Economics 330
Fall 2006
University of Wisconsin-Madison

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Social Sciences 7418

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, in percentage points. Explain why we observe this pattern of spreads.

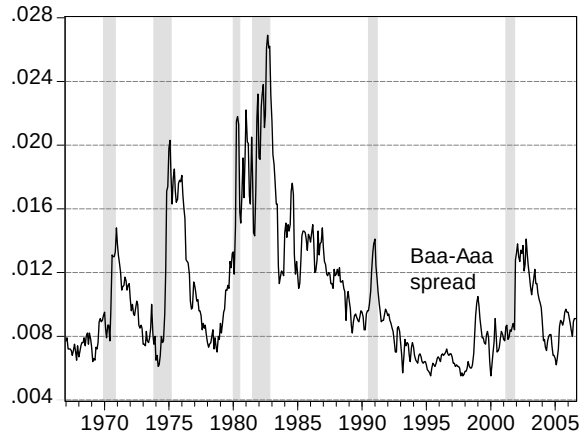
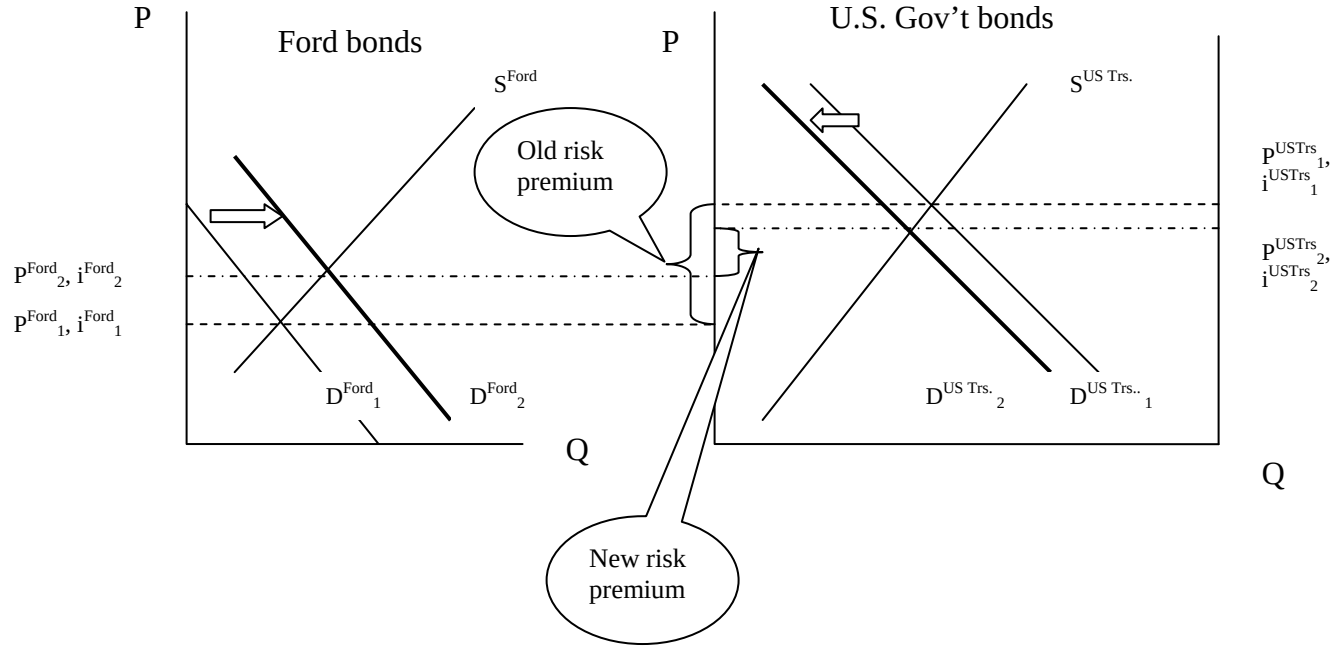


Figure 1: Baa minus Aaa corporate yield. Source: Moody's via St. Louis Fed.

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 Ford Motor Company. If the U.S. Government were to declare that it would ensure that Ford would not go bankrupt, what would happen to yields on Ford 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".

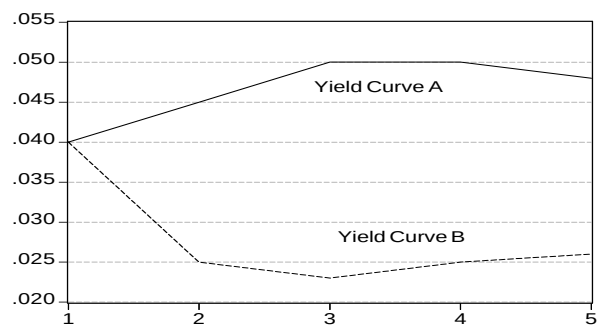
3.1. Assume the expectations theory of the term structure is correct. Draw the yield curves (at 1, 3 and 5 years) for the following series of one year interest rates:

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).

Term	Short rate A	Short rate B	YieldCurve A	YieldCurve B
1	0.04	0.04	0.04	0.04
2	0.05	0.01	0.045	0.025
3	0.06	0.02	0.05	0.023
4	0.05	0.03	0.05	0.025
5	0.04	0.04	0.048	0.028



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:

$$i_{3t} = \frac{(i_t + i^e_{t+1} + i^e_{t+2})}{3}$$

So

$$\Delta i_{3t} = \frac{(\Delta i_t + \Delta i^e_{t+1} + \Delta i^e_{t+2})}{3}$$

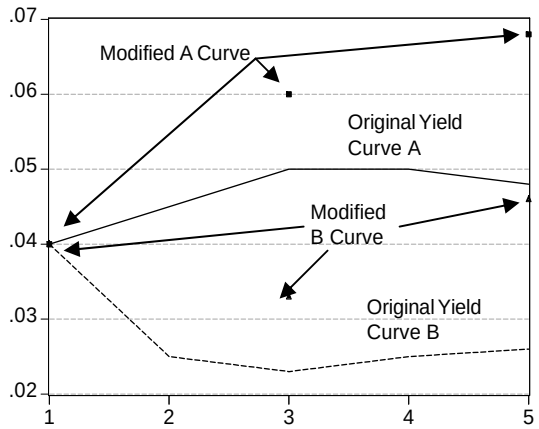
Setting $\Delta i_t = 0$, one sees that

$$0.02 = \frac{(\Delta i^e_{t+1} + \Delta i^e_{t+2})}{3}$$

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 $\ell_{1t} = 0$, $\ell_{3t} = .01$, and $\ell_{5t} = .02$. Recalculate the yield curves.

obs	Yield Curve A	Yield Curve B	Modified Yield Curve A	Modified Yield Curve B
1	0.04	0.04	0.04	0.04
2	0.045	0.025	NA	NA
3	0.05	0.023	0.06	0.033
4	0.05	0.025	NA	NA
5	0.048	0.026	0.068	0.046



4. Consider the Figure 2, a graph of yield curves on September 27, 2005. Compare it against Figure 3, a graph of the yield curves on September 22, 2006.

4.1 What has happened at the short end (3 month), 5 year, 10 year and 20 year maturities, relative to September 27, 2005?

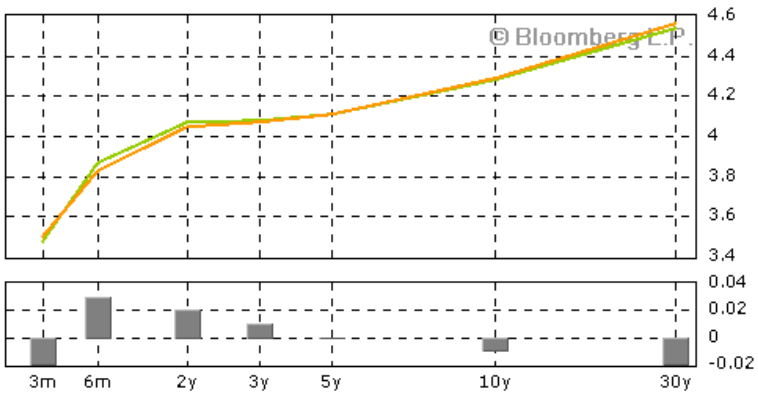


Figure 2: Yield Curve 9/27/05. Source: Bloomberg.

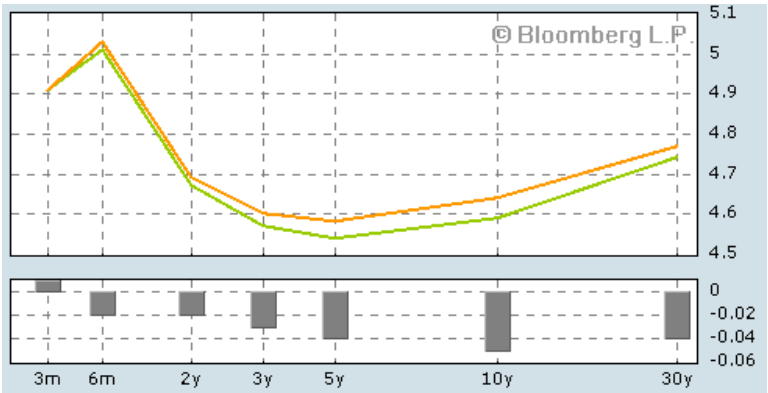


Figure 3: Yield Curve 9/22/06. Source: Bloomberg.

Answer. The short rate has risen from 3.5% to 4.9%; the 5 year has risen from 4.1% to 4.55%, the 10 year from 4.3% to 4.6%, and the 20 year from 4.4% to 4.65%. (The *changes* are approximately 1.4%, 0.45%, 0.3% and 0.25%.)

4.2. Can you explain economically why the slope of the yield curve has changed since one year ago?

Answer. The short rate has risen, and with anticipations of a growth slowdown, expected short term rates are expected to be higher in the next three to six months, and thereafter lower than the overnight 6-month ahead rate thereafter. Given the expectations hypothesis of the term structure and a small liquidity premium, the long maturities are expected have lower yields than those at 6 months. In other words, the yield curve is inverted over that range.

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 *down*ward 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:

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

Substituting in the numbers yields:

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

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

$$P_t = \frac{1}{(0.03-0)} = 33.3\overline{3}$$