***European Option Put-Call Parity***

Buying a stock and buying a put option is equivalent to buying a call option and buying government bonds, where both European-style options are written on the same underlying stock, with the same strike price and maturity, and the government bond investment equals the present value of the options’ strike price:

LongStock + LongPut = LongCall + LongGovtBonds

$$ S\_{0} + p\_{0} = c\_{0 }+ K\_{T}.e^{-r.T}$$

The above equation shows asset prices at time zero (now).

This relationship should always hold before and at maturity. At any time t:

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$$S\_{t}+p\_{t}=c\_{t}+K\_{T}.e^{-r.(T-t)}$$

At maturity (T):

$$ S\_{T }+ p\_{T} = c\_{T} + K\_{T}$$





***Investments versus Cash Flows***

A positive investment is a negative cash flow, so put-call parity expressed as an investment now (t=0) uses the familiar equation:

$$S\_{0}+p\_{0}=c\_{0}+K\_{T}.e^{-r.T}$$

But put-call parity expressed as cash flows now (t=0) is:

$$-S\_{0}-p\_{0}=-c\_{0}-K\_{T}.e^{-r.T}$$

This is because investing in, say, a stock, means paying money now which is a negative cash flow now, hence the switch in the signs (+ to -). So:

Buying stock = Long stock = Investing in stock = Spending cash on stock = Negative cash flow on stock purchase

***Adjustment for Dividends***

Dividends can be included by simply replacing all instances of $S\_{0}$ with:

* $S\_{0}-D\_{0}$ where $D\_{0}$ is the present value of the discrete dividend paid at time t, so $D\_{0}=D\_{t}.e^{-r.t}$ and r is the continuously compounded risk free rate:

$$(S\_{0}-D\_{0})+p\_{0}=c\_{0}+K\_{T}.e^{-r.T}$$

* $S\_{0}.e^{-q.t}$ where $q$ is the continuously compounded annual dividend yield, say when $S$ is a stock index such as the S&P500:

$$(S\_{0}.e^{-q.t})+p\_{0}=c\_{0}+K\_{T}.e^{-r.T}$$