

Second Midterm Exam

Fall 2021

Econ 180-367

Closed Book.

No Formula Sheet Provided. Calculators OK.

Time Allowed: 1 hour 15 minutes

All interest rates are quoted as annual rates with specified compounding frequency

Please write your answers on the page below each question

1. (5 pts) Suppose that the one-year interest rate is 0.2 percent, the one-year interest rate in one year's time is expected to be 0.4 percent and the one-year interest rate in two years' time is expected to be 1 percent. According to the expectations hypothesis of the term structure, what should the three year yield be today? All interest rates are quoted with annual compounding.
2. (10 pts) Suppose that I buy a ten-year zero-coupon bond with a yield to maturity of 2 percent (with semiannual compounding). One year later, the yield to maturity has fallen to 1 percent. What is my return on holding this bond for one year?
3. (10 pts) The interest rate is 2% (at all maturities, with annual compounding). An insurance company must pay \$11,487 in seven years. It wants to immunize this liability with a portfolio of a five-year zero coupon bond and a nine-year zero coupon bond. How much will the insurance company invest in each of these two bonds? For full credit, you must give the dollar amounts invested today, not just the proportions.
4. (10 pts). A three-year bond has a 4% coupon rate (paid semiannually), and trades at par. What is its duration?
5. (15 pts). A ten-year bond has a 4% coupon rate (paid semiannually). The face value is \$100, but it trades for \$105. The zero-coupon ten-year bond has an interest rate of 3.8% (with semiannual compounding). Assuming no arbitrage, what is the price of a ten-year bond with a face value of \$100 and an 8% coupon rate (paid semiannually)?
6. (10 points) Suppose that the ten-year par government bond yield is 2 percent, the ten-year swap rate is 1.8 percent, and the LIBOR rate is 30 basis points above the repo rate, and is certain to remain so for the next ten years. Suppose that there are no regulatory constraints, transactions costs or default risks. In this case, there is profit-making arbitrage opportunity. In this arbitrage:
 - (a) Do you go long or short the government bond? Please just answer long or short.
 - (b) Do you pay fixed or floating in a swap contract? Please just answer pay fixed or pay floating.
 - (c) Do you borrow or lend in the repo market? Please just answer borrow or lend.
7. (10 points) The required return on Remsen enterprises is 8%. Its dividends will grow at a 4% annual rate forever. Next year, its dividends will be \$2 per share. According to the dividend discount model, what is the fair value of a share in Remsen enterprises?

8. (30 points) Multiple choice questions. Only one option is correct. Please indicate which one it is.

(i) Which of the following is closest to the current ten-year real TIPS yield?

- A. – 1 percent.
- B. 0 percent.
- C. 1 percent.
- D. 2 percent.
- E. 5 percent

(ii) Which of the following is true of TIPS securities?

- A. The coupons are indexed to inflation, but the principal is not.
- B. The principal is indexed to inflation, but the coupon is not.
- C. The coupons and principal are both indexed to inflation.
- D. TIPS pay no coupons and the principal is indexed to inflation.
- E. TIPS are perpetual securities where the principal is never paid back.

(iii) Researchers have found that in the weeks after a firm has announced stronger-than-expected earnings, the stock outperforms other stocks. Which of the following statements is most accurate?

- A. This is evidence against the weak form of the efficient markets hypothesis.
- B. This is evidence against the semi-strong form of the efficient markets hypothesis.
- C. This is evidence against all forms of the efficient markets hypothesis.
- D. This is evidence for the strong form of the efficient markets hypothesis.
- E. This is evidence for all forms of the efficient markets hypothesis.

(iv) Which of the following best describes the US Treasury yield curve over the last 50 years?

- A. The yield curve has typically been downward sloping. The occasions when it was upward sloping came just before bursts of inflation.
- B. The yield curve has typically been upward sloping. The occasions when it was downward sloping came just before recessions.
- C. The yield curve has typically been downward sloping. The occasions when it was upward sloping came when the federal funds rate was unusually high.
- D. The yield curve has typically been upward sloping. The occasions when it was downward sloping came just before bursts of inflation.
- E. The yield curve has typically been downward sloping. The occasions when it was upward sloping came just before recessions.

(v) Which of the following is the best definition of a closed end fund?

- A. A mutual fund which lasts for a fixed time period.
- B. A mutual fund where the number of shares is fixed.
- C. A mutual fund where shares can only be redeemed by selling them to the manager.
- D. A mutual fund where large investors can cancel the shares and obtain the underlying securities.
- E. A mutual fund investing only in US securities.

(vi) Which of the following is the name given to the phenomenon where investors try to avoid investments in which they do not know the odds of different outcomes?

- A. Ambiguity aversion.
- B. Prospect theory.
- C. Anchoring.
- D. Loss aversion.
- E. The leverage cycle.

(vii) You buy a US Treasury bond with a 4% annual coupon rate for settlement 49 days since the last coupon. There are 184 days between the last and the next coupon. The face value is \$100. The clean price is \$120. What is the dirty price?

- A. \$119.00.
- B. \$119.50.
- C. \$120.00.
- D. \$120.50.
- E. \$121.00

(viii) Which of the following best describes Treasury STRIPS?

- A. Securities issued by the Treasury with very long maturities.
- B. Securities issued by the Treasury whose value is adjusted in line with inflation.
- C. Securities issued by the Treasury with floating interest rates.
- D. Mortgage backed securities created by the US Treasury.
- E. Securities created by selling each coupon or principal payment from a Treasury bond as a separate cashflow.

(ix) How many US corporations currently have AAA credit ratings from Standard and Poors?

- A. None.
- B. Two.
- C. 14.
- D. 86.
- E. Over 500.

(x) Convexity of a non-callable bond implies which of the following:

- A. The percent increase in price when yields drop by one percentage point **is the same as** the percent decrease in price when yields rise by one percentage point.
- B. The percent increase in price when yields drop by one percentage point **is bigger than** the percent decrease in price when yields rise by one percentage point.
- C. The percent increase in price when yields drop by one percentage point **is smaller than** the percent decrease in price when yields rise by one percentage point.
- D. Bond prices increase when yields increase.
- E. Bonds have higher volatility than stocks.

Solutions and Grading Rubric

1. $(1 + y_3)^3 = 1.002 * 1.004 * 1.01$. So the three year yield is 53 basis points. 50 basis points is acceptable as an approximation. No credit to people who tried to work out forward rates instead of the actual yield. 2 points for computing the total return over 3 years (it is supposed to be annualized). 2 points for having the right formula except replacing $(1 + y_3)^3$ with $(1 + y_3)^2$.

2. The price of the bond today is $\frac{100}{1.01^{20}} = \81.95 . After one year, the price of the bond is

$$\frac{100}{1.005^{18}} = \$91.41. \text{ So the holding period return is } \frac{91.41 - 81.95}{81.95} = 11.54\%.$$

8 points for a pure algebra mistake.

7 points for people who got the price wrong by replacing the 18 in the 2nd denominator by 20, but otherwise got everything right.

5 points for people who otherwise computed the bond prices incorrectly by a mistake in the bond pricing formula related to annual/semiannual compounding like having 1.02^{20} or 1.01^{10} in the denominator for the first bond price but otherwise got everything right.

3 points for people who did not compute prices by any recognizable method, but who worked out the holding period return correctly given the incorrect prices.

3 points off for adding in interest to the holding period return (it is a zero coupon bond).

3. Duration of liability is 7 years. Duration of asset is $5w + 9(1-w)$ where w is the weight in the five-year bond. So

$w=0.5$. The present value of the liability is $\frac{11,487}{1.02^7} = 10,000$. So you invest \$5,000 in the five-year bond and

\$5,000 in the 9 year bond. 7 points if you got the weights right but said that the total amount you invest is \$11,487, rather than it's present value (\$10,000).

$$4. D = \frac{2}{1.02} 0.5 + \frac{2}{1.02^2} 1 + \frac{2}{1.02^3} 1.5 + \frac{2}{1.02^4} 2 + \frac{2}{1.02^5} 2.5 + \frac{102}{1.02^6} 3 = 2.86$$

4 points for people who forgot about the principal in the last term and so for whom the last term was $\frac{2}{1.02^6} 3$.

5. The price of the zero-coupon ten-year bond with a face value of \$100 is $\frac{100}{1.019^{20}} = 68.63$. The ten-year bond

with an 8% coupon rate is equivalent to two units of the bond with a 4% coupon rate minus a ten-year zero coupon bond. So the price of the ten-year bond with an 8% coupon rate has to be $2 * 105 - 68.63 = 141.37$. 10 points if you put 1.038^{20} in the denominator of the price of the bond.

6. 3 points for getting 1 right, 7 points for getting 2 right and 10 points for getting all right.

(a) Go long the government bond.

(b) Pay fixed in the swap contract.

(c) Borrow in the repo market.

7. It is $\frac{2}{0.08 - 0.04} = \50 .

- 8. (i) A
- (ii) C
- (iii) B
- (iv) B
- (v) B
- (vi) A
- (vii) D
- (viii) E
- (ix) B
- (x) B