## Chapter 4 Questions

1. Explain why you would be more or less willing to buy a share of Polaroid stock in the following situations:
	1. Your wealth falls. Less willing because your wealth falls
	2. You expect it to appreciate in value. More because its relative expected value increases
	3. The bond market becomes more liquid. Less because it becomes less liquid relative to bonds
	4. Prices in the bond market become more volatile. More because it becomes less risky relative to bonds.
2. Explain why you would be more or less willing to buy a house under the following circumstances:
	1. You just inherited $100,000. More because your wealth has increased
	2. Real estate commissions fall from 6% of the sales price to 4% of the sales price. More because it has become more liquid
	3. You expect Polaroid stock to double in value next year. Less because its expected return relative to other investments has reduced
	4. You expect housing prices to fall. Less because its expected return has fallen.
3. “The more risk-averse people are, the more likely they are to diversify.” Is this statement true, false or uncertain? Explain your answer. True, because the benefits to diversification are greater for a person who cares more about reducing risk.
4. I own a professional football team, and I plan to diversify in either a company that owns a professional basketball team or a pharmaceutical company. Which of these two investments is more likely to reduce the overall risk I face? Why? Purchasing shares in the pharmaceutical company is more likely to reduce my overall risk because the correlation of returns on my investment in a football team with the returns on the pharmaceutical company shares should be low. By contrast, the correlation of returns on an investment in a football team and an investment in a basketball team are probably pretty high, so in this case there would be little risk reduction if I invested in both.
5. “No one who is risk-averse will ever buy a security that has a lower expected return, more risk and less liquidity than another security.” Is this statement true, false or uncertain? Explain your answer. True, because for a risk adverse person, more risk, a lower expected return, and less liquidity make a security less desirable.

For questions 6-13, answer each question by drawing the appropriate supply and demand diagrams.

1. An important way in which the Federal Reserve decreases the money supply is by selling bonds to the public. Using a supply-and-demand analysis for bonds, show what effect this action has on interest rates. When the Fed sells bonds to the public, it increases the supply of bonds, thus shifting the supply curve *Bs* to the right. The result is that the intersection of the supply and demand curves *Bs* and *Bd* occurs at a lower equilibrium bond price and thus a higher equilibrium interest rate, and the interest rate rises.
2. Using the supply-and-demand for bonds framework show why interest rates are pro-cyclical (rising when the economy is expanding and falling during recessions). When the economy booms, the demand for bonds increases: The public’s income and wealth rises while the supply of bonds also increases, because firms have more attractive investment opportunities. Both the supply and demand curves (*Bd* and *Bs*) shift to the right, but as is indicated in the text, the demand curve probably shifts less than the supply curve so the equilibrium interest rate rises. Similarly, when the economy enters a recession, both the supply and demand curves shift to the left, but the demand curve shifts less than the supply curve so that the bond price rises and the interest rate falls. The conclusion is that bond prices fall and interest rates rise during booms and fall during recessions, that is, interest rates are procyclical.
3. Find the “Credit Markets” column in the Wall Street Journal. Underline the statements in the column that explain bond price movements, and draw the appropriate supply-and-demand diagrams that support these statements.
4. What effect will a sudden increase in the volatility of gold prices have on interest rates? Interest rates fall. The increased volatility of gold prices makes bonds relatively less risky relative to gold and causes the demand for bonds to increase. The demand curve, *Bd*, shifts to the right and the equilibrium bond price rises and the interest rate falls.
5. How might a sudden increase in people’s expectations of future real estate prices affect interest rates? Interest rates would rise. A sudden increase in people’s expectations of future real estate prices raises the expected return on real estate relative to bonds, so the demand for bonds falls. The demand curve *Bd* shifts to the left, and the equilibrium bond price falls, so the interest rate rises.
6. Explain what effect a large federal deficit might have on interest rates. The increased riskiness of bonds lowers the demand for bonds. The demand curve shifts to the left and the equilibrium bond price falls and the interest rate rises.
7. Using a supply and demand analysis for bonds, show what the effect is on interest rates when the riskiness of bonds rises. The increased riskiness of bonds lowers the demand for bonds. The demand curve *Bd* shifts to the left, the equilibrium bond price falls and the interest rate rises.
8. Will there be an effect on interest rates if brokerage commissions on stocks fall? Explain your answer. Yes, interest rates will rise. The lower commission on stocks makes them more liquid than bonds, and the demand for bonds will fall. The demand curve Bd will therefore shift to the left, and the equilibrium bond price falls and the interest rate will rise.

## Explaining the Future

1. The president of the United States announces in a press conference that he will fight the higher inflation rate with a new anti-inflation program. Predict what will happen to interest rates if the public believes him. If the public believes the president’s program will be successful, interest rates will fall. The president’s announcement will lower expected inflation so that the expected return on goods decreases relative to bonds. The demand for bonds increases and the demand curve, Bd, shifts to the right. For a given nominal interest rate, the lower expected inflation means that the real interest rate has risen, raising the cost of borrowing so that the supply of bonds falls. The resulting leftward shift of the supply curve, Bs, and the rightward shift of the demand curve, Bd, causes the equilibrium bond price to rise and the interest rate to fall.
2. The chairman of the Fed announces that interest rates will rise sharply next year, and the market believes him. What will happen to today’s interest rate on AT&T bonds, such as the 8 1/8s of 2022? The interest rate on the AT&T bonds will rise. Because people now expect interest rates to rise, the expected return on long-term bonds such as the 8 1/8s of 2022 will fall, and the demand for these bonds will decline. The demand curve *Bd* will therefore shift to the left, and the equilibrium bond price falls and the interest rate will rise.
3. Predict what will happen to interest rates if the public suddenly expects a large increase in stock prices? Interest rates will rise. The expected increase in stock prices raises the expected return on stocks relative to bonds and so the demand for bonds falls. The demand curve, Bd, shift to the left and the equilibrium bond price falls and the interest rate rises.
4. Predict what will happen to interest rates if prices in the bond market become more volatile. Interest rates will rise. When bond prices become volatile and bonds become riskier, the demand for bonds will fall. The demand curve Bd will shift to the left, and the equilibrium bond price falls and the interest rate will rise.

## Chapter 4 Quantitative Problems

1. You own a $1,000-par zero-coupon bond that has 5 years of remaining maturity. You plan on selling the bond in one year, and believe that the yield to maturity next year will have the following probability distribution

|  |  |
| --- | --- |
| Probability  | Yield % |
| 0.1 | 6.60% |
| 0.2 | 6.75% |
| 0.4 | 7.00% |
| 0.2 | 7.20% |
| 0.1 | 7.45% |

* 1. What is your expected price when you sell the bond? The expected price is the probability weighted sum of the prices. 763.07
	2. What is the standard deviation of the bond price? The standard deviation is the square root of the probability weighted sum of the square of the differences between the price and the expected price. 6.79



1. Consider a $1,000-par junk bond paying a 12% annual coupon with 2 years to maturity. The issuing company has a 20% chance of defaulting this year in which case the bond would not pay anything. If the company survives the first year, paying the annual coupon payment then it has a 25% chance of defaulting in the second year. If the company defaults in the second year then neither the final coupon payment nor the par value of the bond will be paid
	1. What price must investors pay for this bond to expect a 10% yield to maturity? The expected cash-flow in the first year is 80% of 120 or 96. The expected cash-flow in the second year is 80% of 75% of 1120 or 672. To have an expected 10% yield to maturity we discount these expected cash-flows at 10% and find 642.64.
	2. At that price what is the expected holding period return and standard deviation of returns? Assume that periodic cash flows are reinvested at 10%



1. Last month, corporations supplied $250 billion in 1 year discount bonds to investors at an average market rate of 11.8%. This month, an additional $25bn in one-year discount bonds became available, and market rates increased to 12.2%. Assuming that the demand curve remained constant, derive a linear equation for the demand for bonds, using prices instead of interest rates.

First, translate the interest rates into prices.

 We know two points on the demand curve:

 So, the slope =

 Using the point-slope form of the line, Price = 0.12755 × Quantity + Constant. We can substitute in either point to determine the constant. Let’s use the first point:

 Finally, we have:

1. An economist has concluded that, near the point of equilibrium, the demand curve and supply curve for 1-year discount bonds can be estimated using the following equations

$$B^{d}:Price= \frac{-2}{5}Quantity+940$$

$$B^{s}:Price= Quantity+500$$

* 1. What is the expected equilibrium price and quantity of bonds in this market? Solve the equation simultaneously and find Q=314.2857. The price is 814.2857.
	2. Given your answer to part (a), what is the expected interest rate in this market? 22.8%
1. Use the same supply and demand curves in question 4. Following a dramatic increase in the value of the stock market, many retirees starting moving money out of the stock market and into bonds. This results in a parallel shift in the demand for bonds, such that the price of bonds at all quantities increased $50. Assuming no change in the supply equation for bonds, what is the new equilibrium price and quantity? What is the new market interest rate? The new demand curve is:

$$B^{d}:Price= \frac{-2}{5}Quantity+990$$

If you solve this and the supply equation simultaneously then you find Q=350.00. The new price is 850.00 and the new interest rate is 17.6%.

1. The demand curve and supply curve for 1-year discount bonds were estimated using the following equations:

$$B^{d}:Price= \frac{-2}{5}Quantity+990$$

$$B^{s}:Price= Quantity+500$$

As the stock market continued to rise, the Federal Reserve felt the need to increase the interest rates. As a result the new market interest rate increased to 19.65%, but the equilibrium quantity remained unchanged. What are the new demand and supply equations. Assume parallel shifts in the equations. Prior to the change the quantity was 350.00 and the price was 850. The new equilibrium price is P=1000/(1+19.65%)=835.771. Thus the point (350,835.771) will be common to both equations. As the shifts are parallel the first equation must change to be

$$B^{d}:Price= \frac{-2}{5}Quantity+constant$$

$$B^{d}:Price= \frac{-2}{5}Quantity+975.771$$

$$B^{s}:Price= Quantity+485.771$$

## Chapter 5 Questions

1. Which should have the higher risk premium on its interest rates, a corporate bond with a Moody’s Baa rating or a corporate bond with a C rating? Why? The bond with a C rating should have a higher risk premium because it has a higher default risk, which reduces its demand and raises its interest rate relative to that of the Baa bond.
2. Why do U.S. Treasury Bills have lower interest rates than large-denomination negotiable bank CDs? U.S. Treasury bills have lower default risk and more liquidity than negotiable CDs. Consequently, the demand for Treasury bills is higher, and they have a lower interest rate.
3. Risk premiums on corporate bonds are usually anti-cyclical; that is they decrease during business cycle expansions and increase during recessions? Why? During business cycle booms, fewer corporations go bankrupt and there is less default risk on corporate bonds, which lowers their risk premium. Similarly, during recessions, default risk on corporate bonds increases and their risk premium increases. The risk premium on corporate bonds is thus anticyclical, rising during recessions and falling during booms.
4. “If bonds of different maturities are close substitutes, their interest rates are more likely to move together.” Is this statement true, false or uncertain? Explain your answer. True. When bonds of different maturities are close substitutes, a rise in interest rates for one bond causes the interest rates for others to rise because the expected returns on bonds of different maturities cannot get too far out of line.
5. If yield curves, on average, were flat, what would this say about the liquidity premiums in the term structure? Would you be more or less willing to accept the pure expectations theory? If yield curves on average were flat and the risk premium on long-term relative to short term bonds were positive then one would expect interest rates to fall more often than rise. Given that rates are as likely to rise as to fall this would force the risk premium to be zero. Thus we would be more willing to accept the pure expectations theory.
6. If a yield curve looks like the one shown here, what is the market predicting about future short-term interest rates? What might the yield curve indicate about the inflation rate in the future?



The flat yield curve at shorter maturities suggests that short-term interest rates are expected to fall moderately in the near future, while the steep upward slope of the yield curve at longer maturities indicates that interest rates further into the future are expected to rise. Because interest rates and expected inflation move together, the yield curve suggests that the market expects inflation to fall moderately in the near future but to rise later on.

1. If the yield curve looks like the one below, what is the market predicting about the movement of future short-term interest rates? What might the yield curve indicate about the inflation rate in the future?

The steep upward-sloping yield curve at shorter maturities suggests that short-term interest rates are expected to rise moderately in the near future because the initial, steep upward slope indicates that the average of expected short-term interest rates in the near future is above the current short-term interest rate. The downward slope for longer maturities indicates that short-term interest rates are eventually expected to fall sharply. With a positive risk premium on long-term bonds, as in the liquidity premium theory, a downward slope of the yield curve occurs only if the average of expected short-term interest rates is declining, which occurs only if short-term interest rates far into the future are falling. Since interest rates and expected inflation move together, the yield curve suggests that the market expects inflation to rise moderately in the near future but fall later on.

1. What effect would reducing income tax rates have on the interest rates of municipal bonds? Would interest rates of Treasury securities be affected, and, if so, how? The reduction in income tax rates would make the tax-exempt privilege for municipal bonds less valuable, and they would be less desirable than taxable Treasury bonds. The resulting decline in the demand for municipal bonds and increase in demand for Treasury bonds would raise interest rates on municipal bonds while causing interest rates on Treasury bonds to fall.
2. Predict what will happen to interest rates on a corporation’s bonds if the federal government guarantees today that it will pay creditors if the corporation goes bankrupt in the future? What will happen to the interest rates on Treasury securities? The government guarantee will reduce the default risk on corporate bonds, making them more desirable relative to Treasury securities. The increased demand for corporate bonds and decreased demand for Treasury securities will lower interest rates on corporate bonds and raise them on Treasury bonds.
3. Predict what would happen to the risk premium on corporate bonds if brokerage commissions were lowered in the corporate bond market. Lower brokerage commissions for corporate bonds would make them more liquid and thus increase their demand, which would lower their risk premium.
4. If the income tax exemption on municipal bonds were abolished, what would happen to the interest rate on these bonds? What effect would it have on the rates of US treasury securities? Abolishing the tax-exempt feature of municipal bonds would make them less desirable relative to Treasury bonds. The resulting decline in the demand for municipal bonds and increase in demand for Treasury bonds would raise the interest rates on municipal bonds, while the interest rates on Treasury bonds would fall.

## Chapter 5 Quantitative Problems

1. Assuming that the expectations theory is the correct theory of the term structure, calculate the interest rates in the term structure for maturities of 1 to 5 years and plot the resulting yield curves for the following series of 1-year interest rates over the next 5 years:
	1. 5%, 7%, 7%, 7%, 7% The yield to maturity for a 1 year bond would be 5%, 5.9953% for a 2 year bond, 6.3291% for a three-year bond, 6.4965% for a four year bond and 6.5970% for a 5-year bond,
	2. 5%, 4%, 4%, 4%, 4% The yield to maturity would be 5% for a one-year bond, 4.4988% for a two-year bond, 4.3323% for a three-year bond, 4.2491% for a four-year bond, and 4.1992% for a five-year bond

How would your yield curves change if people preferred shorter-term bonds over longer-term bonds? The upward-sloping yield curve in (a) would be even steeper if people preferred short-term bonds over long-term bonds because long-term bonds would then have a positive risk premium. The downward-sloping yield curve in (b) would be less steep and might even have a slight positive upward slope if the long-term bonds have a positive risk premium.

1. Government economists have forecasted one-year T-bill rates for the following 5 years:

|  |  |
| --- | --- |
| Year | 1-year rate % |
| 1 | 4.25 |
| 2 | 5.15 |
| 3 | 5.50 |
| 4 | 6.25 |
| 5 | 7.10 |

You have a liquidity premium of 0.25% for the next two years and 0.50% thereafter. Would you be willing to purchase a 4-year T-Bond at a 5.75% interest rate? For this problem we will assume that T-Bonds have annual coupons. On the other hand we will assume that the problem is talking about discount rates for the T-bills that need to be converted into yields to maturity. The formula for converting these is

$$r=\frac{1}{1-discountRate\frac{364}{360}}-1$$

The new rates become 4.4902%, 5.4933%, 5.8886 and 6.7457% (we do not need the rate for year 5.) We then use the formula for liquidity premium to back out the rate.

$$\left(1+r\right)^{4}=1.044902×1.054933×1.58886×1.067457+.005$$

this implies r=5.7572%. As the bond has a yield slightly below the expected rate you should not buy the bond.

1. How does the after-tax yield on a $1,000,000 municipal bond with a coupon rate of 8% paying interest annually, compare with that of a $1,000,000 corporate bond with a coupon rate of 10% paying interest annually? Assume you are in the 25% tax bracket. Municipal bond coupon payments equal $80,000 per year. No taxes are deducted; therefore, the yield would equal 8%. The coupon payments on a corporate bond equal $100,000 per year. But you only keep $75,000 because you are in the 25% tax bracket. Therefore your after-tax yield is only 7.5%
2. Consider the decision to purchase either a 5-year corporate bond or a 5-year municipal bond. The corporate bond is a 12% annual coupon bond with a par value of $1,000. It is currently yielding 11.5%. The municipal bond has an 8.5% annual coupon and a par value of $1,000. It is currently yielding 7%. Which of the two bonds would be more beneficial to you? Assume that your marginal tax rate is 35%. Using the PV function in excel PV(7%,5,-85,-1000) gives a price of $1061.50. The corporate bond has a PV of 1018.25. The 35% tax rate changes the coupon on the corporate bond to $78. This gives a yield of 7.35%. Thus the corporate bond is better value.
3. Debt is issued by Southeastern Corporation currently yields 12%. A municipal bond of equal risk currently yields 8%. At what marginal tax rate would an investor be indifferent between these two bonds? The corporate bond yield is adjusted by (1-marginal tax rate). Thus the marginal tax rate is 33%
4. One year T-bill rates are expected to steadily increase by 150 basis points per year over the next six years. Determine the required interest rate on a three-year T-bond and a six-year T-bond if the current 1-year interest rate is 7.5%. Assume that the expectations hypothesis for interest rates holds. Assuming that the T-Bill rates are discount rates and that the T-bonds are annual coupon paying. See problem 2 for the T-bill yield to maturity conversion formula. The expected forward rates become 8.23%, 10.04%, 11.19%, 13.85%, 15.85% and 17.94%. The three year bond has a yield to maturity of 10.0515% and the 6 year bond has a yield to maturity of 12.9233%.
5. The one year interest rate over the next 10 years will be 3%, 4.5%, 6%, 7.5%, 9%, 10.5%, 13%, 14.5%, 16% and 17.5%. Using the expectations theory, what will be the interest rates on a 3-year, 6-year and 9-year bond? This can be solved by taking the average of the appropriate rates

3-year bond  [(3  4.5  6)]/(3)  4.5%

6-year bond  [(3  4.5  6  7.5  9  10.5)]/(6)  6.75%

9-year bond  [(3  4.5  6  7.5  9  10.5  13  14.5  16)]/(9)  9.333%

Alternatively doing the mathematics correctly one finds

(1+r)^3=(1.03)\*(1.045)\*(1.06)🡪 r=4.4928% for the 3 year bond, r=6.7193% for the 6-year bond and 9.2502% for the 9-year bond.

1. Using the information from the previous question, now assume that investors prefer holding short-term bonds. A liquidity premium of 10 basis points is required for each year of a bond’s maturity. What will be the interest rate on a 3-year, 6-year and 9-year bond? Using the textbook approximation the liquidity premium is added to the interest rates thus the results are 4.8%, 7.35% and 10.233%. The more standard formula gives

(1+r)^3 = (1.03)\*(1.045)\*(1.06)+.003🡪r=4.5843%. The six period bond has a rate of 6.7914% and the 9 year has a rate of 9.2993%. Note these are significantly different because the liquidity premium is not scaled properly between the two formulas.

1. Which bond will produce a greater return if the expectations theory were to hold true, a two-year bond with an interest rate of 15% or two 1-year bonds with sequential interest payments of 13% and 17%? According to the textbook’s approximation these two bonds will produce the same return. In reality the two year bond will yield (1.15)^2=1.3225 and the two 1-year sequential bonds will yield (1.13)(1.17) = 1.3221. Thus the two year bond produces a greater return.
2. Little Monsters Inc., borrowed $1,000,000 for two years from NorthernBank Inc., at an 11.5% interest rate. The current risk-free rate is 2%, and Little Monsters’ financial conditions warrants a default risk premium of 3% and a liquidity risk premium of 2%. The maturity risk premium for a two-year loan is 1%, and inflation is expected to be 3% next year. What does this information imply about the rate of inflation in the second year? Apologies for this but this question is not well worded. Please ignore.
3. One year T-bill rates are 2% currently. If interest rates are expected to go up after three years by 2% every year, what should be the required interest rate on a 10-year bond issued today? Assume that the expectations theory holds. Using the approximation from the text book one needs to take an average of

(2+2+2+2\*(1.02)+2\*(1.02)^2+…+2\*(1.02)^7)/10 = 2.1166%. Doing this correctly one computes the interest over 10 years as

$$\left[\left(1.02\right)^{3}\left(1+0.02×1.02\right)\left(1+0.02×1.02^{2}\right)×\cdots ×\left(1+0.02×1.02^{7}\right)\right]^{0.1}-1=2.1165$$

1. One year T-bill rates over the next four years are expected to be 3%, 4%, 5% and 5.5%. If four-year T-Bonds are yielding 4.5%, what is the liquidity premium on this bond? Using the approximations in the text book - the expectations theory would give a yield of 17.5%/4 = 4.375% which implies that the liquidity premium is 0.125%. If we do the problem correctly then we need to convert the T-bill rates into yields to maturity. This gives us rates of 3.1282%, 4.2149%, 5.3248% and 5.8888%. This then becomes a problem like 8 and the liquidity premium is -0.6116%.
2. At your favorite bond store, Bonds-R-Us, you see the following prices
	1. 1 year $100 zero selling for $90.19
	2. Three-year 10% coupon $1,000 par bond selling for $1,000
	3. Two-year 10% coupon $1,000 par bond selling for $1,000

Assume that the expectations theory for the term structure of interest rates holds, no liquidity premium exists, and the bonds are equally risky. What is the implied one-year rate two years from now? From the first bond we can see that the 1 year interest rate is (100-90.19)/90.19 = 10.8770%. Now we can value the two year bond as 1000=100/(1.10877)+1100/(1+r)^2. This implies the two year rate is 9.9565%. We can then value the three year bond as 1000=100/(1.10877)+100/(1.09957)^2+1100/(1+r)^3. This implies that the three year rate is 9.9710. We can then back out the forward rates. The one year rate one year forward is 9.0436%. The one year rate two years from now is 10.0000%.

1. You observe the following market interest rates for both borrowing and lending:
	1. One year rate = 5%
	2. Two year rate = 6%
	3. One year rate one year from now = 7.25%

How can you take advantage of these rates to earn a riskless profit? Assume that the expectations theory of interest rates holds. According to the expectations theory of interest rates you can see that the one year rate on year from now is too high. You wish to earn interest on this forward rate. Thus you need to lend money one year from now. In order to capture the risk free profit you borrow x dollars for two years, and lend x dollars for one year. You enter into a contract to lend x\*(1.05) dollars in one years time at 7.25%. Today you require no up-front cash as you are borrowing x dollars and lending x dollars. In two years you will receive x\*(1.05)\*(1.0725) = 1.126125\*x dollars and owe x\*(1.06)^2 = 1.1236\*x dollars. You earn 0.2525\*x dollars on this trade.

1. If the interest rates on 1 to 5 year bonds are currently 4%, 5%, 6%, 7% and 8%, and the term premiums for 1 to 5 year bonds are 0%, 0.25%, 0.35%, 0.4% and 0.5%, predict what the one-year interest rate will be two years from now. We will assume the term premiums are the liquidity premiums. The one year rate one year from now is ((1.05)^2-0.25%)/1.04-1=5.5769%. The one year rate two years from now is ((1.06)^3-0.35%)/(1.04\*1.057692)-1 = 7.9560%. Note – these are my formulas for these results rather than the book’s formulas.

## Additional Questions

1. Current yields on 1 year T-bills are 25bps. The current yield to maturity on 10 year T-bonds is 2%. Assume both instruments are trading at par today. If we buy the T-Bond and expect to hold it for 1 year. If the return on the bond over the holding period is the same as the T-Bill rate at what price will one sell the bond? What is the 1-year forward yield to maturity on the T-Bond? Assume semi-annual coupons on the T-Bond where each coupon pays half the T-Bond rate. In order to compute the forward price of the bond one needs to take the current value of the bond (100), grow this at the T-Bill yield to maturity(to be computed) and subtract off the forward value of the cashflows (grown with the T-Bill yield to maturity). The T-Bill yield to maturity is computed as:

$$r=\frac{1}{1-0.0025^{364}/\_{360}}-1=0.2534\%$$

There are two cashflows that are relevant to the calculation – one in 0.5 years and the other in 1 year. The cashflow in 0.5 years is worth

$$1\%×\left(1+.2534\%\right)^{0.5}=1.0013\%$$

and the cashflow in 1 year is worth 1%. This gives a forward price of

$$100\%×\left(1+0.2534\%\right)-1.0013\%-1\%=98.2522\%$$

The forward yield to maturity on the bond can be computed using goal seek in excel. Each cash-flow is discounted to 1 year using the yield to maturity. The cash-flows are 1% before maturity and 101% for the maturity cashflow. The yield to maturity is 2.2275%.

1. Assume the expectations theory of interest rates. The current yield to maturity on 5 year T-Bonds is 1.25%. Assume that we buy the T-Bond at par today and hold it for 1 year. In one years time we sell the T-Bond at 99.17. What is the 1-year T-Bill rate today? What is the 1-year forward 4-year T-Bond rate?

To compute the T-Bill rate we need to compute the yield to maturity over the 1 year period. We do this through goal seek in excel. If we guess a yield to maturity for the T-Bill, r, we can then value the first two T-Bond cash-flows 1 year forward. The return on the T-Bond is then (99.17+.625\*(1+r)^0.5+.625 -100)/100. This must be the return on the T-Bill (1+r)^1-1 = r. Using goal seek we find r=0.4213%. The T-Bill discount rate becomes 0.4149% using the formula df=1/(1-discount rate\*days/360). The T-Bond 1 year forward yield to maturity is computed by laying out the cash-flows in a spreadsheet, discounting them to 1 year forward and using goal seek. The rate is 1.1793%.

1. You own a $100-par 5% annual coupon bond that has 10 years of remaining maturity. Today’s yield to maturity on this bond is 7%. You plan on selling the bond in one year, and believe that the yield to maturity next year will have the following probability distribution

|  |  |
| --- | --- |
| Probability  | Yield % |
| 0.1 | 6.60% |
| 0.2 | 6.75% |
| 0.4 | 7.00% |
| 0.2 | 7.20% |
| 0.1 | 7.45% |

* 1. What is your expected price when you sell the bond? Using the PV function in excel we find the prices for the given yields are $89.40, 88.48, 86.97, 85.79, 84.34. Using the above probabilities we find that the expected return is $87.01.
	2. What is the standard deviation of the bond price? To compute this we need the quantities (Price – Expected Price)^2. We then take the square root of the probability weighted sum. This yields 1.418.
	3. What is the probability of losing money on my bond investment? The current price is $85.95. In one years time the value of our investment is the price +$5 for the coupon. In none of the possible yield scenarios do you lose money.
	4. What is your expected return when you sell the bond? The returns on the bond are 9.82%, 8.75%, 7%, 5.625%, 3.93%. The expected return is the probability weighted sum of these returns or 7.0518%.
	5. What is the standard deviation of return? This is the square root of the probability weighted sum of the quantities (Return-Expected Return)^2. This is 1.6503%.
1. If the 26W T-Bill rate is 3% and the 52W T-Bill rate is 2.75% then what is the expected 26W T-Bill rate in 26W time. Use the market expectations theory. Using the ForwardTBills spreadsheet we find the rate to be 2.539%.
2. If the 26W T-Bill rate is 4% and the expected 26W T-Bill rate in 26W time is 4.25%, what is the 52W T-Bill rate? Use the market expectations theory. Using the ForwardTBills spreadsheet and goal seek we find the rate to be 4.082%
3. If the 26W T-Bill rate is 3%, the 52W T-Bill rate is 3.25% and expected 26W T-Bill rate in 26W time is 2.75% what is the liquidity premium for the 52W T-Bill? Use the Liquidity Premium Theory of Term Structure. From the ForwardTBills spreadsheet the liquidity premium is 0.4262%
4. If the 26W T-Bill rate is 2%, the 52W T-Bill rate is 2.25% and the liquidity premium for the 52W T-Bill is 0.25%, what is the expected 26W T-Bill rate in 26W time? Use the Liquidity Premium Theory of Term Structure. From the ForwardTBills spreadsheet the rate is 2.049%.