Hw4p4

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HW4 (Stochastic Methods Lab)

Problem 4

Given:

Portfolio A: Buy one call and sell one put for the same stock with price S at time 0 and S(T) at expiration T.,

Strike price (same) K.

Portfolio B: Buy one stock and borrow bonds worth K at time T. Then we a "non-arbitrage argument" to derive a relationship between the prices of European calls and puts.

put-call Parity.
↳ If you want to get the upside of owning the stock still mitigating the downside in case it goes down

The resulting formula is called the "put-call parity."

Put Call parity formula: $C + K = P + S$

Let

$C \rightarrow$ price of call option
$P \rightarrow$ price of put option
$K \rightarrow$ Strike price.
$S \rightarrow$ Stock price at $t=0$
$S(T) \rightarrow$ Stock price at expiration $(t=T)$
Let there is loan X.

The initial cash flow $= C-P-S+K$. (from portfolio A) — (1)

At expiration,

Case I:
Call option worthless and put option will be worth $X - S(T)$

Case II:
Put option worthless and call option will be worth $S(T) - X$

After exercising everything and repaying X, net future cash flow $= 0$.
$\Rightarrow$ No arbitrage principle applied which sets up initial cash flow to zero in either case.

$\therefore$ (1) $= 0$.
$\Rightarrow C-P-S+K = 0$
$\Rightarrow \boxed{C+K = P+S}$ ← put-call parity.