

Quantitative finance

Lecture 12

Definition

- Kingsley, et al. (1998) define operational risk to be the “risk of loss caused by failures in operational processes or the systems that support them, including those adversely affecting reputation, legal enforcement of contracts and claims.”
- Can include strategic and business risk.
- Breakdowns of people, processes and systems (usually, but not limited to technology) within the organization.

Table 5.1
Operational Risk Categories

Process Risk

Pre-transaction: marketing risks, selling risks, new connection, model risk
Transaction: error, fraud, contract risk, product complexity, capacity risk
Management Information
Erroneous disclosure risk

People Risk

Integrity: fraud, collusion, malice, unauthorized use of information, rogue trading
Competency
Management
Key personnel
Health and safety

Systems Risk

Data corruption
Programming errors/fraud
Security breach
Capacity risks
System suitability
Compatibility risks
System failure
Strategic risks (platform/supplier)

Business Strategy Risk

Change management
Project management
Strategy
Political

External Environmental Risk

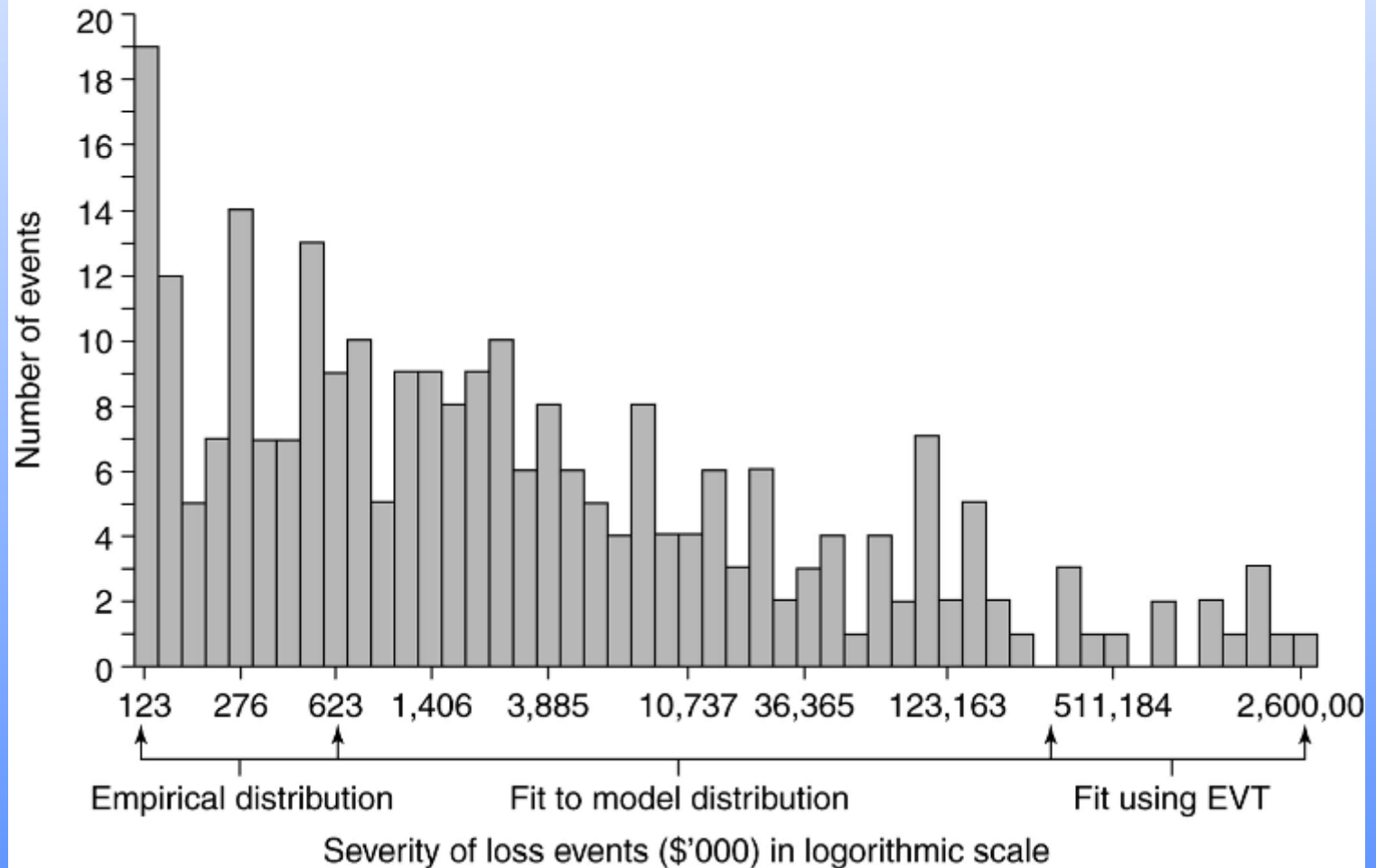
Outsourcing/external supplier risk
Physical security
Money laundering
Compliance
Financial reporting
Tax
Legal (litigation)
Natural disaster
Terrorist threat
Strike risk

Distribution of Operational Risk Events

- High Frequency, Low Severity events – may be insurable or can be priced
- Low Frequency, High Severity events – catastrophic risk.
- Expected Losses = $EL = PE \times LGE$
 - PE=probability of operational risk event
 - LGE=loss given event
- Figure 5.1

Figure 5.1 Frequency and severity of loss events

Source: Ceske & Hernandez (1999), p.19.



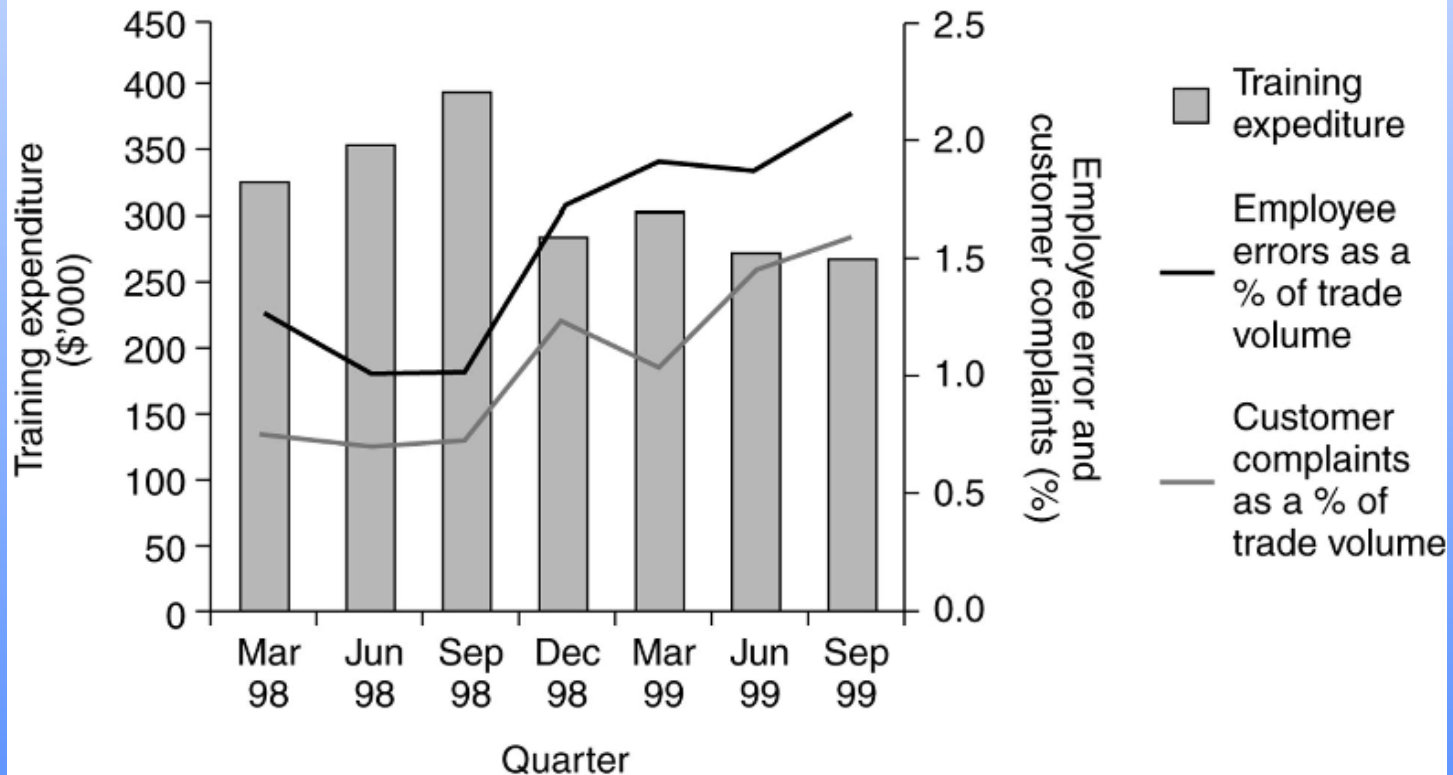
Top Down Models

- Measure overall cost of operational risk events across firm using broad metrics.
- Multifactor Models
 - Data: equity returns and operational risk indices
$$R_{it} = \alpha_{it} + \beta_{1i}I_{1t} + \beta_{2i}I_{2t} + \beta_{3i}I_{3t} + \dots + \varepsilon_{it}$$
- Income Based Models
 - Examines income volatility = Earnings at Risk
- Expense Based Models
 - Volatility of adjusted expenses
- Operating Leverage Models
 - Fixed relationship of operating expenses to assets.
- Scenario Analysis

Risk Profiling Example

Figure 5.2 Composite risk indicators: training dollars v. employee error rate v. customer complaints

Source: Taylor & Hoffman (1999), p.15.



Pros and Cons of Top Down Models

- Pros:
 - Data availability
 - Ease of estimation
 - Can use industry-wide metrics to proxy for LFHS events
 - Can be used to estimate capital requirements
- Cons:
 - Cannot diagnose risk problems (weak points)
 - Back-ward looking
 - Cannot incorporate risk mitigation techniques
 - Over-aggregated

Bottom Up Models

- Process Approaches
 - Causal Networks or Scorecards
 - Connectivity Models
 - Reliability Models
- Actuarial Approaches
 - Empirical Loss Distributions
 - Parametric Loss Distributions
 - Extreme Value Theory

Causal Networks

- Break down complex processes into steps to analyze possible operational risk events.
- Data on risk factors are related to process map to score impact of risk at each step.
- Event trees: another form of risk scorecard.
- Choose correct level of aggregation (don't ignore interdependencies) or disaggregation (not overly complex).
- Subjective. Must assign probabilities to each event.

Figure 5.3 Process map for a transaction settlement

Source: Smithson (2000), p.58.

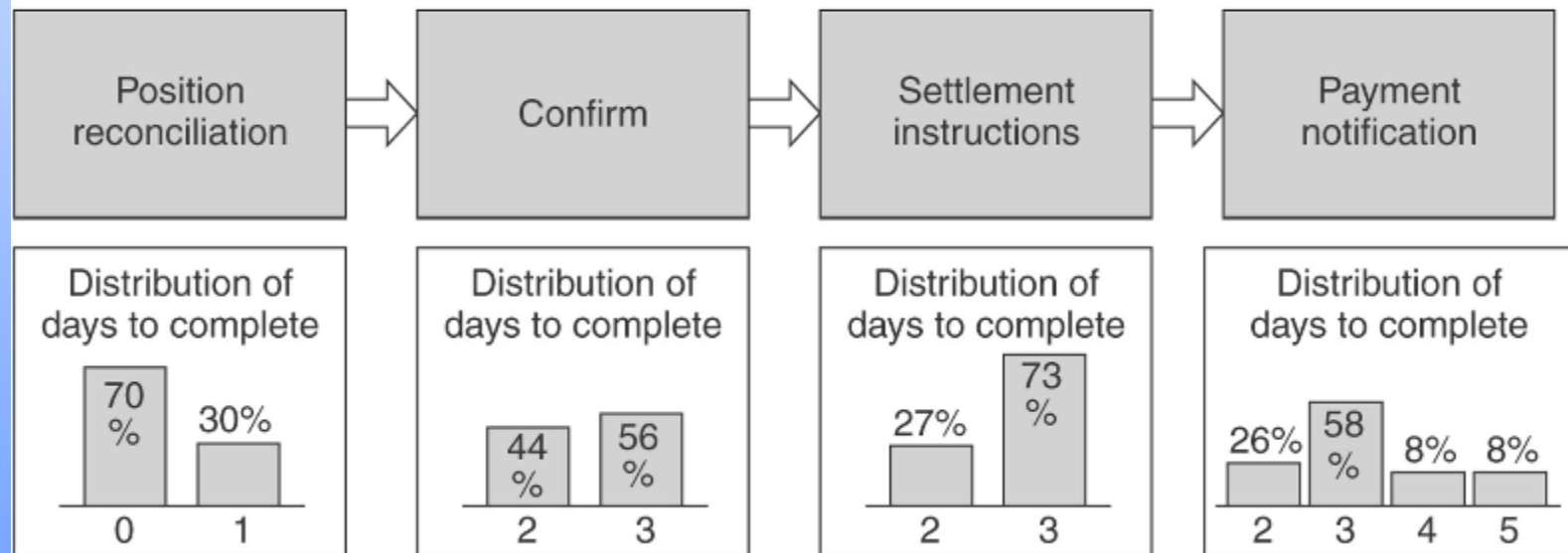



Figure 5.4 Generic event tree

Source: Marshall (2001), p. 259.

Time Progression 

| Event occurrence | Event detection | Response identification | Response implementation | Outcome |
|-------------------------|------------------------------|------------------------------------|---|----------------|
| External event occurs | Staff detects event | Staff correctly diagnoses response | Staff implements appropriate response | Success |
| | | | Staff implements inappropriate response | Failure |
| | | Staff misdiagnoses response | | Failure |
| | Staff fails to detect event. | | | Failure |