PROBLEM SET 5

Due on Monday, May 8, 2006

To get credit for this problem set, it must be handed in on Monday, May 8 in the discussion section.
Late homework will not be accepted.


2. (Taken from Professor Quinzii’s 2005 midterm) John has just inherited $100,000 that he is going to use for remodelling his house. He needs to invest the money until the plans are done and the construction begins. This may take one or two years. Since he has a short horizon and he is risk averse, he decides to invest in safe government bonds. He contracts a broker and is told that a one year zero-coupon bond with face value $1,000 sells for $952.38 and a two-year zero-coupon bond with face value $1,000 sells for $898.45.

(a) What is the current one-year interest rate?
(b) What is the current annualized two-year interest rate?
(c) What is the forward rate?
(d) His broker also points out the possibility of buying two-year bonds with 10% coupons, paid annually, in case the planning stage lasts for two years but John needs to pay some expenses after one year. According to the broker the current yield on these coupon bonds with face value $1,000 is 5.25%.
   i. If the broker is right, what is the current price of a coupon bond?
   ii. What is the maximum price that John will accept to pay for this bond?
   iii. Why do you think that the broker has made some mistake in calculating the yield?
   iv. Give your best estimate of what the yield on the coupon bond actually is. Explain how you obtain your answer.
(e) John is really tempted by the low price of the two-year zero-coupon bond but, as his broker points out, if he buys two-year bonds he is not sure of how much money he will have to spend on the remodel. Thus, for the first time in his life, John reads the financial and economic pages of his newspaper and forms his expectations about the likely values of the interest rate next year. He estimates that there is a 50% chance that in one year the one-year interest rate will be 6%, that there is 30% chance that it will be 5.5% and 20% chance that it will be 5%.
   i. What is John’s expected value for the interest rate next year?
   ii. Is his estimate consistent with the expectations hypothesis on the term structure of the interest rates? Explain the content of the expectations hypothesis, under which conditions it is likely to be satisfied, and discuss whether these conditions are likely to be met.
   iii. Is his estimate consistent with the liquidity preference hypothesis? Explain the content of the liquidity preference hypothesis, under which conditions it is likely to be satisfied, and discuss whether these conditions are likely to be met.
3. (Adapted from Bodie et al. 1993) Consider an 8% coupon bond with three years until maturity making annual coupon payments and face value $1,000. The interest rates in the next three years will be, with certainty, \( r_1 = 8\% \), \( r_2 = 10\% \), \( r_3 = 12\% \). Calculate the price and yield to maturity of the bond.

4. (Adapted from Bodie et al. 1993) The yield to maturity on one-year zero-coupon bonds is currently 7%; the YTM of two-year zeros is 8%. The Treasury plans to issue a two-year maturity coupon bond, paying coupons once per year with a coupon rate of 9%. The face value of the bond is $100.

   (a) At what price will the bond sell?
   (b) What will the yield to maturity on the bond be?
   (c) If the expectations theory of the yield curve is correct, what is the market expectation of the price that the bond will sell for next year?
   (d) Recalculate your answer to (c) if you believe in the liquidity preference theory and you believe that the liquidity premium is 1%.

5. Suppose that the prices of U.S. Treasury Strips (another type of zero-coupon bonds) with face value $1,000 are approximately as follows:

<table>
<thead>
<tr>
<th>Maturity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 2007</td>
<td>$942.8</td>
</tr>
<tr>
<td>May 2010</td>
<td>$820.9</td>
</tr>
<tr>
<td>May 2016</td>
<td>$600.4</td>
</tr>
</tbody>
</table>

   (a) Compute the one-,
   (b) four-, and
   (c) ten-year spot rates.
   (d) Based on this little information, sketch the (hypothetical) current yield curve.

6. (This problem has to be solved in a separate sheet and will be graded.) To answer this problem you will need to read “The long and the short of it” posted on the website. (Also reading “Admiring those shapely curves,” also in the website, will help.)

   (a) On the Jan 5, 2006 reading it states “[...] Suppose the five-year rate is 5% now, but the investor expects it to rise to 10% in five years’ time. In that case, ten-year bonds must offer a yield of about 7.5% today to attract his money.” Is this true (do the calculation)? With these data, what is the shape of the yield curve?
   (b) The same paragraph continues “[...] On the other hand, if the investor expects five-year rates to fall to just 3% in five years’ time, he will accept a ten-year yield of only about 4%.” Check if the numbers in this statement are correct. How does the yield curve look like now? Explain in maximum ten lines, how this shape is related to the likelihood of a recession, and how it is argued in the article.
   (c) In class we said that the yield curve is a leading indicator of the business cycle. Do you know of any other leading indicators? How do they work? Explain.