Financial Derivatives and Risk Management
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Lecture 34: Basic Option Trading Strategies

We talk about trading strategies with options. These trading strategies may involve combinations of options with the underlying assets or with other options or even other forms of derivatives. Now, before we discuss trading strategies, it is important to emphasize that that these strategies are purely illustrative. The strategies that will be discussed in the sequel are by no means exhaustive. What kind of strategy an investor desires to implement is entirely based on his perception of the manner in which the relevant investment instruments are going to evolve over his investment horizon. It is entirely the investor's discretion (subject of course to the market regulations) and it is based on his perception. The objective here is to present some of the commonly adopted strategies by way of illustrating (i) the manner of assessing the strategies' payoffs and implications; and (ii) the relationship between a particular strategy and the investor's perception. The objective is to illustrate the methodology, the mechanism by which strategies can be analysed so that one that seems compatible with the investor's perception may be opted by him.

The usual approach is to start with working out the payoffs from the strategies at maturity of the option. Note that for the moment we confine our analysis to European options.

These strategies evolve as zero-sum games, so that the profit on a long position equals the loss on the short position and vice versa. Hence, the payoff and profit profiles of the two positions are mirror images about the horizontal axis.

Stated precisely, we shall be exploring the behaviour of the combinations of options with underlyings or options inter se at maturity of the options.

Common trading strategies

(i) Long & short calls
(ii) Long & short puts
(iii) Covered call strategy
(iv) Protective put strategy
(v) Straddles & strangles
(vi) Strips & straps
(vii) Spread strategies

Long & short call

A long European call position entitles the investor to buy the underlying stock at the pre-determined exercise price K on the date of maturity of the option T. Clearly, if the market price of the stock on maturity date of option $S_T<K$, the call-holder will not exercise the call i.e. let it lapse and buy the stock in the market for S_T, so that the payoff from the call would be zero. On the other

hand, if $S_T>K$, the call-holder will exercise the call, buy the stock under the call contract by paying K and sell it in the market for S_T, thereby pocketing a net payoff of S_T-K. Hence, the payoff on a long call position takes the form: $\Pi_{long\ call}(S_T) = \max(0,S_T-K)$. However, the premium paid on acquiring the call is paid upfront at t=0, and constitutes a sunk cost. The profit on the long call is therefore, $\pi_{long\ call}(S_T) = \max(0,S_T-K)-c$, where we ignore the time value of the premium on option purchase.

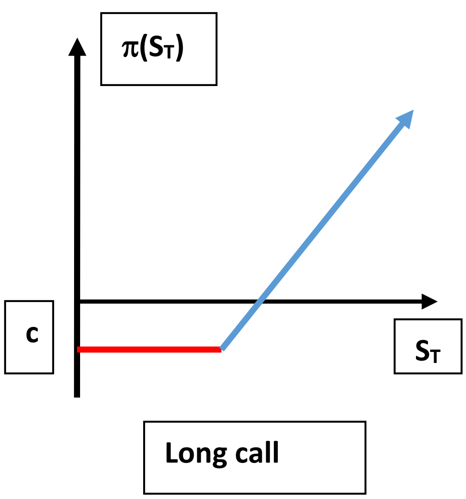
Clearly, after the maturity stock price exceeds the exercise price K, every further increase in stock price is mimicked by an equal increase in the call payoff. Thus, an investor would take up this position when he is strongly bullish about the underlying stock at call maturity, higher the stock price higher is his call payoff.

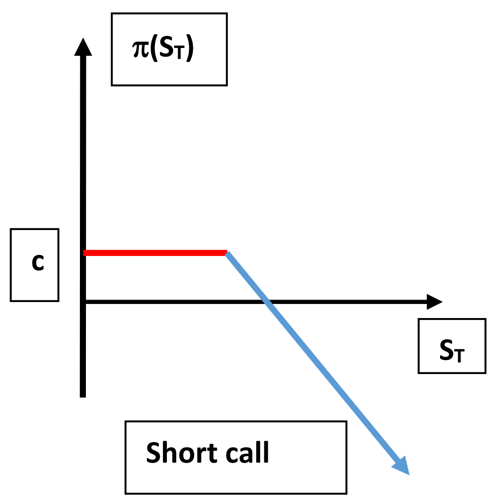
The breakeven will occur at $0=\pi_{long\ call}(S_T) = \max(0,S_{BEP}-K)-c= \max(-c,S_{BEP}-K-c)$ or $S_{BEP}=K+c$.

Similarly, since long and short call form a zero sum game, we have $\Pi_{short\ call}(S_T) =- \max(0,S_T-K)= \min(0,K-S_T)$. However, the premium received on writing the call is received upfront at t=0. The profit on the short call is therefore, $\pi_{short\ call}(S_T) = \min(0,K-S_T)+c$, where we ignore the time value of the premium on option purchase.

Clearly, after the maturity stock price exceeds the exercise price K, every further increase in stock price is mimicked by an equal increase in the call payoff. Hence, the option writer's loss increases by equal amount. Thus, an investor would take up this position when he is bearish about the underlying stock at call maturity. If the stock remains below the strike price, the call holder will not exercise the option so that the call writer gets an unencumbered right to the option premium.

The breakeven will occur at $0=\pi_{short\ call}(S_T) = \min(0,K-S_{BEP})+c= \max(c,c+K-S_{BEP})$ or $S_{BEP}=K+c$.





<u>Long & short put</u>

A long European put position entitles the investor to sell the underlying stock at the pre-determined exercise price K on the date of maturity of the option T. Clearly, if the market price of the stock on maturity date of option $S_T>K$, the call-holder will not exercise the call i.e. let it lapse and sell the stock in the market for S_T, so that the payoff from the put would be zero. On the other hand, if $S_T<K$, the put-holder will buy the stock from the market at S_T, exercise the put and sell the stock under the put contract for K thereby pocketing a net payoff of $K-S_T$. Hence, the payoff on a long put position takes the form: $\Pi_{long\ put}(S_T) = max(K-S_T,0)$. However, the premium paid on acquiring the put is paid upfront at t=0, and constitutes a sunk cost. The profit on the long put is therefore, $\pi_{long\ put}(S_T) = max(K-S_T,0)-p$, where we ignore the time value of the premium on option purchase.

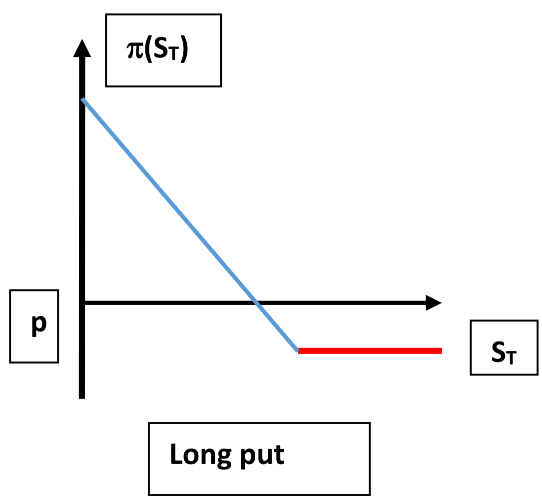
Clearly, below the strike price K, every further decrease in stock price is mimicked by an equal in magnitude increase in the put payoff. Thus, an investor would take up this position when he is strongly bearish about the underlying stock at put maturity, lower the stock price, higher is his put payoff, provided the stock price is low K.

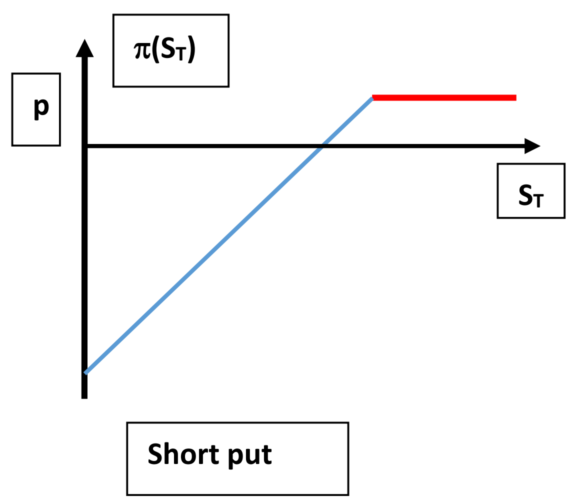
The breakeven will occur at $0=\pi_{long\ put}(S_T) = max(K-S_{BEP},0)-p= max(K-S_{BEP}-p,-p)$ or $S_{BEP}=K-p$.

Similarly, since long and short puts form a zero sum game, we have $\Pi_{short\ put}(S_T) =- max(K-S_T,0)= min(S_T-K,0)$. However, the premium received on writing the put is received upfront at t=0. The profit on the short put is therefore, $\pi_{short\ put}(S_T) = min(S_T-K,0)+c$, where we ignore the time value of the premium on option purchase.

Clearly, provided the maturity stock price is below the strike price K, every further decrease in stock price is mimicked by an equal increase in the put payoff. Hence, the option writer's loss increases by equal amount. Thus, an investor would take up the short put position when he is bullish about the underlying stock at call maturity. If the stock remains above the strike price, the put holder will not exercise the put option so that the put writer gets an unencumbered right to the option premium.

The breakeven will occur at $0=\pi_{short\ put}(S_T) = min(S_{BEP}-K,0)+p= max(S_{BEP}-K+p,p)$ or $S_{BEP}=K-p$.





Covered call strategy

The covered call strategy comprises of the following:

(i) A long position in the underlying asset S; and
(ii) A call written on the same underlying S.

Let K be the strike price, t=T the maturity and c the premium of the call option. Then, the payoff & profit on the strategy at option maturity t=T is:

$\Pi_{\text{covered call}}=S_T-\max(0,S_T-K)=S_T-\max(S_T-S_T,S_T-K)=S_T-S_T+\min(S_T,K)=\min(S_T,K)$
$\pi_{\text{covered call}}(S_T)=\pi_{\text{long stock}}(S_T)+\pi_{\text{short call}}(S_T)=S_T-S_0-\max(0,S_T-K)+c=S_T-S_0-\max(K-S_T,0)+K-S_T+c$
$=-\max(K-S_T,0)+K-S_0+c=\Pi_{\text{short put}}+K-S_0+c$

$$\Pi_{Covered\ \ Call}=\Pi_{Long\ Stock}+\Pi_{Short\ Call}=\begin{cases}S_T\ \ if\ \ S_T<K\\ S_T-(S_T-K)\ if\ \ S_T\geq K\end{cases}$$
$$=\begin{cases}S_T\ \ if\ \ S_T<K\\ K\ if\ \ S_T\geq K\end{cases}=K+\begin{cases}-(K-S_T)\ \ if\ \ S_T<K\\ 0\ if\ \ S_T\geq K\end{cases}=K+\Pi_{Short\ Put}$$
$$\pi_{Covered\ \ Call}=\pi_{Long\ Stock}+\pi_{Short\ Call}=\begin{cases}(S_T-S_0)+c\ \ if\ \ S_T<K\\ (S_T-S_0)-(S_T-K)+c\ if\ \ S_T\geq K\end{cases}$$
$$=\begin{cases}(K-S_0)-(K-S_T)+c\ \ if\ \ S_T<K\\ (K-S_0)+c\ if\ \ S_T\geq K\end{cases}=(c-S_0)+K+\begin{cases}-(K-S_T)\ \ if\ \ S_T<K\\ 0\ if\ \ S_T\geq K\end{cases}$$
$$=(c-S_0)+K+\Pi_{Short\ Put}$$

	t=0	t=T	
		$S_T<K$	$S_T>K$
BUY STOCK	$-S_0$	S_T	S_T
WRITE CALL	+c	0	$-(S_T-K)$
TOTAL	$c-S_0$	S_T	K
	$c-S_0$	$-(K-S_T)+K$	(K-K)+K
Payoff of covered call is parallel to payoff of short put.			

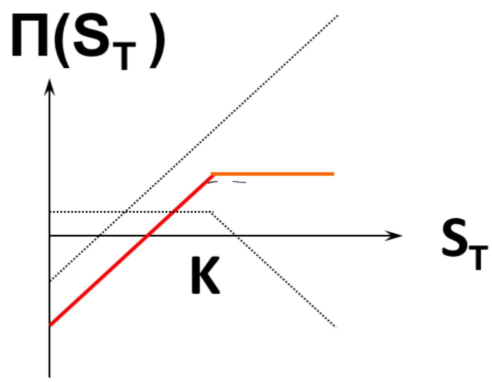
The covered call strategy is a combination of long position in the underlying asset and a short position in a call option on the same asset. Thus, you have the stock and you have written a call on that stock.

<u>Why “covered”?</u>

A short call position entails that the call writer will deliver the asset at a predetermined price to the party who is long in the call. If the party who is long in the call invokes the call, exercises the call option, then the call writer is obligated to deliver the underlying asset at a predetermined price. Now, if the price of the asset were to go up in the market, then obviously he would incur a loss because he would have to buy the asset from the market and deliver it under the call contract at a predetermined price.

Now, if the writer at the point of time of writing of the call also takes a long position in the underlying, then, in the event that the underlying price increases and he is obligated to deliver the underlying on account of exercise by the holder, he already possesses the underlying with him. He need not purchase the asset from the market to make the delivery.

The implication is that if the price goes up, while his loss on the short call will increase in equal magnitude to the stock price, the value of his long holding in the underlying will also increase by an equal amount i.e. the loss on his short call position is compensated by the profit on his long underlying. They would neutralize each other and therefore, that would put a ceiling on the loss. Thus, the short call is covered by the long stock position.



Let us look at the pay offs. Again, we split the spectrum of stock prices into two partitions $S_T<K$ and $S_T>K$. The long stock will yield a payoff of S_T in either scenario. The short call will not be exercised by the holder if $S_T<K$, so that no obligation devolves on the option writer and hence no payoff. Since, he retains the call premium, his aggregate profit is $c+S_T-S_0$ where S_0 is the acquisition cost of the stock. However, if $S_T>K$, the short option position entails a payoff of $-(S_T-K)$ whence the aggregate payoff becomes $S_T-(S_T-K)=K$. Thus, the strategy gives a payoff of ST if $S_T<K$ and K if $S_T>K$ i.e. $\min(S_T,K)$ and the profit is $\min(S_T,K)-S_0+c$. Hence, payoff is bounded: it is confined to K. The cash outflow for setting the strategy at t=0 is $c-S_0$.

The interesting point here is that if you look at this payoff, you find that this is parallel to the payoff of a short put strategy.

<u>Protective put</u>

The protective put strategy comprises of the following:

(i) A long position in the underlying asset S; and
(ii) A long put on the same underlying S.

Let K be the strike price, t=T the maturity and p the premium of the put option. Then, the payoff & profit on the strategy at option maturity t=T is:

$\Pi_{\text{protective put}}=S_T+\max(K-S_T,0)=S_T+\max(K-S_T,S_T-S_T)=S_T-S_T+\max(K,S_T)=\max(K,S_T)$
$\pi_{\text{protective put}}(S_T)=\pi_{\text{long stock}}(S_T)+\pi_{\text{long put}}(S_T)=S_T-S_0+\max(K-S_T,0)-p=S_T-S_0+\max(K-S_T,S_T-S_T)-p$
$=S_T-S_0+\max(K,S_T)-S_T-p=\max(K,S_T)-S_0-p=\max(K-K,S_T-K)+K-S_0-p=\max(0,S_T-K)+K-S_0-p$
$=\Pi_{\text{long call}}+K-S_0-p$

$$\pi_{\text{Protective Put}}=\pi_{\text{Long Stock}}+\pi_{\text{Long Put}}=\begin{cases}(S_T-S_0)+(K-S_T)-p & if\ S_T<K\\(S_T-S_0)-p & if\ S_T\geq K\end{cases}$$
$$=\begin{cases}(K-S_0)-p & if\ S_T<K\\(K-S_0)+(S_T-K)-p & if\ S_T\geq K\end{cases}=-(p+S_0)+K+\begin{cases}0 & if\ S_T<K\\(S_T-K) & if\ S_T\geq K\end{cases}$$
$$=-(p+S_0)+K+\Pi_{\text{Long Call}}\ or\ \pi_{\text{Protective Put}}=-(p+S_0)e^{rT}+K+\Pi_{\text{Long Call}}$$

	t=0	t=T	
		S_T<K	S_T>K
BUY STOCK	$-S_0$	S_T	S_T
BUY PUT	-p	$K-S_T$	0
TOTAL	$-p-S_0$	K	S_T
	$-p-S_0$	(K-K)+K	$(S_T-K)+K$
Payoff of protective put is parallel to payoff of long call.			

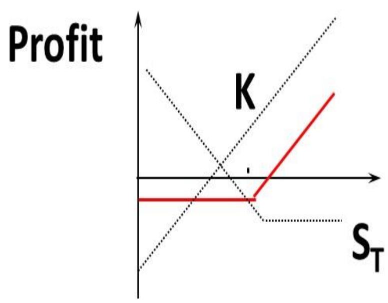
The protective put strategy is a combination of long position in the underlying asset and a long position in a put option on the same asset. Thus, you have the stock and you have bought a put on that stock.

Why “protective”?

A long put position entails that the put holder has the right to sell the underlying asset at a predetermined price to the party who is short in the put. If the party who is long in the put invokes the put, exercises the put option, then the put writer is obligated to buy the underlying asset at a predetermined price. Now, if the investor is having a naked investment in an asset, he is susceptible to market volatility and in particular would be adversely affected by a fall in the price of the asset. In order to protect himself against the loss due to price fall, the investor may opt to buy a put option on the same asset. Now, if the price falls below a predetermined price (the put’s strike price), the investor can invoke the put option and sell the asset at the strike price. Thus, he gets insulated against a price fall in this holdings below a certain (chosen) level. In other words, the long put protects the investor against loss due to the price fall of the underlying asset in which he is invested.

The implication is that if the price goes down, while his loss on the long asset will increase in equal magnitude to the asset price decrease, his profit on the long put will increase by precisely the same amount i.e. the loss on his long asset position is compensated by the profit on his long put. They would neutralize each other and therefore, that would put a ceiling on the loss. Thus, the long asset is protected by the long put.

If there is a decline in price below exercise price K, the investor will incur a loss on the long underlying but because he has a put on the same asset, he can invoke the put and sell the asset at the exercise price. Therefore, the investor is not affected below a certain threshold. He will not be influenced by the decline in market price of his holding of the underlying asset.



Let us look at the pay offs. Again, we split the spectrum of stock prices into two partitions $S_T<K$ and $S_T>K$. The long stock will yield a payoff of S_T in either scenario. The long put will not be exercised by the holder if $S_T>K$, hence no payoff. Since, the put holder has paid the premium for acquiring the put upfront, he loses the put premium, his aggregate profit is S_T-S_0-p where S_0 is the acquisition cost of the stock. However, if $S_T<K$, the long put position entails a payoff of $K-S_T$ whence the aggregate payoff becomes $S_T+(K-S_T)=K$. Thus, the strategy gives a payoff of S_T if $S_T>K$ and K if $S_T<K$ i.e. $\max(K,S_T)$ and the profit is $\max(K,S_T)-S_0-p$. Hence, payoff is unbounded upwards but with a bounded minimum of K. The cash outflow for setting the strategy at t=0 is $-p-S_0$.

The interesting point here is that if you look at this payoff, you find that this is parallel to the payoff of a long call strategy.

From above, we have: $\pi_{\text{protective put}}(S_T)=\Pi_{\text{long call}}+K-S_0-p$. It is pertinent to examine the sign of $K-S_0-p$. Of course, we have ignored time value of money in the above analysis. If we factor in the time value of money, the above relation gets modified to: $\pi_{\text{protective put}}(S_T)=\Pi_{\text{long call}}+K-(S_0+p)e^{rT}$. Now, from put-call parity we have $c+Ke^{-rT}=p+S_0$ or $K-(p+S_0)e^{rT}=-ce^{rT}<0$. Thus, if we plot the profit profiles of the protective put as a function of the payoff of the long call, we have a negative Y-intercept. Otherwise, the two traces are parallel to each other.

Covered call & protective put and put-call parity

It is pertinent to point out that the covered call & the protective put strategies can be inferred directly from the put-call relationship. We have, $c+Ke^{-rT}=p+S_0$ or, ignoring time value, $c+Ke^{-rT}=p+S_0$ whence, we have $c-S_0=p-Ke^{-rT}$. This shows that the cost of setting up a covered call strategy equals a riskfree investment of Ke^{-rT} together with a short put option. It immediately follows (because there are no intermediate cash flows) that the payoff of the covered call strategy at maturity of options will equal the payoff from the short put and the redeemed value of the investment (K). Compare it with the direct calculation:

$\Pi_{covered\ call}=S_T-\max(0,S_T-K)=S_T-\max(S_T-S_T,S_T-K)=S_T-S_T+\min(S_T,K)=\min(S_T,K)$
$=-\max(-S_T,-K)=K-\max(K-S_T,0)=K+\Pi_{short\ put}$

A similarly analysis holds for the protective put.

Long Straddle

The long straddle strategy comprises of the following:

(i) A long call option on stock S with strike K and maturity T; and
(ii) A long put option on the same stock S with same strike K and same maturity T.

Let c, p be the premia on the call & put respectively. Then, the payoff & profit on the strategy at option maturity t=T is:

$\Pi_{straddle}=\max(0,S_T-K)+\max(K-S_T,0)=\max(K-S_T,S_T-K)$
$\pi_{straddle}(S_T)=\pi_{long\ call}(S_T)+\pi_{long\ put}(S_T)=\max(0,S_T-K)-c+\max(K-S_T,0)-p$
$=\max(K-S_T,S_T-K)-(c+p)$.

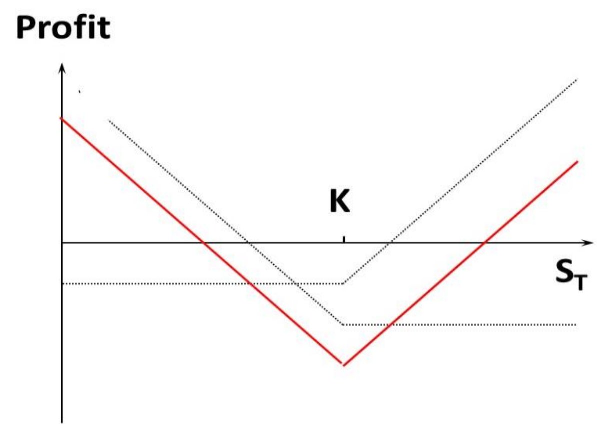
Clearly maximum loss is at $S_T=K$ and is given by (c+p).

The BEPs are: $0=\max(K-S_{BEP},S_{BEP}-K)-(c+p)$ or $S_{BEP}=K-(c+p),\ K+(c+p)$.

$$\pi_{Straddle}=\pi_{Long\,Call\ A}+\pi_{Long\ Put\ B}=\begin{cases}(K-S_T)-(p+c) & if\ \ S_T<K\\(S_T-K)-(p+c) & if\ \ S_T>K\end{cases}$$
$$\pi^{MAX}_{STRADDLE}=\infty;\ \ \pi^{MIN}_{STRADDLE}=p+c;S^{BEP}_T=K-(p+c),\ \ K+(p+c)$$

	t=0	t=T	
		$S_T<K$	$S_T>K$

LONG CALL	**-c**	**0**	**S_T-K**
LONG PUT	**-p**	**K-S_T**	**0**
TOTAL	**-(c+p)**	**K-S_T**	**S_T-K**



Let us look at the pay offs. Again, we split the spectrum of stock prices into two partitions $S_T<K$ and $S_T>K$. If $S_T<K$, the put option will be exercised while the call will lapse so that the payoff will be K-S_T. On the other hand, if $S_T>K$, the put will lapse unexercised while the call will be exercised yielding a payoff of S_T-K. Thus, the payoff is K-S_T if $S_T<k$ and S_T-K if $S_T>K$. The payoff is bounded on the one side since we must have $S_T>0$, while being unbounded on the other. Thus, the profit on the straddle is unbounded while the maximum loss equals the aggregate premia paid on the two options and occurs at $S_T=K$ when neither option gets exercised.

Investor perception & straddle

If I implement a straddle strategy, what is my perception about the evolution pf the stock price at option maturity? Now, as we can see from the diagram showing the straddle payoff, the investor makes a profit if the stock price ends up radically away from the exercise price either to the left or to the right. Further, greater the deviation from the exercise price, greater is the profit. In other words, the perception is that the price is going to move and move radically, move significantly but the investor is not sure about the direction in which the price is going to move. There is some uncertain event, contingent event which is likely to happen at option maturity such that the outcome would significantly affect the stock price. If that outcome is, say X then it would be significantly beneficial for the company (whose stock is the underlying) and the stock price could increase significantly above the strike price and if the outcome is, say Y, it could spell doom for the company and the stock price could register a huge fall. But the investor is unbiased about the outcome being X or Y. He feels that there is going to be a significant shift in the stock price whatever the outcome is. If it is a positive outcome the stock price is going to jump up and if it is a negative outcome the stock price is going to jump down by a large amount.
For example, it could be an impending judgement on a legal suit, or the opening of an IPO or a potential merger announcement, bonus announcement or some other corporate event.

The above combination is a long straddle. We can also have a short straddle. A short straddle would comprise of short positions in the aforesaid options. An investor considering a short straddle would be betting on small swings around the strike price K. He does not expect a large swing.