Lecture

INSTITUTE OF ACTUARIAL & QUANTITATIVE STUDIES

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Class: SY BSc

Subject : Introduction to Derivatives and Financial Markets

Subject Code: PUSASQF302

Chapter: Unit 3 – Chapter 3

Chapter Name: Trading Strategies Involving Options

Precap

- There are six factors affecting the value of a stock option: the current stock price, the strike price, the expiration date, the stock price volatility, the risk-free interest rate, and the dividends expected during the life of the option.
- A European call option on a non-dividend-paying stock must be worth more than max($S_0 - Ke^{-rT}$, 0) where S_0 is the stock price, K is the strike price, r is the risk-free interest rate, and T is the time to expiration.
- A European put option on a non-dividend-paying stock must be worth more than max($Ke^{-rT} - S_0$, 0).
- When dividends with present value D will be paid, the lower bound for a European call option becomes max($S_0 - D - Ke^{-rT}$, 0) and the lower bound for a European put option becomes max($D + Ke^{-rT} - S_0$, 0).

Precap

- Put–call parity is a relationship between the price, c, of a European call option on a stock and the price, p, of a European put option on a stock. For a non-dividend-paying stock, it is

$$c + Ke^{-rT} = S_0 + p$$

- For a dividend-paying stock, the put–call parity relationship is

$$c + D + Ke^{-rT} = S_0 + p$$

- Put–call parity does not hold for American options. However, it is possible to use arbitrage arguments to obtain upper and lower bounds for the difference between the price of an American call and the price of an American put.

Question

1. When dividends increase with all else remaining the same, which of the following is true?

A. Both calls and puts increase in value
B. Both calls and puts decrease in value
C. Calls increase in value while puts decrease in value
D. Puts increase in value while calls decrease in value

Answer: D

Dividends during the life of an option reduce the final stock price. As a result dividend increases cause puts to increase in value and calls to decrease in value.

Question

2. When the strike price increases with all else remaining the same, which of the following is true?

A. Both calls and puts increase in value
B. Both calls and puts decrease in value
C. Calls increase in value while puts decrease in value
D. Puts increase in value while calls decrease in value

Answer: D

Strike price increase cause the values of puts to increase and the values of calls to decline.

Question

3. The price of a stock, which pays no dividends, is $30 and the strike price of a one year European call option on the stock is $25. The risk-free rate is 4% (continuously compounded). Which of the following is a lower bound for the option such that there are arbitrage opportunities if the price is below the lower bound and no arbitrage opportunities if it is above the lower bound?

A. 5.00
B. 5.98
C. 4.98
D. 3.98

Answer: B

The lower bound in $S_0 - Ke^{-rT}$. In this case it is $30 - 25e^{-0.04\times1} = \$5.98$.

Today's Agenda

0 Introduction

1. An Option and a Zero Coupon Bond Market Crisis
    1. Example
    2. Pros and Cons

2. An Option and an Underlying Asset
    1. Long Stock & Short Call
    2. Short Stock & Long Call
    3. Long Put & Long Stock
    4. Short Put & Short Stock

3. Spreads
    1. Why Option Spreads
    2. Main Types of Option Spreads

4. Bull Spread
    1. Bull Call Spread
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5. Bear Spreads
    1. Bear Put Spread
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6. Box Spread
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Today's Agenda

8. Calendar Spreads
    1. Calendar Spread – Types

9. Combinations
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0 Introduction

In this chapter, we look at what can be achieved when an option is traded in conjunction with other assets.

There are many options strategies that both limit risk and maximize return. With a little effort, traders can learn how to take advantage of the flexibility and power that stock options can provide.

In particular, we examine the properties of portfolios consisting of positions in

(a) an option and a zero-coupon bond,
(b) an option and the asset underlying the option, and
(c) two or more options on the same underlying asset.

1 An option and a zero-coupon bond

Options are often used to create what are termed principal-protected notes for the retail market. These are products that appeal to conservative investors.

A principal protected note (PPN) is a fixed-income security that guarantees a minimum return equal to the investor's initial investment (the principal amount), regardless of the performance of the underlying assets.

- Principal-protected notes can be created from a zero-coupon bond and a European call/put option.
- The return earned by the investor depends on the performance of a stock, a stock index, or other risky asset, but the initial principal amount invested is not at risk.

1.1 Example!

Suppose that the 3-year interest rate is 6% with continuous compounding. This means that $1{,}000e^{-0.06x3} = \$835{:}27$ will grow to \$1,000 in 3 years. The difference between \$1,000 and \$835.27 is \$164.73. Suppose that a stock portfolio is worth \$1,000 and provides a dividend yield of 1.5% per annum. Suppose further that a 3-year at-the-money European call option on the stock portfolio can be purchased for less than \$164.73.

A bank can offer clients a \$1,000 investment opportunity consisting of:
1. A 3-year zero-coupon bond with a principal of \$1,000
2. A 3-year at-the-money European call option on the stock portfolio.

If the value of the portfolio increases the investor gets whatever \$1,000 invested in the portfolio would have grown to. (This is because the zero-coupon bond pays off \$1,000 and this equals the strike price of the option.)

If the value of the portfolio goes down, the option has no value, but payoff from the zero-coupon bond ensures that the investor receives the original \$1,000 principal invested.

1.2 Pros and Cons

- The attraction of a principal-protected note is that an investor is able to take a risky position without risking any principal.
- The worst that can happen is that the investor loses the chance to earn interest, or other income such as dividends, on the initial investment for the life of the note.
- There are many variations on the product we have described.
- An investor who thinks that the price of an asset will decline can buy a principal-protected note consisting of a zero-coupon bond plus a put option.

Question

1. If a call option is far 'out of the money' the value of the option will be:

A. Equal to the value of a put option with same strike price.
B. Greater than the value of a put option with same strike price.
C. Zero
D. Less than the value of a put option with same strike price.

Answer: D

Question

2. Which of the following statements is false?

A. The intrinsic value reflects the option's potential appreciation
B. Option prices almost always exceed intrinsic values
C. Out-of-the-money for a call means that the stock price is less than the exercising price
D. An option's premium cannot decline below intrinsic value

Answer: A

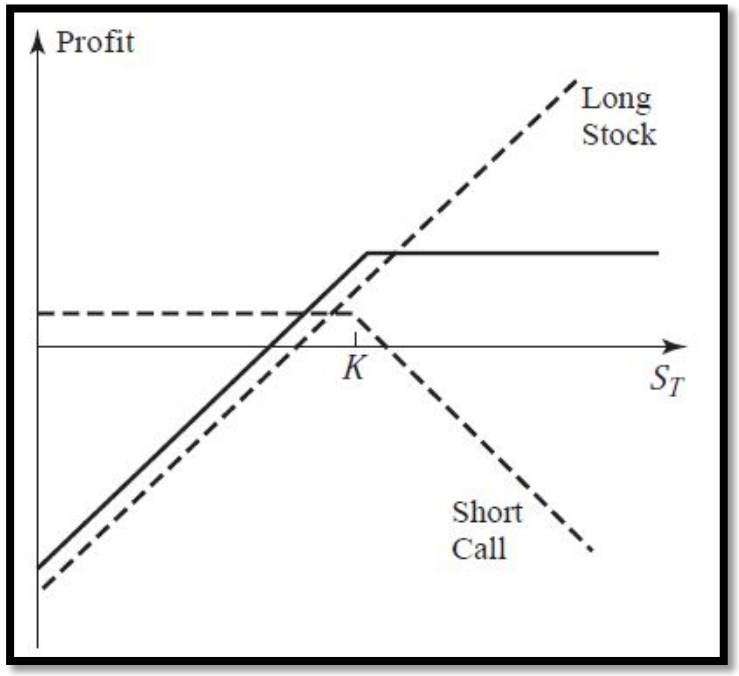
2 An Option and the Underlying Asset

- There are a number of different trading strategies involving a single option on a stock and the stock itself.
- For convenience, we will assume that the asset underlying the options considered is a stock. (Similar trading strategies can be developed for other assets.)
- We will follow the usual practice of calculating the profit from a trading strategy as the final payoff minus the initial cost without discounting.
- In the graphs further, the dashed line shows the relationship between profit and the stock price for the individual securities constituting the portfolio, whereas the solid line shows the relationship between profit and the stock price for the whole portfolio

2.1 Long Stock & Short Call

The portfolio consists of a long position in a stock plus a short position in a European call option. This is known as writing a covered call.

The long stock position "covers" or protects the investor from the payoff on the short call that becomes necessary if there is a sharp rise in the stock price.



Check Out!

You can check of any option strategy on the site below: Understand the strategy, when to apply, the payoff and the graph.

https://www.chittorgarh.com/options-trading-strategy/covered-call/6/

2.1 Example!

A simple example of a covered call strategy.

You've decided to purchase 100 shares of TCS. for $100 per share. You believe that the stock market will not experience significant volatility in the near future. You also predict that the share price of TCS will grow to $105 in the next six months.

In order to lock up your profits, you sell 1 call option contract with the strike price of $105 that will expire in six months (note that one call option contract consists of 100 shares). The premium on this call option is $3 per share in the contract.

Your future payoff depends on the price of the stock in six months.

You face three scenarios. Let's see

2.1 Example!

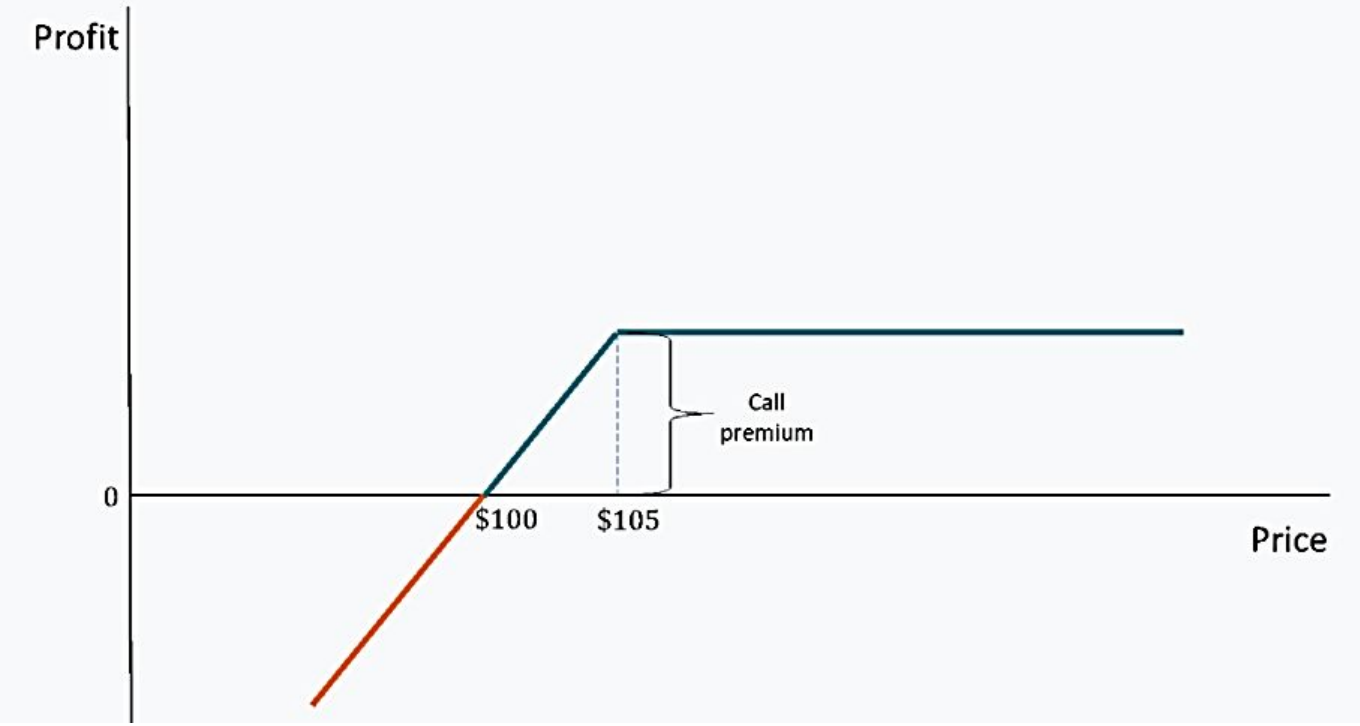
Scenario 1: Stock price remains at $100 per share.
In such a scenario, the buyer will not exercise the call option because it is out-of-money (strike price exceeds the market price). Since the price will remain unchanged, you will not earn any return from the stock. However, you will earn $3 per share from the call premium.

Scenario 2: Stock price increases to $110.
If a stock price increases to $110 per share after six months, the buyer will exercise the call option. You will receive $105 per share (strike price of the option) and the $3 per share from the call premium. In this covered call scenario, you've sacrificed a small portion of potential profit in return for risk protection.

Scenario 3: Stock price decreases to $90.
In such a case, the call option will expire similarly to scenario 1. The stock will lose $10 per share in value, but the call premium of $3 per share will partially offset the loss. Thus, your final loss will be $7 per share.

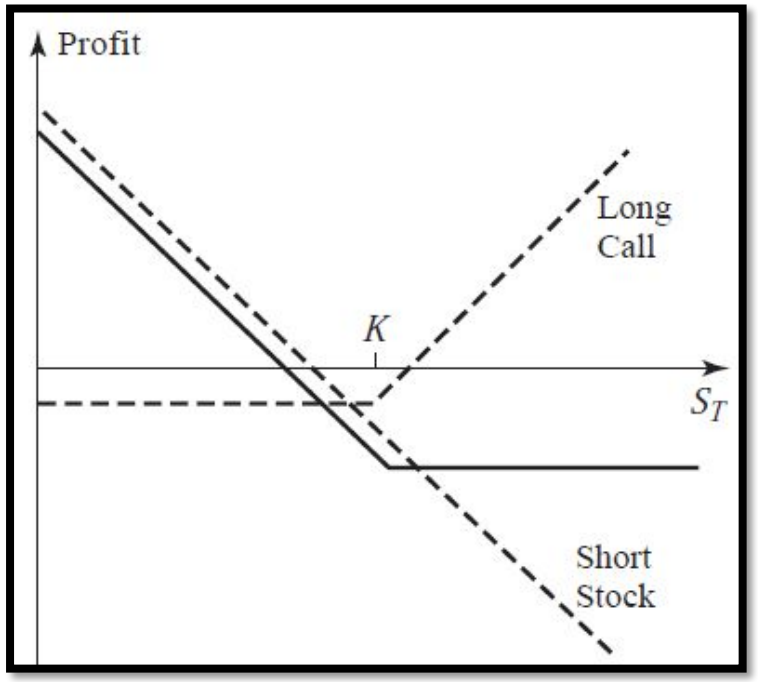
2.1 Example!

The profit graph looks like this:



2.2 Short Stock & Long Call

A portfolio consisting of a short position in a stock is combined with a long position in a call option. This is the reverse of writing a covered call.
This can also be considered as a Protective call.

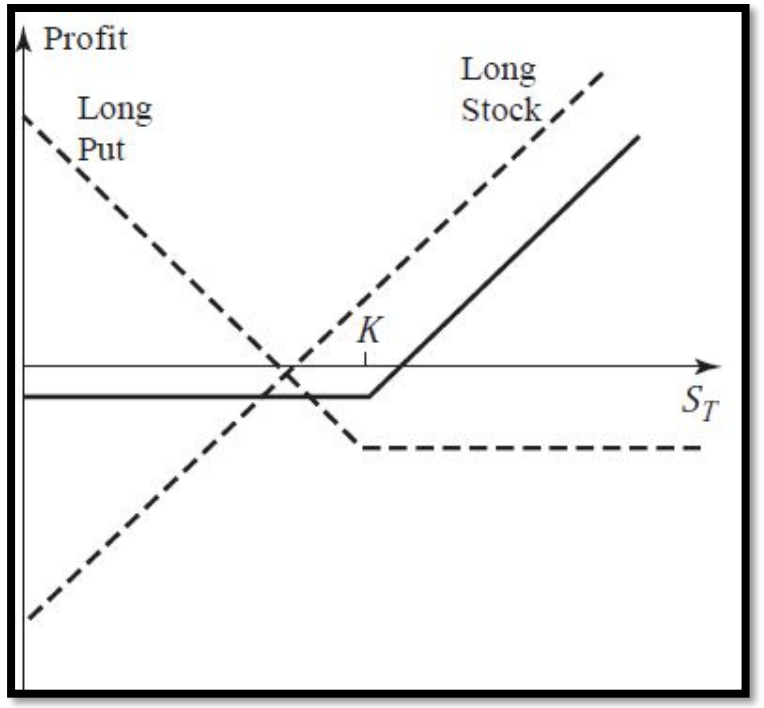


2.3 Long Put & Long Stock

The investment strategy that involves buying a European put option on a stock and the stock itself. The approach is referred to as a protective put strategy.
A protective put strategy is also known as a Synthetic call.

A Synthetic Call option strategy is when a trader is Bullish on long term holdings but is also concerned with the associated downside risk.

A protective put strategy is analogous to the nature of insurance. The main goal of a protective put is to limit potential losses that may result from an unexpected price drop of the underlying asset.



2.3 Example!

You own 100 shares in RIL, with each share valued at $100. You believe that the price of your shares will increase in the future.

However, you want to hedge against the risk of an unexpected price decline.

Therefore, you decide to purchase one protective put contract (one put contract contains 100 shares) with a strike price of $100. The premium of the protective put is $5.

The payoff from the protective put depends on the future price of the company's shares. The following scenarios are possible:

2.3 Example!

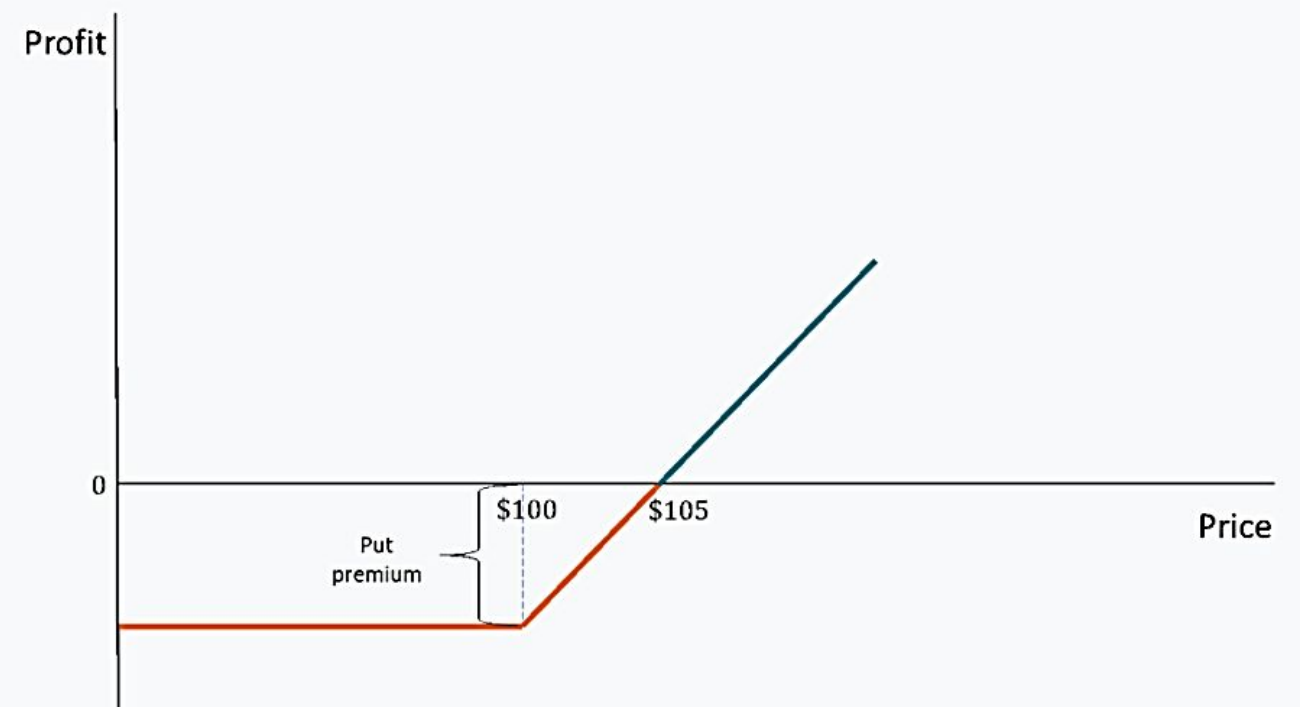
Scenario 1: Share price above $105.
If the share price goes beyond $105, you will experience an unrealized gain. The profit can be calculated as Current Share Price – $105 (it includes initial share price plus put premium). The put will not be exercised.

Scenario 2: Share price between $100 and $105.
In this scenario, the share price will remain the same or slightly rise. However, you will still lose money or hit the breakeven point in the best case. The small loss is caused by the premium you paid for the put contract. Similar to the previous scenario, the put will not be exercised.

Scenario 3: Share price below $100.
In this case, you will exercise the protective put option to limit the losses. After the put is exercised, you will sell your 100 shares at $100. Thus, your loss will be limited to the premium paid for the protective put.

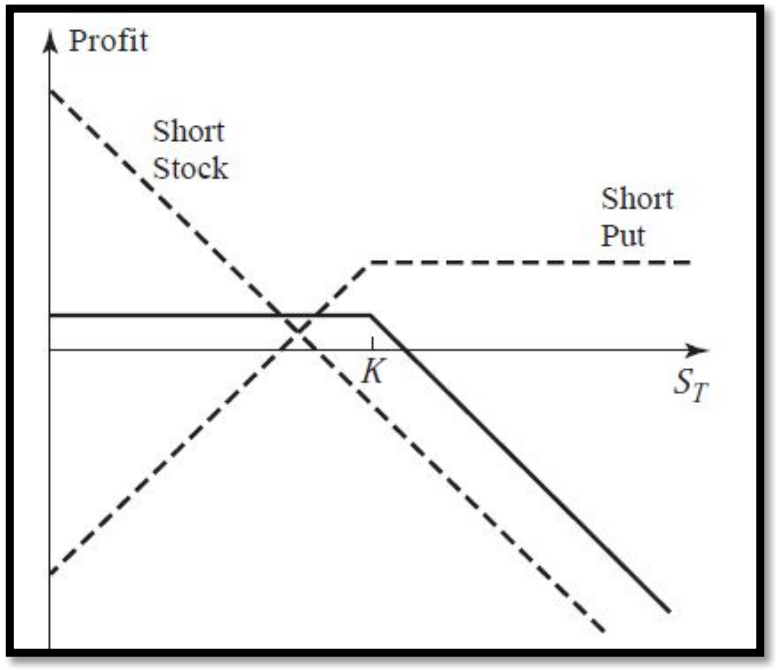
2.3 Example!

The profit graph looks like this:



2.4 Short Put & Short Stock

Portfolio with a short position in a put option is combined with a short position in the stock. This is the reverse of a protective put.
This can be also called as a covered put or a married put.



3 Spreads

An options spread is an options trading strategy in which a trader will buy and sell multiple options of the same type – either call or put – with the same underlying asset. These options are similar, but typically vary in terms of strike price, expiry date, or both.

Any spread that is constructed using calls can be referred to as a call spread. Similarly, put spreads are spreads created using put options.

3.1 Why Option Spreads

- Option buyers can consider using spreads to reduce the net cost of entering a trade.
- Options spreads are common strategies used to minimize risk or bet on various market outcomes using two or more options.
- Naked option sellers can use spreads instead to lower margin requirements so as to free up buying power while simultaneously putting a cap on the maximum loss potential.

3.2 Main Types of Spreads

The three basic classes of spreads are the vertical spread, the horizontal spread and the diagonal spread. They are categorized by the relationships between the strike price and expiration dates of the options involved.

- **Vertical spreads** are constructed using options of the same class, same underlying security, same expiration month, but at different strike prices.
- **Horizontal** spreads are constructed using options of the same underlying security, same strike prices but with different expiration dates.
- **Diagonal** spreads are created using options of the same underlying security but different strike prices and expiration dates.

4 Bull Spreads

Bull spread can be created by buying a European call option on a stock with a certain strike price and selling a European call option on the same stock with a higher strike price. Both options have the same expiration date. This is a vertical spread.

Bull spreads can be created using put options also.

An investor who enters into a bull spread is hoping that the stock price will increase.

4.1 Bull Call Spread

- The strategy involves taking two positions of buying a Call Option and selling of a Call Option. The risk and reward in this strategy is limited.
- A Bull Call Spread strategy generally involves Buy ITM Call Option and Sell OTM Call Option.

- A Bull Call Spread strategy works well when you're Bullish of the market but expect the underlying to gain mildly in near future.
- Because a call price always decreases as the strike price increases, the value of the option sold is always less than the value of the option bought.
- A bull spread, when created from calls, therefore requires an initial investment.

4.1 Bull Call Spread

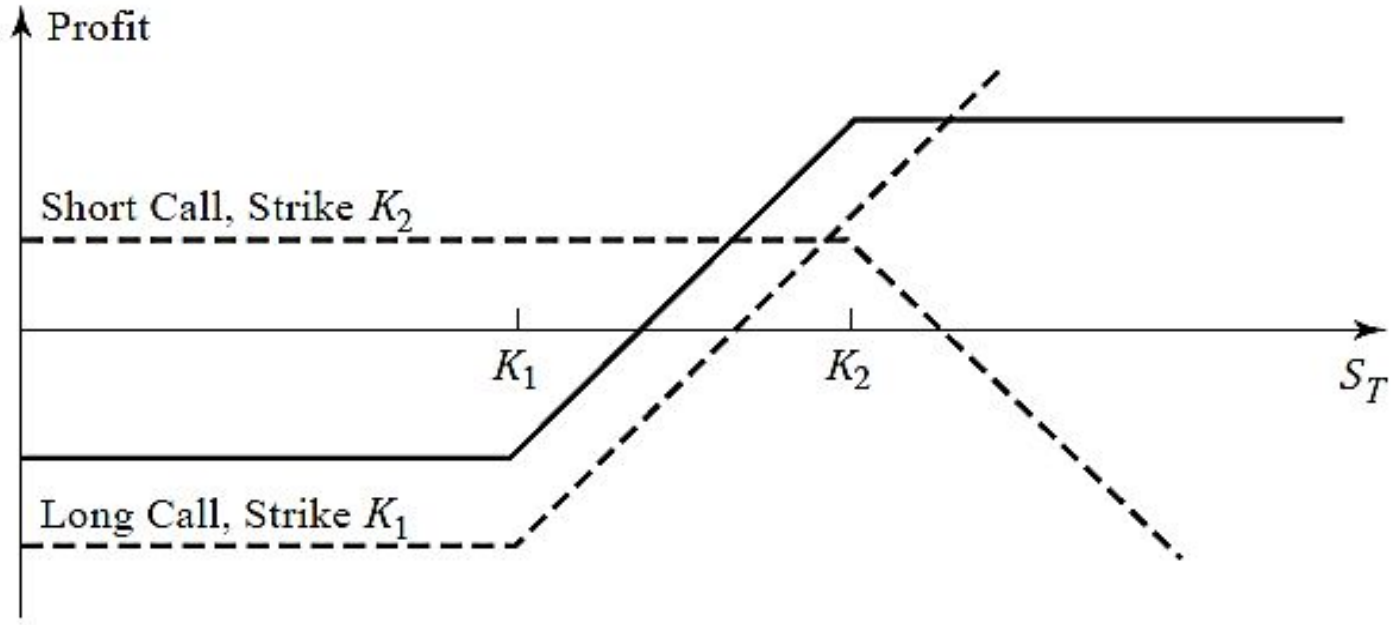
A bull spread strategy limits the investor's upside as well as downside risk. The strategy can be described by saying that the investor has bought a call option with a strike price equal to K_1 and has chosen to give up some upside potential by selling a call option with strike price K_2 ($K_2 > K_1$). In return for giving up the upside potential, the investor gets the price of the option with strike price K_2.

Payoff from bull spread using call options.

Stock price range	*Payoff from long call option*	*Payoff from short call option*	*Total payoff*
$S_T \leqslant K_1$	0	0	0
$K_1 < S_T < K_2$	$S_T - K_1$	0	$S_T - K_1$
$S_T \geqslant K_2$	$S_T - K_1$	$-(S_T - K_2)$	$K_2 - K_1$

4.1 Bull Call Spread

Profit from bull spread created using call options.



4.1 Bull Call Spread - Example

Suppose you are bullish on Nifty, currently trading 10,500, and expecting a mild rise in its price. You can benefit from this strategy by buying a Call with a Strike price of 10,300 at a premium of 170 and selling a Call option with a strike price 10,700 at a premium of Rs 60. The net premium paid here is Rs 110 which is also your maximum loss.

Bull Call Spread of NIFTY

Current Nifty	10,500
Option Lot Size	75
Strike Price of Call Option	Rs 10,300
Premium Paid	Rs 170
Strike Price of short Call Option	10,700
Premium Received	Rs 60
Net Premium Paid	Rs 110
Break Even Point (Strike Price of bought call + Net Premium)	10,410

4.1 Bull Call Spread - Example

What has the Bull Call Spread done for the Investor??

The Bull Call spread strategy has done 3 things:

- It has brought down the break-even point. If only the Call Option was purchased, the break-even point would have been 10, 470. Now it is 10,410.

- It has brought down the net premium. If only the Call Option was purchased, the premium paid would have been Rs 170. Now it is Rs 110.

- It has also brought down the extent of the loss. If only the Call Option was purchased, the maximum loss would have been Rs 170. Now it is Rs 110.

4.1 Bull Call Spread - Example

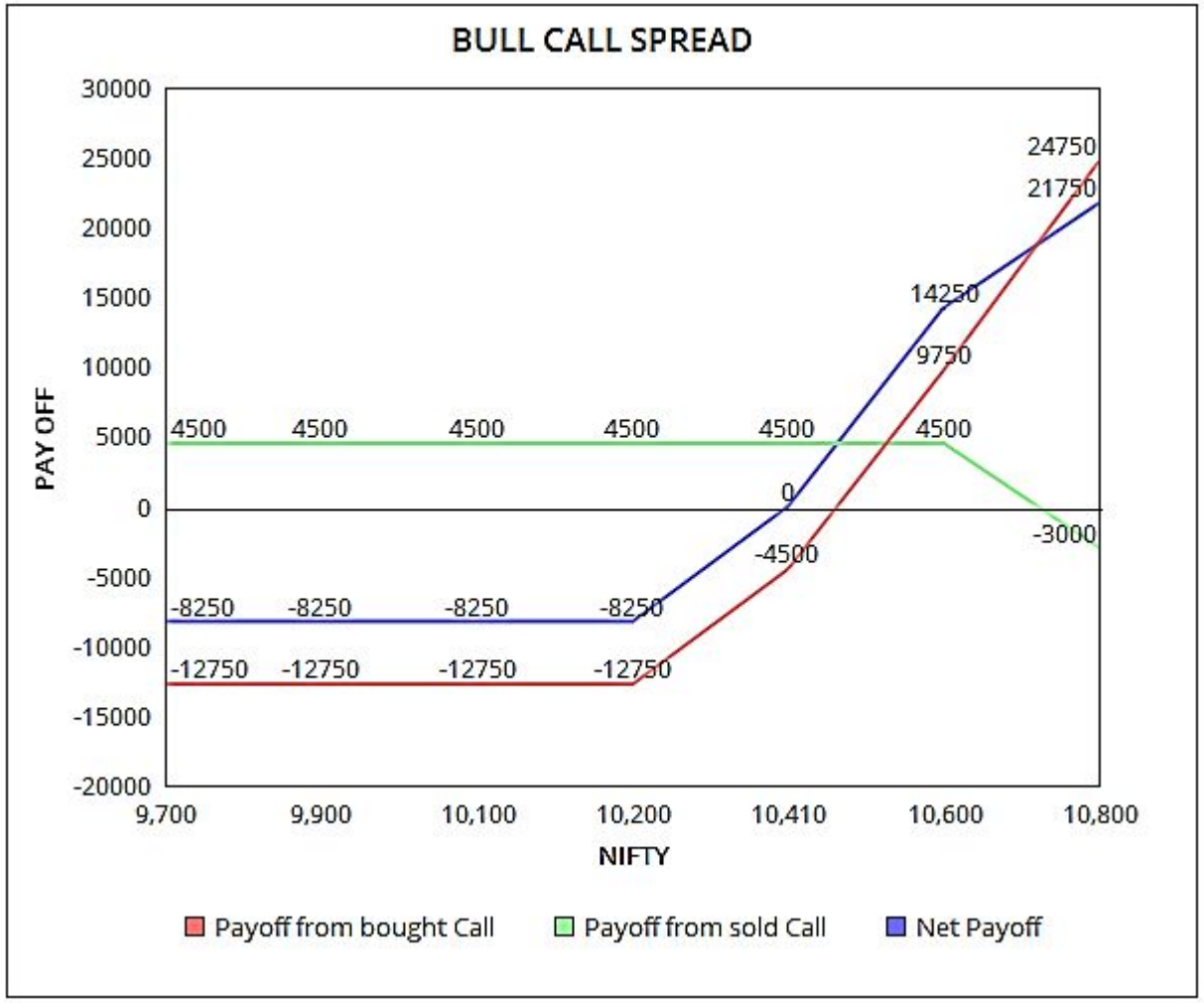
Bull Call Spread Strategy Payoff Schedule

Payoff Schedule

	Payoff from		
Nifty on Expiry	**Long Call Option (SP-BEP) BEP = 10,470 Max Loss = 12750**	**Short Call Option (BEP-SP) BEP = 10,760 Max Profit = 4500**	**Net Payoff(Rs)**
9,700	-12750	4500	-8250
9,900	-12750	4500	-8250
10,100	-12750	4500	-8250
10,200	-12750	4500	-8250
10,410	-4500	4500	0
10,600	9750	4500	14250
10,800	24750	-3000	21750

4.1 Bull Call Spread - Example

Bull Call Spread Strategy Payoff Graph



4.2 Bull Put Spread

- A Bull Put Strategy involves Buy OTM Put Option and Sell ITM Put Option.
- This strategy works well when you're of the view that the price of a particular underlying will rise, move sideways, or marginally fall.

For example –
Date – 7th December 2015
Outlook – Moderately bullish (expect the market to go higher)
Nifty Spot – 7805

Bull Put Spread, trade set up –

- **Buy 7700 PE** by paying Rs.72/- as premium; do note this is an OTM option. Since money is going out of my account this is a debit transaction
- **Sell 7900 PE** and receive Rs.163/- as premium, do note this is an ITM option. Since I receive money, this is a credit transaction
- The net cash flow is the difference between the debit and credit i.e 163 – 72 = **+91,** since this is a positive cash flow, there is a net credit to my account.

4.2 Bull Put Spread

After we initiate the trade, the market can move in any direction and expiry at any level. Therefore let us take up a few scenarios to get a sense of what would happen to the bull put spread for different levels of expiry.

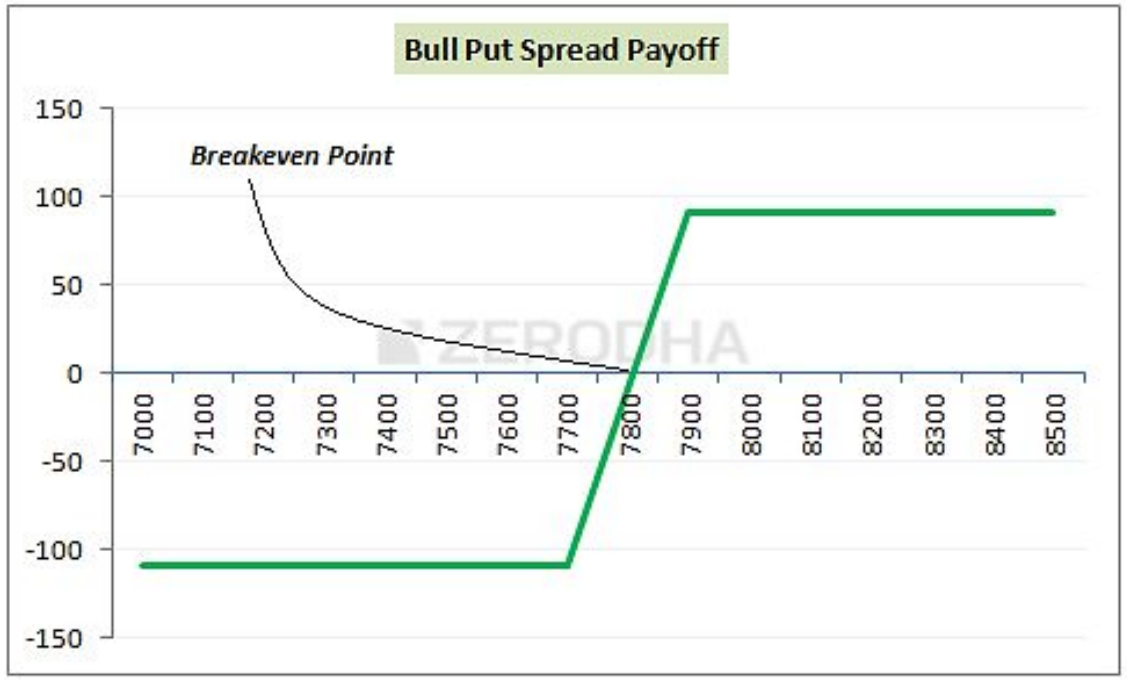
Market Expiry	7700 PE (intrinsic value)	7900 PE (intrinsic value)	Net pay off
7600	100	300	-109
7700	0	200	-109
7900	0	0	91
8000	0	0	91

From this analysis, 3 things should be clear to you –

1. The strategy is profitable as and when the market moves higher
2. Irrespective of the down move in the market, the loss is restricted to Rs.109, the maximum loss also happens to be the difference between "**Spread and net credit**' of the strategy
3. The maximum profit is capped to 91. This also happens to be the **net credit** of the strategy.

4.2 Bull Put Spread

This is how the pay off diagram of the Bull Put Spread looks like –



Question

Suppose that put options on a stock with strike prices $30 and $35 cost $4 and $7, respectively. How can the options be used to create a bull spread? Construct a table that shows the profit and payoff for spread.

Solution

A bull spread is created by buying the \$30 put and selling the \$35 put. This strategy gives rise to an initial cash inflow of \$3. The outcome is as follows:

Stock Price	Payoff	Profit
$S_T \geq 35$	0	3
$30 \leq S_T < 35$	$S_T - 35$	$S_T - 32$
$S_T < 30$	-5	-2

5 Bear Spreads

- A bear spread is a bearish options strategy used when an investor expects a moderate decline in the price of the underlying asset.
- There are two types of bear spreads that a trader can initiate—a bear put spread and a bear call spread.
- The strategy involves the simultaneous purchase and sale of either puts or calls for the same underlying contract with the same expiration date but at different strike prices.
- Bear spreads achieve maximum profit if the underlying asset closes at or below the lower strike price.

5.1 Bear Put Spread

The Bear Put strategy involves selling a Put Option while simultaneously buying a Put option.

This strategy is used when the trader believes that the price of underlying asset will go down moderately. The strategy minimizes your risk in the event of prime movements going against your expectations.

5.1 Bear Put Spread - Example

Suppose Bank Nifty Spot Price is 8900. The Bank Nifty Lot Size is 25.

Consider the following Bear Put Strategy

	Strike Price(Rs)	Premium(Rs)	Total Premium Paid(Rs) (Premium * lot size 25)
Buy 1 ITM Put	9100	500	12500
Sell 1 OTM Put	8800	400	10000
Net Premium (500-400)		**100**	2500

5.1 Bear Put Spread - Example

The analysis is as follows:

Breakeven(Rs)	Strike price of the Long Put – Net Premium (9100 – 100)	9000
Maximum Possible Loss (Rs)	Net Premium Received * Lot Size (100)*25	2500
Maximum Possible Profit (Rs)	(Strike Price of Long Put – Strike Price of Short Put – Net Premium Paid) * Lot Size (9100-8800-100)*25	5000

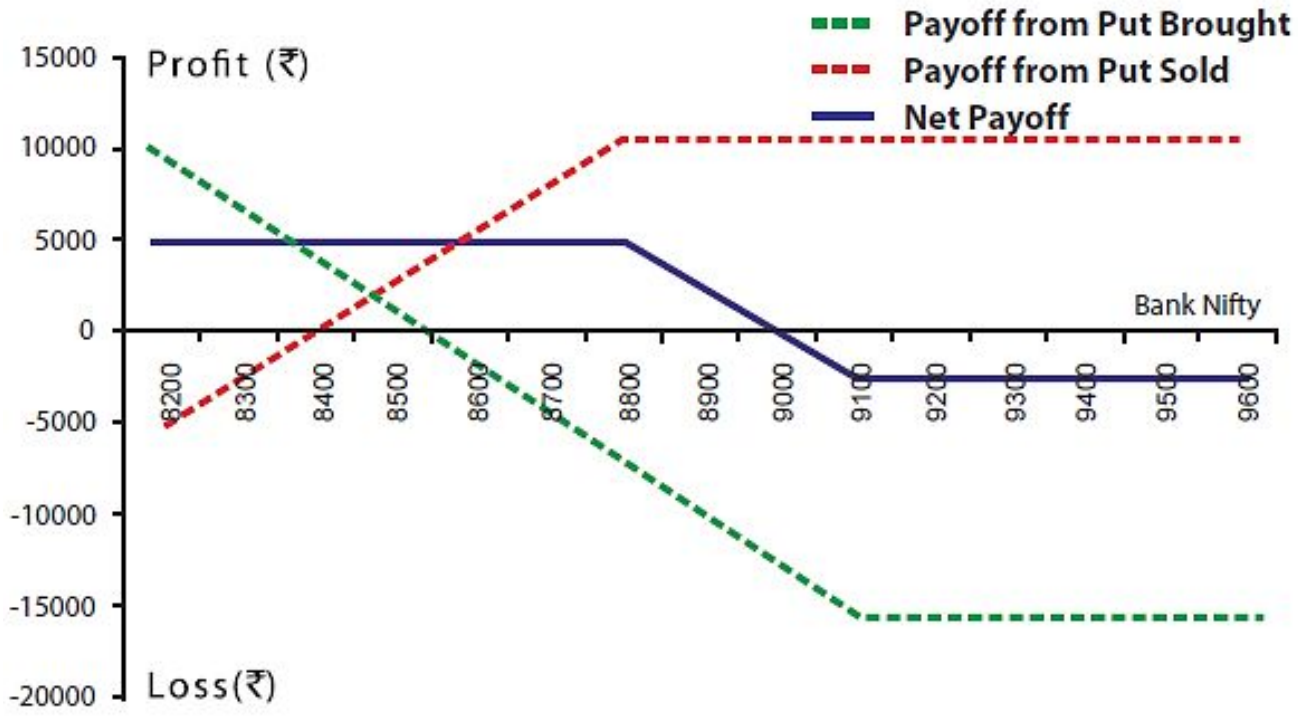
5.1 Bear Put Spread - Example

Market scenarios possible during expiry

On Expiry Bank NIFTY closes at	Net Payoff from 1 ITM Put Brought (Rs) @9100	Net Payoff from 1 OTM Put Sold (Rs) @8800	Net Payoff (Rs)
8600	0	5000	5000
8800	-5000	10000	5000
9000	-10000	10000	0
9200	-12500	10000	-2500
9400	-12500	10000	-2500

5.1 Bear Put Spread - Example

The payoff Graph looks like:



Question

Suppose that put options on a stock with strike prices $30 and $35 cost $4 and $7, respectively. How can the options be used to create a bear spread? Construct a table that shows the profit and payoff for the spread.

Solution

A bear spread is created by selling the \$30 put and buying the \$35 put. This strategy costs \$3 initially. The outcome is as follows:

Stock Price	Payoff	Profit
$S_T \geq 35$	0	-3
$30 \leq S_T < 35$	$35 - S_T$	$32 - S_T$
$S_T < 30$	5	2

5.2 Bear Call Spread

A Bear Call Spread strategy involves buying a Call Option while simultaneously selling a Call Option of lower strike price on same underlying asset and expiry date.

You receive a premium for selling a Call Option and pay a premium for buying a Call Option. So your cost of investment is much lower.

This strategy is used when the trader believes that the price of underlying asset will go down moderately.

5.2 Bear Call Spread - Example

Bear Call Spread Example
Bank Nifty

Bank Nifty Spot Price	8900
Bank Nifty Lot Size	25

Bear Call Spread Options Strategy

	Strike Price(Rs)	**Premium(Rs)**	**Total Premium Paid(Rs) (Premium * lot size 25)**
Buy 1 OTM Call	9000	400	10000
Sell 1 ITM Call	8800	500	12500
Net Premium (500-400)		**100**	2500

5.2 Bear Call Spread - Example

The analysis is as follows:

Breakeven(Rs)	Strike price of the Ssort Call + Net Premium (8800 + 100)	8900
Maximum Possible Loss (Rs)	(Strike Price of Long Call - Strike Price of Short Call - Net Premium Received) * Lot Size (9000-8800-100)*25	2500
Maximum Possible Profit (Rs)	Net Premium Received * Lot Size (100)*25	2500

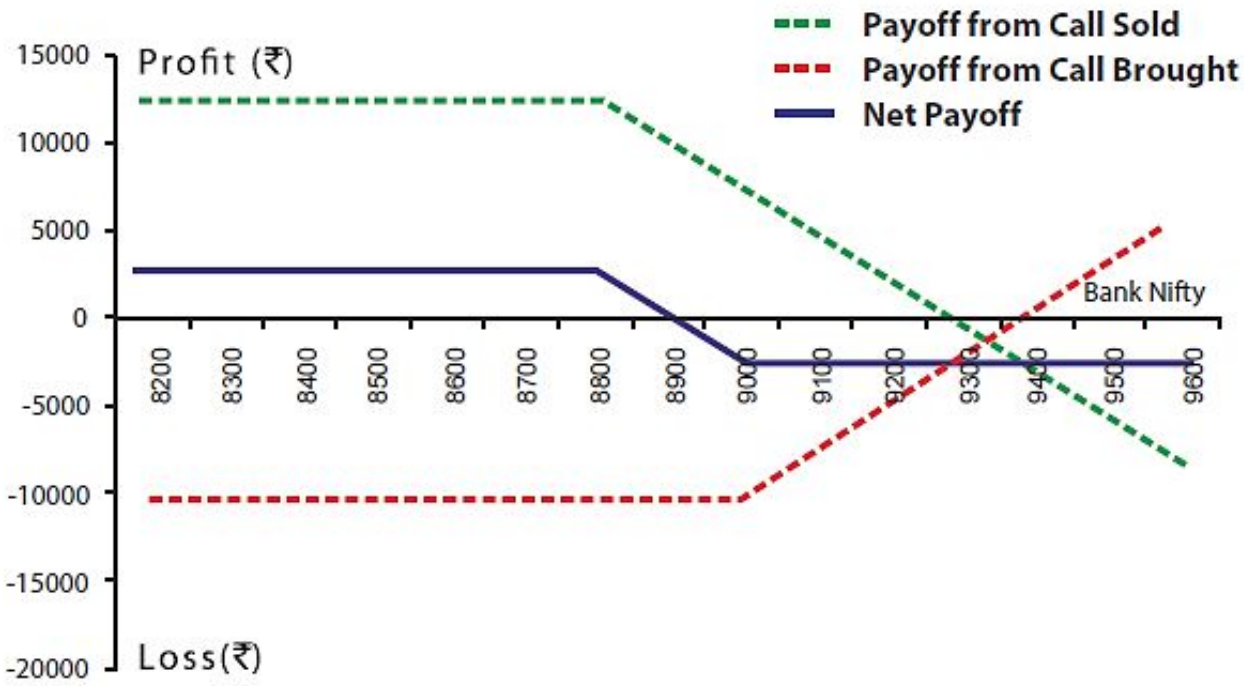
5.1 Bear Call Spread - Example

Market scenarios at expiry:

On Expiry Bank NIFTY closes at	Net Payoff from 1 ITM Call Sold (Rs) @8800	Net Payoff from 1 OTM Call Brought (Rs) @9000	Net Payoff (Rs)
8500	12500	-10000	2500
8700	12500	-10000	2500
8900	10000	-10000	0
9100	5000	-7500	-2500
9300	0	-2500	-2500

5.1 Bear Call Spread - Example

The Payoff Graph looks like:



6 Box Spread

Box Spread is an arbitrage strategy. It involves buying a Bull Call Spread (1 ITM and 1 OTM Call) together with the corresponding Bear Put Spread (1 ITM and 1 OTM Put), with both spreads having the same strike prices and expiration dates.

The strategy is called Box Spread as it is combination of 2 spreads (4 trades) and the profit/loss calculated together as 1 trade.

6 Box Spread

A box spread is a combination of a bull call spread with strike prices K_1 and K_2 and a bear put spread with the same two strike prices. As shown in Table below, the payoff from a box spread is always K_2 - K_1. The value of a box spread is therefore always the present value of this payoff or $(K_2 - K_1)\, e^{-rT}$. If it has a different value there is an arbitrage opportunity.

If the market price of the box spread is too low, it is profitable to buy the box. This involves buying a call with strike price K_1, buying a put with strike price K_2, selling a call with strike price K_2, and selling a put with strike price K_1.

If the market price of the box spread is too high, it is profitable to sell the box. This involves buying a call with strike price K_2, buying a put with strike price K_1, selling a call with strike price K_1, and selling a put with strike price K_2.

It is important to realize that a box-spread arbitrage only works with European options.

6 Box Spread

As shown in Table below, the payoff from a box spread is always K_2 - K_1. The value of a box spread is therefore always the present value of this payoff or (K_2 - K_1) e^{-rT}.

Stock price range	*Payoff from bull call spread*	*Payoff from bear put spread*	*Total payoff*
$S_T \leqslant K_1$	0	$K_2 - K_1$	$K_2 - K_1$
$K_1 < S_T < K_2$	$S_T - K_1$	$K_2 - S_T$	$K_2 - K_1$
$S_T \geqslant K_2$	$K_2 - K_1$	0	$K_2 - K_1$

6.1 Box Spread - Example

Consider Company A that is trading at $25 per share. In order to execute a box spread, the investor needs to purchase an in-the-money (ITM) call and put and then turn around and sell an out-of-the-money (OTM) call and put.

Company A buys:
20 (ITM) calls for $650 debit
30 (ITM) puts for $600 debit

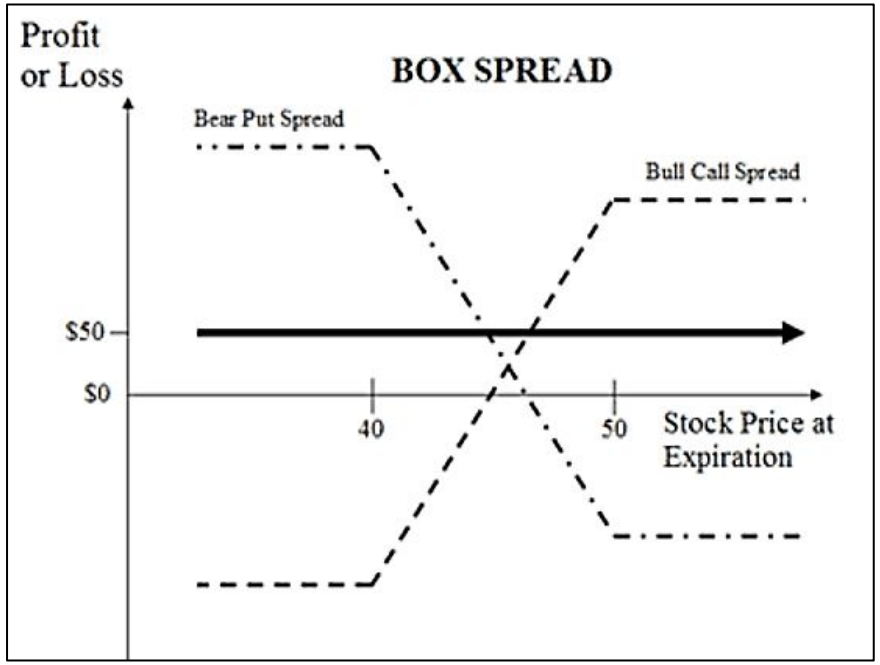
Company A sells:
30 (OTM) calls for $150 credit
20 (OTM) puts for $150 credit

6.1 Box Spread - Example

Before any commissions are added, the total cost to the trader is as follows:
$650 – $150 (call spread) = $500
$600 – $150 (put spread) = $450
So, the total cost of the box spread is **$950**.

The strike price spread is the difference between the highest and lowest strike prices. For the example above, the spread would be 30 – 20 = 10. There are four legs to the box. Each options contract contains 100 shares:
100 shares x $10 = $1,000
The total of the expiration value of the box spread is **$1,000**.

The profit (before transaction costs) for the spread options strategy is then $1,000 – $950 = **$50**.



Question

“A box spread comprises four options. Two can be combined to create a long forward position and two can be combined to create a short forward position.”

Explain this statement.

Question

A box spread is a bull spread created using calls and a bear spread created using puts. With the notation in the text it consists of a) a long call with strike K_1, b) a short call with strike K_2, c) a long put with strike K_2, and d) a short put with strike K_1. a) and d) give a long forward contract with delivery price K_1; b) and c) give a short forward contract with delivery price K_2. The two forward contracts taken together give the payoff of $K_2 - K_1$.

7 Butterfly Spread

A butterfly spread involves positions in options with three different strike prices. This strategy should be used when you're expecting no volatility in the price of the underlying.

Butterfly Spread using call options

It can be created by buying a European call option with a relatively low strike price K_1, buying a European call option with a relatively high strike price K_3, and selling two European call options with a strike price K_2 that is halfway between K_1 and K_3.

Generally, K_2 is close to the current stock price.

A butterfly spread leads to a profit if the stock price stays close to K_2, but gives rise to a small loss if there is a significant stock price move in either direction.

The strategy requires a small investment initially.

7 Butterfly Spread

It can be created by buying a European call option with a relatively low strike price K_1, buying a European call option with a relatively high strike price K_3, and selling two European call options with a strike price K_2 that is halfway between K_1 and K_3.

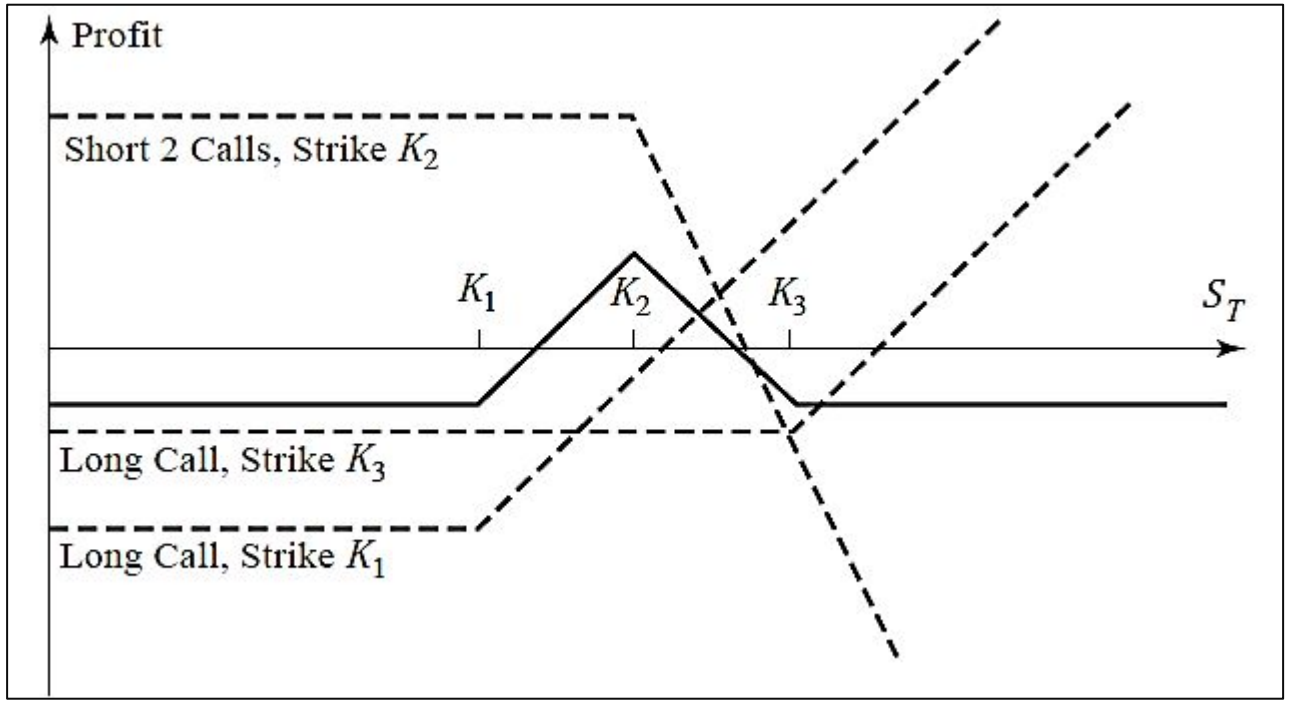
The payoff from a butterfly spread is shown in Table below

Stock price range	*Payoff from first long call*	*Payoff from second long call*	*Payoff from short calls*	*Total payoff**
$S_T \leqslant K_1$	0	0	0	0
$K_1 < S_T \leqslant K_2$	$S_T - K_1$	0	0	$S_T - K_1$
$K_2 < S_T < K_3$	$S_T - K_1$	0	$-2(S_T - K_2)$	$K_3 - S_T$
$S_T \geqslant K_3$	$S_T - K_1$	$S_T - K_3$	$-2(S_T - K_2)$	0

* These payoffs are calculated using the relationship $K_2 = 0.5(K_1 + K_3)$.

7 Butterfly Spread

The pattern of profits from the strategy (butterfly spread using call options) is shown in Figure below:

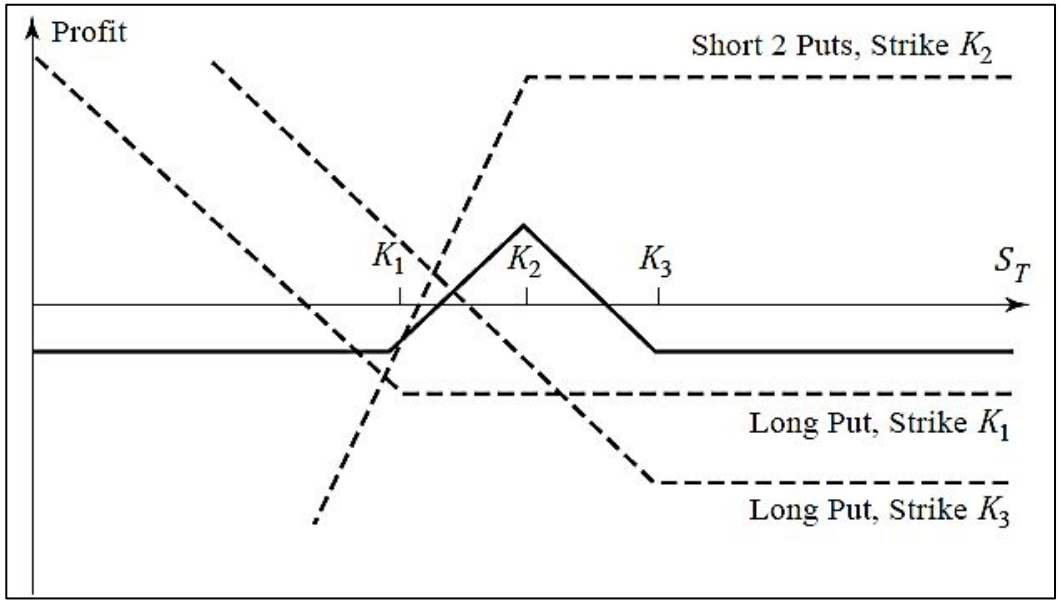


7 Butterfly Spread

Butterfly spread using put options

Butterfly spreads can be created using put options. The investor buys two European puts, one with a low strike price and one with a high strike price, and sells two European puts with an intermediate strike price.

The profit pattern is shown in the graph below:



7.1 Butterfly Spread - Example

Suppose that a certain stock is currently worth $61. Consider an investor who feels that a significant price move in the next 6 months is unlikely. Suppose that the market prices of 6-month European calls are as follows:

Strike price ($)	Call price ($)
55	10
60	7
65	5

How can a butterfly spread be created in this situation?

7.1 Butterfly Spread - Example

The investor could create a butterfly spread by buying one call with a $55 strike price, buying one call with a $65 strike price, and selling two calls with a $60 strike price.

It costs $10 + $5 – (2 x $7) = $1 to create the spread.

If the stock price in 6 months is greater than $65 or less than $55, the total payoff is zero, and the investor incurs a net loss of $1.

If the stock price is between $56 and $64, a profit is made. The maximum profit, $4, occurs when the stock price in 6 months is $60.

Question

Call options on a stock are available with strike prices of $15, $17.5 , and $20, and expiration dates in 3 months. Their prices are $4, $2, and $1/2, respectively.

Explain how the options can be used to create a butterfly spread. Construct a table showing how profit varies with stock price for the butterfly spread.

Question

An investor can create a butterfly spread by buying call options with strike prices of \$15 and \$20 and selling two call options with strike prices of $\$17\frac{1}{2}$. The initial investment is $4 + \frac{1}{2} - 2 \times 2 = \$\frac{1}{2}$. The following table shows the variation of profit with the final stock price:

Stock Price S_T	Profit
$S_T < 15$	$-\frac{1}{2}$
$15 < S_T < 17\frac{1}{2}$	$(S_T - 15) - \frac{1}{2}$
$17\frac{1}{2} < S_T < 20$	$(20 - S_T) - \frac{1}{2}$
$S_T > 20$	$-\frac{1}{2}$

Question

1. A protective put strategy is

A. A long put plus a long position in the underlying asset.
B. A long put plus a long call on the same underlying asset.
C. A long call plus a short put on the same underlying asset.
D. A long put plus a short call on the same underlying asset.

Answer: A

Question

2. A covered call position is

A. The simultaneous purchase of the call and the underlying asset.
B. The purchase of a share of stock with a simultaneous sale of a put on that stock.
C. The short sale of a share of stock with a simultaneous sale of a call on that stock.
D. The purchase of a share of stock with a simultaneous sale of a call on that stock.

Answer: D

8 Calendar Spreads

Up to now we have assumed that the options used to create a spread all expire at the same time. We now move on to calendar spreads in which the options have the same strike price and different expiration dates.

A calendar spread is an options or futures strategy established by simultaneously entering a long and short position on the same underlying asset but with different delivery dates.

The longer the maturity of an option, the more expensive it usually is. A calendar spread therefore usually requires an initial investment.

Profit diagrams for calendar spreads are usually produced so that they show the profit when the short-maturity option expires on the assumption that the long-maturity option is closed out at that time.

8 Calendar Spreads

Understanding Profit Patterns from a Calendar Spread

A calendar spread can be created by selling a European call option with a certain strike price and buying a longer-maturity European call option with the same strike price

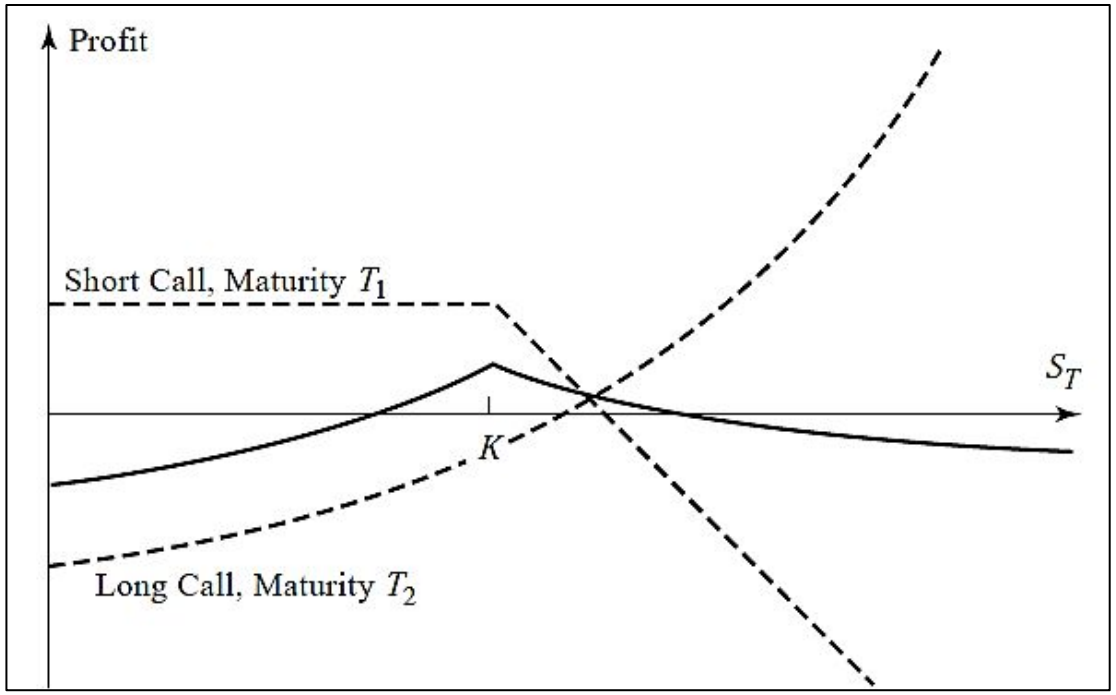
To understand the profit pattern from a calendar spread, first consider what happens if the stock price is very low when the short-maturity option expires. The short-maturity option is worthless and the value of the long-maturity option is close to zero. The investor therefore incurs a loss that is close to the cost of setting up the spread initially.

Consider next what happens if the stock price, S_T , is very high when the short-maturity option expires. The short-maturity option costs the investor S_T - K , and the long maturity option is worth close to S_T - K , where K is the strike price of the options. Again, the investor makes a net loss that is close to the cost of setting up the spread initially.

If S_T is close to K, the short-maturity option costs the investor either a small amount or nothing at all. However, the long-maturity option is still quite valuable. In this case a significant net profit is made.

8 Calendar spreads

Profit from calendar spread created using two call options, calculated at the time when the short-maturity call option expires.



8.1 Calendar Spreads - Types

- In a neutral calendar spread, a strike price close to the current stock price is chosen.
- A bullish calendar spread involves a higher strike price, whereas a bearish calendar spread involves a lower strike price.
- Calendar spreads can be created with put options as well as call options. The investor buys a long-maturity put option and sells a short-maturity put option.
- A reverse calendar spread is the opposite to that in normal one. The investor buys a short-maturity option and sells a long-maturity option. A small profit arises if the stock price at the expiration of the short-maturity option is well above or well below the strike price of the short-maturity option. However, a significant loss results if it is close to the strike price

8 Calendar Spreads

Watch Video – Calendar Spreads

https://www.cmegroup.com/education/courses/option-strategies/option-calendar-spreads.html

9 Combinations

A combination is an option trading strategy that involves taking a position in both calls and puts on the same stock.

We will consider 4 combinations

- Straddles
- Strips
- Straps
- Strangles.

9.1 Straddle

One popular combination is a straddle, which involves buying a European call and put with the same strike price and expiration date.

In a long straddle, the trader buys both the call and put options. The expiry date and strike price for the options must be the same. It is also known as bottom straddle.

A short straddle is the opposite of a long straddle and happens when the trader sells both call and put options with the same strike price and date of expiry. It is also known as top straddle.

A straddle is appropriate when an investor is expecting a large move in a stock price but does not know in which direction the move will be.

9.1 Straddle

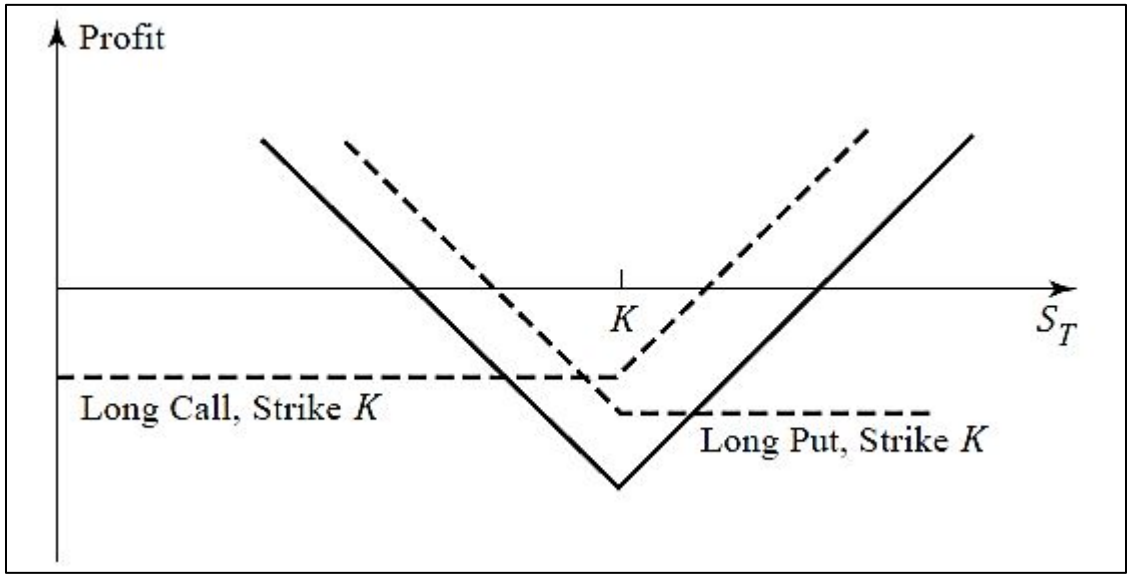
The strike price is denoted by K. If the stock price is close to this strike price at expiration of the options, the straddle leads to a loss. However, if there is a sufficiently large move in either direction, a significant profit will result.

The payoff from a straddle is as explained in the table:

Range of stock price	*Payoff from call*	*Payoff from put*	*Total payoff*
$S_T \leqslant K$	0	$K - S_T$	$K - S_T$
$S_T > K$	$S_T - K$	0	$S_T - K$

9.1 Straddle

The profit from a straddle is shown in the figure below:



9.1 Straddle - Example

Consider an investor who feels that the price of a certain stock, currently valued at $69 by the market, will move significantly in the next 3 months.

The investor could create a straddle by buying both a put and a call with a strike price of $70 and an expiration date in 3 months. Suppose that the call costs $4 and the put costs $3.

If the stock price stays at $69, it is easy to see that the strategy costs the investor $6. (An up-front investment of $7 is required, the call expires worthless, and the put expires worth $1.)

If the stock price moves to $70, a loss of $7 is experienced. (This is the worst that can happen.)

However, if the stock price jumps up to $90, a profit of $13 is made; if the stock moves down to $55, a profit of $8 is made; and so on.

Question

A call with a strike price of $60 costs $6. A put with the same strike price and expiration date costs $4. Construct a table that shows the profit from a straddle. For what range of stock prices would the straddle lead to a loss?

Solution

A straddle is created by buying both the call and the put. This strategy costs \$10. The profit/loss is shown in the following table:

Stock Price	Payoff	Profit
$S_T > 60$	$S_T - 60$	$S_T - 70$
$S_T \leq 60$	$60 - S_T$	$50 - S_T$

This shows that the straddle will lead to a loss if the final stock price is between \$50 and \$70.

9.1 Straddle

How to Make Money from Trading Straddles

Suppose that a big move is expected in a company's stock price because there is a takeover bid for the company or the outcome of a major lawsuit involving the company is about to be announced. Should you trade a straddle?

A straddle seems a natural trading strategy in this case. However, if your view of the company's situation is much the same as that of other market participants, this view will be reflected in the prices of options. Options on the stock will be significantly more expensive than options on a similar stock for which no jump is expected. The *V* –shaped profit pattern from the straddle will have moved downward, so that a bigger move in the stock price is necessary for you to make a profit.

For a straddle to be an effective strategy, you must believe that there are likely to be big movements in the stock price and these beliefs must be different from those of most other investors. Market prices incorporate the beliefs of market participants.

To make money from any investment strategy, you must take a view that is different from most of the rest of the market—and you must be right!

9.2 Strips

A strip consists of a long position in one European call and two European puts with the same strike price and expiration date .

In a strip the investor is betting that there will be a big stock price move and considers a decrease in the stock price to be more likely than an increase. Consequently, they purchase two puts to double their potential profits from any decreases in the stock's value.

The maximum potential loss on a strip is the price paid for the options plus fees or commissions where as there can be maximum unlimited profit.

Strip Option Strategy Construction
Buy 2 ATM Put Options
Buy 1 ATM Call Option

9.2 Strips - Example!

Ms. Annie is bearish on NIFTY and enters in a Strip Strategy, buys 2 5200 NIFTY ATM Put Options at a premium of Rs. 85, buys 1 5200 ATM Call Option at a premium of Rs. 100. Her net investment will be Rs. 13500 [{(85*2) + (100)}*50]

Market Outcomes

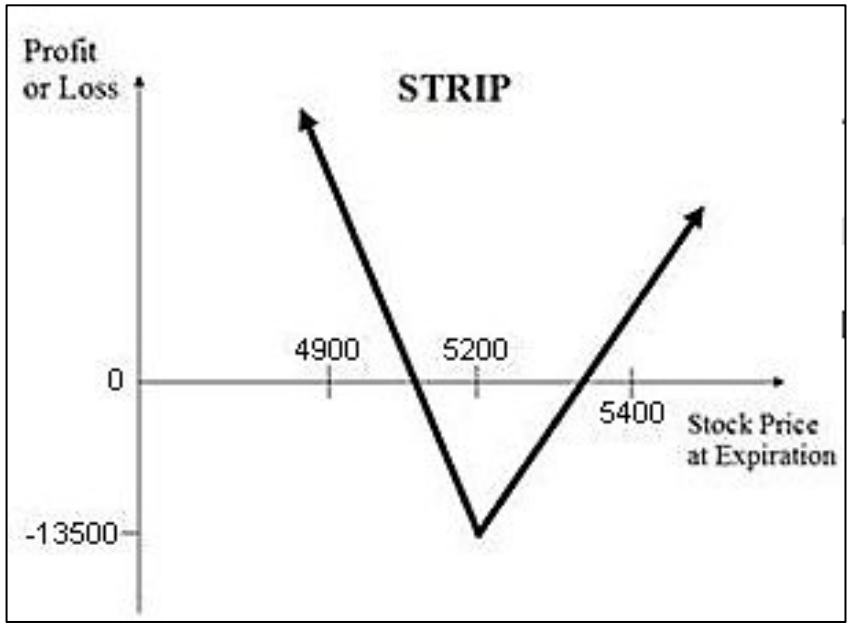
Case 1: At expiry if NIFTY closes at 4900, then she will make a profit of Rs. 16500.
[{((300-85)*2) - (100)}*50]

Case 2: At expiry if NIFTY closes at 5200, then she will make a loss of Rs. 13500 (entire investment value).
[{((0-85)*2) + (0-100)}*50]

Case 3: At expiry if NIFTY closes at 5400, then she will make a loss of Rs. 3500.
[{(200-100)-(85*2)}*50]

9.2 Strips - Example!

The Payoff for the strip strategy



9.3 Straps

A strap consists of a long position in two European calls and one European put with the same strike price and expiration date.

In a strap the investor is also betting that there will be a big stock price move. However, in this case, an increase in the stock price is considered to be more likely than a decrease. For this reason, straps involve two call options that will double the profits from any increases in the stock's value.

Strap Construction
The cost of constructing the strap (which is the max loss) is high because it requires three options purchases:
Buy 2 ATM (at-the-money) call options
Buy 1 ATM (at-the-money) put option

9.3 Straps - Example!

Mr. X is bullish on NIFTY and enters in a Strap Strategy. He buys two 5200 NIFTY ATM Call Options at a premium of Rs. 100 and simultaneously buys one 5200 ATM Put Option at a premium of Rs. 85. His net investment will be Rs. 14250 [{(100*2) + (85)}*50]

Market Outcomes

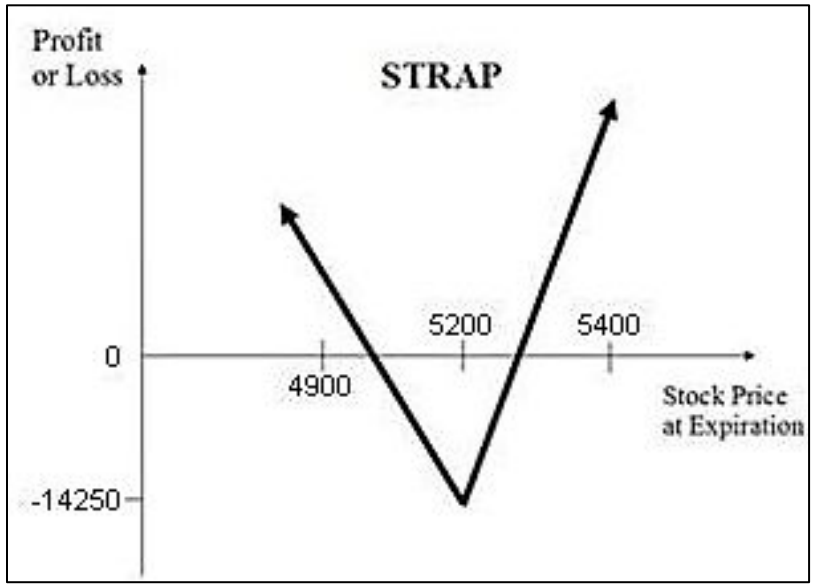
Case 1: At expiry if NIFTY closes at 4900, then Mr. X will make a profit of Rs. 750.
[{(300-85) + (0-200)}*50]

Case 2: At expiry if NIFTY closes at 5200, then Mr. X will make a loss of Rs. 14250 (Entire investment amount). [{(0-200) + (0-85)}*50]

Case 3: At expiry if NIFTY closes at 5400, then Mr. X will make a profit of Rs. 5750.
[{((200-100)*2)-(85)}*50]

9.3 Straps - Example!

The Payoff for the strap strategy



9.4 Strangles

In a strangle, sometimes called a bottom vertical combination, an investor buys a European put and a European call with the same expiration date and different strike prices.

- A strangle is a similar strategy to a straddle. The investor is betting that there will be a large price move, but is uncertain whether it will be an increase or a decrease.
- The stock price has to move farther in a strangle than in a straddle for the investor to make a profit. However, the downside risk if the stock price ends up at a central value is less with a strangle.
- The profit pattern obtained with a strangle depends on how close together the strike prices are. The farther they are apart, the less the downside risk and the farther the stock price has to move for a profit to be realized.
- The sale of a strangle is sometimes referred to as a top vertical combination. It can be appropriate for an investor who feels that large stock price moves are unlikely.

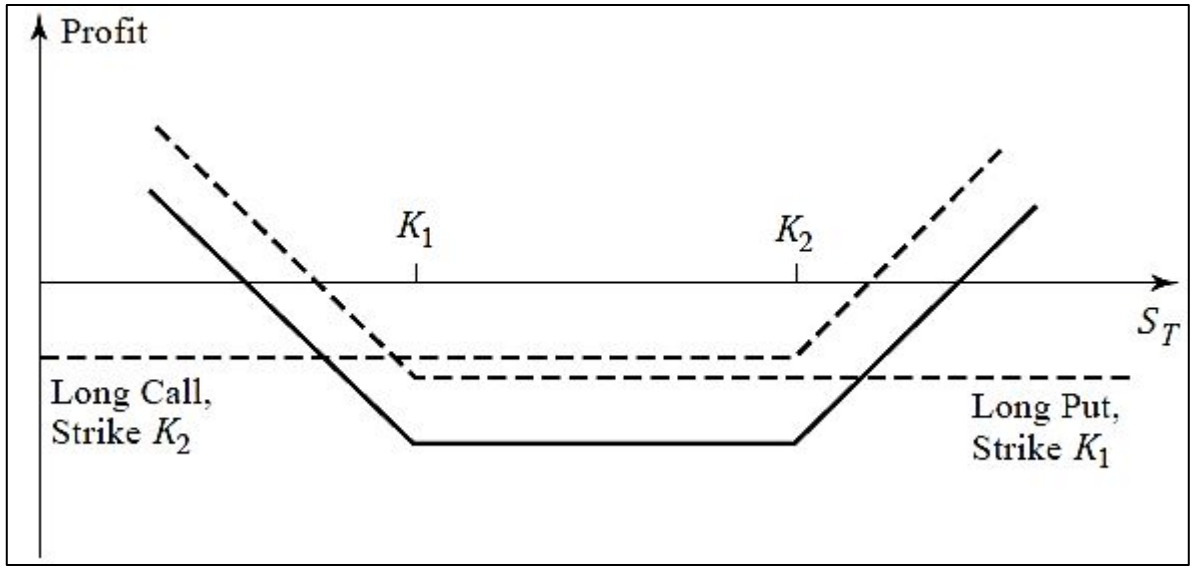
9.4 Strangles

The call strike price, K_2, is higher than the put strike price, K_1. The payoff function for a strangle is calculated in Table below.

Range of stock price	*Payoff from call*	*Payoff from put*	*Total payoff*
$S_T \leqslant K_1$	0	$K_1 - S_T$	$K_1 - S_T$
$K_1 < S_T < K_2$	0	0	0
$S_T \geqslant K_2$	$S_T - K_2$	0	$S_T - K_2$

9.4 Strangles

The call strike price, K_2, is higher than the put strike price, K_1. The profit pattern for a strangle is shown in the figure below.



9.4 Strangles - Example

The illustration below shows the profit/loss scenario for a stock that is trading at $40 when the option investor buys a $50 strike price call and a $30 strike price put option.
Let's assume that the premium – the cost – of each option is $100. It makes the total investment for the strategy $200 plus transaction costs, which represents the maximum potential loss.

The maximum loss will occur only if the stock stays – until the expiration of the options – at or near the same price it was trading at when the options were purchased.
Any substantial movement in the price of the stock, either up or down, can make the strategy profitable.

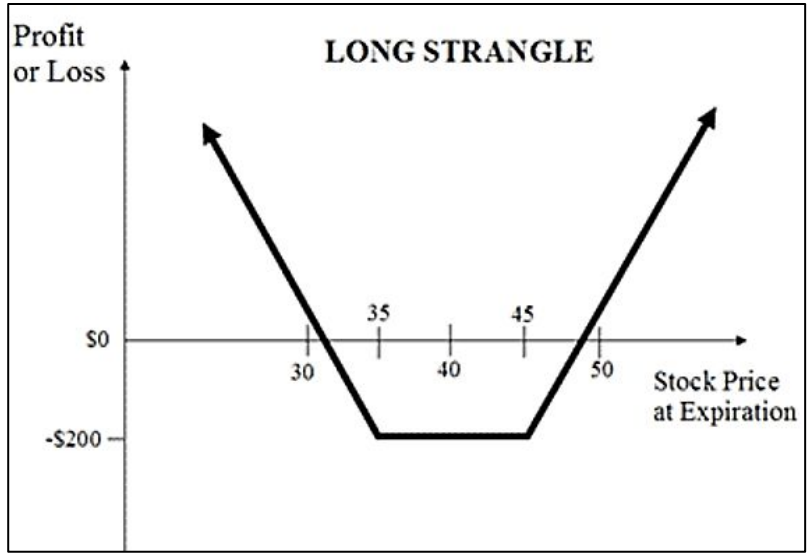
Staying with the example of the strategy implemented by purchasing a $50 call and $30 put on a stock trading at $40 – if the stock's price rises to, say, $48, then the call option increases in value considerably. Also, if the stock's price drops to $32, then the put option significantly increases in value.

Once the price of either one of the options becomes greater than the total cost of both options, then the investor can sell both options for a profit.

9.4 Strangles - Example

For example, if the stock's price rises to $48, making the $50 call option just out of the money, that option's premium value may increase from $100 to perhaps $250. The $30 strike price put option's value may decline to $25. The investor can then liquidate both option positions for a total of $275. His profit would then be $75 ($275 – $200 cost of the options), minus transaction fees.

The maximum potential profit with a long strangle is unlimited. The strategy generates considerable profits if the underlying stock moves enough to place one option or the other in-the-money



Question

A call option with a strike price of $50 costs $2. A put option with a strike price of $45 costs $3. Explain how a strangle can be created from these two options. What is the pattern of profits from the strangle?

Solution

A strangle is created by buying both options. The pattern of profits is as follows:

Stock Price S_T	Profit
$S_T < 45$	$(45 - S_T) - 5$
$45 < S_T < 50$	-5
$S_T > 50$	$(S_T - 50) - 5$

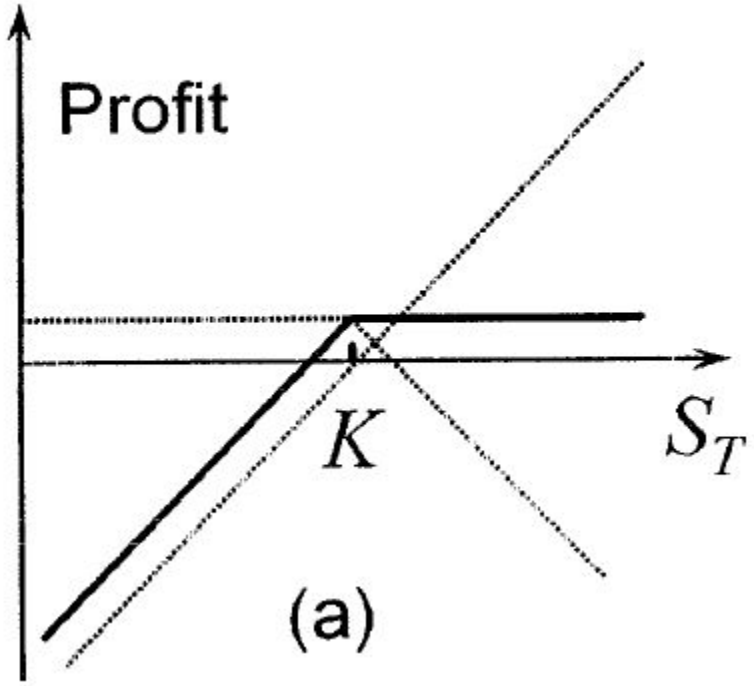
Question

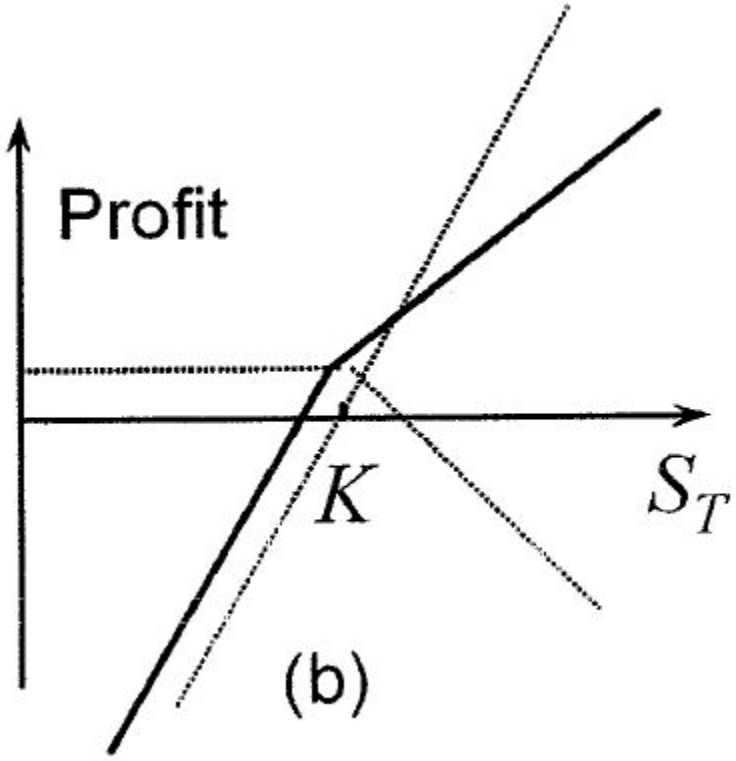
Draw a diagram showing the variation of an investor's profit and loss with the terminal stock price for a portfolio consisting of :

(a) One share and a short position in one call option
(b) Two shares and a short position in one call option

In each case, assume that the call option has an exercise price equal to the current stock price.

Solution





Recap

- We look at trading strategies with options. We understand the strategy and the profit payoffs from those.
- Options are often used to create what are termed principal-protected notes for the retail market.
- A principal protected note (PPN) is a fixed-income security that guarantees a minimum return equal to the investor's initial investment.
- Principal-protected notes can be created from a zero-coupon bond and a European call/put option.

Recap

- There are a number of different trading strategies involving a single option on a stock and the stock itself.
- The portfolio consists of a long position in a stock plus a short position in a European call option. This is known as writing a covered call.
- A portfolio consisting of a short position in a stock is combined with a long position in a call option. This is the reverse of writing a covered call.
- The investment strategy that involves buying a European put option on a stock and the stock itself. The approach is referred to as a protective put strategy.
- Portfolio with a short position in a put option is combined with a short position in the stock. This is the reverse of a protective put.

Recap

- An options spread is an options trading strategy in which a trader will buy and sell multiple options of the same type – either call or put – with the same underlying asset.
- The three basic classes of spreads are the vertical spread, the horizontal spread and the diagonal spread. They are categorized by the relationships between the strike price and expiration dates of the options involved.
- An investor who enters into a bull spread is hoping that the stock price will increase.
- Bull Call strategy involves taking two positions of buying a Call Option and selling of a Call Option. A Bull Call Spread strategy generally involves Buy ITM Call Option and Sell OTM Call Option.
- A Bull Put Strategy involves Buy OTM Put Option and Sell ITM Put Option.

Recap

- A bear spread is a bearish options strategy used when an investor expects a moderate decline in the price of the underlying asset.
- The Bear Put strategy involves selling a Put Option while simultaneously buying a Put option.
- A Bear Call Spread strategy involves buying a Call Option while simultaneously selling a Call Option of lower strike price on same underlying asset and expiry date.
- Box Spread is an arbitrage strategy. It involves buying a Bull Call Spread (1 ITM and 1 OTM Call) together with the corresponding Bear Put Spread (1 ITM and 1 OTM Put), with both spreads having the same strike prices and expiration dates.
- If the market price of the box spread is too low, it is profitable to buy the box. If the market price of the box spread is too high, it is profitable to sell the box.

Recap

- A butterfly spread involves positions in options with three different strike prices.
- It can be created by buying a European call option with a relatively low strike price, buying a European call option with a relatively high strike price, and selling two European call options with a strike price that is halfway between the two.
- Using put options, the investor buys two European puts, one with a low strike price and one with a high strike price, and sells two European puts with an intermediate strike price.
- A calendar spread is an options or futures strategy established by simultaneously entering a long and short position on the same underlying asset but with different delivery dates.
- A combination is an option trading strategy that involves taking a position in both calls and puts on the same stock.
- One popular combination is a straddle, which involves buying a European call and put with the same strike price and expiration date.

Recap

- Combinations involve taking a position in both calls and puts on the same stock.
- A straddle combination involves taking a long position in a call and a long position in a put with the same strike price and expiration date.
- A strip consists of a long position in one call and two puts with the same strike price and expiration date.
- A strap consists of a long position in two calls and one put with the same strike price and expiration date.
- A strangle consists of a long position in a call and a put with different strike prices and the same expiration date.
- There are many other ways in which options can be used to produce interesting payoffs. It is not surprising that option trading has steadily increased in popularity and continues to fascinate investors.

Recap

Have a quick check at all the option strategies we covered:

http://billiontrader.com/options-strategies/