

Derivatives



Derivatives

Trading Options

- **Option premium:** Price which is paid by option buyers to option sellers.
- As options are traded, option premium keeps on changing.
- Option premium can be bifurcated into two components:
 - **Intrinsic Value:** It is the value to be received if the option is exercised immediately. Or the value by which the option is **In-the-money**.
 - **Time Value:** It is the difference between option premium and Intrinsic value

Derivatives

Trading Options

To recap, for call options:

- ▶ **out-of-the-money** implies that the price of an asset is **below** the exercise price;
- ▶ **at-the-money** implies that the price of the asset **equals** the exercise price; and
- ▶ **in-the-money** implies that the price of the asset is **above** the exercise price.

And for put options:

- ▶ **out-of-the-money** implies that the price of an asset is **above** the exercise price;
- ▶ **at-the-money** implies that the price of the asset **equals** the exercise price; and
- ▶ **in-the-money** implies that the price of the asset is **below** the exercise price.

Derivatives

Trading Options: Intrinsic and Time Value of options

Call Option

Premium: \$4; Strike Price: \$90; Spot Price: \$85

Put Option

Premium: \$8; Strike Price: \$110; Spot Price: \$115

Call Option

Premium: \$11; Strike Price: \$150; Spot Price: \$155

Put Option

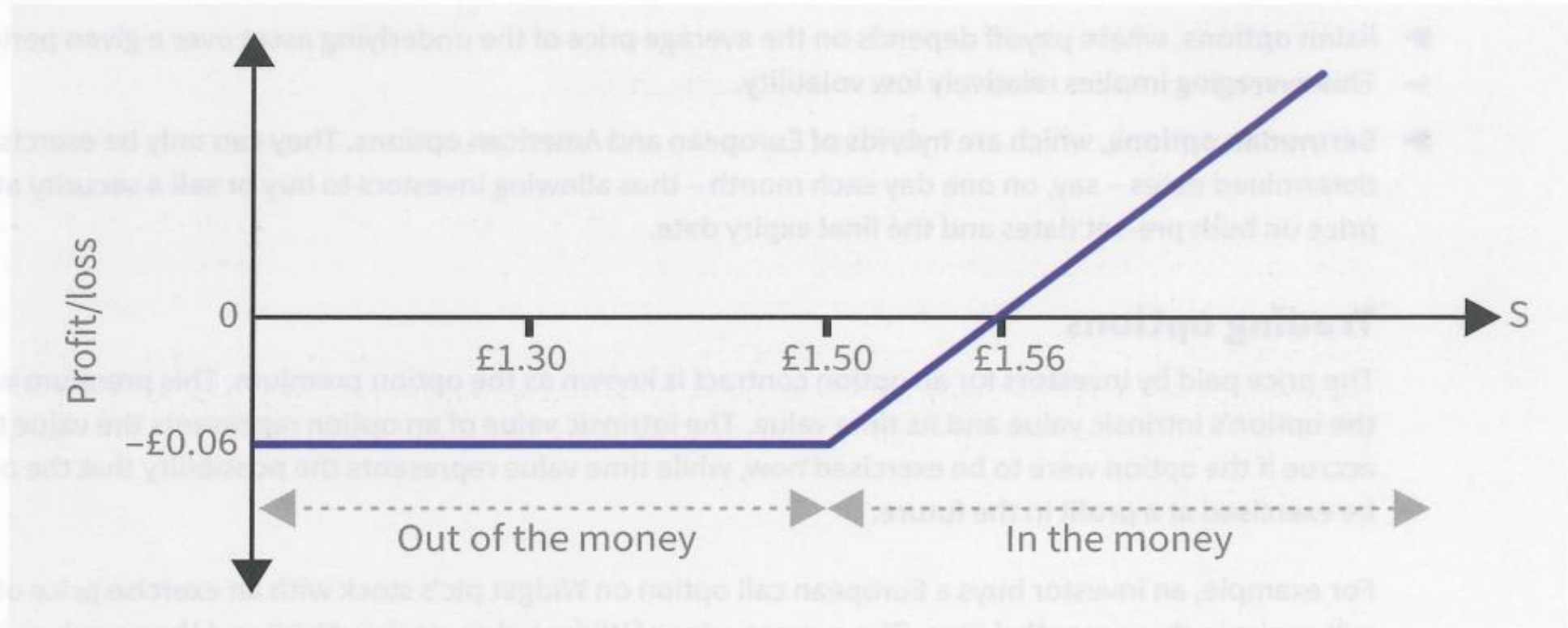
Premium: \$17; Strike Price: \$320; Spot Price: \$310

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Trading Options: Long Call: Premium: £0.06; Strike Price: £1.50

PROFIT/LOSS OF HOLDER OF CALL OPTION ON THE STOCK OF WIDGET PLC



Derivatives

Trading Options: Long Call: Premium: £0.06; Strike Price: £1.50

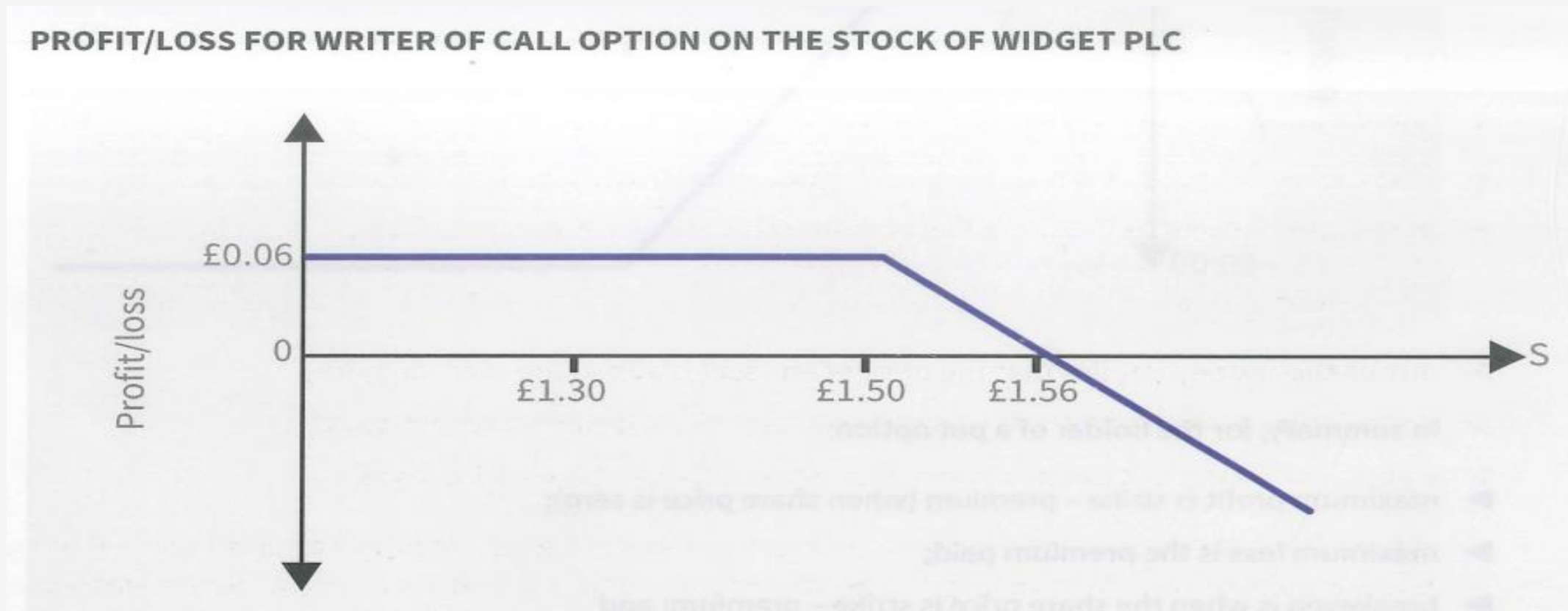
- ▶ limits their loss to £0.06 per contract, but does not limit their possible gain;
- ▶ will exercise the option as long as the spot price is greater than the strike price (a bullish motivation); and
- ▶ will break even when the strike price plus the premium equals the spot price.

In summary, for the holder of a call option:

- ▶ maximum profit is potentially unlimited;
- ▶ maximum loss is the premium paid;
- ▶ breakeven is when the share price is strike + premium; and
- ▶ motivation for the trade: bullish (expecting market to rise).

Derivatives

Trading Options: Short Call or Writing Call: Premium: £0.06; Strike Price: £1.50



Derivatives

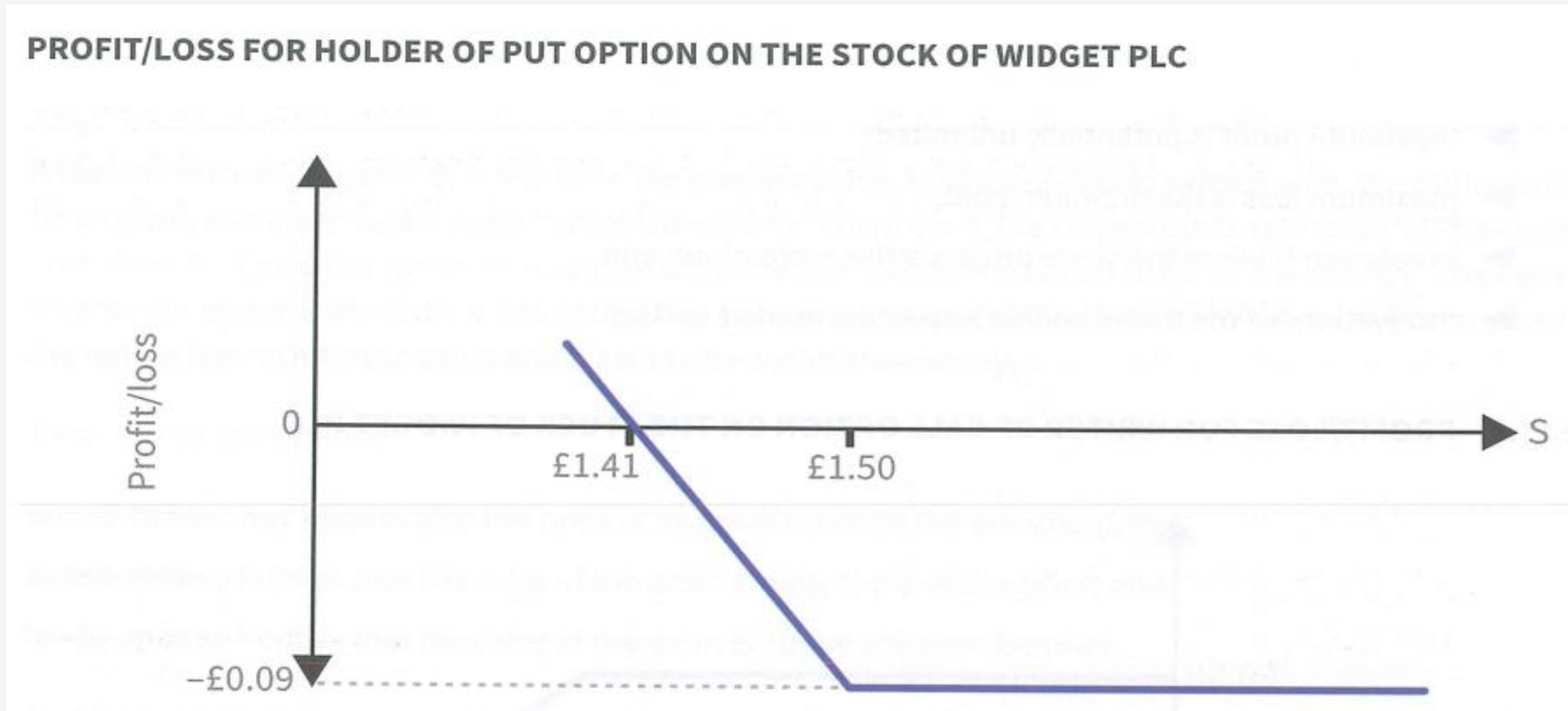
Trading Options: Short Call or Writing Call: Premium: £0.06; Strike Price: £1.50

In summary, for the writer of a call option:

- ▶ maximum profit is the premium earned;
- ▶ maximum loss is potentially unlimited;
- ▶ breakeven is when the share price is strike + premium; and
- ▶ motivation for the trade: bearish/neutral (expecting market to fall or remain static).

Derivatives

Trading Options: Long Put: Premium: £0.09; Strike Price: £1.50



Derivatives

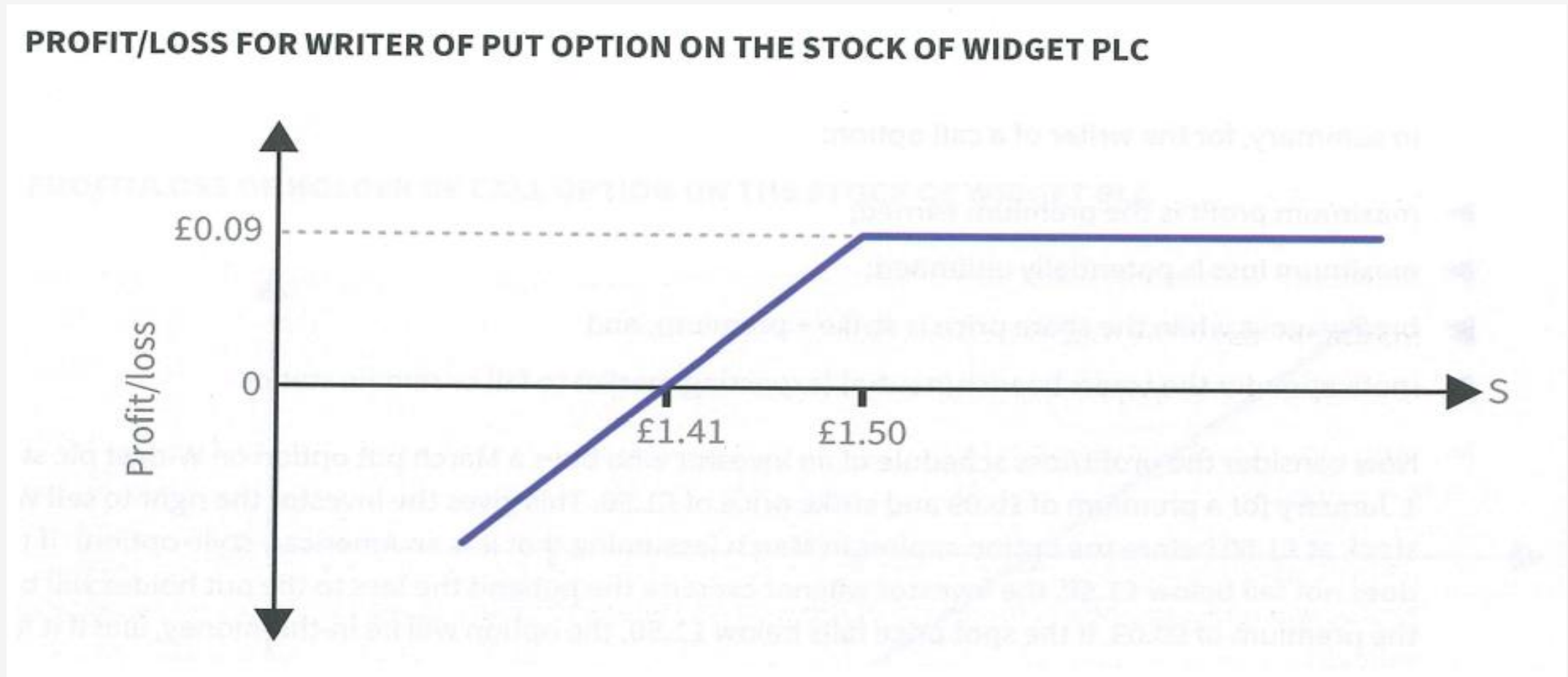
Trading Options: Long Put: Premium: £0.09; Strike Price: £1.50

In summary, for the holder of a put option:

- ▶ maximum profit is strike – premium (when share price is zero);
- ▶ maximum loss is the premium paid;
- ▶ breakeven is when the share price is strike – premium; and
- ▶ motivation for the trade: bearish.

Derivatives

Trading Options: Short Put or Writing Put: Premium: £0.09; Strike Price: £1.50



Derivatives

Trading Options: Short Put or Writing Put: Premium: £0.09; Strike Price: £1.50

In summary, for the writer of a put option:

- ▶ maximum profit is premium earned;
- ▶ maximum loss is strike – premium (when share price is zero);
- ▶ breakeven is when the share price is strike – premium; and
- ▶ motivation for the trade: bullish/neutral.

Derivatives

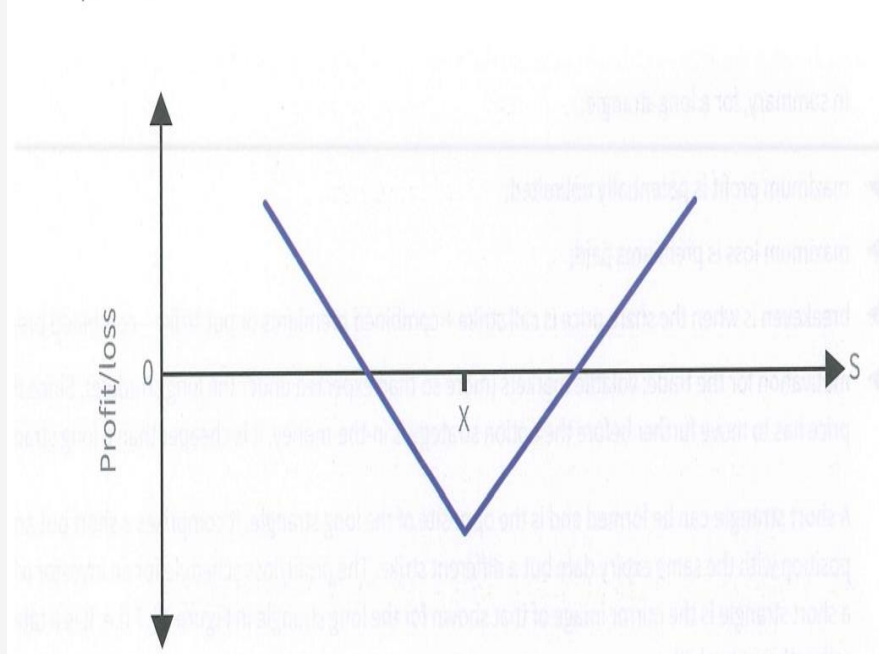
Trading Options: Short Put or Writing Put: Premium: £0.09; Strike Price: £1.50

Derivatives

Trading Options: Combining Options

- **Long Straddle:** Buy Call and Buy Put at **same strike** and same expiry date

PROFIT/LOSS OF LONG STRADDLE



In summary, for a long straddle:

- ▶ maximum profit is potentially unlimited;
- ▶ maximum loss is the total premiums paid (for call + put);
- ▶ breakeven is when the share price is strike \pm premiums; and
- ▶ motivation for the trade: volatile markets (the investor thinks the market is unstable but is not sure which way the prices will go).

Derivatives

Trading Options: Combining Options

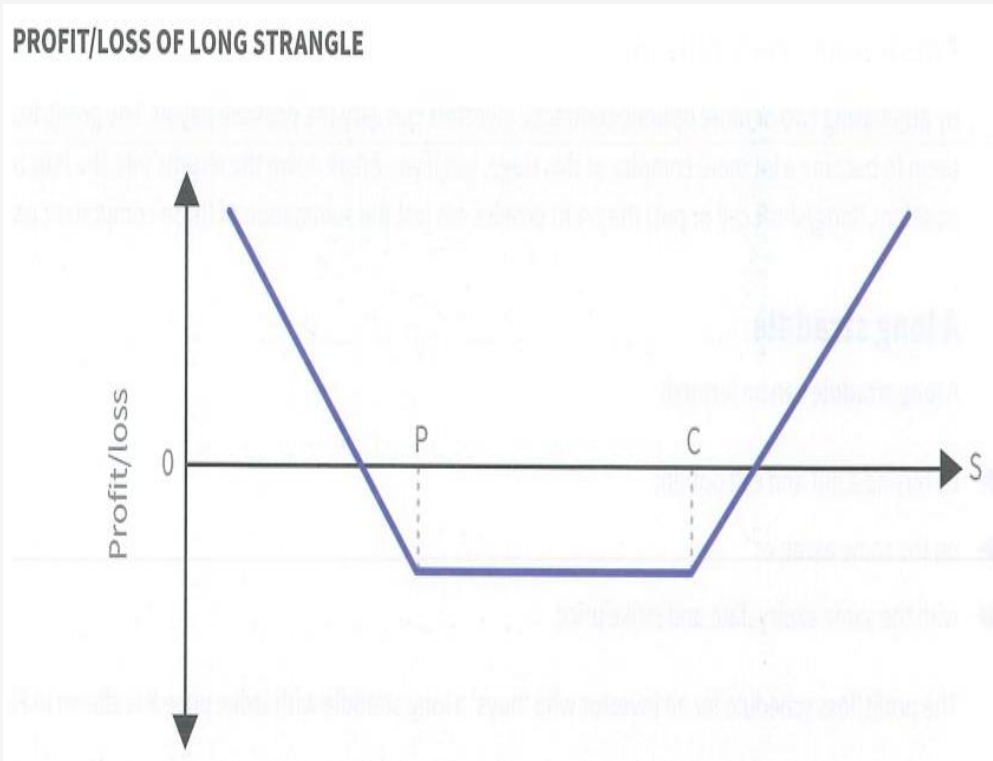
➤ **Short Straddle**: Sell Call and Sell Put at **same strike** and same expiry date

The maximum profit is the sum of the premiums; the maximum loss is potentially unlimited, and the breakeven is the same as that of the long straddle. The motivation would be the opposite for that of the long straddle – i.e. static markets. The investor believes that markets are not going to move much above or below the strike.

Derivatives

Trading Options: Combining Options

➤ **Long Strangle:** Buy Call and Buy Put at **different strike** and same expiry date



In summary, for a long strangle:

- ▶ maximum profit is potentially unlimited;
- ▶ maximum loss is premiums paid;
- ▶ breakeven is when the share price is call strike + combined premiums or put strike - combined premiums; and
- ▶ motivation for the trade: volatile markets (more so than expected under the long straddle). Since the share price has to move further before the option strategy is in-the-money, it is cheaper than a long straddle.

Derivatives

Trading Options: Combining Options

- **Short Strangle**: Sell Call and Sell Put at **different strike** and same expiry date

The maximum profit is the combined premiums paid, and the maximum loss is potentially unlimited (if the share price goes high enough). The breakeven is the same as that of the long strangle. The motivation for the trade is the opposite to that of the long strangle, i.e. a stable market is expected. The investor thinks that the market is a little less stable than expected with the short straddle, so they make sure that the share price has to move further before either option is in-the-money. So the premium income is lower than that for a short straddle.

Derivatives

Trading Options: Combining Options with underlying asset

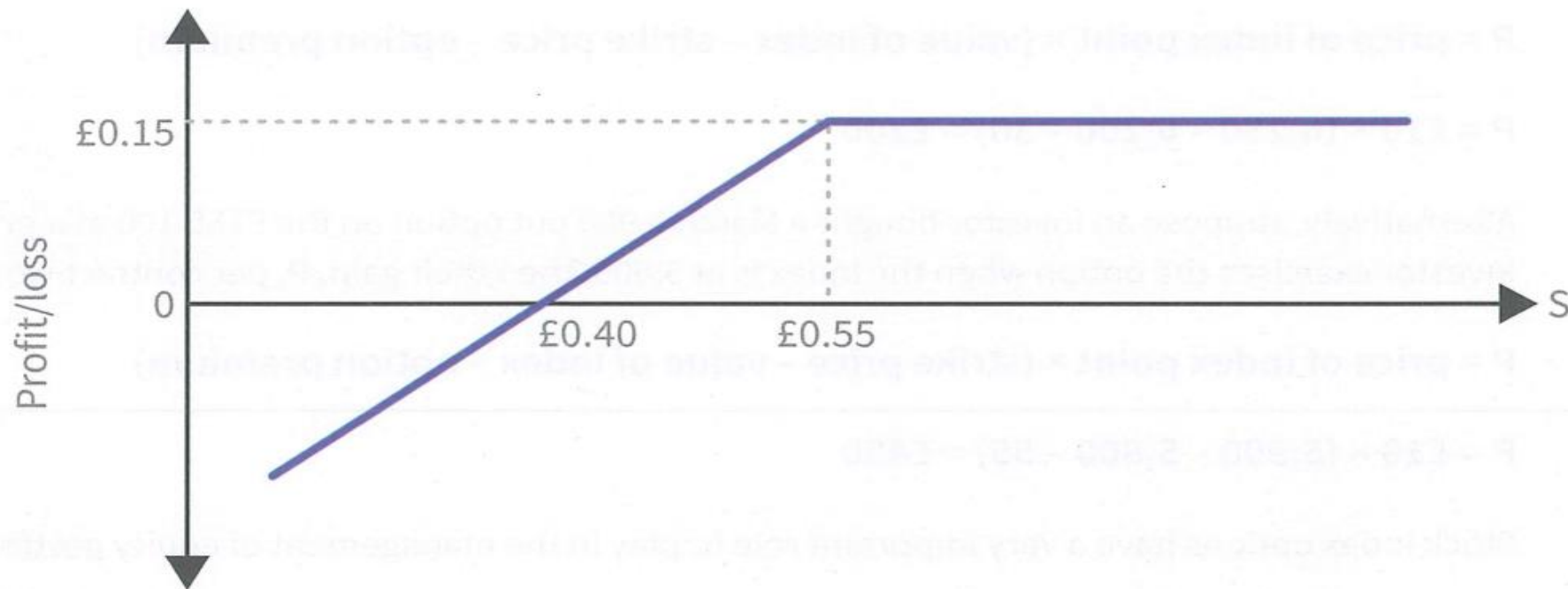
- **Covered Call:** Buy Stock and Sell Call
- Example: An investor buys stock at £0.50 and sells a call option with a strike of £0.55 for a premium of £0.10.
 - This provides a protection from fall in stock price till £0.40
 - Maximum gain is £0.15

Derivatives

Trading Options: Combining Options with underlying asset

- **Covered Call:** Buy Stock and Sell Call

PROFIT/LOSS FROM COMBINING A LONG POSITION WITH A SHORT CALL ON THE ASSET (COVERED CALL)



Derivatives

Trading Options: Combining Options with underlying asset

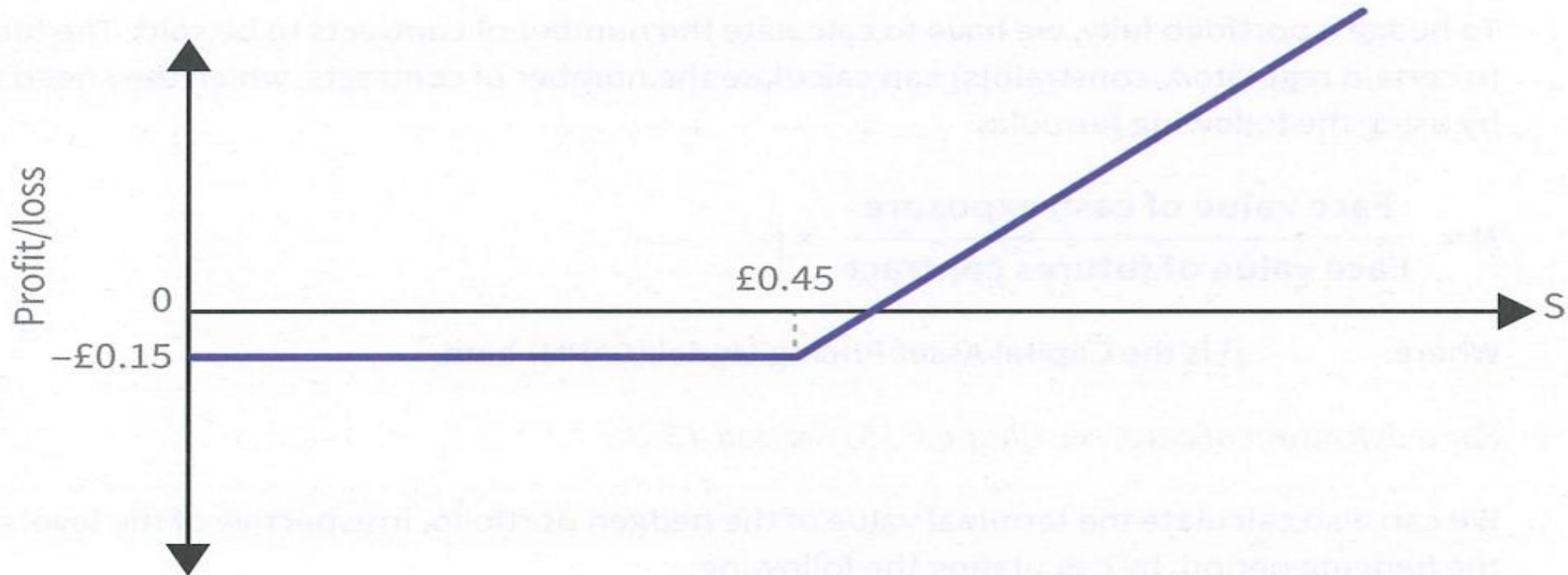
- **Protective Put:** Buy Stock and Buy Put
- Example: An investor buys stock at £0.50 and buys a put option with a strike of £0.45 for a premium of £0.10.
 - This provides full protection from fall in stock price
 - Maximum loss is £0.15
 - Maximum gain is unlimited

Derivatives

Trading Options: Combining Options with underlying asset

- **Protective Put:** Buy Stock and Buy Put

PROFIT/LOSS FROM COMBINING A LONG ASSET POSITION WITH A LONG PUT ON THE ASSET (PROTECTIVE PUT)



Derivatives

Trading Options: Combining Options with underlying asset

Derivatives

Trading Options: Stock Index Options

- Index options are traded in most of the exchanges.
- In ICE Futures, FTSE 100 is the index option that is cash settled.
 - Each point on index is valued at £0.10.

Derivatives

Trading Options: Stock Index Options

The premium of ICE Futures Europe stock index option is quoted in index points. For example, suppose an investor purchased a March 6,200 call option on the FTSE 100, at a price of 30. This means that the investor

will exercise the option if the index rises above 6,200 before expiry in March, where the price of the option is £300 (30 × £10). If the investor exercises the option when the index is at 6,250, then their gain, **P**, per contract would be:

$$P = \text{price of index point} \times (\text{value of index} - \text{strike price} - \text{option premium})$$

$$P = £10 \times (6,250 - 6,200 - 30) = £200$$

Derivatives

Trading Options: Stock Index Options

Alternatively, suppose an investor bought a March 5,900 put option on the FTSE 100 at a price of 55. If the investor exercises the option when the index is at 5,800, then their gain, **P**, per contract would be:

$P = \text{price of index point} \times (\text{strike price} - \text{value of index} - \text{option premium})$

$$P = £10 \times (5,900 - 5,800 - 55) = £450$$

Stock index options have a very important role to play in the management of equity portfolios.

Derivatives

Role of Derivatives in Portfolio Management: Hedging with Futures

- An equity portfolio manager can hedge a portfolio of UK equities by **selling** FTSE 100 stock index futures.
- The **number of contracts to sell** to hedge a portfolio can be calculated as follows:

$$N = \frac{\text{Face value of cash exposure}}{\text{Face value of futures contract}} \times \beta$$

$$TV_1 = MV_0 \times \left[1 + \left[\frac{P^f - P^s}{P^s} \times \beta \right] \right]$$

- The terminal value of the hedged portfolio is calculated as follows:

Where: TV_1 is the terminal value of the portfolio;

MV_0 is the initial value of the portfolio; and

P^f and P^s are the current (at inception) prices of the futures contract and the spot index, respectively.

Derivatives

Role of Derivatives in Portfolio Management: Hedging with Futures

- We can calculate hedge efficiency to know how effective was hedge:

$$\text{Hedge efficiency} = \frac{\text{Absolute gain/loss from futures position}}{\text{Absolute gain/loss from cash market}} \times 100\%$$

Derivatives

Role of Derivatives in Portfolio Management: Hedging with Options

- An equity portfolio manager can hedge a portfolio of UK equities by **buying** FTSE 100 stock index puts.
- This has the advantages that
 - It protects from downside
 - It allows to benefit from upside
- Number of puts to be used for hedging are calculated as follows:

$$N = \frac{\text{Face value of cash exposure}}{\text{Face value of index option}} \times \beta$$

Derivatives

Determinants of Option Premium

	Call Option	Put Option
Spot Price	Direct	Inverse
Exercise Price	Inverse	Direct
Time to Expiry	Direct	Direct
Volatility of share price	Direct	Direct
Discount rate (Interest rate)	Direct	Inverse

Derivatives

Delta and Other Greeks

Delta	Measures sensitivity of option price to the underlying asset price
Theta	Measures sensitivity of option price to the passage of time
Vega	Measures sensitivity of option price to the change in the volatility of the underlying asset
Rho	Measures sensitivity of option price to the change in interest rates