AMA Four Data Elements

The Australian Experience

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Agenda

Introduction and Context

Internal Loss Data (ILD)

External Loss Data (ELD)

Scenario Analysis (SA)

Business Environment and Internal Control Factors (BEICFs)

Combining the Elements

Concluding Remarks

Introduction and Context

The Australian Banking System

	Year end Dec 2006		Year end Dec 2007		AMA Applicants 1 Jan '08 start	
	Number of Entities	Total Assets (AUD$bn)	Number of Entities	Total Assets (AUD$bn)	Number of Entities	Total Assets (AUD$bn)
Major Banks	4	1,550 (69%)	4	1,810 (66%)	4	1,810 (66%)
Other Domestic Banks	9	284 (13%)	9	381 (14%)	1	96 (3%)
Foreign Subsidiary Banks	10	123 (5%)	10	146 (5%)	1	53 (2%)
Foreign Branch Banks	30	242 (11%)	31	354 (13%)	0	0
Credit Unions	144	38 (1%)	139	41 (1%)	0	0
Building Societies	14	19 (1%)	13	21 (1%)	0	0
All	**211**	**2,257 (100%)**	**206**	**2,753 (100%)**	**6**	**1,959 (71%)**

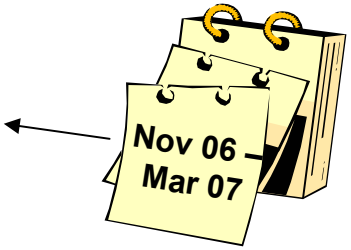
Introduction and Context

AMA Accreditation Timeline

APRA commenced work on reviewing AMA applications. This involved designing tailored visits and regular discussions.

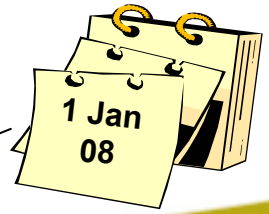
The First Round of Visits commenced in March 2006. These visits involved meeting with the operational risk teams, internal and external auditors, and senior executives of selected business units within each bank.

After the First Round of visits, APRA closely monitored gap closures. This period also involved regular discussions on various technical issues.



APRA's Second Round of visits commenced in March 2007. These visits had a stronger focus on business unit embeddedness. Sessions took place with selected business units so that APRA could assess how closely the ORM system was integrated in their day to day risk management processes.

AMA applicants who satisfied the criteria set out in APRA's Prudential Standard had their AMA models accredited for use from 1 Jan 2008



Introduction and Context

Four Data Elements

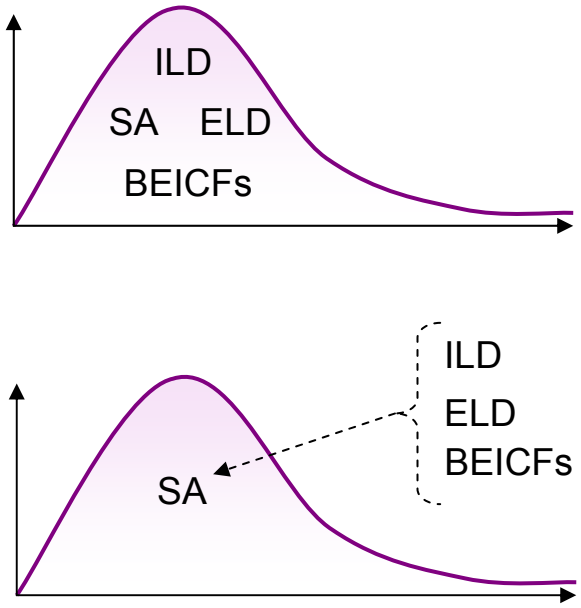
All Australian AMA banks included each of the four data elements either directly or indirectly in their approach.

Range of practice varied between:

- direct use of some combination of the elements to derive the aggregate loss distribution;

- direct use of Scenario Analysis (SA) to derive the aggregate loss distribution, with indirect use of Internal Loss Data (ILD), External Loss Data (ELD) and Business Environment and Internal Control Factors (BEICFs) via consideration in SA.

Direct and indirect use of the four elements



Introduction and Context

Information Papers – AMA Data Elements

APRA published four Information Papers covering the AMA data elements. These papers can be accessed from APRA's website: http://www.apra.gov.au/adi/ADI-Publications.cfm

- 'The Utilisation of Internal Loss Data in the Measurement and Management of Operational Risk in Australian AMA Banks', July 2008.

- 'Developing Business Environment and Internal Control Factors for Operational Risk Measurement and Management', April 2008.

- 'A Review of Correction Techniques for Inherent Biases in External Operational Loss Data', November 2007.

- 'Applying a Structured Approach to Operational Risk Scenario Analysis in Australia', September 2007.

Internal Loss Data

The value of Internal Loss Data

The collection of ILD assisted Australian AMA banks to identify, measure and monitor their operational risk exposures. Banks used ILD to identify emerging trends in their loss profile, and to alert managers to areas where action is required. An embedded ILD collection policy ensures that staff are on the lookout for loss events, which contributes to the prevention and reduction of potential future losses.

Incorporating Internal Loss Data in AMA

- Most Australian AMA banks fitted a statistical distribution to their ILD. This was largely focussed on the high frequency-low impact area of the distribution, where the quantum of data is sufficient. Some banks used an empirical distribution, rather than a parametric distribution.
- ILD feeds into Key Risk Indicators, and other BEICFs, which are used by the banks for both measurement and management purposes.
- Most Australian AMA banks use ILD as a reference source to inform the scenario assessors of relevant historical events in their scenario analysis workshops.
- Banks also used ILD to allocate total operational risk capital to individual business lines.

Internal Loss Data

Recording Loss Amounts

Gross Loss

All applicants must capture the gross loss amount, with a separate field for insurance and non-insurance recoveries.

Near Miss

The collection of Near Miss events is not required by APRA, however many Australian AMA banks incorporated them in their risk management and measurement systems. The treatment of Near Miss events varied:

- recording the maximum potential loss as the gross loss;
- recording a gross loss with a recovery; or
- recording a gross loss of $0 and including the amount either in a separate 'Near Miss' field or in the description field, for use in scenario analysis or for other decision making purposes.

Rapid Recoveries

Monies mistakenly transferred to professional market counterparties may be recovered with a high degree of certainty and within a short time period. No applicant is using these rapidly recovered losses explicitly for capital measurement. Instead, they are included implicitly through consideration in scenario analysis, and are used for management purposes.

Internal Loss Data

Thresholds for Collection and Modelling

A data *collection* threshold is the level above which all operational risk data must be collected and recorded in the internal loss database. The data collection threshold can differ from the data *modelling* threshold. Australian banks' collection thresholds have ranged from $1 to $20,000; and the modelling thresholds extend to $100,000. Some banks use different thresholds for each business unit, to maximise the usability and relevance of the data. APRA asked the AMA banks to justify their choice of thresholds.

Capturing Dates

Dates are recorded for both capital measurement and case management purposes. APRA expects the time between Discovery Date and Date Recorded to be less than 5 business days for timeliness of reporting. Australian AMA banks continue to work toward improving the timeliness of reporting.

Internal Loss Data

Boundary Issues

APRA's Prudential Standard *APS115: Capital Adequacy - Advanced Measurement Approaches to Operational Risk*, prescribes a method for the classification of credit and market risk related operational losses. This followed detailed discussion with the banks, during the AMA policy drafting period.

- Credit related operational losses must be treated as credit risk, with the exception of fraud perpetuated by parties other than the borrower (e.g. credit card fraud);
- Market related operational losses must be treated as operational risk.

Validation

All Australian AMA banks have in place formal ILD validation policies which require the business unit to record the loss and management to approve the loss. Emphasis is placed on segregation of duties to ensure the validity of loss events, and the loss database is often compared with the General Ledger as a sensibility check. Senior management and the board are informed of significant losses through escalation policies.

Internal Loss Data

Key Issues: ILD

- ILD is used for both risk management and measurement in all AMA banks, either explicitly in the modelling process or as a reference source in BEICFs and Scenario Analysis.
- Banks' ILD databases must be capable of separating insurance and non-insurance recoveries, since the inclusion of insurance as a risk mitigant must be separately approved by APRA.
- Data *collection* thresholds should maximise the utility of business unit managers. A range of data *modelling* threshold choices should be tested for their effect on the capital estimate.
- Australian AMA banks are continuing to improve the accuracy of their internal data, and the timeliness of reporting into the ILD database.
- Boundary risks are clearly defined to avoid regulatory capital arbitrage.
- Data validation is an essential process for ensuring the integrity of the loss data.

External Loss Data

The value of External Loss Data

ELD contributes to the sparse amount of low frequency-high impact data that helps to estimate the tail of an operational risk distribution. External data provides valuable information about the losses experienced by other businesses, and it assists a bank to quantify its exposure to risk events that have not been experienced internally.

Incorporating External Loss Data in AMA

- Australian AMA banks developed selection criteria to filter ELD for losses that are relevant to their operational risk profile.
- Some banks fitted a parametric distribution to the relevant ELD, and some used the data empirically. Banks used scaled data, rather than raw data.
- Most Australian banks used ELD as a reference source in their scenario analysis workshops, to provide insight into the types of events that the bank is exposed to, and the frequency and severity of an event type. Most banks experienced difficulty finding relevant ELD for their scenarios.

External Loss Data

Sources of ELD

Australian AMA banks use ELD from one or more of the following sources:

- **Publicly Available Data**: Public databases generally only contain very large losses which are likely to attract the attention of media. Some risk types (e.g. fraud) are more likely to attract attention than others (e.g. execution, delivery and process management). The loss amounts published are unlikely to be accurate, since they may not include all of the costs associated with the event, and they are typically subject to rounding. However, public data is desirable since it discloses the identity of the bank that suffered the loss, which is useful for scaling purposes.

- **Consortium Data**: Consortium facilitators compile non-public data from member institutions and provide anonymous statistical analysis and basic loss information. To ensure the anonymity of the consortium members, all identifying information is removed from each loss, making any meaningful analysis and scaling of the data difficult.

- **Insurance Data**: Provided by insurance brokers, the data originates from operational risk related insurance claims. The risk types and severity ranges likely to be included in insurance data depends on the types of policies taken by the banks, and the policy deductibles. The data will cover only those risk types which are insurable.

External Loss Data

Reporting Bias

Reporting bias means that the available loss data is not representative of a random sample of the population under consideration. Reporting bias is evident in all three sources of ELD:

- **Consortium Data:** The data thresholds used by the individual banks may differ from the threshold used by the consortium. This will distort the quantiles of the data. The individual thresholds can not be observed, since the data must be aggregated to preserve anonymity.
- **Insurance Data:** Insurance data represents the portion of operational risks that have resulted in insurance claims. The bias arises from the policy terms and conditions, and the size of the deductible.
- **Public Data:** Reporting bias arises because the probability that a loss is reported by the media tends to increase with the severity of the loss. Consequently, the proportion of large losses tends to be overstated.

Some Australian AMA banks used a statistical function to correct for reporting bias in their ELD. These functions increase the frequency of the losses across severities, with the amount of the increase dependent on the severity. This approach makes up for the missing data, particularly for smaller losses which tend to be underreported. This ensures that banks' ELD distributions reflect both reported and unreported losses.

External Loss Data

Control bias

Control bias arises because different banks operate under different control environments. This affects the homogeneity of the data, and the relevance of a data point to an individual bank. Banks can filter the data to obtain a subset that is relevant to their own operations and control structure. However, Australian banks have acknowledged that it is difficult to judge the internal control environment of other banks, so the potential for scaling in this area is limited. The problem is exacerbated if external data is anonymised.

Scale Bias

Scale bias occurs because the losses recorded within each database come from banks of different sizes, in terms of their operations, assets, number of employees, revenue, and so on. Some studies have shown that a relationship exists between the size of a firm and the severity of the loss. However, there is no consensus on which is the best proxy measure which captures this relationship.

Most Australian banks employed some form of scaling of external loss data. APRA required each bank to document the rationale and assumptions behind its scaling method, and to support the choice of scaling with references to academic literature. AMA banks were asked to describe the effect of scaling external data on the operational risk capital requirement using sensitivity analysis.

External Loss Data

Key Issues: ELD

- Australian AMA banks use ELD from three sources: Publicly available data, Consortium data, and Insurance data.
- ELD is used for both operational risk measurement and management purposes.
- ELD has a number of inherent biases, including reporting bias, control bias and scale bias. Unless corrected, these biases will transfer to biases in the operational risk distribution, and hence the capital estimate.
- Research is continuing in this area, and the challenge remains for Australian AMA banks to keep up with industry developments.

Scenario Analysis

Scenario Analysis

Scenario Analysis typically involves the examination of rare, significant, yet plausible future events, taking into consideration the alternative possible outcomes for those events, and assigning probabilities to the various scenarios. Australian banks conduct scenario workshops annually, with semi-annual reviews. Range of practice has varied by the workshop structure, content, and the wording of questions asked of participants.

The level of understanding of scenario workshop participants has varied, both within and between applicants. This has largely depended on the wording of the questions asked, the training given prior to or during the workshops, and the level of guidance and challenge provided by the group operational risk function.

Scenario analysis provides an important link between the measurement and management of operational risk. SA is an area where banks observed a high level of commitment from managers. This benefit has been particularly strong where SA results are used to determine the capital allocation to business units. A challenge arises since there is an opportunity for managers to game the capital number by deliberately undervaluing scenario assessments for their business unit. A challenge process is used to ensure that the assessments are valued appropriately.

Scenario Analysis

Incorporating Scenario Analysis in AMA

• Most Australian AMA banks used the results from SA to parameterise their operational risk distribution. Some banks went further and elicited information to select the *type* of distribution assigned to each risk.

• Scenarios were also used indirectly, to stress test the ability of the capital to withstand extreme events or conditions. Banks compared their capital to individual scenarios, and considered cases where two extreme scenarios occurred simultaneously.

Overcoming scenario challenges

Traditional arguments against using scenario analysis are that it is too subjective, and that it is too difficult to make estimates accurately.

• Subjective input is necessary to fill in gaps in the data, and to ensure that the model outcomes reflect the current operational risk profile of the bank. Subjective scenario assessments allow banks to include risks for which data may be unavailable, and subjective expert opinion effectively scales the data to the current environment, unique to the bank.

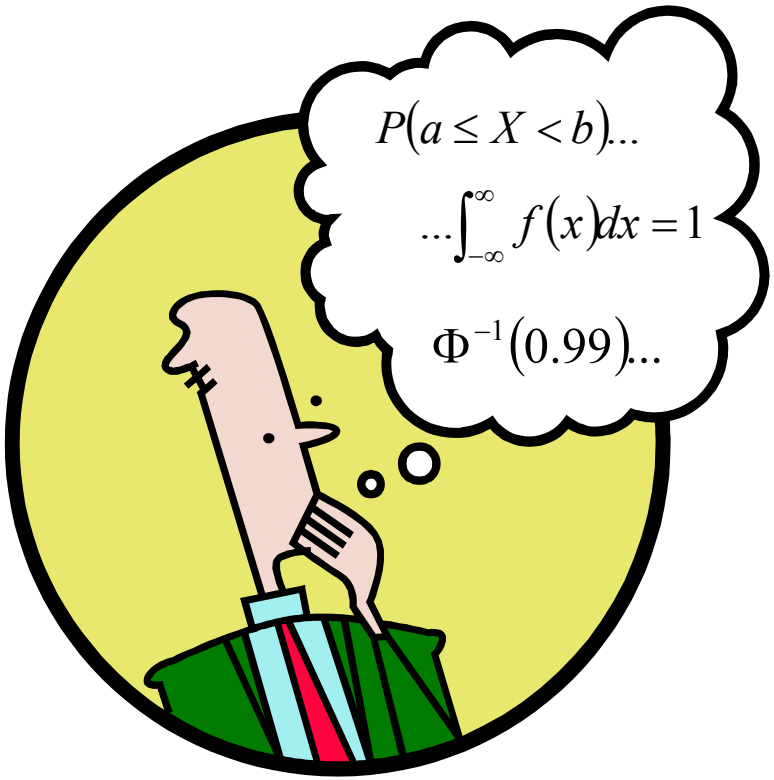
• Academic literature spanning over thirty years is available on the development of sound and pragmatic principles for eliciting subjective probabilities from experts. Much of this work is informed by the research of psychologists and others into the nature of the difficulties that ordinary people have in specifying probabilities. Banks can leverage off this research and the work of other industries, to develop a structured approach to scenario analysis, that reduces subjectivity and assists experts to quantify their beliefs accurately.

Scenario Analysis

Experts and Facilitators

Expertise in a business area is not the same as expertise in Probability and Statistics. Business unit staff, or subject matter experts, may possess the requisite knowledge, and have a good feel for how often a scenario may occur, and how severe it could be. However, they often have trouble translating their beliefs into probabilistic terms, such as *frequency*, *impact*, *percentiles*, *conditional distributions*, and *confidence intervals*. This can lead to scenario assessments that are poorly calibrated or internally inconsistent, and do not reflect the underlying beliefs of the expert.

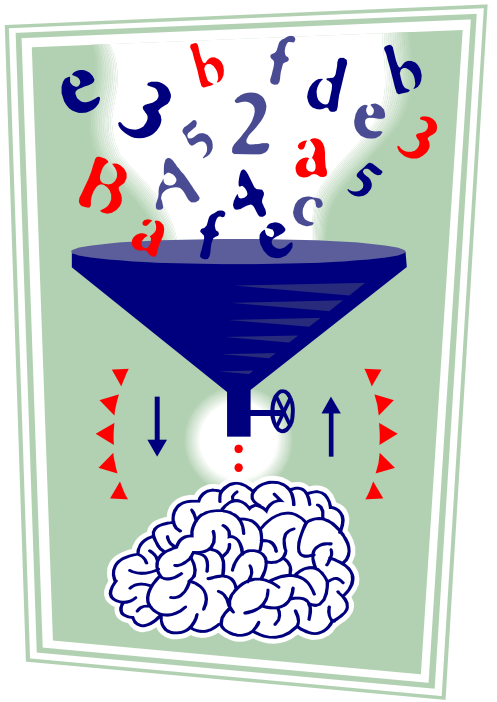
The use of a facilitator with skills in probability assessment techniques can assist the subject matter experts to interpret statistical terms and concepts, and can identify any inconsistencies or biases that may arise.



Scenario Analysis

Scenario assessment biases

Human limitations, in the ability to process data and information, can often lead to assessments that are poorly calibrated or internally inconsistent.



Availability – assessments depend on our memory, or our ability to imagine an unfamiliar scenario.

Anchoring – presenting workshop participants with internal or external loss data that anchor their assessments on those values.

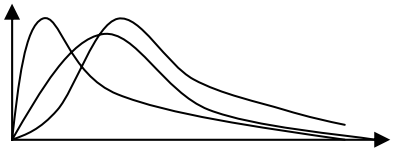
Partition Dependence and Granularity – Dividing the set of possible outcomes into 'buckets' or ranges can potentially increase the level of uncertainty in the estimate. If the ranges are too narrow, the subject may be unable to decide which band to choose; if too wide, they may feel that their answer is uninformative.

Motivational Bias - managers have an incentive to understate potential losses in order to reduce the capital that is allocated to their business unit. Managers may feel uncomfortable making scenario assessments at extreme percentiles, and may become defensive when asked to consider the fallibility of their controls.

Scenario Analysis

Challenge and Validation of Scenario Assessments

$$\sum \sum f(w_i, x_i, \rho_{i,M})$$



Mathematical Approach

The assessments are elicited individually and then aggregated using a weighting approach. The weights can be determined based on the level of expertise of each expert. This method should consider the lack of independence due to the common knowledge of the experts. This method has been criticised because the final result is not really an expert opinion.

Behavioural Approach

A group of experts share information between themselves and establish a consensus assessment. This approach promotes discussion and awareness of risk exposures for management purposes and hence is better aligned with the Basel II Framework. All Australian AMA banks used the behavioural approach.

Scenario Analysis

Challenge and Validation of Scenario Assessments

Some banks have used graphical or other feedback to validate the statistical distributions they have derived from the expert's responses. This helps to ensure that the SA inputs to the model accurately reflect the experts underlying beliefs, and that none of the information was distorted in its translation to a statistical distribution.

Scenario Analysis Documentation

Applicants are required to provide documentation of the rationale and assumptions used to make scenario assessments in the workshops. This provides a means for those outside the workshops to assess the level of understanding of the participants and their interpretation of the assessment questions.

Thorough documentation assists in the challenge and validation of scenario assessments. The Group operational risk function should ensure that scenario assessments are consistent between business units, and that assessments are well-reasoned. Challenge processes can be strengthened and tightened to ensure greater consistency and robustness of assessments through time and across the organisation.

Scenario Analysis

Key Issues: Scenario Analysis

- APRA expects the Australian AMA banks to continue to improve the design, conduct, understanding and use of the scenario process. This includes identifying and mitigating biases, improving understanding of the quantities and risks being assessed, and ensuring that scenario assessments more accurately reflect experts' underlying beliefs about future outcomes.
- Academic literature covering scenario analysis and elicitation methods provides opportunities to enhance the robustness of the elicitation process.
- The use of a facilitator with elicitation skills can assist the subject matter experts to interpret statistical terms and concepts, and can identify any inconsistencies or biases that may arise.
- Graphical or visual playback can be used to verify that the elicitation is consistent with the expert's underlying beliefs.
- Thorough documentation provides transparency for third parties to interpret the rationale behind the assessments, and allows the evaluation of consistency within and across assessments.

Business Environment & Internal Control Factors

Business Environment and Internal Control Factors (BEICFs)

- **Business Environment Factors** are the characteristics of a bank's internal and external operating environment that create operational risk exposures. *Internal* factors include the size and volume of business, or the skills and turnover level of the staff. *External* factors include the economic, legal, regulatory, geographic and natural environments.
- **Internal Control Factors** reflect elements of the bank's internal control system that are used to mitigate its risk exposures. Controls can be preventative, detective or remedial, although these classifications are often blurred in practice.

Key considerations

- Which BEICFs drive the Operational Risk profile?
- Does a BEICF influence the frequency or severity of a risk exposure, or both?
- Is the relationship between a BEICF and a risk exposure linear or non-linear?
- Could that relationship change over time?

Business Environment & Internal Control Factors

Key Risk Indicators

BEICFs can be used to construct Key Risk Indicators (KRIs), which can measure the level of, and changes in, the bank's operational risk profile. KRIs can be *leading* or *lagging*, and banks should use a balance of both types of indicators. The timely use of leading indicators can provide an early warning signal for trouble ahead, allowing management to act appropriately and avoid potential losses. Whilst this opportunity is ideal, the development of predictive (leading) KRIs remains a challenge for Australian AMA banks.

Capturing BEICFs data

The data required to measure BEICFs includes both *objective* data, such as revenue or staff turnover, and *subjective* data, such as the level of complexity or the pace of change.

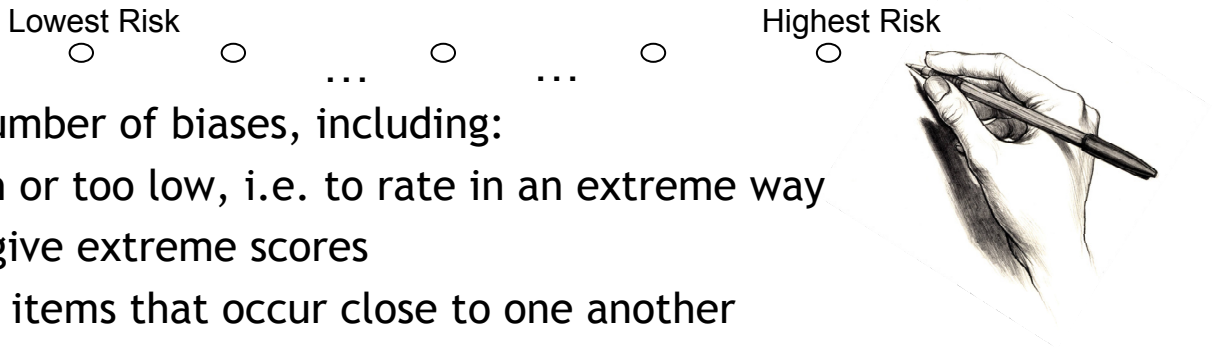
Business Environment & Internal Control Factors

Using Scorecards to measure BEICFs

Some Australian banks used Scorecards to measure their BEICFs. The effectiveness of this method depends on how the response scale is constructed, and the recognition of biases in the respondents' answers.

Constructing Scales

The banks must choose the number of points on the scale. A highly granular scale (lots of points) can introduce spurious accuracy, whilst a sparse scale (too few points) may fail to capture information precisely. For some types of scales, an odd number of points can be used to provide a middle or neutral option, whereas an even number of points will force a decision either way. Australian AMA banks' scales range from three points to nine points, with a mixture of odd and even numbered scales being used.



Scorecard Biases

Respondents' scoring may exhibit a number of biases, including:

- **Leniency:** tendency to rate too high or too low, i.e. to rate in an extreme way
- **Central tendency**: a reluctance to give extreme scores
- **Proximity**: give similar responses to items that occur close to one another

Some Australian banks overcame these biases by objectively defining each point on the scale, to reduce open interpretation. Others used the *relative* scores, rather than the absolute scores, to eliminate the bias effects.

Business Environment & Internal Control Factors

Aggregating BEICFs

There are potentially hundreds of BEICF metrics that can be constructed, and some are more useful than others. Using too many metrics can be burdensome and difficult for management to interpret. Alternatively, aggregating the metrics into a summary measure can disguise underlying issues and make it difficult for managers to identify where and when they need to take action.

Aggregating BEICFs presents challenges because the individual factors are measured using different units, each has different tolerance thresholds, and some factors deserve a higher importance weighting than others. Indeed, Australian AMA banks who aggregated BEICFs using addition or arithmetic averaging often found that the aggregate scores do not reflect the true level of risk, and that a more sophisticated approach may be required. However, due to the lack of consensus on optimal aggregation methodologies, the meaningful aggregation of KRIs remains an ongoing challenge for Australian AMA banks.

Business Environment & Internal Control Factors

Incorporating BEICFs in AMA

• **Directly model:** Some banks used BEICFs to quantify their risk exposures. The results are used to set parameters for the statistical distributions used to calculate operational risk capital.

• **Consideration in Scenario Analysis:** Most Australian banks considered BEICFs in their Scenario Analysis process. BEICFs can assist the scenario assessors in tailoring their estimates to reflect the current risk profile. Scenario assessments of frequency and severity should adjust to reflect changes in BEICFs, with supporting documentation explaining the rationale behind the changes.

• **Allocation Mechanisms:** Some Australian AMA banks used BEICFs to allocate Group OR capital to the business units. The intention is that the business units hold capital commensurate with their residual risk profile. Allocations are typically calculated using scorecards. The Australian banks' Group OR Functions play a role in checking for consistency in interpretation of the scorecard across business units.

• **Interim Adjustments:** BEICFs were used by Australian banks to update the capital estimate, reflecting changes in the risk profile that occur between the annual formal capital calculations.

Business Environment & Internal Control Factors

Key Issues: BEICFs

- BEICFs provide a key link between the measurement and management components of the AMA
- Quantifying a set of risk metrics can be challenging, but worthwhile as they provide a useful management tool for decision-making, driving behaviour, and promoting accountability between management layers.
- The Basel II deadline saw banks developing their KRI programs under pressure, and there remains scope for improvement within the banks, across the industry, and internationally.
- BEICFs are a means by which banks can improve their understanding of the nature of operational risk, including analyses of root causes and effects.
- The exercise of setting suitable thresholds and monitoring indicator trends promotes discussion and awareness of risk management issues, and helps to direct management attention toward risk, not just performance.
- BEICF programs are expected to become a tool that is willingly embraced and fully embedded within the banks' management culture, and not just the offshoot of a regulatory compliance exercise.

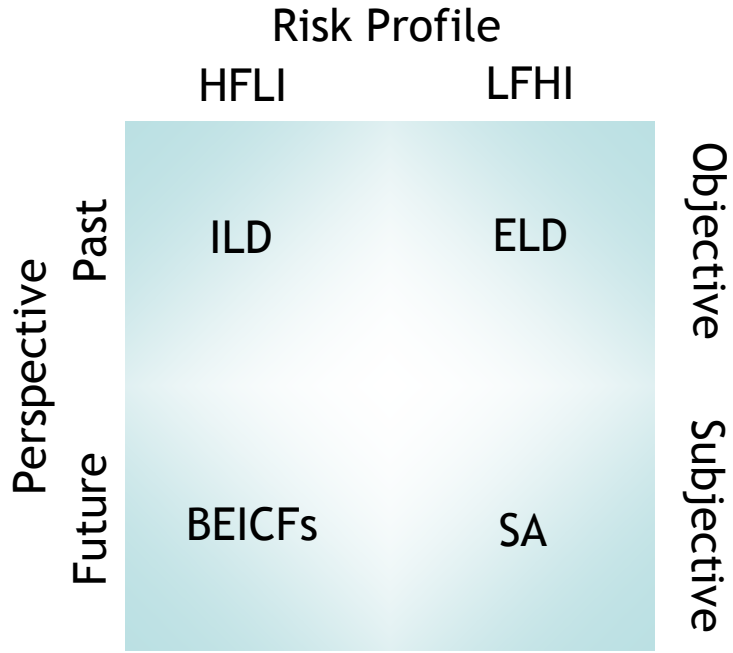
Combining the Elements

Combining the Four Data Elements

Most Australian banks found that their internal loss data and BEICFs are more relevant for the high frequency-low impact (HFLI) area of the operational risk distribution, and external loss data and scenario analysis are more useful for investigating the low frequency-high impact (HFLI) 'tail' of the distribution.

Scenario analysis and BEICFs provide a forward-looking perspective, to balance the historically based internal and external loss data.

The use of all four data elements provides a balance of objective and subjective data. Subjective input is useful for making up for the limitations of the available data, such as when the data contains gaps, is only partially relevant, or is out of date.



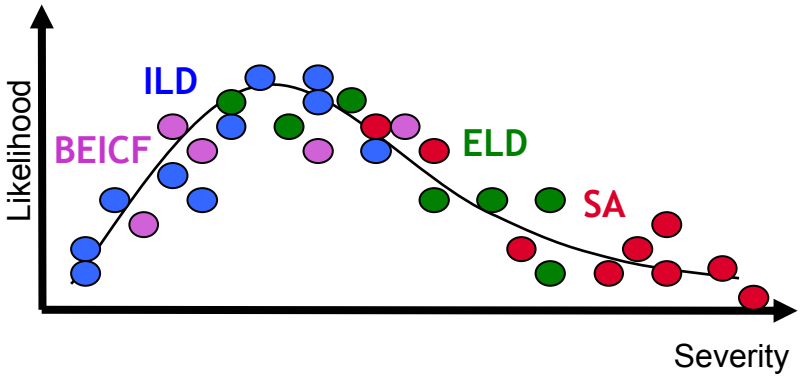
Combining the Elements

Model Combinations

Australian AMA banks have taken a variety of approaches to combining the four data elements.

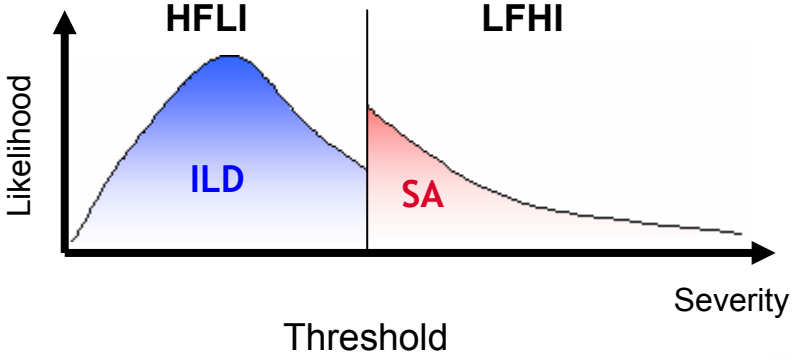
Mixing

Some banks mixed two or more of the data sources to create one data set. Banks using this approach were faced with the additional uncertainty that arises when combining data from different underlying distributions, i.e. the data source is not homogeneous.



Splicing

Some banks spliced the distribution, modelling the HFLI and LFHI regions separately, based on different data elements. Banks using this approach were asked to justify their choice of threshold. This included investigating the sensitivity of the final capital estimate to the threshold choice.

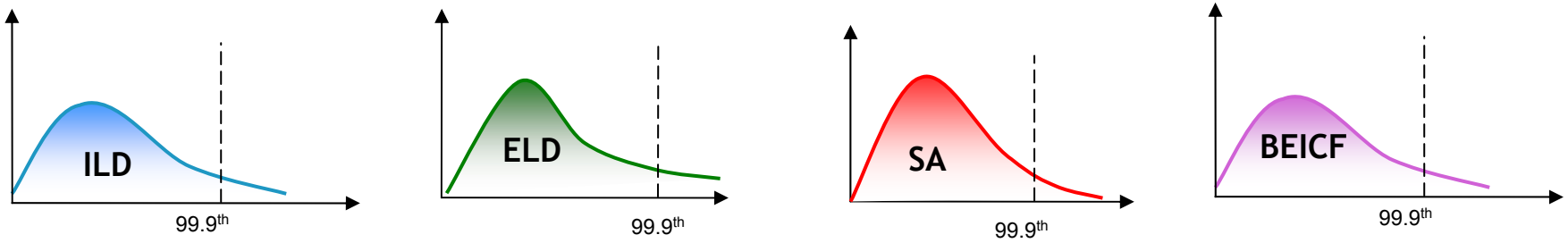


Combining the Elements

Model Combinations cont.

Model Independently

Some banks modelled the data elements independently. The capital was calculated as a weighted average of the 99.9th percentile of the individual distributions. Banks using this approach were asked to justify the choice of weights used to calculate the final capital estimate.

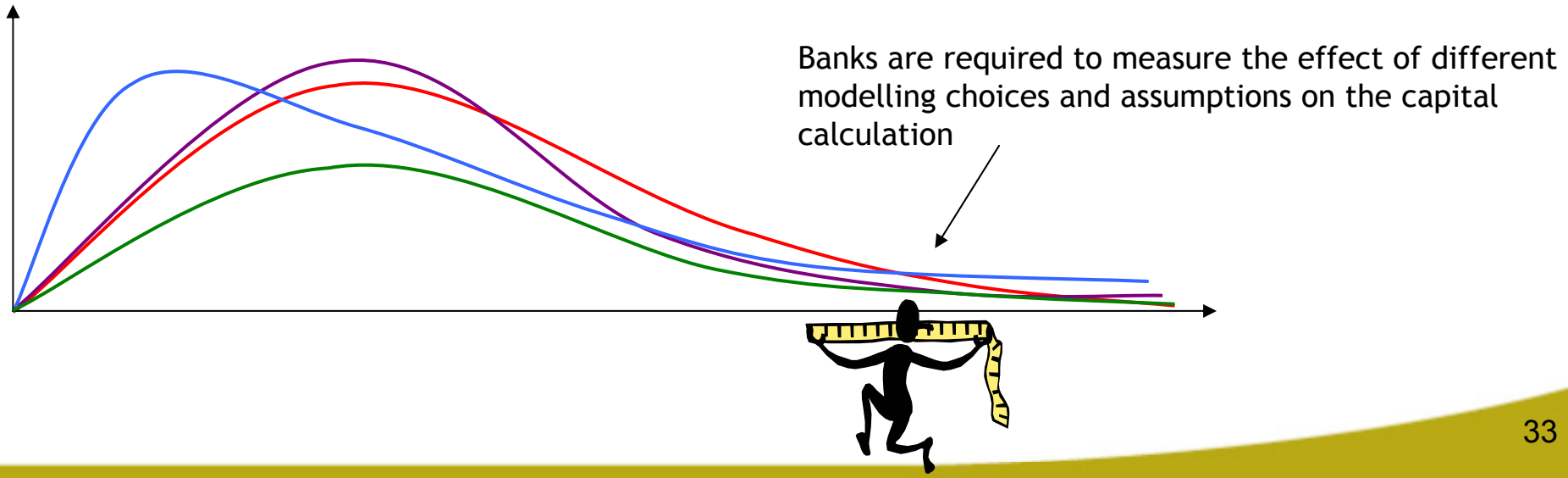


Total OR Capital = a*ILDcapital + b*ELDcapital + c*SAcapital + d*BEICFcapital

Combining the Elements

Model Uncertainty

- Given the uncertainty involved in the operational risk modelling process, Australian banks must ensure that they are conservative in their modelling choices and assumptions, and give consideration to the results of sensitivity analysis.
- Sensitivity Analysis is the study of how the variation or uncertainty in the *output* of the model can be attributed to different sources of variation in the *input* of the model. The degree of conservatism embedded in banks' modelling choices should be commensurate with the amount of model uncertainty as measured by sensitivity analysis.



Combining the Elements

Key Issues: Combining the Elements

- The four elements complement each other, providing a mixture of both historical and forward looking perspectives, objective and subjective inputs, and covering both the high frequency-low impact and low frequency-high impact ends of the spectrum.
- Australian AMA banks combined the data elements using techniques such as mixing, splicing, and modelling the elements independently. For each choice, banks justified the weighting of the elements in the final distribution, or the threshold in the case of splicing.
- APRA asked AMA applicants to investigate the effects of their modelling choices and assumptions on the final capital estimate. This was achieved using sensitivity analysis.
- Australian AMA banks continue to work towards improving the quality of the data captured under each of the four elements. As the quality and quantity of data for each element improves over time, the relative weighting of the elements in the AMA methodologies may be altered as a consequence.

Concluding Remarks

Concluding Remarks

APRA and the Australian AMA banks continue to work towards improving the quality and use of the four data inputs. This includes:

- ILD: accuracy and timeliness of reporting;
- ELD: addressing reporting bias, control bias and scaling;
- SA: addressing availability bias, anchoring, partition dependence and motivation bias, and improving managers' understanding and use of the SA process;
- BEICFs: improving quantification methods, timeliness of capture and use of BEICFs, including the development of more predictive (leading) KRIs

The appropriate weighting of the four elements in the final capital estimate remains a challenge. The 2008 Loss Data Collection Exercise currently underway through BIS/AIGOR will assist banks and regulators to benchmark the relative weighting of the elements under the variety of methodologies used by AMA banks.