ADVANCING THE CITY RISK INDEX

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Centre for Risk Studies
Cambridge Global Risk Index

300 Cities
22 Threats
$1.17 Trillion of GDP@Risk a year
2017 Risk Index: Update by Threat

- Market Crash
- Interstate Conflict
- Wind Storm
- Human Pandemic
- Earthquake
- Flood
- Cyber Attack
- Separatism Conflict
- Sovereign Crisis
- Commodity Prices
- Terrorism
- Drought
- Power Outage
- Volcanic Eruption
- Plant Epidemic
- Solar Storm
- Social Unrest
- Temperate Wind
- Freeze
- Heatwave
- Nuclear Accident
- Tsunami

Increase from 2015
Decrease from 2015

GDP@Risk ($Bn)
What's New on the Risk Landscape?

Financial, Economic & Trade Risks

Banking Crisis Risk
- Basel III progress – close to TLAC
  - TLAC (Total Loss Absorbing Capacity) of G-SIBs is near completion
- Italian banking crisis
- Central banks less likely to bail out

Asset Bubble Risk
- Property bubbles continue to build
- Global debt explodes at 'eye-watering' pace to hit £170 trillion

Zero Interest Rate Policy:
'Everything' Bubble'

Sovereign Crisis Risk
- BREXIT UK Rating Downgrade
- Continuing Eurozone strain
- A Chinese Sovereign Debt Default?

Price Shock Risk
- China slump
- Oil price collapse
- Commodity pricing slump
- Food price volatility

Source: Basel Committee on Banking Supervision:
Implementation of Basel standards August 2016
What’s New on the Risk Landscape?
Geopolitical & Security Risks

- Saudi Arabia and six other nations cut ties with Qatar
- Terrorism activity in mainland Europe
  - Paris and London Attacks
  - Increased activity but micro attacks
  - Potential for much larger attacks
- Tensions in the East China Sea
- Taliban in Afghanistan
- Civil War in Syria
- Territorial Disputes in the South China Sea
- North Korea Crisis
- War Against Islamic State in Iraq
- Civil War in Libya
What’s New on the Risk Landscape? Technology & Space

- Cyber attack severities are increasing
  - Major recent cyber hacks have consistently broken previous records
    - WannaCry ransomware attack: World's biggest cyberattack sends countries into 'disaster recovery mode'
    - Largest ever data exfiltration attacks (Yahoo 500m records and Mossack Fonseca 2.6 Tbytes)
    - Largest known attempted cyber bank theft (Lazarus SWIFT $1Bn attempt)
    - Largest Denial of Service attacks: 1,000 Gbps
  - 2016 saw a cyber attack on Ukrainian power grid cause outage to 225,000
- Cyber security is also increasing in response
  - Worldwide spending on cybersecurity products and services projected to exceed $1 trillion over next 5 yrs
- Solar storm has been a major subject of CCRS study in 2015/16 with the release of Helios Solar Storm report
  - Solar cycle may not be a good indicator of threat of CME but we are currently in declining phase of cycle 24 of solar activity
- Nuclear risk diminishing as 3 nuclear plants decommissioned last year
## 2017 City Rankings – Total GDP@Risk

<table>
<thead>
<tr>
<th>2017 Rank</th>
<th>City Name</th>
<th>GDP@Risk ($US Bn)</th>
<th>Change in Rank from Baseline</th>
<th>Change in GDP@Risk from Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Taipei</td>
<td>20.57</td>
<td>0 -</td>
<td>0.4%</td>
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<tr>
<td>2</td>
<td>Tokyo</td>
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<td>0 -</td>
<td>24.4%</td>
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<tr>
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<td>Seoul</td>
<td>13.76</td>
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<td>▲ 2.0%</td>
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<tr>
<td>4</td>
<td>Manila</td>
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<td>0 -</td>
<td>▲ 1.6%</td>
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<tr>
<td>5</td>
<td>Istanbul</td>
<td>12.06</td>
<td>0 -</td>
<td>▲ 19.5%</td>
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<tr>
<td>6</td>
<td>Tehran</td>
<td>10.66</td>
<td>0 -</td>
<td>▲ 6.9%</td>
</tr>
<tr>
<td>7</td>
<td>Osaka</td>
<td>10.02</td>
<td>7</td>
<td>▲ 20.6%</td>
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<tr>
<td>8</td>
<td>Mumbai</td>
<td>9.72</td>
<td>▲ 0 -</td>
<td>▲ 5.4%</td>
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<tr>
<td>9</td>
<td>New York</td>
<td>9.23</td>
<td>-2</td>
<td>▲ 1.1%</td>
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<tr>
<td>10</td>
<td>Delhi</td>
<td>9.22</td>
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<td>▼ 5.2%</td>
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<tr>
<td>11</td>
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<td>-0.8%</td>
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<tr>
<td>13</td>
<td>Lima</td>
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<td>▼ 1</td>
<td>0.8%</td>
</tr>
<tr>
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<td>Hong Kong</td>
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<tr>
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<td>Buenos Aires</td>
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<td>18</td>
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<tr>
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<td>▲ 3.4%</td>
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<tr>
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</tr>
<tr>
<td>26</td>
<td>Paris</td>
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<td>-1.1%</td>
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<tr>
<td>27</td>
<td>Tianjin</td>
<td>5.02</td>
<td>▼ 0 -</td>
<td>▼ 0.3%</td>
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<tr>
<td>28</td>
<td>Tel Aviv</td>
<td>4.94</td>
<td>5</td>
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<tr>
<td>29</td>
<td>Guangzhou</td>
<td>4.91</td>
<td>▲ 1</td>
<td>▲ 0.4%</td>
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<tr>
<td>30</td>
<td>Chengdu</td>
<td>4.87</td>
<td>▼ 1</td>
<td>▲ 0.5%</td>
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</tbody>
</table>

### 3yr Risk Outlook
Defining ALL the Trillion Dollar Event Scenarios

- The economy is relatively robust to minor and localized shocks
- A shock that destroys a trillion dollars or more of economic output is sufficiently large to trigger significant stockmarket equity devaluations
  - It becomes systemic and impacts connections and wider scale relationships
- Our objective to define all the likely causes of trillion dollar shocks to the global economy in a scenario event set

**Modelled Macroeconomic Impact**

- Stockmarket Shock: Reduction of S&P500 Index in One Quarter

**GDP@Risk**

$ Economic Output Loss from Event
**A Scenario is Defined By…**

**Interstate Conflict Scenario: IC04**  
**Name:** Saudi Arabia & Iran  
**Description:** Bilateral border conflict between two medium powers

<table>
<thead>
<tr>
<th>CRS City ID</th>
<th>City Name</th>
<th>IC1 (small)</th>
<th>IC2 (medium)</th>
<th>IC3 (large)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAU_ARI</td>
<td>Riyadh</td>
<td>43.6</td>
<td>224.6</td>
<td>391.8</td>
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<tr>
<td>SAU_JED</td>
<td>Jeddah</td>
<td>42.4</td>
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<td>Tehran</td>
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<td>167.4</td>
<td>296.4</td>
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<tr>
<td>IRN_KHR</td>
<td>Mashhad</td>
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<td>31.2</td>
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<td>27.4</td>
<td>48.3</td>
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<td>Kermanshah</td>
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<td>31.0</td>
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<table>
<thead>
<tr>
<th></th>
<th></th>
<th>IC1 (small)</th>
<th>IC2 (medium)</th>
<th>IC3 (large)</th>
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<tbody>
<tr>
<td><strong>Total GDP@Risk ($US bn)</strong></td>
<td></td>
<td>1,009</td>
<td></td>
<td></td>
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<tr>
<td><strong>Estimated Return Period</strong></td>
<td></td>
<td></td>
<td></td>
<td>600</td>
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</table>
Global Catastrophe Exceedance Probability Curve

- $1\text{tr}$ events have an 8 year return period
- $10\text{tr}$ events have a 47 year return period
- $16\text{tr}$ events have a 100 year return period
- $22\text{tr}$ events have a 200 year return period

- Mt Fuji Eruption at VEI VII
- Warm case hurricane season NE USA
- Solar storm impacting North America & Europe
- Major global market crash
- Global virulent pandemic
- Level 4 interstate conflict between China & India

- Finance, Economics & Trade Risks
- Geopolitics & Security
- Technology & Space
- Natural Catastrophe & Climate
- Health & Humanity
A Typology of Disaster Impacts

- **Direct (stock) losses**
  - **Flow Losses (GDP)**
    - Direct damage & disruption to productive assets, inventories, infrastructure and markets
    - Disrupted labour supply
      - Death, illness, injury
      - Infrastructure disruption
    - Supply chain disruptions
    - Reduced consumer demand
      - Confidence
      - Loss of income
  - **Secondary Effects**
    - Lost jobs leading to lower consumer demand
    - Lost tax revenues and emergency budgets leading to lower public demand
    - Major planned investments delayed or cancelled
    - Consecutive natural disasters may cause uncertainty that discourages potential investors
    - International spill overs
Pandora Economic Spillover Model

- Footprints of threat scenarios are used to quantify international and domestic spillover.
- The global bilateral trade data is used to estimate Pandora cities trade network.
- The reconstructed network is a complete city to city trade flow representation.

Cambridge Risk Index City Connectivity
Source: United Nations Comtrade Database, CRS Analyses
Global EP Curve – Accounting for the ‘Rest’

Rest-of-country: Direct impact on non-Pandora cities

Economic spillover

Return Period

Impact ($trn)

Finance, Economics & Trade
Geopolitics & Security
Natural Catastrophe & Climate
Health & Humanity
Technology & Space

TOTAL IMPACT
Cambridge Risk Index 2018

- We provide an objective, quantified index of risk for threats

- The index provides useful relativities between
  - Locations: “Where might my business operations suffer disruptions?”
  - Threats: “What should I be most concerned to protect against?”
  - Timelines: “How might my business plan be impacted?”

- Threat model updates
  - Probability assessments
  - City economic characteristics
  - City resilience assessment

- Methodology Updates
  - Validation of regional result aggregations

- Analytics dashboard

- Launch early 2018