

Cambridge Judge Business School

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Cambridge Centre for Risk Studies 2018 Risk Summit

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# CAMBRIDGE GLOBAL RISK INDEX FOR 2018

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**Risk Studies**



UNIVERSITY OF  
CAMBRIDGE  
Judge Business School

# Threat Models

## Finance, Economics and Trade



Market  
crash



Sovereign  
crisis



Price  
shock

## Geopolitics and Security



Interstate  
Conflict



Terrorism



Separatism  
Conflict



Social  
Unrest

## Natural Catastrophe and Climate



Earthquake



Tropical  
Windstorm



Temperate  
Windstorm



Tsunami



Flood



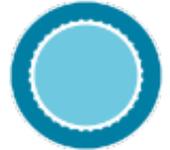
Volcanic  
eruption



Drought



Freeze



Heatwave

## Technology and Space



Nuclear  
Accident



Power  
Outage



Cyber  
Attack



Solar  
Storm

## Health and Humanity

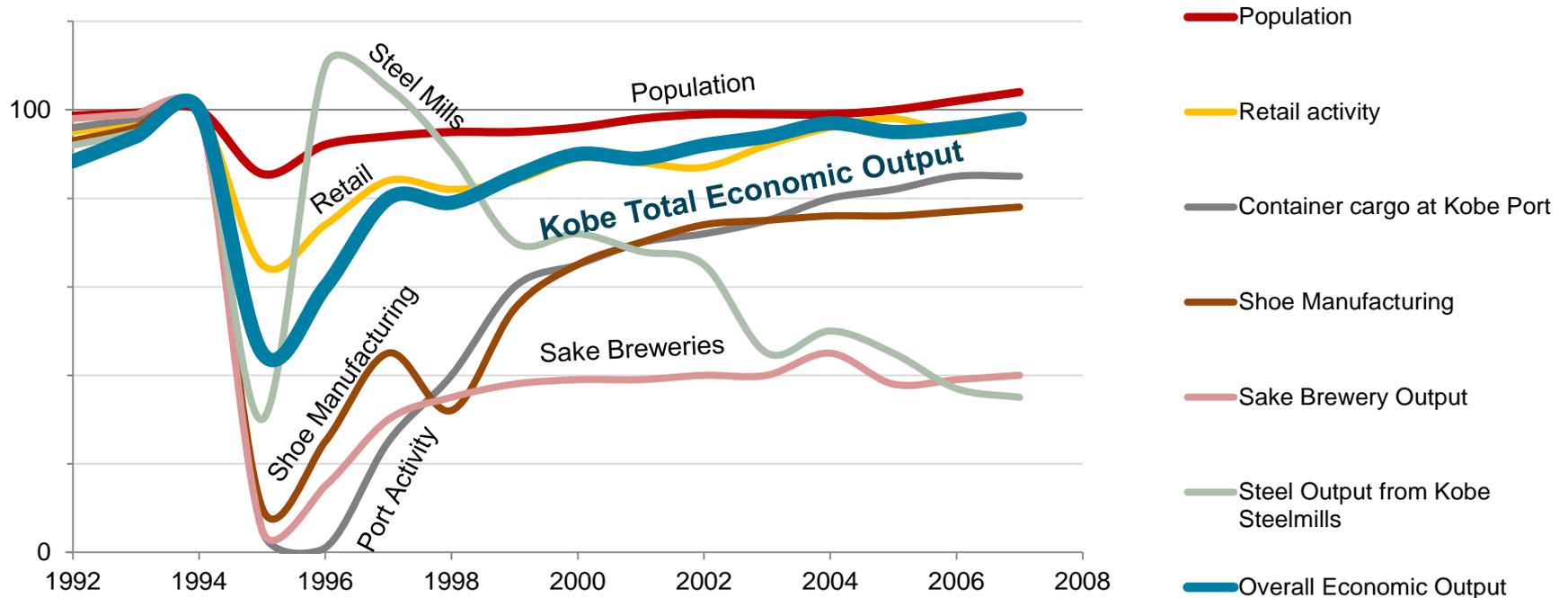


Human  
pandemic



Plant  
epidemic

# How a Catastrophe Impacts a City's Economy



# 2018 Global Risk Index

Measure impact of 22 threats on cities that contribute to 41% of global GDP



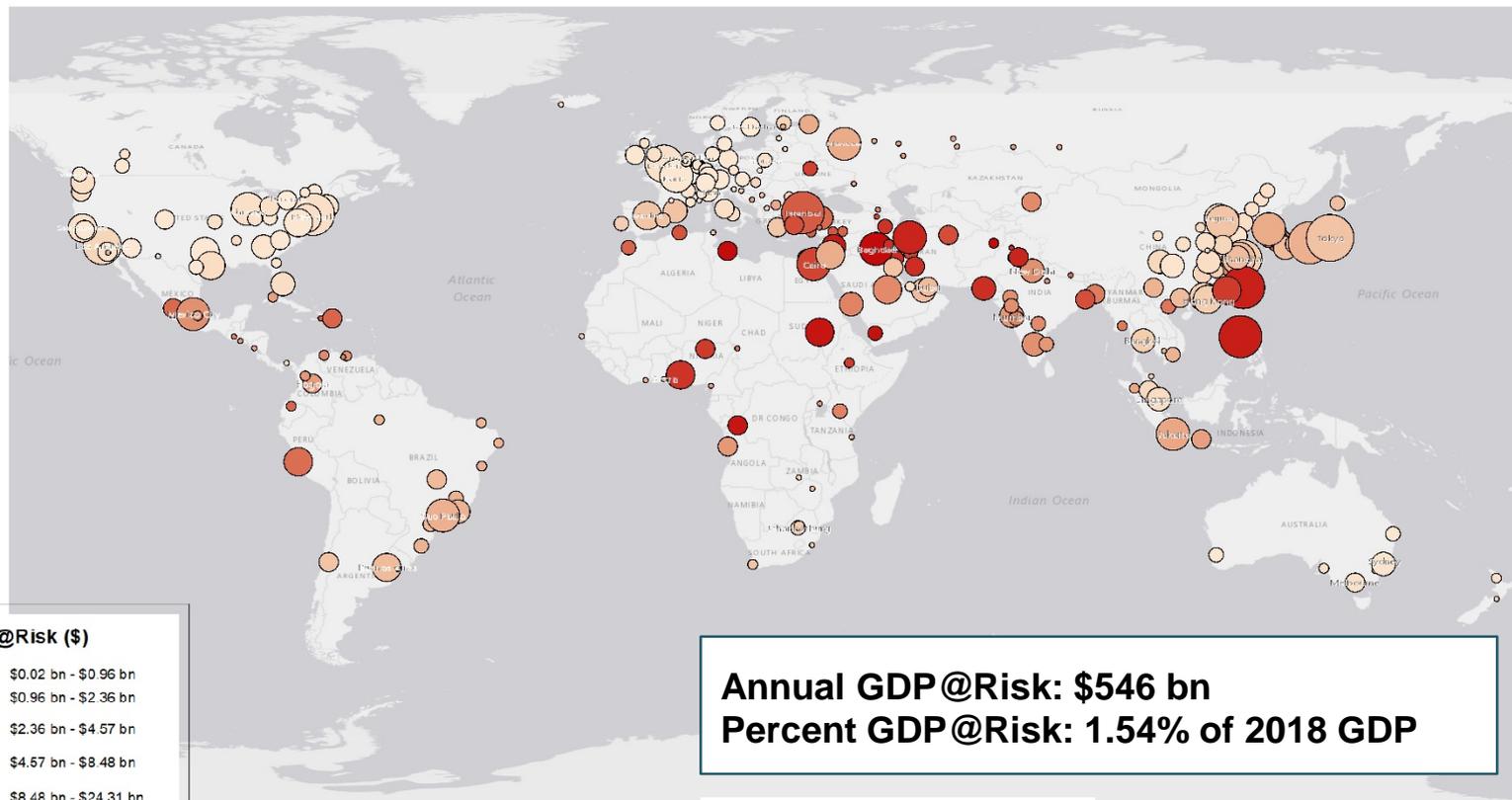
Annual update of GDP@Risk:

**2015: \$475bn**

**2016: \$494bn**

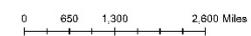
**2017: \$513bn**

**2018: \$546bn**



**Annual GDP@Risk: \$546 bn**  
**Percent GDP@Risk: 1.54% of 2018 GDP**

Number of Cities: 279  
 GDP: \$35.4 trn (2018)  
 Outlook Period: 3 years



Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

# A History of Urban Economic Shocks

The cities in the Global Risk Index have:



Lost more than a million of their citizens to earthquakes



Seen a third or more of their economic capital wiped out by stock market crashes 5 times



Experienced thousands of cyber attacks



Half of them have suffered a serious flood



A quarter of them have been flooded more than 5 times



32 cities have had to cope with a volcanic eruption less than 100 km away



Suffered more than 1,000 terrorist car bombs in city centres



Financial crisis of their governments defaulting on sovereign debts on 50 occasions



Had to combat the outbreak of a previously unknown disease five times

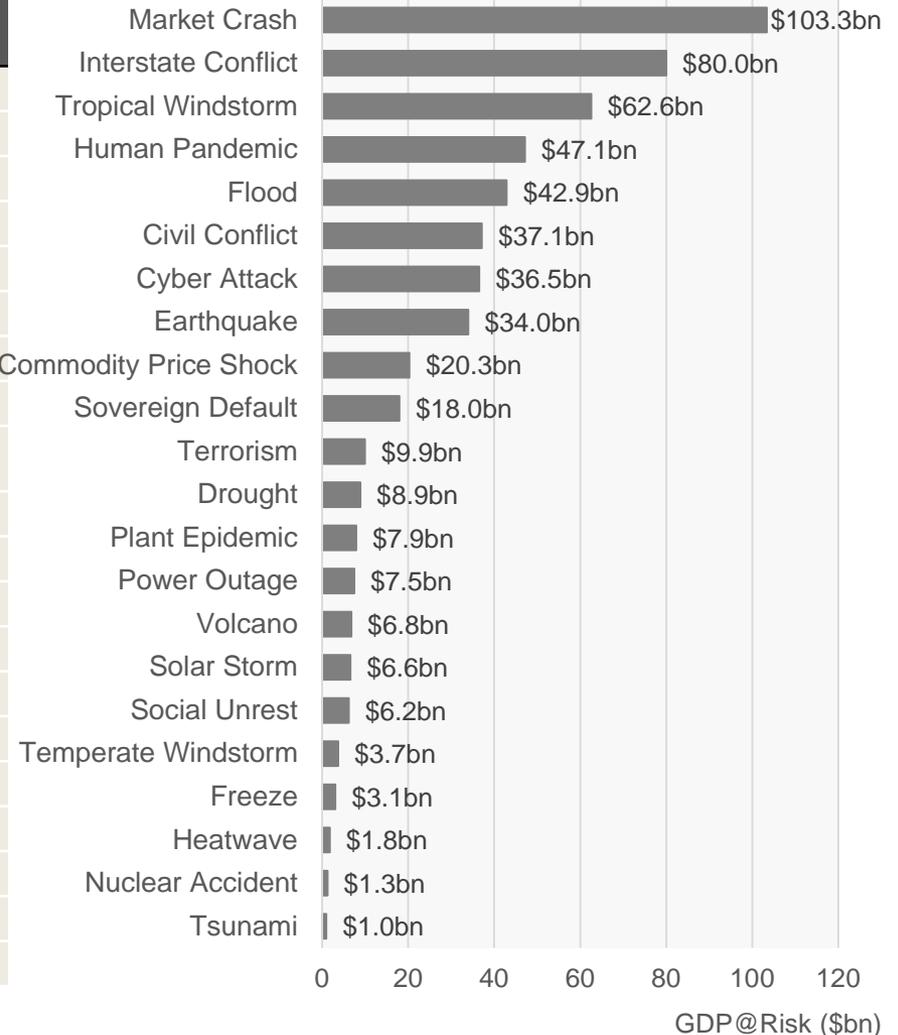
# 2018 Views of Risk

## Top 20 Cities at Risk

+Top Risk Type

City	Country	GDP@Risk (\$bn)	Top City Threat	GDP@Risk (\$bn)
Tokyo	Japan	24.31	Interstate Conflict	37%
New York	United States	14.83	Market Crash	21%
Manila	Philippines	13.27	Tropical Windstorm	56%
Taipei	Taiwan	12.88	Tropical Windstorm	62%
Istanbul	Turkey	12.74	Interstate Conflict	20%
Osaka	Japan	12.42	Interstate Conflict	30%
Los Angeles	United States	11.56	Earthquake	23%
Shanghai	China	8.48	Tropical Windstorm	28%
London	United Kingdom	8.43	Market Crash	22%
Baghdad	Iraq	7.91	Interstate Conflict	55%
Mexico City	Mexico	7.78	Market Crash	35%
Seoul	Korea	7.13	Tropical Windstorm	37%
São Paulo	Brazil	6.55	Market Crash	46%
Hangzhou	China	6.45	Tropical Windstorm	68%
Jakarta	Indonesia	6.29	Civil Conflict	30%
Moscow	Russia	6.27	Market Crash	44%
Nagoya	Japan	6.15	Interstate Conflict	36%
Paris	France	5.94	Market Crash	24%
Cairo	Egypt	5.73	Interstate Conflict	55%
Suzhou	China	5.73	Tropical Windstorm	51%

## Ranking of Threats



# GDP@Risk - Methodology

## City GDP Projection

*Oxford Economics*

## Threat Vulnerability

*Evidence Base*

## City Resilience

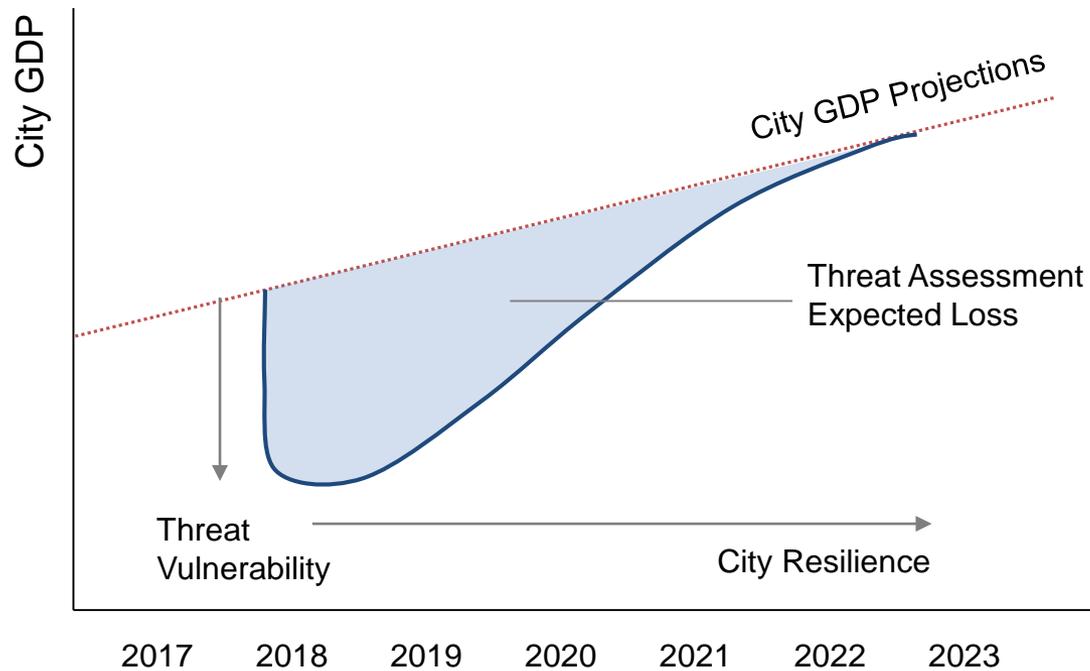
*INFORM + Sigma*

## Threat Assessment

*Evidence Base*

## Expected Loss

*Simplify calculation*



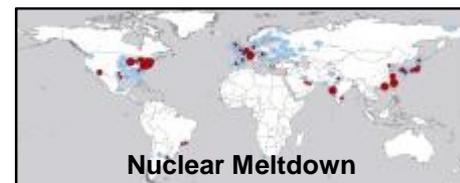
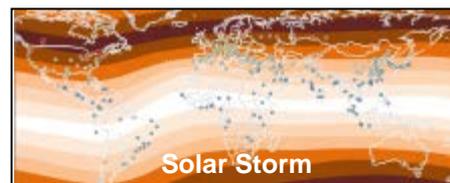
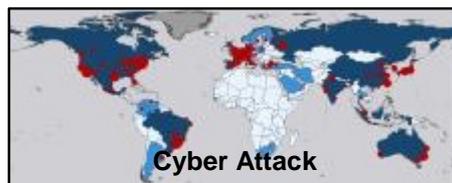
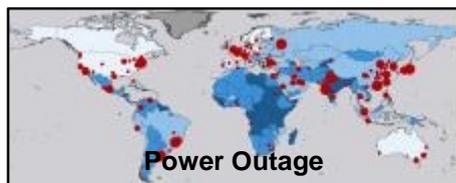
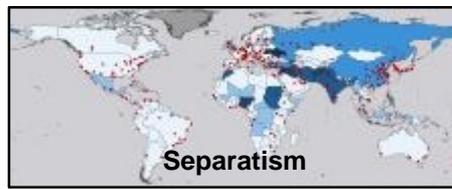
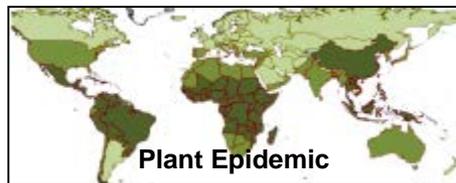
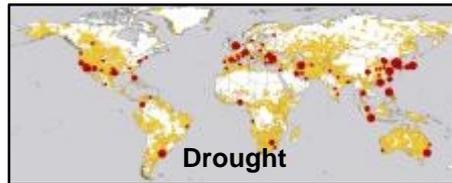
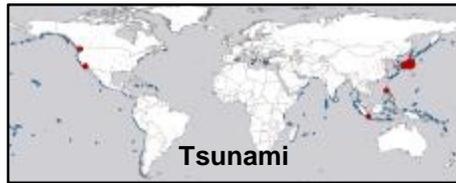
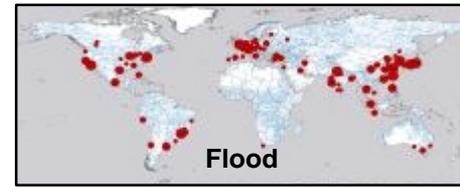
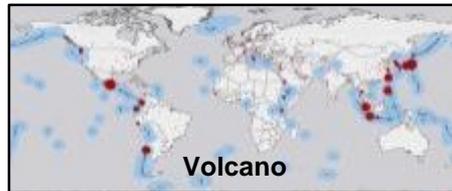
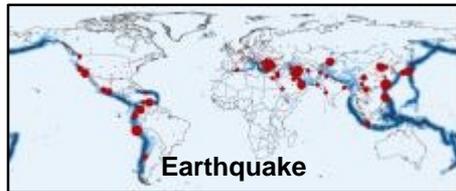
# City Definitions and GDP Projections

- How do we define a city?
- Standardize city definition and GDP estimates
  - Oxford Economics City GDP data
  - Detailed specification of city boundaries and estimation methodology
  - Cities defined as larger urban agglomerations which we believe is better suited for economic impact analysis
    - E.g. Tokyo Major Metropolitan Area: Tokyo, Yokohama-shi, Kawasaki-shi, Saitama-shi, Chiba-shi
- **300 cities → 279 cities**
  - Some cities have unreliable GDP data
  - Some cities have been merged



*Open source (CC0) image edited by CRS staff.*

# Geographical Mapping of All the Threats



# Vulnerability Ratings

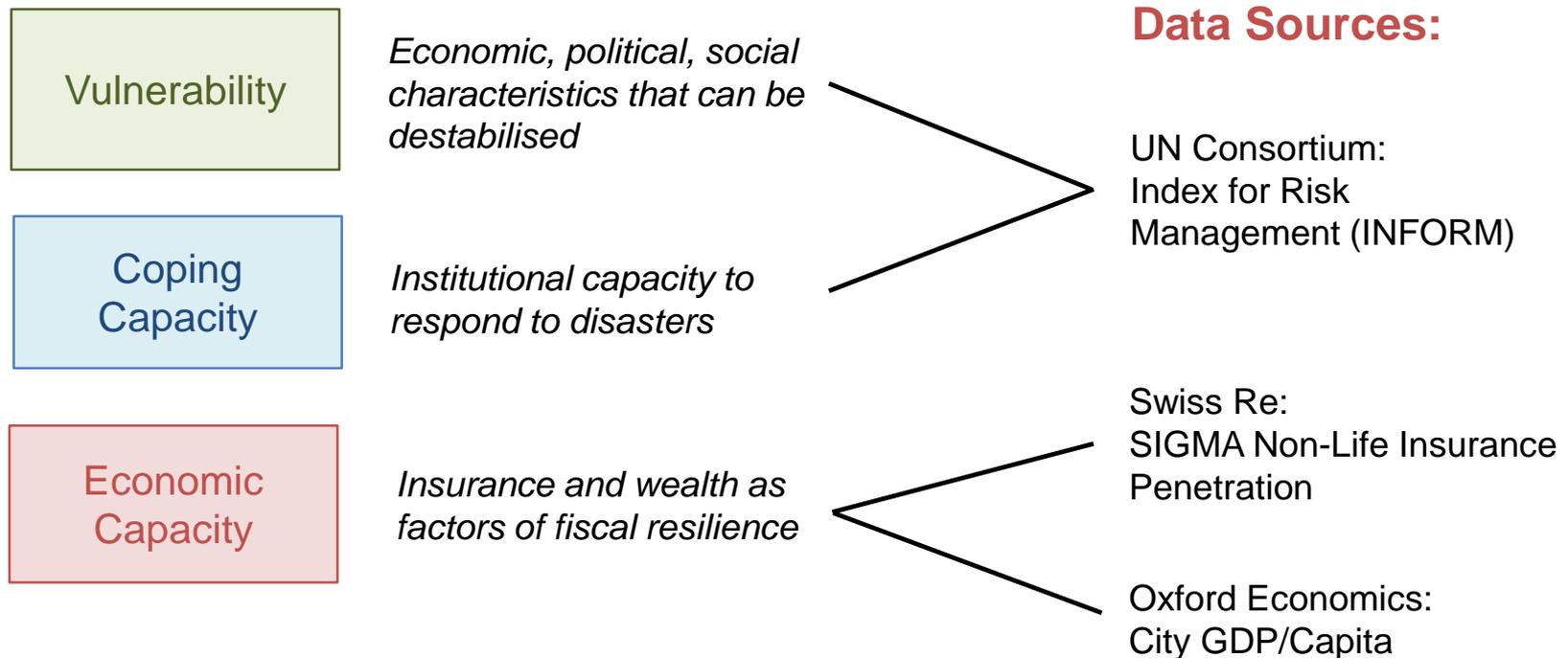
- Determines how significant the initial shock to the city's economy would be in the case of an event
- Vulnerability varies by threat type
  - Market Crash: City Economy's Reliance on Private Capital
  - Commodity Price Shock: Reliance on fossil fuel per unit of GDP
  - Various threats: Quality of buildings and infrastructure
  - Flood and drought: service versus agriculture oriented economies
  - Cyber Attack: dependence on IT for economic productivity
  - Human Pandemic: Access to healthcare facilities

# Resilience – Rate of Recovery

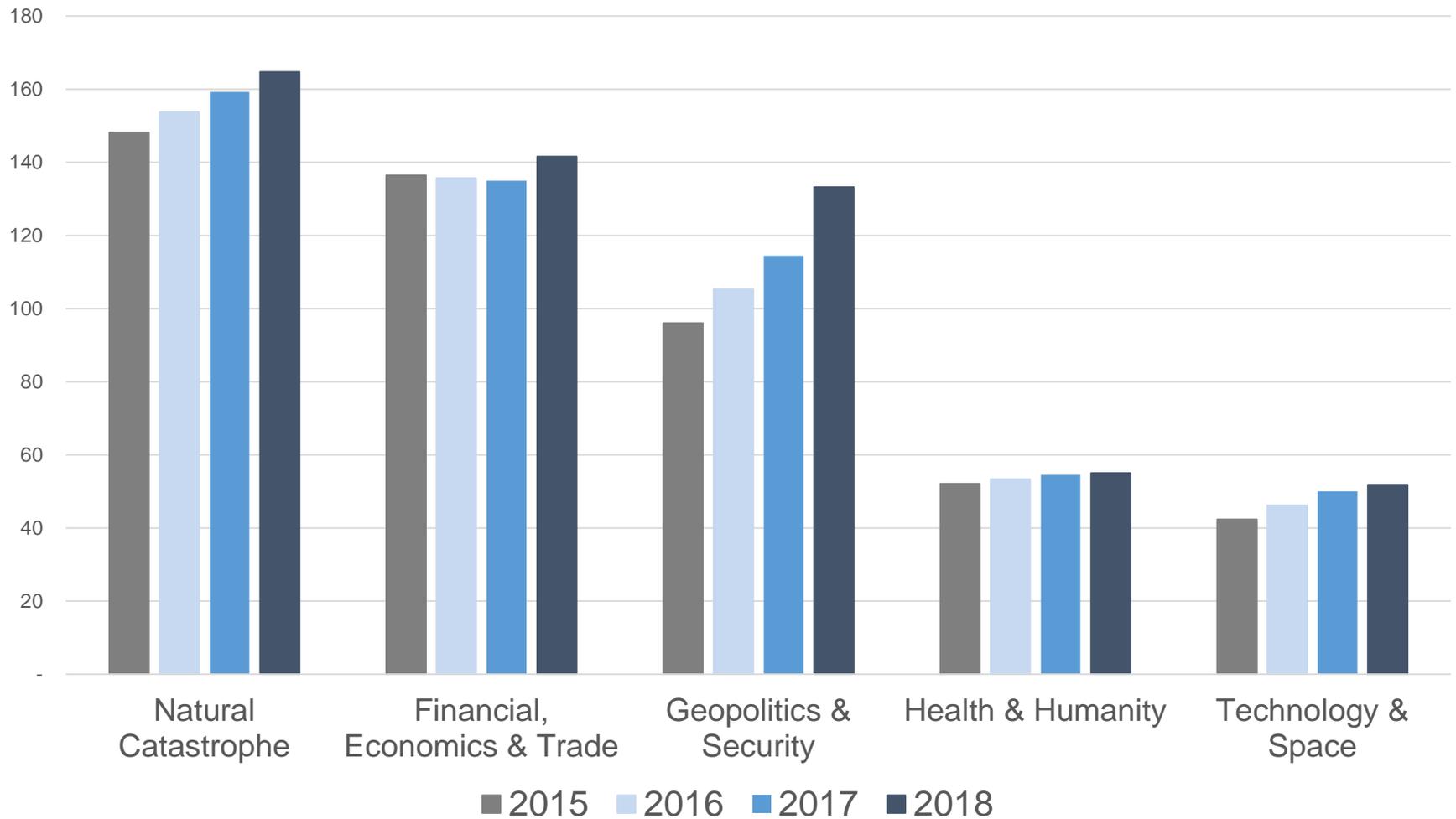
- Each city is assigned a city resilience score based on three core components

$$\text{City Resilience Score} = \text{Vulnerability}^{1/3} * \text{Coping Capacity}^{1/3} * \text{Economic capacity}^{1/3}$$

- City Resilience Scores are grouped into five resilience levels
  - 1 Very Strong, 2 Strong, 3 Moderate, 4 Weak, 5 Very Weak
  - Reflect major step changes and group similar cities
- **Impact estimate:** 2.0% decrease in GDP@Risk (part model-driven, part actual)

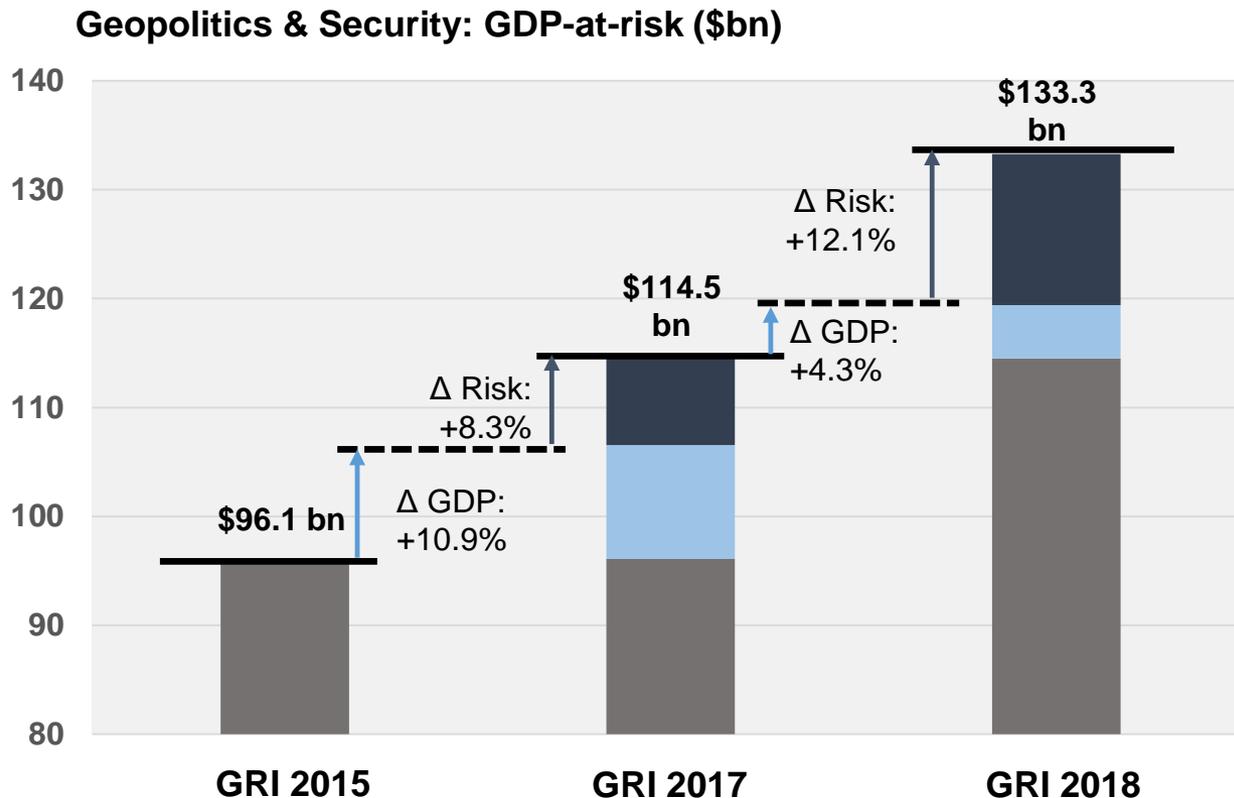


# Change in Risk over Time



# How Risk is Changing

- Increasing threat of geopolitical risk in many parts of the world
  - Threat of civil conflict to emerging economies
  - Potential for interstate war is higher than at any time post-WWII



# Geopolitical Risks – Interstate Conflict, Terrorism



## ■ Interstate Conflict

- Data layer: Global Firepower Index; conflict pair identification
- Ceasefire broken between **Armenia** and **Azerbaijan**
- Heightened tensions between **Saudi Arabia** and **Qatar**
- Tensions between the **US and North Korea** seem to have cooled down substantially



## ■ Terrorism

- Data layer: Global Terrorism Index
- Terrorist cells increasingly fragmented giving rise to 'lone-wolf' attacks, but potential for large-scale attacks still remain
  - **Syria/Iraq**: ISIS caliphate continues to be eroded through military coalition
  - **Philippines, Malaysia, Indonesia**: Increased presence of ISIS
  - Incidences in **Egypt** (300 killed in November) and **Turkey** have increased
  - Increase in number of 'low-tech' attacks in Western European countries including **Finland, Denmark, Sweden, Germany, France** but counter-terrorism efforts are still strong and interdicts most plots
  - **Myanmar**: Divisive ethnic tensions especially between Muslims and Buddhists. Possibility of IS and other extremist groups exploiting refugee crisis.



## Egyptian warplanes strike 'terrorist' targets after mosque attack kills 305

Scores more wounded when al-Rawdah mosque in north Sinai bombed and fleeing worshippers gunned down



# Geopolitical Risks – Social Unrest, Civil Conflict



## ■ Social Unrest

- Data Layer: Economist Intelligence Unit's Social Unrest Index
- **United States**: experiencing heightened social/racial tensions and increased polarization following Trump election; social media bias playing a role
- Protests in **Venezuela** and **Iran**
- **Greece** and **Egypt**: showing signs of stabilization
- Increasing social unrest in **India** about ethnic, caste and religious issues, labour and employment, and minority and women's rights

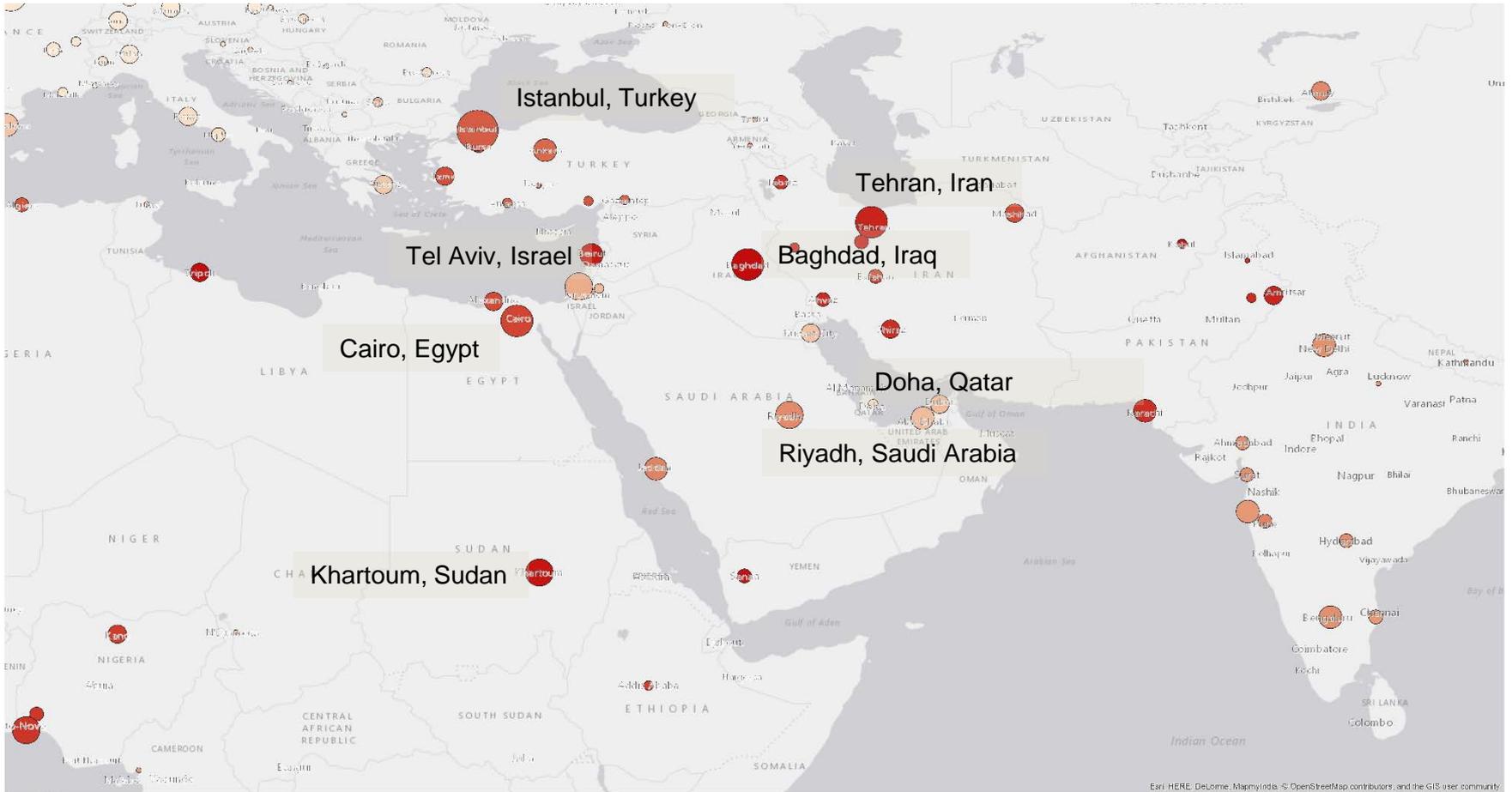


## ■ Civil Conflict (previously Separatism)

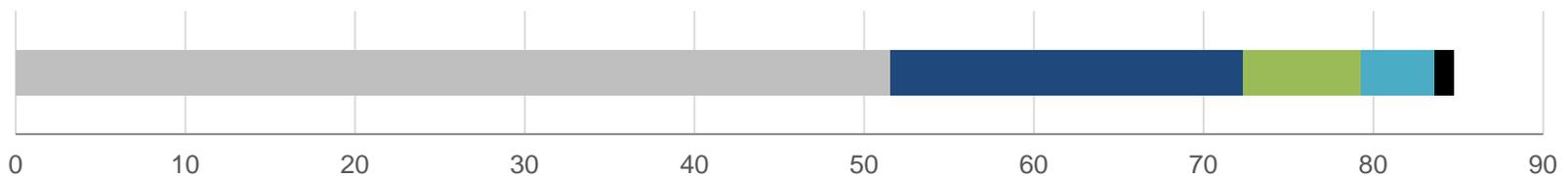
- Data Layer: Global Internal Violent Conflict Risk Index
- **Myanmar**: Divisive ethnic tensions have increased significantly in Rakhine state. Over 600,000 Rohingya displaced.
- Increased separatist activity seen in Kashmir, **India** that has led to Indian military interventions in 2017



# Regional Focus – Middle East and Africa

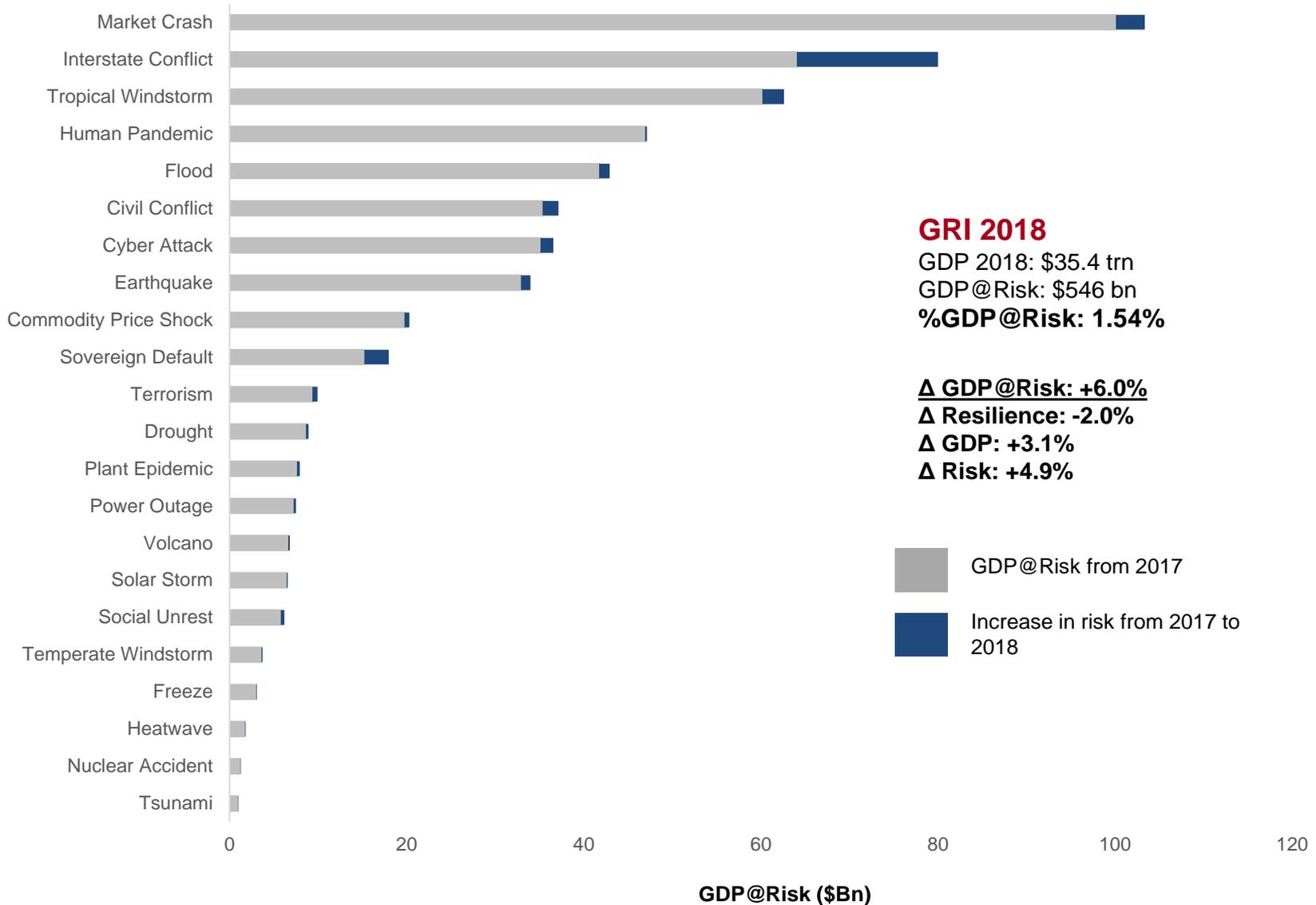


■ Geopolitics and Security ■ Finance, Economics and Trade ■ Natural Catastrophe ■ Health and Humanity ■ Technology and Space



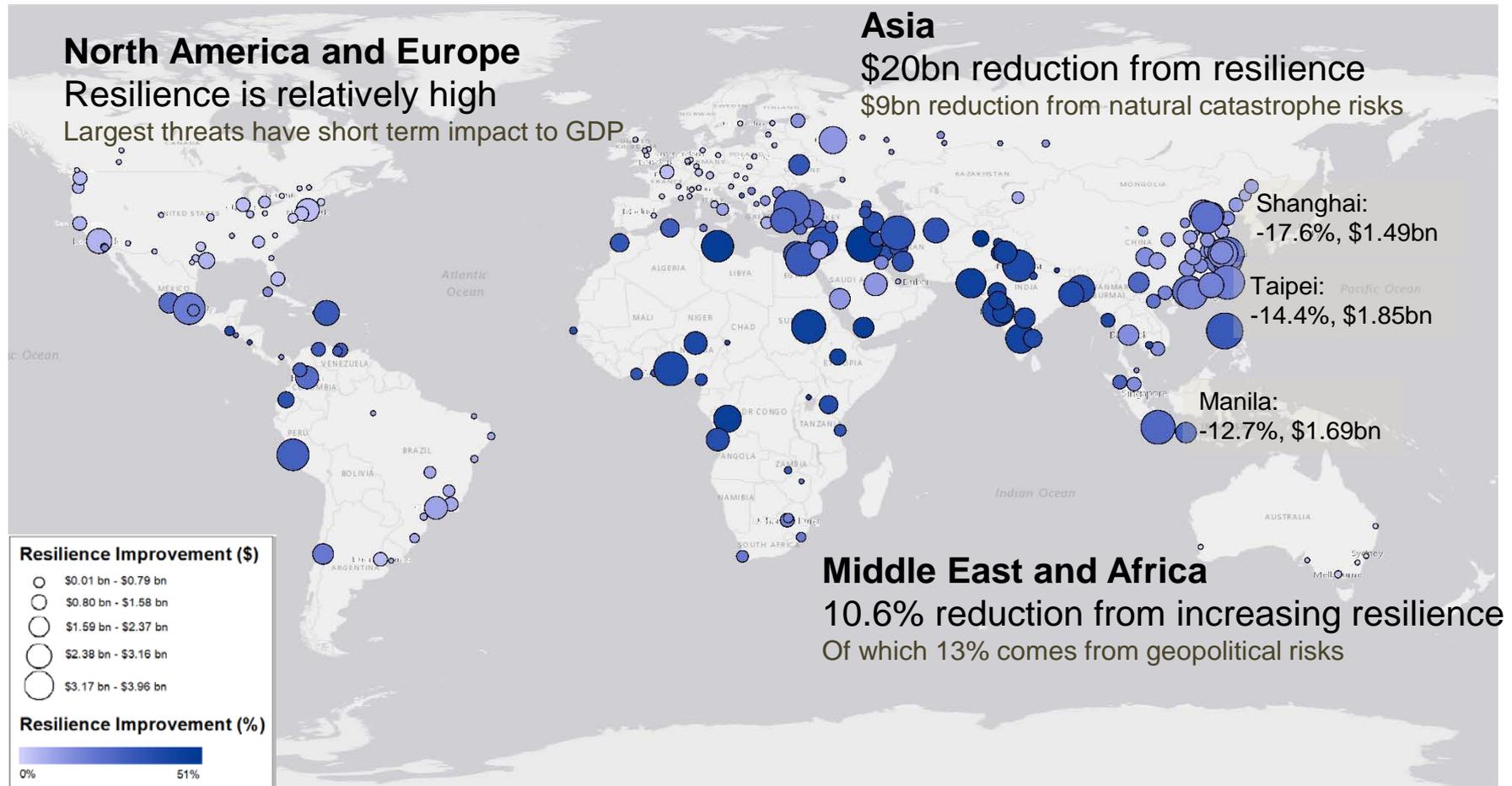
GDP@Risk (\$bn)

# 2017 to 2018



# Increasing Resilience

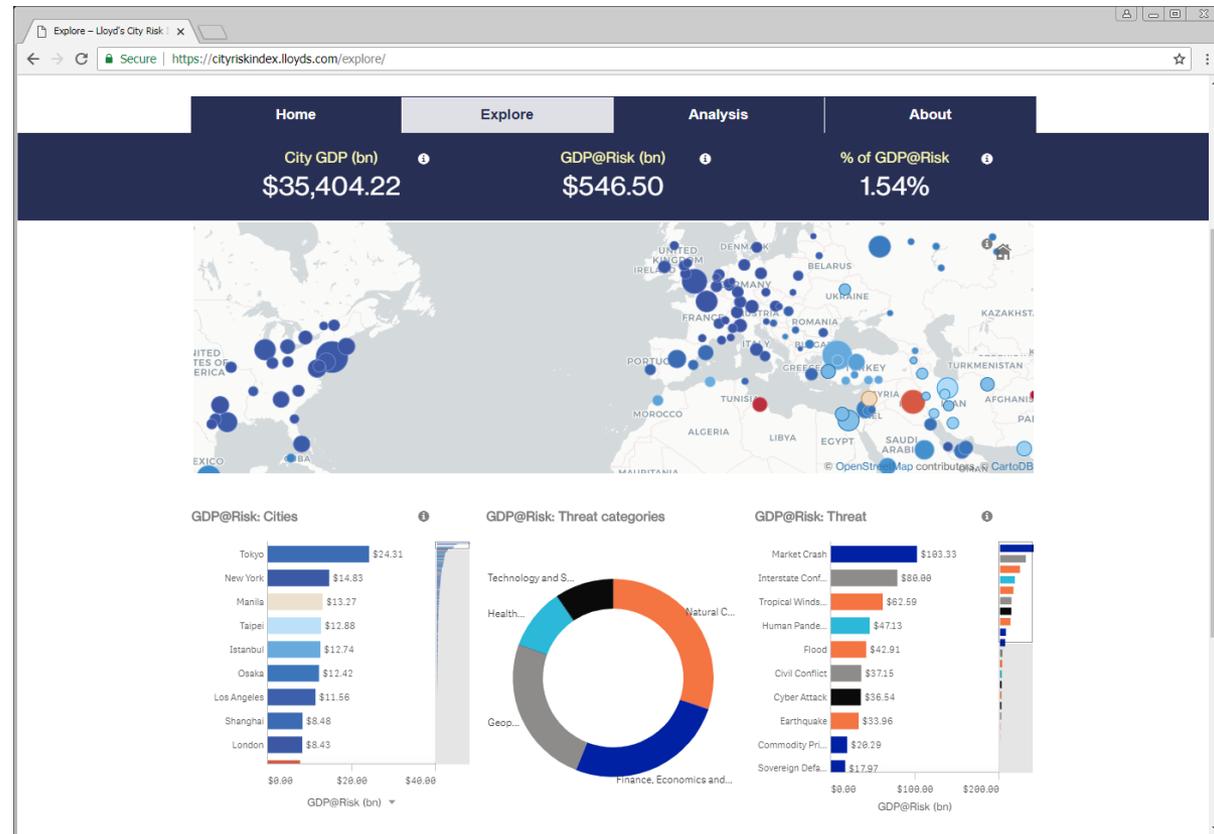
- If all cities increased their resilience by one ranking, GDP@Risk decreases by \$38bn to \$508bn, a 6.9% reduction in expected loss.



# Lloyd's City Risk Index 2018



- Launch at Lloyd's on 6 June
  - Lloyd's CRI [interactive website](#)
  - [Viewpoints blog](#) related to the launch
  - Executive Summary of the 2018 Index is available [here](#)



# Future Work

## ■ Global City Risk Index 2019

- We will continue to maintain this index with an update this fall
- Planned updates include:
  - Update 2019+ GDP predictions
  - Complete annual threat review and forecast
  - Improve cyber threat model
  - Improve market crash threat model
  - Refine analysis of climate change trend risk

## ■ Save the date for Global Risk Index 2019 Launch in Dec 2018

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