Q6.14. $P = 106 + \frac{21 + \frac{1}{8}}{32} = 106.6601563$, $T=4$, $c = 6.75\%$,

yield $= 4.89635\%$.

a). $P(y+0.01\%) = P(4.90635\%) = 106.6228279$

$P(y-0.01\%) = P(4.88635\%) = 106.697531$

$$DV01 = -\frac{P(y+0.01\%) - P(y-0.01\%)}{2} = 0.03735$$

b). $P(y+0.1\%) = P(4.99635\%) = 106.2874448$

$P(y-0.1\%) = P(4.79635\%) = 107.0344776$

$$D = -\frac{1}{P} \times \frac{\Delta P}{\Delta y} = 3.5019$$

c). $$C = \frac{1}{P} \frac{(P(y+\Delta y) - 2P(y) + P(y-\Delta y))}{\Delta y^2}$$

$$C = \frac{1}{106.6602} \frac{106.2874 - 2(106.6602) + 107.0345}{0.001^2}$$

$$C = 15.09279618$$

For a yield change of 25bps, the actual prices are

$P(y+0.25\%) = P(5.14635\%) = 105.7312993$

$P(y-0.25\%) = P(4.64635\%) = 107.5989146$

$$\Delta P = -D \times P \times \Delta y + \tfrac{1}{2} C \times P \times \Delta y^2 = -0.9188$$

$P(y+\Delta y) = P + \Delta P = 106.6602 - 0.9188 = 105.7414$

$P(y-\Delta y) = P - \Delta P = 106.6602 + 0.9188 = 107.579$

$\therefore$ The estimation is quite close to the actual price.

Q3.15

The true value $= \sum_{i=1}^{40} \frac{25000}{1.06^i} = \frac{25000}{0.06}\left(1-\frac{1}{1.06^{40}}\right) = \$376157.$

Q3.16

Monthly payment $= \dfrac{500{,}000 \times \frac{3.25\%}{12}}{1-\left(1+\frac{3.25\%}{12}\right)^{-360}} = \$21760.32$

Q 6.3.

We have

$$P = 100\left(\frac{c}{y}\left(1-\frac{1}{\left(1+\frac{y}{2}\right)^{2T}}\right)+\frac{1}{\left(1+\frac{y}{2}\right)^{2T}}\right)$$

For bond 1, $P = 131 + \dfrac{12\frac{7}{8}}{32} = 131.4023438$, $T=19$, $y=5.96532$.

$c = 8.75\%$

$P(y+0.01\%) = P(5.97532\%) = 131.2649361$

$P(y-0.01\%) = P(5.95532\%) = 131.5393706$

$DV01 = -\dfrac{P(y+0.01\%) - P(y-0.01\%)}{2} = 0.1372$

Modified duration for bond 1 $= -\frac{1}{P} \times \frac{\Delta P}{\Delta y} = 10.44.$

For bond 2. $P = 124 + \dfrac{(24+\frac{1}{8})}{32} = 124.7539063$, $T=20$, $y=5.98577\%$,

$c = 8.125\%$.

$P(y+0.01\%) = P(5.99577\%) = 124.6176972$

$P(y-0.01\%) = P(5.97577\%) = 124.8891502$

$DV01 = -\dfrac{P(y+0.01\%) - P(y-0.012)}{2} = 0.1357.$

Modified period for bond 2 $= -\frac{1}{P} \times \frac{\Delta P}{\Delta y} = 10.88$

3.13. $f(\frac{i}{4}) = 0.0175 + 0.00125\left(\frac{i-1}{4}\right)$

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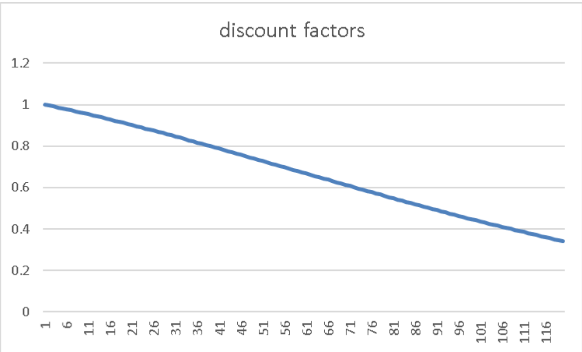
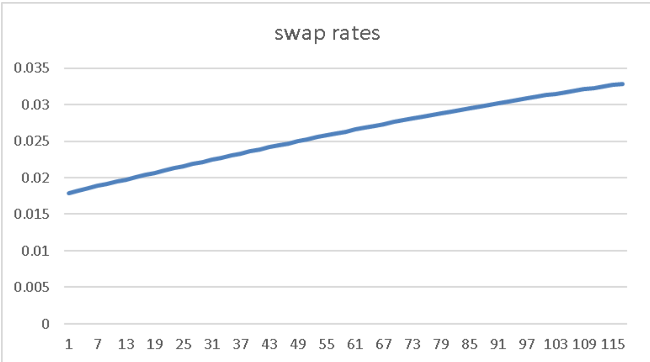
a). $f(\frac{i}{4}) = 4\left(\frac{d(\frac{i-1}{4})}{d(\frac{i}{4})} - 1\right)$

$$\frac{1}{4}f\left(\frac{i}{4}\right)+1 = \frac{d(\frac{i-1}{4})}{d(\frac{i}{4})}$$

$$d\left(\frac{i}{4}\right) = \frac{d(\frac{i-1}{4})}{1+\frac{1}{4}f(\frac{i}{4})}$$





b). $S(T) = \frac{1-d(T)}{\sum_{i=1}^{2T}\frac{1}{2}d(\frac{i}{2})}$ curve =

c). For 10-year receiver swap, swap rate $s(10) = 0.023417091$,

after one year, it becomes 9-year swap. $s'(9) = 0.023285246$.

P&L for buyer for the receiver swap =

$$\left(s(10) - s'(9)\right)\left(\frac{1}{2}\right)\sum_{i=1}^{18} d'\left(\frac{i}{2}\right) = 0.001071379.$$

3.14. $f(2.25) = 0.02$

$f'(1.25) = 0.02$

Profit & Loss: $d'(1.25) \times \frac{1}{4} \times \$1m \times (2\% - 2\%) = \$0.$