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Ethical and Professional Standards

Derivatives and Currency Management

Learning Module 1: Option Strategies

LESSON 1: POSITION EQUIVALENCIES

LOS: Demonstrate how an asset's returns may be replicated by using options.

Derivatives can be combined to create a synthetic position with a specific payoff and desired risk exposure.

As the curriculum states, "**Put-call parity** shows the equivalence (or parity) of a portfolio of a call and a risk-free bond with a portfolio of a put and the underlying stock."

Put-call parity can be expressed in the following formula:

$$S_0 + p_0 = c_0 + X/(1 + r)^T$$

where:

S_0 is the price of the underlying security
p_0 and c_0 are the prices of the put and call options, respectively, both with strike price "X" and expiry "T."
$X/(1 + r)^T$ is the present value of a risk-free zero-coupon bond paying X at the expiry of the options.

Recall the basic fair pricing formula for a forward contract with delivery at time T, $F_0(T)$, with no costs or benefits of carry:

$$F_0(T) = S_0(1 + r)^T$$

Rearranging this expression, the current spot price of the underlying asset can be viewed as the present value of the fair forward price. Substituting this into the put-call parity formula gives put-call-*forward* parity:

$$\frac{F_0(T)}{(1 + r)^T} + p_0 = c_0 + \frac{X}{(1 + r)^T}$$

A **synthetic long forward position** is the combination of a long call and short put that have identical strike prices and expirations. The long call creates the upside, the short put the downside.

To demonstrate this relationship, consider an investor who buys an at-the-money (ATM) call and simultaneously sells a put with the same strike and the same expiration date.

At the expiration date:

- If the underlying security is above the strike price, the investor will exercise the call, and purchase the underlying security at the strike price.

- If the security price is below the strike price, the put owner will exercise the put and sell the security to the investor for the strike price.

The key point here is that *the investor purchases the underlying stock at the strike price at expiry, regardless of the value of the underlying security at expiry.*

This synthetic long position therefore has the same payoff as a physical purchase of the shares at the strike price at expiry of the options, or a synthetic long forward contract entered into at the strike price of the options. Note that this analysis assumes there is no dividend income on the underlying security.

Example 1-1

A derivatives trader is short a forward contract on 1,000 shares of ABC Inc. at $7.14. Relevant market information is as follows:

- Current spot price equals $7.0.
- Annualized interest rate is 0.8%.
- No dividends before the hedge matures.
- The cost of a put and a call are the same.

Discuss how the trader can hedge his short forward position using a synthetic long forward position. **Explain** what happens at expiry should the underlying asset price be (a) above $7.14 and (b) below 7.14.

Answer:

Create a synthetic long position by purchasing a call option and selling a put option on 1,000 shares both with the same strike price of $7.14 and expiry in three months.

a. If the underlying is above $7.14 at expiry:
The trader will exercise the call and purchase 1,000 shares for a total cost of 1,000 $\times$ $7.14 = $7,140.
Under the forward contract, 1,000 shares are delivered out in return for a payment of $7,140.
These two positions offset each other, hence, the trader is hedged against losses due to a rising share price over the next three months.

b. If the underlying is below $7.14 at expiry the put will be exercised and 1,000 shares will be put to the trader at a cost of 1,000 $\times$ 7.14 = $7,140.
Under the forward contract, 1,000 shares are delivered out in return for a payment of $7,140.
These two positions offset each other, hence, the trader has also hedged away the benefit of share price falls over the next three months.

Example 1-2

The following information relates to the current position of a derivatives trader:

- Short two-month forward contract for 2,500 shares at $10.
- The current underlying share price equals $9.50.
- The shares are not owned and do not pay dividends.

The trader wishes to hedge potential losses on her forward position, but at the same time maintain some exposure to profits should prices move in her favor. At-the-money calls and puts are both currently selling for $0.25.

Discuss how the trader can achieve her objective using the options market.

Answer:

The short forward position of the trader will suffer losses if the underlying share price rises above the forward price of $10.

To mitigate this risk, a two-month call option can be bought with a strike price at $9.50 for $0.25.

If the underlying share price at delivery of the forward (and expiry of the option) is S_T, payoffs will be:

- Short forward contract: $2,500 \times (\$10 - S_T)$
- Long call option: $2,500 \times (\text{MAX}[0,(S_T - \$9.5)] - 0.25)$
- If $S_T < \$9.50$, the call will expire worthless.
    - The profit per share will amount to $(\$10 - S_T) - \$0.25$.
- If $S_T > \$9.50$, the call is exercised and profit per share equals $(\$10 - S) + (S - \$9.50) - \$0.25 = \$0.25$.

LESSON 2: COVERED CALLS AND PROTECTIVE PUTS

LOS: Discuss the investment objective(s), structure, payoff, risk(s), value at expiration, profit, maximum profit, maximum loss, and breakeven underlying price at expiration of a covered call position.

Covered calls are a combination of a long underlying security position and a short call position. It is referred to as a "covered" call position because the long position in the underlying security covers the potential obligation to deliver the shares out under the short call position, should the call holder choose to exercise. The possible investment objectives for using a covered call include:

- **Yield enhancement**: The most common motivation for entering into a covered call position is to generate premium income on portfolio holdings. By writing slightly out-of-the-money calls on portfolio assets, a fund manager can generate income return in a static market when prices are not expected to rise significantly. Note that by selling calls the manager gives up potential upside in the share price should prices rise above the strike of the short call position.
- **Reducing an overweight portfolio position**: Selling an in-the-money call in a static market on an overweight portfolio position increases the effective sale price of the asset versus an outright sell of the security since the manager will earn the time value of the call option, as well as collect strike proceeds on exercise of the call. However, the manager runs the risk of an unexpected *fall* in the underlying stock price to a level significantly below the strike price of the call. In this event, the call would not be exercised and the manager would suffer losses on the overweight portfolio position, ultimately realizing a much lower sale price for the asset.

- **Target price realization**: This is a hybrid of the first two objectives where an out-the-money call is written with a strike price close to the target price for a portfolio holding at which the manager would be happy to sell the position. Therefore, if the stock price increases enough and the call option is exercised, the investor gets both the stock price appreciation and the call premium. However, if the stock's price drops, there is an opportunity loss because the stock could have been sold outright before the price dropped.

Profit and Loss at Expiration

At option expiration, the value of a covered call position is the stock price minus the exercise value of the call. Any price increases beyond the strike price of the covered call belong to the buyer of the call. Therefore, the value of a covered call at expiration $= S_T - \text{Max}[(S_T - X),0]$.

Subtracting the inital value of the portfolio, $S_0 - c_0$, from this end value gives the formula for profit/loss at option expiration:

$S_T - \text{Max}[(S_T - X),0] + c_0 - S_0$

where:

S_T = Underlying security price at expiration
X = Strike Price
S_0 = Underlying security price at inception
c_0 = Call premium

Since all price appreciation gains above the strike price flow to the call option holder, the investor in a covered call can not earn more profits than at the point where $S_T = X$. This means the maximum profit under a covered call is given by:

Maximum profit: $S_T - (S_T - X) + c_0 - S_0 = X - S_0 + c_0$

The maximum loss on a covered call position occurs when the long stock position falls to zero, i.e., $S_T = 0$:

Maximum loss: $S_0 - c_0$

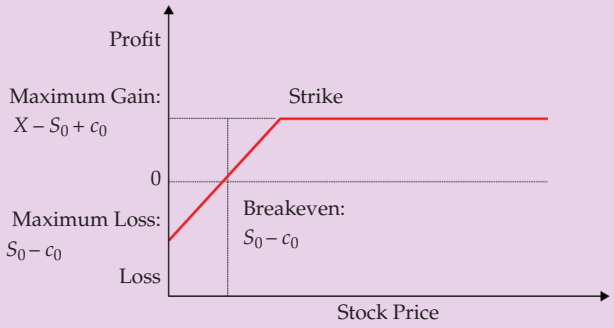
An investor in a covered call will break even when the share price falls by the call premium income:

Breakeven: $S_0 - c_0$

- Once the stock price drops below the initial price minus the call premium, a loss is generated.
- *For a covered call, the breakeven price and the maximum loss are the same.*

One risk to a covered call strategy is stock price depreciation. Covered calls do not protect against downside, although the receipt of the call premium offsets losses. There is another risk if a stock rises beyond the strike price. If this occurs, the investor has lost the opportunity to profit from price appreciation (opportunity loss). This relationship is demonstrated in the following graph.

Figure 2-1: Covered Call Profit and Loss Diagram



Maximum Gain = Appreciation to Exercise Price + Option Premium

Example 2-1

Assume the following: A covered call with a strike price of $X = \$45$ initiated at a price of $S_0 = \$40$, the current underlying asset price equals \$44 and the call premium generated was \$2.25. What is the breakeven price and the current profit? What was the maximum gain and maximum loss?

$S_0 = \$40$
$X = \$45$
$S_T = \$44$
$c_0 = \$2.25$

Answer:

- Profit: $S_T - \text{Max}[(S_T - X),0] + c_0 - S_0 = 44 - 0 + 2.25 - 40 = \$6.25$
- Breakeven: $S_0 - c_0 = 40 - 2.25 = \$37.75$
- Maximum loss: $S_T - \text{Max}[(S_T - X),0] + c_0 - S_0 = 0 - 0 - S_0 + c_0 = -40 + 2.25 = \$-37.75$
- Maximum profit: $S_T - \text{Max}[(S_T - X),0] + c_0 - S_0 = S_T - S_T + X + c_0 - S_0 = 45 + 2.25 - 40 = \$7.25$

LESSON 3: OPTION STRATEGIES

LOS: Discuss the investment objective(s), structure, payoff, risk(s), value at expiration, profit, maximum profit, maximum loss, and breakeven underlying price at expiration of a protective put position.

As a reminder from earlier levels of the CFA program, protective puts are basically a form of insurance with the objective of protecting against investment loss. It is best to think of the put premium paid as the cost of insurance, with the cost varying as a function of strike price and duration of the put insurance.

A protective put is a combination of a long underlying security position and a long put position on the security. The major risk to protective puts is that they have a finite term and must be rolled over periodically to maintain the insurance, which gets expensive over time. Another

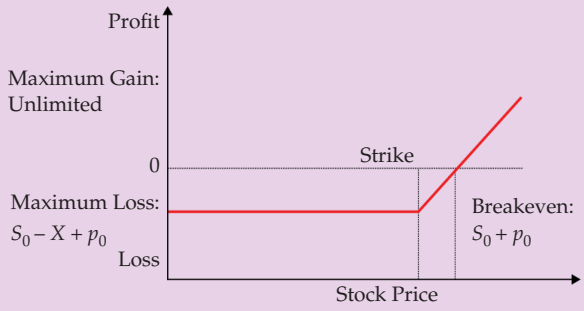
minor risk is that purchasing a put before a stock rises will reduce total return of the portfolio since the put will expire worthless.

The following data provide the details necessary to compute value, profit, maximum profit, maximum loss, and breakeven underlying price at expiration of a protective put position.

- **Value at expiration:** $S_T + \text{Max}[(X - S_T),0]$
- **Profit/loss at expiration:** $S_T + \text{Max}[(X - S_T), 0] - S_0 - p_0$,
- **Maximum profit:** Theoretically unlimited; since the gains on the underlying long position are unbounded above, but put losses are capped to the relatively small premium.
- **Maximum loss:** Limited to $S_0 - X + p_0$
- **Breakeven point**: $S_0 + p_0$

To look at the structure of a protective put, see Figure 3-1. It shows that the profit and loss diagram for protective puts is similar to holding a long call. This similarity is the result of put-call parity—being long the asset and long the put is equivalent to being long a call plus long a risk-free bond.

Figure 3-1: Protective Put Profit and Loss Diagram



Example 3-1

Calculate the gain, breakeven price, and maximum loss of the following protective put.

- $S_0 = \$40$
- $X = \$35$
- $S_T = \$44$
- $p_0 = \$2.25$ (option premium)

Answer:

Profit: $S_T + \text{Max}[(X - S_T),0] - S_0 - p_0 = 44 + 0 - 40 - 2.25 = \$1.75$

Breakeven: $S_0 + p_0 = 40 + 2.25 = \$42.25$

Maximum loss: $S_0 - X + p_0 = 40 - 35 + 2.25 = \$7.25$

LOS: Compare the delta of covered call and protective put positions with the position of being long an asset and short a forward on the underlying asset.

As a reminder, delta (Δ) is the change in an option's price due to a price change in the underlying security, all else equal. Delta offers an approximation of how an option price will change as a result of price changes in the underlying security. Delta for long calls is always positive, between 0 and +1; delta for long puts is always negative, between 0 and –1.

- Delta (Δ) ≈ Change in value of option/Change in value of underlying security

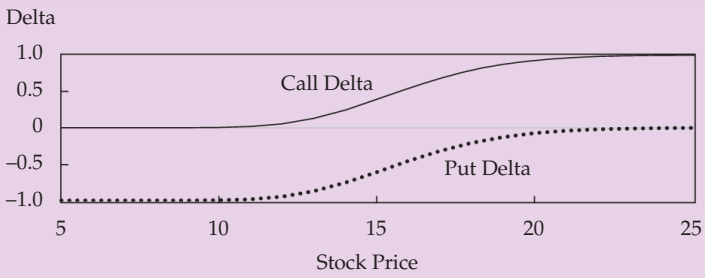
Covered Call and Protective Put Delta

Because a long call/put increases/decreases in value as the underlying security price rises, call deltas are always positive (0 to 1) and put deltas are always negative (0 to –1). **Keep in mind that the +/– signs are reversed for short positions**.

- A long asset position has a delta of 1.0, whereas a short position has a delta of –1.0.
- When the stock price is close to the strike price, a long ATM call option will have a delta of approximately 0.5; an ATM put option has a delta of –0.5.

Figure 3-2 graphically shows the relationship between the delta of a long call and long put with a strike price of $15.

Figure 3-2: Delta of PBR Options vs. Stock Price[1]



To compare the deltas of long calls and puts, consider an investor who has a portfolio of 100 shares of a stock trading at $50.

- The delta of the 100 shares is 100 × 1 (or 100).
- An ATM call contract has a delta of 50 (100 × 0.50).
  - A short call has a delta of –50.
- An ATM put has a delta of –50; 100 × –0.5.
  - A short put has a delta of 50.

Therefore, a covered call position delta is 50: 100 for the stock and –50 for the short call. A protective put position would also have a delta of 50: 100 for the stock and –0.50 for the long put.

Long Asset and Short Forward Delta

Assume an investor is long 100 shares and short forward on 50 shares. If we assume the underlying stock does not pay dividends, forwards (and futures) are proxies for the stock. This

[1] Modified from Exhibit 12, Volume 2, CFA Program Curriculum 2024.