Problem Set #2 Answers

Due in lecture on Wednesday, October 4th. No late submissions will be accepted. Make sure your name is on your problem set, as well as the name of your (official) TA.

1. Consider Figure 1, a graph of the yield spread, percentage points. Explain why we observe pattern of spreads.

Answer: Note that in Figure 1, the NBER recessions have been superimposed (in gray shading). Baa rated debt is riskier than Aaa debt (although both are riskier than US Treasury debt). The spread widens during recessions. Recessions are periods when bankruptcies tend to rise, and hence when more firms are unable to service their debt (i.e., when firms default). Hence, the spread, a measure of default risk, tends to rise during recessions. (One notable exception is in 2003, when the spread rose despite the expansion; this event was caused by Enron’s bankruptcy).

2. Consider the corporate bonds associated with GM Motor Company. If the U.S. Government were to declare that it would ensure that GM would not go bankrupt, what would happen to yields on GM Motor Company bonds? Use diagrams to explain what happens.
Answer. If the U.S. Government insures that Ford will not go bankrupt, then default risk falls, and the risk premium shrinks, while the price of Ford bonds go up. Presumably, the risk of default for the U.S. Government goes up slightly. Hence the price of U.S. Government bonds falls as well, although probably less than Ford bond prices rise. The spread between the two types of bonds shrinks, from "Old risk premium" to "New risk premium".

3.1. Assume the expectations theory of the term structure is correct. Draw the yield curves (at 1, 3 and 5 years) for the following series of one year interest rates:
   a) .04, .05, .06, .05, .04
   b) .04, .01, .02, .03, .04
(Where the interest rates are expressed in decimal form, i.e., 15% = 0.15).

<table>
<thead>
<tr>
<th>Term</th>
<th>Short rate A</th>
<th>Short rate B</th>
<th>YieldCurve A</th>
<th>YieldCurve B</th>
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<tr>
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<td>0.04</td>
<td>0.04</td>
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<td>0.05</td>
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<td>0.03</td>
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<tr>
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<td>0.04</td>
<td>0.048</td>
<td>0.028</td>
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3.2. Suppose in case (b), \(i_{3t}\) jumped by .02 (2 percentage point), while \(i_t\) remained constant. Can you say when and by how much future expected short term interest rates changed? Why or why not?

Answer. Recall:
\[ i_{3t} = \frac{i_t + i_{t+1}^e + i_{t+2}^e}{3} \]
So
\[ \Delta i_{3t} = \frac{\Delta i_t + \Delta i^e_{t+1} + \Delta i^e_{t+2}}{3} \]

Setting \( \Delta i_t = 0 \), one sees that

\[ 0.02 = \frac{\Delta i^e_{t+1} + \Delta i^e_{t+2}}{3} \]

So it is clear that one cannot tell whether it is period \( t+1 \) or period \( t+2 \) interest rates that are expected to rise; rather all one knows is that the sum must equal 0.06.

3.3. Returning to the figures given to you in part 3.1., suppose the liquidity premiums at different horizons are: \( \ell_{t1} = 0 \), \( \ell_{3t} = .01 \), and \( \ell_{5t} = .02 \). Recalculate the yield curves.

<table>
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<tr>
<th>obs</th>
<th>Yield Curve A</th>
<th>Yield Curve B</th>
<th>Modified Yield Curve A</th>
<th>Modified Yield Curve B</th>
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4. Consider the Figure 2, a graph of yield curves on November 2, 2010. What is your interpretation of the yield curve’s implications?

**Figure 2:** US yield curve, 11/2/2010. Source: FT.

**Answer.** Short term interest rates are expected to be near zero for the next six months. Between 6 months ahead and 2 years ahead, short interest rates are going to be above zero. Notice that the interest rate for 10 year maturity Treasurys is 2.5%, while at 30 years, it is 4%. Average short term interest rates must be 2.5% for 0 to 10 years. One can solve out for what the average short term interest rate is over the 10-30 year period by solving:
$$(2z + 2.5\%) / 3 = 4\%, \ 2z = 9.5\%, \ z = 4.75\%$$

5. Chapter 7, #3. Compute the price of a share of stock that pays a $1 per year dividend and that you expect to be able to sell in one year for $20, assuming you require a 15% return.

**Answer.** Recall one expression for the present value of a stock is given by:

$$P_t = \frac{D_{t+1}}{1+k_e} + \frac{E_t P_{t+1}}{1+k_e}$$

Substituting in the relevant information leads to:

$$P_t = \frac{1}{1 + 0.15} + \frac{20}{1 + 0.15} = \frac{21}{1.15} \approx 18.26$$

6. Calculate the price of a share of stock, assuming dividends are expected to be constant at $D_0 = 1$ and $k_e$ is also expected to be constant at 0.05. Show your algebraic work. Suppose that you revise your expectations regarding $k_e$ downward by 2 percentage points. What immediately happens to the price of the share of stock? Once again, show your work.

**Answer.** Recall the Gordon model is given by:

$$P_t = D_t \times \left[ \frac{(1+g)^1 + (1+g)^2 + \ldots + (1+g)^\infty}{(1+k_e)^1 + (1+k_e)^2 + \ldots + (1+k_e)^\infty} \right] = \frac{D_t}{(k_e - g)}$$

Substituting in the numbers yields:

$$P_t = \frac{1}{(0.05 - 0)} = 20$$

If the discount rate falls by 0.02, then one obtains:

$$P_t = \frac{1}{(0.03 - 0)} = 33.33$$