

Essentials of Investments (BKM 7th Ed.)
Answers to Suggested Problems – Lecture 6

Chapter 10:

3. The bond callable at 105 should sell at a lower price because the call provision is more valuable to the firm when the call price is lower. Because the call feature is more valuable to the firm (and more costly to investors), investors will require a higher yield to maturity, resulting in a lower price.
4. Lower. Interest rates have fallen since the bond was issued. Thus, the bond is selling at a premium and the price will decrease (toward par value) as the bond approaches maturity.
5. True. Under the Expectations Hypothesis, there are no risk premia built into bond prices. The only reason for an upward sloping yield curve is the expectation of increased short-term rates in the future.
8. If the yield curve is upward sloping, you cannot conclude that investors expect short-term interest rates to rise because the rising slope could either be due to expectations of future increases in rates or due to a liquidity premium. In fact, with a liquidity premium, the yield curve can be upward sloping even if future short-term rates are expected to remain flat or even decrease.
9. a) The bond pays \$50 every 6 months
Current price = \$1052.42
Assuming that market interest rates remain at 4% per half year:
the price 6 months from now = \$1044.52
- b) Rate of return = $[1044.52 - 1052.42 + 50]/1052.42 = .04$ or 4% per 6 months. Because the yield has not changed, the bond prices adjust such that the bond earns exactly the YTM.
35. a) The forward rate, f , is the rate that makes rolling over one-year bonds equally attractive as investing in the two-year maturity bond and holding until maturity:
$$(1.08)(1 + f) = (1.09)^2 \quad \text{which implies that } f = 0.1001 \text{ or } 10.01\%$$
- b) According to the expectations hypothesis, the forward rate equals the expected short rate next year, so the best guess would be 10.01%.
- c) According to the liquidity preference (liquidity premium) hypothesis, the forward rate exceeds the expected short-term rate for next year (by the amount of the liquidity premium), so the best guess would be less than 10.01%.
37. a. We obtain forward rates from the following table:

<u>Maturity</u> <u>(years)</u>	<u>YTM</u>	<u>Forward rate</u>	<u>Price (for part c)</u>
1	10.0%		\$909.09 (\$1000/1.10)
2	11.0%	12.01% [(1.11 ² /1.10) - 1]	\$811.62 (\$1000/1.11 ²)
3	12.0%	14.03% [(1.12 ³ /1.11 ²) - 1]	\$711.78 (\$1000/1.12 ³)

- b. We obtain next year's prices and yields by discounting each zero's face value at the forward rates derived in part (a):

<u>Maturity</u> <u>(years)</u>	<u>Price</u>		<u>YTM</u>
1	\$892.78	[= 1000/1.1201]	12.01%
2	\$782.93	[= 1000/(1.1201 x 1.1403)]	13.02%

Note that this year's upward sloping yield curve implies, according to the expectations hypothesis, a shift upward in next year's curve.

- c. Next year, the two-year zero will be a one-year zero, and it will therefore sell at: \$1000/1.1201 = \$892.78

Similarly, the current three-year zero will be a two-year zero, and it will sell for: \$782.93

Expected total rate of return:

$$\text{two-year bond: } \frac{\$892.78}{\$811.62} - 1 = 0.1000 = 10.00\%$$

$$\text{three-year bond: } \frac{\$782.93}{\$711.78} - 1 = 0.1000 = 10.00\%$$

Chapter 11:

Solutions to the concept checks are provided at the end of the chapter.

$$1. \quad \frac{\Delta B}{B} = -D \cdot \frac{\Delta y}{1+y} \quad -7.194 * (.005/1.10) = -.0327 \text{ or a decline of 3.27\%}$$

2. If YTM=6%, Duration=2.833 years
If YTM=10%, Duration=2.824 years

6. a) Bond B has a higher yield since it is selling at a discount (perhaps because it has lower credit quality). Thus, the duration of bond B is lower (it is less sensitive to interest rate changes).
- b) Bond B is callable, has a higher coupon, and has a higher yield (both because it is callable and because $Y=C$ when the bond is selling for par value). Thus, the duration of bond B is therefore lower (it is less sensitive to interest rate changes).

9. a) $PV = 10,000/(1.08) + 10,000/((1.08)^2) = \$17,832.65$

$$\text{Duration} = (9259.26/17832.65)*1 + (8573.39/17832.65)*2 = 1.4808 \text{ years}$$

- b) A zero-coupon bond with 1.4808 years to maturity (duration=1.4808) would immunize the obligation against interest rate risk.
- c) We need a bond position with a present value of \$17,832.65. Thus, the face value of the bond position must be:

$$\$17,832.65*(1.08)^{1.4808} = \$19,985.26$$

If interest rates increase to 9%, the value of the bond would be:

$$\$19,985.26/((1.09)^{1.4808}) = \$17,590.92$$

The tuition obligation would be:

$$10,000/1.09 + 10,000/((1.09)^2) = \$17,591.11$$

or a net position change of only \$0.19.

If interest rates decrease to 7%, the value of the bond would be:

$$\$19,985.26/((1.07)^{1.4808}) = \$18,079.99$$

The tuition obligation would be:

$$10,000/(1.07) + 10,000/((1.07)^2) = \$18,080.18$$

or a net position change of \$0.19.

**The slight differences result from the fact that duration is only a linear approximation of the true convex relationship between fixed-income values and interest rates.

11. a) The duration of the perpetuity is $1.05/.05 = 21$ years. Let w be the weight of the zero-coupon bond. Then we find w by solving:

$$w \times 5 + (1 - w) \times 21 = 10$$

$$21 - 16w = 10$$

$$w = 11/16 \text{ or } .6875$$

Therefore, your portfolio would be 11/16 invested in the zero and 5/16 in the perpetuity.

- b) The zero-coupon bond now will have a duration of 4 years while the perpetuity will still have a 21-year duration. To get a portfolio duration of 9 years, which is now the duration of the obligation, we again solve for w :

$$w \times 4 + (1 - w) \times 21 = 9$$

$$21 - 17w = 9$$

$$w = 12/17 \text{ or } .7059$$

So the proportion invested in the zero has to increase to 12/17 and the proportion in the perpetuity has to fall to 5/17.

24. a) 4
b) 4
c) 4
d) 2

29. Choose the longer-duration bond to benefit from a rate decrease.

- a) The Aaa-rated bond will have the lower yield to maturity and, therefore, the longer duration.
- b) The lower-coupon bond will have the longer duration (it also has more de facto call protection, leading to a lower yield and, thus, a longer duration).
- c) The lower-coupon bond will have a longer duration.