Delta

In my previous article, I discussed risk measures such as Delta, Gamma, Theta, and Vega, which I've summarized in Figure 1 below. In this article, I take a closer look at Delta as it relates to actual and combined positions--known as position Delta--a very important concept for option sellers. Below I begin with a quick review of the risk measure Delta, and then proceed to explaining position Delta, including an example of what it means to be position Delta neutral.

Simple Delta

Let's review some basic concepts before jumping right into position Delta. Delta is one of four major risk measures used by option traders, all of which are outlined in Figure 1 below. Delta gauges the degree to which an option is exposed to shifts in the price of the underlying asset (i.e. stock) or commodity (i.e. futures contract). Values range from +1.0 to −1.0 (or +100 to −100, depending on convention employed). For example, if you buy a call or a put option that is just out of the money (i.e. the strike price of the option is above the price of the underlying if the option is a call and below the price of the underlying if the option is a put), then the option will always have a Delta value that is somewhere between 1.0 and −1.0. Generally speaking an at-the-money option usually has a Delta at approximately .5 or -.5.

Vega	Theta	Delta	Gamma
Measures Impact of a Change in Volatility	Measures Impact of a Change in Time Remaining	Measures Impact of a Change in the Price of Underlying	Measures the Rate of Change of Delta

Figure 1 – Delta and the Other "Greeks"

Figure 2 contains some hypothetical values for S&P 500 call options that are at, out, and, in the money (in all these cases I am using long options). Call Delta values range from 0 to 1.0, while put Delta values range from 0 to −1.0. As you can see, the at-the-money call option (strike price at 900) in Figure 2 has a .5 Delta, while the out-of-the-money (strike price at 950) call option has a .25 Delta and the in-the-money (strike at 850) has a Delta value of .75.

Keep in mind that these call Delta values are all positive because we are dealing with long call options, a point to which we will return later. If these were puts, the same values would have a negative sign attached to them. This reflects the fact that put options increase in value when the underlying asset price falls. (An inverse relationship is indicated by the negative Delta sign.) You will see below, when we look at short option positions and the concept of position Delta, that the story gets a bit more complicated.

Strikes	Delta
950	.75
900	.5
850	.25
Note: We are assuming that the underlying S&P 500 is trading at 900	

Figure 2 – Hypothetical S&P 500 Long Call Options

At this point you might be wondering what these Delta values are telling you. Let me offer an example to help illustrate the concept of simple Delta and the meaning of these values. For example, if an S&P 500 call option has a Delta of .5 (for a near or at-the-money option), a one-point move (which is worth $250) of the underlying futures contract would produce a .5 (or 50%) change (worth $125) in the price of the call option. A Delta value of .5, therefore, tells you that for every $250 change in value of the underlying futures, the option changes in value by about $125. If you were long this call option and the S&P 500 futures move up by one point, your call option would gain approximately $125 in value, assuming no other variables change in the short run. We say "approximately" because as the underlying moves, Delta will change as well. To understand this relationship, see discussion of Gamma in my previous article.

Be aware that as the option gets further in the money, Delta approaches 1.00 on a call and –1.00 on a put. At these extremes there is a near or actual one-for-one relationship between changes in the price of the underlying and subsequent changes in the option price. In effect, at Delta values of –1.00 and 1.00, the option mirrors the underlying in terms of price changes.

Additionally, bear in mind that this simple example assumes no change in other variables like the following: (1) Delta tends to increase as you get closer to expiration for near or at-the-money options. (2) Delta is not a constant, a concept related to Gamma, another risk measurement, which is a measure of the rate of change of Delta given a move by the underlying. (3) Delta is subject to change given changes in implied volatility.

Long vs. Short Options and Delta

As a segue into looking at position Delta, let me say a few words about how short and long positions change the picture somewhat. First, the negative and positive signs for values of Delta mentioned above do not tell the full story. As indicated in Figure 3 below, if you are long a call or a put (that is, you purchased them to open these positions), then the put will be Delta negative and the call Delta positive; however, our actual position will determine the Delta of the option as it appears in our portfolio. Note how the signs are reversed for short put and short call.

Long Call	**Short Call**	**Long Put**	**Short Put**
Delta Positive	Delta Negative	Delta Negative	Delta Positive

Figure 3 –Delta Signs for Long and Short Options

The Delta sign in your portfolio for this position will be positive, not negative. This is because the value of the position will increase if the underlying increases. Likewise, if you are short a call position, you will see that the sign is reversed. The short call now acquires a negative Delta, which means that if the underlying rises, the short call position will lose value. This is getting us closer to an actual discussion of position Delta, so let's turn to this concept now.

Position Delta

Position Delta can be understood by reference to the idea of a hedge ratio. Delta is in effect a hedge ratio because it tells us how many options contracts are needed to hedge a long or short position in the underlying. It is a very easy concept to grasp. For example, if an at-the-money call option has a Delta value of approximately .5--which means that there is a 50% chance the option will end in the money and a 50% chance it will end out of the money--then this Delta tells us that it would take two at-the-money call options to hedge one short contract of the underlying. In other words, you need two long call options to hedge one short futures contract. (2 long call options x Delta of .5 = position Delta of 1.0, which equals 1 short futures position). This means that a one-point rise in the S&P 500 futures (a loss of $250), which you are short, will be offset by a one-point (2 x $125 = +$250) gain in the value of the two long call options. In this example we would say that we are position Delta neutral.

By changing the ratio of calls to number of positions in the underlying, we can turn this position Delta either positive or negative. For example, if are bullish we might add another long call, so we are now Delta positive because our overall strategy is set to gain if the futures rise. We would have three long calls with Delta of .5 each, which means we have a net long position Delta by +.5. On the other hand, if we are bearish, we could reduce our long calls to just one, which we would now make us net short position Delta. This means that we are net short the futures by -.5.

Conclusion

This article explains the concept of simple Delta and then proceeds to explain how position Delta is a measure of how net long or net short the underlying you are when taking into account your entire portfolio of options (and futures). In my next article, I will explore some strategies whereby Delta neutrality is employed as a central concept.

There is risk of loss in trading options and futures. Trade with risk capital only.