# Homework Assignment – Week 2

## Chapter 3

1. Write down the formula that is used to calculate the yield to maturity on a 20-year 10% coupon bond with $1,000 face value that sells for $2,000. Assume yearly coupons.
2. If there is a decline in interest rates, which would you rather be holding, long-term bonds or short-term bonds? Why? Which type of bond has the greater interest-rate risk?
3. A financial advisor has just given you the following advice: “Long-term bonds are a great investment because their interest rate is over 20%.” Is the financial advisor necessarily correct?
4. If mortgage rates rise from 5% to 10%, but the expected rate of increase in housing prices rises from 2% to 9%, are people more or less likely to buy houses?

## Chapter 3 - Quantitative Questions

1. Calculate the present value of a $1,000 zero-coupon bond with five years to maturity if the yield to maturity is 6%.
2. A lottery claims their grand price is $10 million, payable over 20 years at $500,000 per year. If the first payment is made immediately, what is this grand prize really worth? Use an interest rate of 6%.
3. Consider a bond with a 7% annual coupon and a face value of $1,000. Complete the following table. What relationships do you observe between maturity and discount rate and the current price?

|  |  |  |
| --- | --- | --- |
| Years to Maturity | Yield to Maturity | Current Price |
| 3 | 5% |  |
| 3 | 7% |  |
| 6 | 7% |  |
| 9 | 7% |  |
| 9 | 9% |  |

1. Consider a coupon bond that has a $1,000 par value and a coupon rate of 10%. The bond is currently selling for $1,150 and has eight years to maturity? What is the bond’s yield to maturity?
2. You are willing to pay $15,625 now to purchase a perpetuity that will pay you and your heirs $1,250 each year, forever, starting at the end of this year. If your required rate of return does not change, how much would you be willing to pay if this were a 20-year, annual payment, ordinary annuity instead of perpetuity?
3. What is the price of a perpetuity that has a coupon of $50 per year and a yield of 2.5%? If the yield doubles, what happens to the price?
4. Property taxes in DeKalb County are roughly 2.66% of the purchase price every year. If you just bought a $100,000 home, what is the PV of all future property tax payments? Assume that the house remains worth $100,000 forever, property tax rates never change and that a 9% interest rate is used for discounting.
5. Assume you just deposited $1,000 into a bank account. The current real interest rate is 2%, and inflation is expected to be 6% over the next year. What nominal rate would you require from the bank over the next year? How much money will you have at the end of 1 year? If you are saving to buy a stereo that currently sells for $1,050, will you have enough to buy it?
6. A 10-year, 7% coupon bond with a face value of $1,000 is currently selling for $871.65. Coupon your rate of return if you sell the bond next year for $880.10.
7. You have paid $980.30 for an 8% coupon bond with a face value of $1,000 that matures in 5 years. You plan on holding the bond for 1 year. If you want to earn a 9% rate of return on this investment, what price must you sell the bond for? For this to occur what must happen to the yield to maturity on the bond over that year?
8. Calculate the duration of a $1,000, 6% coupon bond with three years to maturity. Assume that all market interest rates are 7%.
9. Consider the bond in the previous question. Calculate the expected price change in interest rates drop to 6.75% using the duration approximation. Calculate the actual price change using discounted cash flows.
10. The duration of a $100 million portfolio is 10 years. $40 million in new securities are added to the portfolio, increasing the duration of the portfolio to 12.5 years. What is the duration of the $40 million in new securities?
11. (Note numbers are different than in the text) A bank has two 3-year commercial loans with a present value of $70 million. The first is a $30m loan that requires a single payment of $37.8 million in three years with no other payments until then. The second loan is for $40m. It requires an annual interest payment of $3.6m. The principal of $40m is due in three years.
    1. What is the duration of the bank’s commercial loan portfolio?
    2. What will happen to the value of its portfolio if the general level of interest rates increases from 8% to 8.5%?
12. Consider a bond that promises the following cash flows. The yield to maturity is 12%. You plan to buy this bond, hold it for 2.5 years, and then sell the bond
    1. What total cash will you receive from the bond after the 2.5 years? Assume that periodic cash flows are reinvested at 12%.
    2. If immediately after buying this bond all market interest rates drop to 11% (including your reinvestment rate), what will be the impact on your total cash flow after 2.5 years? How does this compare to part (a)?
    3. Assuming all market interest rates are 12%, what is the duration of this bond?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | 0 | 1 | 2 | 3 | 4 |
| Promised Payment | 160 | 160 | 170 | 180 | 230 |

## Chapter 11 Questions

1. What characteristics define the money markets?
2. Is a Treasury Bond issued 29 years ago with 6 months remaining before it matures a money market instrument?
3. Why do banks not eliminate the need for money markets?
4. Distinguish between a term security and a demand security?
5. What was the purpose motivating regulators to impose interest ceilings on bank savings accounts? What effect did this eventually have on the money markets?
6. Why does the U.S. Government use the money markets?
7. Why do businesses use the money markets?
8. What purpose initially motivated Merrill Lynch to offer money market mutual funds to its customers?
9. Why are more funds from property and casualty insurance companies than funds from life insurance companies invested in the money markets?
10. Which of the money market securities is the most liquid and considered the most risk-free? Why?
11. Distinguish between competitive bidding and non-competitive bidding for Treasury Securities.
12. Who issues federal funds, and what is the usual purpose of these funds?
13. Does the Federal Reserve directly set the federal funds interest rate? How does the Fed influence this rate?
14. Who issues commercial paper and for what purpose?
15. Why are banker’s acceptances so popular for international transactions?

## Chapter 11 Quantitative Problems

T-Bill Math exercises – Fill in the blanks (problems 1-4,6,8 from text)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Price | Principal | Maturity (days) | Annualized Discount Rate | Annualized Investment Rate |
| $4,925 | $5,000 | 182 |  |  |
| $9,940 | $10,000 | 91 |  |  |
|  | $5,000 | 91 | 3.5% |  |
| $9,900 | $10,000 | 91 |  |  |
|  | $10,000 | 182 | 1.8% |  |
|  | $10,000 | 364 | 3% |  |

1. The price of 182-day commercial paper is $7,840. If the annualized investment rate is 4.093% what will the paper pay at maturity?
2. The price of $8,000 face value commercial paper is $7,930. If the annualized discount rate is 4%, when will the paper mature? If the annualized investment rate is 4%, when will the paper mature?
3. The annualized discount rate on a particular money market instrument is 3.75%. The face value is $200,000 and it matures in 51 days. What is its price? What would be the price if it had 71 days to maturity?
4. The annualized yield is 3% for 91-day commercial paper and 3.5% for 182-day commercial paper. What is the expected 91-day commercial paper rate 91 days from now?
5. In a Treasury auction of $2.1 billion par value 91-day T-bills, the following bids were submitted. If only these competitive bids are received, who will receive T-Bill, in what quantity and at what price? If the Treasury also received $800m in non-competitive bids then who will receive T-bills, in what quantity and at what price?

|  |  |  |
| --- | --- | --- |
| Bidder | Bid Amount | Price |
| 1 | $500mn | $0.9940 |
| 2 | $750mn | $0.9901 |
| 3 | $1.5bn | $0.9925 |
| 4 | $1bn | $0.9936 |
| 5 | $600m | $0.9939 |

## Additional Questions

1. In the book there is an example of a 25-year fixed payment loan worth $1,000 with a fixed annual payment of $85.81. This gives a yield to maturity of 7%. Set up an excel spreadsheet that
   1. Splits the fixed payment into interest and principal for each cash flow. Note this will be a different amount for each cash flow.
   2. Create a graph with two lines – one for the interest payment and one for the principal payment.
   3. Explain why the two lines look like they do
2. During the 1980’s recession the Federal Reserve chairman, Paul Volker, raised interest rates significantly to try to reduce inflation. Why is raising interest rates thought to reduce inflation?
3. In exercise 11 of chapter 11’s quantitative problems there is a mistake in the description of the bidding process. What is it?
4. How often are T-bills auctioned? Find the announcement and results of the latest 4W T-bill auction on the Treasury Direct website. Find
   1. The amount to be auctioned
   2. The amount that went to non-competitive bidders
   3. The amount that went to competitive bidders
5. Fill in the blanks in the following table (assume annual coupons and a face value of 100)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bond | Maturity | Coupon | Yield to Maturity | Present Value | Duration |
| A | 3 | 7% | 3.5% |  |  |
| B | 3 | 6% | 8% |  |  |
| C | 5 | 2% | 5% |  |  |
| D | 5 | 7% | 3.5% |  |  |
| E | 7 | 6% | 8% |  |  |

1. From the above example, what is the duration of a portfolio consisting of bonds A & B? What is the duration of a portfolio consisting of two units of bond C with 5 units of bond E?