ICBC Standard Bank

10 Fundamental Laws of Operational Risk

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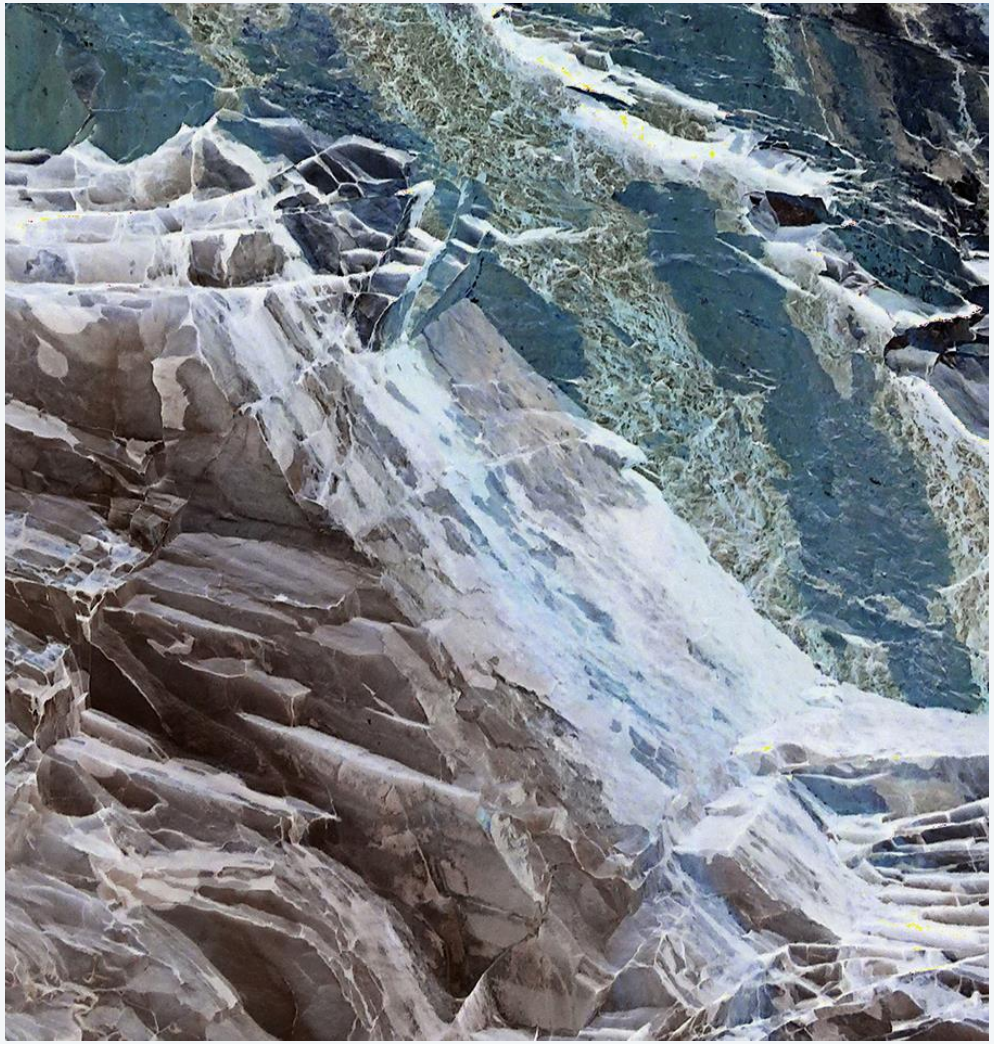


Some of the Op Risk profession's struggles with its toolset, such as, predictive KRIs, RCSAs and cyclicality, over the last 25 years, may originate from its lack of an overarching theory…

"Unlike Credit and Market Risk,

Operational Risk is lacking in basic theory as to

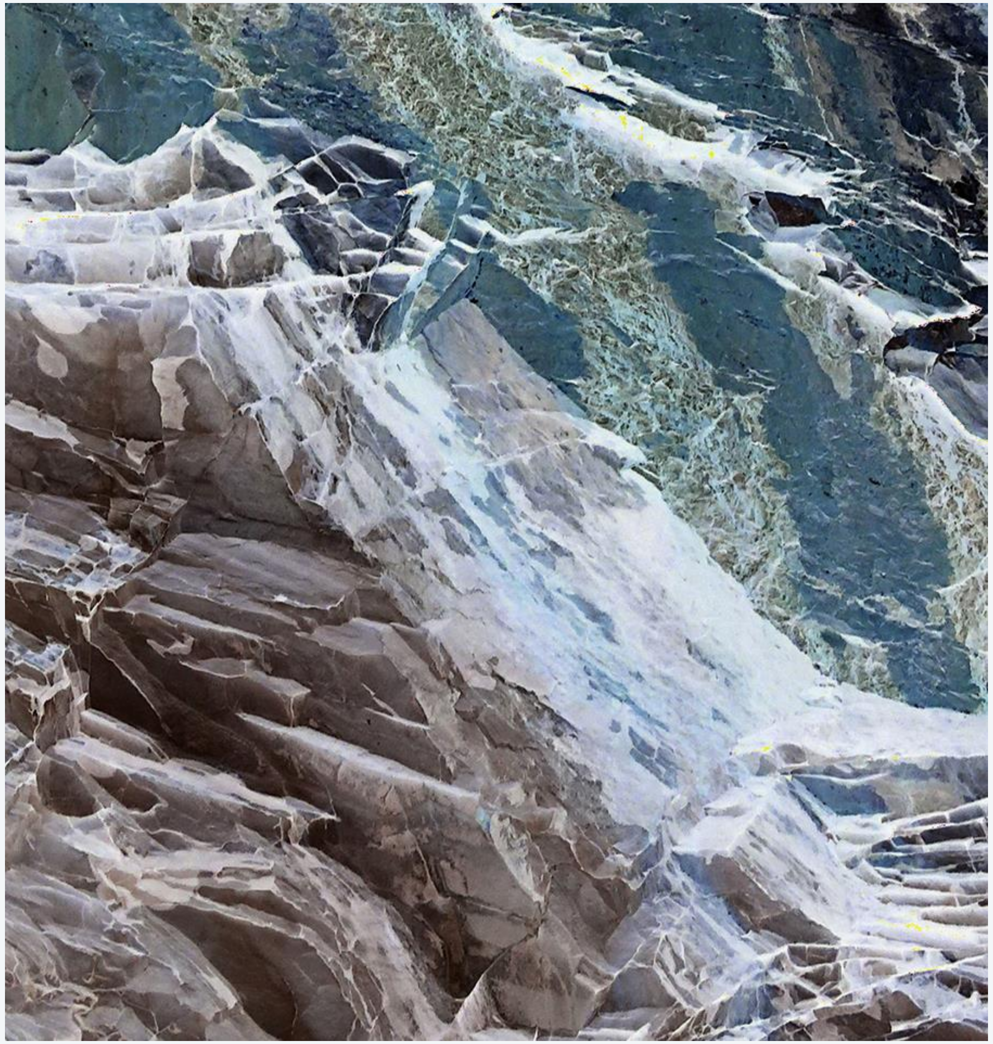
***why, where and when** Operational Risk losses occur."*

Dr Pat McConnell, 2017[1]

By analysing loss data I have identified 10 Fundamental Laws of Op Risk. Using these laws I'll:

- Answer 3 questions to illustrate its different characteristics; and
- Conclude with how the profession's toolset can be better tailored.

1. "*Two Laws of Operational Risk*". LinkedIn https://www.linkedin.com/pulse/two-laws-operational-risk-patrick-mcconnell/



Question 1

"Whilst firms actively take Market & Credit Risks to generate revenues, this is not the case for Op Risk"

Do you...

- Agree?
- Disagree?
- Neither agree nor disagree?

1. Do firms proactively take Op Risk? – Revenues & risks

The risk profiles of the 3 main types of revenue differ significantly…

Types of revenue	Primary risk for each source of revenue	Op Risk
1. Interest income : • Loans; and • Deposits.	• **Primarily Credit Risk.** • By-products include Liquidity, Market & Op Risks.	By-product
2. Trading income: • Cash products; and • Derivatives.	• **Primarily Market & Credit Risks.** • By-products include Liquidity & Op Risks.	
3. Fees & commissions: • Selling products / transferring risks; and • Providing services.	• **Primarily Op Risk.** • By-products include Credit, Market & Liquidity Risks, but these are very small, in comparison.	Proactively taken

…fee & commission businesses tend to have very high RoEs as the underlying transactions are off-balance sheet, and the associated Op Risks are often under-estimated…

1. Op Risk losses can also sometimes arise from a firm's infrastructure and its corporate governance e.g. damage to physical assets.

1. Do firms proactively take Op Risk? – The G-SIBs' revenues & risks

Fee & commission income streams generate more & greater large losses (≥$0.1bn) than the other income streams…

10th Law: Operational Risk losses generated by a firm's business profile

Operational Risk losses generated by a firm's business profile, $	≈	Fee & commission income	+	Trading & interest income	+	A firm's infrastructure and corporate governance
		Proactively taken Operational Risks		Passively taken Operational Risks		Passively taken Operational Risks
% of large losses (≥$0.1bn):						
• 2007 to 2017		68%		31%		1%
• 1996 to 2006		46%		47%		8%

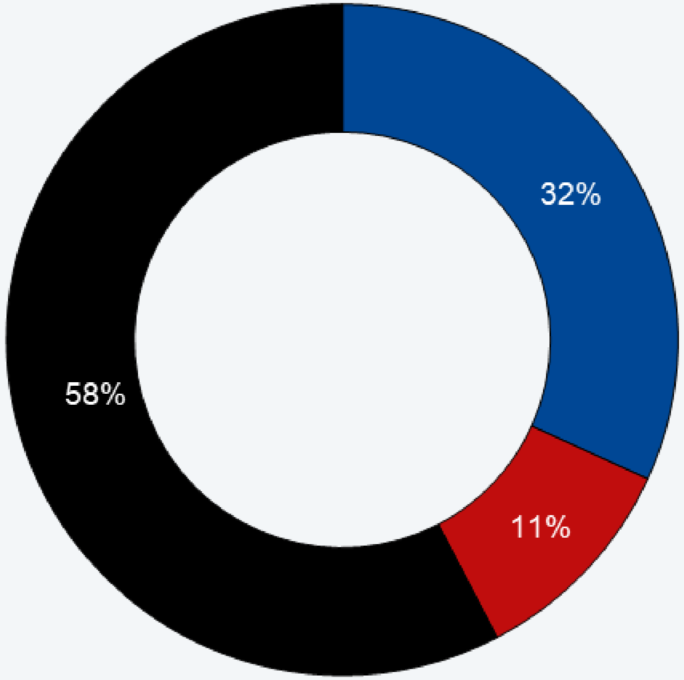
…and this was exacerbated following the Financial Crisis…

Source: Grimwade, M., (unpublished but recently submitted to the JOR) *"Ten fundamental Laws of Operational Risk"*

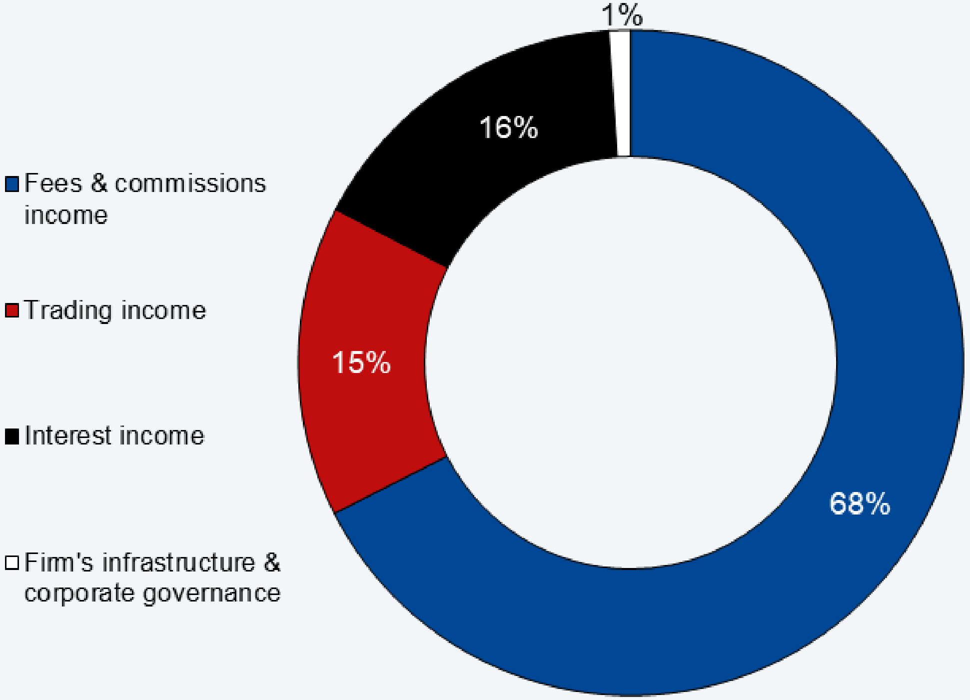
1. Do firms proactively take Op Risk? – The G-SIBs revenues & risks

Losses arising from fee & commission income also seem to be disproportionately large…

Split of income type for 2017



Value of large losses from 2007 to 2017 analysed by income type



…this may reflect the value of the assets and transactions processed to generate this fee & commission income.

Source: Grimwade, M., (unpublished but recently submitted to the JOR) *"Ten fundamental Laws of Operational Risk"*

1. Do firms proactively take Op Risk? – Risk transfer

When a product is mis-sold or mis-structured or mis-managed then the quantum of risk is conserved…

9th Law: Risk conservation of the quantum of risk

	Manufacture a fund	
Quantum of Operational Risks	≈	**Quantum of Market + Credit Risks**
(Retained by the arranger / manager / distributor in the case of mis-conduct)		(Transferred to customers / investors)

9th Law: Reduction in frequency / likelihood

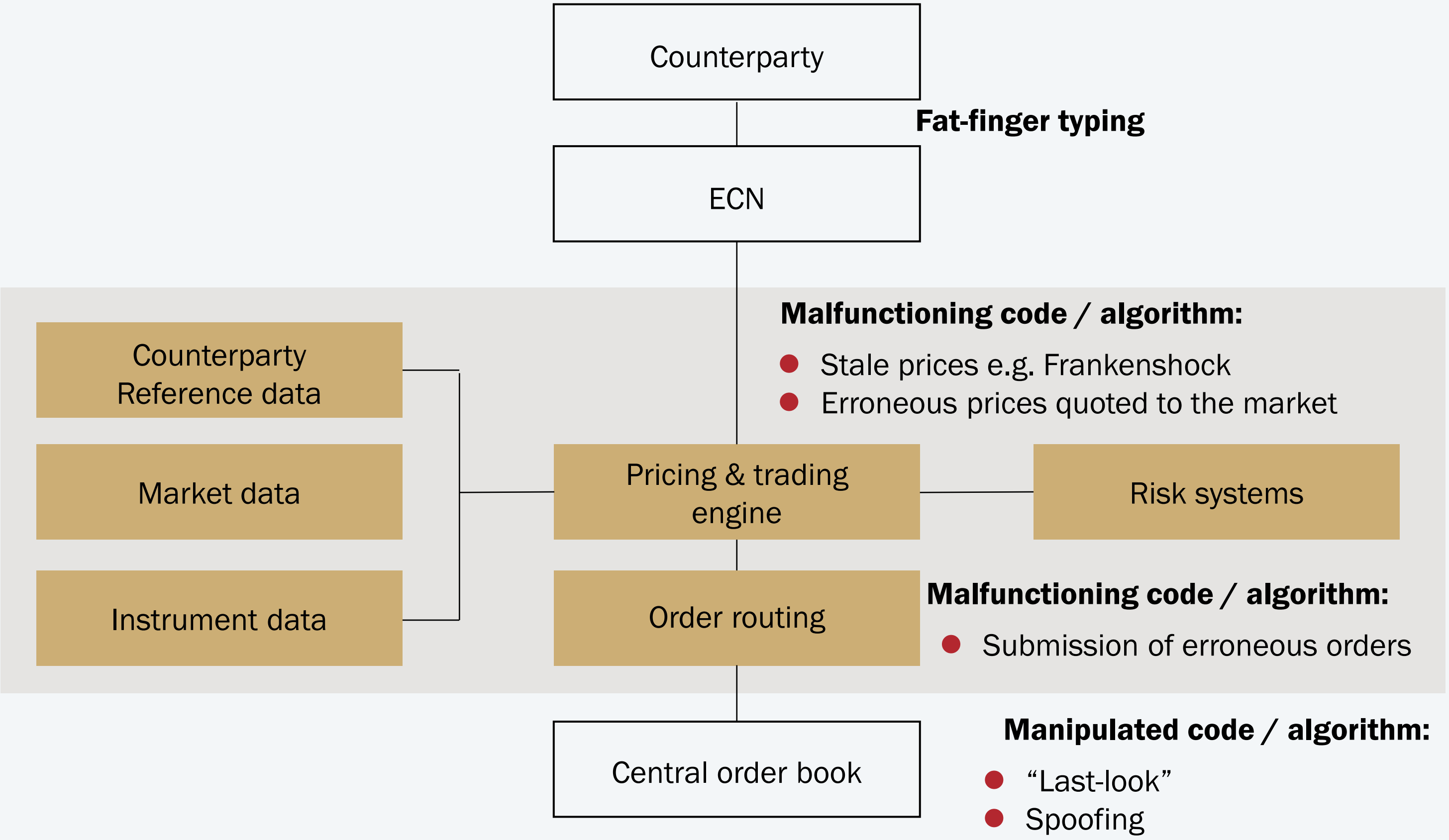
Frequency of Operational Risk events suffered by the arranger / manager / distributor, events per period	≈	Frequency of material Market & Credit Risk losses suffered by customers / investors	x	% services provided involving misconduct by the arranger / distributor
		Driven by external causes		**Driven by internal causes**

…but the frequency / likelihood is reduced.

Source: Grimwade, M., (unpublished but recently submitted to the JOR) *"Ten fundamental Laws of Operational Risk"*

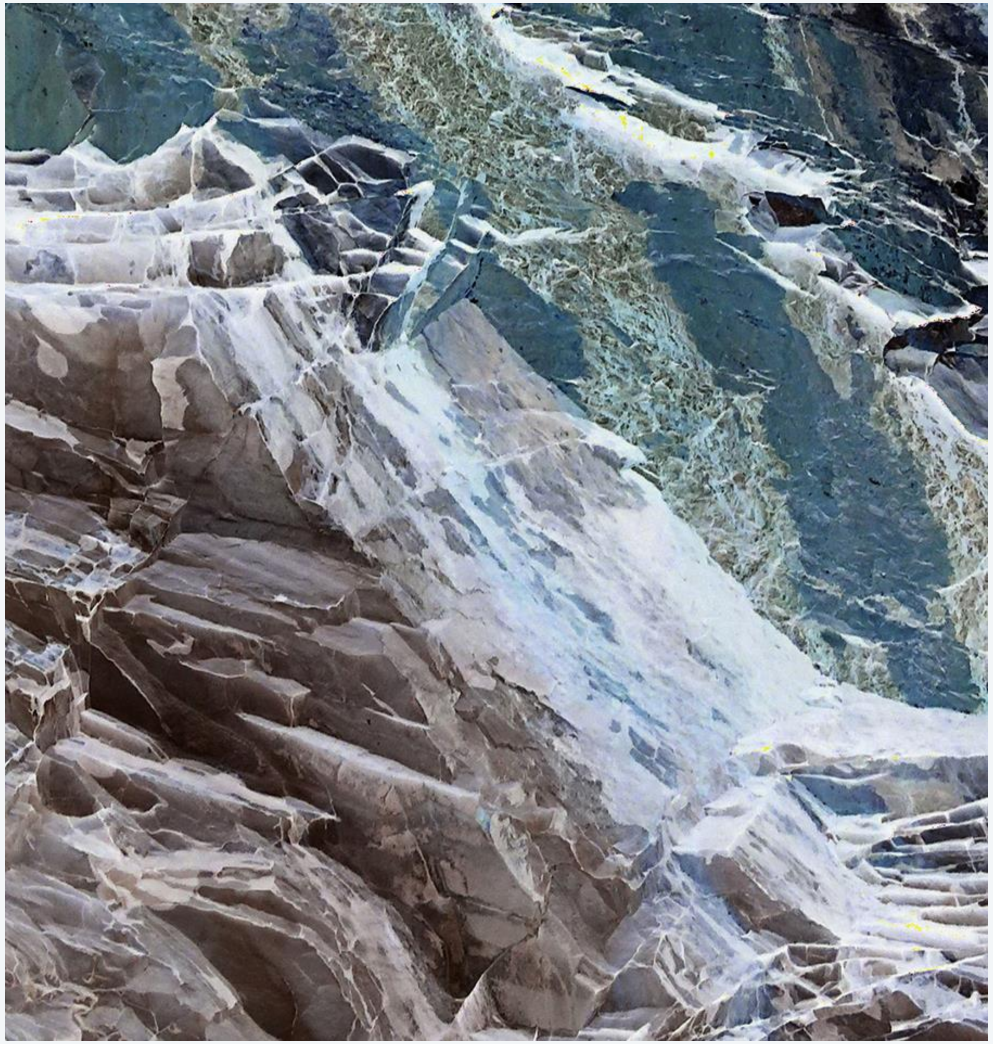
1. Do firms proactively take Op Risk? – Provision of services

Electronic trading can generate a range of Op Risks arising from mistakes, IT and mis-conduct…



…the largest losses arise when these failures lead to accidental Market Risk exposures.

Source: “*Managing Operational Risk: New Insights & Lessons Learnt*”, by Michael Grimwade, and published by RiskBooks.



Question 2

Do you think...

"Weakening controls causes Op Risk losses to..."

- Rise?
- Fall?
- Stay the same?

2. Understanding the impacts of weakening controls - Occurrence

The **Occurrence** of Op Risk events is driven by a variety of factors…

1st Law: Occurrence of events

$$\text{Occurrence of Op Risk events, number of events} \approx \overbrace{(\text{Business profile}^1 \times \text{“}\textit{Inadequacies or failures}\text{”} \times \text{Internal causes}^1)}^{\text{Inherent propensity for events to occur}} - \underbrace{(\text{Preventative controls}^2 - \text{Internal causes})}_{\text{Reduction in occurrence of events due to controls}}$$

Weakening Preventative Controls increases Op Risk incidents if the “*inadequacies & failures*” are persistent. The nature of “*inadequacies or failures*” and internal causes are considered further…

1. “*Business Profile*” and “*Causes*” are numerical factors i.e. they have no units.
2. For some risks there are no Preventative Controls e.g. fat-fingered typing.

2. Understanding the impacts of weakening controls - Occurrence

"*Inadequacies & failures*": The majority by number arise from mistakes & omissions…

Nature of the events		Basel II event taxonomy: EDPM	CPBP	EPWS	IF	EF	BDSF	DPA
People	• Mistakes & omissions							
	• Systemic misconduct							
	• Misconduct by individuals							
Systems	• Application failure							
	• Application malfunction							
	• Hardware outage							
	• Infrastructure failure							
Process	• Design / systemic failure							
External	• 3rd party failure							
	• Malicious acts							
	• Acts of God							
Ratios of events	• Trading & sales (ORX: 2013 - 2018)	71%	11%	8%	<½%	1%	7%	1%
	• Asset Management (ORX: 2013 - 2018)	56%	34%	6%	½%	2%	2%	0%

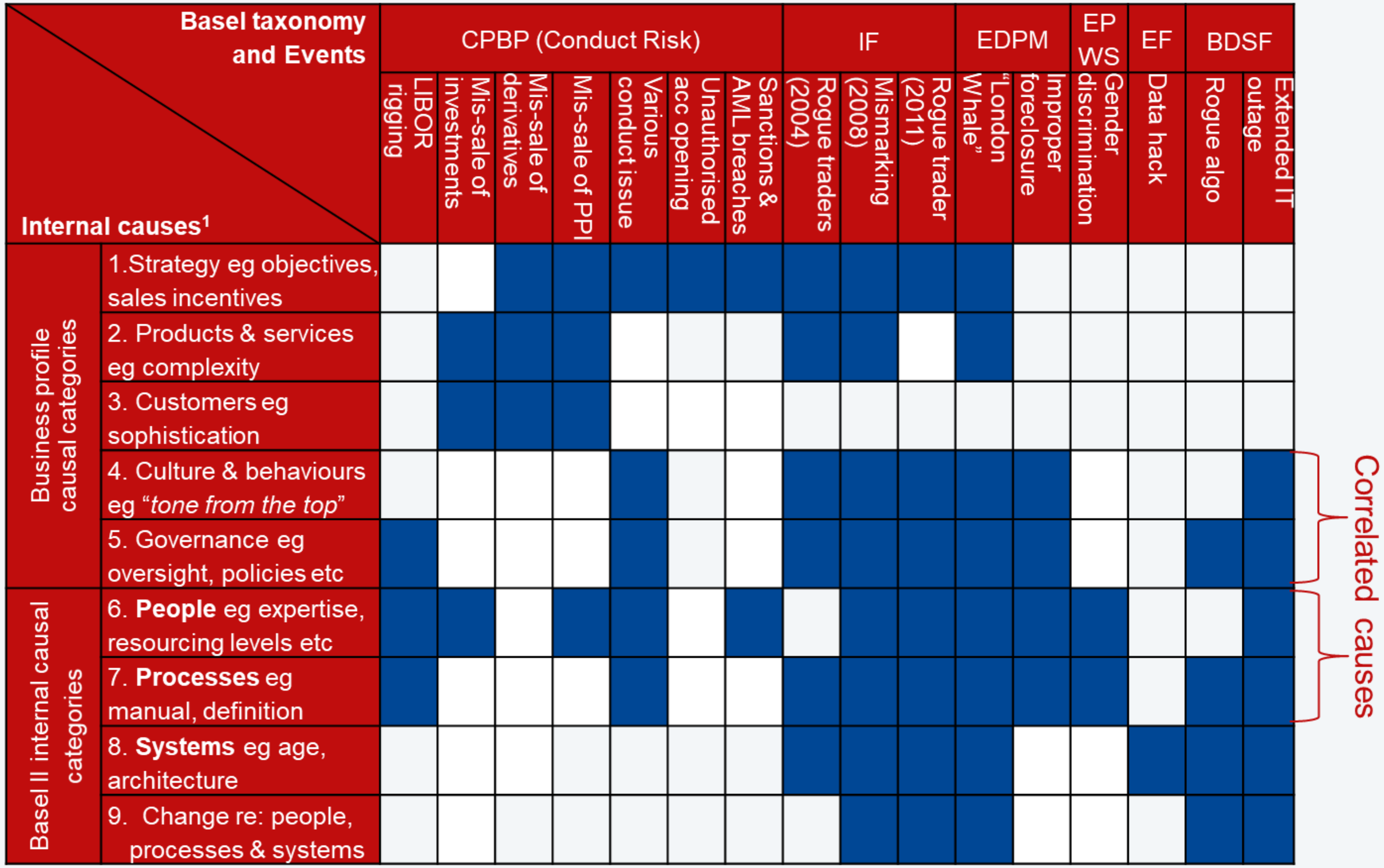
Trading & Sales and Asset Management have similar incident profiles

…however, the largest losses, by value, arise from misconduct i.e. 56% for AM and 67% for T&S.

Source: Grimwade, M., (unpublished but recently submitted to the JOR) *"Ten fundamental Laws of Operational Risk"*

2. Understanding the impacts of weakening controls - Occurrence

Causes: The most important relate to people, process, culture, incentives & governance[1]…



Internal causes can be correlated and can drive frequency by altering both occurrence and through the weakening of preventative controls.

1. These were cited in 16 well-documented events (e.g. in regulatory notices). They have also been collated into a causal taxonomy.

2. Understanding the impacts of weakening controls - Detection

Weakening Detective Controls may not directly effect **Occurrence**, but it does impact reported Op Risk events…

2nd Law: Frequency of reported events

$$\text{Frequency of reported events, events per period} \approx \frac{(\text{Currently occurring events} + \text{Historical undiscovered events}) \times \overbrace{(\text{Detective controls} + / - \text{Causes})}^{\text{Detection Rates (\%)}}}{\text{Time}}$$

Historical undiscovered events may include past mis-sale or mismanagement of funds.

Intuitively, weakening Detective Controls will lead to a short-term decline in reported Op Risk events…

Source: Grimwade, M., (unpublished but recently submitted to the JOR) *"Ten fundamental Laws of Operational Risk"*

2. Understanding the impacts of weakening controls - Severity

The severity of Op Risk events is driven by **Velocity** (the rate at which losses are suffered) and **Duration**…

3rd & 4th Laws: Velocity and Duration

Severity of an Op Risk event, \$ ≈ (Velocity[1] – Impact Limiting Controls[2]) x (Duration – (Detective Controls – Internal causes))

Velocity is itself driven by the Nature of the Impacts and External Causes, primarily sensitivity to economic cycles, but also regulatory inflation…

1. Chaparro, M. R., (2013) "*A new dimension to Risk Assessment*" Centre for Mathematical Sciences Lund University.
2. Impact Limiting Controls: Neither prevent events from occurring nor detect them, but instead they limit the impacts of an event through controls such as recovery sites to enhance Operational Resilience, and risk transference via insurance policies.

2. Understanding the impacts of weakening controls – Nature of impacts

Data is sparse, but when available, losses are often dominated by a single impact…

Events	Impacts (Basel III)	L.S.D.	Direct charges				Costs incurred		
			Compen-sation	Market Risk	Fines & penalties	Loss / write-down of assets / P&L	Incremental costs	3^{rd} party costs	Improving controls
Fuller disclosure	Mis-sale of PPI	£19bn						Unknown	
	AML breach	Kr55bn			Mooted settlement				
	Data hack	$1bn			Provision				
	Extended IT outage	<£½bn			Yet to be imposed				Unknown
Partial disclosure	Improper foreclosure	$25bn						Unknown	
	Mis-sale of MBS	$16bn						Unknown	
	London Whale	$7bn						Unknown	
	Rogue algo	$½bn						Unknown	

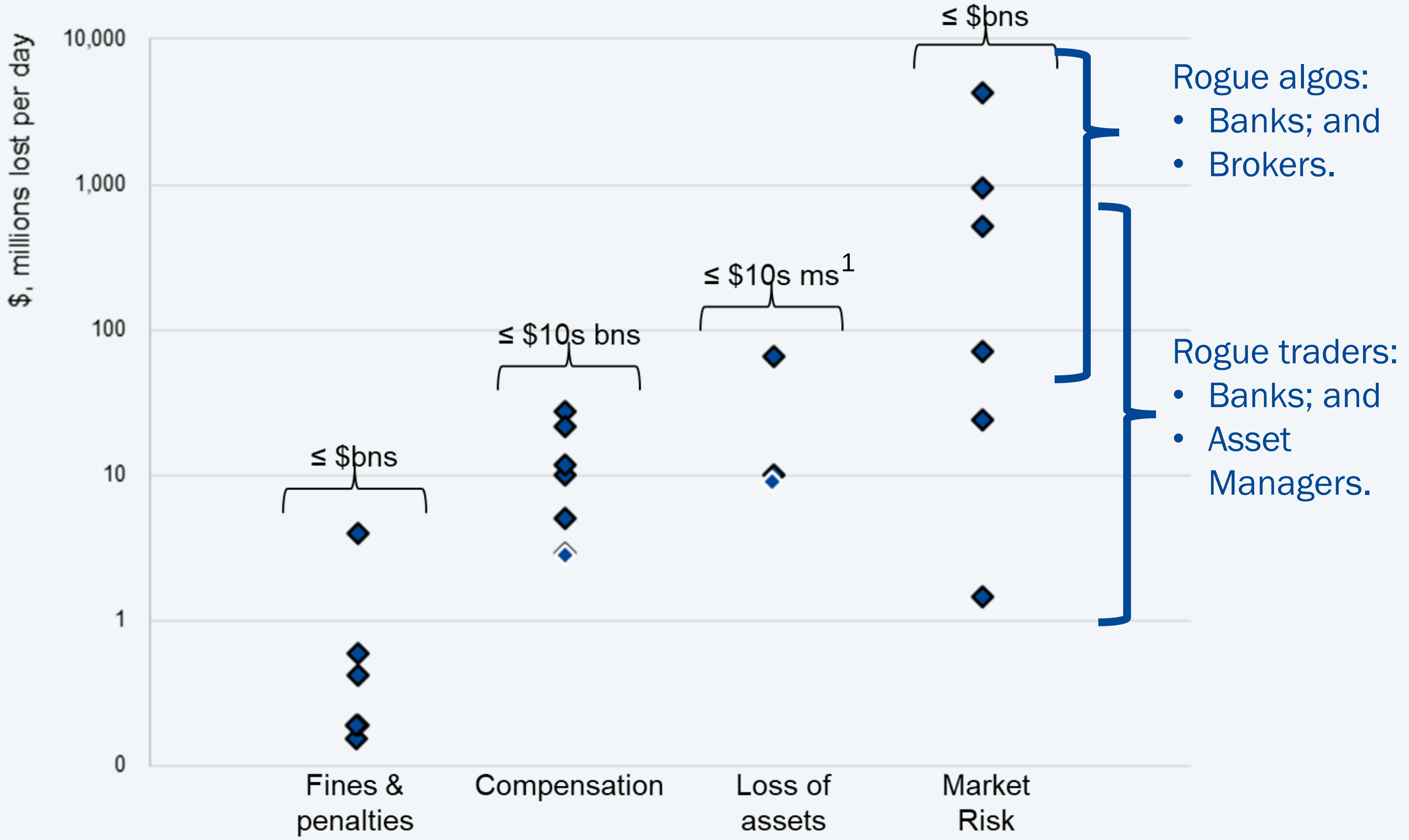
Key: % of total losses: ≥76% 51% to 75% 25% to 50% ≤25%

Source: Grimwade, M., (unpublished but recently submitted to the JOR) *"Ten fundamental Laws of Operational Risk"*

2. Understanding the impacts of weakening controls – Velocity

Risks for which the main impact is Market Risk have the highest **Velocities** but not the highest losses…

Differing rates of velocity of four significant impact categories



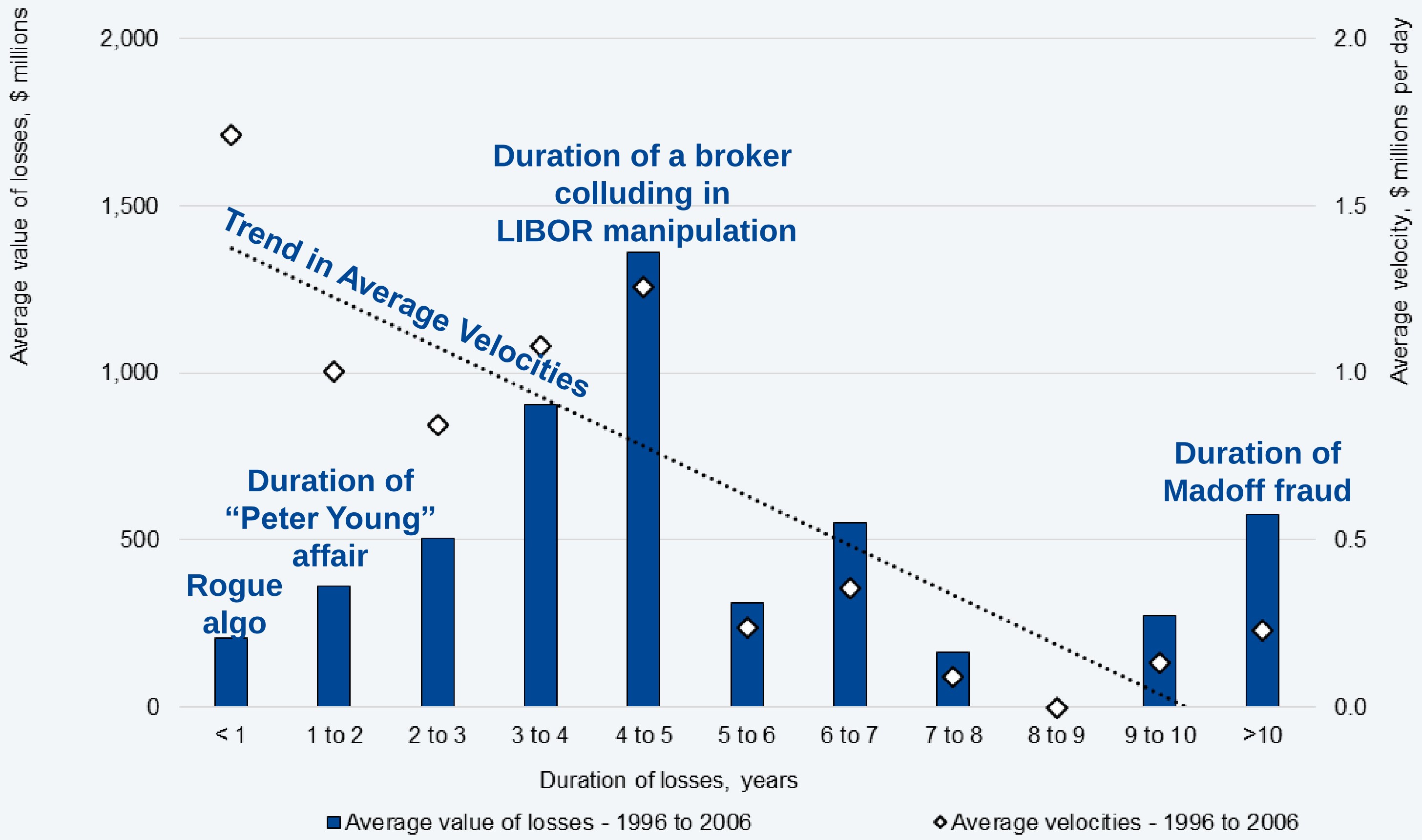
…the higher the **Velocity**, the higher the required frequency of performance of Detective Controls.

1. The publically available data is not particularly precise on the duration of SWIFT cyber thefts.

2. Understanding the impacts of weakening controls – Duration

Duration: Large Op Risk events (≥$0.1bn) with durations of 4 to 5 years have the highest average impacts…

Duration & velocity for losses ≥$0.1bn suffered by the G-SIBs pre-crisis (2007 to 2017)



Weakening Detective Controls, extends the **Duration** of events, hence the value of losses may be higher…

Source: Grimwade, M., (unpublished but recently submitted to the JOR) *"Ten fundamental Laws of Operational Risk"*

2. Understanding the impacts of weakening controls - Homeostasis

Risk Homeostasis[1] describes how firms respond to current or expected risk exposures by investing in controls to remain within appetite….

8th Law: Appetite for expected losses over time

$$\text{Appetite for expected losses over time, \$} \approx \Delta\,(\text{Frequency x Velocity x Duration}) - \Delta\,(\text{Preventative + Detective + Impact limiting controls})$$

Delaying the detection of incidents that are outside of appetite will delay these responses….

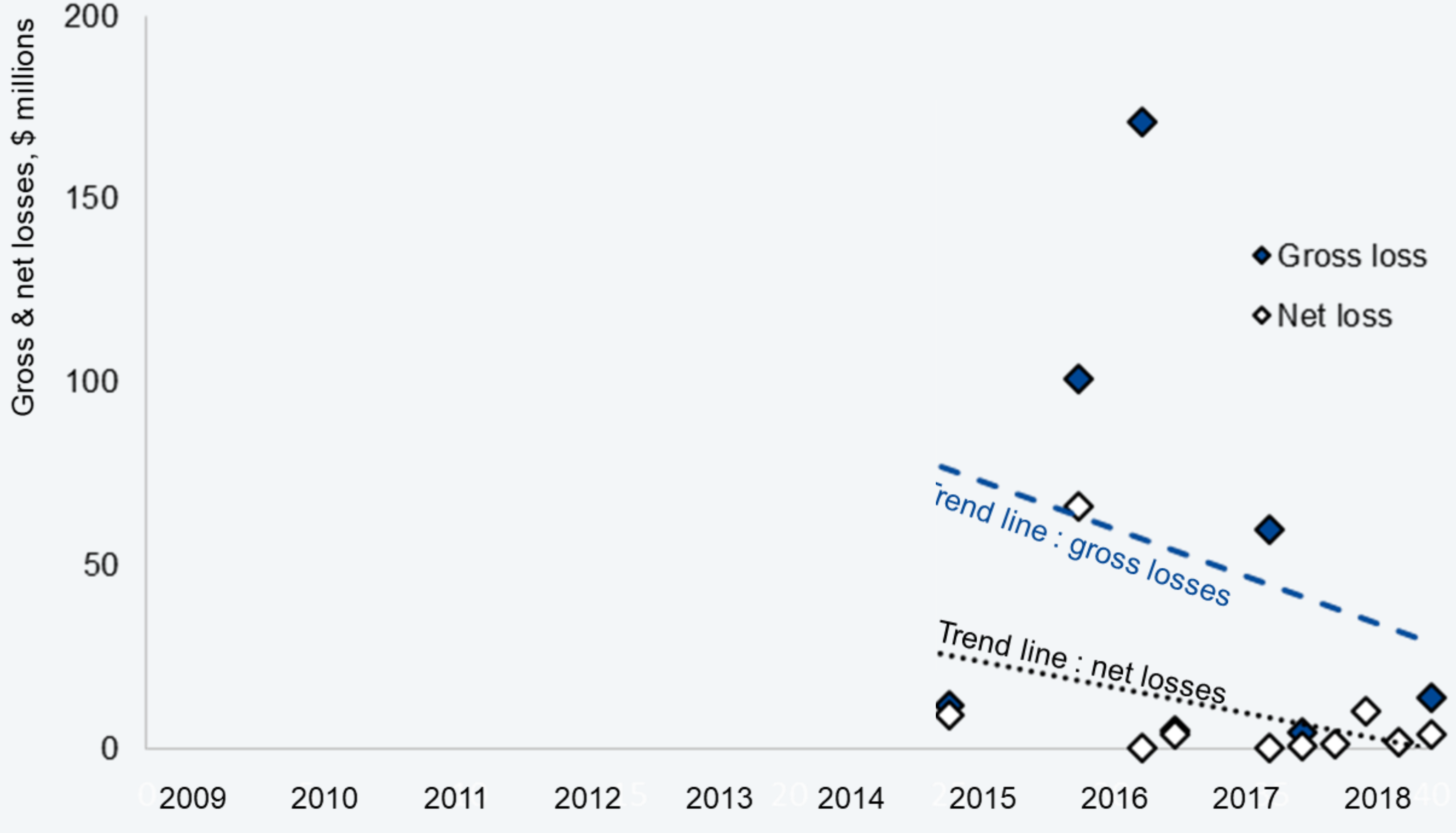
1. Wilde, G. J. S., (1998) "*Risk homeostasis theory: an overview*". Injury Prevention. 4 (2): 89–91.

Source: Grimwade, M., (unpublished but recently submitted to the JOR) *"Ten fundamental Laws of Operational Risk"*

2. Understanding the impacts of weakening controls - Homeostasis

Risk Homeostasis can be seen in the trends in new risks, and the industry's response to emerging threats e.g. Y2K…

Gross & net losses from public SWIFT cyber payments frauds over the last decade



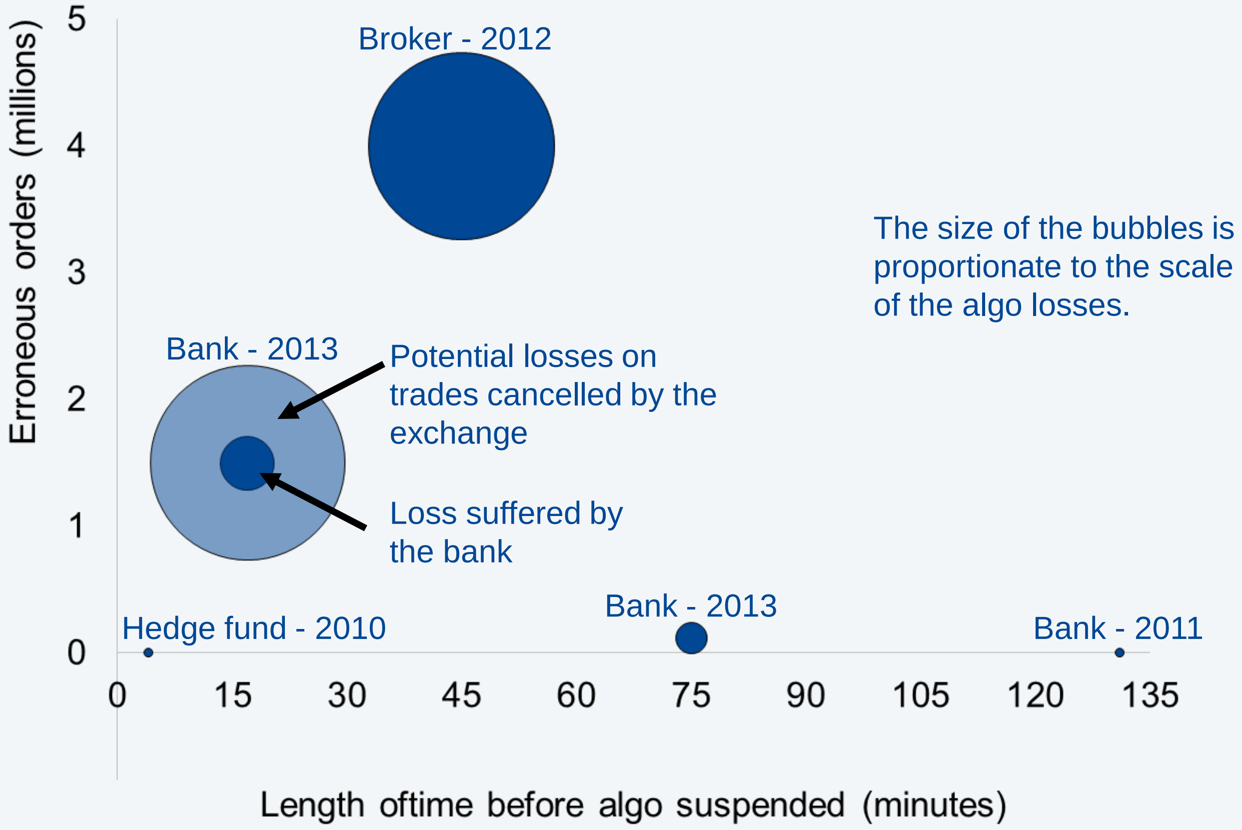
…**Risk Homeostasis** suggests that losses from cyber-crime will equilibrate.

Source: Grimwade, M., (2019) "*Applying existing scenario techniques to the quantification of emerging Operational Risks*". JOR, Vol 14, No 3.

2. Understanding the impacts of weakening controls – Rogue algos

Reviewing losses arising from rogue algos illustrates the importance of the Nature of Impacts, Velocity and Duration, as well as the industry's responses....

Losses arising from malfunctioning algos



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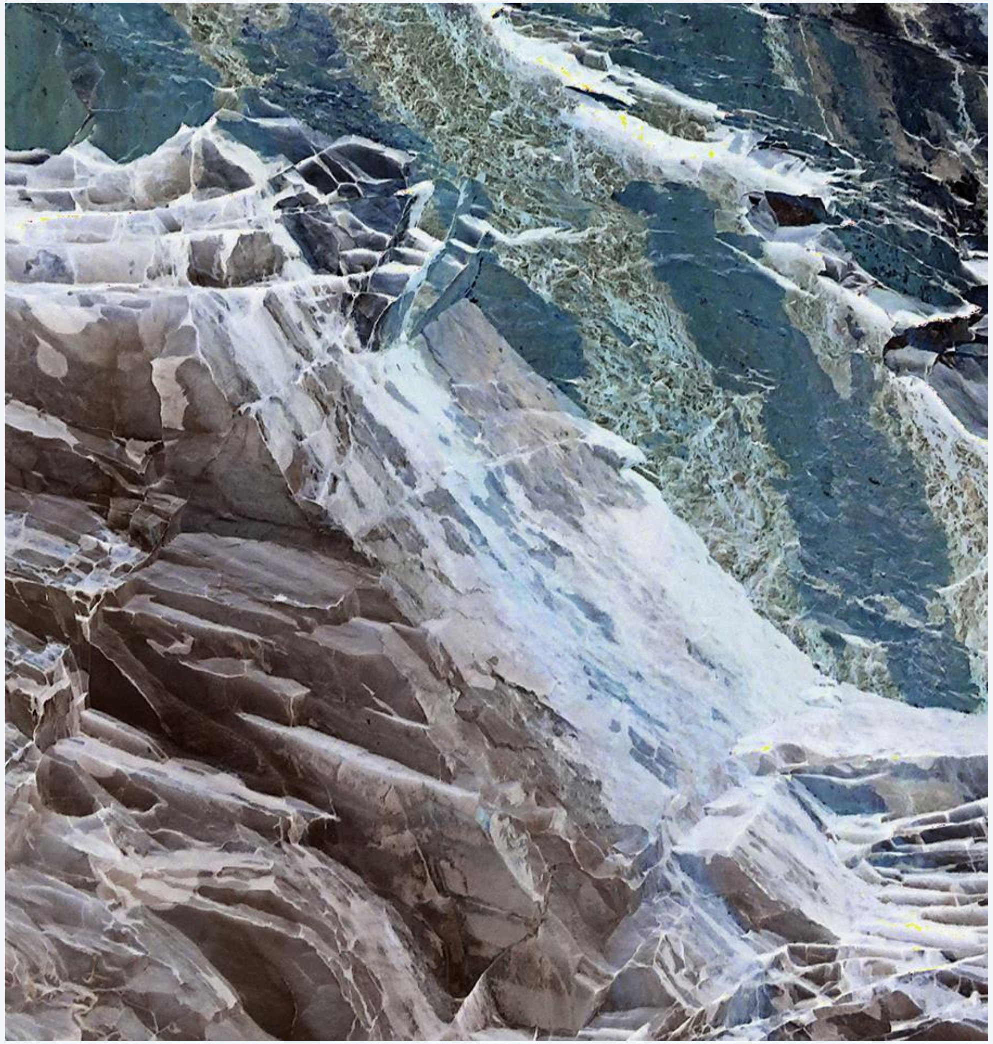


Question 3

"Op Risk losses rise during a recession"

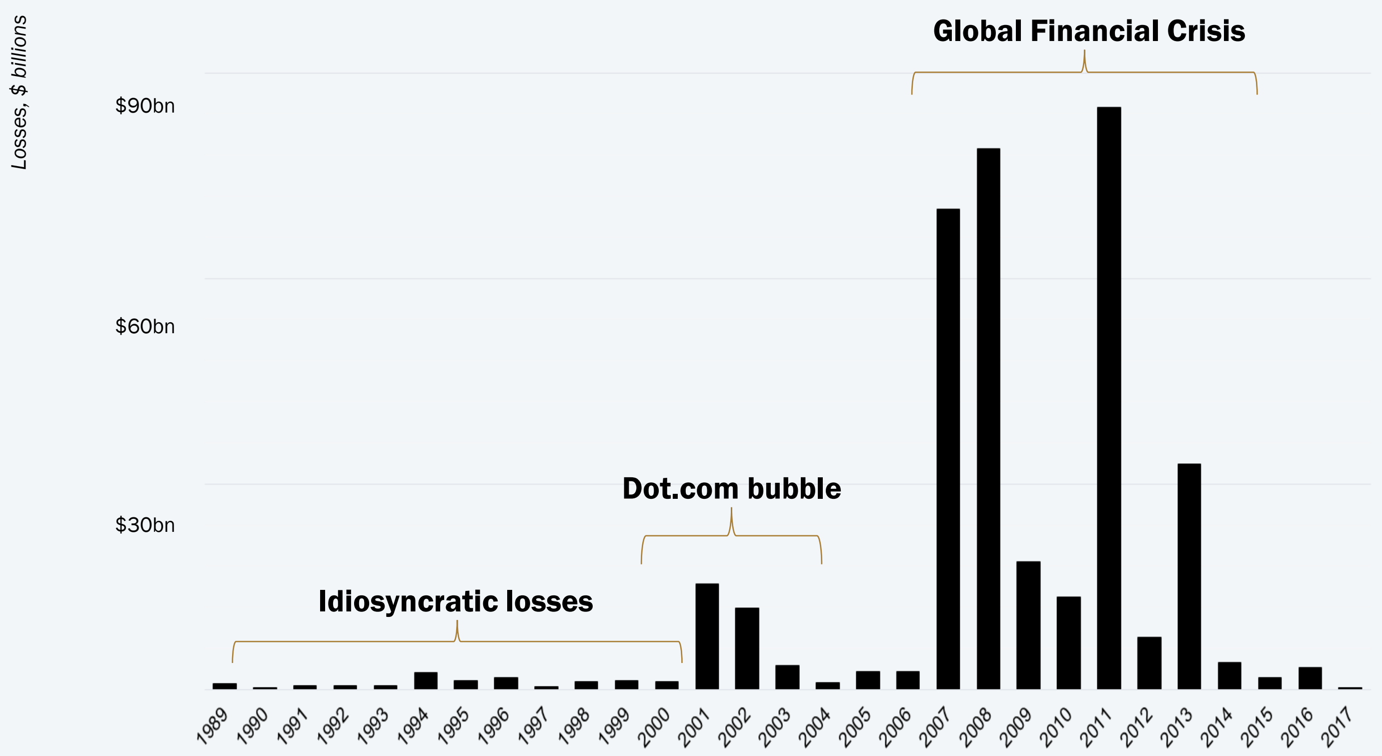
Do you…

- Rise?
- Fall?
- Stay the same?

3. Do Op Risk losses rise during a recession? – The G-SIBs

Op Risk losses, when analysed by end date, seem to spike during economic shocks…

Op Patterns in end-dates of Op Risk losses ≥$0.1bn for 31 current & former G-SIBs[1]



…these patterns need to be reflected within the quantification of these risks.

Source: *"Managing Operational Risk: New Insights & Lessons Learnt",* by M. Grimwade and published by RiskBooks.

3. Do Op Risk losses rise during a recession? – The G-SIBs

A recession seems to drive increases in Frequency, Velocity & Duration of large Op Risk losses (≥$0.1bn)...

7th Law: Correlation due to external causes

Changes in frequency or severity (Δ)	≈	(Δ Frequency of Occurrence	+	Δ Detection Rates)	x	Δ Velocity	x	Δ Duration
Ratio of large losses ($0.1bn) Pre & post-crisis i.e.: 2007 to 2017 vs 1996 to 2006		1st & 2nd Laws				3rd Law 2.3x		4th Law 1.3x
		3.2x Driven by internal & external causes				**2.9x** Driven by internal & external causes		

...the question is why?....

3. Do Op Risk losses rise during a recession? – Different drivers

Op Risks losses rise during & after economic shocks for a variety of reasons…

Drivers of these Op Risk losses	Examples of losses
1. Existing losses are exacerbated, whilst others decline	• Payment errors e.g. accidental payments to Lehman. • A rise in account take-over frauds. • But a decline in retail application frauds.
2. Historical failures uncovered	• Litigation against funds that "*broke the buck*". • Negative rates revealed deficiencies in documentation / structures. • Fraudulent funds uncovered e.g. Madoff. • Benchmark manipulation came to light in the crisis.
3. Responses to an economic shock may lead to new losses e.g.: • Firms; or • Individuals.	• Injections into funds after "*breaking the buck*". • Failure to respond to changing market conditions e.g. the AIG funds. • Staff litigation re: bonuses and dismissals.

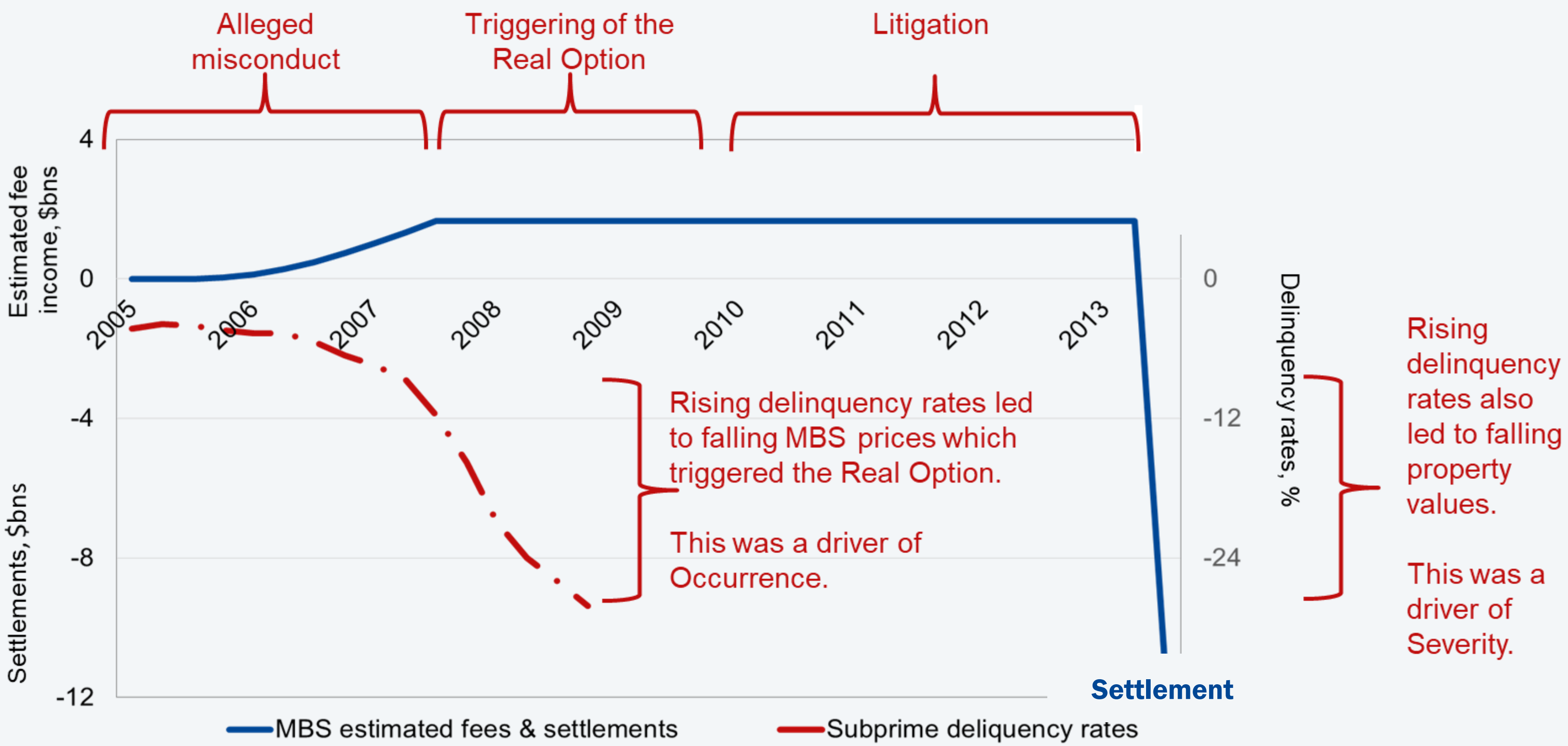
These losses are sensitive to Market & Credit Risks

For example, when a money market fund "*breaks the buck*" it may lead to Op Risk losses if the asset manager has mis-represented the fund's risks or invested outside of mandate.

3. Do Op Risk losses rise during a recession? – Real options

When firms behave inappropriately they essentially grant their customers & investors a “*Real Option*” - the right to claim redress if they suffer a loss, turning their Market & Credit Risk losses into Op Risk losses for their banks or asset managers…

Estimated revenues from arranging MBS and subsequent settlements for one US bank



Source: Grimwade, M., (2019) “*Applying existing scenario techniques to the quantification of emerging Operational Risks*”. JOR, Vol 14, No 3.

3. Do Op Risk losses rise during a recession? – Lags

The length of time between discovery & settlement is linked to systemic misconduct; regulatory involvement; litigation; sensitivity to economic cycles; and the distribution of compensation…

5th Law: Total losses equals current and prior year events

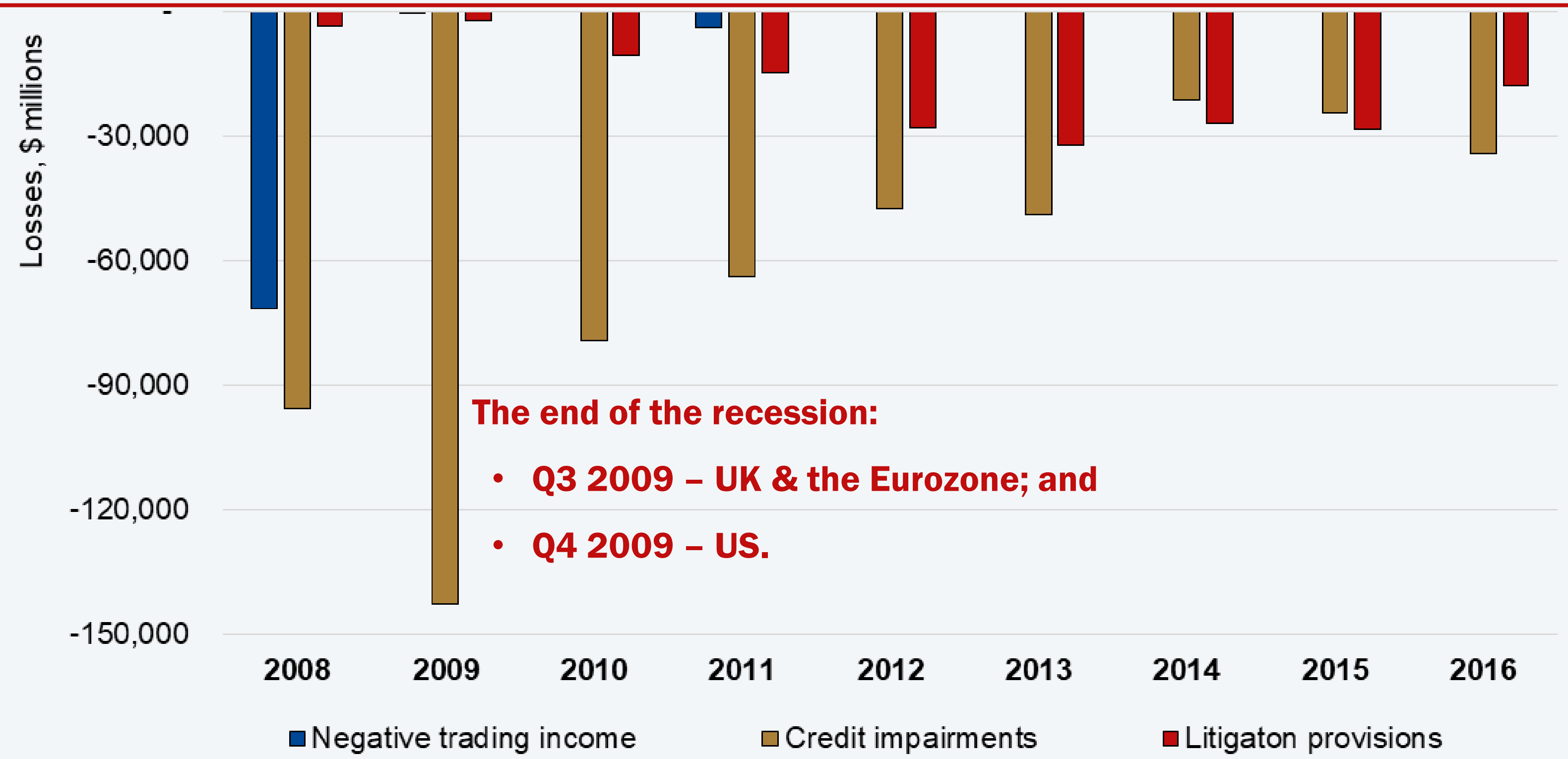
Losses crystallising in the current year	**≈**	**Losses discovered and crystallised in the current year**	**+**	**Events that were discovered in prior years but crystallise in the current year**
%, by value for large losses (≥$0.1bn): 1989 to 2007		**28% by value**		**72% by value**

…whilst most other categories of Op Risk crystallise almost immediately upon discovery e.g. internal & external frauds, systems' failures and processing errors…

3. Do Op Risk losses rise during a recession? – Lags

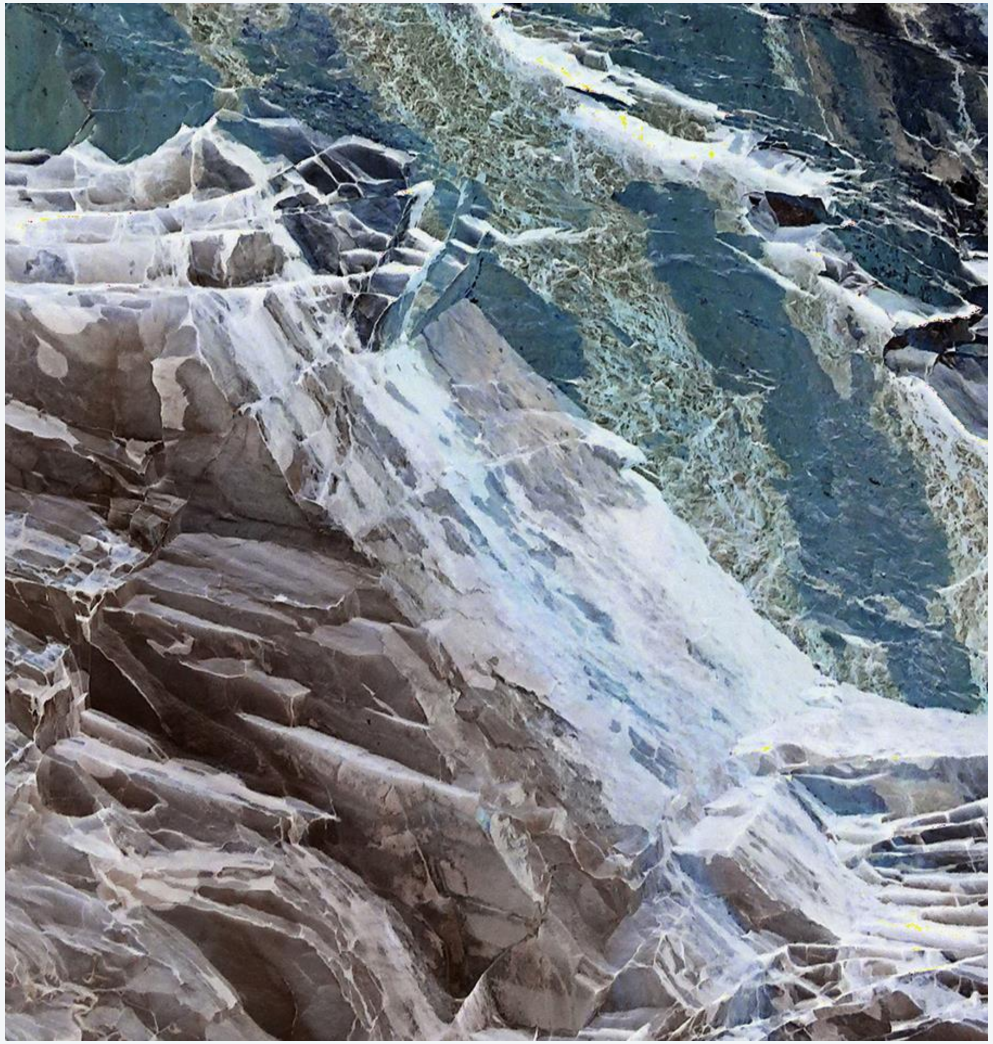
Analysing actual losses recognised in the P&L of 13 large banks reveals that after the Financial Crisis, losses came in overlapping waves for the different risks...

Profile of negative trading income, impairments and litigation & regulatory settlements



...Op Risk losses peaked ~3 years after the end of these recessions.

Source: Grimwade, M., (2019) "*Applying existing scenario techniques to the quantification of emerging Operational Risks*". JOR, Vol 14, No 3.



4

Conclusions

10 Fundamental Laws of Op Risk

These 10 Fundamental Laws cover the nature of individual events, correlations and the impacts of decisions made by firms…

Coverage of the 10 Fundamental Laws and their units…	
1. Occurrence of events, (events)	6. Correlation – internal, (%)
2. Detection frequency, (events / time)	7. Correlation – external, (%)
3. Velocity of losses, ($ / time)	8. Risk homeostasis, ($)
4. Duration of events, (time)	9. Risk conservation, ($ and events / time)
5. Lags in settlement, (time)	10. Proactive Op Risk taking, ($)

Individual events

Correlations

Impacts of decisions

…time features quite significantly in these laws.

Source: Grimwade, M., (unpublished but recently submitted to the JOR) *"Ten fundamental Laws of Operational Risk"*

Tailoring tools - RCSAs

The Laws suggest a number of enhancements as to how RCSAs should be conducted:

- **Causes:** Firms should focus upon the causes of losses, e.g. resourcing, expertise, clarity of responsibilities; process design & documentation; culture; incentives & governance.

- **Lags:** The likelihood of large losses occurring in the next year is more likely to be driven by weaknesses in <u>historical preventative controls</u> than the current controls.

- **Velocity & Controls:** The frequencies of a firm's controls should be aligned to the velocity of the risks that they are mitigating.

- **Risk homeostasis**: As firms naturally respond to Op Risk losses by enhancing their controls, then RCSAs should focus upon lower likelihood : higher impact Op Risks.

- **Duration:** As large losses have average durations of ~4 years, then contrary to the current fashion for trigger-based RCSAs, firms should also focus on what is "*hiding in plain sight*".

- **Fee & Commission income:** In assessing the associated risks, firms need to consider:
  - How their customers may suffer losses; and / or
  - How they may themselves become exposed to Market & Credit Risks.

Tailoring tools – Predictive KRIs

KRIs may predict changes in the occurrence of events, their detection, velocity and duration:

- **Mistakes & omissions:** Metrics relating to stretch - increased activity levels but reduced resourcing due to unfilled vacancies & staff turnover should be predictive.
- **Malicious acts:** Metrics highlighting weaknesses in controls that are preventing persistent external threats of malicious acts (e.g. cyber-crime) may be highly predictive of losses.
- **Individual misconduct:**
  - Weaknesses in controls may not automatically be exploited by staff; but
  - Portfolios of metrics focused on suspicious patterns may help identify live issues.
- **Systemic misconduct:** KRIs should also focus on the causes e.g. culture; incentives & governance; resourcing, expertise, clarity of responsibilities; and process design & documentation.
- **Detection:** Metrics focussed on deficiencies in detective controls may predict both increased future discovery of events and also increased severity.
- **External metrics:** Falling GDP and rising unemployment may foretell investor and customer losses (and their scale) and hence litigation relating to historical sales.

Tailoring tools – Cyclicality

When conducting stress testing consider how economic shocks alter a firm's Op Risk profile…

	Economic factors	Relevant scenarios	Occurrence & detection	Velocity	Duration	Lags
Mistakes	• Increased market volatility (VIX).	• Fat-fingered typing.	• Increased trade volumes.	• One day market movements.	N/A	< 1 year
Responses to crisis	• Management actions e.g. reduce headcount.	• Staff related litigation – in response to redundancies.	• Robustness of current redundancy process.	• The number of claims against a firm increases.	3 months after redundancy	6 months to 1 year
Responses to crisis	• Increased mortgage delinquency and defaults.	• Treating customers fairly in financial difficulties.	• Robustness current foreclosure processes.	• Loss given default.	N/A	>2 years
Historical systemic misconduct	• Rising corporate defaults / credit spreads.	• Post-underwriting litigation. • Mis-sale of CLOs.	• Robustness of historical sales processes & due diligence.	• Loss given default also increases.	2 years	>3 year
Historical systemic misconduct	• Rising bond yields. • Falling equity markets.	• Mis-sale of higher risk yielding investments. • Mis-sale of equity linked products.	• Robustness of historical sales processes.	• Revalue investments reflecting: – Rising yields; – Falling equity values.	~3 years	4 to 6 years
Historical systemic misconduct	• Directional moves in interest rates.	• Mis-sale of interest rate derivatives.	• Robustness of historical sales processes.	• Lost opportunity costs or investor losses.	>10 years	>3 years

Source: Grimwade, M., (unpublished but recently submitted to the JOR) *"Ten fundamental Laws of Operational Risk"*

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