Get on the fast track with gamma

Gamma digs deeper into explaining how underlying price moves affect an option's price.

BY BRIAN OVERBY

The option "Greeks" may seem like obscure calculations, but they help explain how and why option prices move. Delta and gamma are especially important because they determine how underlying price moves affect an option's price. The other Greeks such as theta, rho, and vega show how time decay, interest rates, and implied volatility influence an option's price.

Last month, we discussed delta, or the amount an option's price will change when the underlying instrument moves one (1.00) point (see "Related reading"). Here, we describe gamma, which measures delta's rate of change.

Gamma as an option's acceleration

Delta is dynamic — it moves not only as the underlying instrument does, but also as expiration approaches. Gamma determines the degree of that move, defined as the amount an option's delta will change for a corresponding one-point (1.00) change in the underlying's price. But here's a more intuitive definition: Think of delta as the "speed" of an option position and gamma as the "acceleration."

If your option has a large gamma, its delta will approach 1.00 quickly, which means it won't take long to move in line (1 to 1) with the stock. Of course, large gammas have drawbacks: If you buy a high-gamma option, it will lose value quickly and as expiration nears, the delta will approach zero rapidly.

Generally, gamma is highest for near-term, at-the-money (ATM) strike prices and declines as the strike prices move more in the money (ITM) and out of the money (OTM). This explains why the near-term, ATM-strike options usually have the largest volumes each day. Option buyers like high gammas.

Figure 1 shows a near-term 85 strike call (15 days to expiration) in red and a longer-term call with the same strike (45 days to expiration) in blue. The underlying stock trades at 85, so both options are ATM. Notice the near-term call's gamma (0.10) is twice as large as the longer-term call's gamma (0.05).

Also, as the underlying stock moves up or down, gamma drops in value because delta is either approaching 1.00 or zero. Because gamma is based on delta's moves, it decreases as delta approaches its theoretical limits of 1.00 or zero. You wouldn't accelerate if you were heading for a brick wall, right?

The delta-gamma relationship

Let's assume an ATM call has a strike price of 50, the stock trades at 50, and there's one day until expiration. In this case, delta is exactly 0.50. Why? If the stock rises, the call will move in-the-money, and if it drops, the call will move out-of-the-money. The option has a 50-50 chance of finishing ITM at expiration, so its delta is 0.50. (Market makers often view delta as the probability of an option moving ITM at expiration — a non-standard definition.)

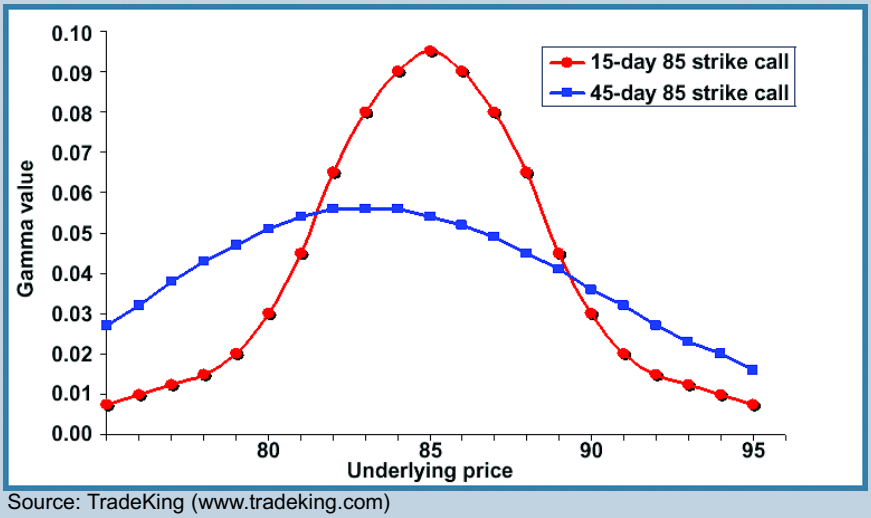
If the stock trades at 51, then the 50 call is already ITM. What's the delta now? Think about that alternate definition. If the call is one point (1.00) ITM, and it expires tomorrow, that option will likely stay in-the-money, which translates into a much larger delta, close to 0.95.

What's gamma then? Remember the definition. If the stock moves one point, gamma measures delta's acceleration — from 0.50 to 0.95. When the stock still trades at 50, gamma will be 0.45.

If we lengthen the time to expiration,

FIGURE 1 — ATM OPTIONS' GAMMAS

Gamma is highest when an option is at-the-money and approaching expiration. The gammas of ITM or OTM options are low because delta is near its theoretical limit of 1.00 or zero.



Source: TradeKing (www.tradeking.com)

it vastly changes the way the option will behave. Let's assume the 50 call has 60 days until expiration, and the stock trades at 51. What's the probability of the option being ITM at expiration? It's much lower, because the stock has more time to move. Here, the 50 call's delta will be around 0.60. Therefore, its gamma was 0.10 when the stock traded at 50.

Position gamma

The next step is to calculate gamma for an entire position, which measures the rate at which an option position will gain or lose deltas. Because one delta (0.01) acts as a surrogate for one share of stock, a position's gamma represents the number of shares gained or lost if the underlying moves up or down by one point.

A position's gamma is calculated similar to its delta. Figure 2 shows October and December 170 calls on the Mini Nasdaq 100 index (MNX). The MNX traded at 170.07 on Oct. 18, and you could buy 15 October 170 calls that have three days until expiration for 1.00. Or, you could buy 15 December same-strike calls that have 59 days until expiration for 5.50.

Each October 170 call has a gamma of 0.1714 and each December 170 call has a gamma of 0.0340. To calculate the October position's total gamma, multiply the individual gamma (0.1714) by the number of contracts (15) and the $100 options multiplier (0.1714 gamma*15 contracts*$100 = 257.10). Use the same formula to calculate the December position's gamma (0.0340 gamma*15 contracts*$100 = 51). Because the October calls are ATM and expire shortly, their gamma is much higher than the longer-term December calls.

Now compare the October position's total delta (959.70) with the December calls' delta (888.78). In terms of risk, these comparable deltas only tell part of the story. The October position will resemble 959.71 shares of the MNX index, but with every one-point index move, these calls will gain or lose 257 "shares," according to gamma. And the December position will only gain or lose 51 shares, one-fifth as large as the October position's delta change. This emphasizes how gamma changes as expiration approaches and how delta acts accordingly.

Related reading by Brian Overby

"Delta for the rest of us," *Options Trader,* October 2006.
A detailed look at the best-known "Greek" explains how underlying price moves affect an option's value.

"Getting a grip on implied volatility," *Options Trader,* February 2006.
Implied volatility is a crucial, but often misunderstood, concept. We explain what it means and how you can use it to improve a trade's chance of success.

"Controlling risk with spreads," *Options Trader,* July 2005.
Tired of fighting time decay and volatility fluctuations? This bull call option spread has much lower risk than an outright purchase.

Other articles:

"The option Greeks," *Options Trader,* May 2005.
Knowing what these calculations represent and how they affect an option's price will give you a better handle on how options behave — as well as a deeper understanding of risk.

"Options 101," *Options Trader,* April 2005.
Options can seem complex, but learning a few basic concepts will remove much of the mystery and intimidation. Here's what you need to know to get started in the world of puts and calls.

You can purchase and download past articles at www.activetradermag.com/purchase_articles.htm.

Hedging and re-hedging

Gamma is usually largest in near-term ATM options. If the stock trades flat as expiration approaches, gamma will increase sharply, meaning those options gain and lose delta much quicker. In the last week before expiration, market makers will evaluate and re-hedge their positions more often because of this phenomenon.

You can't ignore the gamma risk of Figure 2's October calls. If the index moves against you, this position could become a nightmare in a hurry. This is especially true if you're short the options and exposed to unlimited risk.

Options trading involves trade-offs. Option buyers like the acceleration features of high-gamma options, but they are always battling time decay (theta). Near-term ATM options have large gammas but also lose their time value quickly. Balancing these two variables requires an in-depth understanding of both Greeks. We'll explore concepts behind theta in an upcoming issue.

For information on the author see p. 4.

FIGURE 2 — GAMMA RISES AS EXPIRATION NEARS

In terms of risk, the comparable deltas of the October and December calls tell only part of the story. According to gamma, the October position will gain or lose 257 "shares" with every one-point index move, but the same-strike December calls only gain or lose 51 shares.

BUY/SELL	QTY	UNDL	EXP/STRIKE	TYPE	PRICE	IV	DELTA	GAMMA	THETA	VEGA
BUY	15	MNX	Oct06 170	C	1.00	14.65	959.75	257.10	-267.05	92.05
BUY	15	MNX	Dec06 170	C	5.50	16.89	888.78	51.00	-78.09	403.59

Source: TradeKing (www.tradeking.com)