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:: Put-Call Parity Relationship::

Consider buying a put and selling a call option on the same underlying, at the same strike price E and same expiry time T. This will guarantee a payoff of E-S(T) at expiry:

$$\begin{aligned} &\text{Payoff}\ (t = T) = \\ &C\ (S,\ t = T) - \text{Put}\ (S,\ t = T) \\ &= \text{Max}\,[E - S\ (T),\ 0] - \text{Max}\,[S\ (T) - E,\ 0] \\ &= E - S\ (T) \end{aligned}$$

So if we further also consider buying the underlying we can guarantee a payoff of E. This is a riskless investment, and so according to there being no arbitrage opportunities this investment must at all times be the same as having invested **E exp(-r T)** (i.e. the discounted value of E), assuming a constant riskless interest rate r. So at any time t between the writing of the options and expiry, the following relation must hold:

$$S\ (t) + P\ (S,\ t) - C\ (S,\ t) = E e^{-rT} e^{rt}$$

or equivalently:

$$C\ (S,\ t) - P\ (S,\ t) = S\ (t) - E e^{-r\,(T-t)}$$

Where C(S,t) and P(S,t) are the respective values of the call and the put at time t.

This is the **Put-Call Parity** relation. So having priced a call option one can use this to price a put option on the same underlying with the same strike and expiry.

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