**FINAL PROJECT - SII**

Consider a simplified insurance company whose assets and liabilities sides are characterized as follows:

ASSETS

* there is a unique fund made of a bond combined with an equity
* at every time step t the value of the fund (before deducting the fees) is Ft = Bt + St
* at the beginning (t=0) the value of the fund is equal to the insured capital F0 = C0 = 1000
* bond features
  + AAA corporate zero coupon bond with maturity T=20
  + B0=800, face amount N=1000
* equity features
  + listed in the regulated markets in the EEA
  + S0=200
  + No dividend yield
  + to be simulated with a Risk Neutral GBM (sigma=15%) and a time varying instantaneous risk free rate r derived from the yield curve (EIOPA IT with VA 31.03.21), supposing linear interpolation of the zero rates and using the formula DFt+dt = DFt \* exp[‐rt\*dt]

LIABILITIES

* Term Life policy with term T=20
* the insured capital given in case of death/lapse and survivor at maturity is equal to
  + CASE A:
    - guaranteed
    - Ct = max(C0,F’t)
  + CASE B:
    - not guaranteed
    - Ct = F’t
* where
  + - F’t = Ft  – feest
    - feest = Ft-1 \* 3.00%
* male insured aged x=60
* mortality rates derived from the life table SI2018 (ISTAT website)
* flat annual lapse rates lx=5%

Other specifications:

* the interest rates dynamic is deterministic, while the equity one is stochastic
* the default (credit) spread s has to be computed in the plain case (no IR stress) to match the zero coupon bond price B0=800

QUESTIONS

1. For both cases A and B, code a Matlab script to compute the Basic Solvency Capital Requirement via Standard Formula and provide comments on the results obtained in A and B. The risks to be considered are:

* Market Interest
* Market equity
* Market spread
* Life mortality
* Life lapse
* Life cat

1. Calculate the duration of the liabilities in all the cases and provide comments on the results obtained
2. Replicate the same calculations in an Excel spread sheet using a deterministic projection. Do the results differ from 1? If so, what is the reason behind?
3. Open questions:
   * what happens to the asset and liabilities when the risk free rate increases/decreases with a parallel shift of, say, 100bps? Describe all the effects
   * what happens to the liabilities if the insured age increases? What if there were two model points, one male and one female?

DELIVERABLES

* one .pdf document named “GROUP\_XX\_SII\_project.pdf”, organized al follow
  + cover with group number and full names of the participants
  + index
  + original text of the project
  + 2 summary tables (one for A and one for B) with the results obtained

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Case A / B | Assets | Liabilities | BoF | d\_BoF | dur\_L |
| BASE |  |  |  |  |  |
| IR\_up |  |  |  |  |  |
| IR\_dw |  |  |  |  |  |
| … |  |  |  |  |  |
| … |  |  |  |  |  |
| … |  |  |  |  |  |
| … |  |  |  |  |  |
| … |  |  |  |  |  |
| … |  |  |  |  |  |
| SCR |  |  |  |  |  |

* + section with specifications of all the formulas adopted for the calculations
    - subsections (one per each risk) that recall the results under discussion and provide comments on the outcomes in the two cases (A and B)
  + section that illustrates the deterministic calculations and provides comments on the results
  + section with the answers to the open questions
  + annex with the Matlab code embedded
* one excel workbook named “GROUP\_XX\_SII\_project.xlsx” with the deterministic projections

and a summary tab containing the results of the table above.