Derivatives and other instruments

1. Introduction

1.1. Chapter overview

Derivative products represent one of the fastest growing sectors of the financial markets. They are called derivatives as they 'derive' from other products. Examples of derivatives are **futures** and **options**.

The chapter starts by taking you though futures, making sure you are familiar with the jargon used in relation to derivative products. You will look at the profit and loss profile from the perspective of both the buyer and seller of the future.

After futures, the chapter takes you through an explanation of an option, including the terminology and some option profit and loss profiles.

The chapter moves on to details of some common derivative products traded on NYSE.LIFFE, the main financial derivatives exchange in the UK, as well as the commodity derivatives available for trading.

Other derivative investments, such as swaps and structured products, are covered next, with the chapter ending on the idea of managing the risks of these investments through a clearing house.

1.2. Learning outcomes

On completion of this chapter, you will:

- 13.1.1 Distinguish between forwards, futures and options

Futures

- 13.1.3 Identify the motive for using a futures contract rather than a trade in the underlying asset
- 13.2.3 Explain the nature of contracts for differences
- 13.1.5 Define the 'basis' of a futures contract
- 13.1.4 Explain the nature of, and reasoning behind, a contango and backwardation market
- 13.1.8 Define the concept of index arbitrage

Futures: hedging

- 13.1.15 Explain the use of futures in hedging an equity portfolio
- 13.1.16 Calculate the number of FTSE 100 futures or options contracts required to hedge a portfolio with a specified beta value

Options

- 13.1.9 Distinguish between American style and European style options
- 13.1.11 Determine when an option is in-the-money, out-of-the-money, or at-the money
- 13.1.13 Identify and explain the factors that determine the premium of an option

- 13.1.10 Differentiate the time value and intrinsic value components of an option premium
- 13.1.12 Calculate the time value of an option, given the premium, strike price and current market price

Options: hedging

- 13.1.15 Explain the use of options in hedging an equity portfolio

Strategies

- 13.1.14 Determine the maximum profit, maximum loss and the motivation behind the following option strategies: short and long call, put, straddle, covered call and protective put

Derivatives: products

- 13.1.6 Describe the main features of the following NYSE Liffe contracts: short term interest rate futures, long Gilt futures, FTSE 100 futures
- 13.1.7 Explain the possible uses of the above contracts in an investment management context
- 13.2.4 Explain the nature of, and motivations behind: interest rate swaps, currency swaps, equity swaps and inflation swaps
- 13.4.1 Identify the main purposes, mechanics and implications of a credit default swap (CDS)
- 13.4.2 Identify the main risks to the financial system resulting from the proliferation of credit derivatives

Commodity derivatives

- 14.1.1 Describe the main features of commodities markets
- 14.1.2 Identify the main ways investors can access the commodity markets
- 14.1.3 Explain the characteristics of the main commodity derivatives, including: energy, softs/ biofuels, metals, emissions, weather
- 14.1.4 Identify the main commodity derivative indices
- 14.1.5 Explain how commodity exposure can be viewed as a hedge against inflation and ‘event’ risk

Short selling

- 13.2.1 Explain the mechanics and uses of short selling
- 13.2.2 Explain the role of stock lending in the markets, and the benefits to the participants

Derivatives: clearing

- 13.1.2 Explain the nature, trading and settlement of exchange traded derivatives

2. Futures

2.1. Features

A future is an agreement (or contract) between two parties where one party agrees to buy something in the future and the other party agrees to take the opposite side of the trade and sell.

The terms and conditions of the future transaction (i.e. price, size, quality etc) are agreed **now**.

By fixing the price, the instrument provides certainty about prices in the future. The long knows how much they will pay for the underlying asset, and the short knows how much they will receive for the underlying asset.

Once the contract is made, it is binding on the parties. It no longer matters what happens to the price of the underlying asset, the price at which delivery will be taken or made is set in the terms of the contract.

Basic futures: example

THE BUYER

(Long position)

THE SELLER

(Short position)

'I agree to buy one tonne of cocoa (the underlying asset) from you, in three months, for £500'

'I agree to sell one tonne of cocoa to you, in three months, for £500'

Note that in futures contracts nothing is bought (or sold) today. It is the terms and conditions that are fixed today regarding a transaction to be completed in the future.

2.2. Jargon

The underlying asset

The underlying asset drives the value of the future. It is often referred to as simply the **underlying** or **cash** asset.

Futures are derived from numerous assets. For example, an investor can trade futures on such diverse cash assets as gilts, currencies and orange juice.

The terms and conditions of a futures contract are specified/standardised. This is because futures are traded on derivative exchanges around the world. Standardising the terms and conditions of a contract allows a person to sell their future on to someone else and hence provides liquidity to the market.

Standardised terms are known as **contract specifications**. The price of the future is never standardised. The price does however form part of the total agreement and so is a feature or component of a futures contract.

The long

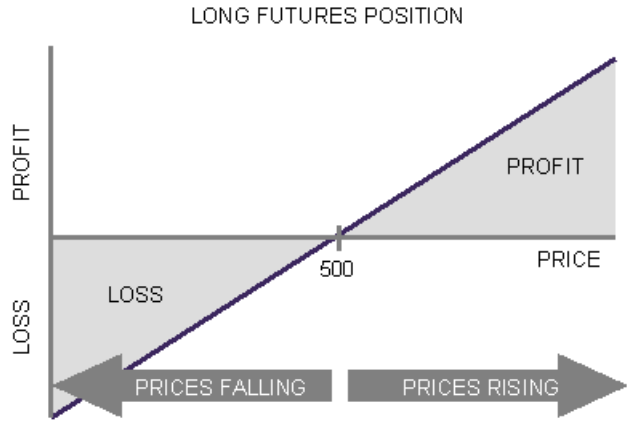
The long position with a future is the future **buyer** of the underlying asset. The long has agreed to **buy** the underlying asset on a future date.

The long thinks that the price of the underlying asset will rise.

For example, if an investor is long June copper futures at £500, he has agreed to buy copper in June for £500 per tonne.

With a future this is a binding contract. Once agreed the long has an obligation to meet the terms set out in the contract, i.e. he must buy the copper for £500 in June.

The long position makes money in a rising market.



The long futures position makes money in a rising market but loses money in a falling market.

The short

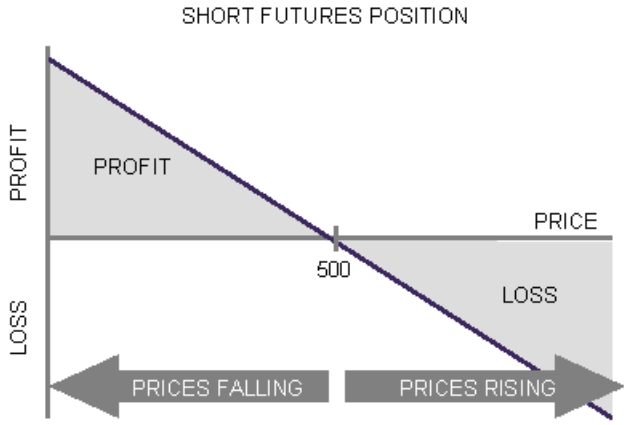
The short position with a future is the future **seller** of the underlying asset. The short has agreed to **sell** the underlying asset on a future date.

The short thinks that the price of the underlying asset will fall.

For example, if an investor is short June copper futures at £500, he has agreed to sell copper in June for £500 per tonne.

Again with a future this is a binding contract. Once agreed the short has an obligation to meet the terms set out in the contract, i.e. he must sell the copper for £500 in June.

The short position makes money in a falling market.



The short futures position makes money in a falling market, but loses money in a rising market.

Summary

Table 8. Futures summary

	Max gain	Max loss
Long futures	Unlimited	Limited to the price of the future
Short futures	Limited to the price of the future	Unlimited

The long and short positions are mirror images of each other. If the long position gains, the short position loses exactly the same amount (and vice versa). Consequently, futures contracts are sometimes called a ‘zero sum game’. This is true of all futures positions.

Delivery date

This is the date on which the agreed transaction takes place. It represents the end of the future's life.

Fair value

Although you will never have to calculate the fair value of a future, you are expected to know the meaning and the components.

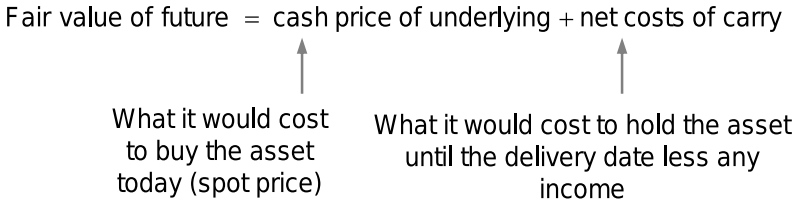
The fair value of a future is a theoretical arbitrage-free value of the future. It is based on the theory that if you were to enter into a long future position on wheat for delivery in three months, there is always another alternative. That alternative to entering into a future contract is to buy the wheat today and hold it in a warehouse for three months.

However, buying the wheat today incurs extra costs above the price of the asset. These costs are referred to as the cost of carry. The cost of carry is comprised of the following:

- Interest rates – you have to spend money to buy an asset; you do not have to spend money to enter into a futures contract

- Storage – for physical asset, they need to be stored
- Insurance – again, for physical assets, they need to be insured.

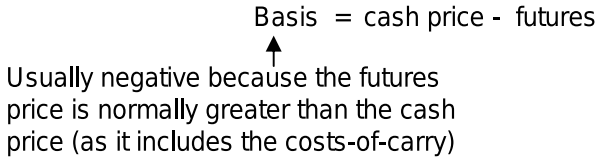
Summary



Basis

Basis quantifies the difference between the cash price of the underlying assets and the futures price.

Basis calculation



Contango

Contango means that basis is **negative** i.e. the cash price is less than the price of the future.

As the future's price indicates the costs of carry, basis is usually negative and the market is described as contango. Negative basis is the norm when there is adequate supply, i.e. 'far' prices (future prices) are higher than 'near' prices (spot prices).

Backwardation ('back')

Backwardation means that basis is **positive** i.e. the cash price is greater than the price of the future.

This might occur, for example, if there were a temporary shortage of the underlying, which would push up the cash/spot price today and produce a **back** market.

Backwardation can also occur where there is an overall benefit of carry rather than a cost of carry. This could arise where the dividend yield on an equity or equity index is above interest rates.

Contingent liability

A contingent liability transaction describes a position where the investor faces a potential liability which is uncertain at the present time. All futures transactions are contingent liability transactions.

Forwards

Futures and forwards are similar products in that both enable something to happen at some time in the future on terms agreed today. The key difference is that futures contracts are exchange-traded and forwards are typically traded over-the-counter (OTC).

The main advantage of forwards (over futures) is that they offer a high degree of **flexibility** to the parties involved, allowing them to set any contract specifications that are mutually acceptable. That is, there is no exchange to standardise the terms of the contract.

The main disadvantage of forwards is direct counterparty risk with the opposite side of the trade. There is no central counterparty or collateral payment, so the credit-worthiness of both counterparties is extremely important. A second problem is that there is no central market place, so it is difficult to value them and price information is not always available.

Common examples of OTC deals include:

- Currency Forwards
- Swaps: a forward applied to the exchange of one series of future cash flows for another

Contracts for differences

A contract for differences (CFD) is a term describing a cash settled derivative. No physical delivery actually takes place. Instead, the contract is settled for the difference between the agreed price and the settlement price.

Examples of CFDs include interest rate futures and futures in equity indices.

Many futures are **physically** settled. This means that at expiry the underlying asset is delivered (to the long position).

Examples of physically delivered futures include LIFFE's Long Gilt

Arbitrage

Arbitrage is the process whereby an investor (usually a market professional) makes a **risk-free profit** by exploiting anomalies and inconsistencies in the prices between two related but different markets.

For example, if cars were cheaper in the rest of Europe than in the UK, someone can buy a car in France, pay the additional import fees, and sell it immediately in the UK for a profit.

By exploiting the inconsistencies between motor car prices in different markets a quick profit can be made.

The same principle is used when arbitraging **between an index and its derivative**. If an investor can buy an asset and pay the cost of carry for less than the price on the future contract, there is an inconsistency in pricing.

An investor alert to this inconsistency, and able to exploit it, can make a profit through buying the asset and holding (cheap) and shorting the future (agreeing to sell at a higher price).

Of course, when performing arbitrage on financial instruments, only the fastest will be able to exploit the arbitrage opportunity. It does not take long for everyone in the market to spot the arbitrage opportunity and the two prices are very quickly brought back into line with one another again.

Closing out

The buyer of a futures contract has two choices:

- To hold the future to expiry and then take delivery of the underlying (if physically deliverable)
- To sell the future before the expiry date. This is known as **closing out** the position

Closing out is achieved by entering into a second equal but opposite contract in order to offset the terms and conditions of the first. Hence, a buyer of a future who has made an **opening purchase** (created an obligation to take delivery of an asset at a future date) closes out by making a **closing sale** (creating an obligation to make delivery of an identical asset at the same future date). Equally, an **opening sale** is closed out by a **closing purchase.**

3. Futures: hedging

3.1. Basic hedging

Futures, like the FTSE 100 future, can be used to hedge portfolios of UK equities against adverse market movements.

The number of contracts required is known as the **hedging ratio**.

Example

A fund manager has a portfolio of major UK stocks worth £200m and is worried that the market may fall and reduce its value:

Table 9. Basic hedging example

PORTFOLIO	val £200m
Barclay's Bank	120,000
Vodafone	100,000
BP	130,000
HSBC	150,000

In order to gain some protection, the fund manager constructs a **short hedge**, by selling FTSE 100 futures.

There are two questions:

1. Which delivery month?

   - Generally speaking the most liquid month is the nearest delivery date. So if it were November when the fund manager decided to construct the hedge, it would be the December future that would be used

2. How many contracts?

   - The contract size for the FTSE 100 future is £5 per half index point (0.5 points is the minimum price move of the contract - called the tick size). This means that if the December future was trading at 6,520.00pts then its equivalent would be £65,200.00 worth of the FTSE100 constituent shares

   - The number of contracts the fund manager's hedge needs therefore is:

$$\frac{£200,000,000}{£65,200} = 3,067.00$$

Note: the actual answer to this sum is 3,067.48, but as you may only deal in whole numbers of contracts, the figure is rounded up or down accordingly.

3.2. Beta hedging

The hedge in the previous example has so far assumed that the portfolio will move in exactly the same way as the market, i.e. if the value of the FTSE 100 index increases by 10%, the value of the portfolio will also increase by 10%. This is not necessarily always the case.

In order to incorporate any disproportionate changes in the portfolio relative to the market, a number called 'Beta' is used.

Beta is an indicator of how many times more (or less) volatile than the index a particular portfolio is.

For example, a portfolio with a Beta of 1.2, is 20% more volatile than the index it is measured against.

Conversely, a portfolio with a Beta of 0.7 is 30% less volatile than the index it is measured against.

To take account of a given Beta value, all that is required is to multiply the number of contracts required for a basic hedge by the Beta of the portfolio.

Example

The fund manager's portfolio has a Beta (β) of 1.32.

This means that the number of futures contracts needed for the hedge is 1.32 times as many as before:

3,067.48 **x** 1.32 = 4,049 contracts

Note: do not round to whole contracts until the final answer.

4. Options

4.1. Features

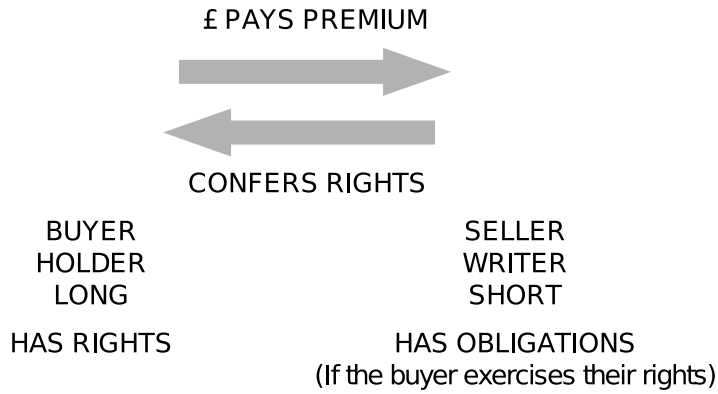
Definition

An option gives the buyer the right (not the obligation) to buy or sell an underlying asset at a fixed price on, or before, a given date in the future.

The main differences between futures and options

Only the seller of an option has a potential obligation while the buyer has a choice. With futures, both the buyer and seller have an obligation.

The buyer of an option pays a premium to the seller. There is no premium paid when buying futures.



4.2. Jargon

Call option

An option that gives the holder the right to **buy** the underlying asset.

Put option

An option that gives the holder the right to **sell** the underlying asset.

Exercise (or strike) price

The price at which the option specifies the underlying asset may be bought (and sold).

Premium

Options are not free, they must be paid for. The price paid for an option is called the premium and is paid by the long position (the holder).

The holder

The term used to describe the **buyer** of an option. Also referred to as the long position.

The writer

The term used to describe the **seller** of an option. Also called the short position.

Expiry date

The rights granted by an option do not last forever. The expiry date is the last day of the option's life.

European style

The holder of the option can exercise their right on the expiry date only.

American style

The holder of the option can exercise their right **at any time**, up to and including the expiry date.

4.3. Basic positions

Introduction

There are four basic option positions:

- Long a call option - the right to **buy** the underlying
- Short a call option - a potential obligation to **sell** the underlying
- Long a put option - the right to **sell** the underlying
- Short a put option - a potential obligation to **buy** the underlying

It is important to note that these profit and loss profiles all represent uncovered (or naked) positions. In other words, the holder or writer in question does not actually own the underlying asset.

For the sake of simplicity, in considering profit and loss profiles, assume that the options are all European style and therefore can only be exercised on the expiry date.

Call options

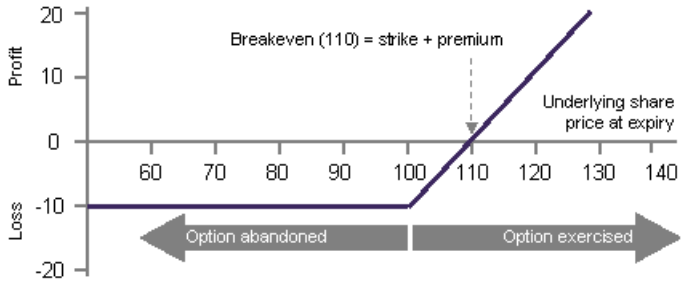
Long call positions

In this situation, the buyer pays a premium and is granted the right to buy the underlying asset on expiry if they wish.

The higher the price of the underlying at expiry, the more profit the buyer will make.

- Buying call options is a **bullish** (or not bullish) strategy.
- The maximum profit for the buyer is unlimited
- The maximum loss for the buyer is the premium
- The breakeven point (the point at which the net profit/loss is zero) is strike price plus premium
- The breakeven point is strike price plus premium

Example: an investor buys a 100 call paying a 10p premium. A long call position is a bullish strategy. It makes money in a rising market.



Short call positions

In this situation, the seller receives a premium and is required to sell the underlying asset on expiry if the buyer requires.

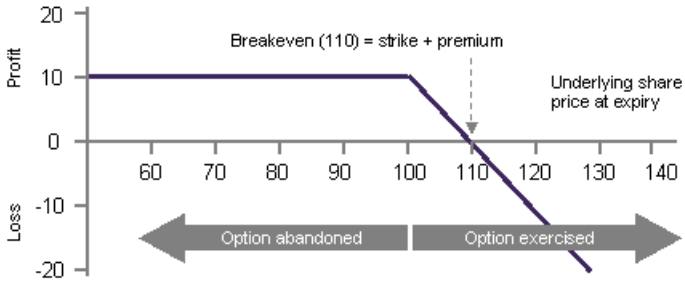
The higher the price of the underlying at expiry, the more loss the seller will make.

Writing call options is a **bearish** strategy.

The maximum profit for the seller is the premium.

The maximum loss for the seller is unlimited.

Example: an investor sells a 100 call option receiving a premium of 10p. A short call position is a bearish/neutral strategy. The writer keeps the premium if the market falls



Put options

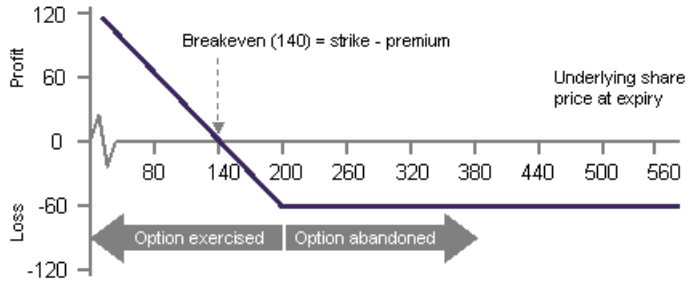
Long put positions

In this situation, the buyer pays a premium and is granted the right to sell the underlying asset on expiry if they wish.

The lower the price of the underlying at expiry, the more profit the buyer will make.

- Buying put options is a **bearish** strategy
- The maximum profit for the buyer is the strike price less the premium paid
- The maximum loss for the buyer is the premium
- The breakeven point is strike price minus premium

Example: an investor buys a 200 put paying a premium of 60p. A long put option is a bearish strategy. You make money in a falling market



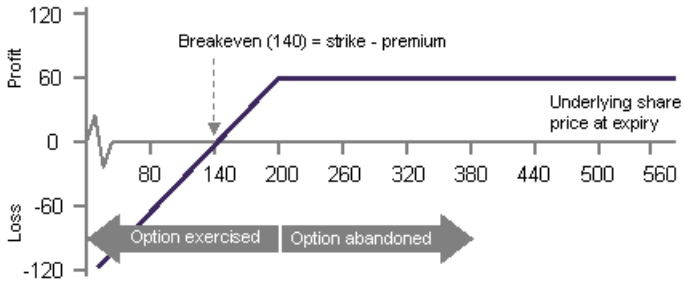
Short put positions

In this situation, the seller receives a premium and is required to buy the underlying asset on expiry if the buyer requires.

The lower the price of the underlying at expiry, the more loss the seller will make.

- Writing put options is a **bullish** (or not bearish) strategy
- The maximum profit for the seller is the premium.
- The maximum loss for the seller is the strike price less the premium
- The breakeven point is strike price minus premium

Example: an investor sells a 200 put and receives a premium of 60p. A short put position is a bullish/ neutral strategy. The writer keeps the premium if the market rises.



Moneyness of an option

Option can be in-the-money, at-the-money or out-of-the money. The easiest way to determine this is ask yourself "**would I exercise the option?**"

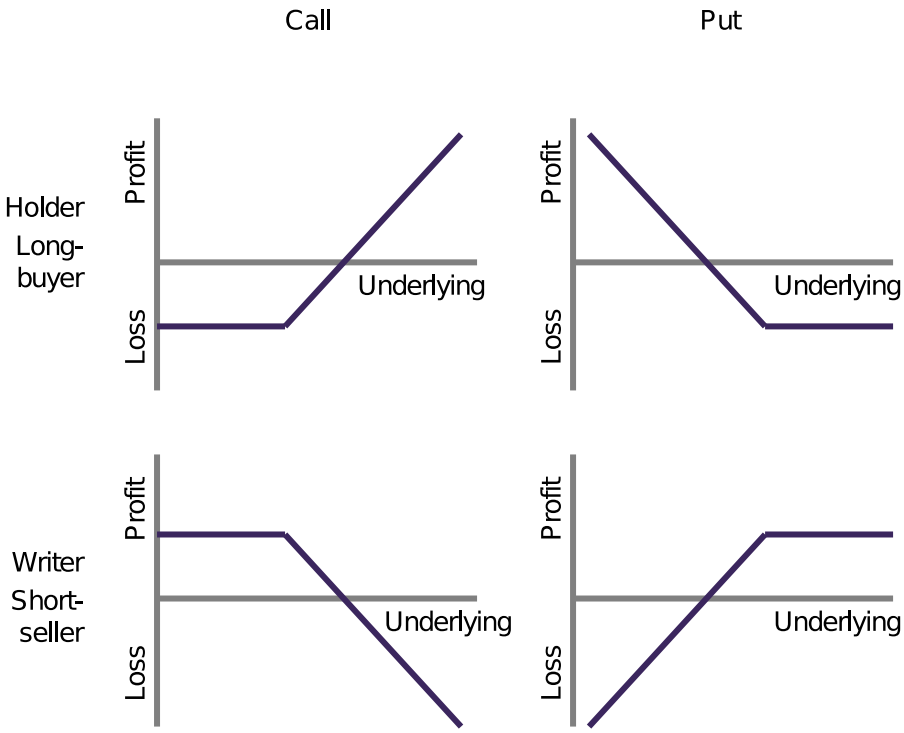
- If the answer is yes – it must be in-the-money
- If the answer is no – it must be out-of- the-money
- If you are indifferent because the price of the asset and the strike price are the same – it must be at-the-money

Summary of the moneyness of an option

Table 10. Summary of the moneyness of an option

Moneyness	Call	Put
Out-of-the-money (OTM)	Asset price < Strike price	Asset price < Strike price
At-the-money (ATM)	Asset price = Strike price	Asset price = Strike price
In-the-money (ITM)	Asset price > Strike price	Asset price > Strike price

4.4. Options positions: summary



4.5. Option premiums

Overview

The premium of an option is made up of intrinsic value and time value.

- Premium = intrinsic value + time value

Intrinsic value

The intrinsic value is the obvious value of the option. It is built in profit (ignoring all other costs) a particular option has were it to be exercised now.

For a call option this would be the price of the share less the strike price. The logic being, if the share price (the price you can sell for) is above the strike price (the price you can buy for), the option has intrinsic value.

For a put option this would be the strike price less the price of the share. The logic is the same but now the strike price is the price you sell for and the share price is the price you buy for.

It is important to point out that intrinsic value can never be less than zero (you would not exercise the option to crystallise a negative intrinsic value).

Numerical example of intrinsic value

If a call option on a share has a strike price of 500. As the underlying share price moves from above the strike price to below it, the intrinsic value of the option changes as follows:

Table 11. Intrinsic value table

Strike price	Share price	Intrinsic value - call	Moneyness - call	Intrinsic value - put	Moneyness - put
500	550	50	ITM	0	OTM
500	500	0	ATM	0	ATM
500	450	0	OTM	50	ITM

As the table shows, a call option will have intrinsic value when the strike price is **below** the underlying asset's price, i.e. by exercising the option, an investor can purchase the asset at a cheaper price than by buying it in the open (cash) market.

A put option will have intrinsic value when the strike price is **above** the underlying asset's price, i.e. by exercising the option, an investor can sell the asset for a higher price than by selling it in the open (cash) market.

As an out-of-the-money option offers the holder less chance of a profit, the premium would be relatively low.

Delta

Delta is a measure of the sensitivity of the option premium to changes in the underlying value of the asset. It is calculated as:

- **Delta = change in price of the option premium / change in price of the underlying**

For example, if the price of copper went up by 20p and the option premium went down by 10p the delta value would be -0.5

- -10p / 20p = -0.5p

Delta is **positive for calls** and is always between 0 and +1.

Delta is **negative for puts** and is always between 0 and -1.

Time value

Time value is the amount over and above the intrinsic value that an investor will pay to buy an option because of what might happen to the price of the underlying between now and the end of the life of the option.

An option with a long time to expiry will have a considerable element of time value incorporated into its price. The longer the period the higher the time value, as there is more time for the price of the underlying to change.

If an option was trading at a premium of 25p and the intrinsic value was 15p (in-the-money), then the time value would be 10p.

$$\text{Premium} = \text{Intrinsic value} + \text{Time value}$$

$$25p = 15p + 10p$$

Time value: influencing factors

Examples of factors that impact on option premiums include:

- Volatility of the price of the underlying asset
- Interest rates
- The remaining life of the option

Each of these also has a sensitivity measure – referred to as the option Greeks – that tells us by how much the option's premium will be affected by a movement in these factors.

Volatility of the price of the underlying asset

The more volatile the price of the underlying asset, the higher the time value (and therefore premiums) of a call and put option.

Vega measures the sensitivity of an option premium relative to a change in the volatility of the price of the underlying.

Interest rates (equity options only)

Movements in interest rates will have different effects on call and put options.

Call options

If interest rates rise, the time value of call options will increase and (all other things being equal) the premium will rise.

The opposite is true when interest rates fall.

Put options

When interest rates rise, the time value of put options decreases.

The opposite is true when interest rates fall.

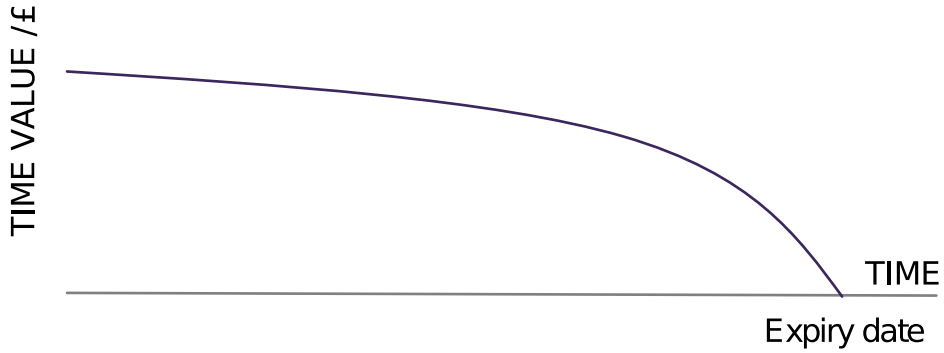
Rho measures the sensitivity of an option premium relative to a change in the interest rate.

Remaining life of the option

The longer an option has to expiry, the higher the time value of the option.

This is because there will be more time for the price of the underlying to change. As the life of an option passes, therefore, its time value decreases.

However, time value does not decrease in a linear fashion. The closer the option is to expiry, the faster the time value will decay. This can be illustrated graphically.



As a consequence of time value decay we would expect longer dated options to be higher priced than shorter dated options (assuming the same underlying with the same strike).

Note: time decay works **against the holder** and therefore operates to the advantage of the writer. That is, if all other things remain stable, a writer of a call/put will be able to close their position out by buying at a lower price than they originally sold for.

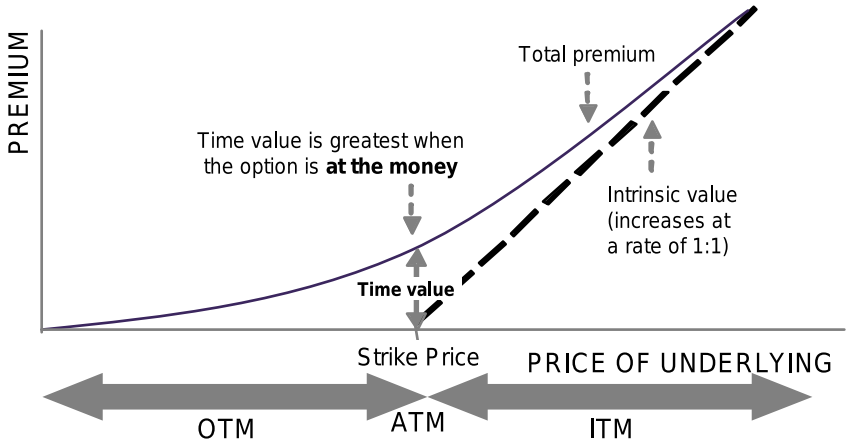
Theta measures the sensitivity of an option premium relative to a change in the remaining life of the option.

Summary

Table 12. Call and put option premiums' reaction to altering factors summary table

Factor	Call option premiums	Put option premiums	Sensitivity measure
Increase in underlying	Increases	Decreases	Delta
Increase in time	Increases	Increases	Theta
Increase in volatility	Increases	Increases	Vega
Increase in interest rates	Increases	Decreases	Rho

Graphical representation of a call option's intrinsic and time value



Points to note

When the option is out-of-the-money, the premium is made up entirely of time value (i.e. there is no intrinsic value).

When the option is at-the-money, the premium is still made up entirely of time value and time value is at its greatest because uncertainty (and therefore risk) is at its greatest.

When the option is in-the-money, the premium is made up of time value and intrinsic value.

5. Options: hedging

5.1. Hedging using options

Options, like futures, can be used to hedge portfolios of UK equities against adverse market movements. The key advantage of using put options to hedge long portfolios of equities is that only downside risk is hedged; if the market rises, the portfolio manager can abandon the put options and enjoy the increase in the value of the portfolio. Using short futures would lock out such upside gains. However, if put options are used, the portfolio manager may not be completely hedged against downside risk. In addition, a premium must be paid to the writer of the put options.

Example

A fund manager has a portfolio of major UK stocks worth £40m and is worried that the market may fall and reduce its value. The beta of her portfolio is 0.9. The fund manager is concerned that she does not want to miss out on any increase in the value of her portfolio should the index rise.

The current FTSE100 index is at 5,800 points, and a FTSE100 5,600 put option is available, with a premium of 48. The contract tick value of the FTSE100 index put option is £10 per point.

If she plans to hold all of the put options to expiry, how many put options should the fund manager buy to hedge against downside risk?

Solution

$$\text{Number of put options to buy} = \frac{\text{Value of portfolio}}{\text{Value of index option}} \times \beta$$

$$= \frac{£40{,}000{,}000}{5{,}600 \times £10} \times 0.9$$

$$= 643 \text{ put contracts to buy}$$

Notice that both the premium for the puts, and the current market index, are irrelevant to this calculation.

The fund manager is hedged beyond falls in the market index of 5,600 (less the cost of the hedge). If the market rises, however, the fund manager can abandon the puts, and enjoy the rise in the value of her portfolio (less the cost of the hedge).

Holding the asset and buying puts to hedge the position, is often referred to as a **protective put**.

6. Strategies

6.1. Covered call

Introduction

A covered call is made up of two independent positions: a short call option and a long position in the underlying asset. The strategy is normally used to **generate income in a static market** and often referred to as a yield enhancement strategy.

The long position in the underlying covers the short call, in case the holder of the call option exercises their right to buy. The premium received from writing the call generates the income.

Motivation

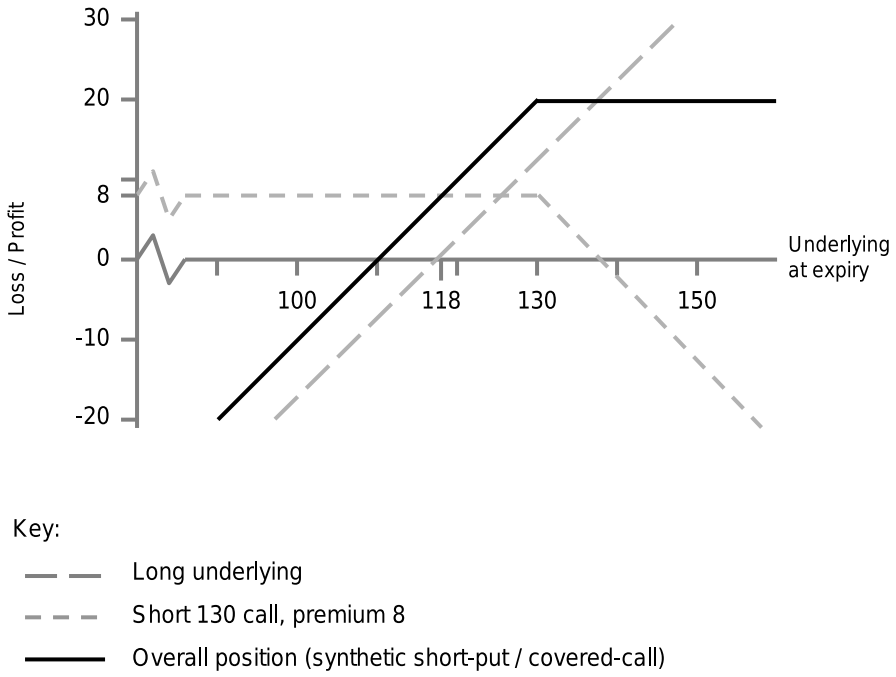
There are three main reasons why a covered call might be used:

- If the call option is sold and the underlying is bought simultaneously, the premium received helps fund the purchase of the underlying stock
- A fund manager, who already holds the underlying shares and believes prices are relatively stable, can use the premium received from writing the call option to enhance the overall performance of the fund
- An investor, who is worried about a fall in share price, can use the cushion (downside protection) that the covered call provides. This will be cheaper than buying a put

Profile

Usually the option is an out-of-the-money option. This has less chance of being exercised but generates less income.

An investor buys shares for 118p. He also writes a 130p call and receives a premium of 8p. The overall profit and loss profile is shown in the diagram below.



Outcome

If the share price falls by expiry

By receiving the premium of 8p from the sale of the call, the investor has a cushion through which the underlying share price may fall before losses are incurred. The premium, in other words, acts as downside protection.

If the share price has not moved by expiry

If the share price has not moved by expiry, the call option will not be exercised. The investor will be holding the share and will keep the premium of 8p.

If the share prices rises by expiry

A rise in the underlying will generate a profit. 20p is the maximum that can be generated from this strategy.

The profit arises at a price of ≥ 130 because the stock purchased for 118p is being delivered to the holder of the option at a strike of 130p.

The overall income is, therefore, the profit of 12p plus the premium received of 8p.

6.2. Protective put

Introduction

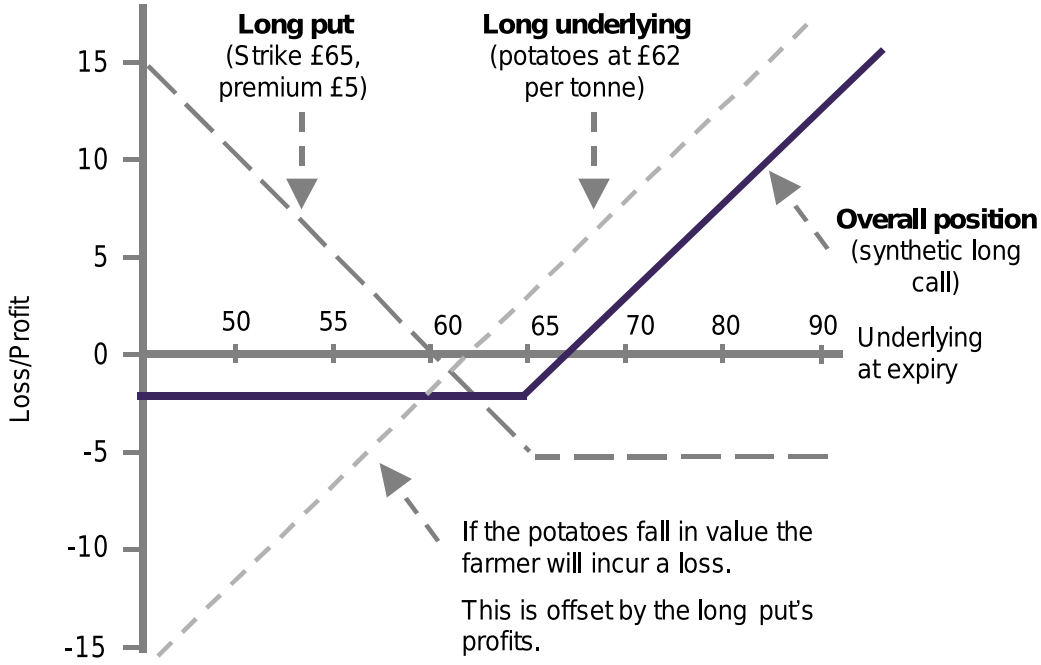
A protective put is made up of two independent positions: a long position in the underlying asset and a long put option. The strategy is normally used to hedge against a falling market.

The long position in the put protects the long underlying, in case the underlying price falls. The premium paid from buying the put reduces the income on the underlying position.

A protective put provides 'insurance' for the buyer, allowing an upside gain whilst limiting losses. The cost of the 'insurance' is the option premium.

Profile

A farmer has one tonne of potatoes and is worried that their price may fall. To protect himself against this he buys a put option.



Outcome

If the underlying price falls by expiry

The strike price of the put will allow the holder to sell the underlying at a set price which creates a limit on the maximum loss that the long is exposed to.

If the share price has not moved by expiry

If the share price has not moved by expiry, the holder has made no gain on the underlying asset and the cost of the put option premium will result in some loss.

If the share prices rises by expiry

The holder will make a gain on the underlying but this will be reduced by the option premium.

6.3. Combinations: straddles and strangles

Introduction

Combinations are **option** strategies that involve a call **and** a put.

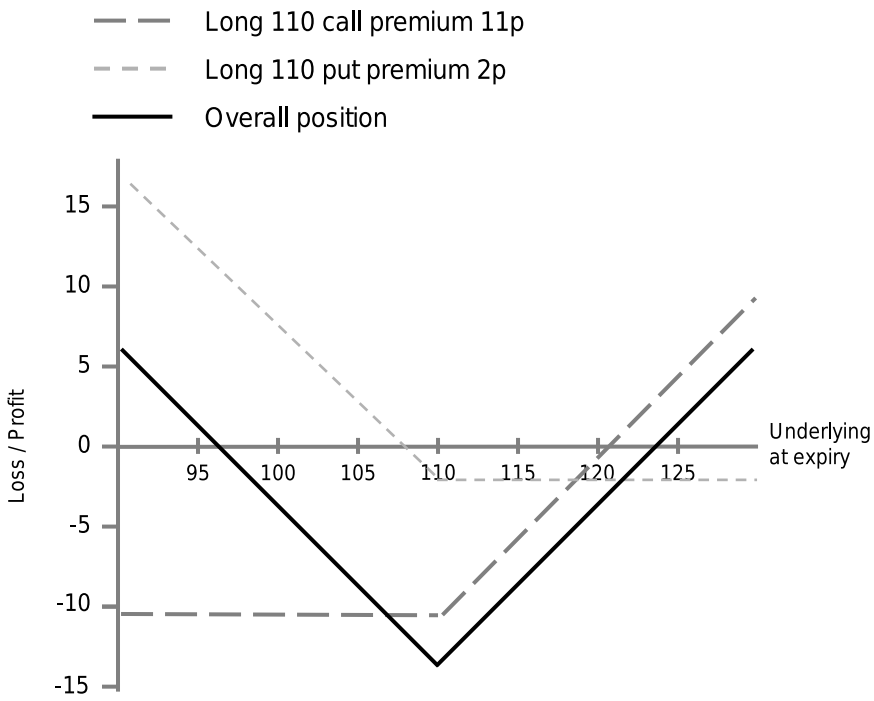
There are two types of combination: straddles and strangles.

Long straddle

To construct a long straddle, a call option and a put option, both with the **same strike** price, are **bought**.

Long straddle: profile

Example



Long straddle: features

Downside breakeven

If the underlying share price at expiry falls below this value, the strategy begins to make a profit.

Downside breakeven = strike – total of both premiums

= 110p – 13p

= 97p

Upside breakeven

If the underlying share price is above this value at expiry, the strategy begins to produce a profit.

Upside breakeven = strike + total of both premiums

= 110p + 13p

= 123p

Maximum loss

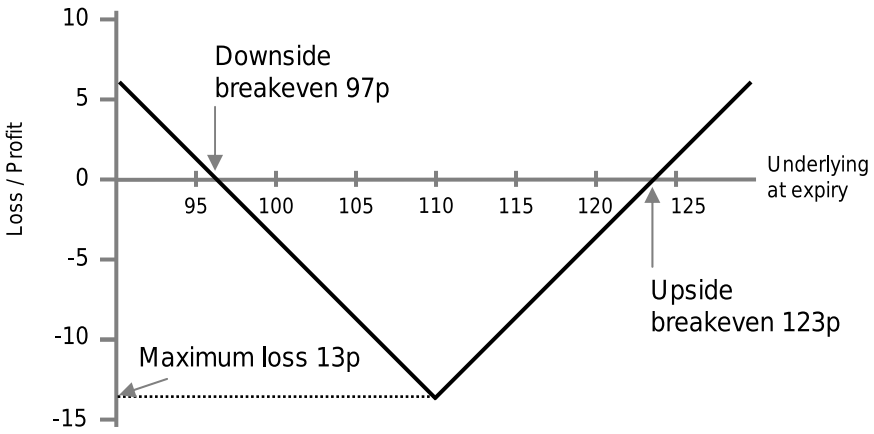
If, at expiry, the underlying is at the strike price, the investor will lose both premiums because neither option will be exercised.

Maximum loss = total of both premiums

= 11p + 2p

= 13p

Summary



Long straddle: motivation

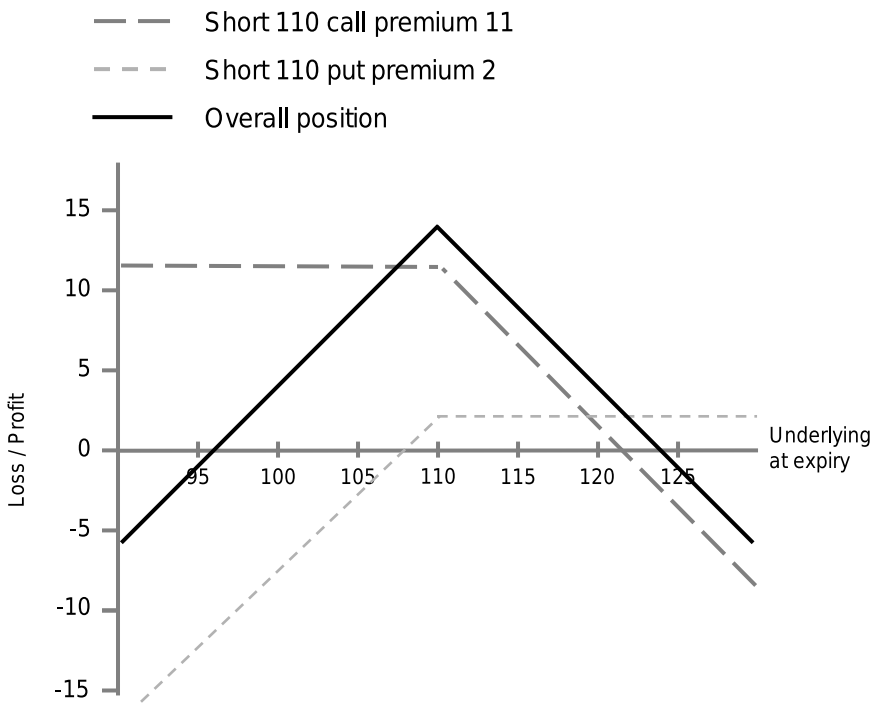
This strategy will produce an overall profit if the underlying share price at expiry lies outside the downside and upside breakeven values (97p and 123p). The investor is trading on the volatility of the share price. This is a departure from the conventional idea of investing in anticipation of either a rise **or** a fall in share price. With a long straddle, investors can gain from **both**.

Short straddle

To construct a short straddle, a call option and a put option, both with the **same strike** price, are **sold**.

Short straddle: profile

For example:



Short straddle: features

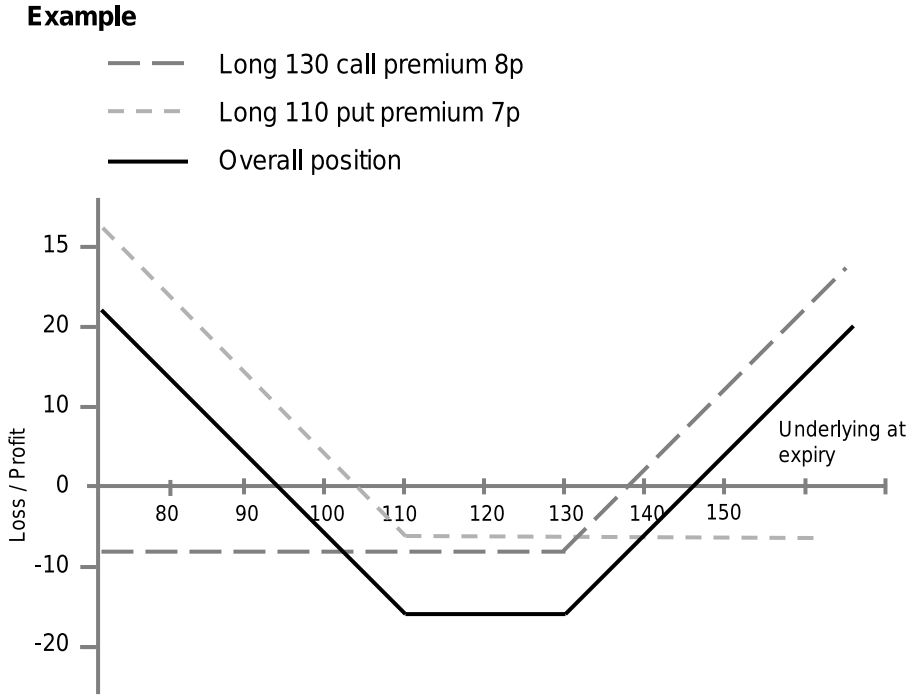
The short straddle is a zero sum game with the long straddle. The maximum profit will be equal to the maximum loss of the long straddle, and the maximum loss will be equal to the maximum profit of the long straddle. The breakeven point will be equal for both.

Long strangles

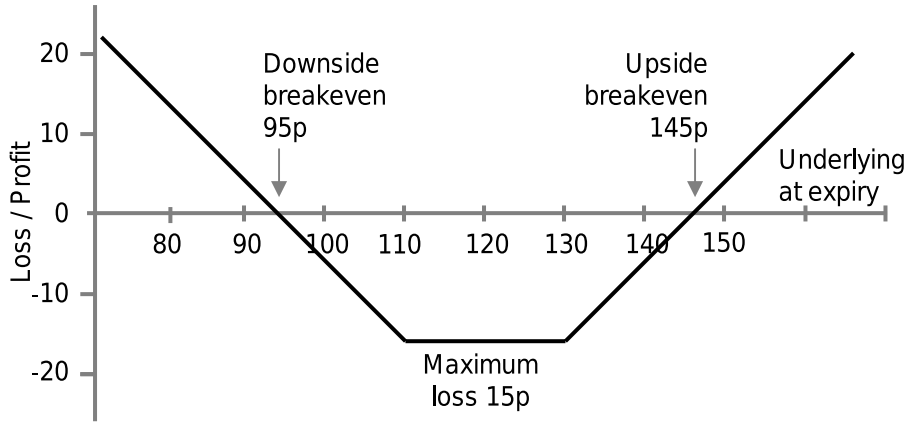
To construct a long strangle, a call and a put with **different strikes** are bought.

Long strangle: profile

Example



A strangle looks like a straddle, except the options have different strikes.



Long strangle: features

Upside breakeven

If, at expiry, the underlying is above this figure, the strategy will again generate a profit.

$$\text{Upside Breakeven} = \text{Strike} + \text{Total of Both Premiums}$$

$$= 130p + 15p$$

$$= 145p$$

Downside breakeven

If, at expiry, the underlying share price is below this figure, the strategy will make money.

$$\text{Downside Breakeven} = \text{Strike} - \text{Total of Both Premiums}$$

$$= 110p - 15p$$

$$= 95p$$

Maximum loss

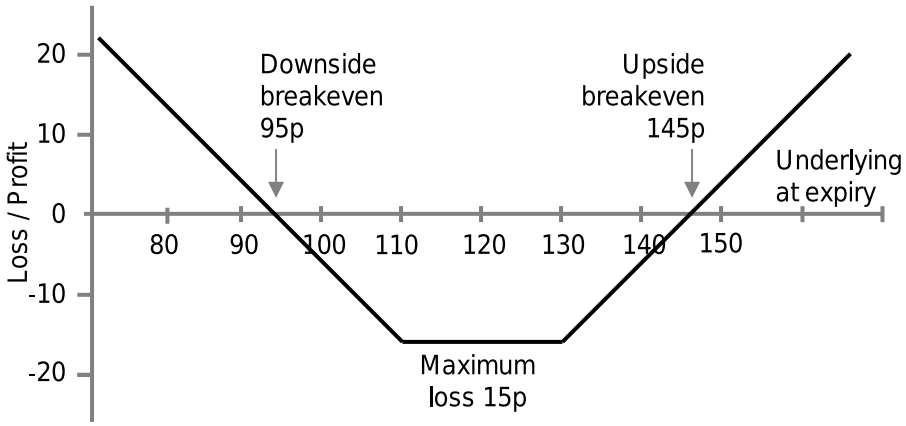
Any underlying share price at expiry between the two strike prices will generate a loss equal to the sum of both premiums.

$$\text{Maximum Loss} = \text{Total of Both Premiums}$$

$$= 8p + 7p$$

$$= 15p$$

Long strangle: Summary



Long strangle: motivation

A long strangle, as with a long straddle, is a volatility trade. However, with long strangles the underlying has to be **more** volatile than with straddles, in order to overcome the wider distance between the downside and upside breakevens.

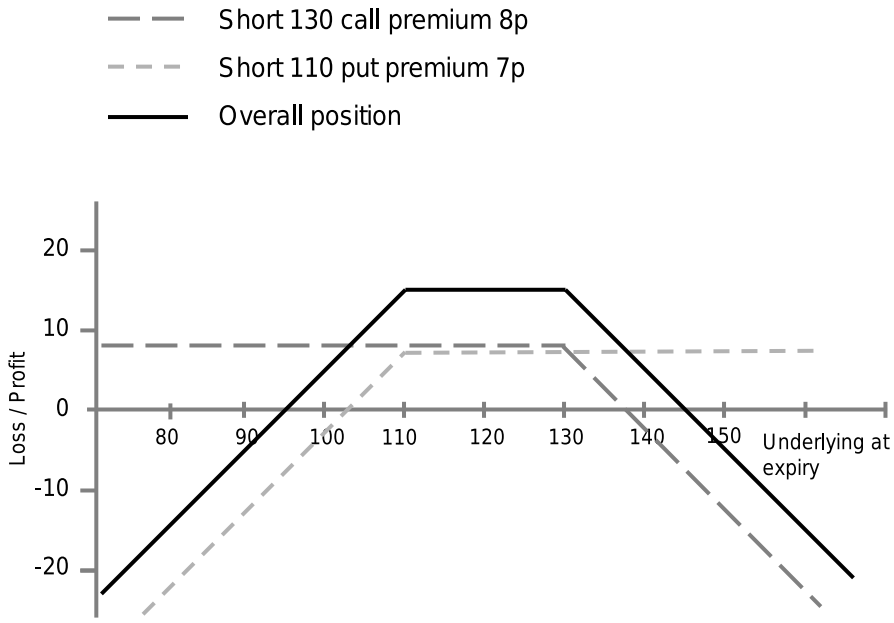
The advantage of using strangles is that the total cost (the premiums) is cheaper.

Short strangles

To construct a short strangle, a call and a put with **different strikes** are sold.

Short strangle: profile

Example



Short strangle: features

The short strangle is a zero sum game with the long strangle. The maximum profit will be equal to the maximum loss of the long strangle and the maximum loss will be equal to the maximum profit of the long strangle. The breakeven point will be equal for both.

7. Derivatives: products

7.1. Equity derivatives

Futures on individual equities

NYSE.LIFFE introduced **Universal Stock Futures**, contracts to buy/sell the shares of a particular company at a pre-determined future date. Contracts on some shares are cash settled, whilst contracts on other shares are physically delivered.

Options on individual equities

In the UK, the largest market in share options is on NYSE.LIFFE. The options are often referred to as **traded options**.

Both put and call options are available on a selection of FTSE 100 stocks.

Traded options are **physically delivered**, with the parties to a trade making or taking delivery of the physical shares on the exercise of the option.

Futures and options on equity indices

The FTSE 100 Index future is settled at £10 per point – although contract specifications state a tick size of 0.5 pts and a tick value of £5. It has delivery dates of March, June, September and December available.

7.2. Bond derivatives

Bond futures

In practice the underlying asset of a bond future is a notional (i.e. imaginary) bond, e.g. the underlying asset of the NYSE.LIFFE Long Gilt future is a notional 10-year, 4% gilt.

At the time of delivery, the relevant exchange announces a list of actual bonds that may be delivered. The short then selects a bond from the list of **deliverable bonds** created by the exchange and delivers it to the long in return for the delivery price. Contracts are therefore **physically delivered**.

The bond selected is referred to as the **cheapest to deliver** (CTD).

7.3. Interest rate derivatives

Interest rate futures

Interest rate futures are futures on the value of a rate of interest.

An example of an interest rate future traded on NYSE.LIFFE is the **short term interest rate future (STIR)**.

Entering into this contract is a bet on the rate of interest that would be paid on a £500,000 deposit for a three-month term starting at a future date. They can be used to speculate on changing interest rates or to hedge against interest rate exposure.

Interest rate futures settle for **cash** and the price is quoted at 100 - interest rate. This means a STIR quoted at 94.75 would imply an interest rate of 5.25%. (100 – 5.25 = 74.75).

Note: this means if you expect interest rates to rise, you would short a STIR future.

7.4. Swaps

Swap market: participants

Financial organisations, such as banks and other money market institutions, are the main operators in the swaps markets. They may offer swaps to any company for whatever period they choose and balance their books themselves.

The swaps market takes place off exchange: it is an over-the-counter (OTC) market.

Interest rate swaps

Features

Interest rate swaps (IRSs) are agreements between two people to exchange or **swap** payments on loans. They are sometimes described as 'agreements to swap cash flows'.

It is because of the different methods of borrowing that IRSs are useful. A company may either borrow money at fixed or variable rates; it would borrow fixed if it thought rates were going up and variable if it thought they were about to fall.

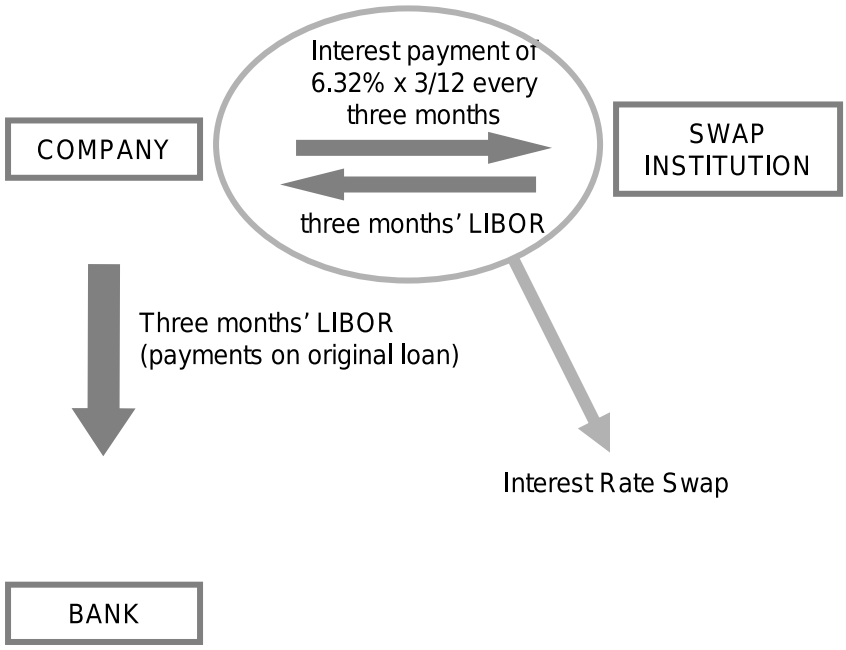
An interest rate swap will allow the company to change borrowing styles part way through the term of the original loan.

Example

Consider a five-year, three-month borrowing facility. The five years are split into three-month periods; at the beginning of each period the LIBOR rate for three months is set and applied to the loan. At the end of each period the interest is paid, and a new LIBOR rate is set for the next three-month period.

A company with such a facility may approach another institution and arrange an interest rate swap. The institution would agree to pay LIBOR to the company at the end of each three-month period in exchange for interest payments from the company at a **fixed** rate.

In this arrangement the company would be defined as the **payer** as they are paying the fixed rate and the swap institution would be deemed the **receiver** since they are receiving the fixed rate.



- In the diagram you can see the company has swapped three-month LIBOR payments for a fixed rate of 6.32% pa
- The company's net outgoings are simply 6.32% over the year, as the LIBORs cancel out

Payments and principal: interest rate swap

In an interest rate swap the principal amount is **notional**, that is the parties will agree the sum over which they will calculate interest percentages but this sum will not actually change hands.

Payments are **netted**, for instance payment of 5% fixed and receipt of 4% floating will result in a net 1% payment. Netting can occur because all payments are in the same currency.

Inflation swap

Inflation swaps are similar to interest rate swaps but one of the legs is based on inflation. They use a real rate coupon and pay a redemption enhancement at maturity.

Real rate swaps

Real rate swaps strip out the effect of inflation by combining a nominal interest rate swap with a less inflation swap.

Cross currency swaps

Features

Currency swaps allow a company to raise funds in one currency and convert them into another currency.

Unlike an interest rate swap, in a currency swap the notional principal actually changes hands at the beginning of the swap and payments are made **without** netting.

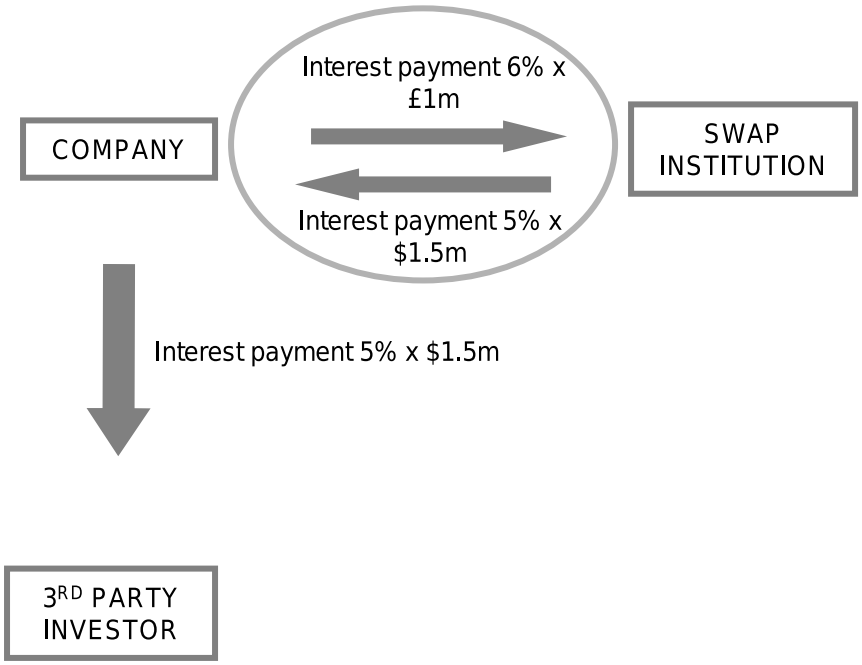
Example

A company raises $1.5m from a third party, paying a fixed rate of 5% pa over a three-year term.

The company then approaches a swap bank and swaps the $1.5m (at an exchange rate of $1.5:£1), receiving £1m for three years at a rate of 6%.

Over the following three years, the company pays the swap institution 6% x £1m and receives 5% x $1.5m. At the end of the three-year period the swap is reversed and the company uses the $1.5m from the swap bank to repay the third party.

The overall effect on the company is that it has raised £1m sterling over three years at a rate of 6%.



In the above example, all interest is paid at fixed rates. This is a 'fixed-for-fixed' currency swap. It is equally possible to swap 'fixed-for-floating'.

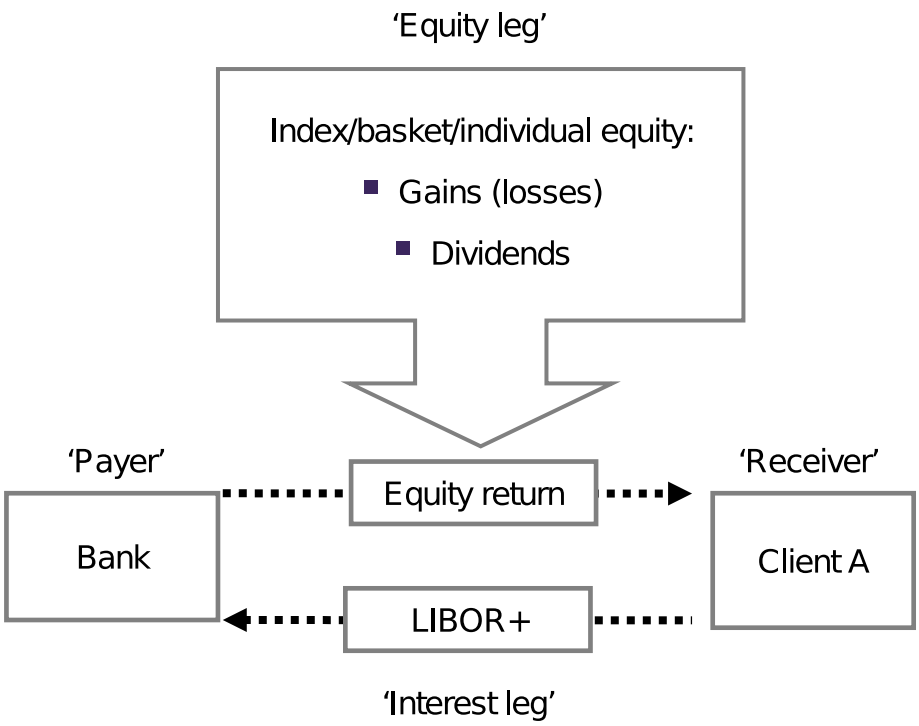
Equity swap

Entering into the equity market comes with various additional costs, such as commissions, charges and tax. An investor can gain exposure to the returns on the equity markets without incurring these additional costs by entering into an equity swap.

The swap would work as follows.

If, for example, an investor has a certain amount of money that she wishes to use to gain equity exposure she could place the money on deposit and enter into an equity swap.

The swap will involve the investor paying a rate of return, usually linked to LIBOR, on the deposit in exchange for the percentage change in the chosen equity. The chosen equity could be an individual share, a basket of shares put together specifically for the swap or shares representing an established index.



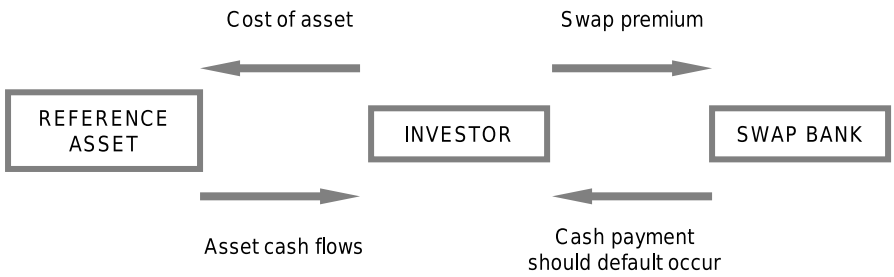
Thus the investor, by making a cash deposit and buying an equity swap, creates a synthetic equity fund without the extra cost of buying equity.

7.5. Credit derivatives

Credit default swaps

A credit default swap is used to reduce credit exposure.

The buyer of a credit default swap pays a premium to the swap bank and in return will receive a cash payment should a default event occur.



Synthetic CDOs

The popularity of CDOs has been overtaken in recent years by synthetic products, sometimes referred to as collateralised synthetic obligations. In a synthetic CDO, no physical transfer of bonds or loans take place from the credit institution to the SPV. Instead, the CDO gains exposure to credit risk by selling a credit default swap to the credit institution who holds the bonds or loans. In other words, the CDO is still being paid for bearing credit risk, just as it would do if it physically owned a bond.

The benefits are many, but the major advantage is that a wider variety of loans become accessible to the CDO as no physical transfer is necessary. Credit institutions, who would not normally pass on a particular client's loan (as this may have jeopardised a business relationship), can now keep the loan but pass on the credit risk.

The risks of credit derivatives

Credit derivatives are divided into two categories:

- An **unfunded credit derivative** is a bilateral contract between two counterparties where each is responsible for making payments and any cash or physical settlement under the contract is without recourse to other assets
- A **funded credit derivative** involves the protection seller making an initial payment that is used to settle any potential credit event

The ability to sell risk or buy risk protection in these ways has increased in popularity at a rapid rate. However, the proliferation of these investments brings with it its own risk to the financial services industry.

Many of the credit derivatives in existence now are purely speculative and cash settled, with no actual debt obligation being protected. This is mainly because the CDS market has become far bigger than the market for the asset on which it is based. Instead, rather like the gilt futures we saw earlier, many are based on a notional underlying asset. Nevertheless, unlike the gilt futures, as most CDSs are cash settled, there is no need to deliver the debt obligation against which it is measured. This in turn allows the CDS market to continue to grow even further.

Pricing of investments is of key concern to investors and generally we think of it as simply supply and demand. There are many theories about how the price can be assessed, and with futures we looked at fair value calculations to show how the value of the future can be derived from the price of the underlying asset.

However, as derivative markets have grown and become more liquid, it becomes less clear which is creating the price: the underlying asset or the derivative.

8. Commodity derivatives

8.1. Introduction

Commodities, such as metals, wheat and energy, are considered real assets. That is, they increase in value along with inflation. For this reason, investment in commodities and commodity indices are often considered a **hedge against inflation**. They also have a negative correlation with shares and bonds, allowing further diversification within the portfolio. Arguments also claim that they are a good hedge against 'event risk'. Where catastrophic events, such as war, hurricanes, earthquakes, can cause the stock markets to fall significantly, they typically increase the value of commodities.

However, commodities also have their own risks that financial investments are not exposed to. What follows is an overview of commodities and the factors that could affect the prices of them. The main influence on price for all these commodities will be **supply and demand**:

- Where supply of a commodity increases, assuming all other things are equal, the price of the commodity falls
- Where the demand for a commodity increases, assuming all other things are equal, the price of the commodity increases

The trading of commodities in the physical markets can be difficult for many reasons – the value of the assets tends to be large, the nature of the asset itself makes it difficult to hold and it is an over-the-counter market.

For this reason the derivatives markets are commonly used for commodity market participants. But even this is not attractive to many smaller or heavily regulated investors. More recently, the development of exchanged-traded products, such as exchange-traded commodities (ETC) allows investors to gain exposure to commodities and commodity indices through he medium of a share in an open ended company. Exchange-traded products are discussed in a later chapter.

8.2. Types of commodity

The term 'commodities' covers a broad range of products that can be broken into categories. The basic categories are:

- Softs and agriculturals
- Metals
- Energy products; and
- Exotics

Softs and agriculturals

The most frequently traded products are grouped into **softs**, which includes coffee, sugar and cocoa, and **agriculturals**, including wheat and barley.

Derivatives on these can be traded in the UK on Liffe.

Metals

Metals are traded actively in the cash market and also constitute underlying assets in a range of derivative products.

Metals fall broadly into two categories: **precious** metals and **base** metals. The precious metals are gold, silver, platinum and palladium. Metals other than precious metals are base metals; for example, copper, nickel, aluminium, zinc and tin.

Derivatives on these can be traded in the UK on the London Metals Exchange (LME).

Energy products

Energy product include oil, natural gas and coal. Carbon emission credits, mentioned below, often trade on energy markets.

Derivatives on these can be traded in the UK in the Intercontinental Exchange (ICE) and in the US on the New York Mercantile Exchange (NYMEX) which is part of the CME Group.

Exotics

In addition to the standard commodities products there is an increasing range of exotic products, allowing investors to speculate and hedge in many more ways.

The major types of exotic products are weather and emissions.

Weather

When considering agricultural commodities, weather was stated as a major influence on their price. Weather is always a risk to the farmer growing the crops, but also to the companies wishing to buy the crops. For example, bad weather causes the supply of crops to be reduced and the cost to rise.

It is not, however, only agriculture that is influenced by the weather. Tourism is an obvious industry that is affected by the weather, but also companies in general can hedge against particularly cold or hot weather and the increased energy consumption due to heating or cooling the buildings.

Weather derivatives can be traded on the Chicago Mercantile Exchange (CME) in the US.

Emissions

With the current political environment relating to climate change, the phrase 'carbon footprint' is on everyone's lips.

‘Emissions trading’ has evolved in response to this.

Certain governments put a limit (a cap) on the companies as to the amount of pollutants that can be emitted. If the company produces fewer pollutants than their cap, they are given credits which they can roll on and add to their caps for the coming years, possibly to allow future expansion.

However, if a company is intending to reduce their emissions over the long-term, they can sell these credits to other companies who are producing more pollutants than their cap allows. This system rewards those producing fewer emissions and penalises those who are not.

As the cap is fixed for all companies, there is a limit to the supply of emissions credits. This allows demand to influence the price of these credits.

Commodity derivative indices

There are many commodity derivative indices; the main ones to be aware of are as follows:

S&P GSCI – Goldman Sachs Commodity Index

The index is constructed by using components based on their liquidity and is weighted in relation to their global production levels. This makes the index valuable as both an economic indicator and as a benchmark for the commodities market in general.

DJUBS – Dow Jones UBS Commodity Index

This is an index that is composed of futures contracts on 19 physical commodities. It is known as a 'rolling index' due to its basing on contacts that avoid the usual delivery process. In order for an investor to avoid actual delivery of a commodity and still maintain a long position, contacts are 'rolled' by selling nearby contracts and purchasing contracts that have not yet reached the delivery period.

RICI – Rogers International Commodity Index

Designed by Jim Rogers on 31 July 1998, this index is calculated from 35 commodities from 11 international exchanges. The eligible commodities for inclusion are decided by the RICI committee and are used if they play a significant role in worldwide consumption by both developed and developing countries. This index is famous for being one of the most diverse of the commodity indices.

TR/J CRB - Thomson Reuters/Jefferies CRB

The Thomson Reuters/Jefferies CRB Index (TR/J CRB) is a commodity futures price index. It was first calculated by Commodity Research Bureau, Inc. in 1957. It is currently made up of 19 commodities as quoted on the NYMEX, CBOT, LME, CME and COMEX exchanges. These are sorted into four groups, each with different weightings.

9. Short selling

9.1. Introduction

Short selling is the selling of a stock that the seller does not own, or rather the sale of a security that is not owned by the seller, but that is promised to be delivered by the seller.

9.2. Process

When an investor sells a stock short, typically his broker will lend it to him. The stock will come from the brokerage's own inventory, from another one of the firm's customers or from another firm (possibly via an SBLI). The shares are sold and the proceeds are credited to the seller’s account.

At some date in the future, the investor must 'close' the short by buying back the same number of shares and returning them to his broker.

If during the time of the short the price has dropped, the investor can buy back the stock at the lower price and make a profit on the difference. If the price of the stock has risen, the investor has to buy it back at the higher price, and he loses money.

9.3. Motivations and risks

Generally, the two main reasons to short are to either speculate on falling prices or to hedge against a long position the investor already holds.

The risks are very similar to those we saw in short futures early in this chapter:

- It is a gamble, but then most speculative trades are
- Losses can be infinite. There is no limit to how high the price of the shorted stock can rise, giving unlimited potential losses
- Needs to be closed out. Shorting stock is not the end of the investment. The stock will need to be returned at some point to the investor that originally owned it
- Arrangement fees. More intermediaries will be involved in these transactions than are in a standard purchase or sale

9.4. Stock borrowing and lending

Introduction

A Stock Borrowing and Lending Intermediary (SBLI) is used to provide liquidity in the secondary market and can assist firms with short positions in a security.

Example

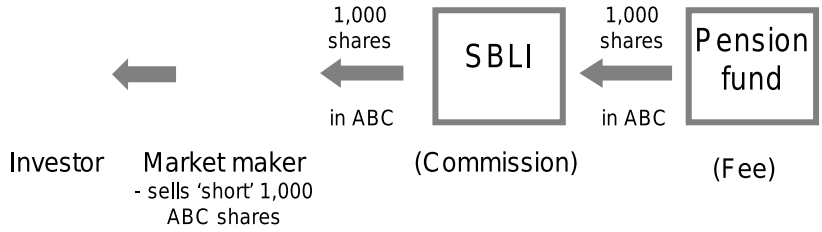
For example, suppose a market maker sells 1,000 shares of a security in which it is registered without owning the shares.

Although this may sound strange, it is very common. Because settlement of that trade is usually T+3, as long as the market maker has the stock to deliver in three days' time, the trade will settle as normal.

In order to achieve this, the market maker can contact an SBLI who will have access to large blocks of institutionally held stock.

For a fee, an institutional investor, for instance a pension fund, will lend the securities out to the market maker via the SBLI. Collateral may be required by the pension fund.

Summary diagram



After the market maker has sold the shares 'short', it will borrow stock via an SBLI so that it can settle its position with the investor.

Key points on the SBLI diagram

The pension fund loses the benefits attached to the securities, i.e. voting rights. All rights are now attributable to the investor. The investor will become the registered owner of the shares.

If this means the pension fund loses out on any dividends paid on the shares during the time the stock is being lent out, an artificial dividend will be manufactured into its fee.

In effect, the pension fund is only lending the stock out, and will therefore want it returned at some point in the future. It is the responsibility of the market maker to return the shares to the pension fund at a pre-determined future date.

10. Derivatives: clearing

10.1. LCH.Clearnet

Once a derivatives contract has been agreed between two parties, there is a risk that at least one of the parties will not meet their obligations.

This is called **counterparty risk.**

For derivatives traded on NYSE.LIFFE, LME and ICE Futures, counterparty risk is removed by a clearing house, such as LCH.Clearnet.

LCH.Clearnet is an independent organisation, owned by its member firms, that carries out the clearing process for the three London derivative exchanges.

Because LCH.Clearnet protects its members against the risk of counterparty default, it is itself exposed should one of the parties not fulfil its contractual obligations.

10.2. Margin

Margin attempts to cover LCH.Clearnet against the risks it faces when acting as central counterparty to a derivative transaction.

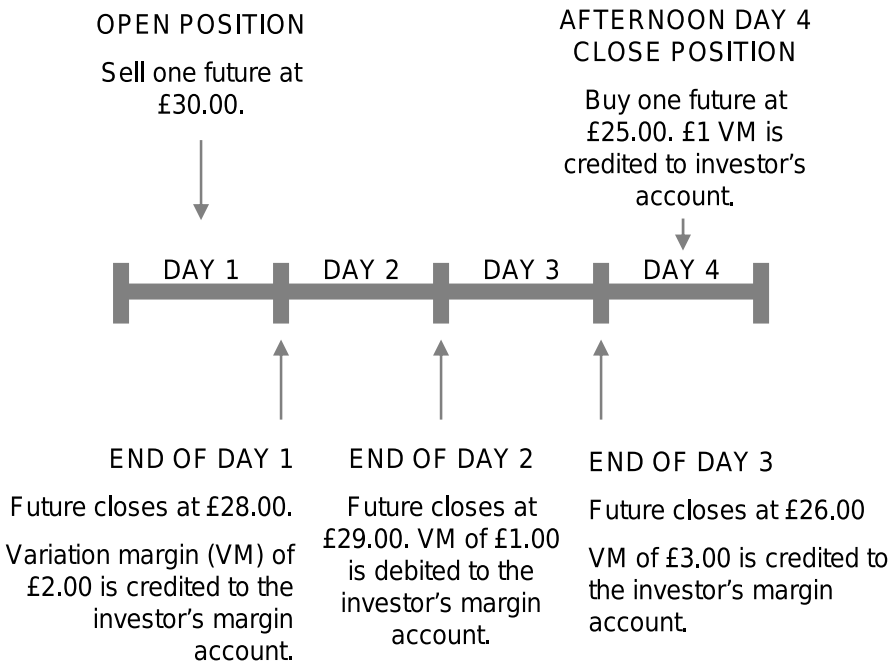
There are two types of margin: **variation** and **initial** margin.

Variation margin relates to the previous day's gains and/or losses made on open derivative positions.

Variation margin is paid by the loser of an open position and received by the winner of an open position.

Initial margin is a deposit of **good faith** usually payable by both sides of a derivative contract. This initial margin is deposited with LCH.Clearnet to cover the risk of the member defaulting.

Buyers and sellers of futures, and writers of options, are required to make margin payments covering both initial and variation margin.


OPEN POSITION
Sell one future at £30.00.
AFTERNOON DAY 4 CLOSE POSITION
Buy one future at £25.00. £1 VM is credited to investor's account.
DAY 1
DAY 2
DAY 3
DAY 4
END OF DAY 1
Future closes at £28.00.
Variation margin (VM) of £2.00 is credited to the investor's margin account.
END OF DAY 2
Future closes at £29.00. VM of £1.00 is debited to the investor's margin account.
END OF DAY 3
Future closes at £26.00
VM of £3.00 is credited to the investor's margin account.

11. Derivatives and other instruments: summary

11.1. Key concepts

13.1.1 Distinguish between forwards, futures and options

Futures

- 13.1.3 Identify the motive for using a futures contract rather than a trade in the underlying asset
- 13.2.3 Explain the nature of contracts for differences
- 13.1.5 Define the ‘basis’ of a futures contract
- 13.1.4 Explain the nature of, and reasoning behind, a contango and backwardation market
- 13.1.8 Define the concept of index arbitrage

Futures: hedging

- 13.1.15 Explain the use of futures in hedging an equity portfolio
- 13.1.16 Calculate the number of FTSE 100 futures or options contracts required to hedge a portfolio with a specified beta value

Options

- 13.1.9 Distinguish between American style and European style options
- 13.1.11 Determine when an option is in-the-money, out-of-the-money, or at-the money
- 13.1.13 Identify and explain the factors that determine the premium of an option
- 13.1.10 Differentiate the time value and intrinsic value components of an option premium
- 13.1.12 Calculate the time value of an option, given the premium, strike price and current market price

Options: hedging

- 13.1.15 Explain the use of options in hedging an equity portfolio

Strategies

- 13.1.14 Determine the maximum profit, maximum loss and the motivation behind the following option strategies: short and long call, put, straddle, covered call and protective put

Derivatives: products

- 13.1.6 Describe the main features of the following NYSE Liffe contracts: short term interest rate futures, long Gilt futures, FTSE 100 futures
- 13.1.7 Explain the possible uses of the above contracts in an investment management context
- 13.2.4 Explain the nature of, and motivations behind: interest rate swaps, currency swaps, equity swaps and inflation swaps

- 13.4.1 Identify the main purposes, mechanics and implications of a credit default swap (CDS)
- 13.4.2 Identify the main risks to the financial system resulting from the proliferation of credit derivatives

Commodity derivatives

- 14.1.1 Describe the main features of commodities markets
- 14.1.2 Identify the main ways investors can access the commodity markets
- 14.1.3 Explain the characteristics of the main commodity derivatives, including: energy, softs/ biofuels, metals, emissions, weather
- 14.1.4 Identify the main commodity derivative indices
- 14.1.5 Explain how commodity exposure can be viewed as a hedge against inflation and 'event' risk

Short selling

- 13.2.1 Explain the mechanics and uses of short selling
- 13.2.2 Explain the role of stock lending in the markets, and the benefits to the participants

Derivatives: clearing

- 13.1.2 Explain the nature, trading and settlement of exchange traded derivatives

Now you have finished this chapter you should attempt the chapter questions.