

Econ 121
Money and Banking
Fall 2009
Instructor: Chao Wei

Midterm

Answer Key

Provide a BRIEF and CONCISE answer to each question. Clearly label each answer. There are 25 points on the exam.

I. Formulas used to compute the solutions are *required* for full credit. Correct answers without formulas will only be granted partial credit.

II. If verbal and graphical explanations contradict with each other, only half or less than half of the credit will be given depending upon the circumstances.

III. The pricing formula for coupon bonds is:

$$P = \frac{C}{1+i} + \frac{C}{(1+i)^2} + \dots + \frac{C}{(1+i)^n} + \frac{F}{(1+i)^n}.$$

1. (3 points) Compute yield to maturity. (1 point each)

- (a) Determine the yield to maturity of a one-year coupon bond with \$1,000 face value, 8% coupon rate, and selling for \$800?

$$\begin{aligned} 800 &= \frac{1000 \times 8\%}{1+i} + \frac{1000}{1+i} \\ \Rightarrow i &= 35\%. \end{aligned}$$

- (b) Determine the yield to maturity of a consol with \$1,000 face value, a current yield of 15%, and selling for \$800.

$$\begin{aligned} i_c &= \frac{C}{P} \\ \Rightarrow C &= 15\% \times 800 \\ \text{For a consol, } i &= \frac{C}{P} = \frac{15\% \times 800}{800} = 15\% \end{aligned}$$

- (c) Determine the yield to maturity of a one-year coupon bond with \$1,000 face value, a current yield of 10%, and selling for \$800?

$$\begin{aligned} i_c &= \frac{C}{P} \\ \Rightarrow C &= 10\% \times 800 = 80 \\ 800 &= \frac{80}{1+i} + \frac{1000}{1+i} \\ \Rightarrow i &= 35\%. \end{aligned}$$

2. (3 points) Understand the relation between price and yield to maturity. (1 point each)

- (a) Would it ever make sense to pay \$1100 for a coupon bond with a face value of \$1000? Briefly explain.

Yes, it make sense to pay above par when the coupon rate is higher than the yield to maturity.

- (b) Would it ever make sense to pay \$1100 for a one-year discount bond with a face value of \$1000? Briefly explain.

No, because the coupon rate (0 in the case of discount bond) is always smaller than the yield to maturity, implying that the discount bond must be sold below par.

- (c) How much will you pay for the discount bond described in (b) if the interest rate is 10%?

$$p = \frac{1000}{1 + 10\%} \approx 909 \quad (1)$$

3. (5 points) Use GRAPHIC ANALYSIS to predict the effect on the interest rate of the following events using EITHER the bond supply and demand analysis OR liquidity preference framework.(1 point each)

- (a) A sudden increase in people's expectations of future housing prices;

Possible answer one: A sudden increase in people's expectations of future housing prices may make real estate investment more attractive than bonds. As a result, the demand for bonds go down, resulting in lower bond prices and higher interest rate.

Possible answer two: A sudden increase in people's expectation of future housing prices restores people's confidence in quick recovery of the economy. The stock market becomes more attractive. As a result, the demand for bonds go down, resulting in lower bond prices and higher interest rate.

Possible answer three: A sudden increase in people's expectations of future housing prices may make homeowners feel wealthier. More wealth implies higher demand for bond, thus higher bond prices and lower interest rate.

- (b) Hundred of billions more have to be spent on the second stimulus package;

Multiple answers are possible for this question. Please give credit to reasonable answers.

Possible answer one: The huge government stimulus may result in huge budget deficit. The government has to increase the bond supply, resulting in lower bond prices and higher interest rates.

Possible answer two: The huge government stimulus might restore people's confidence in the economy. As a result, the stock market might become more attractive relative to bonds. The demand for bonds decreases, resulting in lower bond prices and higher interest rates.

- (c) An increase in money supply.

An increase in the money supply implies an increase in liquidity. For a given money demand curve, an increase in the money supply implies lower interest rate according to the liquidity preference framework.

- (d) The oil price is expected to be rising .

Possible answer one: The rising energy price tag raises people's inflation expectation. Higher inflation expectation leads to an increase in bond supply and a decrease in bond demand. As a result, bond prices go down and the interest rate goes up.

Possible answer two: People interpret the rising energy prices as further indications of strong economy. The stock market becomes more attractive. As a result, the demand for bonds decrease, resulting in a lower bond price and higher interest rate.

- (e) An increase in the price level (but not in expected inflation)

An increase in the price level for any given money supply im-

plies an upward shift in money demand and a higher interest rate according to the liquidity preference framework.

4. (4 points) Compute the rate of returns. (Hint: Calculate the initial price and end-of-period price first, then calculate the return.)
- (a) Suppose you purchase a consol with a yearly payment of \$100 at period t when the yield to maturity is 10%. Calculate the rate of return on the consol for the year, if at period $t + 1$ the yield to maturity unexpectedly rises to 20%.

Denote the price of consol and the yield to maturity at the beginning of the year respectively as P_t and i_t , and denote the annual coupon payment as C :(0.5 point)

$$\begin{aligned} P_t &= \frac{C}{i_t} \\ &= \frac{100}{0.1} \\ &= 1000 \end{aligned}$$

Denote the price of consol and the yield to maturity at the end of the year respectively as P_{t+1} and i_{t+1} , and denote the annual coupon payment as C :(0.5 point)

$$\begin{aligned} P_{t+1} &= \frac{C}{i_{t+1}} \\ &= \frac{100}{0.20} \\ &= 500 \end{aligned}$$

The return for the year, R_{t+1} , can be written as (0.5 point)

$$\begin{aligned} R_{t+1} &= \frac{C}{P_t} + \frac{P_{t+1} - P_t}{P_t} \\ &= \frac{100}{1000} + \frac{500 - 1000}{1000} \\ &= -40\% \end{aligned}$$

- (b) Suppose you purchase a coupon bond, with a face value of \$1000, a coupon rate of 10%, and ONE year to maturity, at period t when the yield to maturity is 10%. Calculate the rate of return on the bond for the year, if at period $t + 1$ the yield to maturity unexpectedly rises to 20%.

The price of the coupon bond at the beginning of the year, P_t , is equal to its face value, 1000.(0.5 point)

Denote the price of the coupon bond at the end of the year as P_{t+1} . Note that in this case the maturity of the bond coincides with the holding period itself. At the end of the year, the bond matures. After the coupon payment is made, anyone holding on to the bond only has claim to the face value of the bond, which is due right at that time. That is, (0.5 point)

$$P_{t+1} = 1000$$

The return for the year, R_{t+1} , can be written as (0.5 point)

$$\begin{aligned} R_{t+1} &= \frac{C}{P_t} + \frac{P_{t+1} - P_t}{P_t} \\ &= \frac{100}{1000} + \frac{1000 - 1000}{1000} \\ &= 10\% \end{aligned}$$

- (c) What explains the differences between the rate of returns in (a) and (b).(1 point)

In (a), the term to maturity is longer than the holding period. A sudden increase in the interest rate implies that all the future coupon payments are discounted at a higher rate, thus resulting in a substantial capital loss. In (b), however, the maturity coincides with the holding period. Since the bond already matures after one year, there will be no future coupon payments, and as a result, higher interest rates have no impact on the price of the

bond, which is equal to the face value after the coupon payment is made.

5. (3 points) Assuming that the expectations hypothesis is the correct theory of the term structure, calculate the interest rates in the term structure for maturities of one to three years, and plot the resulting yield curves for the following series of one-year interest rates over the next three years.

a. 5%, 9%, 7%

b. 5%, 4%, 3%.

For case (b), assume that $l_{2,t} = 1\%$, $l_{3,t} = 2\%$. Plot the yield curve according to the liquidity premium theory, and explain why the liquidity premium theory helps to explain the stylized fact that the yield curve almost always slope upward.

a. 5%, 9%, 7%

$$\begin{aligned}i_{1,t} &= 5\%, \\i_{2,t} &= \frac{5\% + 9\%}{2} = 7\% \\i_{3,t} &= \frac{5\% + 9\% + 7\%}{3} = 7\%\end{aligned}$$

b. 5%, 4%, 3%.

$$\begin{aligned}i_{1,t} &= 5\%, \\i_{2,t} &= \frac{5\% + 4\%}{2} = 4.5\% \\i_{3,t} &= \frac{5\% + 4\% + 3\%}{3} = 4\%\end{aligned}$$

For case (b), assuming that $l_{2,t} = 1\%$, $l_{3,t} = 2\%$,

$$\begin{aligned}i_{1,t} &= 5\% \\i_{2,t} &= \frac{5\% + 4\%}{2} + 1\% = 5.5\% \\i_{3,t} &= \frac{5\% + 4\% + 3\%}{3} + 2\% = 6\%\end{aligned}$$

The fact that $l_{n,t}$ increases as n increases implies that the longer the maturity of the bond, the higher compensation is demanded by the investors for decline in its liquidity. The increasingly higher compensation for liquidity loss in the form of higher interest rate leads to higher long-term interest rates as compared to short-term interest rates.

6. (4 points) On October 9, 2008, CNN reports that, "According to early tallies, the Dow Jones industrial average (INDU) lost 679 points, or 7.3%, after hitting its lowest point since May 27, 2003 during the session." In response to this news, some commentator says, "Because corporations do not actually raise any funds in secondary markets, they are less important to the economy than primary markets." Please explain the importance of the secondary market to the commentator. (Itemize your explanations and be very precise and concise.)

The secondary market is important for two reasons:

First, it provides liquidity to primary market buyers by allowing them to sell shares on the secondary market. (2 points)

Second, it provides valuation to shares. A higher share price on the secondary market always imply that new shares can be issued at a higher price as well. (2 points)

7. (3 points) If the public expects a corporation to lose \$5 per share this quarter and it actually loses \$4, which is still the largest loss in the history of the company, what does the efficient market hypothesis say will happen to the price of the stock when the \$4 loss is announced?

According to the efficient market hypothesis, prices reflect all publicly available information. If the public had expected the corporation to lose \$5 per share this quarter, this expectation has already been reflected into the stock price of this corporation. However, if the corporation performs better than expected (\$4 loss instead of \$5 loss), the unexpected part of the news is good news, which would lead to the price of the stock to go up.