

Extreme risks – summary paper

2013

Extreme risks are potential events that are very unlikely to occur (and therefore infrequent) but could have a significant impact on economic growth and asset returns, should they happen.

We continue to argue that a robust risk management approach should not stop at a particular percentile (whether VaR₉₅ or VaR_{99.5}) and have updated the extreme risks paper we wrote in 2011.¹

The top 15 risks

We maintain a list of the top 15 extreme risks in the following six groups:

- **Financial:** This category of extreme risks concerns an inability to meet liabilities. This can occur as a liquidity event, such as a *banking crisis*, where an institution has insufficient cash or other liquid assets to meet a current demand for payment, even if the institution has more assets than liabilities. Failure to make that payment can cascade rapidly through the financial system, with further institutions then unable, or unwilling due to a collapse in trust, to meet their own payment demands. The alternative mechanism for a financial extreme risk is a solvency-driven crisis, such as an *insurance crisis* or *sovereign default*, where there are insufficient assets to meet the liabilities irrespective of how liquid the assets are.
- **Economic:** These risks arise 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* or *stagnation*. The former has a painful contraction phase but then relatively swift recovery, compared to a stagnation episode where growth is weak for an extended period. Price level shocks can occur in opposite directions; rapid rises in hyperinflation (an extreme risk considered but not included in the top 15) and falling prices in *deflation*. In both cases the 'incorrect' price signals cause serious economic damage and destruction of wealth. If a collapse in trust occurs in the value of a major currency, a *currency crisis* follows.
- **Political:** This category of extreme risks comprises those which derive from policy decisions. *Global trade collapse* follows policy decisions to favour protectionism over openness and globalisation. *Terrorism* 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.
- **Environmental:** The risks in this category are threats to human safety and well-being arising from a disruption to planet earth's environment. Only one environmental extreme risk is included in the top 15 – *global temperature change* caused by human behaviour that tips earth's climate into a less-habitable state.

¹ 'Extreme risks – the 2011 update', Towers Watson, 2011.

- **Social:** The 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 the social risks link to policy decisions, the environment, and, in some cases, to technology. This is obvious in the case of a *food/water/energy crisis* which will have political, environmental and technological drivers as well as offsets. *Health progress backfire* refers to a reversal in the trend of improved health while, in the other direction, *extreme longevity* becomes a risk when viewed through the lens of a retirement provider. In most other contexts it would be considered a boon.
- **Technological:** Our final category of extreme risks concerns technology. The two risks included in the top 15 represent a failure in current technology (*nuclear contamination* and *infrastructure failure*) but it should be noted the risks can also rise from the possible consequences of emerging technology (for example, cyber warfare and biotech catastrophe).

Assessment and ranking

To decide which risks are included in the top 15 and to rank their respective importance, we assess the risks in the following ways:

- **Likelihood:** The more likely a risk, the higher up the ranking it should be.
- **Impact** is considered in two dimensions – intensity (whether a risk event is ‘endurable’, ‘crushing’ or ‘existential’) and scope (whether a risk event has a local or global impact or an impact beyond just the current generation). The greater the intensity of impact and the larger the scope of the impact, the higher up the ranking a risk should be.
- **Uncertainty:** How certain are we about the likelihood and the impact of the risk? The less uncertainty, the higher up the ranking the risk should be.

Our ranking is shown in **Figure 01**. At the top of our ranking is food/water/energy crisis. This is primarily driven by our assessment that this is one of the most likely risks and that there is relatively little uncertainty attached to either the likelihood or the consequences. The consequences themselves, locally crushing, are not particularly severe (in relative terms) and so these are not a driver of the top ranking. The second ranked risk, stagnation, differs only in respect of the intensity of impact which is assessed to be endurable rather crushing. In contrast the third ranked risk, global temperature change, has much more severe consequences (trans-generationally crushing) but is assessed to have a lower likelihood of occurring. The ranking highlights the risks to prioritise when it comes to management actions.

Figure 01. Extreme risks ranking as at 30 June 2013 – top 15 risks

Rank	Risk	Description
1	Food/water/energy crisis	A major shortfall in the supply of food/water/energy
2	Stagnation	A prolonged period of little or no economic growth
3	Global temperature change	Earth’s climate tips into a less-habitable state (hot or cold)
4	Depression	A deep trough in economic output with massive increase in unemployment
5	Global trade collapse	A worldwide protectionist backlash against cross-border trade
6	Banking crisis	Banking activity halts due to lack of liquidity
7	Sovereign default	Non-payment by a major sovereign borrower
8	Currency crisis	Extreme movement between floating rates
9	Deflation	Goods and services prices fall for an extended period
10	Health progress backfire	Massive rise in morbidity or mental ill-health, antibiotic resistance
11	Nuclear contamination	A major nuclear disaster, leading to large radioactivity release and lethal effects
12	Extreme longevity	Significant increase in life expectancy overwhelms support systems
13	Insurance crisis	Insolvency within insurance sector
14	Terrorism	A major ideologically-driven attack
15	Infrastructure failure	An interruption of a major infrastructure network

Investment implications

While interesting in its own right, we believe the consideration of extreme risks can be useful in helping to design more robust investment portfolios and more robust risk management processes.

The starting point to building a robust investment portfolio and reducing (but not eliminating) tail risks is to introduce greater diversity. The next step is to explore some hedging strategies and, broadly, there are three alternatives available to us:

- **Hold cash.** The option value of holding cash increases in periods of market stress, allowing investors with cash to buy truly cheap assets.
- **Derivatives.** It is worth mentioning that cost and usefulness are often in opposition. The cost of derivatives protection can often be reduced by specifying more precise conditions – but the more precise the conditions, the greater the chance that they are not exactly met and hence the ‘insurance’ does not pay out.
- **Hold a negatively-correlated asset.** There is no single asset that will work against all possible bad outcomes. Further, there is no guarantee that the expected performance of the hedge asset will actually transpire in the future event.

In essence the exercise of considering extreme risks is time spent on ‘pre-mortems’. While a post-mortem seeks to establish the cause of death, pre-mortems are about trying to determine in advance what could, colloquially, kill you. We believe that being adept at pre-mortems means you are a better risk manager, and can react more flexibly in the event of an extreme event happening, particularly as the event is unlikely to evolve precisely along the lines predicted. Consequently, the obvious application of extreme-risk thinking is in stress-testing or scenario planning, but it is also constructive to consider whether the thinking can be incorporated within the process for managing an investment institution’s balance sheet.

One option would be to penalise the existing ‘normal state’ assumptions by slightly reducing expected returns, or pushing up volatilities and/or correlations to reflect the impact of infrequent extreme events. A second option is dynamic switching of some sort. We either build two sets of assumptions (‘normal’ and ‘extreme’) or we design a second, extreme-risk portfolio directly from first principles. Then ‘all’ that is left to do is successfully time the switch between the two, not forgetting the need to time the switch back so we can go on harvesting returns when the conditions are conducive.

We would also advocate establishing some sort of early warning system to closely monitor what could develop into extreme events. While this is probably once again one of the areas where things are easier said than done, some promising research does show signs of predicting the seemingly unpredictable. For example, Didier Sornette and his Financial Crisis Observatory have plotted a set of early warning signs for unstable, growing systems.²

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² This is explained in a talk given by Didier Sornette, the director of the Financial Crisis Observatory (http://www.ted.com/talks/didier_sornette_how_we_can_predict_the_next_financial_crisis.html)

Conclusion

So how should investment institutions actually adapt in recognition of extreme risks? We would suggest a prioritisation exercise: first, worry about the events ‘that can kill you’ – that is, permanently impair the investor’s mission. This should identify which extreme risks matter and which can be ignored. For the former, the right thing to do is to pay up for the insurance, given that the prioritisation exercise has shown the investor cannot afford to self-insure. Second, an investor should do the simple things. These would include ensuring the portfolio is as diversified across as many return drivers as possible; diversifying within asset classes; and creating a strategic allocation to cash to provide optionality. Finally, greater complexity can be added over time, assuming it passes a considered cost/benefit analysis. This is likely to involve adding long-dated derivative contracts in a contrarian manner – that is, when they are cheap rather than popular.

Thinking Ahead

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Further information

Longer versions of this paper are available. Please see ‘Extreme risks 2013’, Towers Watson, 2013 and/or ‘Extreme risks, the irreversibility of time and the retirement anomaly’, Towers Watson, 2013.

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