ADVF Model Solutions
Fall 2012

1. **Learning Objectives:**
2. The candidate will understand how the risks faced by an entity can be quantified and the use of metrics to measure risk.

Learning Outcomes:
(2a) Demonstrate an understanding of a variety of quantitative risk measures.

(2b) Articulate shortcomings of statistical risk measures.

Sources:
AVF-113-12: Sweeting, Financial Enterprise Risk Management, Chapter 15.4 Risk Measures

AVF-114-12: "Black Monday and Black Swans," J. Bogle, Financial Analyists Journal

Commentary on Question:
This question primarily tests candidates' understanding of three important risk measures: standard deviation, value at risk, and tail value at risk. Candidates are expected to understand the definition, calculation method, and limitation of each type of risk measure and apply that knowledge to recommend the best risk measure in a given situation. Part (a) specifically tests candidates' qualitative understanding of shortcomings of relying on historical observations, which are described at length in the "Black Monday and Black Swans" reading. Parts (a) and (c) test candidates' Comprehension of the material, while parts (b) and (d) test candidates' Analysis cognitive skills.

Solution:
(a) Describe two limitations of relying solely on historical outcomes in calibrating the statistical distribution models.

Commentary on Question:
Most candidates provided a good first answer, but the second answer was sometimes a rewording of the first answer, rather than being a distinct response. A couple other answers besides those below also were accepted.

1. Past returns are not a good predictor of future returns.
2. Historical outcomes ignore the potential of future black swans.

1. Continued

(b)   Determine whether using the standard deviation to quantify the risk of each of these investments is appropriate.

Commentary on Question:
Candidates could have performed better on part (b) by evaluating using standard deviation for the specific distributions provided. To obtain full credit, candidates were expected to comment on why the distributions provided are not normally distributed and justify that conclusion by noting, for instance, how the skewness or kurtosis of the distribution differs from that of a normal distribution. The skewness test is shown below.

Standard deviation is appropriate as a risk measure if the results are normally distributed. The results are not normally distributed, so standard deviation is not an appropriate risk measure for these investments.

The results are skewed and normal distributions are not skewed.

Distance from median to largest observation (94 for A, 61 for B) is much less than distance from median to smallest observation (458 for A, 389 for B).

(c)   For each individual investment, using the simulated outcomes above:

(i)   Calculate the 99.5% Value at Risk (VaR). Show your work.

(ii)   Calculate the 99.5% Tail Value at Risk (TVaR). Show your work.

Commentary on Question:
Candidates performed well on part (c). Multiple definitions of VaR / TVaR as indicated in various sources earned full credit on this question. Credit was given for other variations to the model solution below including using the sixth lowest observation or the average of the fifth and sixth lowest observations for VaR and the average of the six lowest observations and lower for TVaR. Candidates that determined a relative VaR measure by subtracting the mean were also given credit.

(i) VaR:
       The 99.5% VaR corresponds to the fifth lowest observation (as $(1 - 99.5\%) * 1000 = 5$)
       For Investment A, 99.5% VaR = -40
       For Investment B, 99.5% VaR = -20

(ii) TVaR:
       The 99.5% TVaR is the average of the fifth lowest observation (as $(1 - 99.5\%) * 1000 = 5$) and lower

1. **Continued**

> For Investment A, 99.5% TVaR =
> [(-420) + (-200) + (-100) + (-70) + (-40)] / 5 = -166
>
> For Investment B, 99.5% TVaR =
> [(-356) + (-130) + (-55) + (-25) + (-20)] / 5 = -117

(d) Demonstrate, using the simulated outcomes, whether each of the following supports the CFO's statement. Show your work.

(i) 99.5% VaR

(ii) 99.5% TVaR

Commentary on Question:
Similar to part (c), candidates did well on this part of the question and earned credit for the variations of VaR and TVaR as indicated in the commentary for part (c).

(i) VaR:
> For Investment A + Investment B, 99.5% VaR = -95
>
> (-40) + (-20) = (-60) > (-95)
>
> The sum of the VaR's produces a smaller loss than the VaR of the sum, so VaR does not support the CFO's statement.

(ii) TVaR:
> For Investment A + Investment B, 99.5% TVaR =
> [(-396) + (-395) + (-220) + (-111) + (-95)] / 5 = -243
>
> (-166) + (-117) = (-283) < (-243)
>
> The sum of the TVaR's produces a greater loss than the TVaR of the sum, so TVaR does support the CFO's statement.

2. **Learning Objectives:**
1. The candidate will understand measures of corporate value and be able to analyze the data in corporate financial statements.

Learning Outcomes:
(1a) Explain basic accounting concepts used in producing financial statements:
- In insurance companies
- In other financial institutions
- In non-financial institutions

(1c) Describe the concept of economic measures of value (e.g. MCEV) and demonstrate their uses in the risk management and corporate decision-making processes.

Sources:
AVF-107-12; "Fair Value of Liabilities: Financial Economic Perspective."

AVF-108-12: "Fair Valuation of Insurance Liabilities: Principles and Methods," AAA Monograph

Commentary on Question:
This question tests basic understanding of Fair Value and its calculations and attributes. It is mostly a calculation problem but with more steps than were given in the reading (e.g. from the assets and liabilities, get the equity and know how to derive the leverage (which is simply given in most examples) which is e = equity/liabilities). Part (a) tested candidates' Retrieval cognitive abilities. The calculations in parts (b) and (c) tested candidates' Analysis cognitive abilities. Part (d) tested candidates' Knowledge Utilization cognitive abilities.

Solution:
(a) Summarize the Joint Working Group Hierarchy of Valuation Methods.

Commentary on Question:
Candidates did not always recognize a priority order to this. The subsequent approaches would only be taken if a given approach is not available.

The Joint Working Group Hierarchy of Valuation Methods is as follows, in order of priority:
- Use market value of the instrument, if available.
- If market value of the instrument is not available, use market value of similar instrument in the industry, if available.
- If market value of similar instrument in the industry is not available, use estimate of the present value of future cash flows.

2. Continued

    (b)   Contrast fair value and U.S. GAAP accounting with regard to:

        (i)   treatment of life insurance acquisition costs

        (ii)   updating assumptions regarding future experience for term life insurance (term life falls under SFAS 60 for U.S. GAAP)

        (iii)   updating assumptions regarding future experience for property/casualty insurance

        (iv)   treatment of historical costs

Commentary on Question:
Most candidates did not recognize the time value of money when comparing the Fair Value versus a US GAAP (SFAS60) valuation approach for part (iii). Candidates generally fared well in parts (i), (ii), and, to a certain extent, part (iv).

        (i)   Fair Value does not capitalize acquisition costs, but US GAAP (SFAS60) does capitalize acquisition costs over the life of the product, in most cases.

        (ii)   Fair Value unlocks assumptions at each valuation, but US GAAP (SFAS60) locks in assumptions at issue, only changing them when loss recognition is necessary.

        (iii)   Interest rates influence Fair Value valuation, but US GAAP does not discount property/casualty claims for interest.

        (iv)   Fair Value uses a fully prospective approach, without adjusting for historical costs, while US GAAP adjusts for historical costs.

    (c)   Calculate the liability fair value of the closed block. Assume the return on liabilities for the closed block equals that of the entire company. Show your work.

Commentary on Question:
Most candidates did well on this question. A common mistake was how candidates calculated Equity or Leverage (e). Candidates also made a common mistake in the calculation of the Fair Value by including the Fair Value of the entire block versus only the closed-block as indicated in the question. Most candidates took the straightforward approach, although an interim MVM calculation was also acceptable.

2. **Continued**

Equity = Assets – Liabilities = $200,000 – $160,000 = $40,000

$$e = \frac{\text{Equity}}{\text{Liabilities}} = \frac{\$40,000}{\$160,000} = 25\%$$

$$r_L = r_A - e \times \left(\frac{r_E}{(1-t)} - r_A \right)$$

$$= 5\% - 25\% \times \left(\frac{10\%}{(1-30\%)} - 5\% \right)$$

$$= 2.68\%$$

$$\text{Fair Value} = \frac{C}{1+r_L} = \frac{\$5,000}{1+2.68\%} = \$4,869$$

(d)   Identify four obstacles Avanti may face in finding a potential buyer of the closed block.

Commentary on Question:
There were cases where candidates provided a list much larger than the four obstacles requested in the question. In such instances, only the first four were assessed for credit. Several other answers than the four below were given credit as acceptable answers.

- The block may be too small to be worth a buyers' attention.

- The block terminates in one year so it may not be worth the hassle.

- Buyers may apply different assumptions than Avanti when determining the fair value.

- Buyers may not have sufficient experience to evaluate the risk.

3. **Learning Objectives:**
  2. The candidate will understand how the risks faced by an entity can be quantified and the use of metrics to measure risk.

Learning Outcomes:
(2c) Explain various approaches for the measurement of credit risk.

Sources:
AVF-116-12: Saunders and Allen, Credit risk Management In and Out of the Financial Crisis, Chapter 5 Reduced Form Models: Kamakura's Risk Manager

Commentary on Question:
This question tested knowledge and understanding of credit risk, in particular credit spreads and the items that affect them. Parts (a)-(c) tested candidates' Comprehension cognitive abilities. Part (d) tests candidates' Knowledge Utilization cognitive abilities as it asks candidates to apply their knowledge to a hypothetical crisis situation and understand its impacts.

Solution:
(a) Calculate the price of the bond using a risk-neutral approach. Show your work.

  Commentary on Question:
  Most candidates did well on this question. There were a handful of cases where the candidates did not calculate the recovery rate correctly. The approach below shows how to derive the price by calculating bond prices at each time interval; alternative calculations also work. Many candidates went straight to a tree drawing to assist the calculation, representing the calculation concept described here.

  At time t, the price P of a bond rated R,

  $$P_{R,t} = \frac{P_{A,t+1}Prob\left(A \ at \ t+1\right) \ + \ P_{B,t+1}Prob\left(B \ at \ t+1\right) \ + \ P_{Default,t+1}Prob\left(Default \ at \ t+1\right)}{1+r_f}$$

  where r_f is the risk-free discount rate and *Prob(A at t+1)* is the probability from transitioning from Rating R to Rating A in the one-year risk-neutral credit migration matrix, and

  $$P_{Default,\ 1} = \ P_{Default,\ 2} = \ Face \times \left(1 \ - \ Loss \ Given \ Default\right) \ = \$100 \times \left(1 \ - \ 60\%\right) \ = \ \$40$$

  $$P_{A,2} = \ P_{B,2} = \$100$$

  Applying the formula several times yields

3. **Continued**

$$P_{A,1} = \frac{(\$100 \times 90\%) + (\$100 \times 9\%) + (\$40 \times 1\%)}{1 + 2\%} = \$97.45$$

$$P_{B,1} = \frac{(\$100 \times 5\%) + (\$100 \times 90\%) + (\$40 \times 5\%)}{1 + 2\%} = \$95.10$$

$$P_{A,0} = \frac{(\$97.45 \times 90\%) + (\$95.10 \times 9\%) + (\$40 \times 1\%)}{1 + 2\%} = \$94.77$$

(b)   Calculate the implied credit spread of the bond over the risk-free rate using your result from part (a). Show your work.

Commentary on Question:
Candidates did well on this question; however, there were a few cases where they did not recognize discounting from time 2 to 0.

$$P_{A,0} = \frac{Face}{\left(1 + r_f + credit\ spread\right)^2}$$

where $P_{A,0}$ is the price calculated in part (a) of the question;

$$\$94.77 = \frac{\$100}{(1 + 2\% + credit\ spread)^2}$$

$$\left(1 + 2\% + credit\ spread\right)^2 = 1.0552$$
$$1 + 2\% + credit\ spread = 1.0272$$
$$credit\ spread = 0.72\%$$

(c)   Describe the components, other than the credit spread, of a risky bond yield.

Commentary on Question:
There were several cases where the candidates did not provide any explanation to the list of components. In such cases, the candidates only received partial credit for enumerating a list. In most cases, candidates did not identify the risk-free rate as a component of a risky-bond yield. The error term, while in the text, was not needed to receive full credit.

- Risk-free rate – interest rate on riskless securities, such as US Treasury Bonds or the highest quality corporate bond yield
- Liquidity risk factor – due to bonds being thinly traded, creating liquidity premium

3. **Continued**

- Value of embedded options – embedded options, such as call and conversion features, covenants, and sinking funds, have value
- Carrying costs – administrative costs of holding a portfolio of risky debt OR tax considerations/costs
- Bond pricing error term – random error component, or yield not explained by other factors

(d)

(i) Identify which components of a risky bond yield (including the credit spread) are likely to be materially impacted by this crisis.

Commentary on Question:
In most cases, candidates did not identify the risk-free rate as a component of a risky-bond yield impacted by the market crisis.

- Risk-free rate

- Credit spread

- Liquidity risk factor

(ii) Describe the impact for each component identified in part (i).

Commentary on Question:
In some cases, candidates did not elaborate on the impact for each of the components affected by the market crisis. For credit spread, an argument for uncertain impacts due to the effect on collateral was also accepted.

- Risk-free rate – would decrease in light of the economic downturn and potentially the government taking macro-economic measures (such as lowering the risk-free rate)

- Credit spread – would increase, due to increased defaults from company collapses

- Liquidity risk factor – would increase, due to market crisis, accompanying liquidity crunch

3. Continued

(iii) Evaluate the overall impact on the bond price. Support your response.

Commentary on Question:
In several cases, the candidates did not tie this part of the solution to the earlier sub-parts. There were also some instances where candidates provided the wrong impacts to the price of the security caused by the changes to the underlying components of a risky-bond yield. In such cases, the candidate did not receive credit for this sub-part; understanding the direction for these components was the differentiating factor.

The two factors causing the yield to rise are stronger than the one factor causing the yield to fall, so the yield is expected to rise, causing the bond price to decrease.

4.   **Learning Objectives:**

2.   The candidate will understand how the risks faced by an entity can be quantified and the use of metrics to measure risk.

3.   The candidate will understand various means available for managing risk and capital.

Learning Outcomes:

(2a)   Demonstrate an understanding of a variety of quantitative risk measures.

(2c)   Explain various approaches for the measurement of credit risk.

(3b)   Demonstrate knowledge of advanced methods of reinsurance.

Sources:

AVF-122-12: Tilman, Asset/Liability Management of Financial Institutions, Chapter 9 Measuring and marking Counterparty Risk

AVF-123-12: Tiller, Life, Health and Annuity Reinsurance, Chapter 5 Advanced Methods of Reinsurance

Commentary on Question:

This question tests the candidates' knowledge of counterparty risk and the appropriate methods of calculating counterparty exposure for Something Life. In addition, the question tests the candidates' knowledge of credit risk mitigants that could be utilized by Something Life. Parts (a) and (d) test candidates' Analysis cognitive abilities while parts (b) and (c) test candidates' Comprehension of the material.

Solution:

(a)   Describe Something Life's counterparty risk from Something Special.

Commentary on Question:

This part tests the candidates' knowledge of what counterparty risk is, and how it arises for Something Life. Candidates were generally able to effectively identify Something Life's counterparty risk.

Counterparty risk is the risk that a party fails to deliver on its contractual obligation, causing losses to the other party.

Something Life has counterparty risk because Special Bank may fail to pay reinsured GMDB benefits at the end of the quarter after Something Life has paid the annual reinsurance premium at the beginning of the year.

4. Continued

(b) Something Life's management is evaluating the use of potential future exposure (PFE) models to quantify the counterparty risk for the purpose of calculating economic capital.

    (i) Describe the two methods for calibrating PFE model parameters.

        Commentary on Question:
        This question tests the candidates' knowledge of calibrating Potential Future Exposure models. To get full credit, candidates need to identify the method and provide an explanation. This question was not answered well, as candidates were not able to identify the appropriate methods.

        Real-world calibration: calibrated to historical data, using real world probabilities

        Risk-neutral calibration: calibrated to current market prices, using risk-neutral probabilities

    (ii) Identify the most important determinant of PFE for Something Life.

        Commentary on Question:
        Candidates did poorly in identifying this determinant, which takes into account the specific transaction for Something Life.

        For Something Life, the exposure is subject to a positive correlation between falling unit values (which increases GMDB claims) and increasing defaults

(c) Something Life's management is also considering using the "Mean Exposure times Mean Loss Rate" method to calculate the market value of counterparty risk.

    (i) Describe the steps of this method.

        Commentary on Question:
        This question was testing the candidates' knowledge of how to calculate the market value of counterparty risk where only one of the two counterparties has credit exposure. Candidates fared poorly on this question as the period-by-period calculation was often not incorporated in the solution.

        Step 1: Calculate the risk-neutral expected exposure, EE(t), for each period t

4. **Continued**

Step 2: Calculate the risk-neutral default loss rate, L(t), for each period t
Step 3: Obtain the price of a default-free, zero-coupon bond of maturity t, C(t)
Step 4: Calculate the market value of risk, V(t) = EE(t) * L(t) * C(t), for each period t
Step 5: Calculate the total market value of risk, V(1) + V(2) + … + V(T), where T is the final time period of exposure

(ii)   Describe a deficiency of this method.

This method ignores the possibly substantial effect of correlation between exposure and interest rates.

(d)   Describe how the following risk mitigants could reduce Something Life's counterparty risk:

(i)   Collateral Agreements

(ii)   Netting Rights

(iii)   Funds Withheld Reinsurance

Commentary on Question:
Part (d) was testing the candidates' understanding of credit risk mitigants and applying it to the Something Life. Candidates did well in explaining the risk mitigants, but did not apply it to Something Life. To get full credit, candidates had to explain how the risk mitigants reduced Something Life's counterparty risk.

(i)   Collateral Agreements: Collateral is a transfer of ownership of assets above an exposure threshold. Something Life would have assets to cover benefits over the exposure threshold in the event of default, reducing its overall exposure to a Special Bank default.

(ii)   Netting Rights: Trades are offset when determining the net payable amount upon default of the counterparty. If Special Bank defaults when Something Life is expected to pay Special Bank reinsurance premiums, the reinsurance premiums can be netted against the reinsurance benefits owed.

(iii)   Funds Withheld Reinsurance: Assets underlying the reserves are retained by the ceding company. Something Life would have assets to cover benefits up to the reinsurance premium less year-to-date benefits, reducing its overall exposure to a Special Bank default.

5. **Learning Objectives:**
1. The candidate will understand measures of corporate value and be able to analyze the data in corporate financial statements.

Learning Outcomes:
(1a) Explain basic accounting concepts used in producing financial statements:
- In insurance companies
- In other financial institutions
- In non-financial institutions

(1b) Analyze a specific company financial situation by demonstrating advanced knowledge of balance sheet and income statement structures.

Sources:
AVF-103-12: Fridson, Financial Statement Analysis: A Practitioners Guide, Chapter 3 the Income Statement

Commentary on Question:
The question tests candidates' understanding of a non-financial company's financial statements. Candidates must calculate the combined value of two entities under various scenarios: financing the acquisition with stock or with debt. Candidates must make a recommendation as to whether one company should acquire another and, if so, whether they should use debt or equity financing. Candidates did well on this question and were able to calculate the share price under various scenarios. Providing support when making recommendations was important for getting full credit. Parts (a) and (c) tested candidates' Comprehension cognitive abilities, while parts (b) and (d) tested their Analysis cognitive abilities.

Solution:
(a) Calculate Rocky's share price at the ends of both year 1 and year 2. Show your work.

> **Commentary on Question**
> Many candidates incorporated the calculation concepts, listed first, here, directly into their calculation, sometimes using a straightforward columnar format.
>
> Earnings before Interest and Taxes
> = Revenue − Variable Costs − Fixed Costs
> = Number of Units Sold * Price per Unit - Number of Units Sold *
> Variable Cost per Unit – Fixed
>
> Earnings before Taxes
> = Earnings before Interest and Taxes − Interest Expense
> = Earnings before Interest and Taxes − Total Debt * Interest Rate on Debt

5. **Continued**

Net Income

    = Earnings before Taxes − Taxes

    = Earnings before Taxes − Earnings before Taxes * Tax Rate

(= Earnings before Taxes * (1 − Tax Rate))

Share Price = Net Income * Earnings Multiple / Number of Shares

Rocky Year 1 Net Income

    = (1,000 * 10 − 1,000 * 7 − 2,000 − 10,000 * 6%) * (1 − 35%)

    = 260

Rocky Year 1 Share Price = 260 * 14 / 100 = **36.40**

Rocky Year 2 Net Income

    = (1,100 * 10 − 1,100 * 7 − 2,000 − 10,000 * 6%) * (1 − 35%)

    = 455

Rocky Year 2 Share Price = 455 * 14 / 100 = **63.70**

(b)   Calculate Rocky's share price at the end of year 2 for each of the following independent situations. Show your work.

Commentary on Question

Most candidates did very well on this section, correctly adjusting the number of shares or incorporating the additional debt as needed.

(i)   Rocky purchases Smokey by issuing 100% equity.

    Smokey Year 1 Net Income

        = (200 * 10 − 200 * 7 − 400 − 2,000 * 6%) * (1 − 35%)

        = 52

    Purchase Price of Smokey = Smokey Earnings * 14 = 52 * 14 = 728

    Shares issued = 728 / 36.40 = 20 shares

    Combined Year 2 Net Income

        = (1,320 * 10 − 1320 * 7 − 2,400 − 12,000 * 6%) * (1 − 35%)

        = 546

    Combined Share Price = 546 * 14 / 120 = **63.70**

(ii)   Rocky purchases Smokey by issuing 100% debt at 6%.

    Total debt following purchase = 10,000 + 2,000 + 728 = 12,728

    The number of shares remains at 100

# 5.	Continued

Combined Year 2 Net Income
$$= (1{,}320 * 10 - 1{,}320 * 7 - 2{,}400 - 12{,}728 * 6\%) * (1 - 35\%)$$
$$= 517.61$$
Combined Share Price $= 517.61 * 14 / 100 = \textbf{72.47}$

(c)	Recommend, using the above calculations, whether Rocky should issue 100% stock or 100% debt to acquire Smokey at the end of year 1. Support your recommendation.

Commentary on Question
Most candidates did well, though it was important to make the connection between a higher share price and the goal of maximizing shareholder wealth to receive full credit.

Rocky, based on the calculations above, should use debt to fund the acquisition of Smokey.

The combined share price using debt, 72.47 is greater than the combined share price using equity, 63.40, and thus maximizes shareholder wealth, assuming that assumptions in the calculations do not change.

(d)	Provide three justifications to Rocky's management to support a higher offer.

Commentary on Question
Many candidates said that "goodwill" could be used as a justification. However, goodwill is the result of the price being paid above book value and not a reason in itself. Other answers than the three below were given credit as acceptable answers.

1.	Variable costs may decrease due to increasing purchasing power (due to larger volume transactions).
2.	The market may assign a higher P/E multiple due to the combined franchise value being greater than the sum of the individual franchise values.
3.	Fixed costs may decrease due to more efficient use of equipment and elimination of duplicate staff.

6. **Learning Objectives:**

3. The candidate will understand various means available for managing risk and capital.

Learning Outcomes:

(3c) Define liquidity risk.

(3d) Explain methods for managing this risk, both pre-event and post-event.

Sources:

AVF-119-12: "Report on Life Liquidity," AAA

Commentary on Question:

This question primarily tests candidates' understanding of stress liquidity risk and various means available for managing this risk for a given life insurance portfolio. Candidates are expected to identify various strategies to address stress liquidity risk in part (a); identify sources of liquidity risk in a given set of products in part (b). In part (c), candidates were expected to recommend and justify the best strategy of those identified in part (a) for stress liquidity risk embedded in each of the products in part (b). Parts (a) and (b) tested candidates' Comprehension cognitive abilities, while part (c) required Knowledge Utilization.

Solution:

(a) Describe five strategies to manage stress liquidity risk arising from a life insurance portfolio.

Commentary on Question:

Candidates were expected to limit their answers to 5 strategies and provide a description of the strategy (as opposed to simply listing the strategies). There were alternative strategies not listed below that earned full credit. Candidates were expected to provide strategies to deal with liquidity risk from an existing portfolio; therefore only partial credit was provided for product design solutions.

1. Ladder asset maturities, to match liability maturities and expected payments
2. Have backstop liquidity lines, allowing withdrawal of funds at short notice at a guaranteed price
3. Purchase credit derivatives paying out in the event of a downgrade or spread-widening of the company/sector
4. Purchase liquidity options that generate cash in a stress scenario
5. Set aside capital/surplus backed with liquid assets for extreme events

(b) Describe the liquidity risk from embedded options in the following products:

(i) Individual Universal Life (UL) insurance with surrender charges equaling 100% of account value in year 1, grading to 0% in year 6

6. Continued

> (ii)   Corporate-Owned Life Insurance (COLI)
>
> (iii)   Funding agreements permitting surrender at book value if the insurance company credit rating drops below a specified level

Commentary on Question:
Candidates were generally able to outline the liquidity risk arising from UL and Funding Agreements. For COLI, candidates were expected to highlight the main source of liquidity risk being due to one entity controlling multiple lives hence the risk of large unpredictable surrenders. Catastrophic mortality risk was not considered to be a source of liquidity risk.

(i) UL
For UL, the main liquidity risk is surrendering policies for the cash surrender value. Short-term surrenders will be low due to the high initial surrender charge but will increase over time, spiking in year 6 when the surrender charge is reduced to 0%.

(ii) COLI
COLI contracts are issued on individuals but controlled by a single organization. The option to surrender the contract would be exercised on the entire group of contracts at once, creating a large, unpredictable cash need.

(iii) Funding Agreements
The lack of market value adjustments (i.e. surrendering at book value) could lead to risk of having to pay out higher values than market.
Short notice for exercising the option creates liquidity risk for the company.

(c)   For each product in part (b), recommend the most effective risk management strategy from your answer in part (a). Justify your recommendations.

Commentary on Question:
Candidates could have performed better on part (c) by:
- *Recommending a strategy specifically from their answers in part (a)*
- *Justifying the recommendation by indicating both why the strategy deals with the sources of risks identified in part (b) AND why the chosen strategy is the most appropriate strategy compared to other answers in part (a)*

The answer below is a sample based on the answer in part (a) above. As part (a) answers vary, so do answers for part (c).

6.   Continued

(i) UL
Recommend laddering asset maturities to match expected payments (Strategy 1 from part (a)).

Cash flows are somewhat predictable due to the fixed surrender charge schedule.

This strategy which prepares for future cash needs is preferred to strategies which react to short-term crises (e.g. backstop liquidity lines) due to predictability of the liquidity needs arising from the product.

(ii) COLI
Recommend backstop liquidity lines (Strategy 2 from part (a)).

The potential cash flow need could be large and sudden but quite unpredictable, as the decision to surrender is driven by the cash needs of the owning company.

This is much better than laddering asset maturities, as cash flows for surrenders are highly unpredictable.

(iii) Funding Agreements
Recommend credit derivatives on insurance or financial sector (Strategy 3 from part (a)).

The embedded option can only be exercised after a certain market trigger, so a derivative based on a highly correlated trigger is a cost-effective option.

This is much better than setting aside capital/surplus, which may have already been drawn upon and causing the credit downgrade.