Derivatives

The Greek Letters

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Option Greeks

Delta

Measures the exposure of option price to movement of underlying stock price

The ratio comparing the change in the price of the underlying asset to the corresponding change in the price of a derivative.

Sometimes referred to as the "hedge ratio"

For example, with respect to call options, a delta of 0.7 means that for every $1 the underlying stock increases, the call option will increase by $0.70.

Put option deltas, on the other hand, will be negative, because as the underlying security increases, the value of the option will decrease.

So a put option with a delta of -0.7 will decrease by $0.70 for every $1 the underlying increases in price.

As an in-the-money call option nears expiration, it will approach a delta of 1.00, and as an in-the-money put option nears expiration, it will approach a delta of -1.00.

For European call options on an asset paying a yield q

$$\Delta(Call) = e^{-qT}N(d_1)$$

$$\Delta(Put) = e^{-qT}[N(d_1) - 1]$$

Gamma

Measures the exposure of the option delta to the movement of the underlying stock price

The rate of change for delta with respect to the underlying asset's price. Gamma is an important measure of the convexity of a derivative's value, in relation to the underlying.

Mathematically, gamma is the first derivative of delta and is used when trying to gauge the price movement of an option, relative to the amount it is in or out of the money.

When the option being measured is deep in or out of the money, gamma is small. When the option is near or at the money, gamma is at its largest. Gamma calculations are most accurate for small changes in the price of the underlying asset.

Theta

Measures the exposure of the option price to the passage of time.

A measure of the rate of decline in the value of an option due to the passage of time.

Theta can also be referred to as the time decay on the value of an option. If everything is held constant, then the option will lose value as time moves closer to the maturity of the option.

For example, if the strike price of an option is $1,150 and theta is 53.80, then in theory the value of the option will drop $53.80 per day.

The measure of theta quantifies the risk that time imposes on options as options are only exercisable for a certain period of time. Time has importance for option traders on a conceptual level more than a practical one, so theta is not often used by traders in formulating the value of an option.

Vega

Measures the exposure of the option price to changes in volatility of the underlying

The measurement of an option's sensitivity to changes in the volatility of the underlying asset.

Vega represents the amount that an option contract's price changes in reaction to a 1% change in the volatility of the underlying asset.