Hedging w/ a Collar.

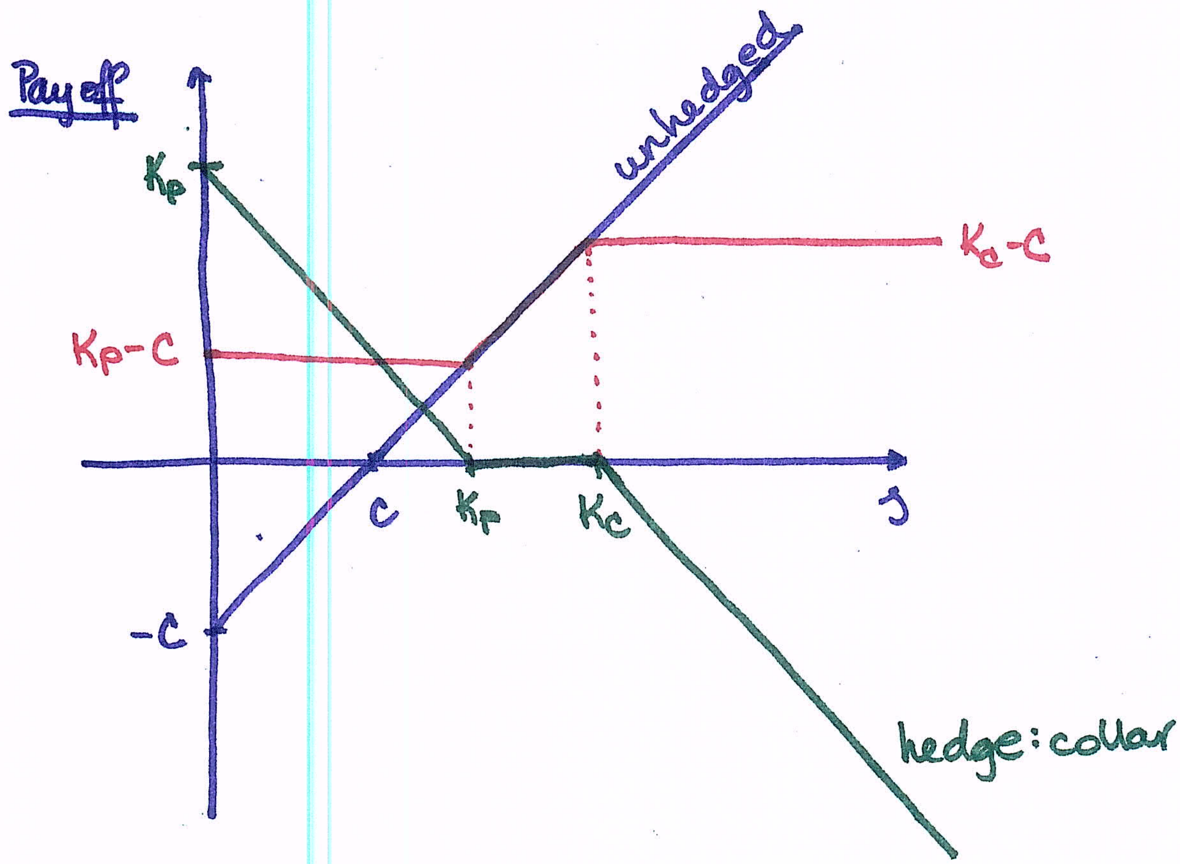
D: Feb 25^{th}, 2019.

Start w/ a producer of gods.
C ... total & aggregate costs of production valued @ the time of sale
$\Rightarrow$ Unhedged payoff f'tion: $S - C$

Hedge: A $\boxed{\text{COLLAR}}$

- long K_P-strike put
- written K_C-strike call

$\Big\}$ w $K_P \leq K_C$



$\Rightarrow$ The payoff range: $[K_P - C, K_C - C]$

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Problem set 6

Collars.

Problem 6.1. Sample FM (Derivatives Markets): Problem #3.
Happy Jalapeños, LLC has an exclusive contract to supply jalapeño peppers to the organizers of the annual jalapeño eating contest. The contract states that the contest organizers will take delivery of 10,000 jalapeños in one year at the market price. It will cost Happy Jalapeños 1,000 to provide 10,000 jalapeños and today's market price is 0.12 for one jalapeño. The continuously compounded risk-free interest rate is 6%.

Happy Jalapeños has decided to hedge as follows (both options are one year, European):

(1) buy 10,000 0.12-strike put options for 84.30, and
(2) sell 10,000 0.14-strike call options for 74.80.

} COLLAR.

Happy Jalapeños believes the market price in one year will be somewhere between 0.10 and 0.15 per pepper. Which interval represents the range of possible profit one year from now for Happy Jalapeños?

A. 200 to 100
B. 110 to 190
C. 100 to 200
D. 190 to 390
E. 200 to 400

Recall that the payoff range is

$$10{,}000 \times [K_P - C, K_C - C] = 10{,}000 [0.12 - 0.10, 0.14 - 0.10]$$

(C ↑ cost per pepper)

$$= \underline{\underline{[200, 400]}}$$

Initial cost: $84.30 - 74.80 = 9.50$

$\Rightarrow FV_{0,1}(9.50) = 9.5e^{0.06} \approx 10.0874$

$\Rightarrow$ Approximate profit range: $[190, 390] \Rightarrow$ (D).

2.

Derivative Securities

... have the value which is based on the market price of another asset

Example. • Forward Contracts:

@ the time the two parties enter the forward contract they agree on the forward price F

$\Rightarrow$ the payoff of the long forward

$$S(T) - F$$

• European Calls:

w/ strike price K

$\Rightarrow$ the payoff of the long call

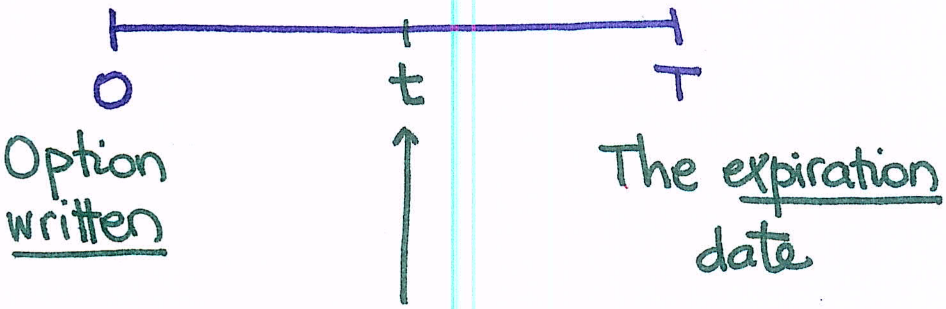
$$(S(T) - K)_+$$

• European Puts:

w/ strike price K

$\Rightarrow$ the payoff of the long put

$$(K - S(T))_+$$



we can observe $S(t)$ ... the price of the underlying asset

$$\{S(t),\ 0 \le t \le T\} \longmapsto \text{PAYOFF}$$

<u>Examples</u>: • Base your payoff on, say, the <u>average</u> behavior of the stock price.

e.g., $$\left(\frac{1}{n}\sum_{k=1}^{n} S(t_k) - K\right)_+$$

⇒ this is a type of an Asian option.

• <u>Introduce</u>: • the minimum observed stock price

$$m(T) := \min_{0 \le t \le T} S(t)$$

• the maximum observed stock price

$$M(T) := \max_{0 \le t \le T} S(t)$$

<u>e.g.</u>, An option which pays a "reward" if the min of the stockprice sinks below a threshold during the life of the option.

⇒ this is a type of rebate option

e.g., $(M(T) - S(T))$

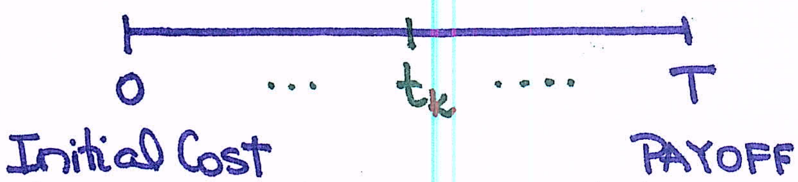
or

$(S(T) - m(T))$

$\Rightarrow$ Lookback options

Dynamic Portfolios.

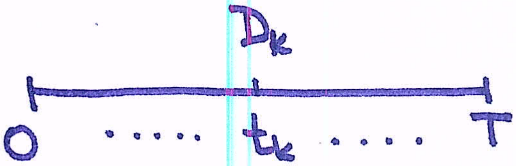
C_k ... intermediate cashflows $\begin{cases} > 0 & \text{inflow} \\ < 0 & \text{outflow} \end{cases}$



$$\text{Profit} := \text{Payoff} - FV_{0,T}(\text{Initial Cost}) + \sum_k FV_{t_k,T}(C_k)$$

generalize!

Example. [Discrete dividend paying stocks]



$k = 1..n$, $t_n \leq T$

Consider an outright purchase of this stock:

$$\text{Profit} = S(T) - FV_{0,T}(S(0)) + \sum_{k=1}^{n} FV_{t_k,T}(D_k)$$

$$= S(T) - S(0)e^{rT} + \sum_{k=1}^{n} D_k e^{r(T-t_k)}$$

r... ccrfir