

4. Learning Objectives:

2. The candidate will demonstrate an understanding of the various sources of risks faced by an insurer.

Learning Outcomes:

- (2b) Identify, categorize and evaluate potential sources of risk in investments including but not limited to credit risk, liquidity, equity-based exposure and asset-liability matching.

Sources:

Chapter 8, Credit Exposure, Credit Risk, Gregory

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a) List three considerations in using collateral to reduce the exposure to credit risk.

Commentary on Question:

Most candidates did well on this part. Some students answered that collateral creates liquidity risk/legal risk/operational risk which was considered to be a valid point and eligible for credit.

Considerations for using collateral to reduce exposure to credit risk:

- Granularity effect - because it is not always possible to ask for all of the collateral required due to parameters such as thresholds and minimum transfer amounts. Should also consider the amount of collateral an institution themselves must post
- Delay in receiving collateral - operational component of requesting and receiving collateral, and possibility of collateral disputes
- Variation in the value of the collateral itself - if not posted as cash, so there may be volatility in collateral amount posted

- (b) Calculate the following credit risk metrics at year 3:

- (i) Expected future value
- (ii) Expected positive exposure
- (iii) Effective expected positive exposure

4. Continued

Commentary on Question:

The majority of the candidates did poorly: a lot of candidates didn't know the difference or were confused with the definition for (ii) "Expected positive exposure" and (iii) "Effective expected positive exposure". In addition, they didn't show the calculation for each of the 3 years, but only showed the 3rd year. Therefore most candidates only got credit for (i) "Expected future value", and very few candidates got points for the other parts of the question which required calculations for all 3 years.

- (i) Expected Future Value = $\sum (\text{probability} \times \text{expected value for each scenario}) = (0.3 \times 60 + 0.6 \times (-5) + 0.1 \times (-15)) = 13.5$
- (ii) Expected positive exposure is defined as the average of expected exposures and expected exposure is the average of all exposure values (only positive values are considered exposures, i.e. negative values are floored to zero)

Step 1: calculating expected exposure (EE) at each time point

$$\text{Year 1: EE} = 0.3 \times 20 + 0.6 \times 15 = 15$$

$$\text{Year 2: EE} = 0.3 \times 45 + 0.6 \times 10 = 19.5$$

$$\text{Year 3: EE} = 0.3 \times 60 = 18$$

$$\text{Step 2: Expected Positive Exposure} = (15 + 19.5 + 18) \div 3 = 17.5$$

- (iii) Step 1: Calculating effective EE which is the non-decreasing EE measured from year 1:

$$\text{Year 1: Effective EE} = \max(15) = 15$$

$$\text{Year 2: Effective EE} = \max(15, 19.5) = 19.5$$

$$\text{Year 3: Effective EE} = \max(15, 19.5, 18) = 19.5$$

$$\text{Step 2: Effective expected positive exposure} = \text{average}(15, 19.5, 19.5) = 18$$

- (c) Explain how forward rates contribute to differences between current future value and expected future value.

Commentary on Question:

Many candidates did not address the key point (i.e. the forward rates are different from current spot rates), and some candidates did not write an answer.

4. Continued

Expected future value depends on the forward rates and the forward rates can be very different from the current spot rates. This is the main reason why expected future value may vary significantly from current value.

- (d) Assess the impact of netting exposures on DEF's swap portfolio.

Commentary on Question:

Many candidates didn't floor the negative value for impact of netting and, when calculating the overall impact, missed considering the probability factor when calculating the net benefit (i.e. $60\% \times 5 = 3$). Some candidates correctly identified that the netting impact would be relatively small because of the correlation of the two swaps.

Netting benefit is a diversification benefit that will allow positive and negative exposures in a portfolio to “net” each other. The netting benefit is lower when the assets are positively correlated.

Comparing the exposures in “no netting” and “netting” scenario, the benefit of netting is $3 = 33 - 30$, which occurs in year 3.

Exposures (No Netting)	Probability	Year 1	Year 2	Year 3
Scenario 1	30%	30	65	90
Scenario 2	60%	35	30	10
Scenario 3	10%	0	0	0
Expected future value = \sum (probability \times value for each scenario)		30	37.5	33

Exposures (Netting)	Probability	Year 1	Year 2	Year 3
Scenario 1	30%	30	65	90
Scenario 2	60%	35	30	5
Scenario 3	10%	0	0	0
Expected future value = \sum (probability \times value for each scenario)		30	37.5	30