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Fixed Income Products - Assignment II

Question 1

C = 8%.

$i^{(P)}$ = 8%.

Sell at par

So,

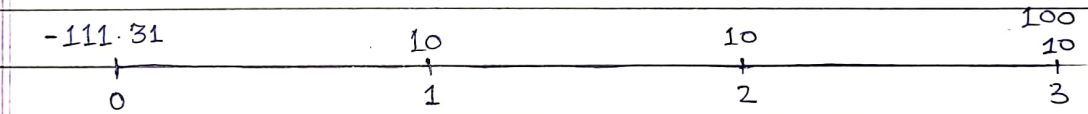
$$(1+i) = \left(\frac{1 + i^{(P)}}{P}\right)^2$$

$$(1+i) = \left(1 + \frac{0.08}{2}\right)^2$$

$$i = 8.16\%.$$

Question 2.

a)



$$-111.31 + 10\left[\frac{1-(1+x)^{-3}}{x}\right] + \frac{100}{(1+x)^3} = 0$$

$$x = 5.7856\%.$$

$$S_3 = 5.7856$$

b) $(1+S_2)^2 = (1+S_1)(1+1Y1Y)$

$(1.0398)^2 = (1.0299)(1+1Y1Y)$

$$1Y1Y = \frac{1.0398^2 - 1}{1.0299}$$

$$= 4.9795\%.$$

Question 3.

Year 1 = $100(1+0.05)$

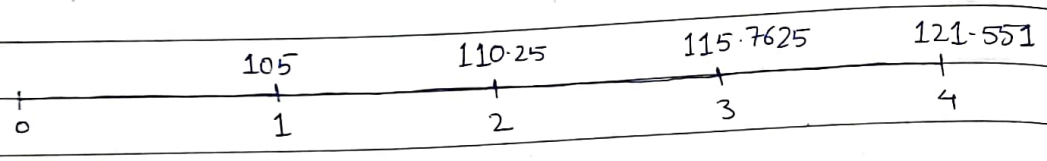
Year 2 = $100(1.05)^2$

Year 3 = $100(1.05)^3$

Year 4 = $100(1.05)^4$

YTM = 5%.

a)



$$P.V = \frac{100(1.05)}{(1.05)} + \frac{100(1.05)^2}{(1.05)^2} + \frac{100(1.05)^3}{(1.05)^3} + \frac{100(1.05)^4}{(1.05)^4}$$

$$= \$400$$

b) Macaulay Duration.

$$= \frac{\Sigma (P.V \cdot t)}{\Sigma P.V}$$

$$= \frac{100 + 200 + 300 + 400}{4}$$

$$= 2.5 \text{ yrs.}$$

$$\text{Modified duration} = -\frac{MCD}{1+YTM}$$

$$= \frac{-2.5}{1.05}$$

$$= 2.38095 \text{ years}$$

Question 4

Ranking the investments from most affected to least affected.

B] Zero Coupon Treasury strips.

C] 5.5% Treasury Coupon

D] 9.25% Treasury Bond

A] Short term treasury Bills.

The lower the coupon, the higher the bond is affected by yield changes. Further, short term securities are less affected.

Question 5

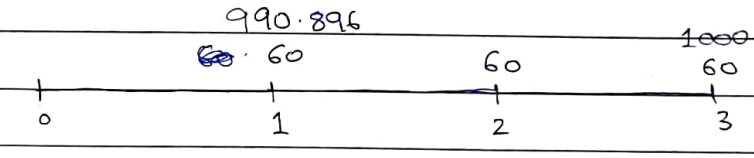
T = 1

C = 6%

FV = $100

y = 6.5%.

a)



6.5%.

Total rate of return from holding the bond for 1yr = 6.5%.
(YTM has not changed)

Verifying this.

$$P.V @ t=1 = 1060(1.065)^{-2} + \frac{60}{1.065} + 60$$

$$= 1050.896$$

Horizon yield = $\frac{1050.896}{986.76} - 1$

$= 7.499\% \approx 7.5\%$

b). Purchase Price at $T=0 = 60\left(\frac{1-(1.065)^{-3}}{0.065}\right) + 1000(1.065)^{-3}$

$= 986.76$

Selling price at $T=1 = 1000$ $(\because C = r)$.

Total inflow at $T=1 = 1000 + 60$

$= 1060.$

$\therefore$ Rate of Return $= \left(\frac{1060}{986.76}\right) - 1.$

$= 7.42227\%$

Question 6.

→ The underwriter assumes the full risk of being unable to resell the bounds at the stipulated offering price.

→ The underwriter bears the risk of interest rate movement between the time of purchase and time of resell.

→ Longer maturity bonds usually have a higher duration and they are exposed to more interest rate risk.

→ Therefore, underwriting fees for longer ~~mact Macaulay duration~~ maturity bonds are higher as the rate is higher.

Question 7.

I disagree with the statement.

Question 8.

P.V = 100

F.V = 100

c = 6%

i = 6%

T = 10

a. i = 15%.

$$P.V = 6\left(\frac{1-(1.15)^{-10}}{0.15}\right) + 100\,(1.15)^{-10}$$

$$= 54.83$$

b. i = 16%.

$$P.V = 6\left(\frac{1-(1.16)^{-10}}{0.16}\right) + 100\,(1.16)^{-10}$$

$$= 51.667$$

$$\text{Percentage change} = 1 - \frac{51.667}{54.83}$$

$$= 5.7678\%.$$

c. $i = 5\%$.

$$P.V = 6\left(\frac{1-(1.05)^{-10}}{0.05}\right) + 100\,(1.05)^{-10}$$

$$= 107.7217$$

d. $i = 6\%$.

$P.V = 100$ as the coupon rate = interest rate.

$$\text{Percentage change} = 1 - \frac{100}{107.7217}$$

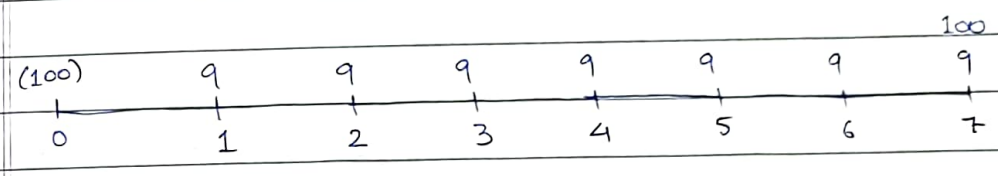
$$= 7.1682\%$$

e. Price volatility is higher at lower interest rates due to the convex nature of price yield curve.

Question 9

F.V = 100

P.V = 100



$$9\left(\frac{(1.094)^5 - 1}{0.094}\right) + 9(1.112)^{-1} + 100(1.112)^{-2}$$

$= 150.5357.$

∴ Total Return =

$$100(1+i)^5 = 150.5357.$$

$$i = 8.524527\%.$$

Question 10

8%.

Question 11.

I disagree with the statement since ZCB's also have a convex price-yield curve.

Question 12.

$$\text{Mod Duration} = -\frac{\text{Macaulay Duration}}{(1 + \text{YTM})}$$

From the equation we can see that as the YTM will tend towards 0 the modified duration will ~~be~~ move towards the macaulay duration. I agree with the statement.

Question 13.

I disagree with the statement. While two portfolios may have the same duration, their convexities might be different, which will lead to unequal changes with change in interest rates.

Question 14

Bond	MV	Duration
W	13	2
X	27	7
Y	60	8
Z	40	14

$\Sigma MV = 140$

a. Duration of Portfolio = $\Sigma w \times$ duration

$$= \frac{13}{140} \times 2 + \frac{27}{140} \times 7 + \frac{60}{140} \times 8 + \frac{40}{140} \times 14$$

$$= 8.96428$$

b. $8.964 \times (0.0005) = 4.482141\%$

c. $W - 2 \times \frac{13}{140} = 0.18571$

$X - 7 \times \frac{27}{140} = 1.35$

$Y - 8 \times \frac{60}{140} = 3.42857$

$Z - 14 \times \frac{40}{140} = 0.4462154$

Question 15

a. The graphical depiction of the relationship between bonds of the same credit quality but different maturities is the yield curve.

b. Since treasury security are free from default risk, it is the most active bond offering with no liquidity issues. Therefore, it is the most watched.