

Operational Risk Management: A Practical Approach and its Regulatory Implications

Federal Reserve Bank of Boston

November 2001

Operational Risk: Is a change required?

Command and Control

Branch Operating Manual
Mandated Controls
Audit
Monitoring resolutions of audit findings

Operational Risk is managed through better controls and better audit process

Managing Operational Risk Based on doing more of the same only better

Inspire and Lead


Guiding Principles
Boundaries
Structured Self Assessments of Risk
Monitoring of OP Risk Levels

Operational Risk is managed through better risk identification and transparency of risk taken

A New Paradigm for Managing Operational Risk Based on \$ at Risk

Under The New Paradigm

To Effective Manage Op Risk Business Leaders need to be able to know how much \$ are at Risk? More precisely answer these questions

- 
- What are my biggest operational risk?
 - What hits can I expect my P&L to take from my biggest operational risk?
 - How bad can those hits get?
 - How bad can those hits really get?
 - How will changes to my business strategy or control environment affect those hits
 - How do my potential hits compare internally or externally

At Bank
At SBU
At BU
at BL

How is operational risk measured

Objective of Measuring Operational Risk

- Provide an accurate view of the operational risk profile of the business over the next 12 months.
 - ▶ What is the expected losses from operational risk
 - ▶ What is the Worst Case Loss from operational risk
- Supports the analysis of Operational Risk
 - ▶ What are the top Op Risk
 - ▶ What is the Worst case loss under stress conditions
 - ▶ How will changes to my business strategy or control environment affect the potential.
 - ▶ How does the potential hit compare with other business units or other banks

Measuring Operational Risk For better Management

Based on analytic techniques widely used in the insurance industry to measure the financial impact of an operational failure

- **The foundation is**

- the historical operational loss experience
- deep understanding of what and why is at risk

- **The edifice is business judgement**

- similar to putting together a business plan
- judgement is used to supplement/ replace or enhance historical loss experience based inputs
- follows the same rigorous process as if all the inputs were historical loss data

- The measure is called OP VaR

- used for determining

- the expected loss from operational failures
- the worst case loss at confidence level
- the required economic and regulatory operational risk capital
- concentration of operational risk

First Step

Recognise Distinct Operational Risk Losses Types

1. Legal Liability:

includes client, employee and other third party lawsuits

2. Regulatory, Compliance and Taxation Penalties

includes fines, or the cost of any other penalties, such as license revocations and associated costs - excludes lost / forgone revenue.

3. Loss of or Damage to Assets:

reduction in value of the firm's non-financial asset and property

4. Client Restitution

includes restitution payments (principal and/or interest) or other compensation to clients.

5. Theft, Fraud and Unauthorized Activities

includes rogue trading

6. Transaction Processing Risk

includes failed or late settlement, wrong amount or wrong counterparty

For a line of business and loss type: The worst case loss (WCL) over the next 12 months

$$\begin{aligned} \text{WCL} &= \text{Expected Losses} \times \gamma \\ &= \text{Expected no of Losses} \times \text{Average Loss} \times \gamma \end{aligned}$$

Expected no of losses the average number of legal liability, or transaction errors, or frauds etc over the next 12 months.

Average Loss the average amount lost per legal liability, or per transaction error, or per frauds etc over the next 12 months

γ Factor to convert the expected loss to worst case loss

WCL Expressed in terms of Components of Expected Losses and Average Loss

$$\begin{aligned} \text{WCL} &= \text{Expected losses} \times \gamma \\ &= \text{Expected no of Losses} \times \text{Average Loss} \times \gamma \\ &= E_f \times PE_f \times E_s \times \text{LGE} \times \gamma \end{aligned}$$

E_f = **Exposure for no of losses**
eg no transactions, no of accounts, no of employees

PE = **Expected Probability of an operational risk loss**
eg Expected number of loss / the number of transactions

E_s = **Exposure for loss amount**
eg Avg transactions value, Avg accounts value, Avg employee compensation

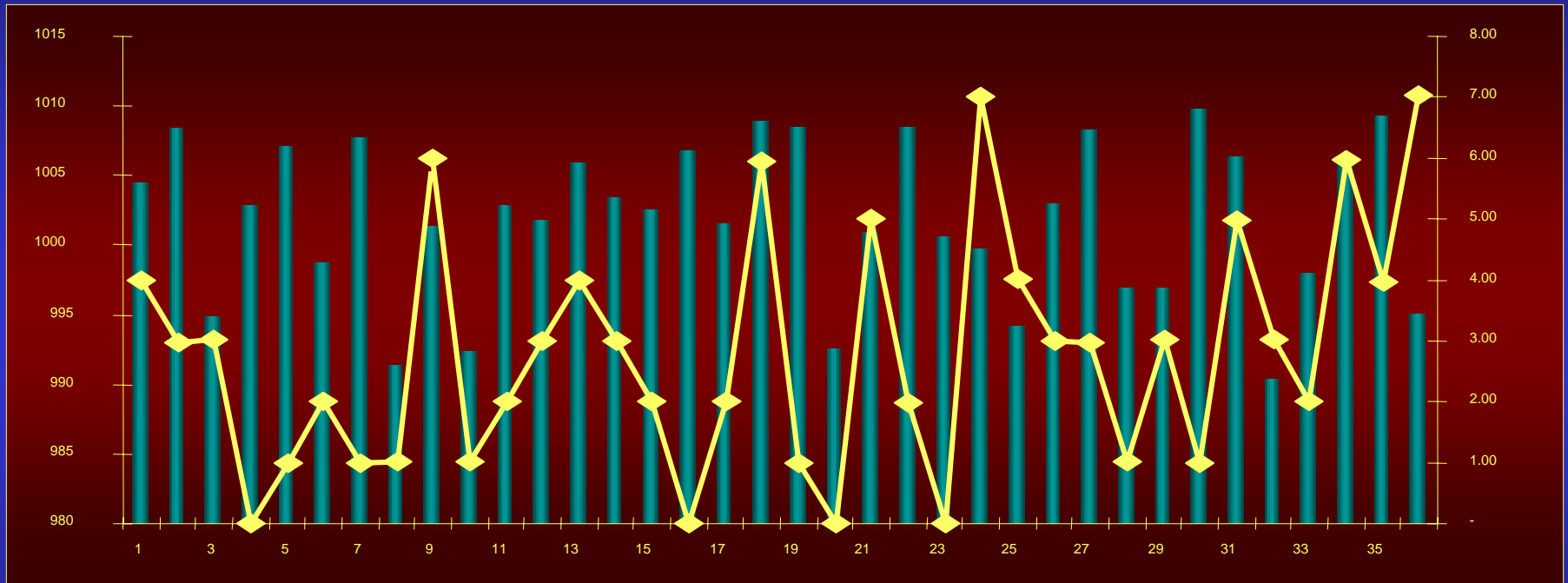
LGE = **Average Loss Given Event Rate**
eg average loss / Avg transactions value

γ = **Factor to convert the expected loss to worst case loss**

Op Risk Measurement Process

Calculation of the Frequency (PE)

Frequency (PE)



No of losses/ no of trades

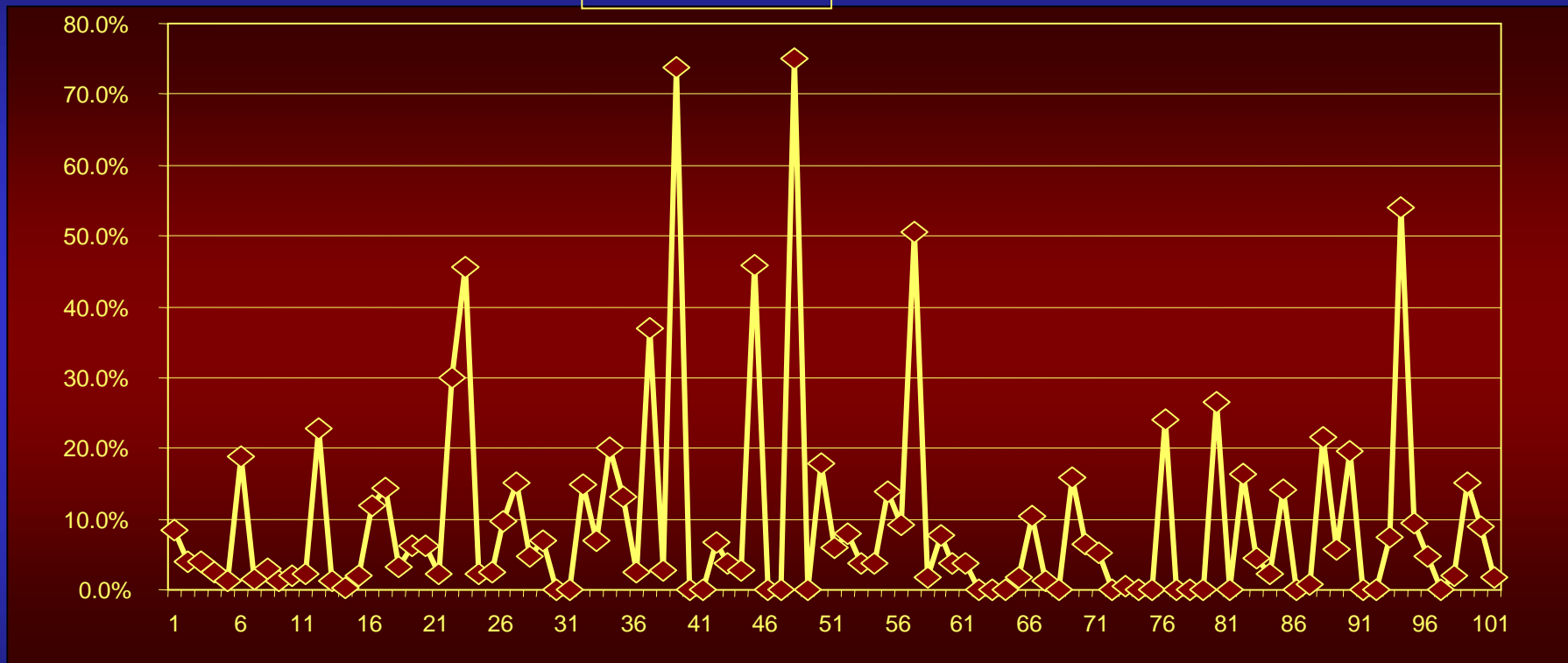
PE = 2.8 per 10,000 Trades

can be desegregated for different type of trades
or trade processing systems)

Op Risk Measurement Process

Calculation of the Severity (LGE)

Severity (LGE)

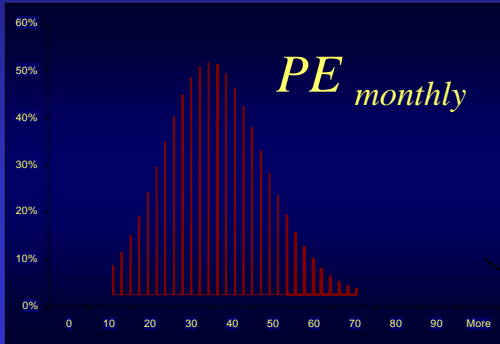


Amount of loss /average trade amount

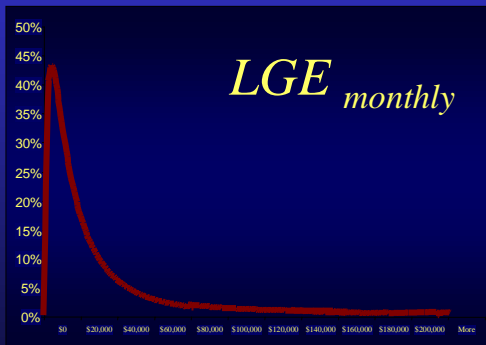
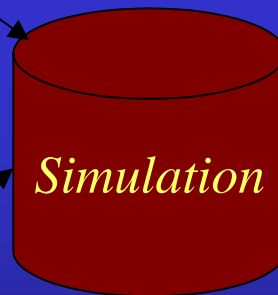
LGE = 9.8 % of Avg. Trade Value

Statistical Distributions and Simulate

Function and Parameters

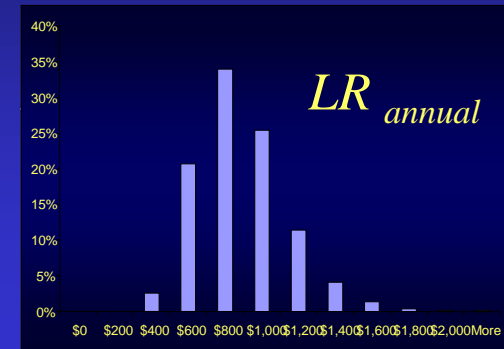
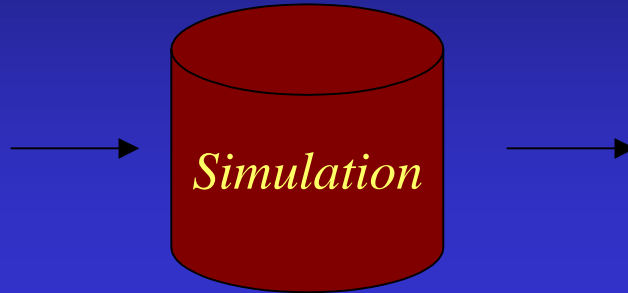
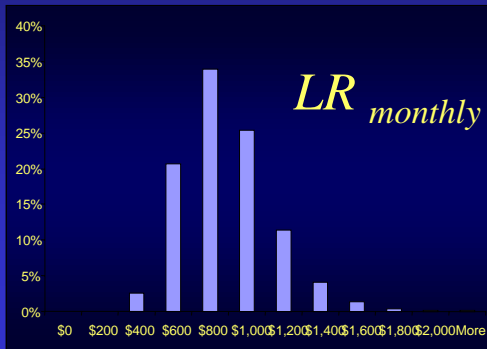


Function Poisson
Mean PE 2.8 losses per
10,000 transactions
Std PE 2 events
10,000 transactions



Function LogNormal
Mean LGE 9.8 %
Std PE 15%

Annualize the Losses And Estimate Exposure



Av Loss Rate	8%
WCL	40%
Gamma	5

With an Exposure of \$10mm the expected loss is \$.8mm (\$10mm x 8%) and the worst case loss is \$4mm (\$10mm x 40%)

How Credible is the Result

- Compare the PE and LGE derived from internal loss history with industry PE and LGE

Example

- ▶ if external loss history shows one event per month
 - the internal loss history of 36 months is sufficient to determine with confidence the actual PE
- ▶ if external loss history shows one event in 10 years
 - the internal loss history of 36 months is not sufficient to determine with confidence the actual PE or the internally calculated PE is not credible
- ▶ When internal data is not credible, then the

$$\text{actual PE} = z_i \text{PE}_i + z_e \text{PE}_e$$

- ▶ Z are credibility factors and there are standard statistical methods for determining Z's

Using external data

Insufficient internal loss data is supplemented with industry loss data

	Risk Types	TP					
LOB							
BU A		Loss rate/ Exposure base \$ value of Transactions			...		

Firm Specific Risk

TP

derived from internal data



General Industry Risk

TP

derived from industry data



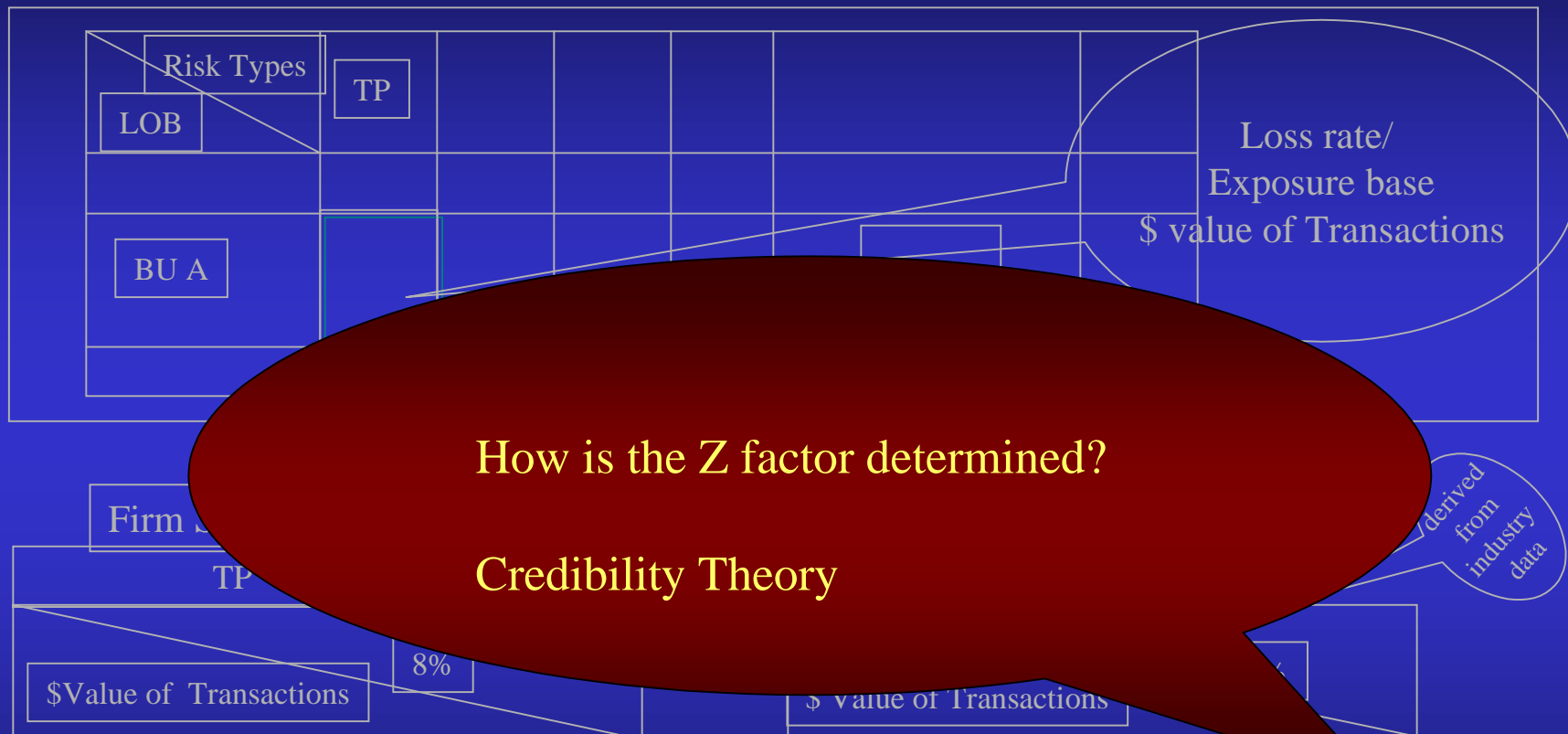
$$\text{Capital} = \$\text{Value of Transactions} \times (\text{specific loss rate} + \text{general loss rate}) \times \gamma$$

$$\$4\text{mm} = \$10,000\text{m} \times \{ (Z)(8\%) + (1-Z)(12\%) \} \times 5 \quad Z = 1$$

$$\$4.6\text{mm} \quad Z = .7$$

Using external data

Insufficient internal loss data is supplemented with industry loss data

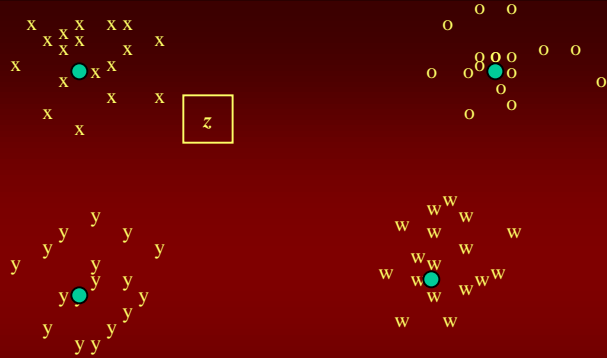


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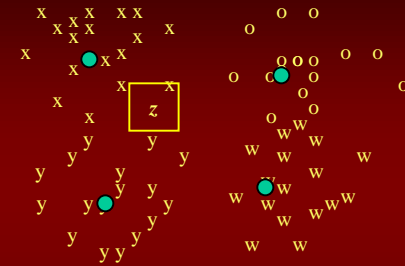
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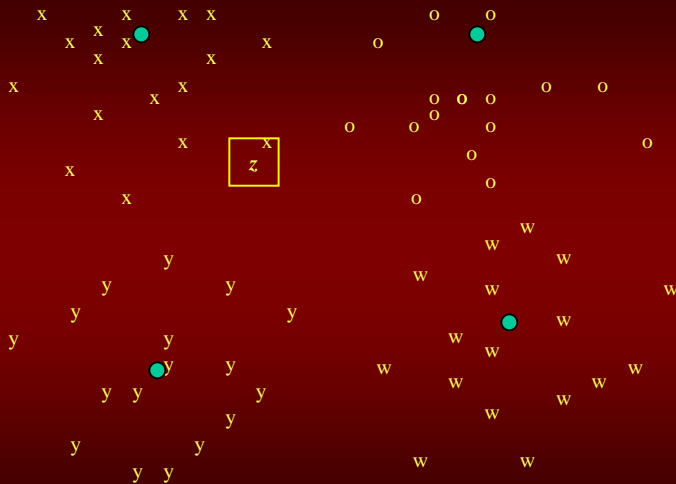
Credibility



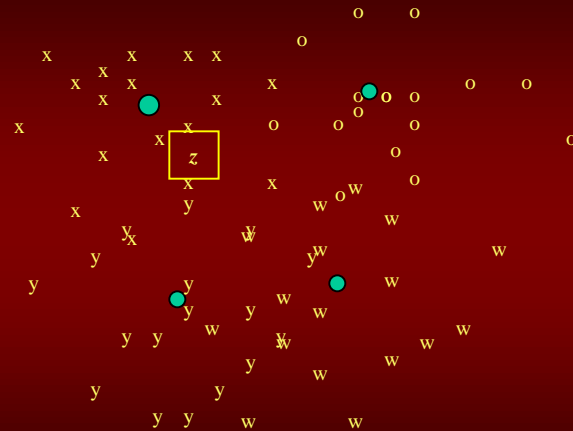
Means Are far Apart, Strong Clustering



Means Are Close, Strong Clustering



Means Are far Apart, Weak Clustering



Means Are Close, Weak Clustering

How Credible is the Result

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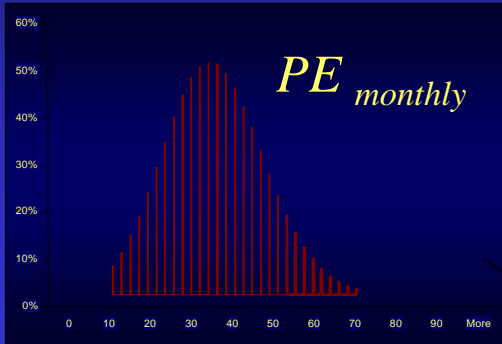
$$PE = z_i PE_i + z_e PE_e$$

- ▶ What happens when external data is insufficient
- ▶ credibility factors and there are standard statistical methods for determining Z's

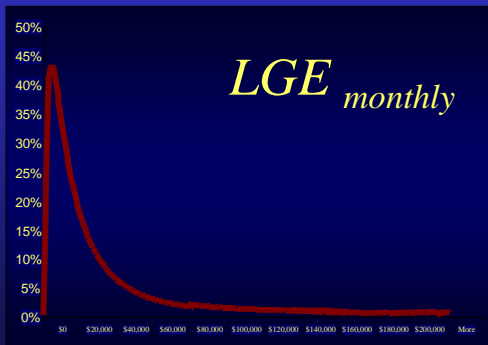
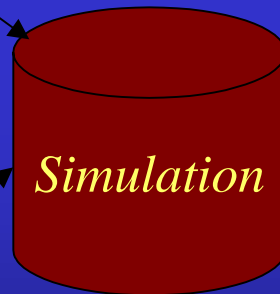
Scenario Analysis

Function and Parameters

These are estimated using Business and Risk Management Judgement



Function Poisson
Mean PE 2.8 losses per 10,000 transactions
Std PE 2 events 10,000 transactions



Function LogNormal
Mean LGE 9.8 %
Std PE 15%

Incorporating Scenario Analysis

$$\text{actual PE} = z_i \text{PE}_i + z_e \text{PE}_e + z_s \text{PE}_s$$

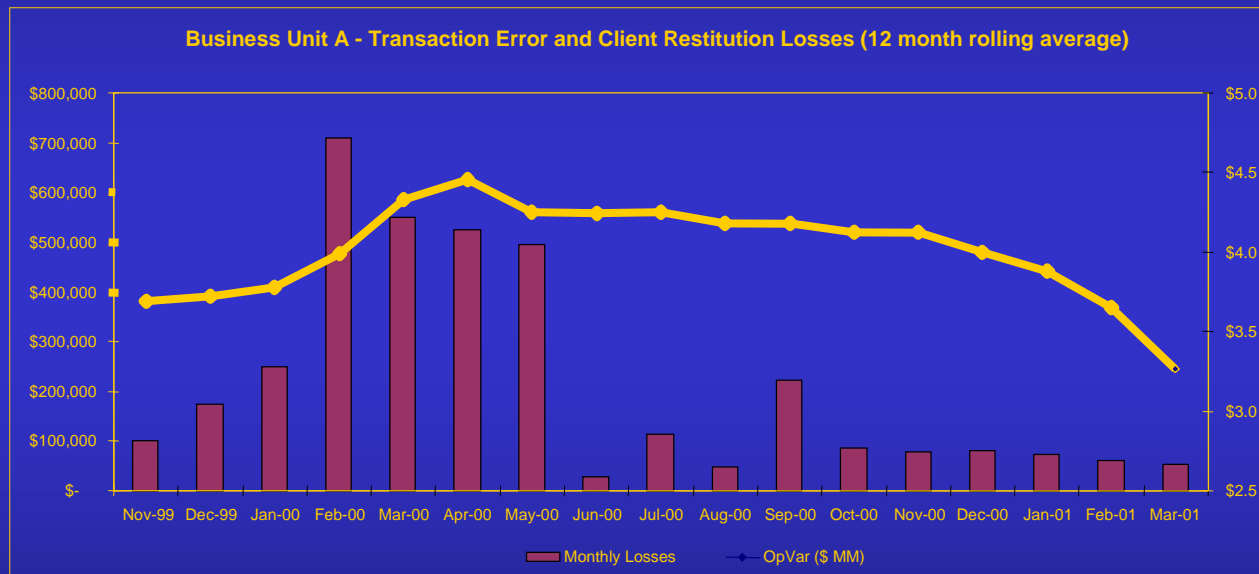


These are estimated using
Statistics

These are estimated using
Business and Risk Management
Judgement

Op VaR Reflects Changes in PE and LE over time

- Business Unit A



- Note the Lag
- How is Δ BCE incorporated

Use Qualitative Adjustments

KRD's: Key Risk Drivers

- Used to monitor changes operational risk for each business and for each loss type **before** the change in loss experience can be observed (ie lag and low frequency events)
- Incorporated into Op VaR, by modifying the risk determined by loss history and can be used to reward and punish for positive or negative changes in risk profile
- Objective standard measure eg a standard score
- Needs to be developed
- Can be as simple as the audit score or as sophisticated as the 100 metrics used by some banks (eg % of book daily independently reevaluated, % of system down time, age of systems)

Example of How KRD can be used to Adjust Op VaR

	Δ KRD %	Δ Op VaR %
	+20	-15
	+10	-10
Op VaR _{LE}	0	0
	-10	+15
	-20	+25

Is there an alternative to the scorecard approach to the Qualitative Adjustment or more precisely to incorporating the Δ BCE

Incorporating Scenario Analysis

$$\text{actual PE} = z_i \text{PE}_i + z_e \text{PE}_e + z_s \text{PE}_s$$

These are estimated using
Statistics

These are estimated using
Business and Risk Management
Judgement

Use the scenario involving the Δ BCE

- Business and Risk Management must estimate the effect of the Δ BCE on PE, LGE and γ

General OP VaR Methodology

$$\begin{aligned} \text{WCL} &= \text{Expected no of Losses} \times \text{Average Loss} \times \gamma \\ &= E_f \times E_s \times \text{PE} \times \text{LGE} \times \gamma \end{aligned}$$

$$E_f \times E_s = E = (1 - z_{le}) E_h + z_{le} E_{le}$$

E_h = 12 month average exposure
 E_{LE} = latest estimate from BM Judgement
 Z_{le} is from RM and BM Judgement

$$\text{PE} = z_h \text{PE}_h + z_e \text{PE}_e + z_{bce} \text{PE}_{bce}$$

PE_h = 36 month average rate from internal loss experience

PE_e = 36 month average rate from external loss experience

PE_{bce} = Scenario analysis (RM and BM Judgement)

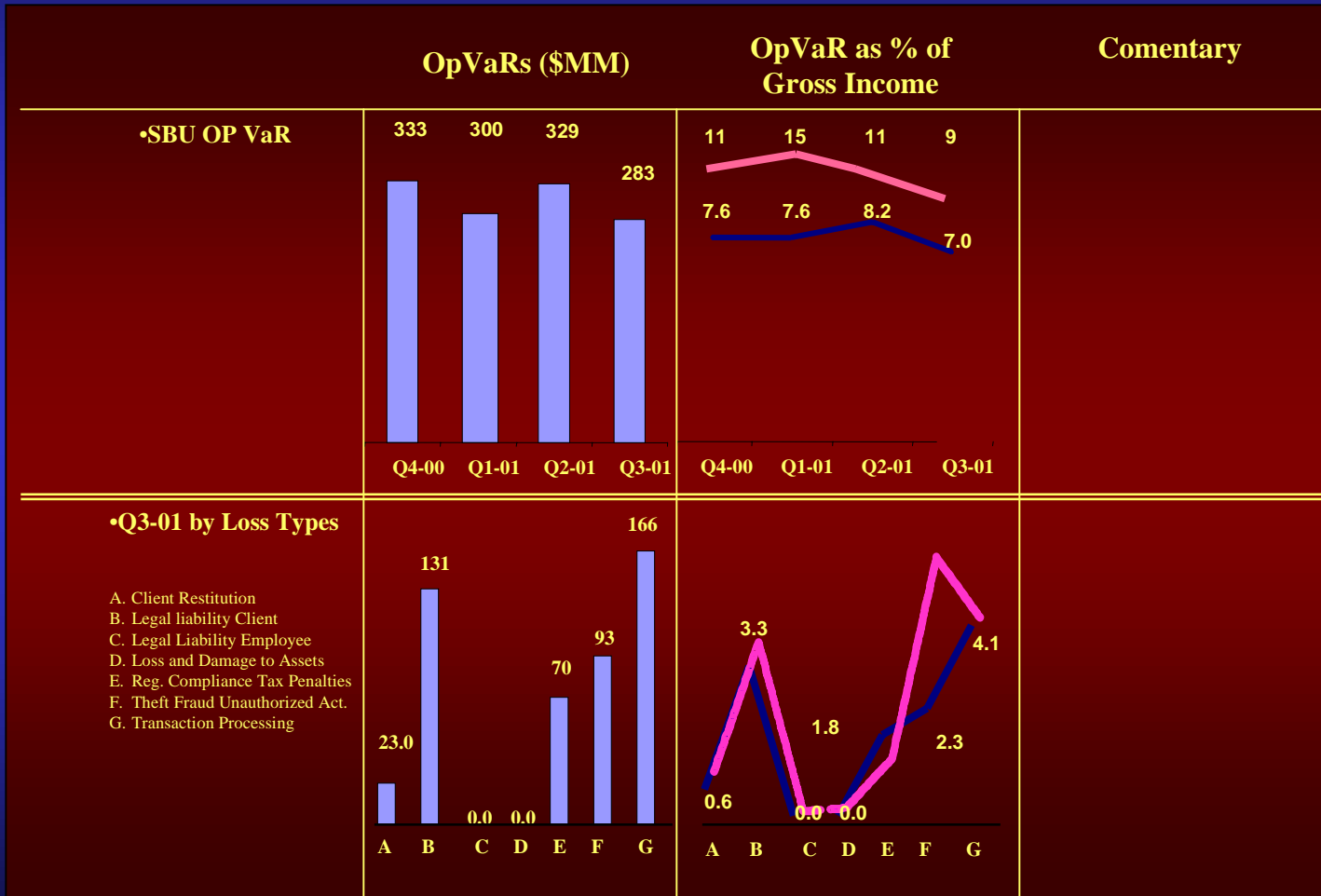
Z_h and Z_e Calculated using statistical credibility theory

Z_{bce} is from RM and BM Judgement

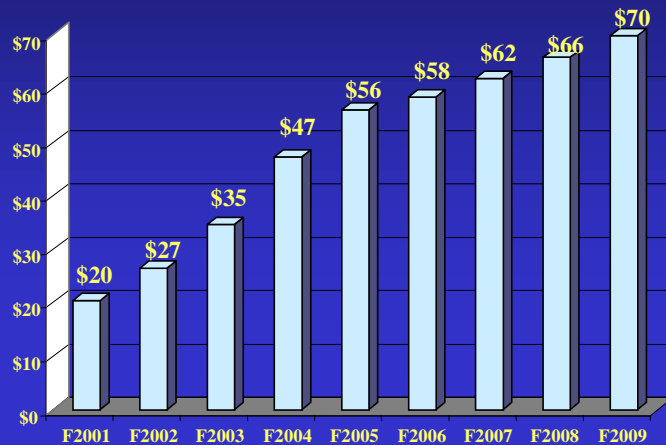
The *AMOR* Report

Analysis and
Monitoring of
Operational
Risk

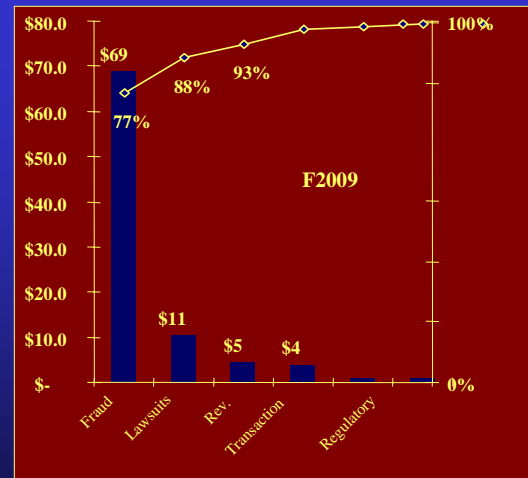
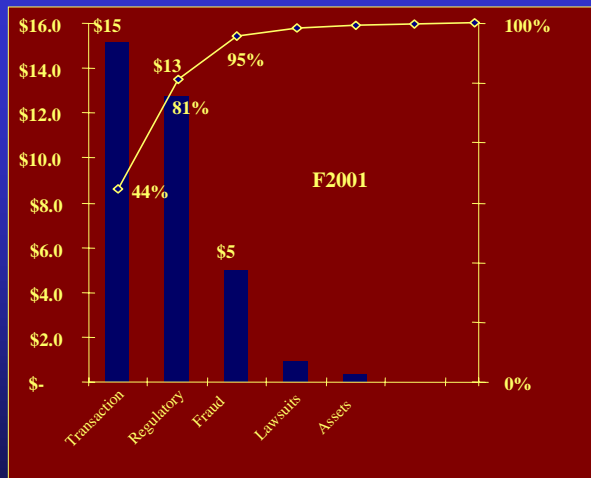
AMOR



Start up Op VaR



- OP VaR increases 2.5 times over 9 years compared to account balance growth 208 times:
 - Reduction in infrastructure build.
 - Reduction in fraud rates because of business maturing..
- Composition of Op VaR changes over the 9 year horizon
 - First year, 81% of risk is Transaction risk reflecting infrastructure (kiosks) build up
 - Ninth year, 77% of the risk is Theft and Fraud.
 - Historical Proxy losses rates have been used





Decomposing Expected No Of Losses

Expected no of Losses can be decomposed into the a measure of the amount of the business activity that can gives rise to the loss and the propensity for losses given that activity.

- ▶ This allows comparison of operational risk over time, by separating out
 - how much of the change is due to the change in the amount of business activity and
 - how much is due to a change in the propensity for losses

- ▶ the measure of the amount of business activity should correlate with the number of expected operational risk losses, this measure is usually referred to as the frequency exposure and denoted as E_f
 - For example: in transaction risk, E_f may be total number of transaction processed

- ▶ the propensity for loss is the probability that business activity gives rise to a loss and is denoted by PE

$$\text{Expected no of Losses} = E_f \times PE$$

Decomposing Average Loss

Average loss can be decomposed into the average of amount at risk per loss event and the percentage lost per loss event

- ▶ this allows the comparison of operational risk over time, by separating out
 - how much of the change is due to the change in the amount at risk per loss event and
 - how much is due to a change in the percentage lost per loss event
 - This decomposition is especially useful for risk management, when action ca
- ▶ the measure of the amount at risk should correlate with average loss per loss event, this measure is usually referred to as the severity exposure and denoted as E_s
 - For example: in transaction risk, E_s may be average value of transaction processed
- ▶ the percentage lost of the amount at risk per loss event is denoted by LGE (loss given event)

$$\text{Average Loss} = E_s \times \text{LGE}$$