

Name..... ID.....

FN 211: Practice Questions (Bond Valuation)

Assume that you purchased an 8 percent, \$1,000 par bond that matures in 3 years, the bond's YTM is 10% and coupon interest is paid semiannually.

(a) Calculate the price of this bond when YTM is 10% and the price of this bond when YTM is 12%

$$\begin{aligned}
 PV &= 40 * \left(1 - \frac{1}{(1+0.05)^6} \right) \left(\frac{1}{0.05} \right) + \frac{1000}{(1+0.05)^6} \\
 &= 203.0277 + 746.2154 \\
 &= 949.2431
 \end{aligned}$$

$$\begin{aligned}
 PV &= 40 * \left(1 - \frac{1}{(1+0.06)^6} \right) \left(\frac{1}{0.06} \right) + \frac{1000}{(1+0.06)^6} \\
 &= 196.693 + 704.9605 \\
 &= 901.6535
 \end{aligned}$$

N = 6, I = 5, PMT = 40, FV = 1000, PV = 949.2431

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(b) Calculate this bond's Macaulay and Modified duration (assuming YTM is 10%).

YTM	10%		
Period	Cash Flow	PV of CF	t x PV
1	40	38.10	38.10
2	40	36.28	72.56
3	40	34.55	103.66
4	40	32.91	131.63
5	40	31.34	156.71
6	1,040	776.06	4,656.38
		949.24	5,159.04

$$\begin{aligned}
 \text{Modified Duration} &= \frac{2.71745}{1 + \left(\frac{0.10}{2} \right)} \\
 &= 2.588
 \end{aligned}$$

Duration	5.43	periods
Duration	2.72	years

Macaulay Duration = 2.72 years

(c) Indicate if Macaulay duration would be more or less than your answer in (b) if the coupon of the bond were 4 percent, not 8 percent. Explain with a SHORT reason.

More, because early cash flows become smaller. More weight is then given to the face value, making duration longer. The average time to receive cash flows becomes longer.

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(d) Indicate if Macauley duration would be more or less than your answer in (b) if the maturity of the bond were 5 years, not 3 years. Explain with a SHORT reason.

More, because longer maturity means average time to receive cash flows becomes longer.

(e) Given Modified Duration of 2.588 and assuming the bond's YTM goes from 10% to 12%, calculate an estimated price using only modified duration.

$$\begin{aligned} \text{Approximate change in price using modified duration only} &= (-)(\text{modified duration})(\Delta \text{ in yield in decimal term}) \\ &= (-)(2.588)(2\%) \\ &= -5.176\% \end{aligned}$$

$$\begin{aligned} \text{Estimated price using modified duration} &= (1-0.05176)(949.2431) \\ &= 900.1103 \end{aligned}$$

Actual Price:
 $N = 6, I = 6, PMT = 40, FV = 1000, PV = 901.6535$

(f) Given Modified Duration of 2.588 and Convexity of 4.1692, and assuming the bond's YTM goes from 10% to 12%, Calculate an estimated price using both modified duration and convexity.

$$\begin{aligned} \text{Approximate change in price using modified duration and convexity} &= (-)(\text{modified duration})(\Delta \text{ in yield in decimal term}) + \text{convexity} \times (\Delta \text{ in yield in decimal term})^2 \\ &= (-)(2.588)(2\%) + 4.1692 \times (0.02)^2 \\ &= -0.05176 + 0.001668 \\ &= -0.050092 \end{aligned}$$

$$\begin{aligned} \text{Estimated price using modified duration + convexity} &= (1 - 0.050092)(949.2431) \\ &= 901.6936. \end{aligned}$$

Actual Price:
 $N = 6, I = 6, PMT = 40, FV = 1000, PV = 901.6535$