

TD3 - Entrainement

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Exercice 1:

$$\begin{aligned} 1) PU &= 5000 \times \bar{A}_{40:25}^{-1} + 10000 \times {}_{25}E_{40} \\ &= 5000 \times \frac{\bar{M}_{40} - \bar{M}_{65}}{D_{40}} + 10000 \times \frac{D_{65}}{D_{40}} \\ &= 2973,892 \end{aligned}$$

$$\begin{aligned} 2) PU &= PA(\ddot{a}_{40:10} + 1,5 \times {}_{10}E_{40} \times \ddot{a}_{50:10}) \\ \Rightarrow PA &= \frac{PU}{\ddot{a}_{40:10} + 1,5 \times {}_{10}E_{40} \times \ddot{a}_{50:10}} = PU \left[\frac{N_{40}-N_{50}}{D_{40}} + 1,5 \times \frac{D_{50}}{D_{40}} \times \frac{N_{50}-N_{60}}{D_{50}} \right]^{-1} \\ &= 196,557 \end{aligned}$$

$$\begin{aligned} 3) PV_0 &= 5000 \times \bar{A}_{45:20}^{-1} + 10000 \times {}_{20}E_{45} - PA(\ddot{a}_{45:51} + 1,5 \times {}_{15}E_{45} \times \ddot{a}_{50:10}) \\ &= 5000 \times \frac{\bar{M}_{45} - \bar{M}_{65}}{D_{45}} + 10000 \times \frac{D_{65}}{D_{45}} - PA \times \left(\frac{N_{45}-N_{50}}{D_{45}} + 1,5 \times \frac{D_{50}}{D_{45}} \times \frac{N_{50}-N_{60}}{D_{50}} \right) \\ &= 5000 \times \frac{\bar{M}_{45} - \bar{M}_{65}}{D_{45}} + 10000 \times \frac{D_{65}}{D_{45}} - PA \left(\frac{N_{45} + 0,5N_{50} - 1,5N_{60}}{D_{45}} \right) \\ &= 1036,374 \end{aligned}$$

Exercice 2:

$$1) i^* = e^{h(1+0,0375)-0,0015} - 1 = 0,03965$$

$$\begin{aligned} 2) PU' &= 200000 (\bar{A}_{40:25}^{-1} + \bar{A}_{40}) + (1+2\%) \times 30000 \times {}_{25}E_{40} \times \ddot{a}_{65}^{(12)} + 100 \times \ddot{a}_{40:25} \\ &= 200000 \left(\frac{\bar{M}_{40} - \bar{M}_{65}}{D_{40}} + \frac{\bar{M}_{40}}{D_{40}} \right) + 1,02 \times 30000 \times \frac{D_{65}}{D_{40}} \times \left(\frac{N_{65}}{D_{65}} - \frac{13}{24} \right) + 100 \times \frac{N_{40}-N_{60}}{D_{40}} \\ &= 176953,8081 \end{aligned}$$

$$\Rightarrow PU' = 176953,8081 \leftarrow \text{Prime unique d'inventaire.}$$

$$\Rightarrow \hat{PU} = \frac{PU'}{(1+3\%)} = 182426,6063 \leftarrow \text{Prime unique de réduct° du contrat}$$

$$3) PA' = \frac{PU'}{\ddot{a}_{40:25}^{(4)}} = PU' \left[\ddot{a}_{40}^{(4)} - {}_{25}E_{40} \ddot{a}_{65}^{(4)} \right]^{-1} = PU' \left[\ddot{a}_{40} - \frac{3}{8} - {}_{25}E_{40} \left(\ddot{a}_{65} - \frac{3}{8} \right) \right]^{-1} = PU' \left[\frac{N_{40}}{D_{40}} - \frac{3}{8} - \frac{D_{65}}{D_{40}} \left(\frac{N_{65}}{D_{65}} - \frac{3}{8} \right) \right]^{-1}$$

$$= 11365,665 \leftarrow \text{Prime annuelle d'inventaire}$$

$$\widehat{PA} = \frac{\widehat{PA}'}{1-3\%} = 11717,160 \leftarrow \text{Prime annuelle de réduct.}$$

$$PA'' = \frac{\widehat{PA}}{1-5\%} = 12333,852 \leftarrow \text{Prime annuelle commerciale.}$$

Exercice 3: $\underline{10P_{60}} = 0,96$ et $\underline{10P_{70}} = 0,83$

$$1) \underline{10P_{60,70}} = \underline{10P_{60}} \times \underline{10P_{70}} = 0,96 \times 0,83 \\ = 0,7802 = 78,02\%$$

$$2) \underline{10P_{60,70}} = \underline{10P_{60}} \times \underline{10q_{70}} + \underline{10q_{60}} \times \underline{10P_{70}} + \underline{10P_{60}} \times \underline{10q_{70}} = 0,9898 = 98,98\%$$

$$3) \text{Proba 1 seul décès dans 10ans} = \underline{10P_{60}} \times \underline{10q_{70}} + \underline{10q_{60}} \times \underline{10P_{70}} = 0,1096 = 10,96\%$$

$$4) \text{Proba au moins 1 décès en 10ans} = \underline{10P_{60}} \times \underline{10q_{70}} + \underline{10q_{60}} \times \underline{10P_{70}} + \underline{10P_{60}} \times \underline{10q_{70}} = 0,1198 = 11,98\%$$

$$5) \text{Proba 2 décès en 10ans} = \underline{10q_{60}} \times \underline{10q_{70}} = 0,0102 = 1,02\%$$

Exercice 4:

$$1) 20000 \underline{a_{60,70}} = 20000 \sum_{k=1}^{\infty} \underline{kP_{60,70}} v^k \\ = 20000 \sum_{k=1}^{\infty} (\underline{kP_{60}} + \underline{kP_{70}} - \underline{kP_{60,70}}) v^k \\ = 20000 (\underline{a_{60}} + \underline{a_{70}} - \underline{a_{60,70}})$$

$$2) 30000 \ddot{a}_{60,70:10} = 30000 \sum_{k=0}^9 \underline{kP_{60,70}} v^k \\ = 30000 (\ddot{a}_{60,70} - \underline{10E_{60,70} \ddot{a}_{70,80}})$$