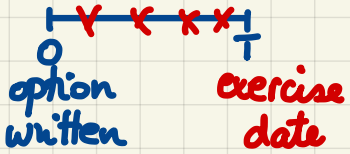
European Put Options.



Usually, a right but not an obligation to SELL the underlying @ the strike price!

At time 0: The writer and the buyer of the put agree on:

- the underlying asset: $S(t)$, $t \geq 0$;
- the exercise date T;
- the strike/exercise price K.

The put premium $V_p(0)$ is paid by the put's buyer to the put's writer.

At time T:

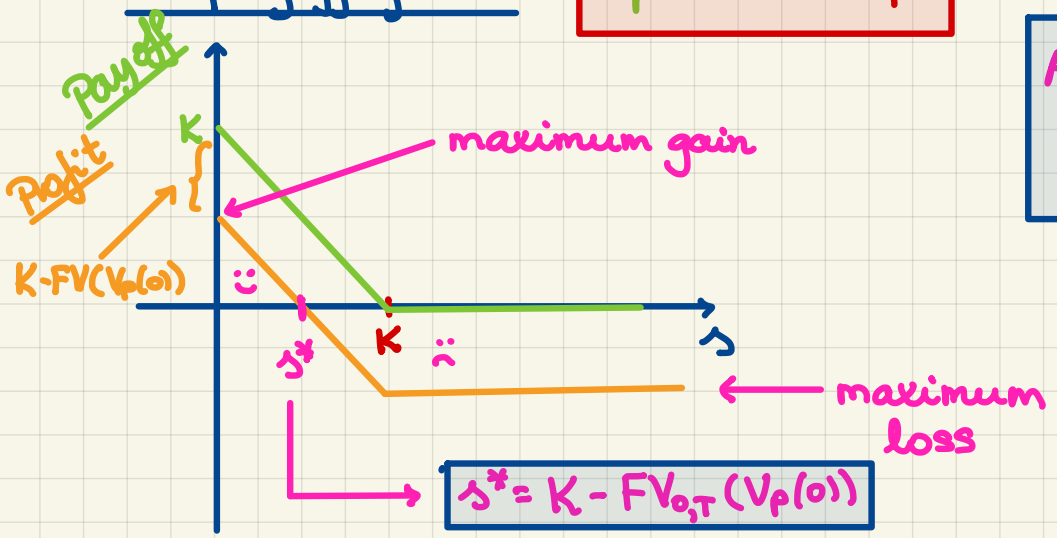
- The put's owner has a right, but not an obligation to SELL one unit of the underlying asset for the strike price K.
- The put's writer is obligated to do what the put's owner decides

The put's owner's optimal behavior is:

	PAYOFF
IF $K > S(T)$, then exercise.	$K - S(T)$
IF $K \leq S(T)$, then do not exercise.	0

The Payoff: $V_p(T) = (K - S(T))_+ = \max(K - S(T), 0)$

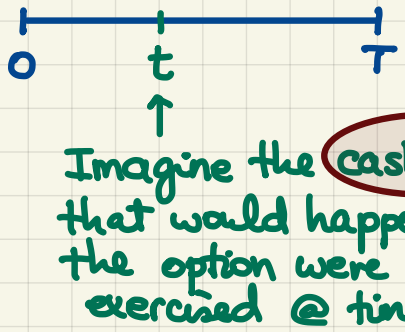
The payoff f'tion: $v_p(s) = (K - s)_+$



A LONG PUT IS A SHORT POSITION w.r.t. the underlying.

Moneyness.

Consider an option written @ time·0 w/ exercise date @ time·T.



Imagine the cashflow that would happen if the option were exercised @ time·t.

e.g.,
call: $S(t)-K$
put: $K-S(t)$

If this cashflow is
- >0 we say the option is in·the·money
- $=0$ we say the option is at·the·money
- <0 —"— —"— out·of·the·money

University of Texas at Austin

Problem Set #6

European put options.

Problem 6.1. The initial price of the market index is \$900. After 3 months the market index is priced at \$915. The nominal rate of interest convertible monthly is 4.8%. The premium on the put, with a strike price of \$930 is \$8.00. What is the profit at expiration for a **long** put?

(a) \$15.00 loss
(b) \$6.90 loss
(c) \$6.90 gain
(d) \$15.00 gain
(e) None of the above.

Distraction!

$i^{(12)}$

$\Rightarrow$ effective monthly i.r. is $\frac{i^{(12)}}{12} = 0.004$

$\longrightarrow$: Payoff: $(K - S(T))_+ = (930 - 915)_+ = 15$

Profit: $15 - 8(1.004)^3 = 6.90$ □

Problem 6.2. Sample FM(DM) #12

Consider a European put option on a stock index without dividends, with 6 months to expiration, and a strike price of 1,000. Suppose that the nominal annual risk-free rate is 4% **convertible semiannually**, and that the put costs 74.20 now. What price must the index be in 6 months so that being long the put would produce the same profit as being short the put?

A. 922.83
B. 924.32
C. 1,000.00
D. 1,075.68
E. 1,077.17

effective per half-year is $\frac{0.04}{2} = 0.02$

We're really looking for the break-even price.

$s^* = K - FV_{0,T}(V_p(0))$

$s^* = 1000 - 74.20(1.02) = 924.32$

Problem 6.3. Farmer Shaun is producing sweet potatoes. He intends to harvest 10,000–cartons' worth in six months. His total costs are \$12.00 per carton.

He wishes to hedge using European put options. There are two puts on sweet potatoes with the exercise date in six months available: one with the strike price of \$13 per carton and another with the strike price of \$15 per carton. Their premiums are \$0.15 and \$0.18, respectvely.

Assume that the prevailing risk-free interest rate is 4% effective for the half-year period.

At harvest time, in six months, it turns out that the sweet-potato spot price equals \$14. What would Farmer Shaun's profit be if he had decided to hedge using the \$13-strike put versus his profit if he had decided to use the \$15-strike put to hedge?

Focus on the Payoff (w/out production costs)

unhedged: $S(T)$

hedge: $(K-S(T))_+$ } +

total hedged:

$$S(T)+(K-S(T))_+ = \begin{cases} K & \text{if } K>S(T) \\ S(T) & \text{if } K\le S(T) \end{cases}$$

$$= \max(S(T),K)$$

FLOOR { • long underlying • long put

\$13 Payoff: $\max(13,14)=14$

answer: $14-12-0.15\cdot 1.04=$ _____

\$15 Payoff: $\max(15,14)=15$

answer: $15-12-0.18\cdot 1.04=$ _____

} $\times$ 10,000

Covered Put.

- written put
- short underlying