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Extreme Risks: What are they and Why do we care?

Keith Goodby and Ashwin Belur, Willis Towers Watson

Key questions for today

- What are Extreme Risks and Why do we Care?
- Do we systemically underestimate the probability of tail events?
- What are the extreme events that we should be concerned about?
- How should a robust risk management approach consider extreme events?



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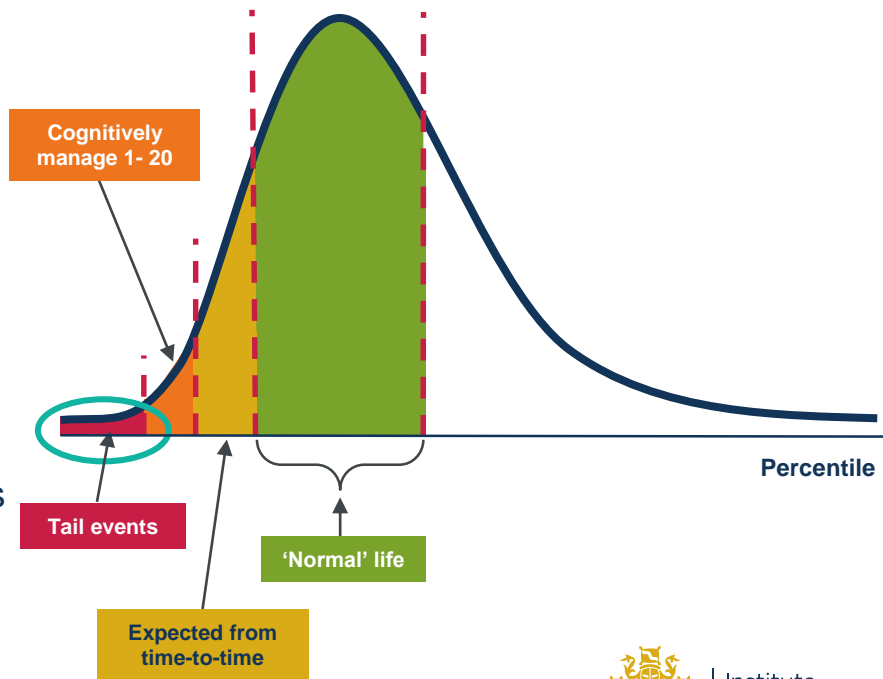
What are Extreme Risks?

7 June 2017

What are Extreme Risks?

Extreme Risks are potential events that on an ex-ante basis seem **very unlikely to occur** but could have a **significant impact on economic growth and asset returns**, should they happen.

- This includes **severe impacts arising from events**, such as a currency or a major banking crisis, and **events typically considered unlikely**, such as a Third World War or return to the gold standard.
- Extreme Risks are not only concerned with events that might occur over the following year.
- Today we will focus on **downside** Extreme Risks.



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Extreme Risks lead to major corporate failures



Fannie Mae™



Freddie
Mac

LEHMAN BROTHERS

BEAR
STEARNS

northern
rock



WaMu



AND MANY MORE!

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Extreme risks

Do we systemically underestimate the probability of tail events?

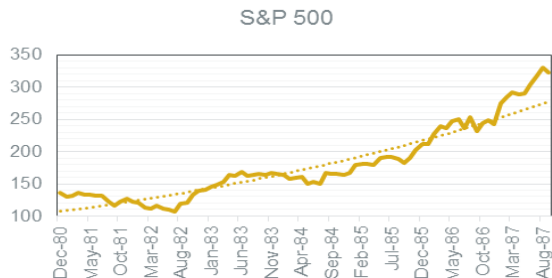
Why do we systemically underestimate the probability of tail events?

Our Perception of Market Events Can Lead to Failures

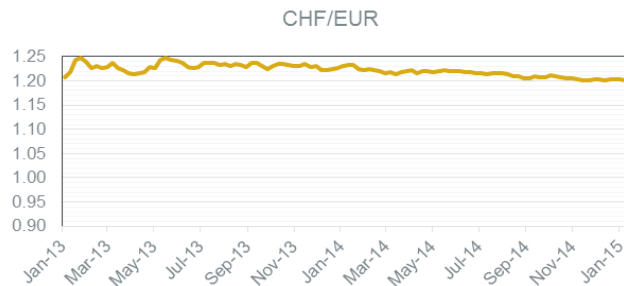


Do Markets Follow Reasonably Predictable Patterns?

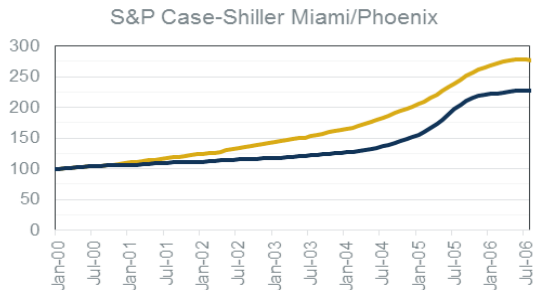
Equity



Currency



Property



Credit



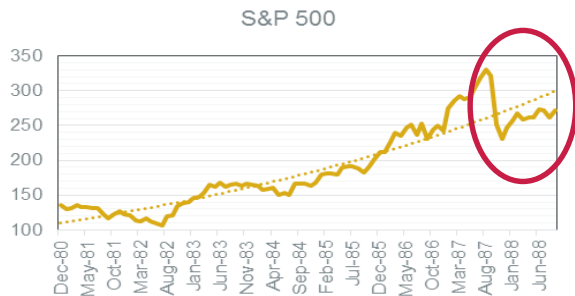
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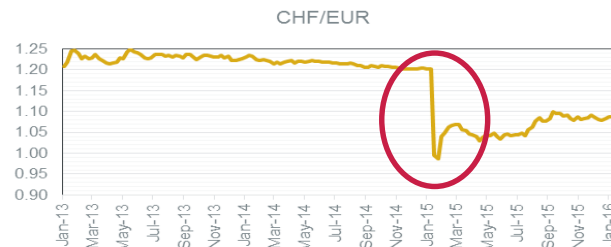
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Do Markets Follow Reasonably Predictable Patterns?

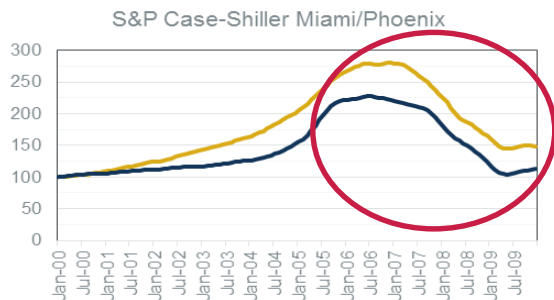
Equity



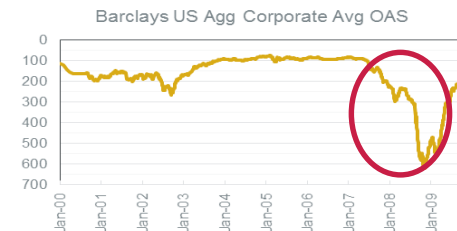
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Do Markets Follow Reasonably Predictable Patterns?

10Y Euro Government Bond Yields



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Historical financial tail events

History shows a plethora of tail events, including:

- Tulip mania in 1637
- the South Sea Bubble of 1720
- the Panic of 1825, in which the Bank of England nearly failed
- the Panic of 1873, leading to the Long Depression
- the Wall Street Crash of 1929, leading to the Great Depression
- the oil crisis of 1973

By the mid-19th century... Britain seemed to operate on a one-crash-per-decade rule: the crisis of 1825-26 was followed by panics in 1837 and 1847. To those aware of the pattern, the crash of 1857 seemed like more of the same. But this time things were different.”

The Economist

Black Monday 19th October 1987

Crash in global equity markets, and the largest one-day percentage decline in the DJIA ever recorded.

Key characteristics

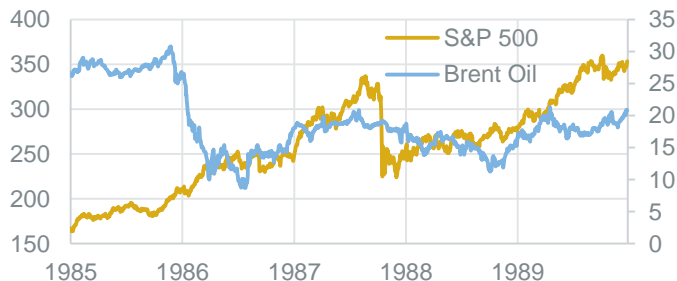
- Market divergence
- Reliance on portfolio insurance
- Predominantly a stock market event

“The 17-sigma crash that occurred ... was simply not every supposed to happen, in the history of the universe.”
Pension Partners

Bonds and Equities diverge in 1987



Oil and Equities survive each others Crash



The Swiss Franc Spike 15th January 2015

A 30% jump in the value of the Swiss Franc when the SNB abandoned the cap on its value.

Key characteristics

- Policy change
- Foreseeable event
- Forgotten risks

“I think it was something like a 20-plus standard-deviation move,”
Goldman Sachs CFO

Foreign exchange broker insolvency: Alpari, FXCM, Global Brokers (NZ).

An Outrageous Spike



But not in the Context of History



Markets Aren't Efficient — significant mispricings occur

“Even apart from the instability due to speculation, **there is the instability due to the characteristic of human nature** that a **large proportion of our positive activities** depend on spontaneous optimism rather than mathematical expectations, whether moral or hedonistic or economic. Most, probably, of our decisions to do something positive, the full consequences of which will be drawn out over many days to come, **can only be taken as the result of animal spirits**—a spontaneous urge to action rather than inaction, and not as the outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities.” *John Maynard Keynes, 1936*

Why do We Systematically Underestimate the Probability of Tail Events?

Trend Following or Herd Mentality

Confirmation Bias

Anchoring Bias

Home Country Bias

This Time is Different

Disposition Effect

Overconfidence / Over-optimism

Institutional Failures Can Lead to Market Innovations

Why do we systemically underestimate the probability of tail events?

Over Reliance on Quantitative Models		
Institutional Failures	Key Psychological Reasons	Market Innovation
FNMA / FHLMC	Confirmation Bias, Overconfidence, This time is Different	TBA
Long-Term Capital Management	Overconfidence, Confirmation Bias	Stricter Collateralization / Haircuts on Repo Funding
US Savings & Loan Crisis	Home Country Bias	US MBS Market
Lehman Brothers	Overconfidence, Over-reliance on Quantitative Models	Strict Collateralization of Swaps, Exchange Traded Swaps
Northern Rock	Home Country Bias	Risk Retention in Securitizations
FXCM / Alpari	Trend Following; Over-reliance on Quantitative Models	More Emphasis on Regime Change



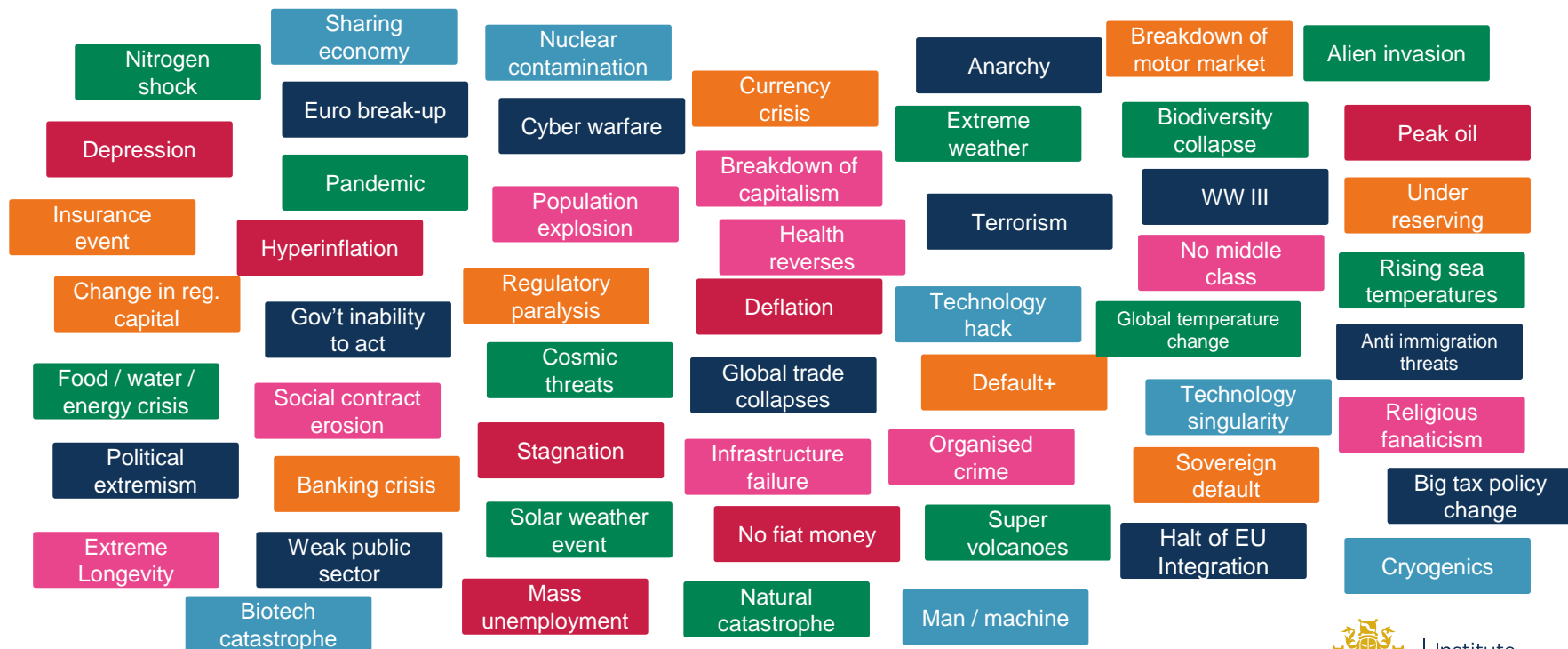
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Extreme risks

What are the extreme events that we should be concerned about?

What Extreme Risks should we be concerned about ?



Extreme Risks survey of insurance executives – top 10 risks

Rank	Risk	Score
1	Pandemic: A new, highly infectious and fatal disease spreads through human, animal or plant populations worldwide	71.9
2	Natural catastrophe: A confluence of major earthquakes, tsunamis, hurricanes, flooding and/or volcanic eruptions	65.9
3	Food/water/energy crisis: major shortfall in the supply of, or access to, food/water/energy, causing severe societal issues	65.5
4	Cyber warfare: Computer sabotage on major scale, severe damage to infrastructure, financial, medical or defense systems	65.2
5	Technology: Large quantity of personal, business, or government data stored in clouds are hacked, compromised, or misused	64.2
6	Depression: Deep and protracted trough in economic output, massive increase in unemployment, restriction of credit, shrinking investment	63.8
7	Banking crisis: Central banks unable/unwilling to supply liquidity in next crisis, causing banking, real economic activity to stop	63.1
8	An extreme event that causes property damage, supply chain failures, business interruption and/or significant death	63.1
9	Extreme weather: Events exceed the capacity of insurance industry / gov'ts to respond, with physical / social implications	63.0
10	Sovereign default: Non-payment by a major sovereign borrower, market panic and adversely disrupts the global economy	62.1

Ranked by 30,000 insurance executives

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Extreme Risks survey – bottom 10 risks

Rank	Risk	Score
...		
48	Sharing Economy: continued democratization, insurance reverts to its main form- risk pooling through technology	31.8
49	Cosmic threats: Planetary risks such as meteorite impact, changed orbit, or giant solar flare/magnetic storm	31.3
50	Anti-immigration sentiment leads to vigilante activity in major cities around the world	29.9
51	Significant change in tax policy that penalizes off-shore transactions	26.3
52	On-going high levels of political correctness , for example, EU gender ruling	25.7
53	Super volcanos in the US (Yellowstone)	24.6
54	Integration of man and machine yielding a form of immortality	18.3
55	Advances in cryogenics that allow people to be preserved for extended periods and then reawakened	18.1
56	Break down of motor market due to automatic driving gears	16.6
57	Alien invasion: Invasion of aliens seeking either to remove earth's resources or enslave/exterminate human life	13.5

Ranked by 30,000 insurance executives

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Which Extreme Risks should we be concerned about ?

Will it happen ?

Is it plausible ?

Does the current state of knowledge suggest it completely implausible ?

Will it impair the company's objective or purpose?

Does it threaten the company's / industry's / human race's existence

Force majeure clauses

Company

Avoiding being first to fail is not sufficient

How will the government / regulator / customers react

A framework is needed to make sense of it all

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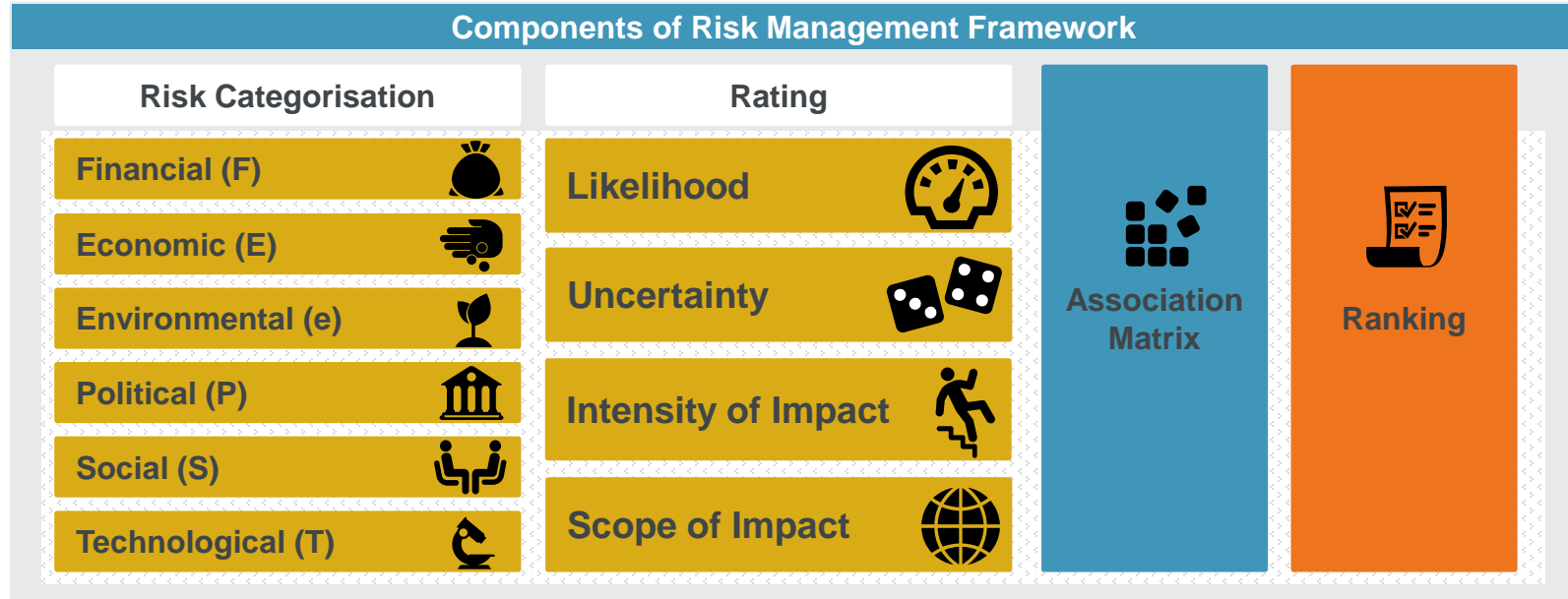
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Extreme risks

How should a robust risk management approach consider extreme events?

Extreme Risks Prioritisation Framework



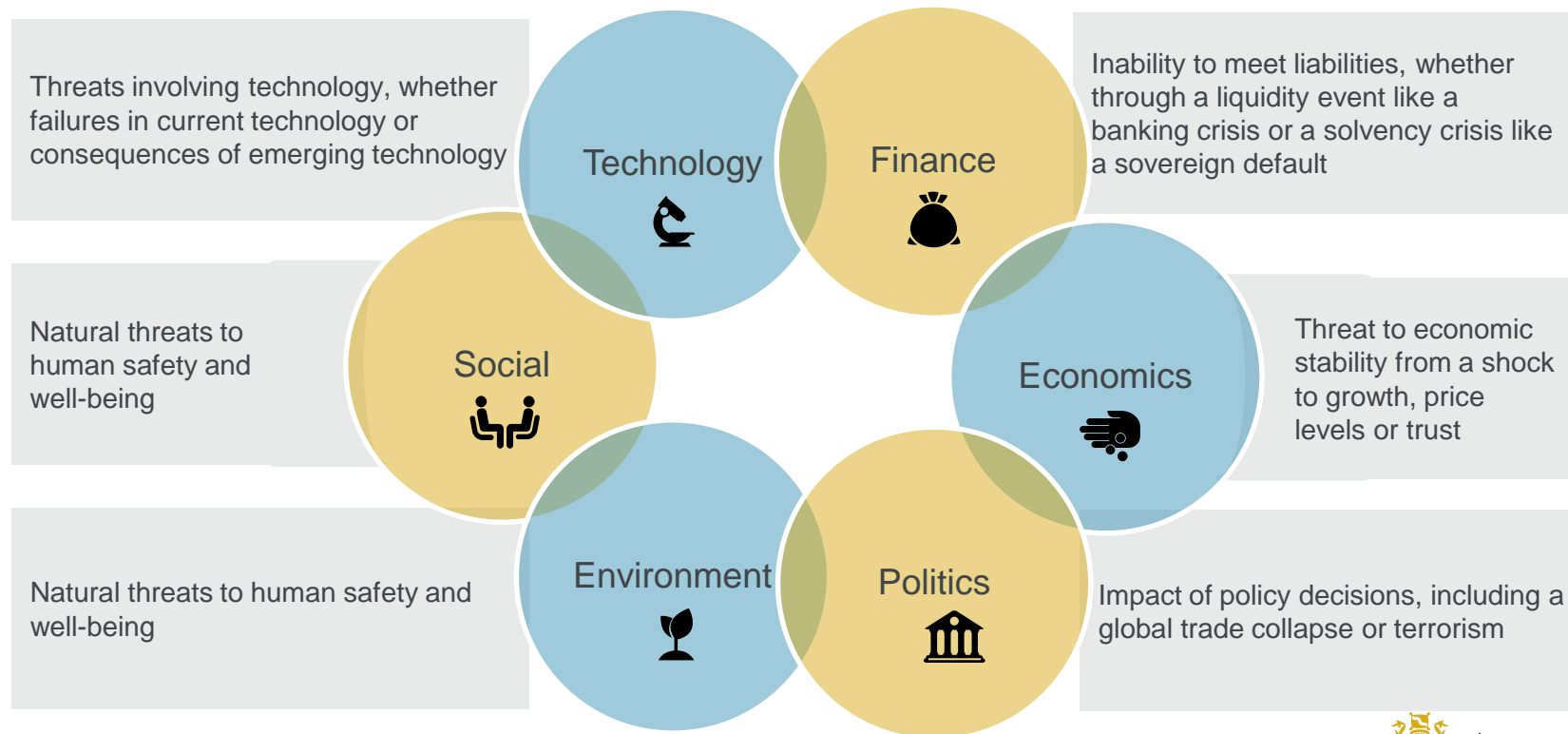
Extreme Risks Committee to oversee

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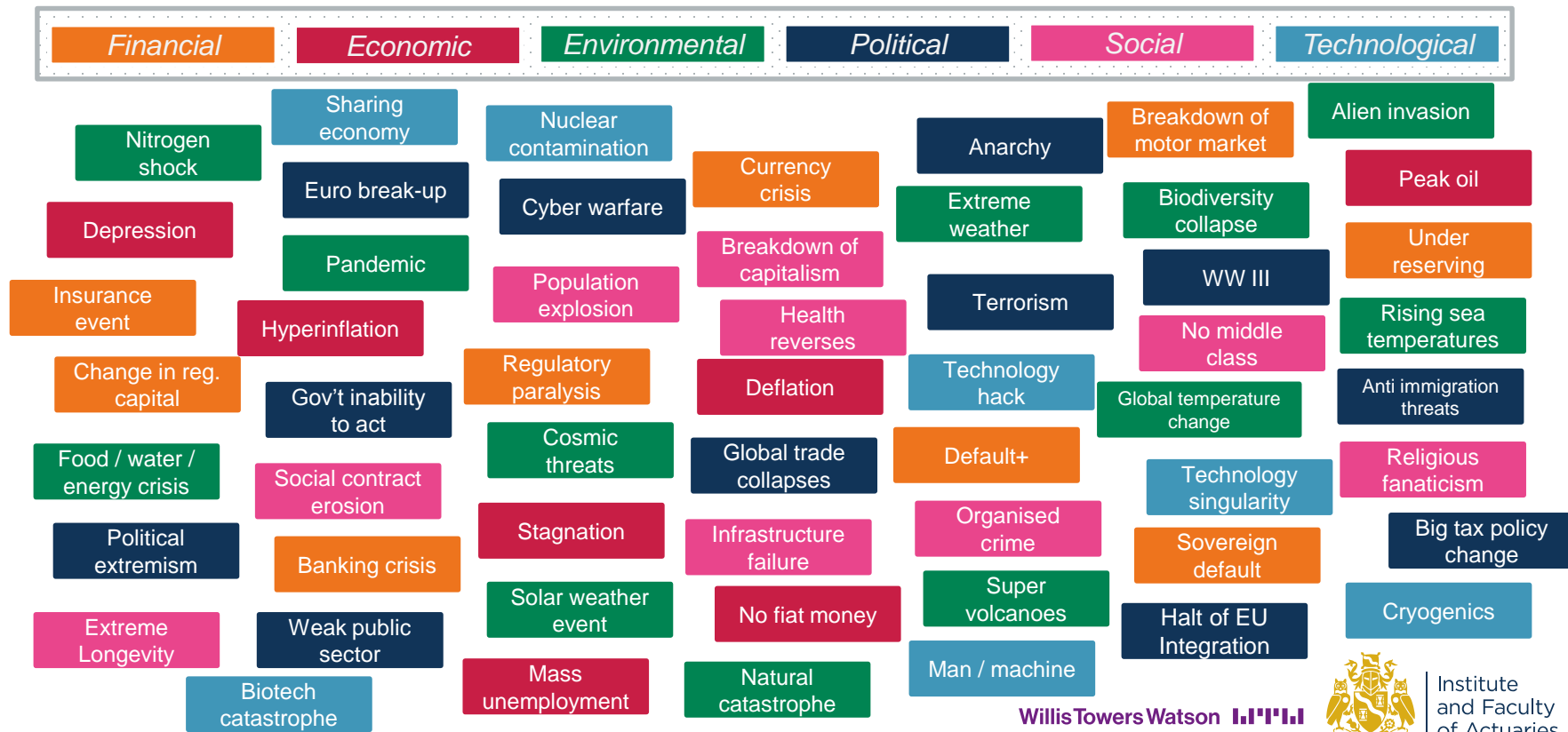


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Risk Categorisation



Categorisation of Extreme Risks



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Rating definitions

Likelihood	Uncertainty	Impact Intensity	Scope of Intensity
1 in 10	Impact	Enduring (1)	Local (1)
1 in 20	Likelihood	Crushing (2)	Global (2)
1 in 100	(H)igh	Existential (3)	Trans-generational (3)
> 1 in 100	(M)edium		Pan-generational (4)
	(L)ow		

Extreme risk rating examples

	Likelihood 1 (1-in-10 years) 2 (1-in-20 years) 3 (1-in-100 years) 4 (1-in-100+ years)	Uncertainty (H) High (M) Medium (L) Low	Impact intensity 1 (Endurable) 2 (Crushing) 3 (Existential)	Impact of scope 1 (Local) 2 (Global) 3 (Trans-generational) 4 (Pan-generational)
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Financial



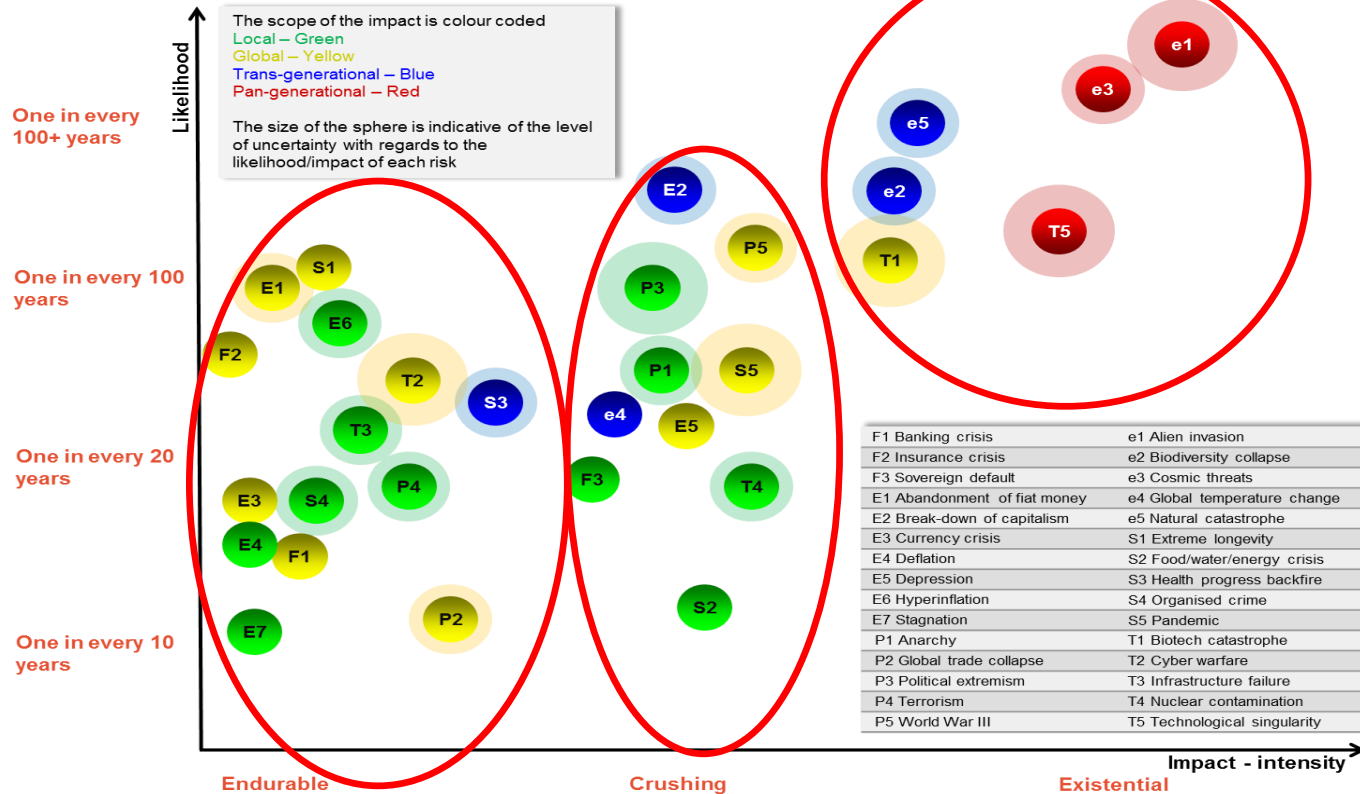
F1 Banking crisis	2	L	1	2
F2 Insurance crisis	3	L	1	2
F3 Sovereign default	2	L	2	1

Economic



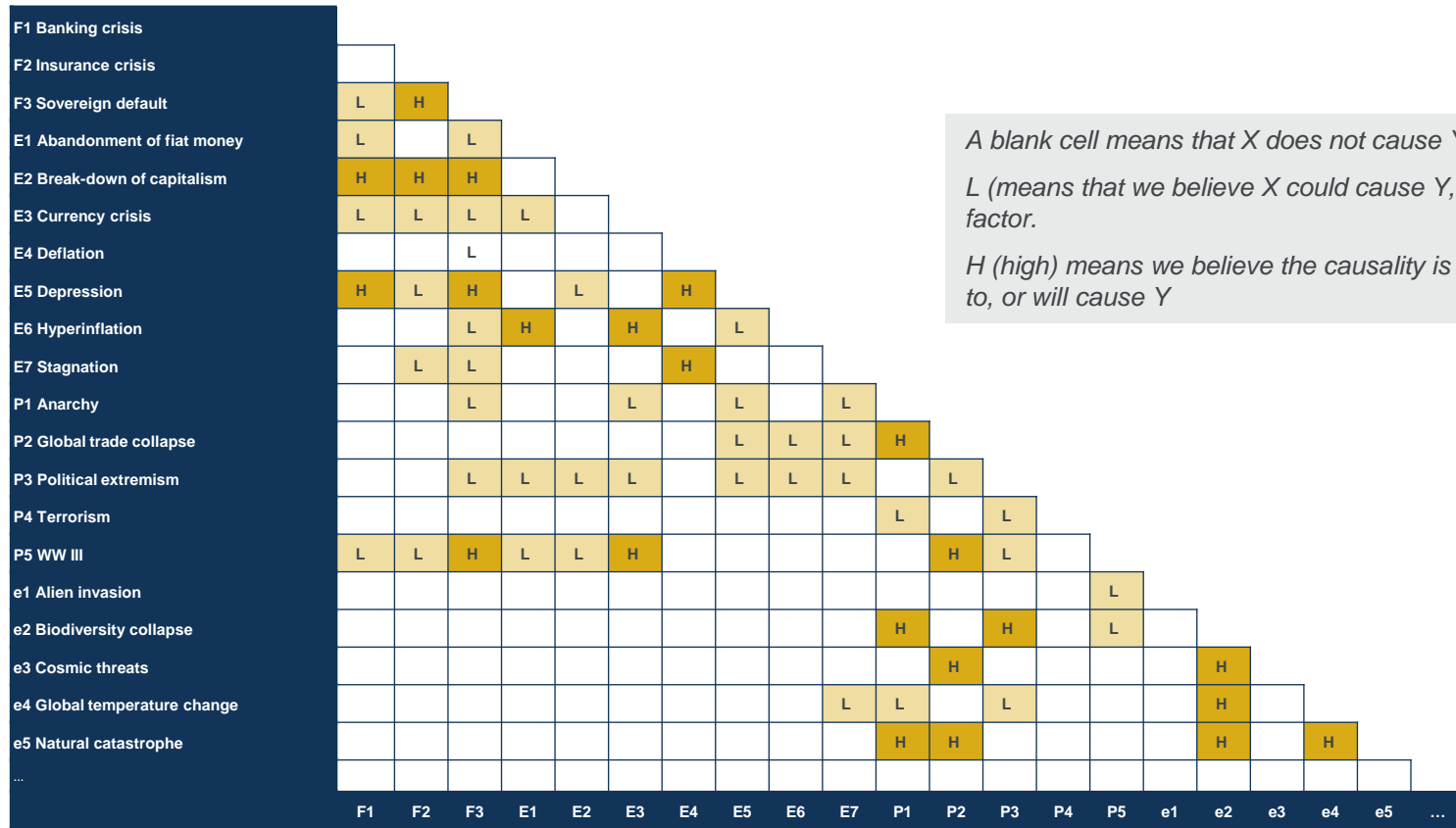
E1 Abandonment of fiat money	3	M	1	2
E2 Breakdown of capitalism	4	M	2	3
E3 Currency crisis	2	L	1	2
E4 Deflation	2	L	1	1
E5 Depression	2	L	2	2
E6 Hyperinflation	3	M	1	1

Likelihood / impact assessment



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Association matrix



A blank cell means that X does not cause Y to any material extent.

L (means that we believe X could cause Y, or is a contributory factor).

H (high) means we believe the causality is material, so X is likely to, or will cause Y

WTW Extreme Risk Ranking

Rank		Rank	
1	S2 Food / water / energy crisis	16	e2 Biodiversity collapse
2	E7 Stagnation	17	S5 Pandemic
3	E4 Global temperature change	18	P5 World War III
4	E5 Depression	19	T5 Technological singularity
5	P2 Global trade collapse	20	E3 Cosmic threats
6	F1 Banking crisis	21	T2 Cyber warfare
7	F3 Sovereign default	22	P1 Anarchy
8	E3 Currency crisis	23	E1 Abandonment of fiat money
9	E4 Deflation	24	S4 Organised crime
10	S3 Health progress backfire	25	E6 Hyperinflation
11	T4 Nuclear contamination	26	e5 Natural catastrophe
12	S1 Extreme longevity	27	E2 Break-down of capitalism
13	F2 Insurance crisis	28	T1 Biotech catastrophe
14	P4 Terrorism	29	E1 Alien invasion
15	T3 Infrastructure failure	30	P3 Political extremism

Investment strategy considerations [1/2]

Approaches

Real
diversification

Thematic
investing

OTM Hedging

Cash

Gold

Globally
diversified
government
bonds

Pitfalls

Not all extreme risks can be hedged

Outcomes are uncertain as is impact on
assets and liabilities

How effective will hedge or other
mitigations be?

*“It is better....to fail conventionally than to
succeed unconventionally”, Keynes*

Why bother?

Investment strategy considerations [2/2]

**Beware of
irrational
behaviours and
biases**

Trend Following or Herd Mentality

- 'Best in Breed' Peer Comparisons or don't follow others

Confirmation Bias

- Relying on a Varied and Diverse sources of Information

Anchoring Bias

- Thematic investing in themes that mitigate risks under certain scenarios

Home Country Bias

- Real Diversification Away from Systemic Risks

This Time is Different

- Out-of-the-Money Hedging Programme with long-term derivative contracts when they are cheap

Disposition Effect

- Pre-commitment to investment strategies in case of market stress

Overconfidence / Over-optimism

- Groupthink risk / Employ a "Red Team" to challenge the convention

Key Takeaways

- Systematic underestimation of extreme risks - behaviour biases / reliance on models / data
- Don't obsess with detailed models / data for events that cannot be predicted accurately
- Be prepared - implement a framework to identify, assess and rate extreme events
- Pre-commitment to investment and hedging actions
- Regularly monitor, update and challenge risk assessment and thinking

Questions

Comments

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