



Extreme Risks for Insurers

2019-20

Introduction

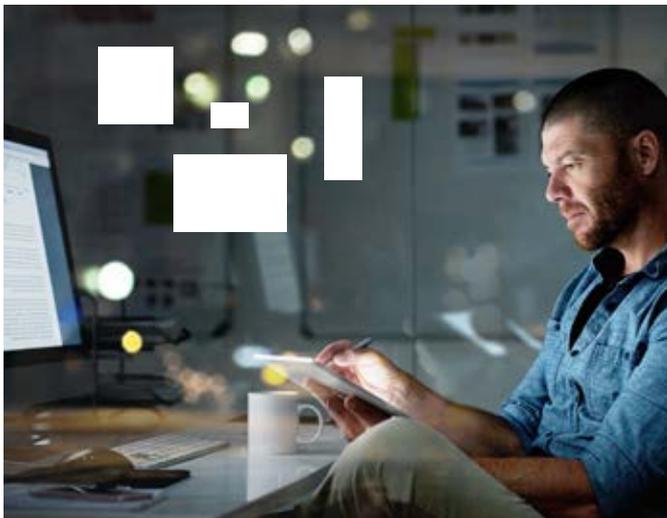
In short

Extreme risks are potential events that are very unlikely to occur (therefore infrequent) but that could have a significant impact on economic growth and asset returns should they happen. The value of this exercise, however, lies outside prediction. To navigate through this complex world, we suggest investors need to be openminded, avoid concentrated risks, be sensitive to early warning signs, constantly adapt and always prepare for the worst.

Why do extreme risks matter?

"Most risk management is really just advanced contingency planning and disciplining yourself to realize that, given enough time, very low probability events not only can happen, but they absolutely will happen. The definition of infinity is that if you wait long enough, everything happens."

Lloyd Blankfein, Goldman Sachs then-CEO, July 2013¹



This quotation highlights one of the important reasons for considering extreme risks. In addition, we have come up with a few others:

- We believe that the world is a complex adaptive system² where sudden and violent regime change is possible. In this description of the world, the tails of the "complexity distribution" are considerably fatter than those of a normal distribution. That means extreme events are much more likely than we previously thought.
- We all only live once³, in a single universe, and we face problems in series, not parallel. This seemingly naive statement, as we argued in a previous paper⁴, is in fact often overlooked in the area of finance and economics when thinking about the "average". This type of thinking has a profound impact on how an extreme risk event should be considered. The very unlucky person who was hit by a lightning strike does not take any comfort from knowing that this is extremely unlikely to happen to anyone. When confronted with an extreme event, there is no going back in time and "diluting" the impact with other less negative outcomes in parallel universes. One must deal with its consequences.
- Last but not least, is that when it comes to assessing risks, particularly low-probability, high-impact events, our limited understanding of the world can have a material impact. In fact the uncertainty and our proneness to error can dominate when the extreme events involve poorly understood natural phenomena, complex social dynamics such as financial markets, or new technology⁵. For example, suppose that our body of knowledge indicates that some catastrophic event X has an extremely low probability $\Pr(X)$ of occurring. The margin of error associated with this estimate, resulting from flaws in our body of knowledge, could be significant. If this seems a strange concept at first, consider that our body of knowledge once thought the solar system was geocentric. In fact the whole history of scientific progress is one of correcting flaws in the previous body of knowledge. Extreme events might be much less extreme than we thought.

¹Goldman CEO on risk: The worst 'absolutely will happen'" CNBA.com. 2013.

²More on this can be found in Thinking Ahead Institute's paper on stronger investment theory.

³Belief in reincarnation does not change the logic of our argument.

⁴"The irreversibility of time – or why you should not listen to financial economists", Thinking Ahead Group, Willis Towers Watson, 2012

⁵"Existential risk prevention as global priority" Global Policy, Nick Bostrom, University of Oxford, 2013

Highlights of survey results

Building on Willis Towers Watson Thinking Ahead Institute's long-running analysis of how extreme risks may impact investment, we asked (re)insurers from late 2019 to early 2020 to assess how those same risks could affect them.

Under six broad headings of political (P), financial (F), economic (e), environmental, (E) social (S) and technological (T) risk, the survey encompassed 30 individual named risks (see *Figure 1* on page 5) ranging from anarchy and alien invasion to a currency crisis and cyber warfare. Over 100 representatives of insurers from around the world evaluated the risks based on their likelihood, intensity, scope and certainty.

By these measures (see *Figure 2* on page 6), insurers rank global temperature change, sovereign default and terrorism as carrying the most wide-ranging risks.

Growing external pressures on both (re)insurers and their clients in areas such as corporate social responsibility, investment choices and public policy means increasingly that climate risk for insurers extends far beyond natural catastrophes (which are nonetheless still ranked fourth in the list of extreme risks). Meanwhile, a sovereign default or major terrorism incidents clearly have the potential to affect multiple lines of business.

Other risks considered relatively likely, such as a banking crisis, organized crime, and infrastructure failure are typically regarded as more enduring and/or local. Meanwhile, several other risk categories, such as a pandemic, nuclear contamination or the breakdown of capitalism, that are recognized as potentially crushing, are viewed as less likely or tempered by high degrees of uncertainty.

The long list of 30 risks

Financial extreme risks essentially revolve around solvency. Can the financial institution pay its debts with available cash? The interconnected nature of the modern financial system and the (still) high levels of leverage mean that insolvency for one institution can quickly become a systemic problem. In this category, we considered three risks: banking crisis (F1), insurance crisis (F2) and sovereign default (F3).

Economic risks are described as arising from a shock to growth, a shock to price levels, or a collapse in trust (which is essential for the efficient working of any economic system). Growth shocks can take the form of a depression (E5) or stagnation (E7). The former has a painful contraction phase but then relatively swift recovery, compared to stagnation where growth is weak for an extended period. Price level shocks can occur in opposite directions: rapid rises in hyperinflation (E6) and falling prices in deflation (E4). In both cases the “incorrect” price signals cause serious economic damage and destruction of wealth. A collapse in trust could occur in the current monetary system (abandonment of fiat money, E1), in the value of a major currency (currency crisis, E3), or in the economic system as a whole (break-down of capitalism, E2).

Political extreme risks comprise those which derive from policy decisions. In two of the cases the link is direct and obvious. Global trade collapse (P2) follows policy decisions to favor protectionism over openness and globalization, and World War III (P5) follows an active decision to declare war. For anarchy (P1) and political extremism (P3) the link is less direct, but in both cases poor prior policy decisions are likely to be a necessary, if not sufficient, condition for these risks to foment. Terrorism (P4) is included in the political category due to its ideological foundation, and as the target chosen for the act of terrorism is likely to have political ramifications. Please note that we are considering extreme manifestations in this paper. Terrorism is a weekly, if not daily, occurrence somewhere around the world and so the extreme risk would be a terrorist act comparable to, or worse than, 9/11.

Environmental risks are threats to human safety and well-being arising from a disruption to planet earth's environment. If we draw the boundary of the system around the earth and its atmosphere, then two of these risks – alien invasion (e1) and cosmic threats (e3) – would be exogenous. Is an alien invasion too extreme to spend any time seriously considering? Quite possibly. After all, both the probability of the event and the consequences are unknowable. However, risk management is about taking action in advance to prepare for possible future

consequences and the value of the exercise is in scanning the horizon with an open mind. We can always apply further filters at a later stage to protect our finite risk management resources (in fact alien invasion does not make it into the top 15 risks we focus on in this paper). Two of the environmental risks, biodiversity collapse (e2) and global temperature change (e4), could be caused by humanity, and would thus represent serious own-goals. The final risk in this category is natural catastrophe (e5). As earthquakes, for example, happen every day the extreme version of this risk is either a confluence of extreme natural catastrophes (think magnitude 10 earthquake, combined with a 25 meter tsunami, helped along by a category five windstorm) or the eruption of a super volcano. This is the downside of living on a planet that regularly brings to the surface useful and valuable minerals.

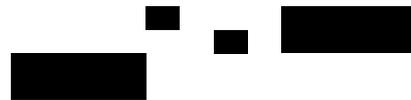
Social extreme risks are those threats that could adversely affect the smooth functioning of society. It should be noted that the categories we are discussing are not independent and it should be clear that the social risks link to policy decisions, the environment, and, in some cases, to technology. This is obvious in the case of food/water/energy crisis (S2) which will have political, environmental and technological drivers as well as offsets. Three of the risks are health related. Pandemics (S5) are a favorite of commentators on extreme risks, as in relative terms there is plenty of good data. For our purposes we postulate a new disease agent that hits the “disease sweet spot” of high infectivity and high mortality (these are typically tradeoffs). Health progress backfire (S3) refers to a reversal in the trend of improved health while, in the other direction, extreme longevity (S1) becomes a risk when viewed through the lens of a retirement provider. In most other contexts it would be considered a boon. The final risk in this category is the growth in organized crime (S4) to the extent that legitimate economic activity ceases to be viable in the (major) country or region concerned.

Our final category of extreme risks concerns **Technology**. These risks range from a failure in current technology (nuclear contamination, T4 and infrastructure failure, T3), through the possible consequences of emerging technology (cyber warfare, T2 and biotech catastrophe, T1), to the unknowable future event of the technological singularity (T5). The latter risk refers to the point in time when humans have designed super-intelligence into machines. What happens beyond that point is unknowable and therefore the subject of speculation. The extreme version has already been foreshadowed in various fictional films where the machines replace their human creators.



Assessment framework: likelihood, impact and uncertainty

For this exercise to be useful we cannot stop at the identification and simple listing of the risks. We need to assess them in order to determine which ones are more material and which are less. As alluded to earlier, our assessment framework is three-dimensional:



1

Assessment of likelihood has a four-point scale representing a likelihood of occurrence of one-in-10 years, one-in-20 years, one-in-100 years, and less likely than one-in-100 years.

2

The potential impact of the risk is split into two separate dimensions, namely the intensity and the scope (or geographical and temporal spread)

- The intensity is assigned to one of three states that are labeled endurable, crushing, and existential. Consider yourself in the three states. An endurable risk could represent a broken leg; crushing might imply the loss of a limb, or paralysis; and existential could refer to the loss of self-awareness or loss of life.
- The scope of the impact attempts to convey both spatial and temporal information by use of four categories: local, global, trans-generational and pan-generational. The first two imply a temporary impact while the latter two imply a lasting impact. We use “trans-generational” to describe an impact that will affect more than one generation but that would then fade or reverse. Pan-generational is used to describe an impact that would affect all subsequent generations, or all previously potential generations (such as extinction of the human species)⁶.

3

The final score assigned to each risk is uncertainty which is assessed as low, medium, or high, including uncertainty regarding the likelihood and uncertainty regarding the impact.

⁶We have drawn on and adapted the qualitative risk categories of Nick Bostrom

Summary of results

The table below summarizes the results for each of the extreme risks for insurance companies:

Figure 1. Extreme risks ranking

Risk category	Likelihood	Uncertainty	Impact-Intensity	Impact-Scope
P1 Anarchy	3	H	1	1
P2 Global trade collapse	2	M	1	2
P3 Political extremism	1	M	1	1
P4 Terrorism	1	L	1	1
P5 World War III	2	H	3	2
F1 Banking crisis	1	M	1	2
F2 Insurance crisis	2	L	1	2
F3 Sovereign default	1	L	1	2
e1 Abandonment of fiat currency	2	L	1	2
e2 Break-down of capitalism	3	H	2	3
e3 Currency crisis	1	M	1	2
e4 Deflation	1	M	1	2
e5 Depression	2	M	1	2
e6 Hyperinflation	2	M	1	1
e7 Stagnation	1	M	1	1
E1 Alien invasion	3	H	3	4
E2 Biodiversity collapse	3	H	3	4
E3 Cosmic threats	2	H	3	4
E4 Global temperature change	1	L	2	4
E5 Natural catastrophe	1	L	1	1
S1 Extreme longevity	2	M	1	4
S2 Food/water/energy crisis	1	M	2	2
S3 Health progress backfire	2	M	1	1
S4 Organized crime	1	L	1	1
S5 Pandemic	2	M	2	2
T1 Biotech catastrophe	2	H	2	2
T2 Cyber warfare	1	M	2	2
T3 Infrastructure failure	1	L	1	1
T4 Nuclear contamination	2	L	2	1
T5 Technological singularity	2	H	2	4

↓	↓	↓	↓
1 = one-in-twenty years 2 = one-in-100 years 3 = one in 100+ years	A degree of high (H) Medium (M) Low (L)	1 – Endurable 2 – Crushing 3 – Existential	1 – Local 2 – Global 3 – Trans-generational 4 – Pan-generational

The top 15 risks for (re)insurers

The final part of our assessment of these risks is to create a ranking of their importance. This introduces no new information but simply combines the four scores for each risk into a single ranking. The intuition is straightforward.

The more likely a risk, the higher up the ranking it should be. Likewise, the less uncertain a risk, the greater the intensity of impact and the larger the scope of the impact, the higher up the ranking a risk should be.

Figure 2. **Top 15 extreme risks ranking**

Rank	Risk	Brief description
1	Global temperature change	Earth's climate tips into a less-habitable state (hot or cold)
2	Sovereign default	Non-payment by a major sovereign borrower
3	Terrorism	A major ideologically-driven attack
4	Natural catastrophe	An extreme natural catastrophe event on an unprecedented scale
5	Organized crime	A significant increase in the scale of illegal operations by organized crime in a major economy
6	Infrastructure failure	An interruption of a major infrastructure network
7	Food/water/energy crisis	A major shortfall in the supply of food/water/energy
8	Cyber warfare	Internet being weaponized that causes severe damage to virtual systems vital to the economy and even to hard infrastructure
9	Banking crisis	Banking activity halts due to lack of liquidity
10	Currency crisis	Extreme movement between exchange rates
11	Deflation	Goods and services prices fall for an extended period
12	Political extremism	Rise in power of extremist groups
13	Stagnation	A prolonged period of little or no economic growth
14	Nuclear contamination	A major nuclear disaster, leading to large radioactivity release and lethal effects
15	Insurance crisis	Insolvency within insurance sector

Thinking Ahead Institute extreme risks paper series

Our journey of thinking about extreme risks started in 2009. Our first paper in this area introduced a rather simplistic two-dimensional framework – likelihood and impact – to assess 15 risks in three categories – financial, economic and others including environmental and political themes. A ranking of these 15 risks was produced based on our subjective assessment of these two dimensions. The top three extreme risks that occupied our minds were economic depression, hyperinflation and excess leverage.

In 2011 we updated our likelihood and impact assessment of the previous 15 risk events. That resulted in two risks – resource scarcity and infrastructure failure – joining the top 15 ranking (at the expense of excessive leverage and the end of capitalism). Economic depression and hyperinflation continued to concern us and sovereign default (by a major developed economy) also became one of the top three risks.

Then two years later in 2013 a major update was conducted. We broke our “other” group into four categories: political, environmental, social and technological. As a result, the total

number of extreme risks covered increased to 30. Perhaps more importantly, we addressed some of the weaknesses in the assessment framework. We introduced a new dimension: uncertainty. This is an important modification of the methodology. Assessment of the likelihood of any extreme risks is hard because they happen very infrequently, if at all, and therefore leave very little evidence for us to study and understand them. So we may assess a banking crisis and a global pandemic to have the same likelihood (say one-in-20 years events), but are they equivalent risks? We use uncertainty to differentiate between them. We believe the set of banking crises is more homogeneous (low uncertainty), while a global pandemic event could take a wide range of forms (high uncertainty).

Why is this important? It helps the risk management function with time and resource allocation decisions. We would argue that time and resources are better spent on turning “unknowns” into “knowns” while steering away from “unknowables”, a trait associated with highly uncertain extreme risks.

Further information

For further information on extreme risks and what they might mean for your business, please see Thinking Ahead Institute Extreme Risks 2019 report. Alternatively, please contact your Willis Towers Watson consultant or email insurer.solutions@willistowerswatson.com



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