

First midterm exam

**No calculators.** Total points on exam: 95. Look over the entire exam before you begin. If I ask you to explain your answer, your grade for the question will depend on your *explanation*. Good luck!

1) 5 pts. A zero-coupon bond will make a payment of \$900 in September 2023, two years from today. The market price of the bond is \$100. What is the yield on this bond, in percent?

\_\_\_\_\_ percent

2) 5 pts. You buy a coupon bond that makes a coupon payment once a year. The price you pay for the bond is \$50. The coupon payment is \$10. The bond will mature 25 years from now. The face value of the bond is \$90. You hold the bond for one year, receive one coupon payment, then sell the bond for \$65. What rate of return did you receive?

\_\_\_\_\_ percent

3) Consider a coupon bond that you can buy today, in September 2021. Call it “bond A.” Bond A will make coupon payments once a year, in September 2022, September 2023 and September 2024. In September 2024 it will also pay off its face value (or principle). The face value is \$500. The coupon rate is 5% (“%” means percent). You look on your Bloomberg terminal and see that current market yields to maturity for “zero coupon” (single-payment) bonds are as follows:

7% for zero-coupon bonds paying off in September 2022 (one year zero-coupon bonds)

8% for zero-coupon bonds paying off in September 2023 (two-year zero-coupon bonds)

12% for zero-coupon bonds paying off September 2024 (three-year zero-coupon bonds)

a) 5 pts. Write a formula that shows the highest price anyone should be willing to pay for bond A. Use the above information as appropriate, *plug in actual numbers wherever you can*, but do not try to solve the formula to get a number for the price.

b) 5 pts. Now suppose that today's market value of bond A is \$300. Write a formula that defines the coupon bond's yield to maturity. Again, use all the information I gave you, plug in numbers where you can, but do not try to solve the formula. **Point out which symbol in the formula stands for the yield to maturity.**

4) 10 pts. Again consider bond A described in question 3). Suppose that today (in September 2021) someone strips off the first coupon on this bond (the IOU that pays off in September 2022) and sells it separately as a zero-coupon bond. The remaining portion of the original coupon bond is now a bond that pays one coupon in September 2023 and a coupon plus the face value in September 2024. Call this “bond B.”

a) Is the “*duration*” of bond B (using the financial-market definition) bigger, smaller, or the same as the duration of the original bond A? \_\_\_\_\_ (bigger, smaller, same)

b) (continuation of question 4). Why would anyone care about the “duration” of a bond? What does it tell an investor that the investor might care about?

5) 15 pts. Draw what the yield curve would look like in each case below. With a dotted line, draw what the yield curve would look like if the expectations hypothesis were correct. With a solid line, draw the actual yield curve.

a) Everyone thinks future overnight rates may be the same as today's, or higher, or lower - all possibilities about equally likely.

b) Everyone thinks future overnight rates may be the same as today's, or higher.

c) Everyone thinks future overnight rates may be the same as today's, or lower.

6) Suppose the “expectations hypothesis of the term structure” is correct, that is there are no term premiums. I want you to figure out what  ${}_1i$ ,  ${}_2i$  and  ${}_3i$  will be in the following situation. Show your work.

Today, the overnight rate is 3%. People are sure it will remain 3% *through the end of this year*. At the beginning of the second year, things can change. There are three things that can happen.

With a probability of 1/3, the overnight rate will remain 3% throughout the second and third years.

With a probability of 1/3, the overnight rate will fall to zero and remain zero throughout the second year *and* the third year.

With a probability of 1/3, the overnight rate will rise to 9%. It will remain 9% throughout the second year. Then at the beginning of the third year the overnight rate will fall to 6% and remain 6% throughout the third year.

a) 5 pts.  ${}_1i =$  \_\_\_\_\_

b) 5 pts.  ${}_2i =$  \_\_\_\_\_

c) 5 pts.  ${}_3i =$  \_\_\_\_\_

d) 5 pts.

Draw the

yield

curve

(without

term

premiums).

Mark actual numbers

on the vertical axis.

e) (continuation of question 6). 10 pts. Before I said to assume there are no term premiums, but now assume there are term premiums (extra yield that compensates a bond investor for taking on interest-rate risk). If beliefs about future overnight rates were exactly as I described above, would you expect *all three* bond yields (that is  ${}_1i$ ,  ${}_2i$  and  ${}_3i$ ) to contain term premiums? Explain your answer.

7) 10 pts. Jimmy Buffett opens a lending business. Jimmy announces that he will lend money to anyone who wants to borrow, at an interest rate of 10 percent. He finds that he does not make a profit because a large fraction of borrowers default on their loans. To cover the cost of these defaults, Jimmy raises the interest rate that he charges. Now he will still lend money to anyone who wants to borrow, but at an interest rate of 12 percent.

a) The increase in the interest rate Jimmy charges will probably *not* increase Jimmy's profit. Explain.

b) What should Jimmy do instead? Explain. (More room on next page if you need it.)

8) 10 pts. Suppose that all bonds, except for bonds just being issued, are sold through bond dealers: anyone who wants to sell an old bond will sell it to a dealer; anyone who wants to buy an old bond will buy it from a dealer. A dealer offers to buy a bond of a given type at the “bid” price, and offers to sell the same bond at the “ask” price. The bond’s yield calculated using the bid price is the “bid” yield. The yield calculated using the ask price is the “ask” yield.

a) Are bid yields generally higher, lower, or the same as ask yields? \_\_\_\_\_ (higher, lower, same)  
Explain!

b) The spread between bid yields and ask yields varies across bonds. What determines whether the bid-ask spread on a particular bond is relatively big, or relatively small? Explain *thoroughly*. Within your explanation, be sure to explain why

- bid-ask spreads tend to be bigger for bonds issued by newly-established companies
- bid-ask spreads tend to be smaller for bonds that have been rated by bond-rating companies such as Moody’s and Standard and Poor’s. Continue your answer on the next page if you need to.