TEACHING NOTE 97-10:

AN OVERVIEW OF OPTION TRADING STRATEGIES: PART I

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This teaching note provides an overview of the most popular basic option trading strategies. This includes calls, puts, covered calls and protective puts. Teaching Note 97-11 covers advanced strategies such as spreads and straddles.

We define the following terms: A(0) = price of underlying asset today, X = exercise price of option, T = expiration date of option. We assume no dividends are paid or costs incurred on holding the underlying asset. Consequently, A(T) = asset price at option expiration and T - 0 = T = time to expiration. We shall work with European options. At any time t, the call price is c(A(t),X,T-t) and the put price is p(A(t),X,T-t). Given values for the risk-free rate (r) and volatility (σ), the option prices are generally provided by the Black-Scholes formula. At expiration, c(A(T),X,0) = Max(0,A(T) - X) and p(A(T),X,0) = Max(0,X - A(T)). In what follows we shall examine the values of various option strategies at the end of two holding periods. In the first we close the option position prior to expiration and in the second we hold the position all the way to the option's expiration.

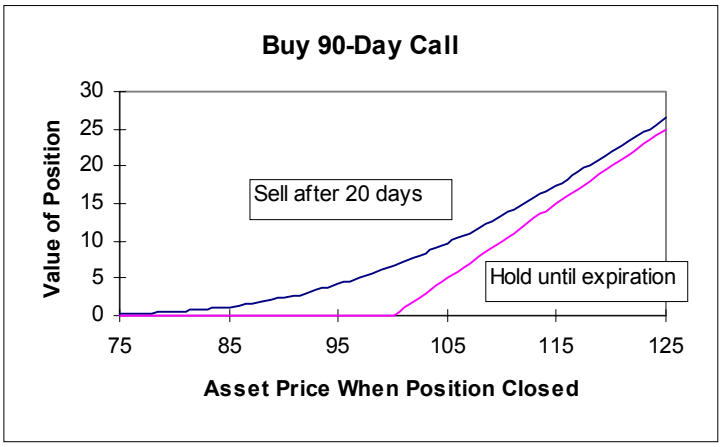
We shall derive formulas for the value of the position and illustrate the results graphically for a range of possible asset prices at the end of the holding period. For the numerical examples, we assume the following values: A(0) = 100, X = 100, r = 5.5 %, and σ = .35. We let the option have 90 days to expiration at the start. When we close the position early, we do so 20 days later, that is, with the option having 70 days remaining until expiration. For the graphs we analyze the position value for asset values when the position is closed ranging from 75 to 125. Now we turn to each strategy.

Buy a Call

The value of the position when the transaction is terminated at time $t \leq T$ is given as

$$V(t) = c(A(t), X, T - t) \quad \text{(buy call)}$$

where this value is provided by the Black-Scholes formula for any chosen value of A(t). Note also that the remaining time to expiration is T-t. When t = T, we still have V(T) = c(A(T),X,0), but as indicated earlier this value is Max(0,A(T) - X). The figure below illustrates this result for the example chosen.



For a given asset price, the value is lower at expiration. This will be true of any long position in an option and reflects the loss of time value of the option. If one knew that the asset price would not change, it would be best to close the position immediately, but of course one does not know that the asset price will not move. The longer the position is held, the greater the chance of a favorable asset price movement.

This call option would cost $7.57 when purchased and would be unprofitable if its value when closed were less than this amount. As is apparent, the minimum value is zero while the maximum value is unlimited.

The position of a seller of this call option would be the mirror image of the position of the buyer. The maximum value at the close of the position is zero and the minimum value is negative infinity.

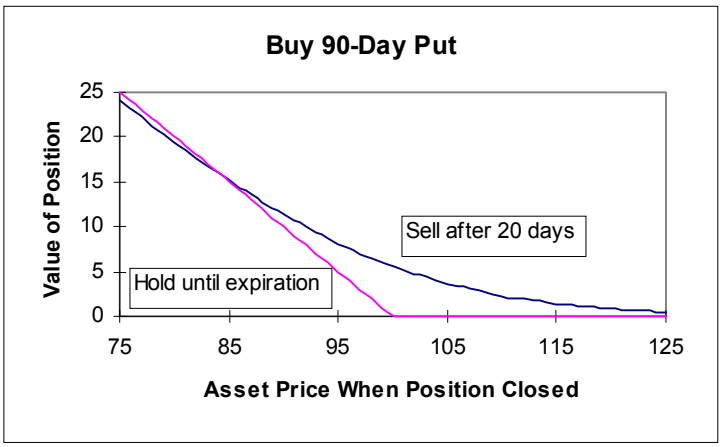
Buy a Put

The value of the position when the transaction is terminated at time $t \leq T$ is given as

$$V(t) = p(A(t), X, T - t) \quad \text{(buy put)}$$

where this value is provided by the Black-Scholes formula for any chosen value of A(t). Again, the remaining time to expiration is T-t. When t = T, we still have V(T) = p(A(T),X,0), but as

indicated earlier this value is Max(0,X - A(T)). The figure below illustrates this result for the example chosen.



Again, we see the effect of the time value decay. The option value is lower the longer the position is held for a given asset price with an exception noted below. This put option would cost $6.23 when purchased and would be unprofitable if its value when closed were less than this amount. As is apparent, the minimum value is zero while the maximum value is limited and would equal the present value of the exercise price.

The position of a seller of this put option would be the mirror image of the position of the buyer. The maximum value at the close of the position is zero and the minimum value is the present value of the exercise price.

Because a European put price at any time $t < T$ can be lower than X - A(t), the two lines cross over at very lower asset prices. In other words, $p(A(t),X,T-t) < \text{Max}(0,X - A(t))$ for some deep in-the-money European puts.

Covered Call

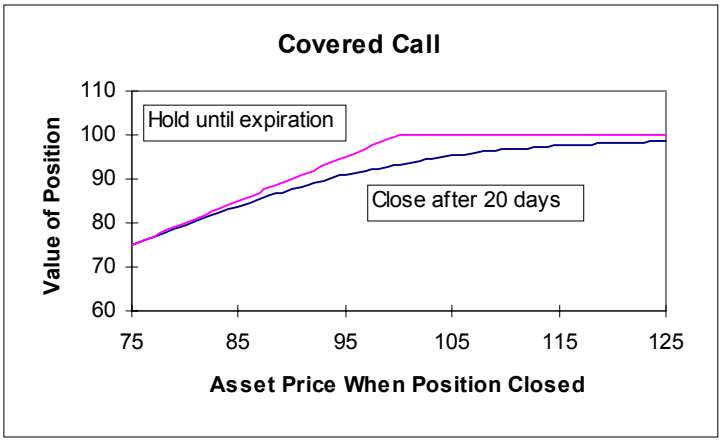
A covered call is a position in the asset and the sale of an equivalent number of call options. For a position of one unit of the asset and one short call, the value of such a position when terminated is given as

$$V(t) = A(t) - c(A(t), X, T - t) \quad \text{(covered call).}$$

At the option's expiration, this value is given as A(T) - Max(0,A(T) - X), which means that

$$V(T) = A(T) - A(T) + X = X \text{ if } A(T) \geq X$$
$$V(T) = A(T) \text{ if } A(T) < X.$$

This is graphed as follows:



This position would cost $100 for the asset, less $7.57 for the option, for a total investment of $92.43. The transaction would not be profitable if it were closed out at less than this value. Note how the value of the position reaches a maximum value at expiration if the asset value ends up above the exercise price. Prior to expiration the short option has time value remaining. For a given asset price, the position value is higher, the closer one moves toward expiration. This is due to the time value decay on the short option. Naturally, however, the longer one holds the position, the greater the chance that the asset price will move downward.

On the downside a position in a covered call is better than a position in the asset alone. The option ends up not being exercised and the holder retains the premium paid up front. On the upside, the holder gives up gains in the asset beyond the price X. In other words, if the holder of a stock writes a call on it, X is the maximum price that the holder of the asset will receive for it, at least during the option's life.

Protective Put

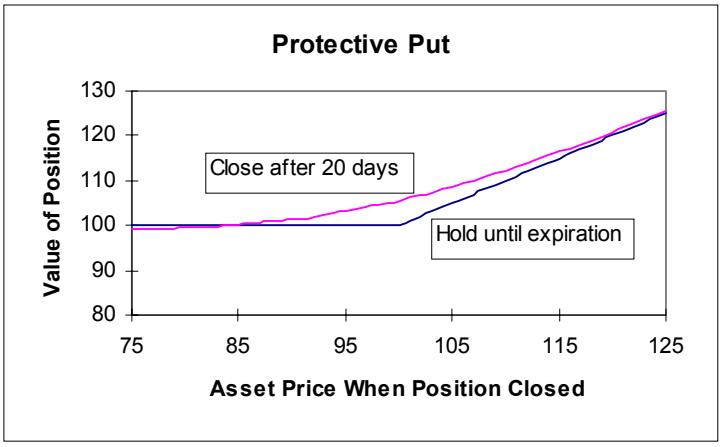
A protective put is a position in the asset and the purchase of an equivalent number of put options. For a position of one unit of the asset and one long put, the value of such a position when terminated is given as

$$V(t) = A(t) + p(A(t), X, T - t) \quad \text{(protective put).}$$

At the option's expiration, this value is given as A(T) + Max(0,X - A(T)), which means

$$V(T) = A(T) \text{ if } A(T) \geq X$$
$$V(T) = A(T) + X - A(T) = X \text{ if } A(T) < X.$$

This is graphed as follows:



This transaction would cost $100 for the asset and $6.23 for the put for a total of $106.23 and would not be profitable if closed out for less than this amount. Note how the value of the position has a minimum at expiration if the asset value ends up below the exercise price. Prior to expiration the long option has time value remaining. For a given asset price, the position value is lower, with an exception noted below, the closer one moves toward expiration, a result due to the decay of the time value on the long put. Naturally the longer one holds the position, the greater the chance that the asset price will move upward. There is an exception, however, to the result that time value decays on the protective put as expiration approaches. As the figure shows and as we discussed in the section on buying puts, a deep in-the-money put can sell for less than Max(0,X - A(t)). Thus, the two lines cross at low asset prices.

On the upside a position in a protective put is worse than a position in the asset alone. The option ends up not being exercised and the put holder has lost the premium paid up front. On the downside, the holder avoids losses in the asset beyond the price X. In other words, if the holder of the asset purchases a put, X is the minimum price that the holder of the asset will receive for the asset, at least during the option's life.

The protective put is equivalent to an insurance policy on the asset. The higher the exercise price chosen, the lower the implied deductible chosen by the policyholder. That is, if a standard insurance policyholder wants to assume less risk, he/she lowers the deductible. This results in a higher premium. In the case of a put option used to insure an asset, the person

chooses a put with a higher exercise price, which raises the premium and results in the person being able to sell the asset at a higher minimum.

References

The following books devote extensive material to option trading strategies:

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Dubofsky, D. A. *Options and Financial Futures: Valuation and Uses* New York: McGraw-Hill (1992), Ch. 3.

Hull, J. C. *Introduction to Options and Futures Markets*, 2nd ed. Englewood Cliffs, New Jersey: Prentice-Hall (1995), Ch. 9.

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