

Answer Key Homework #3

**CHAPTER 15: The Term Structure of Interest Rates**

7. a)

	Maturity(year)	Yield to maturity	Solution
(i)	1	6%	$943.40(1+r)^1 = 1,000; (\frac{1,000}{943.40})^{\frac{1}{1}} - 1$
(ii)	2	5.5%	$898.47(1+r)^2 = 1,000; (\frac{1,000}{898.47})^{\frac{1}{2}} - 1$
(iii)	3	5.7%	$847.62(1+r)^3 = 1,000; (\frac{1,000}{847.62})^{\frac{1}{3}} - 1$
(iv)	4	6%	$792.16(1+r)^4 = 1,000; (\frac{1,000}{792.16})^{\frac{1}{4}} - 1$

b)

	Maturity(year)	Forward rate	Solution
(i)	2	5%	$(1.06)^1 \times (1 + F_{1,2}) = (1.055)^2; \frac{(1.055)^2}{(1.06)^1} - 1$
(ii)	3	6%	$(1.055)^2 \times (1 + F_{2,3}) = (1.057)^3; \frac{(1.057)^3}{(1.055)^2} - 1$
(iii)	4	7%	$(1.057)^3 \times (1 + F_{3,4}) = (1.06)^4; \frac{(1.06)^4}{(1.057)^3} - 1$

8. a)

	Maturity(year)	Price (\$)	Solution
(i)	1	792.16	Price of 4 – year bond from Q7
(ii)	2	839.69	$\frac{1,000}{(1.05)(1.06)(1.07)}$
(iii)	3	881.68	$\frac{1,000}{(1.06)(1.07)}$
(iv)	4	934.58	$\frac{1,000}{(1.07)}$

b)

Maturity(year)	Yield to maturity	Solution
1	6%	$\frac{839.69}{792.16} - 1$
2	5%	$\frac{881.68}{839.69} - 1$
3	6%	$\frac{934.58}{881.68} - 1$
4	7%	$\frac{1,000}{934.58} - 1$

9.

Maturity(year)	Expected rate	Solution
1	5%	From the YTM of 1 – year bond
2	7.01%	$\frac{1.06^2}{1.05}$
3	7.51%	$\frac{1.065^3}{(1.05)(1.0701)}$
4	8.51%	$\frac{1.07^4}{(1.05)(1.0701)(1.0751)}$

Bond	Maturity(year)	YTM	Solution
(a)B	1	7.01%	From the Er of 2 – year bond
(b)C	2	7.26%	$[(1.071)(1.0751)]^{\frac{1}{2}}$
(c)D	3	7.67%	$[(1.071)(1.0751)(1.0851)]^{\frac{1}{3}}$

The one-year interest rate is expected to be higher every year, so there are expectations of yields to increase in the future. Thus, the yield curve will be upward sloping.

11. a. The price of the bond will be:

$$\frac{9}{1.07} + \frac{109}{(1.08)^2} = \frac{9}{1.07} + \frac{109}{(1.07)(1.09)} = \mathbf{\$101.86}$$

b. The yield to maturity on the bond will be:

$$\frac{9}{(1 + YTM)} + \frac{109}{(1 + YTM)^2} = 101.86; YTM = \mathbf{7.958\%}$$

c. The forward rate for next year:

$$1 + F_2 = \frac{(1.08)^2}{(1.07)}; F_2 = \mathbf{9.01\%}$$

$$\therefore \text{The expected price is } \frac{\$109}{1.0901} = \mathbf{\$99.99}$$

13. a. The price of coupon will be:

$$\frac{60}{1.05} + \frac{60}{(1.05)(1.06)} + \frac{60}{(1.05)(1.06)(1.07)} = \$984.14$$

- b. The yield to maturity is:

$$\frac{60}{(1 + YTM)} + \frac{60}{(1 + YTM)^2} + \frac{1060}{(1 + YTM)^3} = \$984.14; YTM = 6.6\%$$

- c. The future value of the bond is:

$$60(1.07)(1.08) + 60(1.08) + 1060 = \$1,194.14$$

The expected realized yield of the coupon bond is:

$$984.14(1 + Y)^3 = 1194.14; Y = 6.66\%$$

- d. Price one year from now:

$$\frac{60}{1.07} + \frac{1060}{(1.07)^2} = \$981.92$$

The holding period return is:

$$\frac{60 + 981.92}{984.14} - 1 = 5.88\%$$

15. a. The price of the two-year coupon bonds:

$$\frac{120}{1.058} + \frac{1,120}{(1.058)^2} = \$1,113.99$$

The price of the 1-year zero-coupon bond with the same rate as 2-year coupon bonds, 120, and 2-year zero-coupon are, 1120:

$$\frac{120}{1.05} + \frac{1,120}{(1.06)^2} = \$1,111.08$$

- b. The arbitrage strategy is to buy zeros with face values of \$120 and \$1,120, and respective maturities of one year and two years, and simultaneously sell the coupon bond. The profit equals  $(1,113.99 - 1,111.08)$  2.91 on each bond.

16. a. The yield to maturity of the 1-year zero-coupon bond:

$$84.99(1 + YTM)^2 = 100$$

$$YTM = 8.472\%$$

- b. The yield to maturity of 1-year zero-coupon bond:

$$\frac{100}{1 + Y_1} = 94.34$$

$$YTM = 6\%$$

The present value of 2-year coupon bond:

$$\frac{12}{1.06} + \frac{112}{(1.0847)^2} = \$106.51$$

The yield to maturity of 2-year coupon bond:

$$\frac{12}{(1 + YTM)} + \frac{112}{(1 + YTM)^2} = \$106.51$$

$$YTM = 8.33\%$$

- c. The forward rate for second year:

$$(1.06)(1 + F_{1,2}) = (1.0847)^2$$

$$F_{1,2} = \frac{(1.0847)^2}{1.06} - 1$$

$$F_{1,2} = 11\%$$

- d. (i) The expected price of the coupon bond at the first year:

$$\frac{112}{(1.11)} = \$100.9$$

- (ii) the expected holding-period return on the coupon bond over the first year:

$$\frac{100.9 + 12}{106.51} - 1 = 6\%$$