Actuaries Embrace Operational Risk

Casualty Actuary Society
Phoenix, Arizona
May 16, 2005

Ali Samad-Khan
President, OpRisk Advisory LLC
ali.samad-khan@opriskadvisory.com
www.opriskadvisory.com

ORA OpRisk Advisory

Agenda

I Introduction
II Loss Data Classification Issues
III Integrated Risk & Control Measurement/Assessment
IV COSO Based Risk Assessment
V Internal and External Loss Data Issues
VI Summary & Conclusions

OpRisk Advisory – Company Profile

OpRisk Advisory

> opriskadvisory.com

OpRisk Advisory provides the full range of operational risk management consulting services to help our clients develop highly-efficient, cost-effective operational risk management programs that meet or exceed industry best practices and satisfy the highest level of BIS compliance.

Advisory & Consulting Services

Having worked with numerous leading financial institutions in this area, we are able to offer many valuable lessons – lessons learned the hard way – about what information is relevant, what is marginally beneficial and what is likely to be of no use at all (e.g., what are the right KRIs).

VaR Outsourcing & Model Validation

Outsourcing this entire function to OpRisk Advisory may allow your organization to meet AMA compliance standards without making a huge investment in people and technology. Alternatively, for organizations that want to build their own internal VaR model, we offer model validation services. These services can be performed at our office in Switzerland.

Training & Education

Through short workshops and management seminars we help shed light on many issues that are causing confusion throughout the industry.

Paris, France | Kuala Lumpur, Malaysia | Singapore | Zurich, Switzerland | Stamford, USA

OpRisk Advisory

INTRODUCTION

Fundamentally different “world views” are driving the differences in the way banks approach operational risk management.

Traditional View

- “Operational risks are in the processes.”
- Begin by identifying the full spectrum of risks within each process.
- Assess these risks before and after controls to identify potential problem areas.
- Accept those risks that are not material or are adequately controlled.
- Develop action plans for those risks that need to be mitigated.

* * * * *

- Modeling operational risk is not useful for managing operational risk.
- Historical loss data is of little value for measurement purposes, because whenever a large loss takes place the organization improves its controls with respect to that risk; so that particular loss is not longer representative of the new control environment or the current risk profile.

Fundamentally different “world views” are driving the differences in the way banks approach operational risk management.

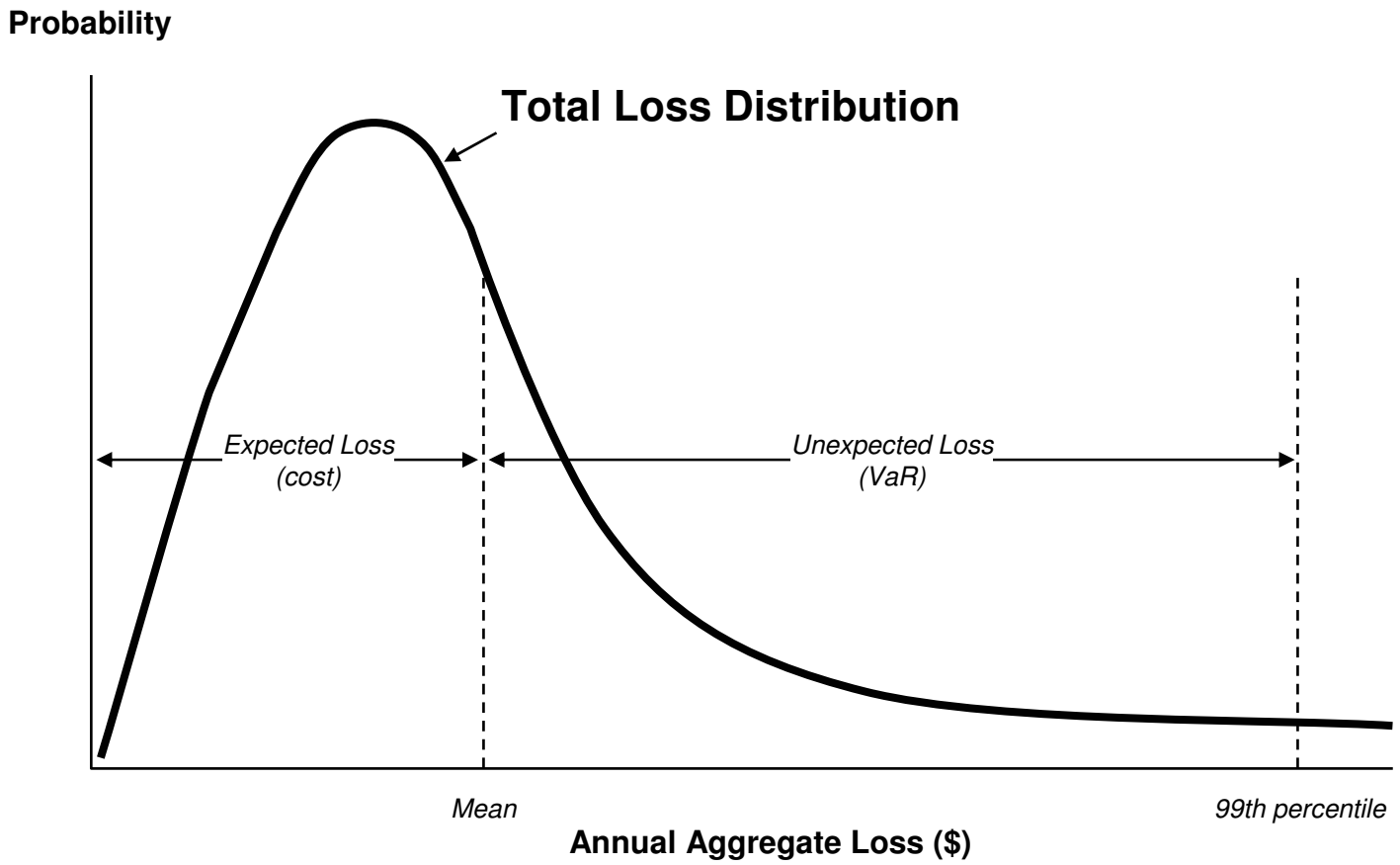
Loss Data Driven View

- “Operational risks manifest themselves across the entire spectrum of businesses.”
- Begin by defining the universe of operational risks using mutually exclusive and exhaustive risk categories.
- Use external historical loss data to populate a business-line/risk matrix; let the data tell you where the risks really exits.
- Measure the risks in each cell within the matrix.
- Using the same matrix calculate scores which represent the quality of the internal control environment; compare risk values and control scores.
- Optimize the risk control relationship in the context of cost benefit analysis.
- Monitor risks values and control scores as they change over time.

Misconceptions about the meaning of key concepts may be driving the differences in methodological approaches.

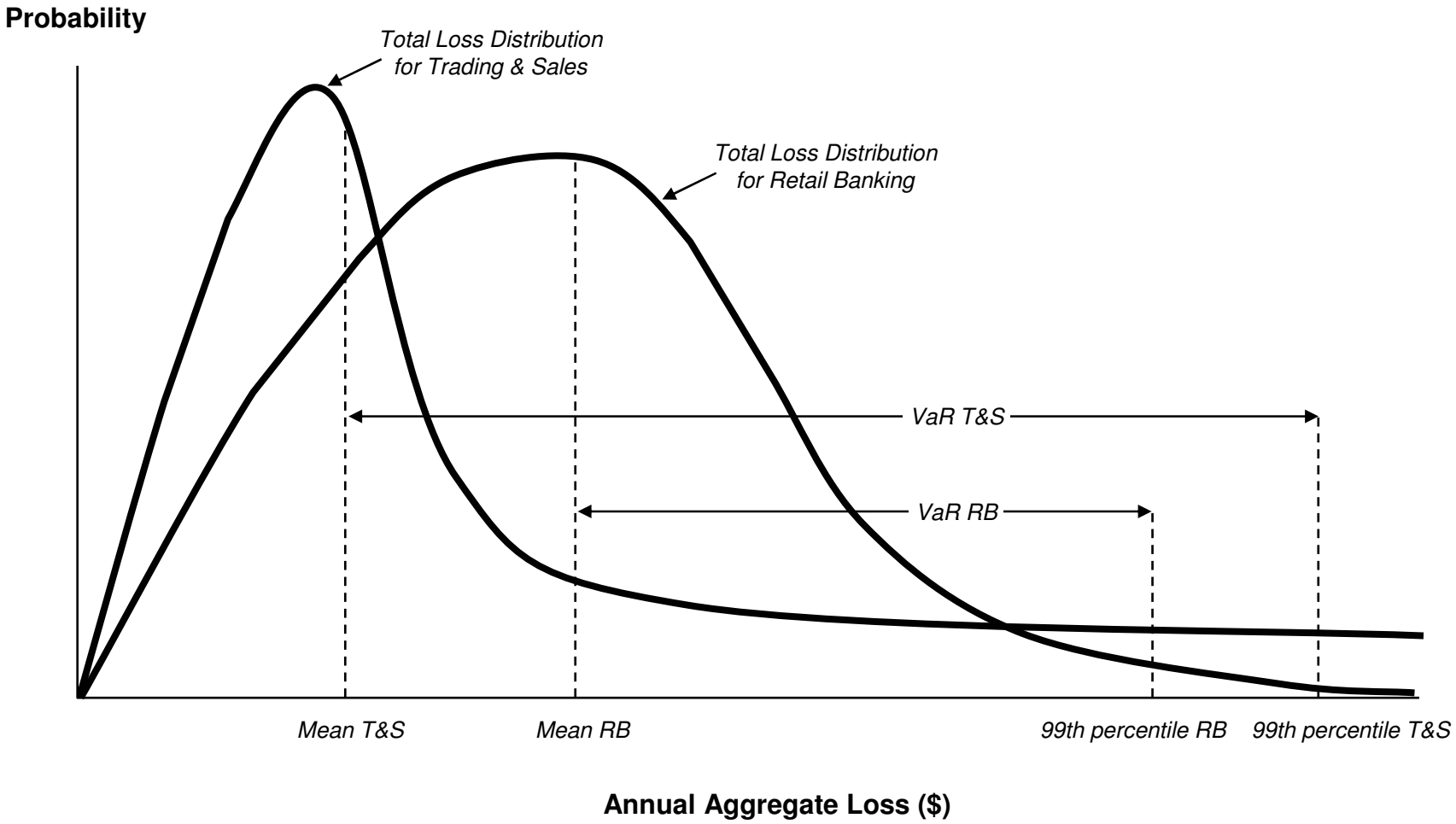
- What is risk?
- What is operational risk?
- What does it mean to measure operational risk?
- What is inherent risk? Is it risk in the absence of controls?
- Is historical loss data relevant or is the past not representative of the present/future?
- What is the most important use of external data?
- What is a near miss? Do near misses represent real or phantom risk?

The expected loss is the mean annual aggregate loss and unexpected loss represents the volatility above this mean at a specified confidence level.



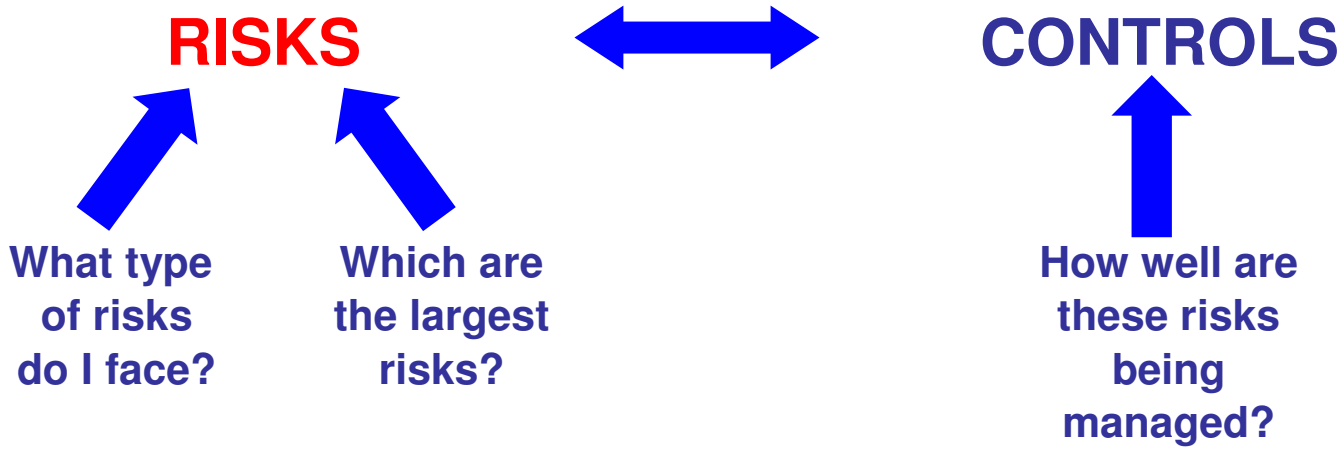
OpRisk Advisory

The aggregate loss distributions reveal the businesses different risk profiles.



OpRisk Advisory

How to get started? Define the goals of an operational risk management program.



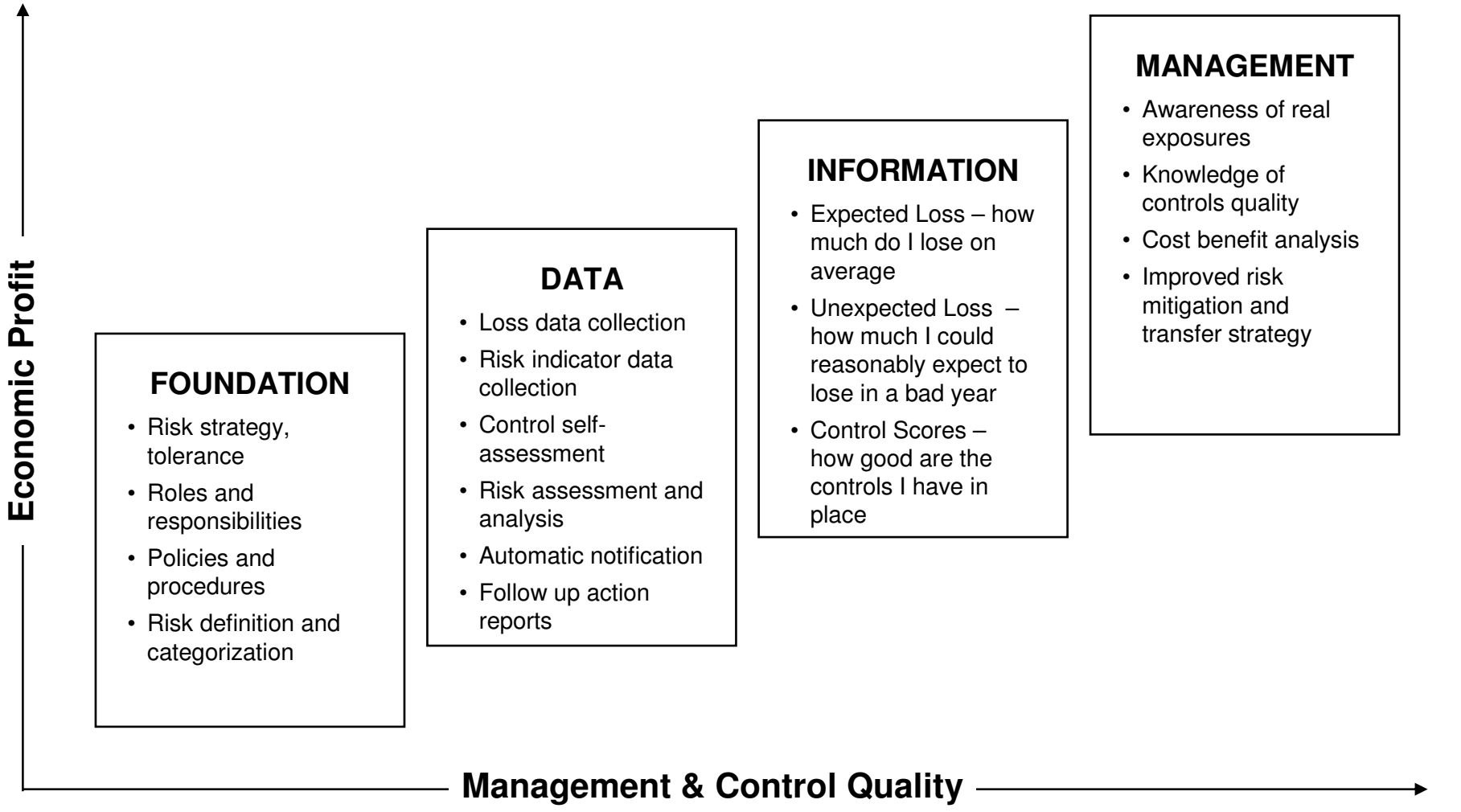
Manage Controls through Cost Benefit Analysis

OpRisk Advisory

To ensure the goal is practical, one needs to express it in the context of a business problem.

- Consider two risks: Unauthorized Trading and Money Transfer
- Past Audits reveal that both risks are under-controlled
- To address Unauthorized Trading risk one must improve segregation of duties and audit frequency. (Solution: hire four new staff; cost = $400,000 per year)
- To address Money Transfer risk one must improve the system (Solutions: buy new system; cost = $5 million + $800,000 per year)
- You have $4 million in your budget. Where do you invest your money?

Effectively managing operational risk requires a foundation designed to turn raw operational risk data into information that supports managerial decision making.



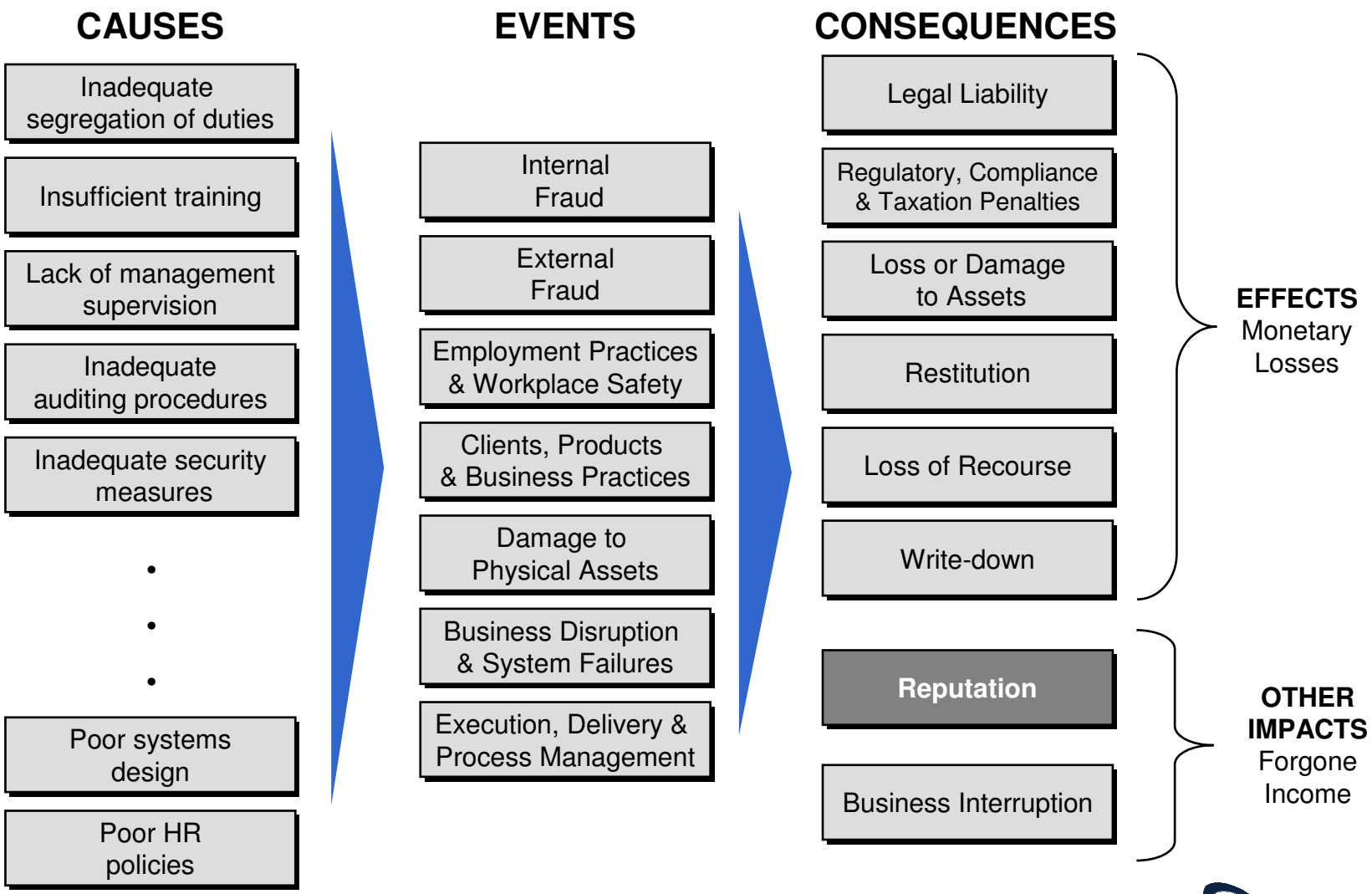
ORA OpRisk Advisory

LOSS DATA CLASSIFICATION ISSUES

We begin be defining the full spectrum of operational risks. But the universe appears not to have structure, since there are numerous overlaps.

Transaction	**Execution**	**Settlement**	**Technological**
Inadequate Supervision	**Information**	**Key Man**	**Lack of Resources**
Reputation	**Relationship**	**Theft**	**Criminal**
Insufficient Training	**People**	**Fraud**	**Rogue Trader**
Compliance	**Legal/Regulatory**	**Fiduciary**	**Physical Assets**
Poor Management	**Fixed Cost Structures**	**Customer**	**Business**
		Business Interruption	**Strategic**

The universe of operational can be structured by using causes, events and consequences.



OpRisk Advisory

What are the standards for defining and categorizing operational risk?

Management Purposes	Grouping of like items (homogenous risk types) with similar characteristics, similar controls, etc.
Technical Consistency	Mutually exclusive (uncorrelated) and exhaustive (comprehensive), homogenous distributions
Practical Considerations	Definitions and classification standards must be easy to understand and implement (based on natural boundaries); consistency within hierarchy.

Placing loss data within a Business Line/Risk matrix helps reveal the risk profile of each business.

		INTERNAL FRAUD	EXTERNAL FRAUD	EMPLOYMENT PRACTICES & WORKPLACE SAFETY	CLIENTS, PRODUCTS & BUSINESS PRACTICES	DAMAGE TO PHYSICAL ASSETS	EXECUTION, DELIVERY & PROCESS MANAGEMENT	BUSINESS DISRUPTION AND SYSTEM FAILURES	TOTAL
Corporate Finance	Number	362	123	25	36	33	150	2	731
	Mean	35,459	52,056	3,456	56,890	56,734	1,246	89,678	44,215
	Standard Deviation	5,694	8,975	3,845	7,890	3,456	245	23,543	6,976
Trading & Sales	Number	50	4	35	50	46	210	3	398
	Mean	53,189	78,084	5,184	85,335	85,101	1,869	134,517	66,322
	Standard Deviation	8,541	13,463	5,768	11,835	5,184	368	35,315	10,464
Retail Banking	Number	45	4	32	45	42	189	3	360
	Mean	47,870	70,276	4,666	73,802	76,591	1,682	121,065	59,690
	Standard Deviation	7,687	12,116	5,191	10,452	4,666	331	31,783	9,417
Commercial Banking	Number	41	3	28	41	37	170	2	322
	Mean	43,083	63,248	4,199	69,121	68,932	1,514	108,959	53,721
	Standard Deviation	6,918	10,905	4,672	9,586	4,199	298	28,605	8,476
Payment & Settlements	Number	37	3	26	37	34	153	2	292
	Mean	38,774	56,923	3,879	62,209	62,039	1,363	98,063	48,349
	Standard Deviation	6,226	9,814	4,020	8,628	3,779	268	25,744	7,628
Agency Services	Number	44	4	31	44	40	184	2	349
	Mean	46,529	68,308	4,535	74,651	74,446	1,635	117,675	58,018
	Standard Deviation	7,472	11,777	5,045	10,353	4,535	321	30,893	9,154
Asset Management	Number	40	3	28	40	36	165	2	314
	Mean	41,876	61,477	4,081	67,186	67,002	1,472	105,908	52,217
	Standard Deviation	6,725	10,599	4,541	9,318	4,081	289	27,804	8,238
Retail Brokerage	Number	48	4	33	48	44	198	3	378
	Mean	50,252	73,773	4,898	80,623	80,402	1,766	127,090	62,660
	Standard Deviation	8069	12719	5449	11182	4898	347	33365	9886
Insurance	Number	43	4	30	43	39	179	2	340
	Mean	45,226	66,395	4,408	72,561	72,362	1,589	114,381	56,394
	Standard Deviation	7,262	11,447	4,904	10,063	4,408	312	30,028	8,897
Total	Number	710	152	268	384	351	1,598	21	3,484
	Mean	45,653	67,021	4,450	73,245	73,044	1,604	115,459	56,926
	Standard Deviation	7,331	11,555	4,950	10,158	4,450	315	30,311	8,981

ORA OpRisk Advisory

Event risk categories are represented in a three tier hierarchy.

Primary	Secondary	Activity Examples
Internal Fraud *Losses due to acts of type intended to defraud misappropriate property, or circumvent regulations, the law or company policy, excluding diversity/discrimination events, which involve at least one internal party*	Unauthorized Activities	Transactions not reported (intentional), Transaction type unauthorized (w/monetary loss), Mismarking of position (intentional)
	Theft & Fraud	Fraud/credit fraud, worthless deposits, Theft, extortion, embezzlement, robbery, Misappropriation of assets, Malicious destruction of assets, Forgery, Check kiting, Smuggling, Accountant takeover, impersonation, Tax noncompliance, evasion (willful), Bribes/Kickbacks, Insider trading (not on firm's account)
External Fraud *Losses due to acts of type intended to defraud misappropriate property, or circumvent regulations, or the law by a third party*	Theft & Fraud	Theft/Robbery Forgery Check kiting
	Systems Security	Hacking damage, Theft of information (w/monetary loss)
Employment Practices and Workplace Safety *Losses arising from acts inconsistent with employment health or safety laws, or agreements, from payment of personal injury claims, or from diversity/discrimination events.*	Employee Relations	Compensation, benefit, termination issues, Organized labor activity, Poaching
	Safe Environment	General liability (slip and fall, etc), Employee health & safety rules events, Workers' compensation
	Diversity and Discrimination	All forms of discrimination

Event risk categories are represented in a three tier hierarchy.

Primary	Secondary	Activity Examples
Clients, Products & Business Practices *Losses arising from an unintentional or negligent failure to meet a professional obligation to specific clients including fiduciary and suitability requirements), or from the nature or design of a product.*	Suitability, Disclosure & Fiduciary	Fiduciary breaches - guideline violations, Suitability - disclosure issues (know your customer etc.), Retail consumer disclosure violations, Breach of privacy, Aggressive sales, Account churning, Misuse of confidential information, Lender liability,
	Selection, Sponsorship & Exposure	Failure to investigate client per guidelines, Exceeding client exposure limits
	Advisory Activities	Disputes over performance of advisory activities
	Improper Business or Market Practices	Antitrust, Improper trade/market practices, Market manipulation, Insider trading (on firm's account), Unlicensed activity, Money Laundering
	Product Flaws	Product defects (unauthorized), Model errors
Damage to Physical Assets *Losses arising from loss or damage to physical assets from natural disaster or other events.*	Disasters and other events	Natural disaster losses, Human losses from external sources (terrorism, vandalism)
Business Disruption and System Failures *Losses arising from disruption of business or systems failures*	Systems	Hardware, Software, Telecommunications Utility outage/disruptions

Event risk categories are represented in a three tier hierarchy.

Primary	Secondary	Activity Examples
Execution, Delivery & Process Management *Losses from failed transaction processing or process management, from relations with trade counter parties and vendors or from systems failures.*	Transaction Capture, Execution & Maintenance	Miscommunication, Data entry, maintenance, or loading error, Missed deadline or responsibility, Model/system misoperation, Accounting error, entity attribution error, Other task misperformance, Delivery failure, Collateral management failure, Reference data maintenance
	Monitoring and Reporting	Failed mandatory reporting obligation, Inadequate oversight, Inaccurate external report (loss incurred)
	Customer Intake and Documentation	Client permissions, disclaimers missing, Legal documents missing, incomplete
	Customer/Client Account Management	Unapproved access given to accounts (includes inadvertent access to one party on a joint account) Incorrect client records (loss incurred), Negligent loss or damage of client assets
	Trade Counter parties	Nonclient counter party misperformance, Misc. nonclient counter party disputes
	Vendors and Suppliers	Outsourcing, Vendor disputes

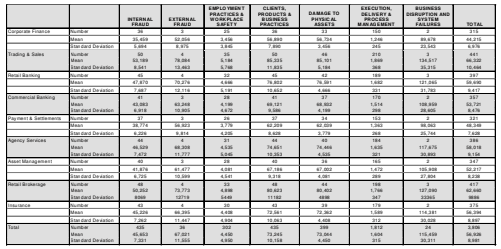
INTEGRATED RISK & CONTROL MEASUREMENT

Risk is measured using internal and external loss data. The two measures of exposure are the aggregate mean and aggregate Value at Risk (VaR).

INDIVIDUAL LOSS EVENTS

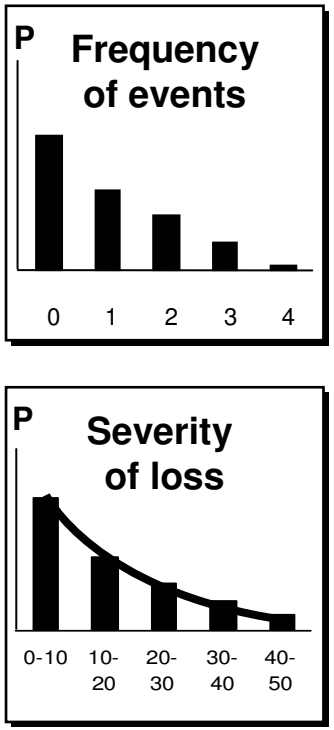
74,712,345
74,603,709
74,457,745
74,345,957
74,344,576
•
•
•
167,245
142,456
123,345
113,342
94,458

RISK MATRIX FOR LOSS DATA



		INTERNAL FRAUD	EXTERNAL FRAUD	EMPLOYMENT PRACTICES & WORKPLACE SAFETY	CLIENTS, PRODUCTS & BUSINESS PRACTICES	DAMAGE TO PHYSICAL ASSETS	EXECUTION, DELIVERY & PROCESS MANAGEMENT	BUSINESS DISRUPTION AND SYSTEM FAILURES	TOTAL
Corporate Finance	Number	26	3	25	39	33	155	2	315
	Mean	33,409	52,206	3,436	66,993	36,734	1,246	89,979	44,215
	Standard Deviation	5,664	6,975	3,845	7,990	3,456	245	23,543	4,976
Trading & Sales	Number	58	4	30	58	48	310	2	441
	Mean	83,589	78,994	5,196	85,205	86,161	2,995	134,517	84,432
	Standard Deviation	6,541	12,463	5,796	11,833	5,184	368	35,215	10,466
Retail Banking	Number	46	4	32	48	42	189	2	287
	Mean	67,870	70,276	4,646	76,802	76,381	1,662	121,265	69,496
	Standard Deviation	7,987	12,116	5,191	10,452	4,664	321	31,783	8,417
Commercial Banking	Number	41	3	29	41	37	170	2	317
	Mean	43,983	62,246	4,196	68,121	68,802	1,514	108,959	63,720
	Standard Deviation	6,918	10,965	4,672	9,586	4,196	266	28,905	9,476
Payment & Settlements	Number	37	3	29	37	34	163	2	321
	Mean	38,774	56,923	3,779	62,209	62,559	1,343	99,062	48,349
	Standard Deviation	6,206	9,814	4,235	8,428	3,778	368	25,744	7,428
Agency Services	Number	44	4	31	44	40	184	2	386
	Mean	46,529	66,209	4,535	74,401	74,466	1,635	117,675	58,018
	Standard Deviation	7,472	11,777	5,646	10,353	4,329	321	30,992	9,154
Asset Management	Number	40	3	28	40	36	165	2	317
	Mean	41,876	61,477	4,091	67,186	67,552	1,472	105,998	52,217
	Standard Deviation	6,733	10,599	4,541	9,318	4,061	289	27,804	8,239
Retail Brokerage	Number	48	4	33	48	44	198	2	417
	Mean	50,252	72,773	4,936	80,403	80,402	1,796	127,299	62,946
	Standard Deviation	8068	12719	5440	11182	4898	347	33945	9886
Insurance	Number	43	4	30	43	39	179	2	275
	Mean	45,209	66,395	4,436	72,581	72,362	1,589	114,381	56,394
	Standard Deviation	7,262	11,447	4,994	10,063	4,408	312	30,936	8,997
Total	Number	435	36	302	435	396	1,812	24	3,936
	Mean	45,622	67,331	4,436	73,243	73,564	1,604	115,439	59,326
	Standard Deviation	7,331	11,555	4,936	10,154	4,458	315	30,311	8,981

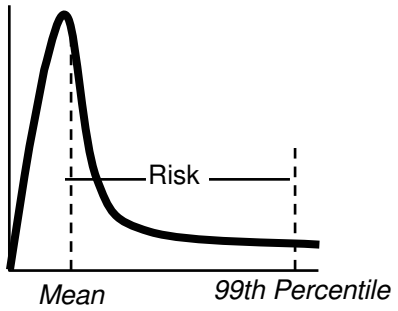
LOSS DISTRIBUTIONS



VAR CALCULATION

VaR Calculator e.g., Monte Carlo Simulation Engine

TOTAL LOSS DISTRIBUTION



Annual Aggregate Loss ($)

ORA OpRisk Advisory

Risk is measured using internal and external loss data. The two measures of exposure are the aggregate mean and aggregate Value at Risk (VaR).

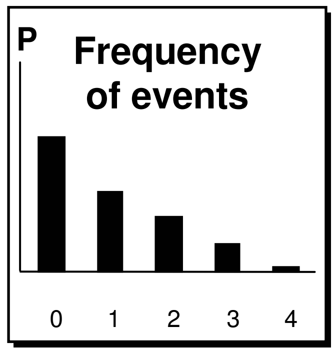
INDIVIDUAL LOSS EVENTS

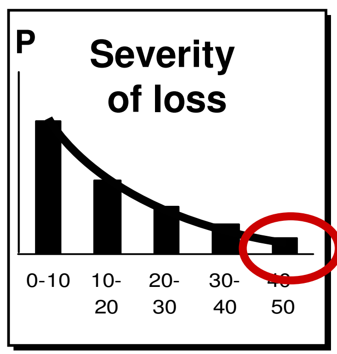
74,712,345
74,603,709
74,457,745
74,345,957
74,344,576
•
•
•
167,245
142,456
123,345
113,342
94,458

RISK MATRIX FOR LOSS DATA

		INTERNAL FRAUD	EXTERNAL FRAUD	EMPLOYMENT PRACTICES & WORKPLACE SAFETY	CLIENTS, PRODUCTS & BUSINESS PRACTICES	DAMAGE TO PHYSICAL ASSETS	EXECUTION, DELIVERY & PROCESS MANAGEMENT	BUSINESS DISRUPTION AND SYSTEM FAILURES	TOTAL
Corporate Finance	Number	36	3	25	36	33	150	2	315
	Mean	35,459	52,056	3,456	56,890	56,734	1,246	89,678	44,215
	Standard Deviation	5,694	8,975	3,845	7,890	3,456	245	23,543	6,976
Trading & Sales	Number	50	4	35	50	46	210	3	441
	Mean	53,189	78,084	5,184	85,335	85,101	1,869	134,517	66,322
	Standard Deviation	8,541	13,463	5,768	11,835	5,184	368	35,315	10,464
Retail Banking	Number	45	4	32	45	42	189	3	397
	Mean	47,870	70,276	4,666	76,802	76,591	1,682	121,065	59,690
	Standard Deviation	7,687	12,116	5,191	10,652	4,666	331	31,783	9,417
Commercial Banking	Number	41	3	28	41	37	170	2	357
	Mean	43,083	63,248	4,199	69,121	68,932	1,514	108,959	53,721
	Standard Deviation	6,918	10,905	4,672	9,586	4,199	298	28,605	8,476
Payment & Settlements	Number	37	3	26	37	34	153	2	321
	Mean	38,774	56,923	3,779	62,209	62,039	1,363	98,063	48,349
	Standard Deviation	6,226	9,814	4,205	8,628	3,779	268	25,744	7,628
Agency Services	Number	44	4	31	44	40	184	2	386
	Mean	46,529	68,308	4,535	74,651	74,446	1,635	117,675	58,018
	Standard Deviation	7,472	11,777	5,045	10,353	4,535	321	30,893	9,154
Asset Management	Number	40	3	28	40	36	165	2	347
	Mean	41,876	61,477	4,081	67,186	67,002	1,472	105,908	52,217
	Standard Deviation	6,725	10,599	4,541	9,318	4,081	289	27,804	8,238
Retail Brokerage	Number	48	4	33	48	44	198	3	417
	Mean	50,252	73,773	4,898	80,623	80,402	1,766	127,090	62,660
	Standard Deviation	8069	12719	5449	11182	4898	347	33365	9886
Insurance	Number	43	4	30	43	39	179	2	375
	Mean	45,226	66,395	4,408	72,561	72,362	1,589	114,381	56,394
	Standard Deviation	7,262	11,447	4,904	10,063	4,408	312	30,028	8,897
Total	Number	435	36	302	435	399	1,812	24	3,806
	Mean	45,653	67,021	4,450	73,245	73,044	1,604	115,459	56,926
	Standard Deviation	7,331	11,555	4,950	10,158	4,450	315	30,311	8,981

LOSS DISTRIBUTIONS

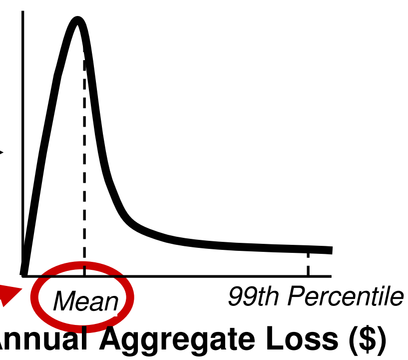




VAR CALCULATION

VaR Calculator e.g., Monte Carlo Simulation Engine

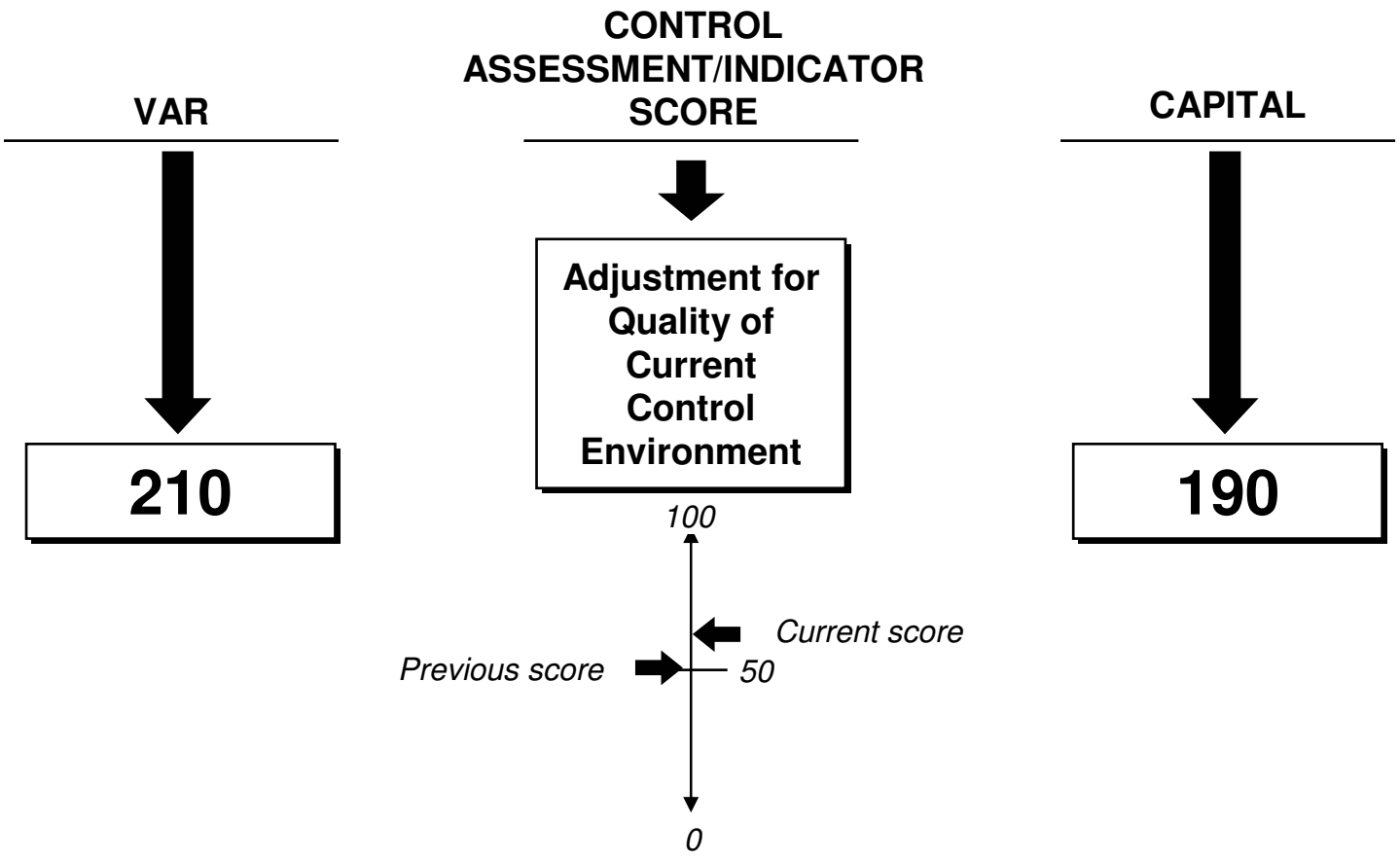
TOTAL LOSS DISTRIBUTION



What is the impact of the tail on the mean?

OpRisk Advisory

By comparing changes in the control environment one can predict changes in each business' risk profile.



Linking capital to changes in the quality of internal controls provides an incentive for desired behavioral change

ORA OpRisk Advisory

The Risk Measurement approach can be used to integrate measures of risk and control, which can be used for allocating economic capital

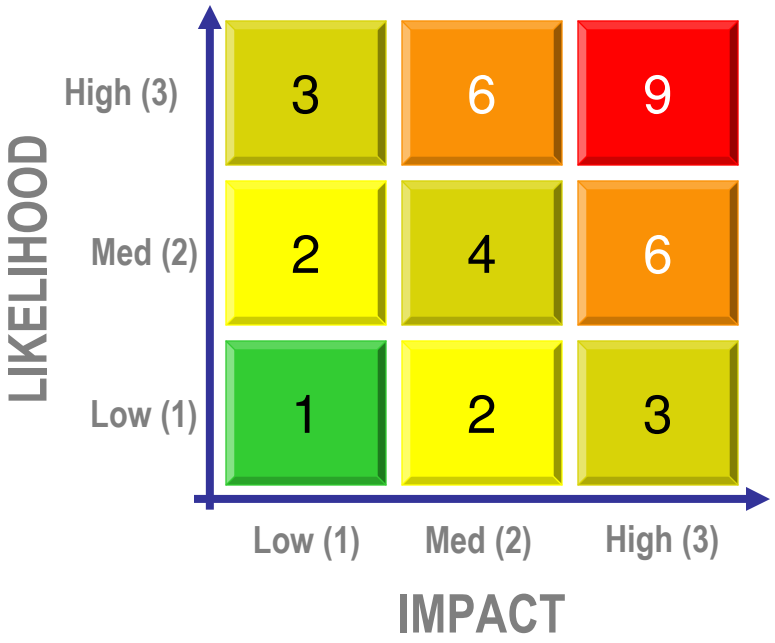
INTEGRATED RISK AND CONTROL MATRIX

		INTERNAL FRAUD	EXTERNAL FRAUD	EMPLOYMENT PRACTICES & WORKPLACE SAFETY	CLIENTS, PRODUCTS & BUSINESS PRACTICES	DAMAGE TO PHYSICAL ASSETS	EXECUTION, DELIVERY & PROCESS MANAGEMENT	BUSINESS DISRUPTION AND SYSTEM FAILURES	TOTAL
Corporate Finance	Previous VaR	21,000,000	36,000,000	62,000,000	75,000,000	124,000,000	86,000,000	36,000,000	362,000,000
	Prev/Current Score	50 55	60 58	75 71	61 61	45 55	50 52	50 55	50 55
	Final Capital	19,000,000	35,000,000	65,000,000	75,000,000	104,000,000	83,000,000	32,000,000	326,000,000

COSO BASED RISK ASSESSMENT

The COSO view of risk assessment is based on the likelihood and impact of a specific type of event; the output is probability weighted impact. The high risk area is in the top right corner of the matrix.

COSO

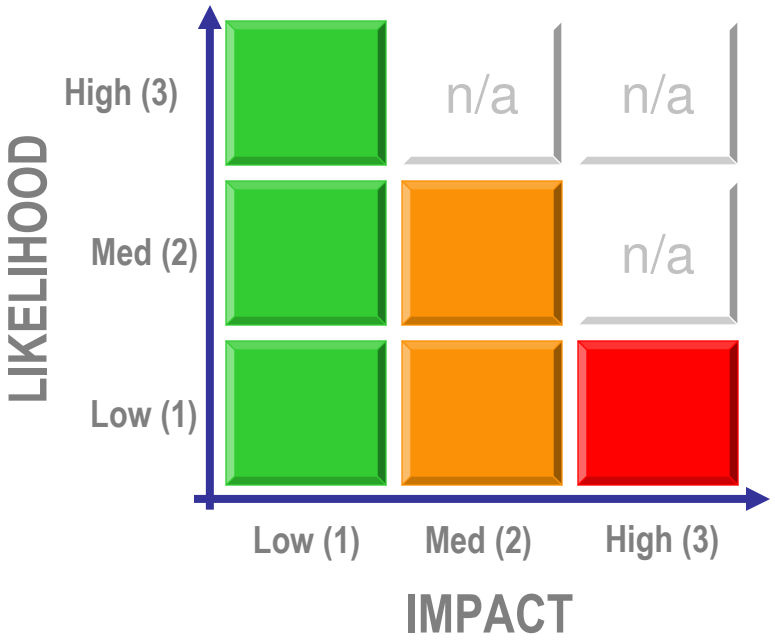


Likelihood x Impact = Risk

OpRisk Advisory

Under the risk management industry approach, the high risk area is the bottom right cell in the matrix.

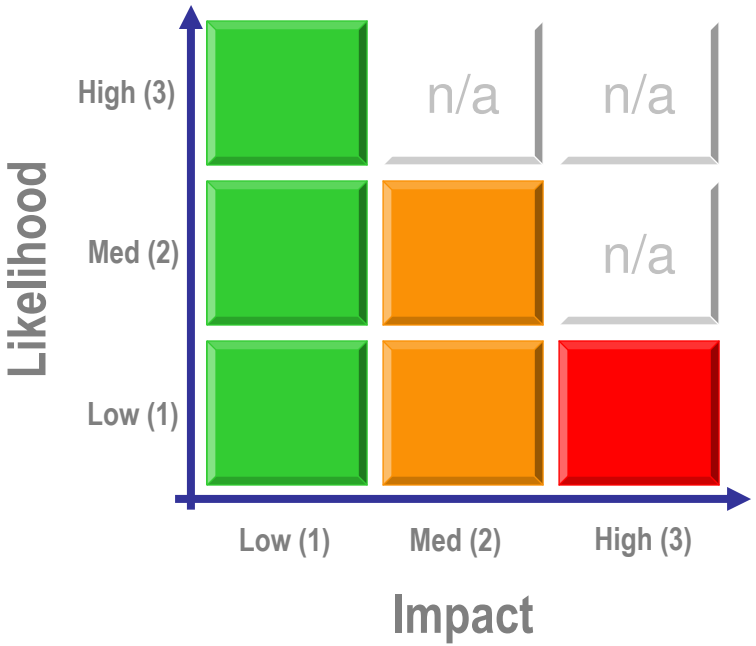
Risk Management Industry



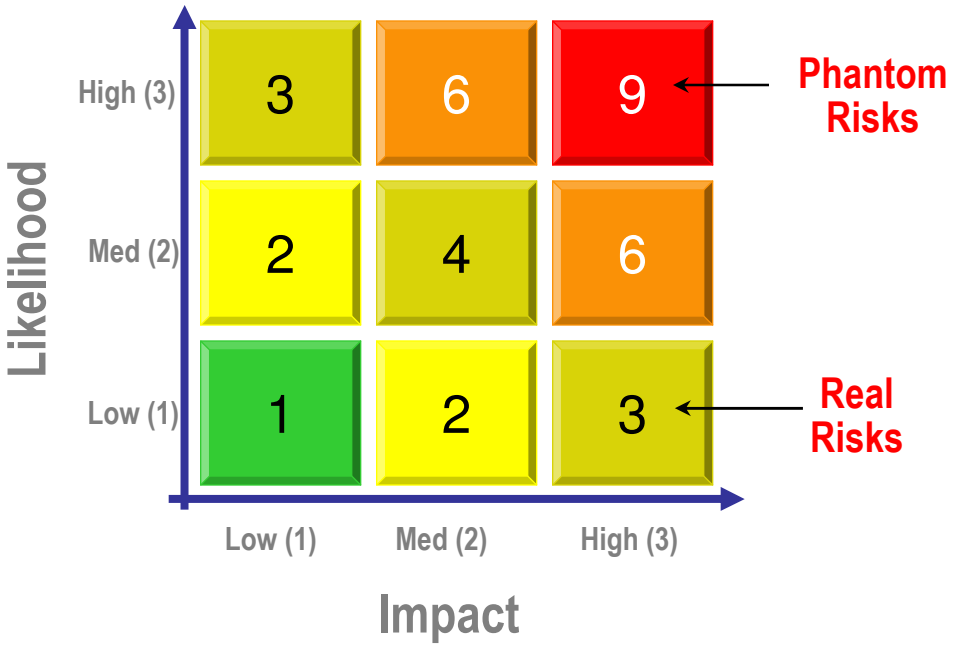
OpRisk Advisory

When compared, there are significant differences ….

Risk Management Industry



COSO



OpRisk Advisory

Using likelihood-impact analysis one can calculate risk results

Likelihood x Impact = Risk

Risk 1 : 10% x $10,000 = $1,000

Using likelihood-impact analysis one can calculate more than one outcome

Likelihood x Impact = Risk

Risk 1 : 10% x $10,000 = $1,000
Risk 2 : 1% x $50,000 = $ 500

Using likelihood-impact analysis one can calculate multiple outcomes

Likelihood x Impact = Risk

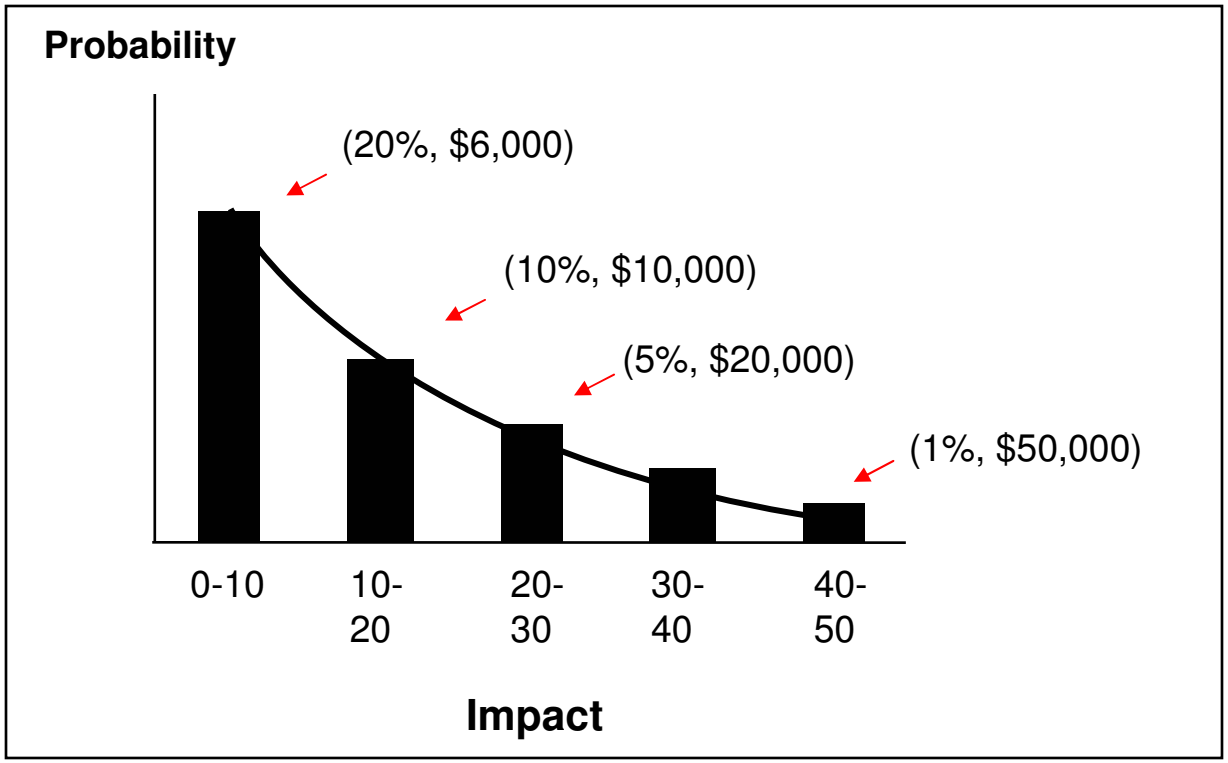
Risk 1 : 10% x $10,000 = $1,000
Risk 2 : 1% x $50,000 = $ 500

.
.
.
.

Risk 999 : 5% x $20,000 = $1,000
Risk 1000 : 20% x $ 6,000 = $1,200

ORA OpRisk Advisory

The many probability and impact combinations represent a continuum.



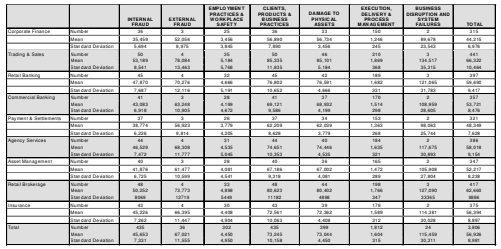
ORA OpRisk Advisory

Risk is measured using internal and external loss data. The two measures of exposure are the aggregate mean and aggregate Value at Risk (VaR).

INDIVIDUAL LOSS EVENTS

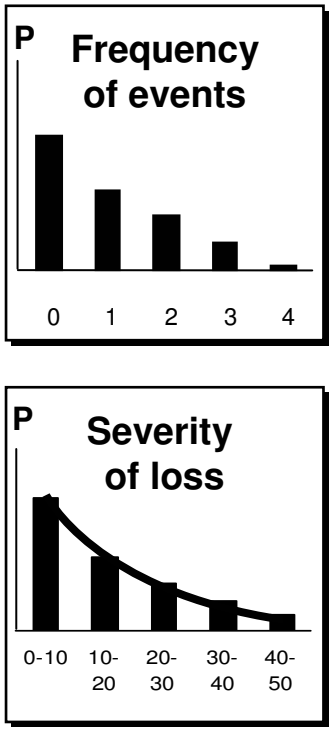
74,712,345
74,603,709
74,457,745
74,345,957
74,344,576
•
•
•
167,245
142,456
123,345
113,342
94,458

RISK MATRIX FOR LOSS DATA



		INTERNAL FRAUD	EXTERNAL FRAUD	EMPLOYMENT PRACTICES & WORKPLACE SAFETY	CLIENTS, PRODUCTS & BUSINESS PRACTICES	DAMAGE TO PHYSICAL ASSETS	EXECUTION, DELIVERY & PROCESS MANAGEMENT	BUSINESS DISRUPTION AND SYSTEM FAILURES	TOTAL
Corporate Finance	Number	26	3	25	39	33	155	2	315
	Mean	33,409	52,206	3,436	66,993	36,734	1,246	89,979	44,215
	Standard Deviation	5,664	6,975	3,845	7,990	3,456	245	23,543	4,976
Trading & Sales	Number	58	4	30	58	48	310	2	441
	Mean	83,589	78,994	5,196	85,205	86,161	2,995	134,517	84,432
	Standard Deviation	6,541	12,463	5,796	11,833	5,184	368	35,215	10,466
Retail Banking	Number	46	4	32	48	42	189	2	287
	Mean	67,870	70,276	4,646	76,802	76,381	1,662	121,265	69,496
	Standard Deviation	7,987	12,116	5,191	10,452	4,664	321	31,783	8,417
Commercial Banking	Number	41	3	29	41	37	170	2	317
	Mean	43,983	62,246	4,196	68,121	68,802	1,514	108,959	63,720
	Standard Deviation	6,918	10,965	4,672	9,586	4,196	266	28,905	9,476
Payment & Settlements	Number	37	3	29	37	34	163	2	321
	Mean	38,774	56,923	3,779	62,209	62,559	1,343	99,062	48,349
	Standard Deviation	6,206	9,814	4,235	8,428	3,778	368	25,744	7,428
Agency Services	Number	44	4	31	44	40	184	2	386
	Mean	46,529	66,209	4,535	74,401	74,466	1,635	117,675	58,018
	Standard Deviation	7,472	11,777	5,646	10,353	4,329	321	30,992	9,154
Asset Management	Number	40	3	28	40	36	165	2	317
	Mean	41,876	61,477	4,091	67,186	67,552	1,472	105,998	52,217
	Standard Deviation	6,733	10,599	4,541	9,318	4,061	289	27,804	8,239
Retail Brokerage	Number	48	4	33	48	44	198	2	417
	Mean	50,252	72,773	4,936	80,403	80,402	1,796	127,299	62,946
	Standard Deviation	8068	12719	5440	11182	4898	347	33945	9886
Insurance	Number	43	4	30	43	39	179	2	275
	Mean	45,209	66,395	4,436	72,581	72,362	1,589	114,381	56,394
	Standard Deviation	7,262	11,447	4,994	10,063	4,408	312	30,936	8,997
Total	Number	435	36	302	435	396	1,812	24	3,936
	Mean	45,622	67,331	4,436	73,243	73,564	1,604	115,439	59,326
	Standard Deviation	7,331	11,555	4,936	10,154	4,458	315	30,311	8,981

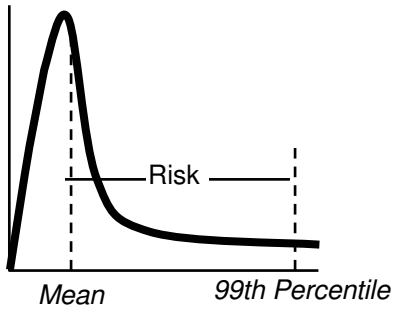
LOSS DISTRIBUTIONS



VAR CALCULATION

VaR Calculator e.g., Monte Carlo Simulation Engine

TOTAL LOSS DISTRIBUTION



Annual Aggregate Loss ($)

ORA OpRisk Advisory

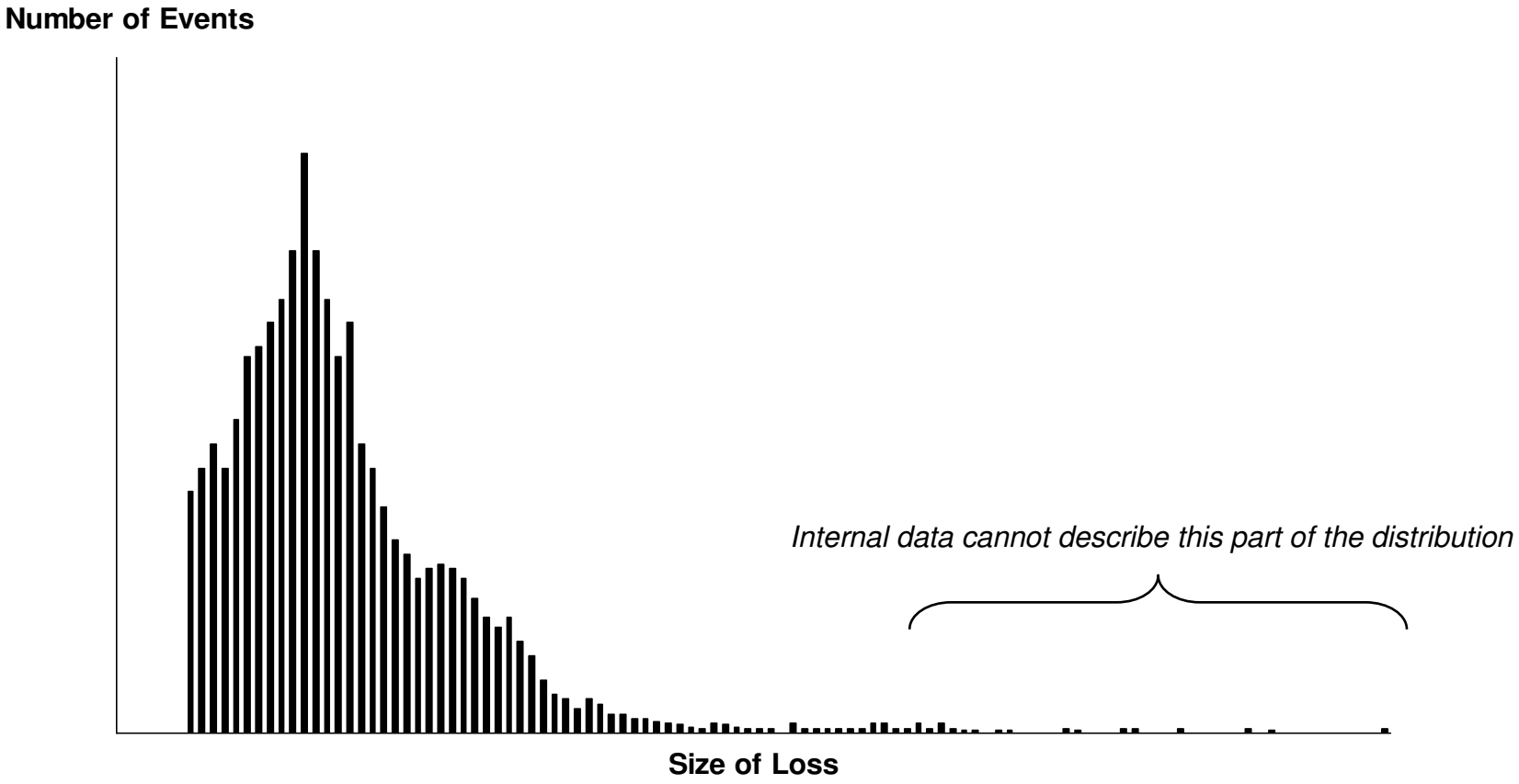
INTERNAL AND EXTERNAL LOSS DATA ISSUES

Three sources of loss data may be considered.

Internal Data	Data drawn directly from the entity whose risk is being measured; this is the most relevant data set, but such data is generally insufficient for most modeling and statistical analysis purposes because of the small sample size
External Pooled Data	Public and non-public data drawn from a loss data sharing consortium; this data is less relevant than internal data, but offers larger sample allowing for more accurate modeling/statistical analysis
External Public Data	Data drawn from public sources; less relevant than internal data, contains a larger set of "tail events," but subject to numerous biases – so cannot be used directly for modeling.

While one would expect that consortium data will eventually prove to be more useful than external public data, this will only be true if these initiatives reach critical mass and the data is honestly reported and consistently categorized

Internal data generally does not contain a sufficient number of the tail events to accurately describe that part of the distribution, therefore one needs to supplement internal data with external data.



OpRisk Advisory

There are several data issues to address in modeling operational value at risk.

- Internal data is the most relevant source of information for measuring operation risk, but it is generally insufficient
- Internal and external data come from fundamentally different distributions and therefore cannot be merged directly
- All operational loss data is collected above a threshold level, making it difficult to estimate parameters for modeling
- Operational loss data are not well represented by traditional two parameter severity distributions, such as the Lognormal or Weibull. Kurtosis (in log terms) ranges from 3-7.
- External data comes from so many diverse institutions, with differing sizes, cultures, risk appetites, control structures, procedures and business mixes that very little of this loss data can be relevant to a given institution

How can external data be relevant to my bank? There are numerous biases in the data.

Size	Larger institutions (and businesses) are likely to experience more losses than smaller institutions. These institutions are also likely to suffer larger losses.
Control	Institutions with weak controls are more likely to be represented in the database because they experience more losses. These institutions are also likely to suffer more large losses than well controlled institutions.
Institutional Culture	More aggressive institutions (and businesses) are likely to experience more losses than less aggressive institutions. These institutions are also likely to suffer larger losses.
Infrastructure / IT	Less technologically advanced institutions (and businesses) are likely to experience more losses than more advanced institutions. These institutions are also likely to suffer larger technology losses.
Media	Large losses more likely to be reported than small losses.
Legal Environment	The legal system in certain countries may lead to more frequent and/or larger losses.

Loss data needs to be adjusted for inflation and scaled for size.

Inflation adjustment:

$10 million loss in 1990 = $12.4 million loss in 2001

Scale Adjustment:

$10 million loss when a $2 billion (revenue) bank = $13.2 million loss when a $6 billion bank[1]

$$Scaled\ Loss = L_{DB}\left[\frac{R_{\text{int}}}{R_{\text{ext}}}\right]^{n}$$

L_{DB} = Actual Loss experienced by bank

R_{ext} = Revenue of external firm

R_{int} = Revenue of firm

n = Scaling co-efficient determined by regression analysis

[1] Shih, J., A. Samad-Khan and P. Medapa, "Is the Size of an Operational Loss Related to Firm Size," *Operational Risk* (January 2000)

Internal and external loss data should be placed in separate matrixes (by business line and risk category).

EXTERNAL
EVENT RISK MATRIX

		INTERNAL FRAUD	EXTERNAL FRAUD	EMPLOYMENT PRACTICES & WORKPLACE SAFETY	CLIENTS, PRODUCTS & BUSINESS PRACTICES	DAMAGE TO PHYSICAL ASSETS	EXECUTION, DELIVERY & PROCESS MANAGEMENT	BUSINESS DISRUPTION AND SYSTEM FAILURES	TOTAL
Corporate Finance	Number	362	123	25	36	33	150	2	731
	Mean	35,459	52,056	3,456	56,890	56,734	1,246	89,678	44,215
	Standard Deviation	5,694	8,975	3,845	7,890	3,456	245	23,543	6,976
Trading & Sales	Number	50	4	35	50	46	210	3	398
	Mean	53,189	78,084	5,184	85,335	85,101	1,869	134,517	66,322
	Standard Deviation	8,541	13,463	5,768	1[illegible]335	5,184	368	35,315	10,464
Retail Banking	Number	45	4	32	[illegible]	42	189	3	360
	Mean	47,870	70,276	4,666	[illegible]802	76,591	1,682	121,065	59,690
	Standard Deviation	7,687	12,116	5,191	[illegible]	4,666	331	31,783	9,417
Commercial Banking	Number	41	3	28	[illegible]	37	170	2	322
	Mean	43,083	63,248	[illegible]	[illegible]121	68,932	1,514	108,959	53,721
	Standard Deviation	6,918	10,905	[illegible]	9,586	4,199	298	28,605	8,476
Payment & Settlements	Number	37	[illegible]	[illegible]	37	34	153	2	292
	Mean	38,774	56,92[illegible]	[illegible]	62,209	62,039	1,363	98,063	48,349
	Standard Deviation	6,226	9,814	[illegible]205	8,628	3,779	268	25,744	7,628
Agency Services	Number	44	4	31	44	40	184	2	349
	Mean	46,529	68,308	4,535	74,651	74,446	1,635	117,675	58,018
	Standard Deviation	7,472	11,777	5,045	10,353	4,535	321	30,893	9,154
Asset Management	Number	40	3	28	40	36	165	2	314
	Mean	41,876	61,477	4,081	67,186	67,002	1,472	105,908	52,217
	Standard Deviation	6,725	10,599	4,541	9,318	4,081	289	27,804	8,238
Retail Brokerage	Number	48	4	33	48	44	198	3	378
	Mean	50,252	73,773	4,898	80,623	80,402	1,766	127,090	62,660
	Standard Deviation	8069	12719	5449	11182	4898	347	33365	9886
Insurance	Number	43	4	30	43	39	179	2	340
	Mean	45,226	66,395	4,408	72,561	72,362	1,589	114,381	56,394
	Standard Deviation	7,262	11,447	4,904	10,063	4,408	312	30,028	8,897
Total	Number	710	152	268	384	351	1,598	21	3,484
	Mean	45,653	67,021	4,450	73,245	73,044	1,604	115,459	56,926
	Standard Deviation	7,331	11,555	4,950	10,158	4,450	315	30,311	8,981

The only severity information one can obtain from external public data is relative information (model transferability) – assuming the biases are consistent across all categories.

EXTERNAL
EVENT RISK MATRIX
SEVERITY PARAMETERS IN LOG TERMS

		INTERNAL FRAUD	EXTERNAL FRAUD	EXECUTION, DELIVERY & PROCESS MANAGEMENT
Corporate Finance	Number	362	123	150
	Mean	9	6	6
	Standard Deviation	6	4	2

EXTERNAL
EVENT RISK MATRIX
SEVERITY PARAMETERS IN RELATIVE TERMS

		INTERNAL FRAUD	EXTERNAL FRAUD	EXECUTION, DELIVERY & PROCESS MANAGEMENT
Corporate Finance	Number	362	123	150
	Mean	1.5	1	1
	Standard Deviation	3	2	1

From internal data we seek pivot cells – those cells that have enough information to reliably calculate severity parameters.

INTERNAL
EVENT RISK MATRIX

		INTERNAL FRAUD	EXTERNAL FRAUD	EMPLOYMENT PRACTICES & WORKPLACE SAFETY	CLIENTS, PRODUCTS & BUSINESS PRACTICES	DAMAGE TO PHYSICAL ASSETS	EXECUTION, DELIVERY & PROCESS MANAGEMENT	BUSINESS DISRUPTION AND SYSTEM FAILURES	TOTAL
Corporate Finance	Number	36	3	25	36	33	234	2	731
	Mean	35,459	52,056	3,456	56,890	56,734	3	89,678	44,215
	Standard Deviation	5,694	8,975	3,845	7,890	3,456	2	23,543	6,976
Trading & Sales	Number	50	4	35	50	46	210	3	398
	Mean	53,189	78,084	5,184	85,335	85,101	1,869	134,517	66,322
	Standard Deviation	8,541	13,463	5,768	11,835	5,184	368	35,315	10,464
Retail Banking	Number	45	4	32	[illegible]	42	189	3	360
	Mean	47,870	70,276	4,666	[illegible]	6,591	1,682	121,065	59,690
	Standard Deviation	7,687	12,116	5,191	[illegible]	4,666	331	31,783	9,417
Commercial Banking	Number	41	3	28	[illegible]	37	170	2	322
	Mean	43,083	63,248	4,199	[illegible]	68,932	1,514	108,959	53,721
	Standard Deviation	6,918	10,905	4,6[illegible]	[illegible]	4,199	298	28,605	8,476
Payment & Settlements	Number	37	3	[illegible]	37	34	153	2	292
	Mean	38,774	56,9[illegible]	[illegible]	62,209	62,039	1,363	98,063	48,349
	Standard Deviation	6,226	9,814	[illegible]	8,628	3,779	268	25,744	7,628
Agency Services	Number	44	4	31	44	40	184	2	349
	Mean	46,529	68,308	4,535	74,651	74,446	1,635	117,675	58,018
	Standard Deviation	7,472	11,777	5,045	10,353	4,535	321	30,893	9,154
Asset Management	Number	40	3	28	40	36	165	2	314
	Mean	41,876	61,477	4,081	67,186	67,002	1,472	105,908	52,217
	Standard Deviation	6,725	10,599	4,541	9,318	4,081	289	27,804	8,238
Retail Brokerage	Number	48	4	33	48	44	198	3	378
	Mean	50,252	73,773	4,898	80,623	80,402	1,766	127,090	62,660
	Standard Deviation	8069	12719	5449	11182	4898	347	33365	9886
Insurance	Number	43	4	30	43	39	179	2	340
	Mean	45,226	66,395	4,408	72,561	72,362	1,589	114,381	56,394
	Standard Deviation	7,262	11,447	4,904	10,063	4,408	312	30,028	8,897
Total	Number	710	152	268	384	351	1,598	21	3,484
	Mean	45,653	67,021	4,450	73,245	73,044	1,604	115,459	56,926
	Standard Deviation	7,331	11,555	4,950	10,158	4,450	315	30,311	8,981

Using the pivot cell and relative parameter ratios from external data we can estimate severity parameter for all cells in a business line.

INITIAL INTERNAL EVENT RISK MATRIX

		INTERNAL FRAUD	EXTERNAL FRAUD	EMPLOYMENT PRACTICES & WORKPLACE SAFETY	CLIENTS, PRODUCTS & BUSINESS PRACTICES	DAMAGE TO PHYSICAL ASSETS	EXECUTION, DELIVERY & PROCESS MANAGEMENT	BUSINESS DISRUPTION AND SYSTEM FAILURES	TOTAL
Corporate Finance	Number						234		
	Mean						3		
	Standard Deviation						2		

PARAMETER RATIOS FROM EXTERNAL EVENT RISK MATRIX

		INTERNAL FRAUD	EXTERNAL FRAUD	EMPLOYMENT PRACTICES & WORKPLACE SAFETY	CLIENTS, PRODUCTS & BUSINESS PRACTICES	DAMAGE TO PHYSICAL ASSETS	EXECUTION, DELIVERY & PROCESS MANAGEMENT	BUSINESS DISRUPTION AND SYSTEM FAILURES	TOTAL
Corporate Finance	Number								
	Mean	1.5	1				1		
	Standard Deviation	3	2				1		

FINAL INTERNAL EVENT RISK MATRIX

		INTERNAL FRAUD	EXTERNAL FRAUD	EMPLOYMENT PRACTICES & WORKPLACE SAFETY	CLIENTS, PRODUCTS & BUSINESS PRACTICES	DAMAGE TO PHYSICAL ASSETS	EXECUTION, DELIVERY & PROCESS MANAGEMENT	BUSINESS DISRUPTION AND SYSTEM FAILURES	TOTAL
Corporate Finance	Number						234		
	Mean	4.5	3				3		
	Standard Deviation	6	4				2		

SUMMARY & CONCLUSIONS

When considering risk and control assessment, what are the priorities?

- Establish a disciplined process. It's the process that matters, the results are less important.
  - A good process lays the foundation for a good risk management culture.
- Establish a process that will produce the most reliable results. The results are more important.
  - If it is clear to end users that the results are fictitious then the entire risk management program will be discredited; the operational risk program will be seen to be adding little value.
- Demonstrate practical value and the program will be a success and subsequently create the right culture.

Questions and Answers

When the answers are unclear…

… is it because we are asking the wrong questions?

Biographical Information

Ali Samad-Khan is *President of OpRisk Advisory LLC*. He has over eight years experience in operational risk measurement and management and more than twenty years experience in financial services. His areas of expertise include: establishing an integrated operational risk measurement and management framework, developing policies and procedures, internal loss event database design and implementation; data quality assessment, data sufficiency, risk indicator identification, risk and control self assessment, disciplined scenario analysis, causal/predictive modeling, advanced VaR measurement techniques and economic capital allocation.

Mr. Samad-Khan has advised many of the world's leading banks on operational risk measurement and management issues. His significant practical experience in this field comes from managing the implementation of ten major operational risk consulting engagements at leading institutions in North America, Europe and Australia. Key elements of the ORA framework and methodology have been adopted by dozens of leading financial institutions worldwide and have also been incorporated into the BIS guidelines.

Mr. Samad-Khan has frequently advised the major bank regulatory authorities, including the Risk Management Group of Basel Committee on Banking Supervision, the Board of Governors of the Federal Reserve System, the Federal Reserve Bank of New York, the Financial Services Authority (UK) and the Australian Prudential Regulatory Authority. He also holds seminars and workshops for the Bank of International Settlements (BIS) and the Institution of International Finance (IIF).

Prior to founding OpRisk Advisory, Mr. Samad-Khan was CEO of OpRisk Analytics LLC, which was acquired by SAS in 2003. (From June 2003 to September 2004 Mr. Samad-Khan provided transitional support for the acquisition of OpRisk Analytics, serving as SAS' Head of Global Operational Risk Strategy.) He has also worked at PricewaterhouseCoopers (PwC) in New York, where for three years he headed the Operational Risk Group within the Financial Risk Management Practice, in the Operational Risk Management Department at Bankers Trust as well as the Federal Reserve Bank of New York and the World Bank.

Mr. Samad-Khan holds a B.A. in Quantitative Economics from Stanford University and an M.B.A. in Finance from Yale University.

Articles include: "Why COSO is Flawed," *Operational Risk Magazine*, January 2005; "Is the Size of an Operational Loss Related to Firm Size," with Jimmy Shih and Pat Medapa, *Operational Risk Magazine*, January 2000; "Measuring Operational Risk," with David Gittleson, *Global Trading*, Fourth Quarter, 1998.
Working papers include: *"How to Categorize Operational Losses – Applying Principals as Opposed to Rules"* March 2002 and *"Categorization Analysis"* January 2003.

ORA OpRisk Advisory

Contact Us

WORLDWIDE OFFICES

Worldwide Offices

OpRisk Advisory, United States (Head Office)
One Stamford Plaza
263 Tresser Boulevard, 9th Floor
Stamford, CT 06901
UNITED STATES
Telephone: +1 203 564 1990
Facsimile: +1 203 322 8364
helen.lee@opriskadvisory.com

OpRisk Advisory, France
12-14, Rond Point des Champs Elysées
75008 Paris
FRANCE
Telephone: +33 (0) 1 53 53 16 07
Facsimile: +33 (0) 1 53 53 14 00
stephane.le-blevec@opriskadvisory.com

OpRisk Advisory, Malaysia
Level 40, Tower 2, Petronas Twin Towers
Kuala Lumpur City Centre
50088 Kuala Lumpur,
MALAYSIA
Telephone: +603 2168 4490
Facsimile: +603 2168 4201
robert.kumar@opriskadvisory.com

OpRisk Advisory, Singapore
UOB Plaza 1, Level 36
80 Raffles Place
Singapore, 048624
SINGAPORE
Telephone: +65 6248 4702
Facsimile: +65 6248 4531
paul.castle@opriskadvisory.com

OpRisk Advisory, Switzerland
Seefeldstrasse 69
8008 Zurich
SWITZERLAND
Telephone: +41 43 488 35 35
Facsimile: +41 43 488 35 00
colin.forrest@opriskadvisory.com