FMI Notes

DATE- 19.9.2012

- As & interest rates changes (go up), bond prices (go down)
- Long bonds move around more than short bonds
- 8% 5yr bond or 0, 30 yr
  - → no coupon
  - → longer maturity
  - ∴ moves around more

- *IR sensitivity different at different places ~~around~~ along the curve.
- Generic formula for change in bond price with change in interest rate.

$$P_{bond} = \frac{C}{1+r} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \frac{C+FV}{(1+r)^4}$$

*(IR = interest rate)

~~cause~~ or :-

$$P = c(1+r)^{-1} + c(1+r)^{-2} + c(1+r)^{-3} + (c+FV)(1+r)^{-4}$$

$$\frac{dP}{dr} = -c(1+r)^{-2} - 2c(1+r)^{-3} - 3c(1+r)^{-4} - 4(c+FV)(1+r)^{-5}$$

$$= \frac{-c}{(1+r)^2} - \frac{2c}{(1+r)^3} - \frac{3c}{(1+r)^4} - \frac{4(c+FV)}{(1+r)^5}$$

$$\frac{dP}{dr} = \frac{-1}{(1+r)}\left[\frac{C}{(1+r)} + \frac{2C}{(1+r)^2} + \frac{3C}{(1+r)^3} + \frac{4(C+FV)}{(1+r)^4}\right]$$

$$\frac{\Delta P / P}{\Delta r} = \frac{-1}{(1+r)}\left[\frac{\frac{C}{1+r} + \frac{2C}{(1+r)^2} + \frac{3C}{(1+r)^3} + \frac{4(C+FV)}{(1+r)^4}}{P}\right]$$

elasticity of bond price

$$\frac{\Delta P / P}{\Delta r} = -\left[\frac{C}{(1+r)} + \frac{2C}{(1+r)^2} + \frac{3C}{(1+r)^3} + \frac{4(C+FV)}{(1+r)^4}\right]$$

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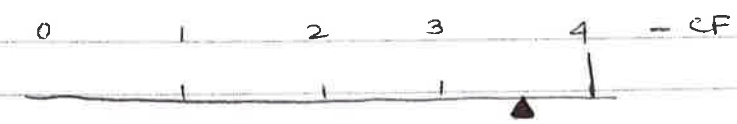
Duration

- not actual balance.



maturity = last pmt.

weighted av. time = use Present value.

$$D = \frac{1\left(\frac{C}{1+r}\right)}{P} + \frac{2\left(\frac{C}{(1+r)^2}\right)}{P} + \frac{3\left(\frac{C}{(1+r)^3}\right)}{P} + \frac{4\left(\frac{C+FV}{(1+r)^4}\right)}{P}$$

what portion of the total price am I getting every year in terms of %?

weight ⇒ %PV of T.Price.

$$\boxed{P_{bond} = \frac{C}{(1+r)} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \frac{C+FV}{(1+r)^4}}$$

let's weigh the time when we are getting our money.

↓ weighted Average time

$$D = \frac{\frac{C}{(1+r)} + \frac{2C}{(1+r)^2} + \frac{3C}{(1+r)^3} + \frac{4(C+FV)}{(1+r)^4}}{P}$$

- Duration is a bond is like β to a stock.
- tells u how much b. price moves with int. rate

(Q) 9% coupon, 4 yr maturity, 8% ytm, FV = 1000

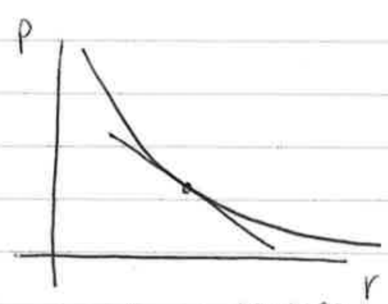
$$pmt = \frac{9 \times 1000}{100} = 90$$

PV of 4 yrs = $1033.12

- As CR ↑, ↓ duration (less sensitive)
  (coupon rate)
- ↑ YTM, ↓ duration (higher discount rate, will pull the value down & pushes balance to zero).
- ↑ Maturity, ↑ duration.

<u>Duration good or bad?</u>
if int rate ↓, duration good (value of bond ↑)

$$\underset{(\$)}{\Delta P} = -D \times P \times \frac{\Delta r}{1+r}$$



$$pmt = \frac{10 \times 1000}{2 \times 100} = 50$$

10% semi annual coupon bond   FV = 1000
n = 4 yrs = 8
8% YTM ~~compounded~~ semi-annually
duration = 3.415628

* int. rate changes from 8% → 9%.

(As IR ↑, P ↓)

$$\Delta P = -D \times P \times \frac{\Delta r}{1+r}$$

$$= -3.415628 \times 1067.33 \times \frac{.01}{1.08}$$

* Read Appendix of Chap. 3.
→ Duration underestimated.

<u>Duration</u> :-
- is the int rate sensitivity of a bond
- weighted average time
- Duration = how much money u need, IR* & coupon rate offset each other.

(*interest rate)