

OPTION MARKET RISK MANAGEMENT

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NAKED POSITION STRATEGY

Do nothing. The call is exercised and shares are bought at the future market price. Costs are given as follows:

- 1) When stock price is higher than the strike price, the costs are equivalent to the numbers of shares bought multiplied by the amount by which the stock price exceeds the strike price.
- 2) When stock price is below the strike price, there are no costs incurred. The profit is equivalent to the premium received for selling the option.

COVERED POSITION STRATEGY

The shares are bought soon after the option is sold. A loss can only be incurred when the stock price drops below the original stock price. The loss is equivalent to the price drop (original stock price minus the new stock price) multiplied by the number of shares bought.

The naked position and the covered position do not provide perfect hedging. Costs in a perfect hedge should be equivalent to the costs calculated using the Black-Scholes formula. The Black-Scholes formula gives a fair value for options and information on how to manage risk of a position.

STOP-LOSS STRATEGY

Hedging involves buying the stock above the strike price and selling the stock below the strike price. The hedger should be in the covered position whenever the stock price is above the strike price and hold the naked position when the stock price is below the strike price. The objective is to own the stock at the time it closes in the money and not to own the stock if the option closes out of the money.

DELTA HEDGING STRATEGY

Delta of a call or put option measures the option's sensitivity to changes in the price of the underlying asset. Delta is also referred to as the Neutral Hedge Ratio which is defined as the fraction of a point by which an option contract is expected to change in relation to a 1-point



change in the price of the underlying asset. A Delta close to zero indicates that a change in the underlying asset price will result in only a small change in the option price. Delta Neutral is a position with Delta of zero created by adjusting various positions in the options and in the underlying security. Delta hedging protects the portfolios from small movements in the price of the underlying asset in the next small interval of time. Delta hedged (Delta neutral) position has a very short life because Delta is affected by both changes in stock price and length of time. Hedging is maintained by continuously rebalancing, thus adjusting the stock position so that the number of shares purchased are always equal to the value of Delta.

DELTA OF FORWARD CONTRACTS

The hedging of a short forward (non-dividend-paying stock) contract on a share is done by purchasing one share. The hedging of a long forward contract is achieved by shorting one share.

DELTAS OF EUROPEAN OPTIONS (NON-DIVIDEND PAYING STOCK)

A long European call option is hedged by maintaining a short position of an equal number of shares at a given time. A long position in a European put option is hedged by a long position in the underlying stock. A short position in a put option is hedged with a short position in the underlying stock.

THETA

The Theta of a put or call option measures the sensitivity of the option price to the expiration of time. As the number of days to expiration decreases, the option value declines, that is why options are referred to as decaying assets. For an out-of-the money option, the value will decline to zero at expiration. For at-the-money or in-the-money option, the value will decline to the intrinsic value. The instantaneous rate at which the value of the option changes as time proceeds is the Theta of the option. There is no uncertainty about the passage of time and hence it is not advisable to hedge using Theta.

GAMMA

The Gamma of an option is the rate of change of Delta. The Gamma measures the sensitivity of Delta to changes in the underlying asset price and also how fast Delta changes. In mathematical terms, it is the second derivative of the change in option price with respect to the change in the underlying asset price. Using the Modified European model, put and call Gamma are equal. Using the Modified Black-Scholes American model or the Quadratic Approximation method, there will be differences in the call and put Gamma. When Delta hedging is used the positions of the underlying asset cannot be changed hence a portfolio Gamma neutral can be used as a correction. The correction is for the time that passes between hedge rebalancing.

VEGA

The Vega of an option measures the sensitivity of the option value to changes in volatility. As volatility increases, the option premium increases. At least two traded derivatives rely on the



underlying asset in order to have a portfolio with both Gamma and Vega neutral. Vega neutrality is responsible for correcting a variable. Both Vega and Gamma hedging depend on the time between hedge rebalancing and the volatility of the volatility.

RHO

Rho calculates the interest rate sensitivity of an option. The higher the interest rate, the larger the amount of lost interest caused by not investing the amount of the exercise price at the interest rate until expiration. Rho of a call is positive and that of a put is negative. The discrete approximation of Rho is calculated by incrementing the interest rate by one percent and finding the difference between the two option values.

SCENARIO ANALYSIS

The most ideal situation would be to maintain Delta neutrality, Gamma neutrality, Rho neutrality etc., but it is very expensive to continuously rebalance the portfolios. Instead of eliminating risk the option traders concentrate on assessing risks. Delta, Gamma and Vega are used to quantify the different aspects of risk. Scenario analysis is used to calculate the gain or loss of the portfolios over a specified period in different scenarios.

