

QFI IRM Model Solutions

Fall 2020

1. Learning Objectives:

1. The candidate will understand the requirements and methods of governing investments.

Learning Outcomes:

- (1c) Describe governance mechanisms that attempt to address these conflicts.
- (1e) Explain how governance may be structured to gain competitive advantages and efficiencies.

Sources:

IAA Note on ERM for Capital and Solvency Purposes in the Insurance Industry

Commentary on Question:

This question tested candidates' knowledge of risk governance through practical examples.

Solution:

- (a) List four responsibilities for the new risk committee.

Commentary on Question:

Candidates performed well on this question.

Risk Committee responsibilities:

- Approving insurer's overall risk management strategy/policy
- Overseeing the process of ensuring that the insurer's responsible persons are fit and proper
- Setting/establishing the risk appetite of the insurer
- Monitoring key risks by ensuring the implementation of a suitable risk management and internal controls framework

- (b)
 - (i) List four qualifications for members of an effective risk committee.
 - (ii) Assess each candidate's qualifications.
 - (iii) Recommend the most qualified individuals.

1. Continued

Commentary on Question:

Candidates performed well on this question. Most candidates identified qualifications and provided an accurate assessment of candidate qualifications to supplement recommendations.

- (i) Four qualifications for members of an effective risk committee:
- Diverse background
 - Relevant experience
 - Inquisitive / Questioning minds
 - Objectivity / Independence
- (ii) John:
- Good organizational knowledge and solid understanding of company processes
 - Objectivity may be questionable, given his personal involvement in the establishment of those processes
- Jane:
- Has significant level of industry risk committee experience
 - Limited knowledge of SLC, processes, and culture
- Al:
- Extensive underwriting experience
 - Does not have a diverse background, and his prior working relationship with John could limit his objectivity
- Beth:
- Diverse background by working in multiple areas, and she could bring a fresh perspective, being a newly credentialed FSA
 - Level of risk management experience is unclear
- (iii) Recommend Jane and Beth
- Jane: would bring years of consulting firm risk committee experience to the role, and also objectivity due to her lack of entrenchment in SLC
 - Beth: has a variety of experience at SLC giving her good organizational knowledge, which would complement Jane's external background. Her actuarial knowledge should also help her with risk committee responsibilities.
- (c) Identify the most appropriate risk category for each risk report.

Commentary on Question:

Candidates performed well on this question.

1. Continued

Audit – operational
VaR – market
Sales – underwriting
Enterprise-wide – operational

(d)

- (i) Critique each component.
- (ii) Recommend any changes to the components above.

Commentary on Question:

Candidate performance was fair on this question. Most candidates were able to critique and recommend changes to some components, but few were able to do so for each component.

- (i) Bullet 1: This is not appropriate. It is important for insurers to develop risk tolerances tailored to their unique circumstances.

Bullet 2: This is partially appropriate. Lines of business should communicate regularly, but monthly is too frequent as risk appetites would not be changed that frequently (more like 3-5 years).

Bullet 3: This is not appropriate. The relationship between the qualitative and quantitative risks should be considered.

Bullet 4: This is appropriate, no changes needed.

- (ii) Bullet 1: Set a risk tolerance tailored to company's situation, independent of regulatory considerations.

Bullet 2: Refine the frequency of meetings (no more frequently than quarterly or annually) and clarify who should be meeting, i.e., senior management, CFO of line of business, etc.

Bullet 3: Consider relationship between qualitative and quantitative risks.

2. Learning Objectives:

3. Understand and be able to apply different approaches to measuring risk exposures.

Learning Outcomes:

- (3a) Explain the advantages and limitations of different risk metrics
- (3e) Evaluate a company's or a portfolio's exposures to various risks.

Sources:

Value at Risk by Jorion, Chapter 7: Portfolio Risk: Analytical Methods

Managing Investment Portfolios: A Dynamic Process by Maginn, Tuttle, etc. Chapter 9

Commentary on Question:

This question tested candidates understanding of some of the quantitative aspects of Value at Risk and asked them to apply their knowledge to a simple case study with two investment options. This question was the first time candidates were asked to perform their calculations in Excel instead of by hand. Overall, candidates seem to have adapted well to this new challenge, and most did a good job of showing the steps of their calculations.

Solution:

- (a) Describe an efficient frontier in the context of portfolio management.

Commentary on Question:

Candidates performed well on this question.

(a) An efficient frontier is the set of optimal portfolios that offer the highest expected return for a given level of risk.

(b)

(i) Calculate the marginal VaR for each index at a 95% confidence level.

(ii) Explain which index carries more marginal risk.

(iii) Recommend directionally how to reach the optimal portfolio.

Commentary on Question:

Candidate performance was fair on this question. Most candidates calculated marginal VaR correctly and recognized that Index Y carried more marginal risk. Some candidates did not adequately explain this using marginal VaR calculation and many struggled to recommend how to reach the optimal portfolio.

Candidates whose calculation was correct also tended to follow good spreadsheet etiquette in Excel by laying out their answer in clear, easy-to-follow steps, instead of trying to calculate the complete answer in a single cell.

2. Continued

(i)

$$\Delta \text{VAR} = \alpha \frac{\text{Cov}(R, R_p)}{\sigma_p}$$

$$\text{Cov}(R, R_p) = \begin{bmatrix} .15^2 & .3 * .15 * .12 \\ .3 * .12 * .15 & .12^2 \end{bmatrix} \begin{bmatrix} 50\% \\ 50\% \end{bmatrix} = \begin{bmatrix} .01395 \\ .00990 \end{bmatrix}$$

$$\sigma_p^2 = \begin{bmatrix} 50\% & 50\% \end{bmatrix} \begin{bmatrix} .01395 \\ .00990 \end{bmatrix} = .011925$$

$$\sigma_p = 10.92\%$$

For a 95% confidence level, $\alpha = 1.645$

$$\Delta \text{VAR for Index Y} = 1.645 \frac{.01395}{10.92\%} = \$0.2101$$

$$\Delta \text{VAR for Index Z} = 1.645 \frac{.00990}{10.92\%} = \$0.1491$$

(ii)

Based on part (b) i), a dollar increase of investment in Index Y will increase the portfolio VaR by about \$0.2101. A dollar increase of investment in Index Z will only increase the portfolio VaR by about \$0.1491. In other words, a marginal dollar invested in Index Y carries more risk than in Index Z. Therefore, Index Y carries more marginal risk.

(iii)

The optimal portfolio will be created when the ratio of all expected returns to marginal VARs are equal.

$$\frac{E_i}{\Delta \text{VAR}} = \begin{bmatrix} 0.1 / .2101 \\ 0.07 / .1491 \end{bmatrix} = \begin{bmatrix} .4760 \\ .4695 \end{bmatrix}$$

Based on this calculation, Index Y returns more for each marginal unit of risk taken. Thus, Bob would need to move funds from Index Z to Index Y.

(c) Calculate the probability that Bob's portfolio declines in value over the next year.

Commentary on Question:

Candidates performed well on this question.

(i)

$$\mu_p = w_Y \mu_Y + w_Z \mu_Z = \$1,500,000 * 10\% + \$1,300,000 * 7\% = \$241,000$$

$$\sigma_p^2 = w_Y^2 \sigma_Y^2 + w_Z^2 \sigma_Z^2 + 2\rho w_Y w_Z \sigma_Y \sigma_Z$$

$$\sigma_p^2 = 1,500,000^2 * .2^2 + 1,300,000^2 * .15^2 + 2 * .3 * 1,500,000 * 1,300,000 * .20 * .15$$

$$\sigma_p = \sqrt{163,125,000,000} = \$403,887.36$$

$$Z = \frac{0 - 241,000}{403,887.36} = -0.5967$$

$$\text{Probability} = 27.54\%$$

2. Continued

- (d)
- (i) Identify the measure most suitable for Bob's situation. Justify your response.
 - (ii) Calculate the measure chosen in i) for both positions in the portfolio based on Table 2.
 - (iii) Recommend which index to reduce his position from based on your results.

Commentary on Question:

Candidate performance was fair on this question. Most candidates could identify Component VaR as the most suitable measure, however some candidates struggled with the Component VaR calculation.

i)

I recommend using the Component VaR for this scenario.

Component VaR is a partition of the portfolio VaR that indicates approximately how much the portfolio VaR would change if the given component was deleted. This is Bob's situation.

Incremental VaR is the change in VaR owing to an additional position, however this example involves reducing one position in favor of another.

Expected return only considers the expected benefit of each position; it does not account for its risk.

ii)

$$CVAR_i = \Delta VAR_i * x_i$$

$$\Delta VAR = \alpha \frac{Cov(R, R_p)}{\sigma_p}$$

$$Cov(R, R_p) = \begin{bmatrix} .2^2 & .3 * .2 * .15 \\ .3 * .2 * .15 & .15^2 \end{bmatrix} \begin{bmatrix} \left(\frac{1,500,000}{2,800,000}\right) \\ \left(\frac{1,300,000}{2,800,000}\right) \end{bmatrix} = \begin{bmatrix} .02561 \\ .01527 \end{bmatrix}$$

$$\sigma_p^2 = \begin{bmatrix} 53.57\% & 46.43\% \end{bmatrix} \begin{bmatrix} .02561 \\ .01527 \end{bmatrix} = 0.02081$$

$$\sigma_p = 14.43\%$$

For a 95% confidence level, $\alpha = 1.645$

$$\Delta VAR \text{ for Index Y} = 1.645 \frac{.02561}{14.43\%} = \$0.2920$$

$$\Delta VAR \text{ for Index Z} = 1.645 \frac{.01527}{14.43\%} = \$0.1741$$

$$CVAR \text{ for Index Y} = 0.2920 \times 1,500,000 = \$438,000$$

$$CVAR \text{ for Index Z} = 0.1741 \times 1,300,000 = \$226,330$$

2. Continued

- iii) Based on the answer from part (d) (ii), we can see that Index Y has the largest contribution to the VaR and is creating the most risk for Bob. Therefore, Bob should divest from Index Y first.

3. Learning Objectives:

2. The candidate will understand and be able to apply the components of an effective risk management system.

Learning Outcomes:

- (2b) Identify and describe the various kinds of risks, including market, credit, operational, etc.
- (2d) Explain the features of a best practices enterprise risk management system.
- (2f) Examine examples of risk management failure.

Sources:

“The Top Ten Operational Risks: A Survival Guide for Investment Management Firms and Hedge Funds”

“Ch. 20 Case Studies”

“QFII-103-14: Advances in Risk Management and Risk Governance”

Commentary on Question:

This question requires the candidate to recall several case studies, exercise judgement in identifying the most relevant “Top Ten” operational risks in each, and compare and contrast the case studies against each other.

Solution:

- (a) Describe each of the above operational risks.

Commentary on Question:

Candidates performed well on this question. Most candidates were able to provide an appropriate and meaningful description to receive full credits. Some candidates had trouble with identifying the true risks associated with Handoffs, Reading the Fine Print, and Reconciliation Gaps.

Amalgamated Assignments: This is the improper segregation of duties. If the same individual is responsible for multiple functions, it can lead to conflicts of interest or the potential for theft or fraud.

Complacency: This risk is characterized by a passive approach toward operational risk management and trivializing or disregarding risks.

Handoffs: Dropped Batons. This is the risk that key information is miscommunicated or overlooked when passed between people, departments, organizations, and systems.

3. Continued

Reading the Fine Print: Know Thy Legal Entities. The risk that issues arise from legal documentation which too few qualified and knowledgeable people read. Often times this is the result of insufficient partnership or involvement between the firm's law department, which examines an agreement from a legal perspective, and those functioning in an operational capacity.

Reconciliation Gaps: A False Sense of Security. The risk that reconciliations are not truly effective and accurate, leading to a false sense of security.

(b)

- (i) Identify the one operational risk most relevant to all three case studies.
- (ii) Explain how this particular risk was present in each of the three case studies.
- (iii) Describe how a best practices enterprise risk management system would have addressed this risk for each case study.

Commentary on Question:

Candidate performance was fair on this question. Most candidates were able to identify complacency as a risk present in each case study and provided adequate explanations. Many candidates did not include components of a best practice enterprise risk management system in descriptions in iii).

- (i) Complacency is the risk present in each case study
- (ii) Korean Air: The pilots did not show enough urgency to convince the captain to use the radio beacon, despite the fact that the captain was endangering the safety of everyone aboard the plane with his decision.

Equitable Life: It was thought that the guarantees were unlikely to apply. Also, the company was unwilling to learn from the practice adopted by other firms, which meant that there was insufficient scrutiny of its own business model.

Bernard Madoff: Investors did not analyze in detail enough of Madoff's investment strategy before trusting him with their capital.

3. Continued

- (iii) Korean Air: One of the main reasons for the crash was that the culture resulted in a lack of challenge even though challenge was obviously needed. A best practices ERM system would have organizational checks and balances. Furthermore, in a risk-conscious culture everybody understands risk and accepts that risk is the responsibility of everyone in the organization.

Equitable Life: It is important to create a risk-conscious culture from the top down. A best practices ERM system would also measure risk using more than a single tool, metric, or judgment. Incorporating stress testing is important in order to manage to tail risks

Bernard Madoff: A best practices ERM system would have performed due diligence before making an investment into the company.

- (c)
- (i) Identify one “Top Ten” operational risk that is most relevant to the Korean Air Flight 801 case study but not the other two case studies.
- (ii) Identify one “Top Ten” operational risk that is most relevant to the Bernard Madoff case study but not the other two case studies.

Commentary on Question:

Candidate performance was fair on this question. For both parts, some candidates were able to identify the correct risk, but did not describe how this risk only applies to one case study and not to the others.

- (i) Handoffs is the risk only present in the Korean Air case study.

Korean Air: The communication failure between the crew and the captain was the main reason for the flight to crash.

Equitable Life: The reasons for the collapse were insufficient capital, failure to accurately model the extent of options against it, and failure to take action at the appropriate time to separate different types of policies. There were also cultural aspects that allowed the mistakes to be made (e.g., tone from the top, insularity, and combining the Appointed Actuary and CEO roles).

Bernard Madoff: Fraud occurred as a result of a lack of oversight, conflicts of interest, lack of expertise, and complacency on behalf of investors and regulators (who were notified by would-be-investors who noticed the fraud).

3. Continued

- (ii) Reconciliation Gaps is the risk only present in the Bernard Madoff case study.

Bernard Madoff: There was little to no internal oversight in Madoff's firm. The only external auditing was carried out by a personal friend who clearly did not reconcile the records accurately. Potential investors that did find inconsistencies in the trades carried out not only avoided investing but also notified the regulator.

Korean Air: The main reasons for the accident were the lack of challenge and communication problems.

Equitable Life: The reasons for the collapse were insufficient capital, failure to accurately model the extent of options against it, and failure to take action at the appropriate time to separate different types of policies. There were also cultural aspects that allowed the mistakes to be made (e.g., tone from the top, insularity, and combining the Appointed Actuary and CEO roles).

- (d) Identify which of the three case studies best corresponds to each of Case Study A, Case Study B, and Case Study C in the table.

Commentary on Question:

Candidates performed poorly on this question. Many candidates did not correctly identify the case studies correctly. Some candidates correctly identified all the case studies, but did not provide any description to justify the answer.

Operational Risk	Bernard Madoff	Korean Air	Equitable Life
Handoffs		✓	
Complacency	✓	✓	✓
Reconciliation Gaps	✓		
Amalgamated Assignments	✓		✓

Case Study A is Bernard Madoff, B is Korean Air, and C is Equitable Life.

From part b), Complacency is the risk present in all case studies, so it must be Operational Risk 2. From part c), Handoffs is the risk only present in Korean Air case study, while Reconciliation Gaps is the risk only present in Bernard Madoff. Equitable Life must be C, as the only case without its own unique operational risk.

3. Continued

Amalgamated Assignments applies to Bernard Madoff because the firm had a very small number of people, leading to power being concentrated in one person. However, Amalgamated Assignments does not apply to Korean Air case study, because the problem was more so that the duties of the captain and crew were too segregated, such that the crew was unwilling to challenge the captain. Therefore, Case A is Bernard Madoff and Case B is Korean Air.

4. Learning Objectives:

3. Understand and be able to apply different approaches to measuring risk exposures.

Learning Outcomes:

- (3a) Explain the advantages and limitations of different risk metrics
- (3c) Analyze and evaluate risk aggregation techniques, including the use and misuse of correlation, integrated risk distributions and copulas.
- (3e) Evaluate a company's or a portfolio's exposures to various risks.

Sources:

QFII-108-14: Developments in Modelling Risk Aggregation

QFII-110-15: The Devil is in the Tails: Actuarial Mathematics and the Subprime Mortgage Crisis

Commentary on Question:

This question tested candidates' understanding of copulas in the context of CDO portfolios. Candidate performance was fair on this question.

Solution:

- (a)
 - (i) Describe the steps necessary to simulate a loss distribution given random variables X_1, X_2, \dots, X_n with distributions F_1, F_2, \dots, F_n , and a copula $C(u_1, \dots, u_n)$.
 - (ii) Compare and contrast rank correlation and linear correlation as a basis for copula calibration.

Commentary on Question:

Candidate performance was fair on this question. Most candidates could accurately describe the steps to simulate the loss distribution, however some could not sufficiently contrast rank and linear correlations.

- (i)
 1. From the copula distribution, draw a joint sample of uniforms (u_1, u_2, \dots, u_n)
 2. For each uniform calculate the percentile of the risk-distribution $F_i^{-1}(u_i)$
 3. Sum the individual distribution percentiles to get the total loss $\sum_i F_i^{-1}(u_i)$
 4. Repeat 1-3 for sufficient number of samples to produce the simulated loss distribution

4. Continued

(ii)

- Both are simple scalar measures that cannot fully specify the joint distribution when the marginals are provided.
- For a given copula, rank correlation is invariant as the marginal distribution changes. This is an advantage not true of linear correlation.

(b) Critique your coworker's statements.

Commentary on Question:

Candidates performed poorly on this question. Many candidates incorrectly stated that the first statement was false.

1. The first statement is correct.

The default behavior of these entities does not depend at all on how a separate entity may combine, tranche and sell exposure.

2. The statement is partially correct.

The one-factor Gaussian model assumes that all underlying entities share a uniform correlation with all others. However, using different correlations for each tranche allows the model to fit to market prices.

(c) Assess the appropriateness of each copula to quantify the risks of this CDO.

Commentary on Question:

Candidate performance was fair on this question. Many candidates correctly identified the Gaussian copula as inappropriate; however, some identified Gumbel as most appropriate.

- The Gumbel copula is symmetric, so fails to account for the first property. It does exhibit tail dependence.
- A Gaussian copula exhibits no tail dependence, so fails the second property.
- A Student t-copula has tail-dependence and can be asymmetric with more than two dimensions, which addresses both properties. The Student t-copula is the most appropriate.

4. Continued

- (d) Describe one advantages and one disadvantage of evaluating risks using scenario-based aggregation.

Commentary on Question:

Candidates performed well on this question.

Advantage:

Scenario-based risk aggregation relates directly to the firm's unique risk-exposures, their risk-drivers and relationships between them.

Disadvantage:

Requires significant technical expertise and/or expert judgment

- (e) Assess the effectiveness of each action in meeting the company's objectives.

Commentary on Question:

Candidates performed poorly on this question, as most did not comment on the effectiveness of each action for each objective.

1. Sell protection on super-senior tranches instead of mezzanine tranches

Effective in limited credit losses: It is very unlikely that super-senior tranches would experience any credit losses or material impacts from single-name defaults, even in a financial crisis similar to 2008.

Not effective in maintaining liquidity: The value of the positions could still decrease substantially and may require posting collateral, limiting liquidity, similar to AIG's situation.

2. Reduce the allocation in CDOs and purchase treasuries

Effective in limiting credit losses: Limits direct credit exposure

Effective in maintaining liquidity: Removes risk of collateral calls; also, high-quality bonds provide regular interest income and maintain liquidity in crisis events

4. Continued

3. Purchase credit default swaps (CDS) for hedging

Not effective limiting credit losses: During the financial crisis, mezzanine tranche hedges often failed; indeed standard models sometimes gave hedge ratios with the wrong sign. Current standard models still suffer most of the same defects. A failed hedge would exacerbate the impact of spread widening or default.

Not effective maintaining liquidity: Purchasing a CDS hedge requires regular premium payments, and potentially delayed timing to settlement which can limit liquidity

- (f) Recommend the most appropriate action.

Commentary on Question:

Candidates performed well on this question.

Reducing the allocation in CDOs and purchasing treasuries is the most appropriate action, as it best satisfies both of the company's objectives.

5. Learning Objectives:

1. The candidate will understand the requirements and methods of governing investments.
2. The candidate will understand and be able to apply the components of an effective risk management system.

Learning Outcomes:

- (1e) Explain how governance may be structured to gain competitive advantages and efficiencies.
- (1f) Demonstrate understanding of how ethics relates to business decision-making, and relate ethics in business to personal ethics.
- (2a) Explain the importance of risk culture in an investment firm.
- (2b) Identify and describe the various kinds of risks, including market, credit, operational, etc.
- (2e) Evaluate a company's risk management process.

Sources:

“Quantitative ERM” by Hardy and Saunders

“Tracing True Origins of Bad Behavior”

“IAA Note on Capital and Solvency”

“Investment Ethics” by Peck, Chapter 7

Commentary on Question:

This question tested candidates' ability to identify risks as well as their knowledge of ERM processes and governance topics.

Solution:

- (a) Identify and describe four risks faced by Flying High.

Commentary on Question:

Candidate performance was fair on this question. Some candidates did not adequately describe how the risk was appropriate and others identified risks not present in the question, such as market risk.

5. Continued

Political risk: Political unrest in Country X.

Legal risk: if plane is developed too quickly and not adequately safety-tested, lawsuits will result

Reputational risk: reputation may be damaged if plane is rushed to market without adequate testing

Operational/Process risk: Company X may have processes in place to inadequately test product

(b)

(i) Identify and describe two sources of conduct risk.

(ii) Recommend an approach to mitigating each conduct risk.

Commentary on Question:

Candidates performed well on this question. Most candidates identified the bonus structure of the head engineer and the lack of internal safety reviews.

Chancers: the head engineer may be more willing to take risks than others because of his bonus structure.

Recommend: Change bonus structure to incentivize more appropriate risk taking. Include others on the team who are less incentivized to take risks.

Work Group risk: The head engineer has set a dangerous precedent to skip safety reviews, and this has been normalized over time, making other engineers comfortable with this.

Recommend: Establish better corporate governance. This might be accomplished by having a clear policy that all new products must go through a safety review, regardless of similarity to past products.

(c)

(i) Critique the ERM process of Flying High.

(ii) Recommend five actions to enhance the ERM process of the firm.

Commentary on Question:

Candidates performed well on this question.

5. Continued

Critique: Ineffective ERM because:

- CEO and CFO solely responsible for ERM; other voices are not part of the process
- Process is not embedded in all aspects of the firm; should not solely be ERM team's responsibility; the current practices do not engage employees beyond the high-level ERM team
- The risk policy manual is a good start but is incomplete.

Recommendations:

- Establish CRO position.
- Include training, focus groups, education, and briefing of executive management
- Examine how risks have been managed in the past, together with better approaches. "War stories" help understanding and engagement.
- Issue a document precisely outlining its goals and behaviors. ERM model should be precise in describing behaviors in measurable and observable terms that can be incorporated into training, reporting, bonus and performance management system.
- Establish a compensation program that is on a risk-adjusted basis.

- (d) Recommend four improvements to the board structure.

Commentary on Question:

Candidates performed well on this question.

- 6-8 members of the board – large boards can be unwieldy and thus ineffective
- Limit the number of boards the members can serve on – they might be stretched too thin and not have time to devote to their duties on Flying High's board
- Directors should be independent (not be on boards of companies that do business with Flying High) to ensure no conflicts of interest
- Board should meet regularly without the CEO, as the CEO can exert undue influence on board when present

- (e) Recommend the most appropriate benchmark.

Commentary on Question:

Candidates performed poorly on this question. Few candidates identified the correct benchmark, and those who did could not provide adequate justification.

5. Continued

Benchmarks 2 and 3 are more appropriate than benchmarks 1 and 4.

- Benchmarks 1 and 4 only use Flying High's performance to determine the bonus; no comparison to peers is made. Benchmarks 2 and 3 do compare to peers.

Benchmark 3 is better than benchmark 2.

- One peer is not a sufficient sample size to ascertain what a reasonable performance should be. The industry average would be a better gauge as to the relative performance of Flying High as it puts it in a broader context.
- The best performing peer is an exceptional case not representative of the industry.

6. Learning Objectives:

2. The candidate will understand and be able to apply the components of an effective risk management system.
3. Understand and be able to apply different approaches to measuring risk exposures.

Learning Outcomes:

- (2b) Identify and describe the various kinds of risks, including market, credit, operational, etc.
- (2c) Identify and describe various approaches for managing risks including risk budgeting, position limits, etc.
- (2d) Explain the features of a best practices enterprise risk management system.
- (2e) Evaluate a company's risk management process.
- (3a) Explain the advantages and limitations of different risk metrics

Sources:

Andersen: How to Deal Effectively with Major Corporate Exposures

Rahl: QFII-103-14: Advances in Risk Management and Risk Governance

Maginn, John L. & Tuttle, Donald L: Managing Investment Portfolios, 3rd Edition, 2007

Commentary on Question:

This question tested candidates' knowledge of risk identification, risk management and various risk metrics.

Solution:

- (a) Describe four modes of viewing the environment that can be used to identify market risks.

Commentary on Question:

Candidate performance was fair for this question. Several candidates were able to recall the list. Some omitted descriptions entirely while others provided descriptions that omitted certain key concepts.

Formal Search – The corporation is structured in a way that obtains relevant information to specific issues as an input to the planning process and decision making.

6. Continued

Conditional Viewing – The corporation tracks pre-selected information from particular sources aimed at understanding specific evolving issues.

Informal search – Where the corporation actively looks for information through unfocused/unstructured efforts to increase understanding of specific developments.

Undirected viewing – The corporation scans many diverse sources of information without specific informational needs.

(b)

(i) Critique each practice.

(ii) Recommend one improvement for each flawed practice.

Commentary on Question:

Candidates performed well on this question. Some candidates struggled in assessing standard deviation (2) and regulatory capital (5).

1) Critique: The floating rate index is likely not an appropriate benchmark for fixed rate liabilities the portfolio is backing.

Recommend: To improve, consider using a fixed rate bond index as a benchmark.

2) Critique: A shortcoming of standard deviation is that it focuses on short-term volatility risk.

Recommend: To improve, consider using more than one risk metric, or other risk management techniques which could include: Stress testing, VaR, Required Capital

3) Critique: The use of a model to value securities introduces “valuation risk” because there are no observable market prices to check model output against. Additional reliance on a model introduces “model risk” where errors in the model could result in incorrect valuations.

Recommend: Monitor the price movements of similar assets that trade in more liquid markets and use these to validate the model output

6. Continued

4) Critique: While the recent graduate is educated, he lacks the experience to approve valuations. The model governance process could also be improved by relying on different people or teams to develop the model and to sign off on the model output.

Recommend: Have a committee and governance process in place to review valuations before signing off

5) Critique: Regulatory capital requirements often do not provide the most robust view of a company's risk profile because regulatory capital requirements typically don't capture correlation or interactions between risks.

Recommend: Consider using an internal capital model in addition to the regulatory capital requirements.

(c)

(i) Calculate the Sharpe ratio for each strategy.

(ii) Recommend one of these strategies.

Commentary on Question:

Candidates performed well on this question.

Sharpe ratio = (mean return – risk-free rate) / standard deviation

Overweight Mean = $40\% * 10\% + 60\% * 2\% = 5.2\%$

Overweight Variance = $(40\% * 10\%^2 + 60\% * 2\%^2) - 5.2\%^2 = 0.1536\%$

Overweight Sharpe Ratio = $(5.2\% - 0\%) / \text{sqrt}(0.1536\%) = 1.33$

Underweight Mean = $40\% * 5\% + 60\% * 4\% = 4.4\%$

Underweight Variance = $(40\% * 5\%^2 + 60\% * 4\%^2) - 4.4\%^2 = 0.0024\%$

Underweight Sharpe Ratio = $(4.4\% - 0\%) / \text{sqrt}(0.004\%) = 8.98$

The underweight credit risk strategy is recommended because it has the higher Sharpe ratio.

(d)

(i) Calculate the new regulatory capital requirement under this scenario.

(ii) Recommend any necessary changes to the asset allocation.

Commentary on Question:

Candidates performed well on this question. Most candidates were able to figure out that the new capital requirement breached the firm's risk limit and proposed a suitable change.

6. Continued

- (i) Downgrades to HY = $10\% * \text{IG Exposure} = 8$
New HY Exposure = $10 + 8 = 18$
New HY Capital = $10\% * 18 = 1.8$
New IG Exposure = $80 - 8 = 72$
New IG Capital = $1\% * 72 = 0.72$
Total New Capital Required = $1.8 + 0.72 = 2.52$

- (ii) Need to change the asset allocation to decrease capital because the risk limit of \$2M would be breached under the proposed scenario

Recommend: Move funds from High Yield Bonds to Investment Grade Bonds.