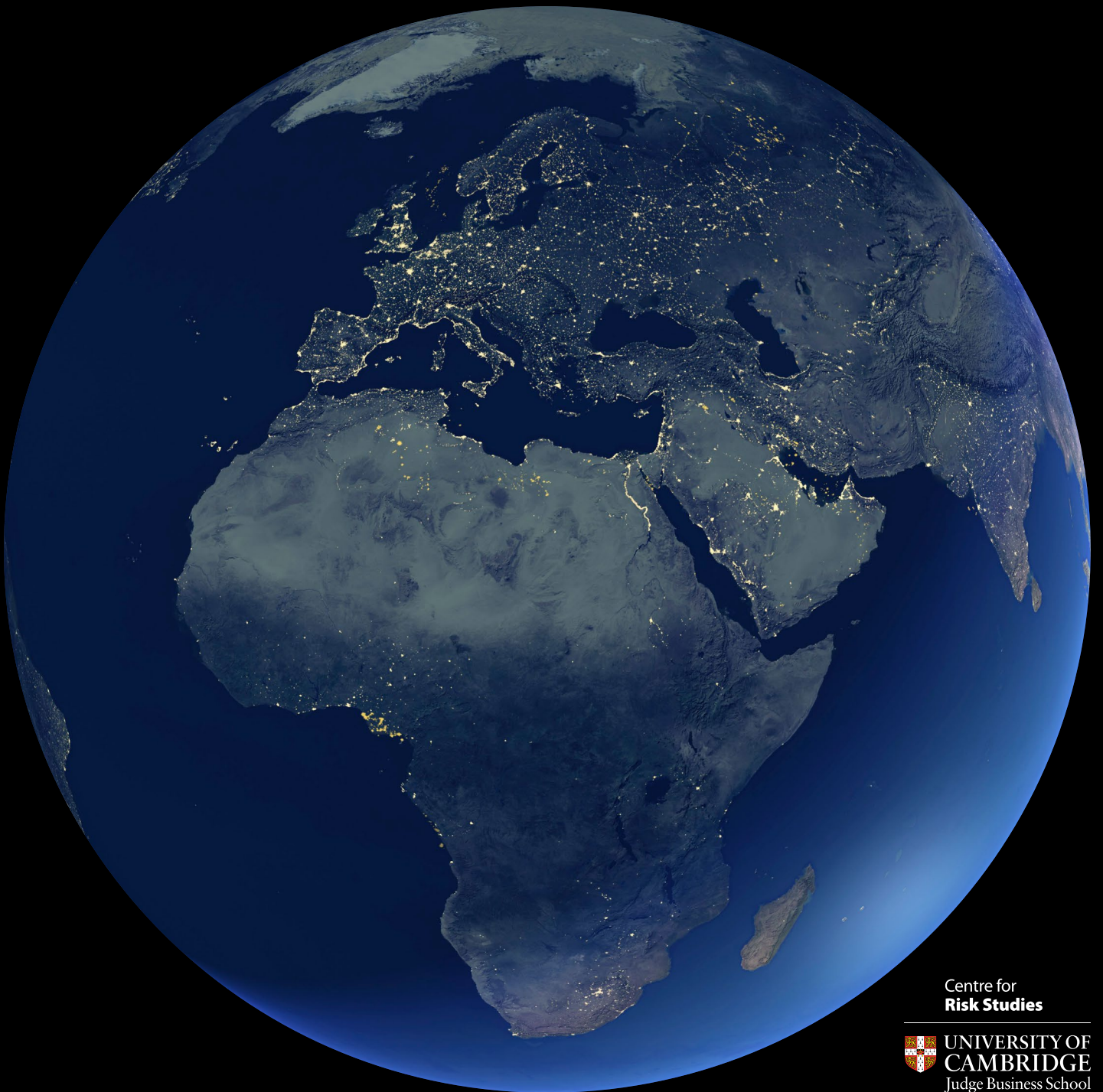


Lloyd's City Risk Index

Executive summary



Centre for
Risk Studies



UNIVERSITY OF
CAMBRIDGE
Judge Business School

Global overview

279 cities. 22 threats

Top ten cities at risk

1. **Tokyo** \$24.31bn
2. **New York** \$14.83bn
3. **Manila** \$13.27bn
4. **Taipei** \$12.88bn
5. **Istanbul** \$12.74bn
6. **Osaka** \$12.42bn
7. **Los Angeles** \$11.56bn
8. **Shanghai** \$8.48bn
9. **London** \$8.43bn
10. **Baghdad** \$7.91bn

Top ten threats

1. **Market crash** \$103.33bn
2. **Interstate conflict** \$80.00bn
3. **Tropical windstorm** \$62.59bn
4. **Human pandemic** \$47.13bn
5. **Flood** \$42.91bn
6. **Civil conflict** \$37.15bn
7. **Cyber attack** \$36.54bn
8. **Earthquake** \$33.96bn
9. **Commodity price shock** \$20.29bn
10. **Sovereign default** \$17.97bn

Cities are growing. In 1900, 13% of people lived in cities¹. Today, the proportion is 54%. In 2050, an estimated 66% of the global population will be urban residents². Cities are already the key drivers of national and global prosperity, accounting for 80% of global GDP³. However, while this brings great efficiencies, as people and assets concentrate in urban centres, they become increasingly vulnerable to risk events. It is therefore important to understand the risks that are threatening the world's cities.

The second Lloyd's City Risk Index, based on original research by the Centre for Risk Studies at Cambridge University's Judge Business School, details the risk landscape in the world's leading 279 cities, responsible for 41% of global economic output in 2018.

The data contained in this report will help policymakers, businesses and insurers make cities more resilient. Risk is managed most effectively by societies who anticipate and learn from each disruptive event, making the next generation safer.

The Lloyd's City Risk Index measures the GDP@Risk of 279 cities across the world from 22 threats in five categories: finance, economics and trade; geopolitics and security; health and humanity; natural catastrophe and climate and technology and space. The cities in the index are some of the world's leading cities, which together generate 41% of global GDP.

Lloyd's City Risk Index

279 cities. 22 threats

\$546.5bn at risk



The index shows how much economic output (GDP) a city would lose annually as a consequence of various types of rare risk events that might only take place once every few years, such as an earthquake, or from more frequently occurring events such as cyber attacks.

GDP@Risk is an expected loss figure – in other words it is a projection based on the likelihood of the loss of economic output from the threat. The resilience levels of each city are taken into account, including the city's governance, social coherence, access to capital and the state of its infrastructure. If some or all of these are resilient they can reduce the overall expected loss.

One way of thinking about GDP@Risk is as the money a prudent city needs to put aside each year to cover the cost of risk events. The concept of GDP@Risk helps policymakers, businesses and societies understand the financial impact of risk in their cities, a first step to building greater resilience.

The index also shows the scenario costs – these are the one-off costs if a specified threat scenario takes place. The index shows two numbers: the lower total is the loss that would occur from a moderate-sized event of that threat category; the higher total is the loss from an extreme scenario. These numbers represent the amount of lost economic output from the city from these types of scenarios. If policyholders hold insurance that covers property damage and business interruption, then some of the economic losses would be compensated from claims payments on these policies. Citizens can also use this data to better understand the threats and impacts of disruptive events and pressure policymakers into building more resilient cities and communities.

Key findings

Across all 279 cities, \$546.50bn is at risk from all 22 threats.

Man-made threats account for 59% of the total GDP@Risk – with market crash the largest single threat, with cities exposed to losses of \$103.33bn on an annual basis.

The ten cities with the highest exposure have a combined \$126.82bn of GDP@Risk, almost a quarter of the global total, with Tokyo standing to lose more than any other city.

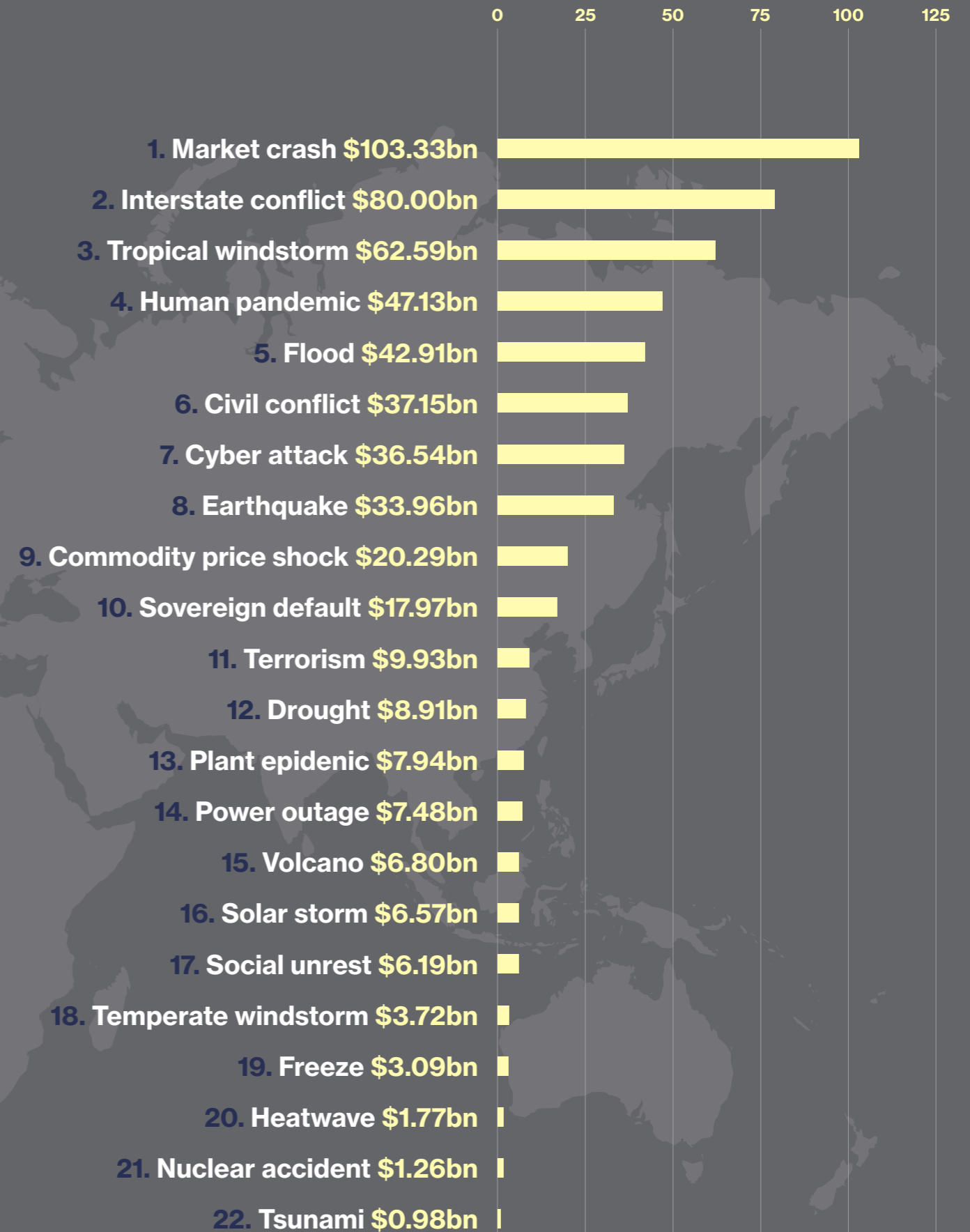
Climate-related risks account for \$122.98bn of GDP under threat, and this sum will grow as extreme weather events grow in frequency and severity.

If cities were to improve their resilience, global GDP exposure to loss would drop by \$73.4bn.

Top ten cities at risk

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Top 22 threats



North America:	17%	\$93bn
Europe:	13%	\$70bn
Latin America:	8%	\$45bn
Middle East and Africa:	18%	\$97bn
Asia:	44%	\$241bn



Executive summary

Man-made threats account for more than half of all GDP@Risk. The index assesses that GDP@Risk in the world's major cities is \$546.50bn per annum, with market crash, interstate conflict and tropical windstorm the three costliest risks to cities in the index.

The inclusion of interstate conflict, along with civil conflict and social unrest, for the first time in this edition of the index has increased the impact of man-made risks, which now make up 59% of the total GDP@Risk. A number of studies published in 2018 indicate that global conflict levels are rising⁴, with some analysts concluding that the likelihood of interstate conflict is at its highest since the end of the cold war. However, within this context, it is worth remembering that the previous half century has, in relative terms, been benign in terms of the number of fatalities from combat.

Asian cities account for 44% of global city risk, with Tokyo standing to lose more than any other city

Asian cities stand to lose the most GDP to risk, accounting for \$241.28bn or 44% of the global total, with tropical windstorm the costliest single risk at \$60bn. North American cities can expect to lose \$92.96bn each year and European cities, \$70.33bn. In both regions, market crash is the single costliest risk. Cities in the Middle East and Africa will lose \$97.20bn of their GDP in total, with interstate conflict the costliest risk. Latin American cities make up less than 10% of the global total, with \$44.73bn of GDP@Risk.

Asia's prominence in the index reflects the emergence of several of its cities as economic powerhouses. This, allied to their exposure to natural threats, which accounts for more than half of their total GDP@Risk, means this region stands to lose more than others. In general terms, cities in the Middle East and Asia, although developing rapidly, have lower value assets, which reduces their GDP@Risk figure. However, many of these cities are exposed to conflict risks.

City	GDP@Risk	Leading threat
Tokyo	\$24.31bn	Interstate conflict
New York	\$14.83bn	Market crash
Manila	\$13.27bn	Tropical windstorm
Taipei	\$12.88bn	Tropical windstorm
Istanbul	\$12.74bn	Interstate conflict
Osaka	\$12.42bn	Interstate conflict
Los Angeles	\$11.56bn	Flood
Shanghai	\$8.48bn	Tropical windstorm
London	\$8.43bn	Market crash
Baghdad	\$7.91bn	Interstate conflict

Executive summary

These ten cities account for \$126.82bn of potential GDP losses - 23% of the total - more than the total amount at risk from Europe and Latin America combined. They will experience 37% of the expected global loss from tropical windstorm (\$23.65bn); 28% of all flood loss (\$12.05bn) and a quarter of all financial loss from heatwave (\$0.47bn). Seven of these cities account for almost a third of earthquake risk.

In general, these ten cities (and Mexico City, the top-ranked Latin American city in the index in 11th place) combine high GDP and large populations with exposure to a wide range of major risks. The risk profile of the top ten cities demonstrates the importance of a 360-degree approach to risk management, which takes into account multiple threats, both man-made and natural. The exception is Baghdad, where geopolitical and security risks account for 90% of the city's total expected loss.

Climate risks will cost cities \$123bn

Cities account for 70% of greenhouse emissions and global waste, and 60% of energy consumption⁵. The former UN Secretary General, Ban-Ki-Moon said in 2012: "Our struggle for sustainability will be won or lost in cities"⁶. Making cities more resilient is in large part about ensuring cities source and use resources sustainably. By 2030, more than 40 cities are projected to have a population of more than 10m people⁷. How do city planners ensure they can supply enough water and energy from finite resources? This will require ingenuity and innovation from policymakers, businesses and communities.

In 2018, Cape Town became the first modern city to consider turning off the taps because its water supply failed, but it will not be the last⁸. Other cities, including Beijing, London and Sao Paulo, also face the challenge of drought. Technology is one solution. For example, systems can be put in place to monitor and manage water systems and consumption.

Cities present a sustainability challenge, but they also face the economic consequences of climate change. Climate events⁹, specifically, will cost cities in the index \$122.98bn annually with temperate and tropical windstorms accounting for \$66.31bn every year and flood potentially adding a further \$42.91bn.

New York is a good example of a city facing climate risks. Windstorm, flood, freeze and heatwave are expected to cost the city \$3.51bn each year, around a quarter of the city's total expected loss. Indeed, New York can expect to lose more to each of these threats than any other city in the world.

The index shows the paradoxical nature of costs associated with climate change. Paris, like New York, is exposed to both extreme heat and extreme cold. London could lose GDP from both flood (\$1.63bn) and drought (\$472m). Cities will need to identify strategies to deal with these polarities as the climate intensifies.

An aerial photograph of a city, likely London, showing a large river (the River Thames) winding through the urban landscape. In the foreground, a large stadium with a distinctive white, ribbed roof is visible. The city extends to the horizon under a clear sky. The text 'Improved resilience could save \$73.4bn each year' is overlaid in white on the top left of the image.

Improved resilience could save \$73.4bn each year

Executive summary

Risk is nothing new. Many cities in this report have grown despite their vulnerability to earthquake, flood or storm. However, this requires a constant focus on resilience. It is likely that some of the cities in the index that face costly risks will become centres of innovation where the technologies to manage these risks are developed.

For example, Tokyo, the city with the biggest exposure in the world in the index, is a world leader in earthquake-resilient technologies; Singapore, which faces ongoing water scarcity, is a pioneer in water management; and Rotterdam in the low-lying Netherlands has designed new ways of living with flood with an innovative “room for the river” policy¹⁰.

Insurance is part of the solution by providing cash injection following a catastrophic event, allowing cities to rebuild and recover more quickly. However, as Lloyd's research on underinsurance has shown, many of the most vulnerable countries in the world have low insurance penetration rates¹¹.

Insurers and brokers must also invest in developing new products, particularly relating to man-made risks which are difficult to quantify in terms of both probability and scale. Products have been developed to cover political risk and cyber crime, and the industry has a good track record in providing cover for high impact risks such as terrorism and nuclear accident.

Of course, insurance is just one mechanism to strengthen a city's defences. While no city can be completely risk free, active risk management can minimise the effect on GDP. The index scores each city's resilience from “very strong” to “very weak”. If every city in the world were to improve its resilience to “very strong”, this would reduce global GDP@Risk by \$73.4bn.

London and Paris are addressing challenges relating to ageing infrastructure, whilst cities in Latin America, Africa and Asia must keep up with the impact of population increases that are putting stress on existing systems.

There is also scope for more innovation in infrastructural design. More than half of the world's future urban spaces are yet to be built¹² so there is an opportunity to build new cities which are highly resilient to both the pressures of urbanisation and a changing climate. Indeed, it is hoped that these emerging cities will blaze a trail that all the cities included in the index can follow.



Lloyd's insurance classes support greater resilience

Executive summary

The Lloyd's market offers a number of innovative insurance products that cover the risks detailed in the City Risk Index. These add to the resilience of cities by providing an injection of cash into a city experiencing a disaster, reducing the GDP loss. Lloyd's pays billions in claims, every year, to cities across the world impacted by these threats.

Insurance cover, by detailing policy terms, also drives businesses and individuals to take measures to reduce risk in their properties and businesses. Examples of insurance products the Lloyd's market offers in relation to the 22 threats in the index include (note: all references to insurance include reinsurance and vice versa; cover may be specific or general; triggers may be parametric or ultimate net loss):

Cyber attack

The Lloyd's market offers cover for perils arising as a consequence of cyber attack. Examples of this include but are not limited to: cyber attack/cyber terrorism cover, which includes indemnification for third-party physical damage and business interruption loss, in addition to first and third-party cyber insurance (including cover for business interruption, crisis management, IT forensics, cyber extortion, digital asset restoration and privacy liability). Directors' and officers' (D&O) insurance products offer indemnification in the event of lawsuits brought about following a data breach.

Market crash

The Lloyd's market offers cover for perils arising as a consequence of market crash. Examples of this include but are not limited to: credit, political risk, contract frustration, financial guarantee insurance, surety bond reinsurance, contingent business interruption, event cancellation and specialist contingency covers, construction delay-in-start-up, travel, directors' and officers', commercial crime insurance, errors and omissions and other specialist professional indemnity products.

Terrorism

The Lloyd's market offers cover for perils arising as a consequence of terrorism. Examples of this include but are not limited to: terrorism reinsurance, political violence, cyber attack, health insurance, workers' compensation and other commercial casualty covers, kidnap and ransom, contingency products, travel insurance, business interruption and contingent business interruption (both damage and non-damage).

To read more about the coverage the Lloyd's market offers in relation to the 22 threats in the index, visit the About page on the Lloyd's City Risk Index website.

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- 9 Climate includes the following threats: drought, heatwave, flood, tropical windstorm, temperate windstorm and freeze.
- 10 Room for the River <http://www.roomfortheriver.com/>
- 11 Lloyd's 2012 <https://www.lloyds.com/news-and-risk-insight/risk-reports/library/understanding-risk/global-underinsurance-report>
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Acknowledgements

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Lloyd's is a global specialist insurance and reinsurance market. Under our globally trusted name, we act as the market's custodian. Backed by diverse global capital and excellent financial ratings, Lloyd's works with a global network to grow the insured world – building resilience of local communities and strengthening global economic growth.

With expertise earned over centuries, Lloyd's is the foundation of the insurance industry and aims to be the future of it. Led by expert underwriters and brokers who cover more than 200 territories, the Lloyd's market develops the essential, complex and critical insurance needed to underwrite human progress.

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The Centre for Risk Studies is a multidisciplinary centre of excellence for the study of the management of economic and societal risks. The Centre's focus is in the analysis, assessment, and mitigation of global vulnerabilities for the advancement of political, business and individual decision makers.

The Centre provides frameworks for recognising, assessing and managing the impacts of systemic threats. The research programme is concerned with catastrophes and how their impacts ripple across an increasingly connected world with consequent effects on the international economy, financial markets, firms in the financial sectors and global corporations. To test research outputs and guide new research agendas, the Centre engages with the business community, government policy makers, regulators and industry bodies.

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Acknowledgements

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Acknowledgements

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Simon Ruffle, Director of Research & Innovation
Dr Andrew Coburn, Director of the Advisory Board
Jennifer Copic, Research Associate
Professor Daniel Ralph, Academic Director
Dr Michelle Tuveson, Executive Director
Jessica Tsang, Research Assistant
Dr Andy Skelton, Senior Risk Researcher

Further thanks go to the following for their expertise, feedback and assistance with the study:

[Data analysis & text provided by](#)
Fiona Sinclair

[Editor](#)
Flemmich Webb, Senior Manager, Strategic Communications, Lloyd's

[Design](#)
Zach John Design