

M339D: February 4th, 2024.

About Project #1.

theoretical	empirical	'R'
location	\bar{x}	$\mu.\hat{=}\text{mean}(\text{return})$
scale b	$\frac{s}{\sqrt{2}}$	$b.\hat{=}\text{sd}(\text{return})/\sqrt{2}$

By moment matching

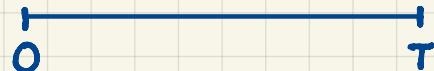
$$2(\hat{b})^2 = \text{var}$$

$$(\hat{b})^2 = \frac{1}{2} \text{var}$$

$$\hat{b} = \frac{\text{sd}}{\sqrt{2}}$$

Problem. [Sample SOA Problem]

[cont'd] Determine which of the following portfolios have the same cashflows as a shortsale of a non-dividend-paying stock.



Initial cost: $-S(0)$

Payoff: $-S(T)$

(v) short forward and a short zero-coupon bond

	<u>Init. Cost</u>	<u>Payoff</u>
Short Forward	0	$F-S(T)$
Short Bond	$-P$	$-Pe^{-rT}$
Total	$-P$	$F-S(T) - Pe^{-rT}$
Short Sale	$-S(0)$	$-S(T)$

Match the bond price P to the stock price $S(0)$.

$$P = S(0)$$

Let's let the forward price be equal to the redemption amount!

$$F = Pe^{rT}$$

$$\Rightarrow F = S(0)e^{rT}$$

Important!

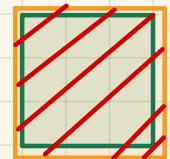
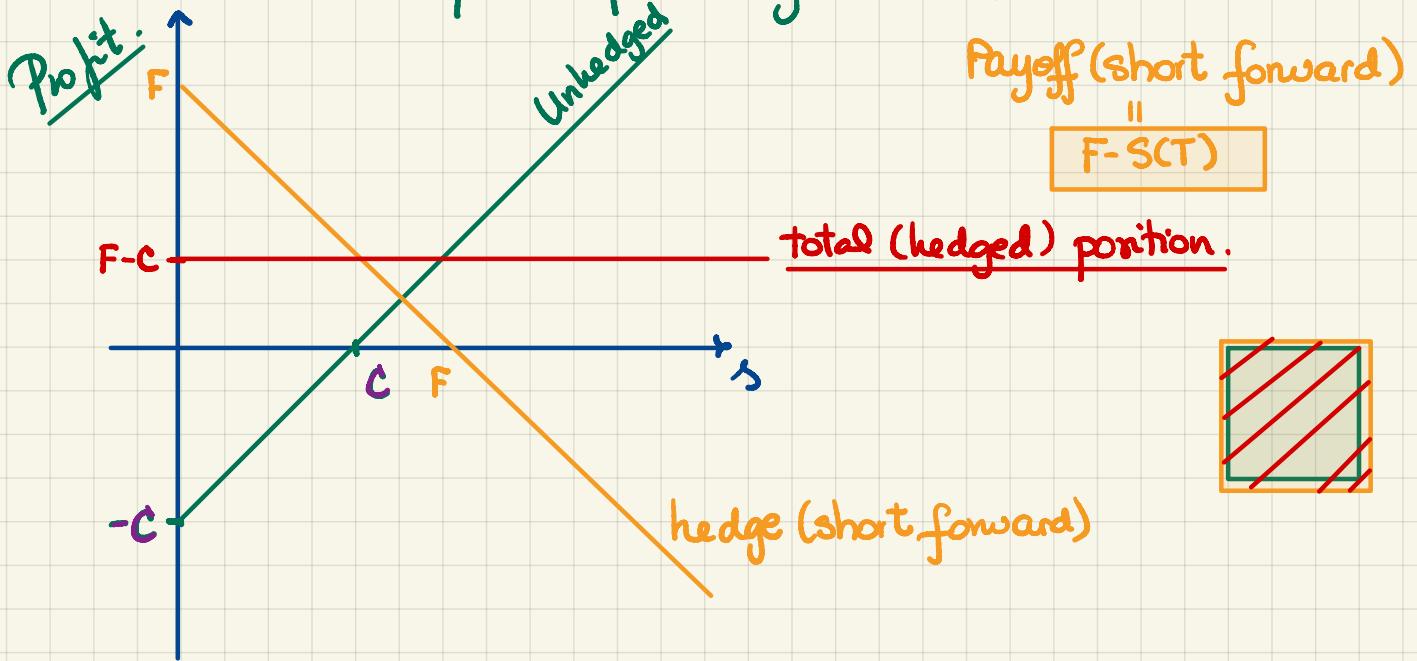


Hedging Using Forward Contracts.

Focus on a producer of goods.

C.. total aggregate costs of production valued @ time $\cdot T$

$S(T)$... the market price of the good @ time $\cdot T$



Algebraically:

$$\text{Profit (Unhedged)} + \text{Profit (hedge)} = \text{Profit (Total Hedged)}$$

$$\cancel{S(T) - C} + \cancel{F - S(T)} = F - C$$

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Problem Set #4

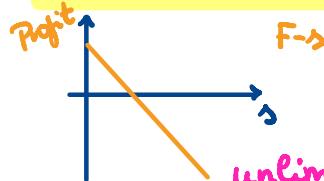
Forward contracts.

Problem 4.1. (5 points) A soy-bean farmer shorts forward contracts on soy in an amount matching his crop volume and with delivery at harvest time. Then, he is considered:

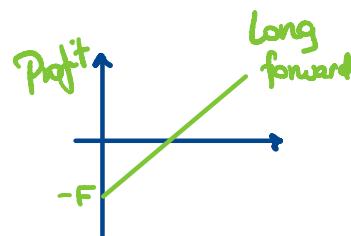
- (a) an arbitrageur.
- (b) a broker.
- (c) a speculator.
- (d) a hedger.
- (e) None of the above.

Problem 4.2. Derivative securities can reduce the risk of both the buyer and the writer of the security. *True or false?*

Problem 4.3. A short forward contract has an unlimited loss potential. *True or false?*



unlimited loss potential (no lower bd)



Problem 4.4. A farmer produces one million bushels of corn. The total cost of production is \$1.3 million. The farmer entered a forward contract to hedge at a forward price of \$2.50 per bushel on one million bushels. What is the farmer's profit?

→ :

$$10^6 \cdot (2.5 - 1.3) = 1.2 \cdot 10^6$$

□

Problem 4.5. Assume that farmer Brown is uncertain about his crop yield. Based on past experience, he thinks the following is a good model:

- 100,000 bushels with probability 1/4;
- 80,000 bushels with probability 3/4.

How many forward contracts do you think farmer Brow should short to hedge against fluctuations in corn prices at harvest time? Explain your way of thinking ...

Idea #1: The Expectation : $\frac{1}{4}(100000) + \frac{3}{4}(80000) = 85,000$

Idea #2: The mode : 80 000

Idea #3: The superhedge: 100,000

Idea #4: The median 80000

Problem 4.6. Pancakes, Inc. produces chocolate chip pancakes. It longed a forward contract on 100 lbs of chocolate chips at \$3.00 per pound. Total fixed revenue is \$2,000 for the pancakes produced with the above chocolate chips. Other costs total \$1200. Find the company's profit.

- (a) 2,000
- (b) 1,700
- (c) 800
- (d) 500
- (e) None of the above.

$$2000 - 3 \cdot 100 - 1200 = 500$$

Problem 4.7. The Extra-Healty Cereal (EHC) company longed 20,000 forward contracts on corn at \$2.80 per bushel. The revenue from cereal made with the above corn is \$200,000 while the other (non-corn) aggregate fixed and variable costs amount to \$120,000. What is the EHC's profit?

$$200,000 - 20000(2.8) - 120000 = 24,000$$

