FIN-465 Derivatives (3 credits) Professor Michel Robe

Practice set #3 and solutions

To help students with the material, seven practice sets with solutions will be handed out. They will not 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 or his command of the material is whether s/he can handle the questions of the relevant practice sets.

NOTE: Questions 4 (ii); 5 (i); and 5 (ii) are not exam material.

Question 1 (5 points)

(i) Someone wishing to profit from rising stock prices is likely to go _____ S&P 500 futures contracts.
   a. long
   b. short

(ii) Someone wishing to profit from rising bond prices is likely to go _____ T-bond futures contracts.
   c. long
   d. short

(iii) Someone wishing to profit from rising interest rates is likely to go _____ T-bond futures contracts.
   e. long
   f. short

Question 2 (5 points)

(i) A 1% increase in long-term (LT) interest rates should cause T-**bond** futures contracts to decrease in value by:
   a. less than 1%
   b. approximately 1%
   c. more than 1%

(ii) A 1% increase in short-term (ST) interest rates should cause 3-month T-**bill** futures contracts to decrease in value by:
   a. less than 1%
   b. approximately 1%
   c. more than 1%

Question 3 (7.5 points)

(i) A savings & loan with the traditional "borrow short/lend long" asset-liability structure could lower its profit volatility and its interest rate risk exposure by_____ debt-based futures contracts.

a. shorting
b. going long

(ii) For the next 90 days, which of the following positions would be most likely to provide the best insurance (hedge) against falling values of a 30-year fixed-rate mortgage portfolio held by an insurance company?

a. T-bill futures
b. T-note futures
c. S&P 500 futures

(iii) In the previous question the appropriate hedge position is a ____ position

a. short
b. long

Question 4 (5 points)

(i) The purchaser of a call option on a T-bond is hoping that interest rates will ____

a. rise
b. fall.
c. stay constant

(ii) If the Treasury yield curve is downward sloping, you would expect that the farthest T-bill futures contracts would be at rates _____ than the nearby contract months.

a. higher
b. lower
c. no different

Question 5 (20 points)

(i) ____% is the standard interest rate on the T-bond futures contract.

Be careful—as discussed in class, the answer recently changed and may be different from what is in Hull's 4th edition.

(ii) If 10% coupon T-bonds are delivered by the short position in the T-bond futures contract the price paid will be _____ the price at which the contract was shorted.

a. higher than
b. lower than
c. the same as

(iii) A bank has a negative GAP (RSA < RSL, i.e., it borrows short and lends long). The logical hedge position for this bank is a _____ position in _____ futures.

a. short…debt-based
b. short…stock index
c. long…debt-based
d. long…stock index

(iv) You observe that the spot market rates on 3- and 6-month T-bills are 6% & 7% respectively. The implied forward rate on 3-month T-bills three months from now is approximately ____%.

a. < 6 b. 6 c. 6.5 d. 7 e. 8 f. 10

(v) Suppose that T-bill futures based on 3-month spot market T-bills are priced for delivery in 3 months at 9%. Using the data from question 5 (iv), we would expect that someone wishing to invest today $1 million in a 6-month T-bill would prefer to:

a. buy a 6-month spot market T-bill
b. buy a 3-month spot market T-bill & go long a T-bill futures contract for delivery in 3 months.

(vi) You observe that the spot market rates on 3-month & 6-month T-bills are both at 6%. If the T-bill futures contract for delivery in three months is at 5%, the more profitable of the following three month investments would be to (see 35 & 36 below).

a. buy a three-month T-bill
b. buy a 6-month T-bill, simultaneously short a T-bill futures contract for delivery in 3 months, then deliver the spot market T-bill into the futures contract position in 3 months (when the original 6-month T-bill will then have 3 months remaining).

(vii) The price of a $1 million face value, 90 day T-bill with a BDR (Bank Discount Rate) of 6% is

a. $1 million
b. $985,000
c. between $985,000 & $980,000
d. $940,000

(viii) The price of a $1 million Face value, 90 day T-bill with a BDR of 5% is $_____.

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Practice set #3: Solutions

Question 1 (5 points)

(i) Someone wishing to profit from rising stock prices is likely to go _____ S&P 500 futures contracts.

a. long: is the answer -- the long party wins, as the price of the underlying asset rises.
b. short

(ii) Someone wishing to profit from rising bond prices is likely to go _____ T-bond futures contracts.

c. long: is the answer -- the long party wins, as the price of the underlying asset rises.
d. short

(iii) Someone wishing to profit from rising interest rates is likely to go _____ T-bond futures contracts.

e. long
f. short: is the answer -- the short party wins as interest rates rise, because bond prices (and, hence, T-bond futures) fall when interest rates go up..

Question 2 (5 points)

(i) A 1% increase in long-term interest rates should cause T-**bond** futures contracts to decrease in value by:

a. less than 1%
b. approximately 1%
c. more than 1%: is the answer – A T-bond futures calls for delivery of a bond that matures at least 15 years from the futures contract maturity. Such a LT bond's price is very sensitive to interest rate changes. To see this, note that a 1% change in the LT interest rates means that you'll be discounting 15+-years worth of cash-flows at a 1% lower discount rate, which should bring about a 15 to 25% increase in the bond's price (depending on the bond's coupon rate and yield to maturity).

(ii) A 1% increase in short-term interest rates should cause 3-month T-**bill** futures contracts to decrease in value by:

a. less than 1%: is the answer – ST bond prices have low duration (low sensitivity to interest rate changes). An annualized 1% increase in ST interest rates corresponds to a 0.25% increase in the 3-month rate and to a roughly equivalent drop in T-bill spot and futures prices.
b. approximately 1%
c. more than 1%

Question 3 (7.5 points)

(i) A savings & loan with the traditional "borrow short/lend long" asset-liability structure could lower its profit volatility and its interest rate risk exposure by_____ debt-based futures contracts.

a. shorting: is the answer – see the class discussion on "keep shorts on." In essence, S&L's make LT fixed-rate loans that they in turn finance with short-term deposits. Thus, these institutions make less (or even lose) money when short-term rates go up. Thus, they want to protect themselves by taking futures position that gain value when interest rates go up. Since debt-based futures lose value when interest rates go up, and the short gains when the futures prices fall, S&L's should take short positions in debt-based futures contracts.
b. going long

(ii) For the next 90 days, which of the following positions would be most likely to provide the best insurance (hedge) against falling values of a 30-year fixed-rate mortgage portfolio held by an insurance company?

a. T-bill futures
b. T-note futures: is the answer – 30-year mortages have an effective maturity (duration) closer to that of T-notes.
c. S&P 500 futures

(iii) In the previous question the appropriate hedge position is a ____ position

a. short: is the answer – the company is long 30-year mortgages and, therefore, should insure against price drops.
b. long

Question 4 (5 points)

(i) The purchaser of a call option on a T-bond is hoping that interest rates will

a. rise
b. fall: is the answer – as interest rates fall, bond prices rise so the option to buy at a fixed price becomes more valuable
c. stay constant

(ii) If the Treasury yield curve is downward sloping, you would expect that the farthest T-bill futures contracts would be at rates _____ than the nearby contract months.

a. higher
b. lower: is the answer – when the term structure is inverted, LT rates are lower.
c. no different

Question 5 (20 points)

(i) _6_% is the standard interest rate on the T-bond futures contract. It used to be 8% (before March, 2000).

(ii) If 10% coupon T-bonds are delivered by the short position in the T-bond futures contract the price paid will be _____ the price at which the contract was shorted.

a. higher than: is the answer – since the "reference rate" is 6%, 10%-bonds trade at a premium to par.
b. lower than
c. the same as

(iii) A bank has a negative GAP (RSA < RSL, i.e., it borrows short and lends long). The logical hedge position for this bank is a _____ position in _____ futures.

a. short…debt-based : is the answer - See Question 4 (i) above as well as the class discussion on "keep shorts on")
b. b. short…stock index
c. long…debt-based
d. d. long…stock index

(iv) You observe that the spot market rates on 3- and 6-month T-bills are 6% & 7% respectively. The implied forward rate on 3-month T-bills three months from now is approximately ____%.

a. < 6 %
b. 6%
c. 6.5%
d. 7%
e. 8%: is the answer – the 7% 6-month cash (or spot) rate is an average of the 6% 3-month cash rate and the 8% (implied) forward rate.
f. >10%

(v) Suppose that T-bill futures based on 3-month spot market T-bills are priced for delivery in 3 months at 9%. Using the data from question 7 (iv), we would expect that someone wishing to invest today $1 million in a 6-month T-bill would prefer to

a. buy a 6-month spot market T-bill.
b. buy a 3-month spot market T-bill & go long a T-bill futures contract for delivery in 3 months

is the answer – 9% is higher than the 8% implied forward rate. See also the discussion in class about FRA's, especially the example about IBM in the FRA handout: a similar logic applies to selling an FRA and to going long T-bill and Eurodollar futures. In both cases, you are locking in a deposit rate.

(vi) You observe that the spot market rates on 3-month & 6-month T-bills are both at 6%. If the T-bill futures contract for delivery in three months is at 5%, the more profitable of the following 3-month investments would be to:

a. buy a three-month T-bill
b. buy a 6-month T-bill, simultaneously short a T-bill futures contract for delivery in 3 months, then deliver the spot market T-bill into the futures contract position in 3 months (when the original 6-month T-bill will then have 3 months remaining) – is the **answer**

(vii) The price of a $1 million face value, 90 day T-bill with a BDR (Bank Discount Rate) of 6% is

a. $1 million
b. $985,000: is the answer -- the quarterly discount is $1/4^{th}$ of 6%, or 1.5%, or $15,000.
c. between $985,000 & $980,000
d. $940,000

(viii) The price of a $1 million Face value, 90 day T-bill with a BDR of 5% is $ 987,500 ..