

Homework 7: Future and Options

Due Monday November 18 5pm (in TA or instructor boxes).

1. **Financial Literacy:** Answer these questions in 3 steps. (1) give an answer to the question, (2) look over the material assigned for class and find a definition (3) modify, if need be, your first answer. The goal is not for you to memorize a given answer but to be sure you can explain the concept to someone. If you can't, then you do not control that concept.
 - a. Forward contract
 - b. Futures contract
 - c. Call option
 - d. Replicating portfolio
 - e. Collateral account
 - f. Counterparty risk
 - g. Option delta
2. **Future:** The NbN airline company sells tickets a year in advance and it flies from Southbend to Southpark. The fuel consumption for each flight is of the form $a+bq$ where q is the number of passengers. The CEO, Alfred H. Sir, contemplates hedging and scheduling.
 - A. On the first day of the month he has to commit to a schedule (number of flights per month) for that month a year hence and at the end of each month he gets an update on how many tickets have been sold. What should he do if it wants to hedge fuel costs?
 - B. Suppose NbN has raised all its capital as equity and in the absence of any hedging has a $\beta=0.5$. Does hedging increase or decrease its β if fuel price volatility is perfectly correlated with market volatility? Why?
 - C. In case B, Alfred H. Sir owns 20% of NbN and is risk averse, does he want to hedge?
 - D. Does its β increase or decrease if fuel price volatility is uncorrelated with market volatility? Do you have enough data to give a formula for that change?
 - E. Suppose NbN has raised 90% of its capital as equity and in the absence of any hedging has a $\beta=4.5$. Does hedging increase or decrease its β if fuel price volatility is uncorrelated with market volatility?
 - F. In case E, Alfred H. Sir owns 20% of NbN and is risk averse, does he want to hedge?

3. Future again

You are a construction operator and are bidding to build a road to do so you will need 100,000 tons of granite rocks every six months to face earthworks.

- A. Supposing the price of granite is \$10 today, the price of storage is zero, the real interest rate is 0.25% a month. What should future prices be for you to decide to hedge your granite rock needs? Give the sequence of price for 6 months, 1 year, and 1.5 years that would make you indifferent between hedging or not.
- B. Suppose you are in the same situation but inflation runs at 0.1% a month. What should future prices be for you to decide to hedge your granite rock needs? Give the sequence of

price for 6 months, 1 year, and 1.5 years that would make you indifferent between hedging or not.

- C. Suppose you do hedge today for the next year and a half using futures. Six month later you take delivery of the first contracts. Then a week later a Canadian firm offers to deliver granite at \$5 a ton. What should you do?
- D. Suppose you do hedge today for the next year and a half using forwards. Six month later you take delivery of the first contracts. Then a week later a Canadian firm offers to deliver granite at \$5 a ton. What should you do?

4. Options

Assume the current value of a stock is S_0 it can either jump up by Δ or go down by Δ . The interest rate is r .

- a. Using the replicating portfolio approach show that a put option with exercise price of S_0 should have a price of $0.5(rS_0 - \Delta)/(1+r)$.
- b. If the formula above is correct increasing the volatility of the stock makes options more valuable even if the expected price stays the same. Explain with words and a graph why that is the case.
- c. Does increasing volatility but keeping the expected price the same make a futures contract more valuable (as in the price of the future).