University of Cambridge Judge Business School Cambridge Centre for Risk Studies

CAMBRIDGE GLOBAL RISK INDEX 2018 EXECUTIVE SUMMARY



Centre for **Risk Studies**



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Website and Research Platform www.jbs.cam.ac.uk/risk The 2018 Global Risk Index quantifies the impact of unpredictable shocks on the world's most prominent cities which, together, yield 41% of global GDP. The Index compiles the impacts of 22 types of threats into a single measurement of economic loss called GDP@ Risk. The Index is unique in providing a quantified comparison of risk exposure across 22 different threats (Figure 1) and 279 different cities. The 2018 headlines are that the GDP@Risk due to geopolitical shocks has risen by 16% in the last year, and that risk savings of 16% provide significant investment opportunities in those cities with lower levels of resilience.

The main change between the 2018 Index and the analysis for 2017 is an increase in risk from Geopolitics and Security threats, notably Civil Conflict, Interstate Conflict and Social Unrest. GDP@Risk for geopolitical shocks has gone up by 16% from its 2017 level to \$133bn in 2018, roughly a quarter of total GDP@Risk for all cities in the Index. In fact the impact of Geopolitics and Security catastrophes has risen by 39% since 2015, the year of the first Global Risk Index. This rise combines high levels of political turbulence in developed economies – challenging the contract between civil society and states, and evidenced by a rise in populism – and a risks to global trade and global security seen in the changing relationship between United States and other powers and regions.

The top three classes of threats in the 2018 Index are the Natural Catastrophes (with GDP@Risk of \$165bn, 30% of total GDP@Risk), Financial, Economics & Trade (GDP@Risk of \$142bn, 26% of total), and Geopolitics & Security in third place.

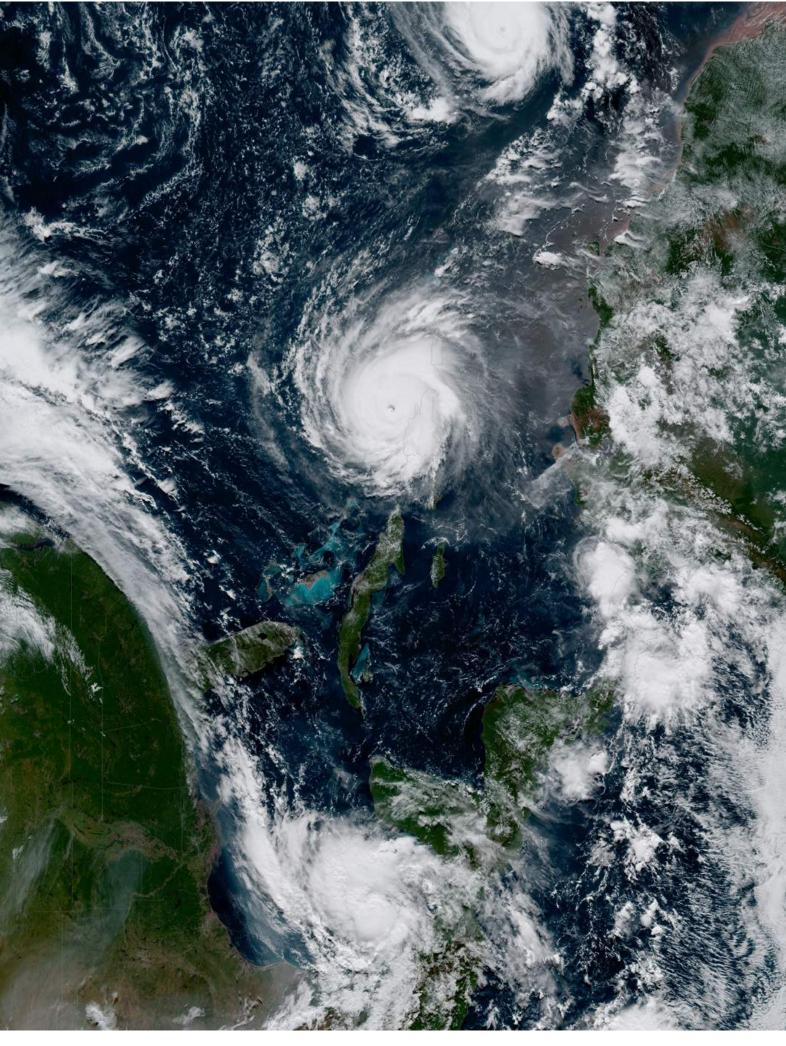
The top three individual threats are Market Crash with GDP@Risk at \$103bn, about a fifth of total GDP@Risk; Interstate Conflict at \$80bn, 15% of total GDP@Risk; and Tropical Windstorm, \$63bn or 11% of total risk. Cyber Attack falls in sixth amongst the threat rankings at \$37bn, 7% of total risk GDP@ Risk. As noted in the 2017 Global Risk Index, the capacity for cyber attacks to cause severe economic damage is on the rise. This is a threat to be closely monitored as the increasing number and severity of attacks is countered by capabilities to protect against them. The complete ranking of the 22 threats in the Global Risk Index are shown in Figure 1.

The top 10 cities by risk exposure are Tokyo followed by New York, Manila, Taipei, Istanbul, Osaka, Los Angeles, Shanghai, London, and Baghdad, see Table 1. Their appearance at the top of the risk list of cities indicates two characteristics: a huge annual GDP output, hence the potential, even if unlikely, for large losses; and exposure to particular shocks associated with the geography and type of economy of each city. The resulting GDP@Risk is mediated by each city's ability to protect itself against shocks as well as its resilience in recovering from them.

Table 1: Top cities by GDP@Risk and threat

	City	GDP@ Risk (\$USbn)	Top Threat	% Contribution
1	Tokyo	24.3	Interstate Conflict	37%
2	New York	14.8	Market Crash	21%
3	Manila	13.3	Tropical Windstorm	56%
4	Taipei	12.9	Tropical Windstorm	62%
5	Istanbul	12.7	Interstate Conflict	20%
6	Osaka	12.4	Interstate Conflict	30%
7	Los Angeles	11.6	Earthquake	23%
8	Shanghai	8.5	Tropical Windstorm	28%
9	London	8.4	Market Crash	22%
10	Baghdad	7.9	Interstate Conflict	55%
11	Mexico City	7.8	Market Crash	35%
12	Seoul	7.1	Tropical Windstorm	37%
13	Sao Paulo	6.5	Market Crash	46%
14	Hangzhou	6.5	Tropical Windstorm	68%
15	Jakarta	6.3	Civil Conflict	30%
16	Moscow	6.3	Market Crash	44%
17	Nagoya	6.1	Interstate Conflict	36%
18	Paris	5.9	Market Crash	24%
19	Cairo	5.7	Interstate Conflict	55%
20	Suzhou	5.7	Tropical Windstorm	51%

Shocks to the global economy are largely inevitable, resulting in real losses to the economy. Mitigation of losses is an essential consideration in understanding those losses. In the Global Risk Index, risk mitigation is closely related to the level of resilience of each city, i.e., the time a city needs to recover from a shock. If the resilience of each of the lowest resilient cities, some 45 out of the 279 covered, were improved by just one level then their relative risk exposure would reduce by 11%. If the resilience of all cities having the lowest two resilience levels, 100 cities altogether, were to be increased to up to the highest resilience level - enjoyed by Tokyo, London, Singapore, Vienna, San Jose and amongst others -, their relative risk exposure would reduce by 30%. This is an indication of what the insurance industry calls the "protection gap", and the size of earnings from investment in preparedness and resilience ahead of inevitable yet unpredictable shocks.



Hurricanes Katia, Irma and Jose strike Mexico and the Carribean in September 2017, the first occurrence of three active Atlantic hurricanes since 2010.

Cambridge Centre for Risk Studies (CCRS) models shocks to the major economies of the world and estimates how likely they are to occur and how much output is at stake.

We analyse the risk to 279 of the world's leading cities, responsible for half of global GDP, and consider a wide range of potential causes of future shocks by modelling around 12,000 scenarios. Economic shock models have been developed for 22 different threats types. The economy of each city is analysed by sector, size, and demography, and

the analysis estimates how much GDP output would be lost if each city were to experience different scenarios of shock for each threat. The model considers scenarios of events impacting multiple cities across a region, and propagates the consequences to other unaffected cities that have trading links or economic codependence.

At present we analyse the loss of output as a measure of economic 'flow'. We recognise that these catastrophes also cause loss to infrastructure, assets and the 'stock'. Flow and stock are interrelated but this Index represents the risk to flow.

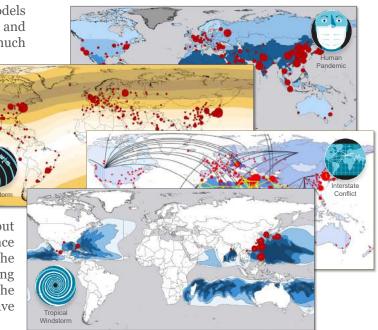
Expected loss

We do not predict that crises and shock events will occur. Each event is rare and unlikely. We analyse the small likelihood of each shock occurring and combine the chances of a rare catastrophe with its consequences to estimate the '*expected loss*' – the average probability-weighted amount of lost GDP, which produces the Cambridge Global Risk Index that can be used to compare different types of loss in various places and over alternative time horizons. The actual amount of lost economic production that would occur from a shock is many times larger than the probability-weighted expected loss index values that we present in this report.

We do not attempt to forecast which city will be hit by what type of events, but we assume that crises will continue to happen and that the risks of crises can be measured.

Threat analysis

The analysis of each threat consists of a geographical risk map, threat assessments for each of the 300 cities, adoption of standardized metrics for frequency and severity of occurrence, localized impact severity scenarios, and economic impacts analyses. CCRS gratefully acknowledges the expertise of our external subject matter specialists who have provided insights into each threat.



How were the threats selected?

The 22 threats were identified as the most significant risks to the global economy through an extensive study of the shocks that have impacted society and the economy over the past thousand years, combined with reviews of published catastrophe typologies, emerging risk registers, and scientific conjectures of potential future threats. This was developed into the *Cambridge Taxonomy of Threats*, published in 2014. Some of these threats have been studied in detail, and published as stress test scenarios in the publication suite of the CCRS, available from our website.

Project Pandora



The Pandora global risk research programme at Cambridge Centre for Risk Studies is named after the Greek myth of the first woman created by the gods, who opened a forbidden container and accidentally released all the world's evils upon humanity. The wide range of threat models being incorporated in the risk analysis represents the contents of Pandora's box.

Building Resilient Cities

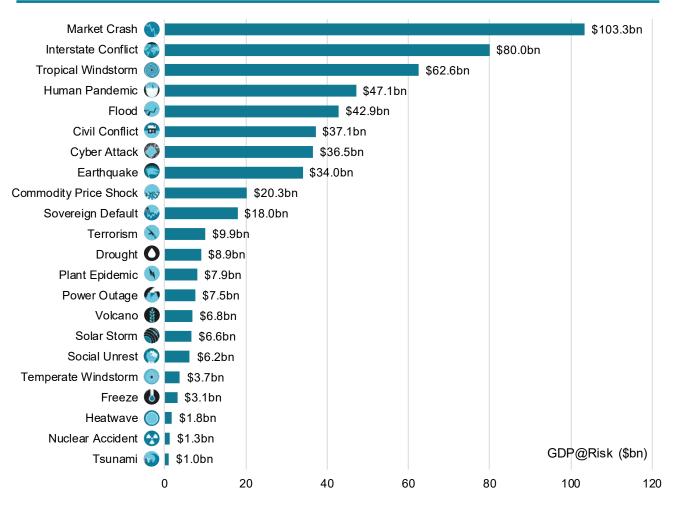


Figure 1: Global Risk Index 2018 Threat Rankings

The Global Risk Index 2018 provides a comprehensive threat analysis for 279 cities that represent 41% of global GDP. The economy of each city is analysed by sector, size, and demography to determine the GDP at risk across different scenarios for 22 threat types.

The definition of a city is critical to measuring the losses that occur in the case of catastrophe. In this year's Global Risk Index, the city size and boundaries are standardised by Oxford Economics Global Cities definitions. Under this new standard, all cities are consistently defined as larger urban agglomerations or official metropolitan areas, where they exist. For example the Tokyo major metropolitan area is an urban agglomeration which was previously considered as five cities separate featured in the 2017 Index: Tokyo, Chiba, Kawasaki, Yokohama and Saitama. The Global Risk Index also makes use of Oxford Economics' GDP data and projections. Using a single source of city GDP data allows more credible comparisons between the Risk Index for different years.

As city clusters drive growth, particularly in developing economies like India and China which show high urbanisation rates relative to more advanced economies, future GDP and therefore GDP@risk will inevitably show geographic shifts over time. These changes are relevant even in the short term: World Bank projections of 2018 GDP growth for the emerging economies is more than double that of the advanced economies.

Our analysis shows that of the 6.5% increase in GDP at risk from 2017 to 2018, 3.5% is from an increase in GDP while 3.0% is from changes in risk levels. Even if risk levels remain the same, wealth will continue to grow and distribute itself unevenly between cities and countries.

City resilience

An economy's ability to recover from a catastrophe is demonstrated by the speed and extent to which it reconstructs factories and homes, repairs damaged infrastructure, regains consumer and market confidence, and re-engages in business activities after an event. The Global Risk Index uses a levelbased resilience metric to determine each city's pace of recovery after a catastrophic shock.

The factors which determine catastrophe recovery are multi-dimensional. The city resilience assessment was updated in the 2018 Global Risk

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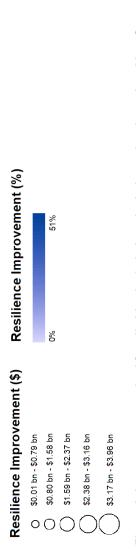


Figure 2: Improvement required for all cities included on the Index to be classed as 'Very Strong' in the resilience categories

Index to explicitly incorporate various determinants of resilience. It is modelled as a composite of socioeconomic factors such as deprivation and inequality, institutional factors such as governance and physical infrastructure, and wealth-related factors such as GDP per capita and the insurance penetration.

If the resilience of the least resilient cities in the study were improved by just one level, their relative risk exposure would reduce by 11%. If the resilience of all cities having the lowest two resilience levels were to be increased to up to the highest resilience level, their relative risk exposure would reduce by 30%. Further if all resilience ratings were increased to the highest resilience level, the overall GDP@Risk would reduce by 13%. Shocks to the global economy are largely inevitable, resulting in real losses to the economy, but this loss level is not pre-determined: The Global Risk Index demonstrates the value of investing in resilience.

Note that changes to city boundary definitions and the resilience metric mean that the Global Risk Index 2017 as published and Global Risk Index 2018 are not directly comparable.

How the Index is constructed

The Centre for Risk Studies generates the Global Risk Index by combining standardised data sets and expert judgement to determine the average impact of 22 threats on the global economy in the next three years. This requires consolidating disparate data sets from multiple sources, deep dive analyses of individual threats ranging from natural disasters to wars and other geopolitical catastrophes to technology shocks like power outage. The Global Risk Index provides a platform to compare these analyses across the world economy through a single metric: GDP at risk.

Data sources for financial, economic and trade risks include current and historical sovereign debt ratings and outlooks, equity market price indices and commodity price indices. For geopolitical and security risks, major data sources include the Global Terrorism Index from the Institute for Economics and Peace, Economist Intelligence Unit's Index of Social Unrest, and the Global Conflict Risk Index by the Joint Research Center of the European Commission. For technology and space risks, major sources include nuclear power plant data from the World Nuclear Association, power outage data from the World Bank, and cyber and infrastructure research from the Centre for Risk Studies. For health and humanity risks, sources include surveillance data from World Health Organization, databases of emerging infectious diseases from EcoHealth Alliance, data from ResistanceMap from the Center

for Disease Dynamics, Economic & Policy, and CABI Plantwise. For natural catastrophes, sources include the UN Environment Programme's Global Risk Data Platform, the EM-DAT International Disaster Database from the Centre for Research on the Epidemiology of Disasters, and other natural hazard maps.

For each threat type, we conduct a horizon-scanning exercise to bring the catalog of threat events up to date. We use this catalog to validate external threat assessments appearing in the data collection (above), and/or determine whether the risk from that threat is expected to increase or decrease from its baseline within the three-year outlook. Lastly, this analysis is complemented by solicitation of expert judgement from a team of subject matter specialists.

Shocks to the global economy are largely inevitable, resulting in real losses to the economy, but this loss level is not predetermined: The Global Risk Index demonstrates the value of investing in resilience.

The following sections describe the data sources used for each risk category and highlights events that occurred in 2017. While the Cambridge Global Risk Index reflects long term processes and historical events, the scan of 2017 events is key to the three year look ahead that is embodied in the Index. The 2017 scan showed that events mostly reflect the risk as determined by the threat assessments in line with the previous year's Index. The one exception is the raised risk of interstate conflict as blockades, militarisation and belligerent rhetoric build up across the globe, underscoring the tense and uncertain geopolitical landscape in 2017.



Decade volcano Mount Rainier viewed over the Seattle skyline







Earthquake





Temperate Windstorm















Natural Catastrophe and Climate

The 2017 year was characterised by record-breaking natural catastrophes.

The U.S. National Oceanic and Atmospheric Administration (NOAA) predicted that warm sea temperatures and lack of El Nino conditions would cause an above-normal hurricane season this year. The risk of landfall hurricanes was up by 10% due to the mild El Nino season.

The Atlantic Hurricane season in 2017 was severely damaging. Hurricane Harvey caused catastrophic damage in Texas and parts of Louisiana, with up to a quarter of refining capacity taken off-line during the storm. Hurricane Irma set the record for longest Category 5 hurricane, lasting 3 days, affecting large parts of Florida and the Caribbean. The estimated cost of Hurricane Harvey could be up to \$190bn by some estimates, and up to \$150bn for Hurricane Irma. Particularly heavy monsoon rains also fell in South Asia in 2017, affecting over 45 million people and killing over 1,200. Heavy flooding also occurred in Peru, Vietnam, China and Australia.

A drought has continued to devastate Somalia, Kenya and Ethiopia since 2015, causing food shortages for 11 million people. A possible 1-in-100 year drought affected parts of Northern United States in summer of 2017, resulting in wildfires which burned 1 million acres of land.

Heatwaves affected large parts of Southern Europe in 2017, with temperatures going above 40C for a few days. Extreme temperatures also led to wildfires in Portugal that killed 100 people. Parts of Asia suffered severely high temperatures, with record country temperature highs broken in Pakistan and Iran. If temperatures continue to rise, parts of South Asia may become uninhabitable by the end of the 21st century.

Scientific consensus seems to be that impacts of natural catastrophes are becoming more severe due to climate change. Of the catastrophe types modelled in the Global Risk Index, there is evidence that flooding, heatwaves and droughts are all becoming more frequent. Since 1993, sea levels have risen about 86mm, increasing the impact of storm surge and flooding following hurricanes.

The increased frequency of natural catastrophe events due to climate change is embedded in the risk assessment of the Global Risk Index. The Index demonstrates the economic impact of asset destruction and economic disruption due to these disasters. Although 2017 was a severe year for natural catastrophes, the uncertainty and long-term nature of climate projections cannot tell us whether short-term trends will escalate.



Interstate Conflict



Terrorism





Geopolitics and Security

Interstate conflict risk is the only threat of the 22 in the Cambridge Risk Taxonomy to have systemically increased this year. The number of states involved in conflict or at risk of conflict combined with the interconnected nature of the international system suggests future conflicts will not be isolated. Accordingly, geopolitical threats such as interstate conflict, social unrest, civil conflict and terrorism will also become progressively interconnected, accelerating a rebalancing of interests between local, regional and international participants. Figure 33 highlights the progressive increase in GDPat-Risk year over year due to heightened geopolitics & security risks in dark blue.

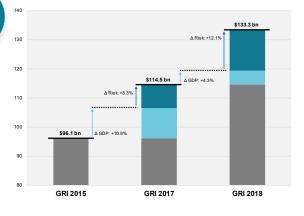


Figure 3: Geopolitics & Security GDP@Risk (\$bn).

2018 has seen the return of great power conflict, resulting in heightened geopolitical competition and the highest expected level of world military spending since the Cold War ended. Tangible displays of aggression combined with diplomatic and trade disputes suggest that the probability of interstate war is increasing. There is great potential for rapid escalation resulting from regional skirmishes; several pressing conflicts are ongoing but have not yet seen intervention from major powers.

Following tests of intercontinental and medium range ballistic missiles over USallied territories, the diplomatic relationship between North Korea and the United States is contentious, resembling brinkmanship that has not been experienced since the Cold War. Although it is likely that a deal or nuclear deterrence will prevent destructive conflict, the situation remains inherently dangerous. Further adding to the complexity of the situation is the geopolitical composition of East Asia, which could have the unintended consequences of turning a North Korean standoff into a great power conflict.

Territorial disputes in the East and South China Seas continue to exacerbate relationships within the same region, positioning local powers into antagonistic relations despite a degree of interdependency. The addition of several other regional states, each with intertwined collective security agreements and their own perceptions of history in the region, into the dispute makes a resolution of the conflict unwieldy and highly complex.

In the Middle East and North Africa (MENA), a diplomatic dispute originating between Saudi Arabia and Qatar quickly expanded, resulting in a halt of diplomatic relations and participation in an ongoing blockade against Qatar. Iran and Turkey aligned themselves with Qatar, lessening the impact of the blockade but underscoring the fractured state of MENA politics. Iran maintains a proxy presence in several conflicts throughout the region, namely in Yemen, Iraq, Syria and Lebanon. Ongoing instability in the MENA region has also seen interventions from global powers, different regional forces and proxy groups, all in support of opposing interests. These interventions could serve as inflection point for a larger conflict. In Eurasia, Azerbaijan and Armenia broke a ceasefire for the second time in two years in the disputed Nagorno-Karabakh region. Although contained, the territorial tension has been a constant source of instability that could intensify into a regional conflict involving other powers such as Iran, Russia and Turkey.

With the fall of the Islamic State's territorial caliphate, terrorism is statistically on a downward trend. However, this threat is evolving: Islamic State and al-Qaeda are increasingly reliant on small scale ambushes and suicide attacks primarily focused on civilian populations. While these methods tend to be less successful or harmful than larger strategic attacks, they still cause death and destruction, oftentimes in a much more geographically diverse area than targeted strategic attacks. Larger attacks are possible as well: al-Qaeda affiliate al-Shabab's likely targeted bomb attack in Mogadishu's centre was one of the largest and deadliest bomb



attacks in Somalia's history. The transition from insurgent tactics to more traditional terrorist tactics also pose a threat to the West—as the rise of lonewolf actors using "low-tech" terror tactics, often inspired and or directed digitally, has challenged Western security authorities, namely in France, Spain and the UK. Competition between the Islamic State and al-Qaeda for localised affiliates throughout the MENA region and other areas such as the Saleh is accelerating.

The 2017 defeat of far-right parties in France and the Netherlands has had little impact on the perception that far-right parties are on the cusp of gaining long-term political constituencies, especially in continental Europe where it is amplified by new technology such as social media to great effect. Social cohesion is fragile in this environment, with many European electorates disagreeing on immigration, integration, austerity, and sociocultural norms issues that populist parties elsewhere in Europe have exploited to gain electoral legitimacy. An independence referendum in Catalonia was met by a violent crackdown by Spanish authorities, encouraging sustained demonstrations and riots. Less impactful but continued instances of social unrest and civil conflict have occurred in Hungary, Poland, Romania, Greece and Serbia.

Similarly, the United States is experiencing perhaps the greatest example of political polarisation since the 1960's. Polarising issues of race and inequality, and the role of government in a variety of social and economic decisions increasingly driven by violence, as seen in widespread protests against police brutality and inequality, and demonstrations by extremist groups. Latin America, Africa, South Asia and MENA have also experienced a moderate level of social unrest. Functioning as the primary drivers of social unrest are: economic inequality, corruption, electoral fraud, partisan politics, sectarianism, environmental factors and ethnic and religious inequality. Brazil, Venezuela, Cameroon, Kenya, South Africa, Zimbabwe, South Sudan, DRC, India, Kashmir, Bangladesh, Myanmar and Iran standout amongst a crowded field.







Power Outage

Solar Storm

Technology and Space

In September 2017, we saw the largest solar flare (X9.3) in more than 12 years, causing brief radio blackouts and a display of auroras. Power grid operators continue to make incremental improvements to their grid infrastructure to maintain capacity and protect against geomagnetic damage however. This is balanced by the risk of power deficits as demand increases. Threat of nuclear accident is also relatively unchanged as three nuclear power plants were decommissioned in 2016. CCRS monitors the construction of new nuclear facilities, with new facilities planned mostly in Asia and Russia.

The cyber threat, as in last year's update, continues to develop at a rapid pace. Cyber attack loss severities are increasing with several recent attacks showing the potential for systemic impacts with global reach. Nearly every country in the industrialised world has reported a loss related to cyber risk. Ransomware continues to be the most significant malware threats; WannaCry and NotPetva ransomware were the most prominent examples seen in 2017. The WannaCry attack in May 2017 was particularly far reaching, with reported infections in 150 countries. A leak of NSA zero-day exploits has been seen as a catalyst for the recent systemic ransomware attacks. The cyber security community has actively targeted these exploit kits and their use is decreasing as a result. Other infection methods are increasing however – e.g. spam botnets, social engineering – and illustrate the evolving nature of this threat.

The cost to industries in terms of business interruption and ransom payments is so far marginal relative to infection rate. Ransomware attacks are increasingly being used for strategic and political reasons rather than financial gain. Data exfiltration and leaks of diplomatic correspondence have fuelled disputes between UAE, Qatar, and Saudi Arabia. Russian intelligence agencies are accused of deliberately spreading misinformation through social media during the US election.

The greatest potential for economic loss from cyber attacks is the threat to critical infrastructure. While several ransomware and data infiltration cyber attacks were executed with high profile and disruption this year, there were few successful or destructive attacks on critical infrastructure. Several attempts and advances have been recorded however. The US Department of Homeland Security released a report in March 2018 indicating Russian hackers had access to critical control systems in several sectors of American infrastructure including energy, nuclear, commercial facilities, water, aviation and manufacturing.





Health and Humanity

Major epidemics were mostly contained to specific regions in 2017. The places affected are typically suffering from climate and geopolitical crises which exacerbate hygiene and public health issues. These epidemics highlight the intersection of threats as events of one type can trigger or exacerbate the effects of another. Whether it is due to the global nature of supply chains, urbanisation or climate change, we see that the potential for epidemics to extend their reach is increasing. Parts of Brazil are experiencing cases of vellow fever that did not exist before, calling for a country-wide vaccination campaign. The prevalence of tropical infections in Southern Europe is increasing, potentially due to economic downturns, climate change and human migrations.

The cholera crisis in Yemen which began in October 2016 has now progressed to over a million cases and has caused over 2200 deaths. While the rate of infection is declining, this outbreak is the worst in history. The situation is made worse by the poor medical and sanitation conditions arising from civil conflict in the region.

Dengue outbreaks also increased in 2017, particularly in Sri Lanka, due to heavy rains and flooding. While outbreaks are endemic to this area, the climactic environment has formed more potential breeding grounds for mosquitoes, the vector of transmission. The increase in number of flood events in 2017 could potentially cause a rise in diseases such as dengue fever, malaria, chikungunya, and Japanese encephalitis in flood-affected areas.

Significant gains have been made in malaria reduction globally due to efforts such as better detection, testing, use of insecticidetreated nets and anti-malarial treatments. The largest gap now resides in the African region, particularly Sub-Sahara Africa, which accounts for 92% of malaria deaths.

A challenge in the health and humanity outlook is the effect of anti-microbial resistance (AMR). Along the Cambodia-Thailand border, a strain of malaria is becoming resistant to almost all available anti-malarial medicines. There is a risk that multi-drug resistance will develop in other parts of the sub-region as well, jeopardising the significant gains made against malaria.

AMR is a serious threat in all parts of the world, including the developed parts with otherwise strong healthcare systems. Antimicrobial infections kill 50,000 people each year in Europe and the US, with global deaths estimated to be 700,000. According to the Review on Antimicrobial Resistance, 300 million people are expected to die prematurely because of drug resistance over the next 35 years and the world's GDP will be 2 to 3.5% lower than it otherwise would be in 2050. While drug resistance is not new, this is an important risk in health that is worsening and will need to be monitored.

Other threats currently on our watchlist include: MERS (Middle East respiratory syndrome), H5N1 (avian flu), H7N9 (new variant avian flu), haemorrhagic viruses (like Ebola), gain of function research and vaccine development.







Commodity Prices

Finance, Economics and Trade

Financial, Economic and Trade Risks have remained largely steady since the publication of the 2017 Global Risk Index. Global financial stability is improving due to higher capital requirements under Basel III but risk appetite has also increased due to positive global growth outlook coupled with a low interest rate environment. Rising debt levels, particularly in the US and China, increase the vulnerability to a crisis – particularly if interest rates rise or growth is subdued.

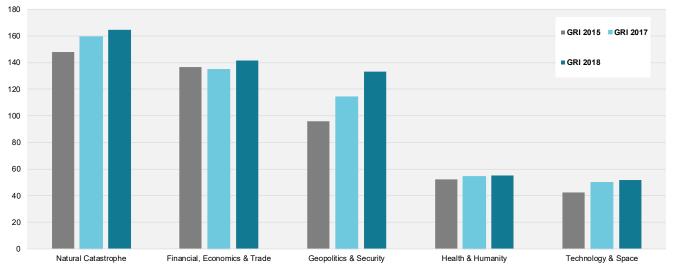
Economic activity has been fairly strong however, particularly in Europe. Italy's banking sector appears to have stabilised following recent bailouts and financial reforms. Portugal debt was also upgraded back to investment grade from junk.

Sovereign debt risks have increased in some countries facing political and economic uncertainty such as UK, US, Mexico, South Africa, and Turkey. A negative outlook for Qatar was issued following regional disputes. China's credit rating was also downgraded this year and El Salvador is in "selective default" after its government missed pension debt payments. However, these risks may be transient in nature and do not necessarily indicate any systemic sovereign failures. World oil and natural gas prices have been recovering steadily since the slump in late 2015/early 2016. Increased demand for natural gas due to its prominent role as a transitional fuel has contributed to its higher demand. Food prices in most countries are rising, which has also fuelled CPI inflation in major economies. While prices have been trending upwards, we see no imminent threat of a severe and sudden shock. While recent natural disasters such as Hurricane Harvey caused local fuel price surges due to lower supply, prices corrected shortly after.



Firing operations are carried out on a series of devastating wildfires in California, spread by unusually strong and persistent Santa Ana winds (Photo: Forest Service, USDA)

Changes in Risk Landscape



Global Risk Index Growth: sub-categories (\$bn)



Changes in Threat Risks

In comparison to the 2017 Global Risk Index, the 2018 outlook has not changed significantly. The most significant threats to the global economy are consistent with last year's risk outlook: Financial, Economics & Trade risks are mitigated compared to the long-term trend as baseline commodity prices are lower than the average of the past decade and severe financial shocks are likely to be contained as banking liquidity returns and capital buffers continue to be put in place. Market Crash risk remains as the top threat overall. While there has been no notable increase in this risk year-over-year, we should be reminded of the severity of a financial crisis on GDP, especially as these crises happen with relatively high frequency throughout history.

Cyber attacks also remain top of mind. Risk levels for this threat were raised in last year's Global Risk Index. The events that occurred in 2017, e.g. WannaCry, NotPetya, illustrate this elevated threat. Cyber protection capabilities are slowly improving in response to the proliferation of cyber criminals, providing a steady but relatively high level of risk, coming in 7th overall out of the 22 threat categories.

Natural catastrophes risks together inflict the most damage to the global economy, with tropical windstorms (3rd), floods (5th) and earthquakes (8th) as the most financially damaging types. The increase year-over-year is mostly due to the growth in GDP of the cities exposed to natural catastrophes. Many wealthy city economies are vulnerable to these threats, although their relative wealth allows them to be more resilient: Tropical Windstorm is the second-most costly threat for Tokyo (\$3.35bn) and Flood is the second-most costly threat for New York (\$2.47bn). Natural catastrophe risks effect on cities regardless of their solvency, however. With the exception of cities in Japan, all Asian cities in the top 20 ranking have a natural catastrophe risk as its top threat.

The only category of threats in the 2018 outlook that has increased materially year-over-year is Geopolitics and Security. The total expected loss from this category is nearing that of Financial, Economic & Trade risk – another category of man-made risks. Man-made risks have shorter time scales compared to natural risks such as Natural Catastrophes and can escalate (and de-escalate) guickly. The events highlighted in this report in East Asia, United States and the Middle East demonstrate the near-term increase in these risks. The likelihood of intense, multipolar conflict is still very low, especially ones which would directly impact militarily strong countries such as the United States or Japan. However, that likelihood is increasing and the physical and economic impact in the event of such a war would be undoubtedly severe.

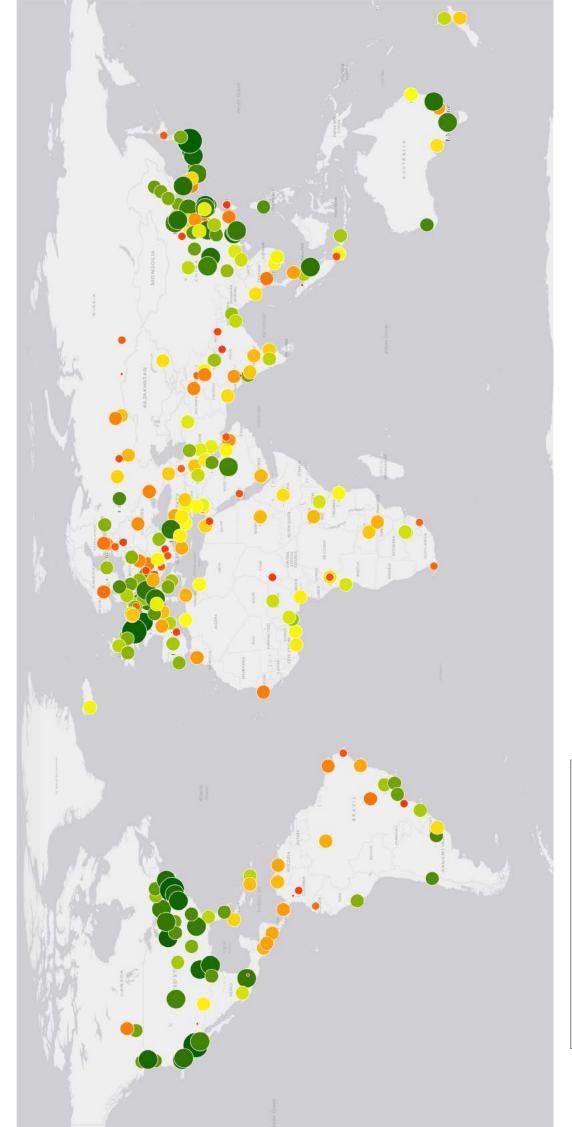




Figure 5: Cambridge Global Risk Index 2018, change in GDP from 2015 to 2018

Conclusion

The risk landscape is changing. The Index provides guidance on where future disruptions to revenues and economic activity are most likely to occur. It provides a framework for incorporating the frequency and severity of future shocks into resilience planning, and inputs into risk registers and formal reporting of risks to shareholders and regulators.

The Index is structured to help with the cost benefit justification of improving resilience. Policy makers can use the Index for civic continuity, economic security, and preparedness, particularly city administrations in identifying the key drivers of risk to the economic prosperity of their metropolis.

Financial services companies providing risk capital can incorporate this type of analysis into their own techniques and country threat assessments. Some risks included in the analysis are not incorporated in conventional risk management products and standard perils covered in traditional insurance. Better understanding of these risks may provide opportunities for insurers to create new product offerings and address new markets.

A Map of the Future Risk Landscape

The Index provides a map of the risk landscape ahead. Understanding the patterns of future risk is the key to successful risk management. We provide these analytics to help businesses, policy-makers, financial services providers, insurers, and other professional risk managers gauge their planning decisions, strategies and investments. We estimate that over half of this risk can be mitigated by improvements in resilience and investment in risk management.

Heightened awareness and improved understanding of risks is the key to building resilience. The 2018 Global Risk Index is unique in quantifying the GDP impact of unpredictable shocks on 279 of the world's most prominent cities. The Index compiles the impacts of 22 types of threats into a single measurement of economic loss called GDP@Risk. This annual update standardises the tracking of a wide variety of systemic types of shocks to the economy. The underlying analytics provide a methodology to quantify the economic value of improvements in city resilience; this has significance for governments, infrastructure providers and insurers, and development organisations.



Cambridge Centre for Risk Studies Publications



Comparison of **Taxonomy of Threats**

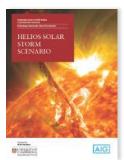


Constru Ministration Construction Construction Salar Learning

Ebola Emerging Risk nario



Dollar Deposed



Helios Solar Storm Emerging Risk S



Geopolitical Conflict



Climate Change



Cyber Accumulation



2017 Cyber Risk Landscape Co-branded with RMS, Inc.



Multi-Threat Risk Analysis and Insurance



Pandemic Emerging Risk S



Global Property Crash



Business Blackout



Cyber Terrorism



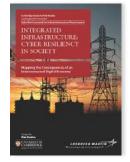
Multiline Data Insurance Schema Surveying



SCOREGUE **Cyber Catastrophe** Emerging Risk



Eurozone Meltdown Financial Risk Scenario



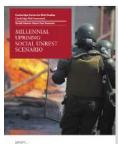
UK Cyber Blackout Lockh



Impacts of Severe NatCats on Markets



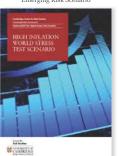
Steering the course



20

WE MANING

Social Unrest Emerging Risk



High Inflation World



World City Risk 2025



Cyber Risk Outlook 2018 Co-branded with RMS, Inc



Cambridge Centre for Risk Studies gratefully acknowledges the expertise provided for the Pandora global risk research programme by our subject matter specialists. Any misinterpretation in use of the advice provided is entirely the responsibility of Cambridge Centre for Risk Studies.

Finance, Economics and Trade Risks



• Cambridge Centre for Financial History, Dr Duncan Needham, *Director*

OXFORD ECONOMICS

• **Oxford Economics**, Keith Church, Senior Economist



• **Financial Networks Analytics Ltd**., Dr Kimmo Soramaki, *CEO and Founder*

• Office of Financial Research, US Federal Reserve, Dr Mark Flood, *Director*

Geopolitics and Society

CYtora

• **Cytora Ltd.**, Richard Hartley, *CEO* and Joshua Wallace, *Product Director*

Terrorism



• International Centre for Political Violence and Terrorism Research, S. Rajaratnam School of International Studies (RSIS) at Nanyang Technological University, Singapore, Prof. Rohan Gunaratna, *Director*



• Risk Management Solutions Inc., Dr Gordon Woo, *Catastrophist*

Natural Catastrophe and Climate

• Risk Management Solutions Inc.



• **Cambridge Architectural Research Ltd**, Dr Robin Spence, *Director*; Luca Leone, *Director*, Antonios Pomonis, *Director*, Hannah Baker, *Associate*

CATIN SIGHT

• CatInsight, Dr Richard Dixon, Director

Cyber and Technology

• Concinnity Risks Ltd., Eireann Leverett, CEO



Computer Laboratory

- University of Cambridge Computer Labs, Dr Frank Stajano, *Reader in Security and Privacy*, Graham Rymer, *Ethical hacker and penetration tester*
- **CyberCrime Centre**, Dr Alice Hutchins, *Criminologist and Senior Research Associate*, Dr Julia Powles, *Postdoctoral Researcher*

Space Weather



British Antarctic Survey NATURAL ENVIRONMENT RESEARCH COUNCIL

- British Antarctic Survey, Dr Richard Horne, Science Leader, Space Weather and Atmosphere team; Dr Mark Clilverd, Senior Scientist, Space Weather and Atmosphere Team.
- UNIVERSITY OF Department of Applied Mathematics and Theoretical Physics (DAMTP)
- Department of Applied Mathematics and Theoretical Physics, University of Cambridge, Dr Helen Mason, Assistant Director of Research.

Infrastructure



• Infrastructure Transitions Research Consortium, University of Oxford, Scott Thacker, Infrastructure Systems Modeller, Dr Raghav Pant, Senior Postdoctoral Researcher - Infrastructure Risk Analyst, Professor Jim W Hall, Professor of Climate and Environmental Risks, Director of the Environmental Change Institute

Health and Disease



• Cambridge Infectious Disease Interdisciplinary Research Centre, Dr Colin Russell, Royal Society Research Fellow, Department of Veterinary Medicine



• **Department of Plant Sciences**, University of Cambridge, Dr Matt Castle, *Senior Research Fellow*



• AgRisk, Dr Claire Souch, Product Manager

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