

First midterm exam

**No calculators.** Total points on exam: 100. 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 February 2027, 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 bond will mature 25 years from now. The face value of the bond is \$200. The coupon rate is 5 percent. 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 fixed-payment bond that you can buy today, in February 2025. Call it "bond A." The maturity of the bond is three years. The fixed payment (the IOU in all years) is \$100. 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 February 2026 (one year zero-coupon bonds)

8% for zero-coupon bonds paying off in February 2027 (two-year zero-coupon bonds)

12% for zero-coupon bonds paying off February 2028 (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 \$225. 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.**

c) 10 pts. Tomorrow someone buys bond A, strips off the first IOU (the IOU that pays off in February 2026) and sells it separately as a zero-coupon bond. The remaining portion of the original bond A is now a bond that pays one IOU in February 2027 and one IOU in February 2028. Call this "bond B." 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)

**Explain.** More room for your answer on next page if you need it.

4) 15 pts. Consider an economy in which the expectations hypothesis is correct. Also, the overnight rate is determined by the supply and demand for real money balances as described in the last section of the notes we covered. The money supply  $M^S$  is controlled by the king. On the graphs below, draw the yield curve that might prevail in each of the situations described.

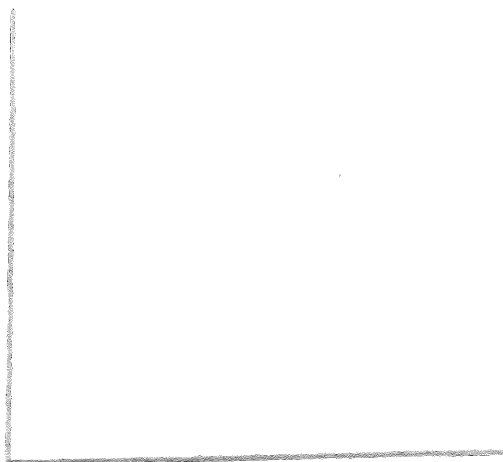
a) Everyone thinks that in the future the price level  $P$  will remain the same as what it is today, but the king will *reduce* the money supply  $M^S$ , so that  $M^S$  will be *smaller* than it is today.



b) Everyone thinks that in the future the price level  $P$  will remain the same as what it is today, but the king will *increase* the money supply  $M^S$ , so that  $M^S$  will be *larger* than it is today.



c) Everyone thinks that in the future the money supply  $M^S$  will remain the same as it is today, but the price level  $P$  will *increase*, so that  $P$  will be *higher* than it is today.



5) Suppose the “expectations hypothesis of the term structure” is correct. I want you to figure out what  ${}_1i$ ,  ${}_2i$  and  ${}_3i$  will be in the following situation. 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.

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.

SHOW YOUR WORK.

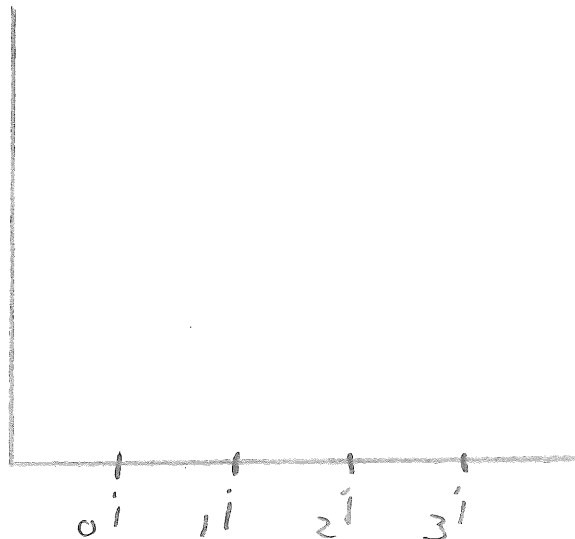
a) 5 pts.  ${}_1i =$  \_\_\_\_\_

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

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

d) Draw the yield curve.

Mark numbers on the vertical axis matching your answers to a), b) and c).



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.

6) 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.)

7) A dealer offers to buy a bond of a given type (issuer and maturity) 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) 5 pts. Are bid yields generally higher, lower, or the same as ask yields? \_\_\_\_\_ (higher, lower, same)

b) 10 pts. A dealer’s bid yields and ask yields vary 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.

**Write on the back if you need more room.**