

UNIVERSITY OF TEXAS AT AUSTIN

Problem Set 3Payoff. Profit.

Problem 3.1. Let the current price of a non-dividend-paying stock be \$40. The continuously compounded, risk-free interest rate is 0.04. You model the distribution of the time-1 price of the above stock as follows:

$$S(1) \sim \begin{cases} 45, & \text{with probability } 1/4, \\ 42, & \text{with probability } 1/2, \\ 38, & \text{with probability } 1/4. \end{cases}$$

What is your expected profit under the above model, if you invest in one share of stock at time-0 and liquidate your investment at time-1?

→: $\text{Profit} = \text{Payoff} - FV_{0,T}(\text{Init. Cost})$

$$\mathbb{E}[\text{Profit}] = \mathbb{E}[\text{Payoff}] - FV_{0,T}(\text{Init. Cost})$$

" " "
 $\mathbb{E}[S(1)]$
" "

$$45\left(\frac{1}{4}\right) + 42\left(\frac{1}{2}\right) + 38\left(\frac{1}{4}\right) = \underline{\underline{41.75}}$$

answer: $41.75 - 40e^{0.04} = \underline{\underline{0.118}}$



Problem 3.2. To plant and harvest 20,000 bushels of corn, Farmer Jayne incurs total aggregate costs totaling \$33,000. The current spot price of corn is \$1.80 per bushel. What is the profit if the spot price is \$1.90 per bushel when she harvests and sells her corn?

- (a) About \$3,000 gain
- (b) About \$3,000 loss
- (c) About \$5,000 loss
- (d) About \$5,000 gain**
- (e) None of the above

deterministic, valued @ time T (the harvest time)

$$\rightarrow: \frac{20000(1.9)}{ } - \frac{33,000}{ } = \underline{\underline{5,000}} \quad \square$$

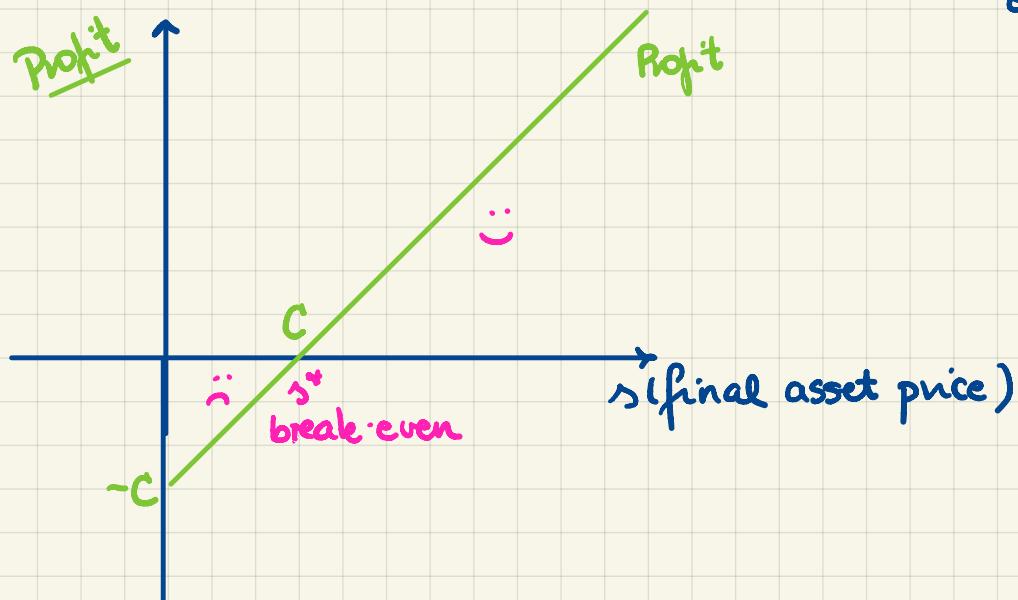
Hedging Motivation.

Example. [Producer of Goods]

- factory producing laptop
- farmers producing corn, apples, peanuts, ...
- mining ore
- factories making "widgets", ...

C... deterministic total aggregate fixed and variable costs of production valued @ time of sale of good; @ time T

If the producer sells their goods in the market, they get the **market price**. This is outside of their domain of influence.



Forward Contract.

* A BINDING CONTRACT ON BOTH SIDES!*

NO CASHFLOW!
Handshake!

T ... delivery date

(when the cash is "exchanged" for the asset)

An agreement:

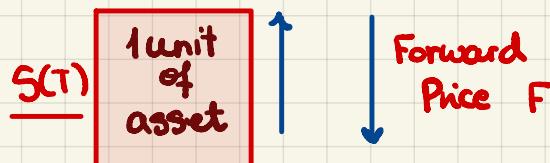
- the underlying asset
- the quantity (for us: 1 unit)
- the type of settlement: physical or cash
- T ... delivery date
- F ... forward price

Initial Cost = 0



Payoff = Profit

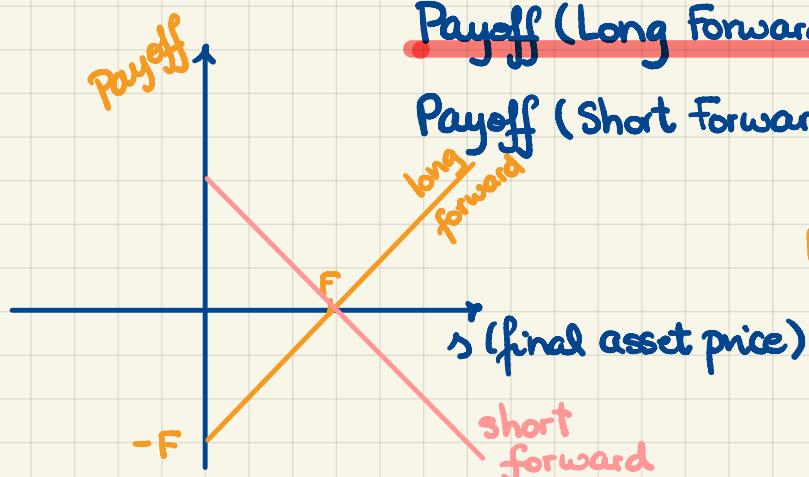
Long Forward : Buy Forward



Short Forward: Selling Forward

$$\text{Payoff (Long Forward)} = S(T) - F \quad \}$$

$$\text{Payoff (Short Forward)} = F - S(T) \quad \}$$



Payoff function: $v(s) = s - F$