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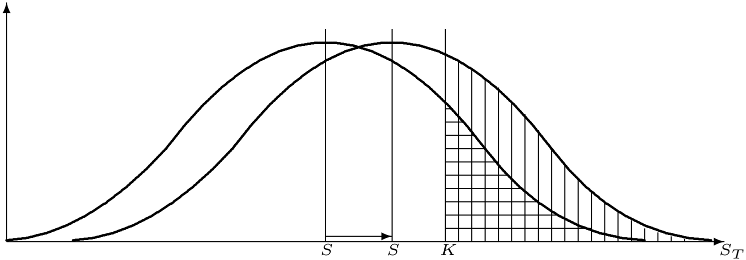
Properties of option prices

Influences on option values

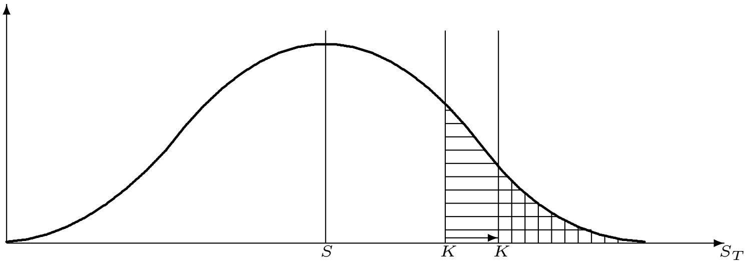
- Option values are affected by a large number of parameters and knowing these can help to hedge the exposure of the underlying asset
- Option pricing theory allows to analyse the influence these variables have on option values
- These influences can be used by investors to hedge risks

Current asset value



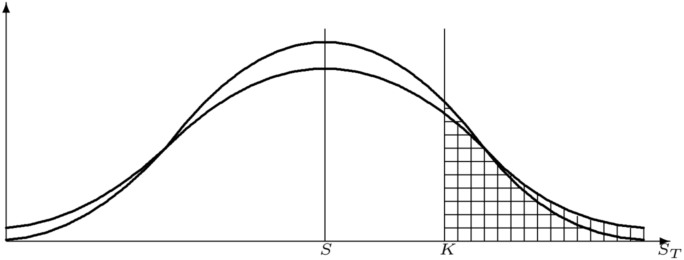
If the current asset value increases, call options become more valuable

Strike price



If the strike price increases, call options become less valuable

Volatility



If the volatility increases, call options become more valuable

A long time to maturity will increase the variability of the final value and affect the option price in the same way

Option Greeks

- The effect of variables have on option prices are known as the Greeks
- The Greeks measure the marginal effect a variable has on the option price

	Call options	**Put options**
Delta	$\Delta_C = \frac{\partial C}{\partial S} = N\left(d_1\right)$	$\Delta_P = \frac{\partial P}{\partial S} = N\left(d_1\right) - 1$
Vega	$\nu_C = \frac{\partial C}{\partial \sigma} = Sn\left(d_1\right)\sqrt{T} = \frac{\partial P}{\partial \sigma} = \nu_P$	
Theta	$\theta_C = \frac{\partial C}{\partial T} = -\frac{Sn(d_1)}{2\sqrt{T}} - rKe^{-rT}N\left(d_2\right)$	$\theta_P = \frac{\partial P}{\partial T} = -\frac{Sn(d_1)}{2\sqrt{T}} + rKe^{-rT}N\left(d_2\right)$
Gamma	$\Gamma_C = \frac{\partial^2 C}{\partial S^2} = \frac{n(d_1)}{S\sigma\sqrt{T}} = \frac{\partial^2 P}{\partial S^2} = \Gamma_P$	

Δ-hedging

- Investors can use options not only to hedge their final payoff, but also the value of their position at any time
- Portfolio value hedged with a put option: $V = S + hP$
- Values do not change as the asset value changes: $\frac{\partial V}{\partial S} = 0$

$\Rightarrow$ $h = \frac{1}{1-N(d_1)} = -\frac{1}{\Delta_P}$

- This is known as the hedge ratio
- For each asset, the investor should hold h put options and the value of their combined position does not change as the asset value changes

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