The data for each year is based on the period from December 1st to the following July 31st.[1] Figure 2 shows that for the past 8 years (1992

[1] We exclude the period prior to December 1 due to the limited trading volumes this far from expiration. Similarly, we exclude the volatility data during the last few days of trading as pricing models do not always provide good estimates of implied volatility when they are very close to expiration.

Figure 2.

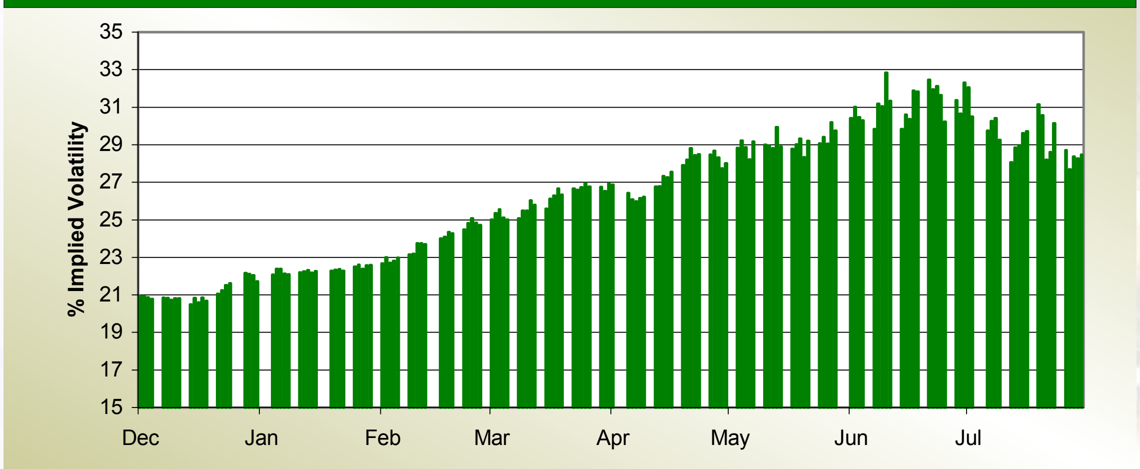
September ATM Corn Call Implied Volatility (1992 to 1999)



to 1999), implied volatility levels in September corn options have increased as we enter the key growing season, however not as sharply as one may be led to believe by looking at a *nearby* implied volatility series. Note that in both 1996 and 1999, September ATM corn volatility spiked to just over 50% for a brief period of time.

Figure 3.

September ATM Corn Call Seasonal Implied Volatility (1992 to 1999 Average)



In Figure 3, we start to get at the heart of what we need to know in order to properly trade volatility. Figure 3 shows the seasonal average move in *September* implied volatility for the December to July period prior to expiration. In this chart we see that the *average* move in implied volatility from January to the end of July is only about 10%.

The other important point we can glean from Figure 3 is that implied volatility typically increases rather gradually as we go from January to July. This is no coincidence. Anyone trying to go long volatility hoping to capture the seasonal increase is faced with one problem — time decay. For example, if we bought September corn calls in February and sold CU futures against it (delta neutral), we will incur time decay in our September calls that we hope to make up for (and more) with the seasonal increase implied volatility. Therefore, you have to take a hard look at what sort of seasonal increase in implied volatility you need to offset your time decay. Not surprisingly, implied volatility increases gradually as we approach the growing season, often by just enough to offset the time decay you would incur by going long volatility on a delta neutral basis. (Don't you just hate efficient markets!)

For example, let's assume you were long CZ 270 calls at the beginning of April at 26.6% implied volatility. If it took until the middle of July for volatility to peak, we would need a 9% increase in implied volatility just to offset the time decay in our calls (all else being equal). Table 1 provides a summary of the increase in volatility needed over various time frames to offset the time decay based on a starting point of 25% implied volatility. As shown, the increase in implied volatility needed to offset time decay can be very substantial, hence the choice of when to initiate a long volatility position is crucial.

Table 1.

Move in Implied Volatility Needed to Offset Time Decay

Starting Point IV = 25% Days to Expiration = 150 ATM CZ = 250					
Days to Expiration: From 150 days to →	125	100	75	50	25
ATM CZ 250 Calls (Necessary increase in IV)	3%	6%	10%	17%	35%

But before we move onto skew, there's one important factor that we've ignored in the above example. As we've discussed in previous articles, when we go long volatility on a delta-neutral basis, we have two potential sources of gains – the increase in implied volatility itself, as well as the potential gains from rebalancing our position. Recall that if we are long options delta-neutral (long calls/short futures or long puts/long futures), we are in effect "long gamma", meaning that we make money in the rebalancing process every time the market whipsaws. If we can position ourselves this way in a very choppy market, we can make substantial gains over and above the actual change in implied volatility. While its difficult to model what kind of gains can be expected from rebalancing, we tend to look for positions for which the seasonal increase in volatility covers off our time decay, and then any rebalancing gains are pure profits (for a refresher on the concept of rebalancing see our article entitled *Delta Neutral Trading in Agricultural Options*).

II. SKEW

We normally think of commodity options as having a positive skew or "smile". That is, both the ITM and OTM options trade at a higher implied volatility level than the ATM options. However, while this is almost always the case for OTM options, the ITM options often trade at lower implied volatilities than the ATM and OTM options. This is particularly the case when we're at the lower end of the historical price range and the amount of downside risk perceived by the market is limited. Figure 4 shows that in the case of September corn, the OTM options normally trade at the highest volatility and the ITM trade at the lowest, with the at-the-monies somewhere in between.

However, what is of most interest to traders is the skew that exists between the ATM options and the various OTM strikes. Figure 5 shows the historical implied volatility levels for September corn calls for the ATM, 1st OTM, 3rd OTM and 5th OTM options. Figure 5 reveals that typically, the further we go out-of-the-money, the higher the implied volatility level.

Figure 4.

Sept Corn Call Implied Volatility Skew (1992 to 1999)

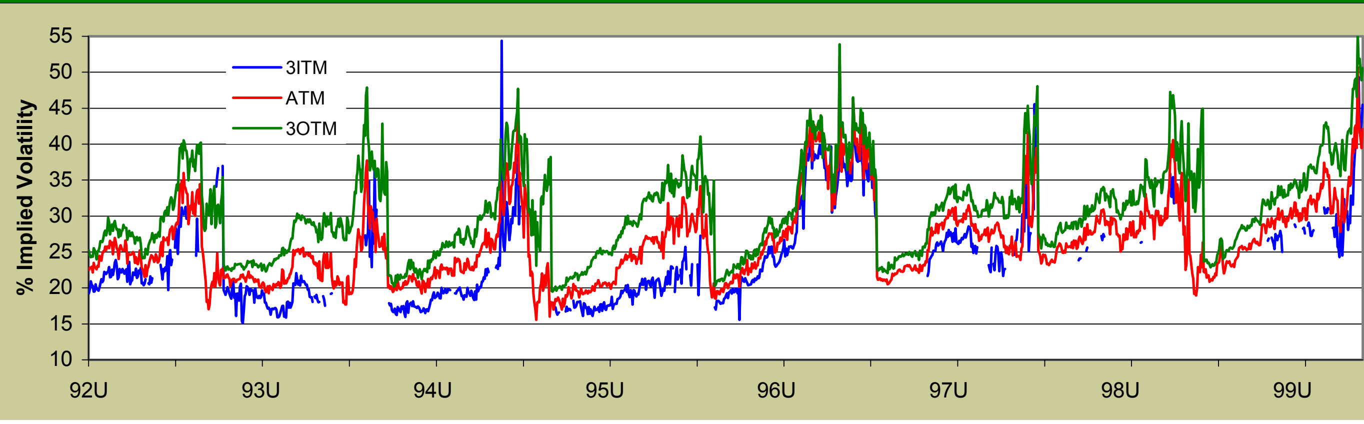


Figure 5.

Sept Corn Call Volatility Skew for OTM Options (1992 to 1999)

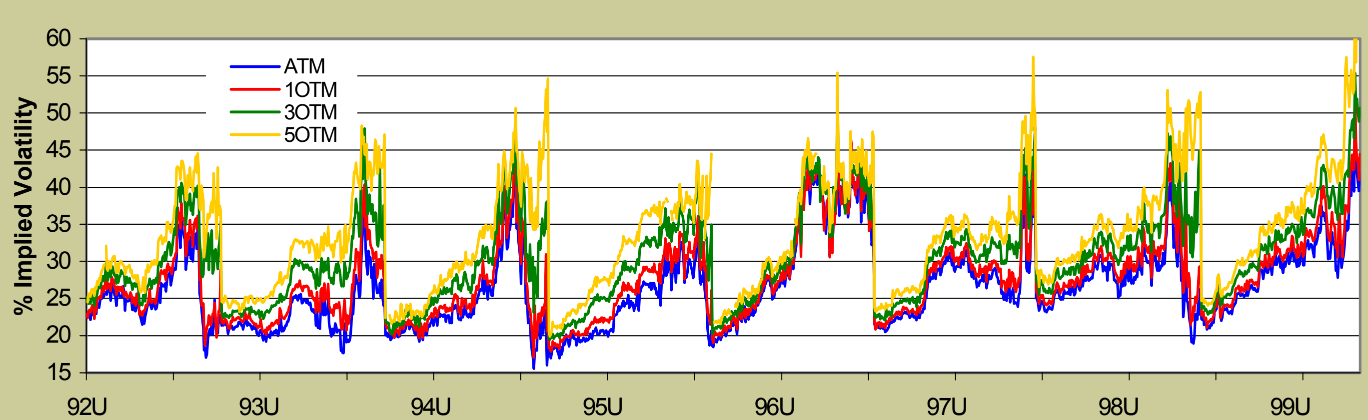
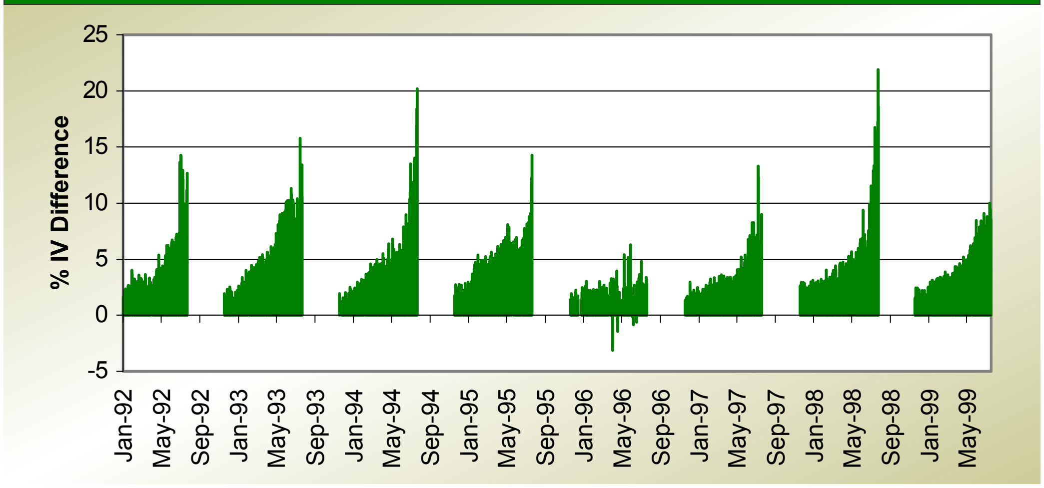


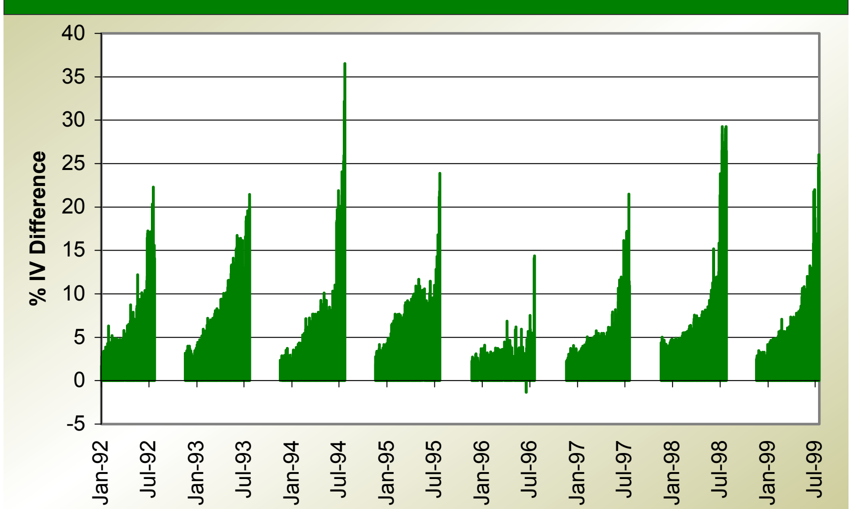
Figure 6.
Sept Corn Call Skew: 3rd OTM Minus ATM Implied Volatility (1992 to 1999)



To further isolate the skew behavior, Figure 6 shows the skew between the ATM and 3rd OTM option for September corn calls for the period 1992 to 1999. Remember that this shows the difference between the implied volatility levels of these strikes, not the absolute level of implied volatility. Figure 6 reveals two very interesting points. First, the positive skew between the ATM and 3rd OTM Sept corn option ranges between about 2 and 8%, with the odd spike above 15%. Secondly, we see that there appears to be a very distinct seasonal pattern to this skew (note how it looks very much like Figure 2).

Figure 7 illustrates the skew between the 5th OTM and the ATM September corn calls. Note that the chart looks very similar to Figure 6 except that the average skew is quite a bit larger than for the 3rd OTM options. The 5th OTM skew in this case ranges from about 4 to 12%, and exhibits the same seasonal pattern as Figure 6.

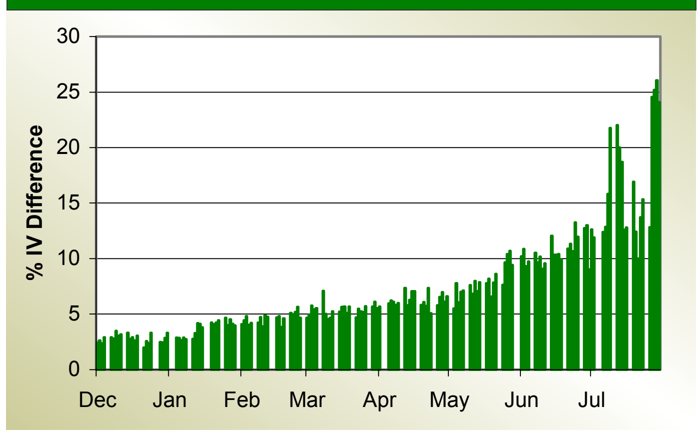
Figure 7.
Sept Corn Call Skew: 5th OTM Minus ATM Implied Volatility (1992 to 1999)



Figures 8 and 9 show the average seasonal move in the skew for the 3rd and 5th OTM options, respectively. Note how the OTM skew tends to increase gradually as we near expiration of the options.

So, what is going on in these options to cause this sort of relationship between the various strikes? First of all, skew is a somewhat confusing concept to begin with. Why do we have different implied volatility levels for different strikes

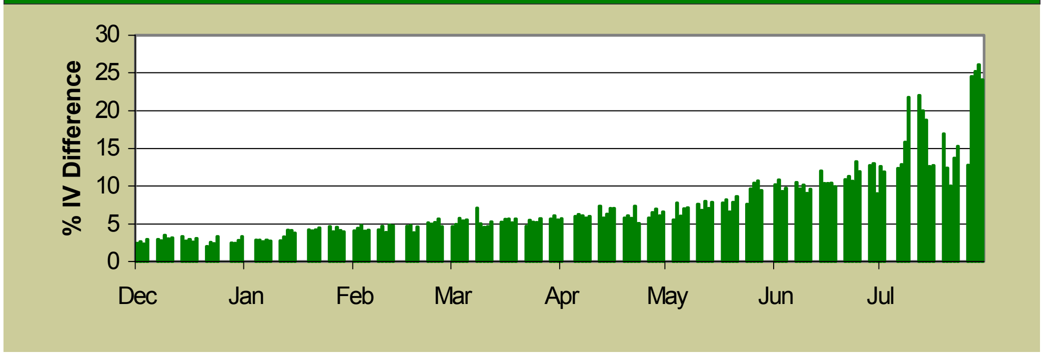
Figure 8.
Sept Corn Call Seasonal Skew
3rd OTM Minus ATM (1992 to 1999 Average)



when they are based on the same underlying contract? If we believe fair market value (in terms of volatility) for the September ATM wheat calls is 25% implied volatility, then why don't we use the same implied volatility for all the September wheat options? The answer is two-fold. First, the log-normal probability distribution used by most option pricing models under-estimates the extremes to which commodity prices will trade. In other words, the market seems to consistently over-price OTM options relative to the ATMs and in so doing is saying that it believes there is greater risk of extreme price moves than reflected in the option-pricing model. Technically speaking, the "real" probability distribution for our markets has thicker tails than the log-normal distribution.

Figure 9.

Sept Corn Call Seasonal Skew: 5th OTM Minus ATM (1992 to 1999 Average)



very little to do with the fact that this coincides with the critical time period for the U.S. corn crop. It actually has more to do with the fact that these options are nearing expiration and the model deficiency gets worse. This can be confirmed by looking at Figure 10, which shows the seasonal skew for December corn calls. Note how the December corn calls exhibit the same pattern as the September calls, with the skew increasing sharply as they near expiration. However during the critical corn production period (July/Aug) when corn futures are usually quite volatile, the skew remains relatively constant.

Why does skew tend to increase as we near expiration? Part of the explanation is that the raw implied volatility measures do not take into account the relative distance between strikes. The distance between 220 and 250 corn with a year to expiration is not the same as when there is only 20 days to expiration. While the underlying futures could very likely range between 220 and 250 within a one year period, it is less likely to do so in 20 days. The pricing models to not capture this fact very well. As a result, you will sometimes see option professionals creating a standardized implied volatility skew by factoring out these imperfections in the models (please see Allen Baird's "Option Market Making" for more on this). However, even after we attempt to factor out model imperfections we find that skew does fluctuate, and hence we need to be aware of the risks and opportunities that this presents.

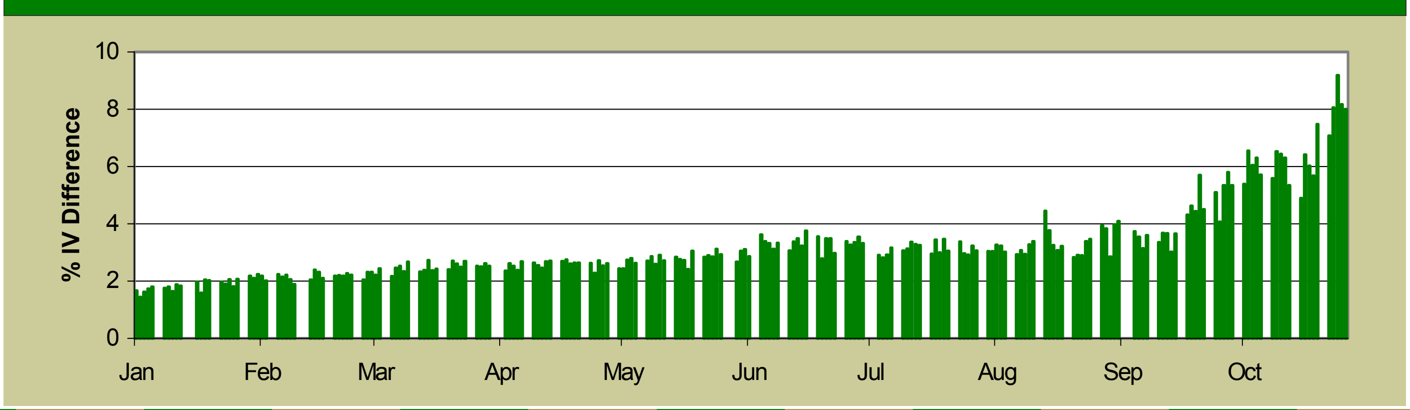
Secondly, from a more practical standpoint, a positive skew for OTM options is consistent with how the market often tends to trade. Option buyers may prefer to be long OTM options due to their low cost and low absolute risk. On the other hand, traders may prefer to be short options that are closer to the money to capture greater time decay. This imbalance in buying and selling pressure at the various strikes can also contribute to the positive skew. How often have you bought deep OTM options for a ¼ or ½ cent knowing that you've paid a huge volatility but were still happy with the absolute price you paid for the options?

In our view, it's the model deficiencies that cause the "normal" positive skew we see in our grain and oilseed OTM options and it's the market dynamics (the actual supply and demand for these options on any given day) that push the skew around (sometimes called the "skew wobble").

But we still haven't explained why the skew tends to increase as we near expiration in our September corn options. You may be surprised to discover that it has

Figure 10.

December Corn Call Seasonal Skew 3rd OTM Minus ATM (1992-1999 Average)



III. THE PRACTICAL SIGNIFICANCE OF SKEW

How do we make practical use of this information? First of all, we must get a handle on what constitutes a "normal" skew for the option we are considering trading. As we've learned in the preceding section, what "normal" is will depend on the option month, the relationship between the strike price and the underlying futures (i.e., how deep OTM or ITM is it?) and the time to expiration. For example, for a September corn call that is 3 strikes OTM, a normal skew (relative to the ATM's) during March is about 3%.

Once we know what constitutes "normal" skew for our options, we can begin to assess the potential skew risk in our trade. First of all, anytime we are trading an option spread, we are incurring skew risk, since we are long one option and short the other (except for a straddle). For example, if we are long the CZ 250 calls and short CZ 300 calls, we are exposing ourselves to the risk that the skew will widen (thereby increasing the value of the 300's relative to the 250's). For this reason, we might not favor this strategy when the skew is flat, or at least below what we feel is a normal level. On the other hand, a flat (or below normal) skew might favor a ratio call spread such as short 1 270 corn call and long 2 290 calls, since a widening of the skew would enhance our position.

Generally speaking, we can treat skew the same as implied volatility itself when constructing trading strategies, in that we always prefer to sell options at higher implied volatility levels and buy options at lower implied volatility levels. If the CZ 300 calls are trading at 35% volatility versus 25% in the 250's, we might favor strategies such as a vertical call spread for upside price protection. However, from a timing standpoint, we also have to consider our view regarding the direction of the skew *after we put the trade on*. Just because the skew is wide, it doesn't mean that it can't get wider.

Finally, it is interesting to note that as the underlying futures price moves, the whole skew distribution moves with it. For example, we might have bought CZ 240 calls when they were 3 strikes OTM, but after a price increase they move to an ATM position. With no change in the ATM implied volatility and a constant 10% skew, part of our gain in terms of flat price is eaten up by the loss in implied volatility due solely to the shift in the distribution of the skew. For example, you might have paid 35% volatility for a call that was 4 strikes OTM, which represented a 10% skew over the ATM option. Assuming the underlying futures gradually moved up 4 strikes, but implied volatility (both the ATM and the skew) stayed the same, your calls would have lost 10% implied volatility, simply because they have moved to the ATM position.

IV. SUMMARY

A proper understanding of implied volatility requires one to delve deeper into the issue than just looking at a nearby ATM series. This article has pointed out some of the considerations we need to be aware of in order to accurately interpret implied volatility, including the seasonality and the implications of skew and skew risk.

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All calculations that appear in this article were made with R.J. O'Brien's proprietary PositionBook© software.

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REFERENCES AND SUGGESTED READING

1. Baird, Allen Jan. (1993). *Option Market Making.* New York: John Wiley & Sons.