Practice Set #4: T-Bond & T-Note 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 (5 points)

(i) Someone wishing to profit from rising long-term bond prices is likely to go ______ T-bond futures contracts.
   a. long
   b. short

(ii) Someone wishing to profit from rising medium-term interest rates is likely to go ______ T-note futures contracts.
   c. long
d. short

(iii) 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%

(iv) 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 2 (7.5 points)

(i) 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

(ii) In the previous question the appropriate hedge position is a _____ position
   a. short
   b. long

Question 3 (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

Question 4 (10 points)

The quoted price of a T-Bond futures is 114:26. Which of the following 3 bonds is cheapest to deliver?

<table>
<thead>
<tr>
<th>Bond</th>
<th>Price</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>162:20</td>
<td>1.3987</td>
</tr>
<tr>
<td>2</td>
<td>138:31</td>
<td>1.2820</td>
</tr>
<tr>
<td>3</td>
<td>131:02</td>
<td>1.1273</td>
</tr>
</tbody>
</table>
Question 5 (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 1 (5 points)

(i) Someone wishing to profit from rising long-term bond prices is likely to go _____ T-bond 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 medium-term interest rates is likely to go _____ T-note futures contracts.
   c. long
   d. short: is the answer -- the short party wins as interest rates rise, because medium-term bond prices (and, hence, T-note futures) fall if those interest rates go up.

(iii) 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% increase in the LT interest rates means that you’ll be discounting 15+ years worth of cash-flows at a 1% higher discount rate, which should bring about a 15 to 25% decrease in the bond’s price (depending on the bond’s coupon rate and yield to maturity).

(iv) 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 2 (7.5 points)**

(i) 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 mortgages have an effective maturity (duration) closer to that of T-notes.
c. S&P 500 futures

(ii) 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

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**Question 3 (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. short…stock index
c. long…debt-based
d. long…stock index
Question 4 (10 points)

The quoted price of a T-Bond futures is 114:26. Which of the following 3 bonds is cheapest to deliver?

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Solution:

For each $100 of face value, the futures price is $(114 + 26/32) = $114.8125 and the net return to the short is:

<table>
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<th>Return</th>
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<tbody>
<tr>
<td>1</td>
<td>114.8125 x 1.3987 - 162.625 = -2.0368</td>
</tr>
<tr>
<td>2</td>
<td>114.8125 x 1.2820 - 138.96875 = 8.2208</td>
</tr>
<tr>
<td>3</td>
<td>114.8125 x 1.1273 - 131.0625 = -1.6344</td>
</tr>
</tbody>
</table>

By far, Bond #2 is the cheapest to deliver.

Question 5 (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