

ILA LRM Model Solutions

Fall 2017

1. Learning Objectives:

1. The candidate will demonstrate an understanding of the principles of Risk Management.

Learning Outcomes:

- (1a) Define and evaluate risk.
- (1b) Evaluate the role of risk management within an insurance company
- (1c) Articulate the economic incentives for applying risk management
- (1d) Describe how risk management techniques may be used to manage capital deployed by insurers and how they impact strategic decision making.

Sources:

ERM Specialty Guide, May 2006– Chapters 1-6

CIA: Dynamic Capital Adequacy Testing (DCAT) Education Note, November 2013 (pages 4 - 33)

LRM - 123 - 15: Enterprise Risk Management, S&P, May 2013, pp. 3 - 28

Commentary on Question:

The candidate was expected to understand the various objectives of risk management within an insurance company.

Overall, the question was done well. Many candidates were able to give reasonable answers based on their knowledge of risk management. Parts C and E were the most challenging for candidates:

For statement C, some candidates did not explain the limitations of ERM or the potential advantages of stress testing models.

For statement E, some candidates did not fully justify their answers explaining the difference between Required Capital and Economic Capital.

1. Continued

Solution:

The Chairman of the Board believes each of the following statements to be true:

- A. *The cost of maintaining a properly functioning Enterprise Risk Management program destroys shareholder value.*
- B. *The total risk exposure of the enterprise is simply the sum of all risks.*
- C. *Given the limitations of ERM, the enterprise should spend its time and money building better stress testing models which will undergo robust validation and vetting.*
- D. *The enterprise would be better served to implement a transparent incentive compensation program for senior management that encourages the achievement of both short-term and long-term goals, which if designed properly and communicated to staff and shareholders, would reduce its agency costs.*
- E. *Provided all risks are understood and have been appropriately modeled, the insurer can use its Required Capital as a proxy to its Economic Capital.*
- F. *ERM will allow the enterprise to avoid losses provided appropriate hedges are utilized.*

Critique the validity of each statement. Justify your answers.

- A. The statement is not valid. ERM adds shareholder value by:
 - Reducing agency costs
 - Reducing probability of bankruptcy
 - Reducing Expected Tax payment
 - Reducing earnings volatility
 - Improving decision making by considering risk adjusted return
- B. The statement is not valid
 - Risks do not occur all at the same time, diversification between risks exist. For example mortality and longevity risk offset each other.
 - Instead of a simple summation a correlation matrix, copulas or integrated model is a more appropriate approach to capture interdependencies between risks/products.
 - The only time the statement is valid is if all risks/products are perfectly correlated.

1. Continued

- C. The statement is partially valid.
- Stress testing is complementary to ERM not instead of ERM.
 - Some of the ERM limitation such as human judgment, breakdown of controls, management override will benefit from stress testing.
 - Stress testing helps with risk identification and control, liquidity management and capital management supporting the validation of the ERM results.
- D. The statement is partially valid.
- To reduce agency cost, the incentive compensation measure needs to be on long-term targets and include risk adjusted measures.
 - Short-term targets should be removed since they could provide staff an incentive for excessive risk-taking which would increase agency costs due to misalignment of shareholders and staff objectives.
 - Transparency and communication will also reduce agency cost by aligning shareholder and staff objectives.
- E. The statement is not valid
- Required capital is a prescribed regulatory capital measure based on industry averages.
 - Economic capital is specific to the company reflecting the specific risk profile and specific risk mitigations.
 - Required capital would only be a reasonable proxy if the risk profile is consistent with the industry averages for all risks. This is generally not the case for most insurers.
- F. The statement is partially valid
- Hedging is a risk mitigation strategy that reduces losses however not all losses will be avoided.
 - Basis risk and counterparty risk are associated with hedging.
 - Hedging is most effective at protecting against tail risk instead of avoiding all losses. The amount of loss to avoid will be determined by the risk appetite of the company.

2. Learning Objectives:

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

Learning Outcomes:

- (2a) Identify, categorize and evaluate potential sources of risk in products including but not limited to mortality, morbidity, and lapse.
- (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:

LRM-126-15: Liquidity Risk, Saunders & Cornett, Ch. 17, pp. 493 – 514

Commentary on Question:

This question tested candidates' understanding on the key product features of Term and UL, and the ability to explain the source of liquidity risk based on their product features. Most candidates were able to identify that the surrender/partial withdrawal benefits could be a main source of liquidity risk on UL, but failed to see that there is no cash value on Term so liquidity risk is minimal. Many students confused the mortality risk under catastrophic/pandemic event with liquidity risk.

Solution:

- (a) Explain the sources of liquidity risk for the following two products of Simple Life:
 - (i) Level premium term insurance, and
 - (ii) Adjustable premium universal life.

Model Solution:

- (i) Term has little liquidity risk exposure because there is no cash value. So minimal liquidity strain to the company even if there are massive lapses.
- (ii)
 - 1) Surrender benefit
UL has surrender value. In a rising market environment, many policyholders may elect to withdraw the policy and seek higher returns elsewhere. This may force the company to sell the asset during a short period at unfavorable price and cause liquidity issue.

2. Continued

2) Surrender charge

Surrender charges may help mitigate the liquidity risk from massive lapses. But the surrender charge drops to zero at year 10, which may lead to a spike in lapses once the surrender charge is gone.

3) Investment Strategy

To seek higher returns, the company proposed to hold some illiquid assets like private placements. This can be a source of liquidity risk.

- (b) Assess the impact on the liquidity risk for each of the Variable Annuity product improvements proposed by Simple Life. Justify your answer.

Commentary on Question:

Candidates were required to explain what impact each VA product improvement had on the liquidity risk and provide reasonable justifications. Most candidates concluded that a wider range of funds and the partial withdrawal option introduced more liquidity risk, but didn't provide proper justification. Few candidates demonstrated an understanding of the immaterial liquidity impact from the GMDB, as it was frequently mistaken for the market risk and mortality risk embedded in the GMDB rider. For the GMIB, most students identified the negative impact but failed to adequately explain the impact on a GMIB. Although many candidates did not compare dollar-for-dollar and proportional partial withdrawal methods, among those who had, most candidates demonstrated a good understanding and explained why the dollar-for-dollar option may not be favorable.

Model Solutions:

- (i) Wider range of fund options
- Negative impact
 - The additional fund options may be more illiquid and volatile, so if those funds perform poorly, policyholders could lapse and invest somewhere else, forcing the company to sell assets at an unfavorable price.
- (ii) Partial withdrawal
- Negative impact
 - The option allows policyholders to selectively withdraw funds; the company may be forced to sell assets at an unfavorable price.
- (Alternate solution)
- Limited impact
 - The partial withdrawal option may not affect liquidity if the assets are managed in a separate account, as compared to a general account.

2. Continued

- (iii) GMDB
 - Immaterial impact
 - A GMDB is life contingent, so it shouldn't have much impact on liquidity risk given the policyholder cannot easily control the insured event.

- (iv) GMIB
 - May have negative impact
 - A GMIB may create a liquidity issue over time if the funds upon annuitization are insufficient to pay the expected income benefits; however the exposure may be spread out over time depending on the annuitization benefit.

- (v) Dollar to dollar partial withdrawals
 - Negative impact
 - The dollar-for-dollar method generally results in a greater residual benefit than the proportional method.
 - For example, if the guaranteed death or income benefits exceed the account value and most of the funds are withdrawn, the dollar-for-dollar method may leave behind a material residual benefit while on a proportional basis, only a small fraction of the benefits would remain.

3. Learning Objectives:

4. The candidate will demonstrate an understanding of the principles of modeling, cash flow testing and asset-liability matching, and perform related calculations.

Learning Outcomes:

- (4a) For an ALM model
 - (i) Select appropriate assumptions and scenarios
 - (ii) Model dynamic behavior of both assets and liabilities
 - (iii) Model and explain various strategies, including hedging
 - (iv) Analyze and evaluate results (including actual v. projected differences)
 - (v) Recommend appropriate strategies

Sources:

Chapter 3, Why Did ALM Become Important, Society of Actuaries

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a) Explain how two major milestones which occurred in the 1980s highlighted the importance of Asset Liability Management (ALM).

Commentary on Question:

Two appropriate explanations were sufficient for full credit. Candidates generally did well if they were able to describe how the interest rates movements impacted product development and policyholder behavior.

- 1) In the early 1980's, the short-term interest rates were at record highs, causing massive disintermediation as policyholders fled to higher yield.
 - 2) In the mid 1980's, a record decline in the level of nominal interest rates resulted in refinancing and prepayments of a large portion of insurers' portfolios.
 - 3) At the end of the 1980's, insurers pursuing higher yields often were caught taking too much credit risk in their investment portfolios.
- (b) Explain which asset has greater interest rate risk. Justify your answer.

Commentary on Question:

To receive full marks, the candidate needed to understand that convexity is broadly tied to the dispersion of cash flows. No calculations were required for full marks. Students who incorrectly based their conclusion on Macaulay (or modified) duration without commenting on convexity, only received partial credit

3. Continued

Asset A is a "bullet" (single CF @ time = duration = D, and asset B is a "barbell" with the same PV and duration as asset A but composed of cash flows (one before time D, one after). The barbell has higher convexity.

Asset B has more convexity, as greater convexity from the pattern with greater dispersion of cash flows. Convexity increases with both dispersion of cash flows and duration. As a result, Asset B has greater interest rate risk.

- (c) Calculate the following measures of interest rate sensitivity for each of the two assets:
- (i) Macaulay logarithmic convexity M^2_M
 - (ii) Measure of dispersion or logarithmic convexity M^2

Commentary on Question:

Candidates generally did not perform well in this question. Many students confused Macaulay convexity or modified convexity for Macaulay logarithmic convexity. Partial marks were awarded for formulas and for any progress made towards calculating the Macaulay logarithmic convexity or logarithmic convexity. This question could be answered with multiple approaches (formulas) and credit was awarded for all reasonable approaches.

Asset A:

$$D_M = 10$$

$$M^2_M = \sum_{t \geq 0} (t - D_M)^2 w_t; \text{ where } w_t = \frac{CF_t e^{-\delta t}}{\sum_{t \geq 0} CF_t e^{-\delta t}}$$

$$= (10 - 10)^2 (1) = 0$$

$$M^2 = v^2(C_M + D_M - D_M^2)$$

$$= v^2(M^2_M + D_M); \text{ since } M^2_M = C_M - D_M^2;$$

$$= e^{-0.03(2)}(0 + 10) = 9.42$$

3. Continued

Asset B:

$$D_M = \frac{1(1050)e^{-0.03} + 30(1127)e^{-0.03(30)}}{(1050)e^{-0.03} + (1127)e^{-0.03(30)}} = 10$$

$$M_M^2 = \sum_{t \geq 0} (t - D_M)^2 w_t; \text{ where } w_t = \frac{CF_t e^{-\delta t}}{\sum_{t \geq 0} CF_t e^{-\delta t}}$$
$$= \frac{(1-10)^2 (1050) e^{-0.03(1)} + (30-10)^2 (1127) e^{-0.03(30)}}{(1050) e^{-0.03(1)} + (1127) e^{-0.03(30)}} = 179.95$$

$$M^2 = v^2(C_M + D_M - D_M^2)$$
$$= v^2(M_M^2 + D_M); \text{ since } M_M^2 = C_M - D_M^2;$$
$$= e^{-0.03(2)}(179.95 + 10) = 178.88$$

(d) Describe how to protect each of the following under the full classical immunization model:

- Absolute surplus level
- Surplus ratio level

Commentary on Question:

Most students performed well on this question. Students who only provided general background on each immunization model, without providing methods to protect surplus, did not receive full credit.

- To protect the absolute surplus level, set:
 - Dollar duration of assets equal to dollar duration of liabilities
 - Assets with more dollar convexity than liabilities.
- To protect the surplus ratio level, set:
 - Duration of assets equal to duration of liabilities
 - Assets with more logarithmic convexity than liabilities

4. Learning Objectives:

1. The candidate will demonstrate an understanding of the principles of Risk Management.
3. The candidate will demonstrate an understanding of important risk measurement techniques along with their uses and limitations, and be able to perform risk measurement calculations.

Learning Outcomes:

- (1d) Describe how risk management techniques may be used to manage capital deployed by insurers and how they impact strategic decision making.
- (3a) Analyze and evaluate risk measures & estimators (e.g., Value-At-Risk, Conditional Tail Expectations, etc.)
- (3c) Analyze and evaluate parameter risk

Sources:

Diversification: Consideration on Modelling Aspects & Related Fungibility and Transferability, CRO, Oct 2013, pp. 4 – 14, 19 - 30

The Theory of Risk Capital in Financial Firms - Chew

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a) Define the top-down and bottom-up approaches for risk aggregation.

Commentary on Question:

Overall, this question was well answered. Candidates were able to explain that the main difference is level of granularity, and most candidates were also able to point out the difference in the way correlation is accounted for. Several candidates incorrectly stated that the difference was whether decisions came from senior management or from staff on the ground.

In a top down approach, risks are measured separately, at the sub-risk level, and then aggregation methods are applied afterwards. Correlation is explicitly specified on a broad basis between different sub-risks, for example using a variance co-variance matrix. Diversification benefits and risk relationships are not inherent within the model process.

4. Continued

In a bottom up approach, risk is measured using a joint model of risk and correlations between the different risk drivers, at a granular level. Therefore, risk relationships are integrated into the risk model. Diversification benefits are realized as part of the risk measurement process, as risks are modelled jointly together.

- (b) Describe the advantages and disadvantages of using the top-down approach.

Commentary on Question:

This question was very well answered. Most candidates were able to list at least one or two, if not more, advantages and disadvantages. The candidates who struggled were the ones who also did not answer part a correctly.

Advantages of top-down approach:

- More intuitive to understand the conceptualize
- Limits the number of dependencies that need to be estimated
- Facilitates a step-wise and potentially not central calculation process
- Easier to make the correlation matrix internally consistent, positive semi-definite

Disadvantages of top-down approach:

- Correct correlations depend on exposure to risk factors, i.e. correlation may contain error
- More approximate than a bottom-up approach, a lot of finer relationships are not captured
- Can lead to inconsistencies in the overall diversification calculation
- Less conducive to decision making at a more granular level
- Can have limitations for risk management when direct interactions between sub-risks become relevant, whereby diversification is only captured indirectly

- (c) Calculate ORD Life's risk capital requirement using the top-down approach, assuming all risks follow the normal distribution.

Commentary on Question:

This question was mostly well answered. The common theme among candidates who did not do well was ignoring part of the given information in the question, either ignoring the correlation between insurance and market risks, or ignoring the correlation between the lowest level risks. Some candidates incorrectly stated the numbers they chose to ignore "were useless".

4. Continued

Additional Commentary: This question is of the highest cognitive level (knowledge utilization) and tests the candidate's ability to synthesize information from different sources. LRM-130-15 (page 14) describes the top down approach and discusses using a covariance matrix. The candidate was then expected to use their knowledge from LRM-100-14 (page 31) to perform the calculation.

In general:

$$\begin{aligned} \text{Total capital} &= \text{sum}(\text{capital}[j] * \text{capital}[j] * \text{cov}(j,j) + \text{capital}[j] * \text{capital}[k] * \\ &\text{cov}(j,k) + \text{capital}[k] * \text{capital}[j] * \text{cov}(k,j) + \text{capital}[k] * \text{capital}[k] * \text{cov}(k,k)) = \\ &\text{sum}(\text{capital}[j]^2 + \text{capital}[k]^2 + 2 * \text{capital}[j] * \text{capital}[k] * \text{cov}(j,k)) \end{aligned}$$

First, aggregate risk capital requirement for mortality and morbidity to get insurance risk capital requirement:

$$= \text{SQRT}(100^2 + 30^2 + 2 * 100 * 30 * 0.75) = 124.0967$$

Aggregate risk capital requirement for equity and interest rate to get market risk capital requirement:

$$= \text{SQRT}(80^2 + 50^2 + 2 * 80 * 50 * -0.25) = 83.0662$$

Finally, aggregate risk capital requirement for insurance and market to get total risk capital requirement:

$$= \text{SQRT}(124.0967^2 + 83.0662^2 + 2 * 124.0967 * 83.0662 * 0.25) = 165.6929$$

- (d) IND Financial is the parent holding company of subsidiaries ORD Life and MDW Re. The latest quarter-end financial reporting for ORD Life shows an excess economic capital of 2 million, while MDW Re shows an economic capital shortage of 0.5 million.

Propose a suitable transaction with ORD Life to resolve MDW Re's economic capital shortage. Justify your answer.

Commentary on Question:

Candidates' performance on this question was a bit of a mixed bag. A high proportion of candidates were able to at least list fungibility and transferability as the core concepts to be considered in the situation, and a subset of these candidates went on to explain what each concept entails. Many candidates failed to mention either concept, and just said "ORD Life should transfer the money to MDW Re", without pointing out any possible constraints that may prevent this, or explaining the method by which a transfer can occur, essentially implying money can just be given out. While there were candidates who listed multiple options to ensure fungibility, few were able to point out the shortcomings of other options to explain why intra-group loan is the suitable transaction.

4. Continued

Fungibility and transferability are key considerations in this situation. Fungibility relates to the ownership of assets and liabilities, and the ability to determine how they are used. When capital is fungible, funds in one entity can be used to absorb losses of another entity within the group. In economic capital modelling, assets and liabilities are considered fully fungible.

Transferability refers to the actual ability to transfer funds from one entity to another entity within the group, within a certain timeframe, usually no more than 9 months. Transferability is affected by the timing and legal constraints around the availability of the assets, and is affected by liquidity considerations. The transfer affects funding level of individual entities, but does not change the total funding level at the group level.

In general, there are 5 options available for the given situation:

1. Intra-group loans: Since ORD Life and MDW Re are both subsidiaries of the same parent, MDW Re can obtain an intra-group loan from ORD Life to cover the economical capital shortage. This can be in the form of a loan or a guarantee.
2. Reinsurance: Some sort of reinsurance arrangement, with an external or internal party, can be used to transfer the risk and related capital
3. Monetize future profits/dividends: Monetize the value in force, usually with the help of an investment bank or investment fund
4. Contingent loan: obtain a loan from a bank, with repayments contingent on future surplus emergence
5. Simplify legal structures through a branching structure: profits will become automatically available, with no obligation to locally keep capital in excess of reserves

Of these options, the most suitable one for this situation is intra-group loan.

Reasons that make the other options not ideal are as follows:

- It is unclear if internal reinsurance is possible, as ORD Life may not be an entity that can assume / facilitate reinsurance
- External reinsurance, monetizing future value in force and contingent loans are transactions that involve external third parties, not ones involving ORD Life as stated by the question
- Moreover, external reinsurance may not be readily available, depending on the underlying product risks within MDW Re
- Monetizing away future value in force can have strategic implications for the total company
- Contingent loans may be difficult and/or expensive to obtain, depending on capital markets conditions
- Simplifying the legal structure may be difficult to undertake in practice, with potential legal, regulatory and tax complications

Therefore, an intra-group loan is the suitable transaction for MDW Re and ORD Life.

5. Learning Objectives:

2. The candidate will demonstrate an understanding of the various sources of risks faced by an insurer.
3. The candidate will demonstrate an understanding of important risk measurement techniques along with their uses and limitations, and be able to perform risk measurement calculations.

Learning Outcomes:

- (2c) Describe and evaluate the other risks an insurance company faces including operational, marketplace and expense risks.
- (3a) Analyze and evaluate risk measures & estimators (e.g., Value-At-Risk, Conditional Tail Expectations, etc.)
- (3b) Apply and analyze scenario and stress testing in managing risk including the calibration and setting of assumptions
- (3c) Analyze and evaluate parameter risk

Sources:

A New Approach for Managing Operational Risk – SOA Research 2008

Commentary on Question:

The main theme of this question was to test how well the candidate understood and could apply operational risk. In particular, key operational risks faced by insurance companies, the limitations of the Traditional Risk Management Method, and how one could apply the Modern Operational Risk Management (MORM) approach to an insurance company's current practice of ORM to address some of these limitations.

Part c tested the candidate on one of the key characteristics of MORM (measurement), by first proposing a suitable metric and then calculating it. Lastly, part c asked the candidate to evaluate the company's current practice, which leaned more on the Traditional method versus the MORM approach.

Solution:

- (a) Define three top-level event risk categories and how they can impact an insurance company.

5. Continued

Commentary on Question:

Part a set the stage by asking the candidate to define 3 top-level event risk categories and their impact on an insurance company. Most candidates listed other risks that did not fall in the category of event level risks. Risks such as Mortality risk or Liquidity risk were mentioned but no credit was given since they did not meet the criteria of an event level category risk. Candidates that provided Operational Risk with agent risk as an example were given partial credit. However, very few candidates got full credit for listing the appropriate risks and providing an example.

Any 3 of the following received credit:

- 1). Principal/Agent Risk, when senior management takes an undue risk due to separation of control and ownership and agents of the company will pursue actions that are in their own best interest. Example, when CEO makes a decision to increase their bonus at the expense of shareholder value.
- 2) Sales Practice, an event that may occur where an agent of the firm commits wrongdoing in the interest of the company, but at the expense of a third party., example: improper disclosure to a customer in order to make a sale.
- 3) System Failures, modeling events caused by hardware/software failures. Example: a policy illustration that shows too much investment income, thereby creating a mis-priced policy
- 4) Execution errors, when human error affects the outcome of a financial transaction. Example, entering in the wrong age on a life policy
- 5) Unauthorized Activities, Deliberate wrongdoing to benefit all parties; Example: Financial trading from a general account, or unauthorized approval of premium
- 6) Criminal and Malicious Acts, conscious wrongdoing at the expense of others; Example: an advisor stealing money from a client
- 7) Act of Nature: Events resulting in worse experience; example, hurricane or earthquake resulting in loss of life higher than expected

- (b) Compare and contrast Traditional and Modern Operational Risk Management.

Commentary on Question:

Part b then took a deeper look at the Modern Operational Risk Management method and asked the candidate to compare and contrast this method to the Traditional Risk Management method. Most candidates were able to receive full credit by comparing all the key characteristics of both ORM methods

- 1) Risk Definition: Traditional defines this as an undesirable event, such as fraud (asks, “What is the risk”). MORM defines as a measure of exposure to a loss from an undesirable event (asks, “How big is the exposure to each risk”).

5. Continued

2) Risk Identification: Traditional relies on asking managers to ID major risks. This typically leads to an unwieldy set of unmanageable risks. MORM defines the “risk universe”, using a finite set of exclusive risk classes. Hard and soft data is used to reveal the large losses.

3) Risk Measurement: Traditional calculates the risk by multiplying likelihood and severity for each risk type. MORM uses Monte Carlo simulation and frequency and severity distributions to calculate cumulative loss potential.

4) Aggregation: TORM cannot be aggregated, MORM losses can be aggregated

5) What is measured: TORM measures the routine loss, MORM measures the worst case

6) Goal: TORM aims for loss prevention, MORM aims for management of key risks

7) Cost: TORM is very resource intensive; MORM is relatively less resource intensive

(c)

(i) Propose a suitable metric to calculate the operational risk capital. Justify your answer.

(ii) Calculate the operational risk capital.

(iii) Evaluate your company’s current practice for determining operational risk capital.

Commentary on Question:

Part c tested the candidate on one of the key characteristics of MORM (measurement), by asking the candidate to propose a suitable metric and then calculate it. Lastly, part c asked the candidate to evaluate the company’s current practice of measuring risk, which currently leaned more on the Traditional method versus the MORM approach. Many candidates identified the correct measurement, CTE, as the optimal metric to use to manage risk. In addition, they were able to provide justifications to their answer. However, many did not calculate it correctly, by omitting the expected loss from the calculation. Most candidates were able to provide the basic answer to part iii correctly, by explaining that internal data is not sufficient. Again, this is consistent with the MORM approach of using hard and soft data to identify and measure risks. However, few candidates provided enough justification to receive full credit.

5. Continued

- (i) CTE (also known as TVAR) is the recommended metric. CTE reflects all the losses beyond the security level. CTE is also a coherent risk measure. VAR is not a coherent risk measure because it minimizes concerns regarding large losses.
- (ii) VAR at 99.5% is 15, so CTE_{99.5} is $(17+22+23+25+35)/5 = 24.4$. Capital is unexpected loss – expected loss, so TVAR/CTE capital is $24.4 - 1 = 23.4$.
- (iii) Capital is probably underestimated since it only relies on internal data.

External data from external peer group should be used and probably required to model frequency and severity

Hard vs soft data; top few losses from other companies are more valuable than a million of hard data points from one company

Can use hard and soft data, where soft data is based on empirical observations

Outliers should not be excluded and are more relevant for Operational Risks which often focus on large, rare events

Data classification - data should be identically distributed

Data sources - two good sources of external data may include public data and consortium data