Practice Set #2: Futures.

What to do with this practice set?

To help students with the material, eight practice sets with solutions shall be handed out. These sets contain mostly problems of my own design as well as a few carefully chosen, worked-out end-of-chapter problems from Hull. None of these Practice Sets will be graded: the number of "points" for a question solely indicates its difficulty in terms of the number of minutes needed to provide an answer.

Students are strongly encouraged to try hard to solve the practice sets and to use office hours to discuss any problems they may have doing so. The best self-test for a student of her/his command of the material is whether s/he can handle the questions of the relevant practice sets.

The questions on the mid-term and final exams will cover the material covered in class. Their format, in particular, shall in large part reflect questions such as the numerical exercises solved in class and/or the questions in the practice sets.

Question 1 (15 points)

Suppose that the Chicago Mercantile Exchange wishes to introduce a new 12-month single-stock futures contract on a company called EMA (Electrical Motor Accessories), and that the SEC and CFTC both give it the green light. Each contract calls for the delivery of 1,000 EMA shares in a year. The one-year risk-free rate is 6%. At the market open, shares of EMA were selling for $120 each. The company has long had a policy of not paying dividends.

a. If market participants expect the company’s dividend policy not to change in the foreseeable future, at what price should the futures contract start trading? Explain and show your work.

b. You are considering investing in EMA, either by buying 1,000 shares directly (i.e., spot) or by taking an appropriately-sized position in EMA futures. Assuming the price you computed in part (a) is correct, does it matter whether you invest on the spot market or on the futures market? If it does matter, would you invest spot or futures? Explain thoroughly (in particular, explain how the “futures strategy” would be implemented).

c. Suppose again that you are considering investing in EMA, either by buying 1,000 shares directly (i.e., spot) or by taking an appropriately-sized position in EMA futures. Unlike other investors, however, you expect EMA to soon start paying dividends. Assuming the price you computed in part (a) will indeed be the CBOT futures price, should you invest on the spot market or on the futures market? Explain intuitively.

(Hint #1: What is the cheapest way for you to invest?)

(Hint #2: Assuming you are correct, should the futures price be higher or lower than your answer in part a?)
Question 2 (5 points)

(i) What will happen to the margin put up on a futures contract if the contract price does not change from the date of entering the contract until the date of offsetting the contract?
   a. It will be refunded
   b. It will be kept by the broker
   c. It will be kept by the counterparty in the futures market

(ii) Intuitively, the dollar value of the initial margin requirement should be __________ for T-bond futures ____ T-bill futures.
   a. higher...than for
   b. lower...than for
   c. the same...as

(Hint: The T-bond futures is a contract on LT interest rates, whereas the T-bill futures is a contract on short-term interest rates – which contract should be more volatile?)

Question 3 (7.5 points)

(i) If program traders see that the S&P 500 futures contract is high relative to the spot S&P 500 index, they are likely to ______ the spot market and ______ the S&P 500 futures contract.
   a. buy...buy
   b. buy...sell
   c. sell...sell
   d. sell...buy

(ii) The CAPM beta of the S&P 500 is approximately
   a. 0.5 or less
   b. 1.0
   c. 1.5 or more

(iii) If you hedge a portfolio with a CAPM beta of 1.5, you should use $______ of S&P 500 futures contract for each $100 of portfolio hedged.
   a. <100
   b. 100
   c. 150
   c. >150
Practice Set #2: Solutions

Question 1 (15 points)

Suppose that the Chicago Mercantile Exchange wishes to introduce a new 12-month futures contract on a company called EMA (Electrical Motor Accessories), and that the SEC gives the green light. Each contract calls for the delivery of 1,000 EMA shares in a year. The one-year risk-free rate is 6%. At the market open, shares of EMA were selling for $120 each. The company has long had a policy of not paying dividends.

a. If market participants expect the company’s dividend policy not to change in the foreseeable future, at what price should the futures contract start trading? Explain and show your work.

b. You are considering investing in EMA, either by buying 1,000 shares directly (i.e., spot) or by taking an appropriately-sized position in EMA futures. Assuming the price you computed in part (a) is correct, does it matter whether you invest on the spot market or on the futures market? If it does matter, would you invest spot or futures? Explain thoroughly (in particular, explain how the “futures strategy” would be implemented).

c. Suppose again that you are considering investing in EMA, either by buying 1,000 shares directly (i.e., spot) or by taking an appropriately-sized position in EMA futures. Unlike other investors, however, you expect EMA to soon start paying dividends. Assuming the price you computed in part (a) will indeed be the CBOT futures price, should you invest on the spot market or on the futures market? Explain intuitively.

Answer:

a. As discussed in class, as long as the company (EMA) pays no dividends until the futures contract matures, you can:
   (i) either buy 1,000 shares of EMA today on the spot market -- in which case the cost is \( S_0 \) today; or
   (ii) go long one futures contract on EMA shares and invest in T-bills today -- in which case you must make sure, by investing today in T-bills the PV of the amount you owe at maturity, that cash will be available at maturity to meet your futures obligations. In that case, the cost today is \( F/(1+r) \), where \( F \) is today’s futures price and \( r \) is the risk-free interest rate for the appropriate time period.

   Obviously, for the market to be efficient, it must be the case that:

   \[ S_0 = F/(1+r) \]

   Hence, \( F = S_0 (1+r) = \$120 \times 1,000 \times (1.06) = \$127,200 \)
b. As long as EMA pays no dividends until the futures contract matures, what you buy is irrelevant: in both cases, your cost today is $120,000. The only reason you might prefer going spot, as opposed to using futures, might be to avoid possible administrative inconveniences from marking to market.

c. If dividends are to be paid, then the futures price should be lower -- intuitively, you only get dividends if you buy the stock spot, not if you merely are long a futures on EMA stock. Hence, if you expect EMA to pay dividends but the market is not pricing those dividends into the futures price, then the market price for the futures is going to be too high -- so you should buy EMA shares spot.

**Question 2 (5 points)**

(i) What will happen to the margin put up on a futures contract if the contract price does not change from the date of entering the contract until the date of offsetting the contract?
   a. It will be refunded: is the answer – no margin was ever called, so no default could have happened
   b. It will be kept by the broker.
   c. It will be kept by the counterparty in the futures market.

(ii) The dollar value of the initial margin requirement is ___ for T-bond futures ___ for T-bill futures.
   a. higher...than: is the answer – T-bill rates are short term interest rates and, hence, not very volatile, so T-bill futures prices are not very volatile either. The reverse is true for T-bonds: when interest rates change even just a little, the impact of that small change affects the discount rate on all the bond’s cash-flows – and the further out those cash-flows are (i.e., the greater the T-bond’s maturity), the more the T-bond’s price should change. Because margins are set to protect futures brokers and clearing houses against the risk of default by futures position holders, and because the risk of default increases with the magnitude of daily price movements in the underlying asset, the margin on the more volatile instrument (the T-bond) should be greater than that on the less volatile instrument See also Question 2 (i) in PS#3 for an additional discussion.

   b. lower...than
   c. the same...as
Question 3 (7.5 points)

(i) If program traders see that the S&P 500 futures contract is high relative to the spot S&P 500 index, they are likely to _______ the spot market and _______ the S&P 500 futures contract.
   a. buy...buy
   b. buy...sell: is the answer – buy low, sell high is the rule of arbitrage. See also the class notes on future spot parity, and the opportunities for arbitrage.
   c. sell...sell
   d. sell...buy

(ii) The CAPM beta of the S&P 500 is approximately
   a. 0.5 or less
   b. 1.0: is the answer – the S&P 500 is a good proxy for (and, thus, as volatile as) the overall stock market.
   c. 1.5 or more

(iii) If you hedge a portfolio with a CAPM beta of 1.5, you should use $______ of S&P 500 futures contract for each $100 of portfolio hedged.
   a. <100
   b. 100
   c. 150: is the answer – you need to make your hedge as volatile as the portfolio hedged.
   d. >150