Lecture 2: 08/03/22

Example 1.7:

Today (t=0): May 3

Maturity date (t=T): Nov 3 (6 months)

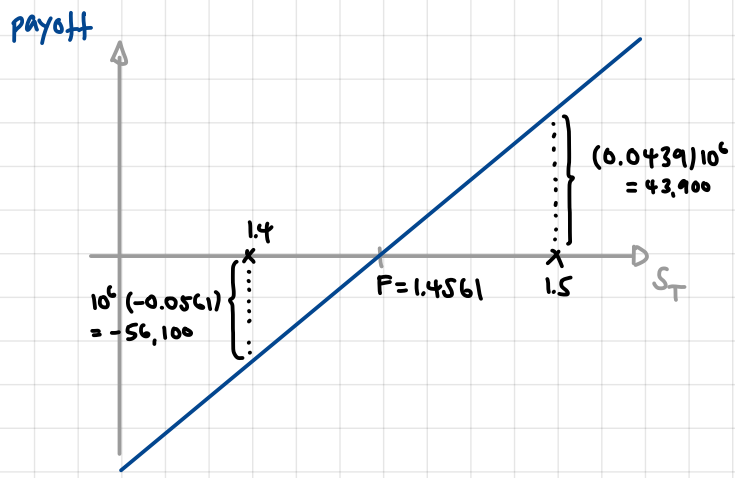
forward price: $F_0(T) = F = \$ 1.4561$ per GBP (size of contract: £ 1,000,000)

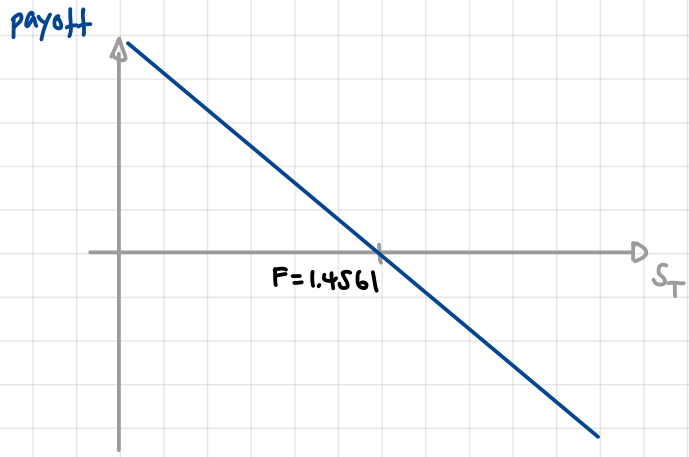
S_T = spot price of GBP in USD at time T

Payoff at time T: (= value of forward contract at time T)

long position: $(S_T - F)\,10^6$ (corporation)

short position: $(F - S_T)\,10^6$ (bank)





Two different scenarios:

(i) $S_T = 1.5$: value of long position in forward contract

$(1.5 - 1.4561) \cdot 1{,}000{,}000 = \$43{,}900$

(ii) $S_T = 1.4$: value of long position in forward contract

$(1.4 - 1.4561) \cdot 1{,}000{,}000 = -\$56{,}100$

Illustrations: payoff profiles and net profits of stock options

T = maturity date

K = strike price

S_T = stock price at time T

$C_0 = C_0(K,T)$ = premium / price of call

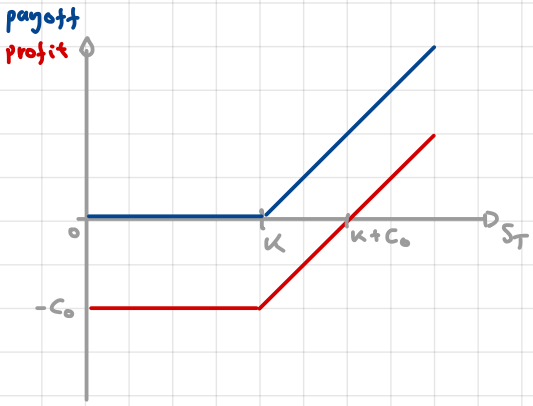
$P_0 = P_0(K,T)$ = premium / price of put

payoff at time T = option's value at time T (mark to market)

(1.) Long call:

payoff: $(S_T - K)^+ = \begin{cases} S_T - K, & S_T > K \\ 0, & S_T \le K \end{cases}$

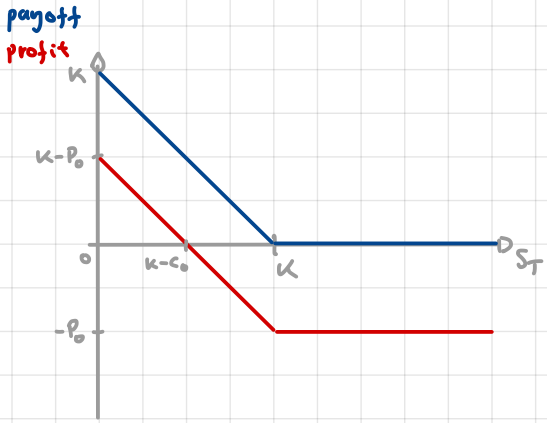
net profit: $(S_T - K)^+ - C_0$



(2.) Long put:

payoff: $(K - S_T)^+ = \begin{cases} K - S_T, & S_T < K \\ 0, & S_T \ge K \end{cases}$

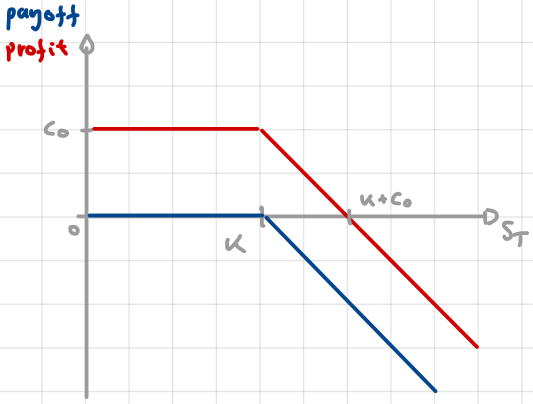
net profit: $(K - S_T)^+ - P_0$



(3.) Short call:

payoff: $-(S_T - K)^+$

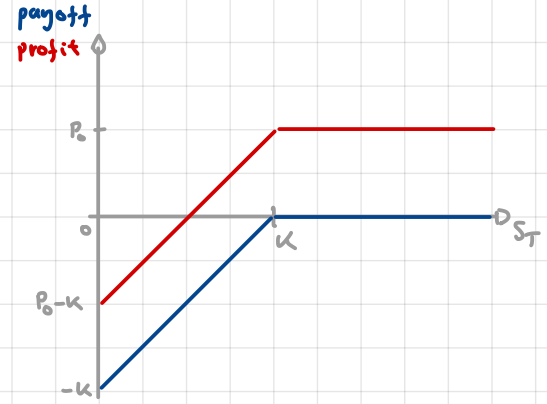
net profit: $C_0 - (S_T - K)^+$



(3.) Short put:

payoff: $-(K - S_T)^+$

net profit: $P_0 - (K - S_T)^+$



Example 1.12:

(a) long one call option contract:

today (t=0): May 3

maturity: December 16

strike price: $K = 700$

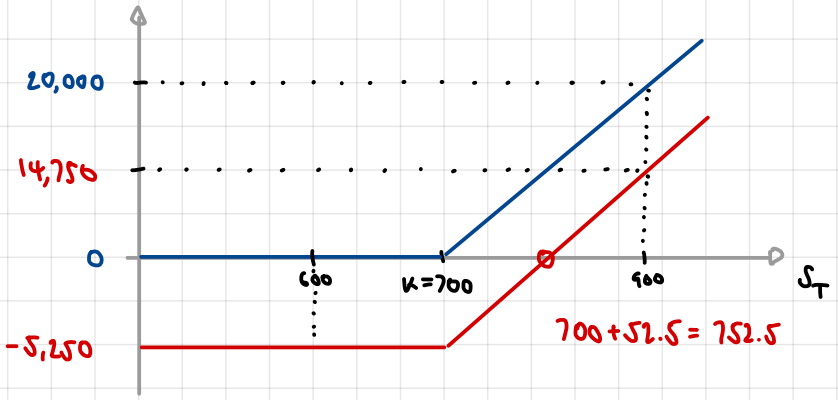
call price: $C_0 = 52.50$ per share (see table in Ex. 1.9)

total upfront premium paid: $52.50 \cdot 100 = 5,250.00$

Payoff and net profit at maturity T.

$$100 \cdot (S_T - 700)^+ = \begin{cases} 100(S_T - 700), & S_T > 700 \\ 0, & S_T \leq 700 \end{cases}$$

$$100 \cdot (S_T - 700)^+ - 5,250$$



Two scenarios:

(1.) $S_T = 600$: trader loses 5,250

(2.) $S_T = 900$: trader gains $100\,(900-700) - 5,250 = 14,750$

(b) Short one put option contract:

today (t=0): May 3

maturity: September 16

strike price: $K = 660$

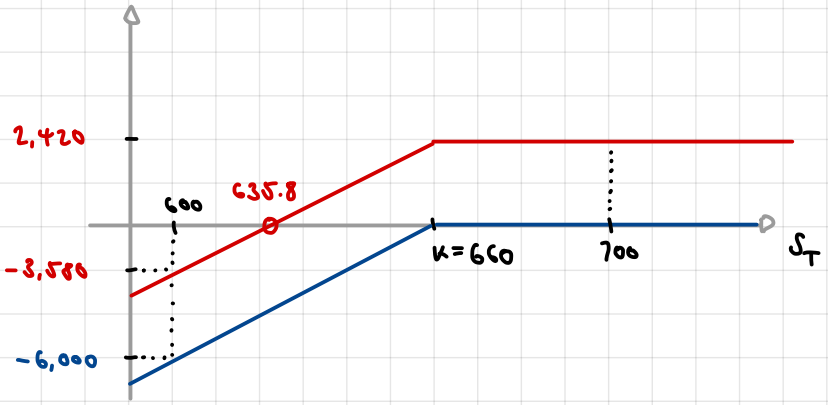
put price: $P_0 = 24.20$ per share (see table in Ex. 1.10)

total upfront premium received: $24.20 \cdot 100 = 2,420$

Payoff and net profit at maturity T.

$$-100 \cdot (660 - S_T)^+ = \begin{cases} -100(660 - S_T) & , \ S_T < 660 \\ 0 & , \ S_T \geq 660 \end{cases}$$

$$2,420 - 100\,(660 - S_T)^+$$



Two scenarios:

(1.) $S_T = 700$: trader gains 2,420

(2.) $S_T = 600$: trader loses $2,420 - 100\,(660 - 600) = -3,580$