The Anatomy of Cyber Risk

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Overview

- Cyber risk is a growing challenge.
  - Staggering amount of malicious activity on the internet, e.g., 80 billion malicious scans daily!
  - Cybercrime costs the world $\sim$1 trillion, or 1% global GDP (McAfee, 2020).

Open questions:

- Implications for firm value, corporate policies, and firm operations?
- How firms do risk management and implications for cyber insurance markets?
- Whether there is a potential for contagion?

Measurement is a challenge:

- How to quantify risk exposures accurately at the firm level or aggregate level?
- Realized losses: (i) not all exposed firms suffer an attack. (ii) firms may under-report attacks.
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This paper

- Measure **firm-level exposures** to cyber risk using a text-based approach, as in Hassan, Hollader, Lent, and Tahoun (2019).
- Transcribe earnings conference calls and create a training library of cyber risk related keywords, e.g., "cyber attack", "data breach".
- Measure the share of conversation related to cyber risk between management and participants (e.g., analysts).

\[ CyberExposure_{it} = \frac{\text{Total cyber keywords}_{it}}{\text{Total terms}_{it}} \]

(+)
- Over 800,000 calls, highly labor intensive. Lot of effort went into it.
- Extensive coverage: 12,000 firms in 80+ countries over 20 years.
- Lower disclosure biases because of pressure from outsiders vis-a-vis 10Ks.

- Exploit the **CyberExposure** measure for interesting asset pricing tests.
1. Accounting for risk and uncertainty

- Cyber keywords are not counted in conjunction with keywords on risk or uncertainty.

Example 1: "we are heavily guarded against cyber crimes.

Example 2: IT firms who sell cyber risk software.

IT Services account for >40% of all mentions of cyber terms.

Suggestion: use the conditional measure Cyber × Risk that you already created as the main measure.
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2. Accounting for cyber risk management

- Plausible that exposed firms take actions to mitigate cyber risk, e.g. higher expenditure on IT infrastructure or cyber insurance.
- Conditional searches reveal that ”insurance” is often mentioned after cyber keywords.

Examples:
- Least exposed: "we can adequately deal with cyber risk through preventive measures."
- Most exposed: "increasing sophistication of hackers makes defending against cyber attacks difficult, despite investments in preventive systems."

Not trivial to do in a text based measure. Potentially measure tone, longer keyword searches.

* Examples taken from Florackis, Louca, Michaely, and Weber (2020).
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3. Digging deeper into zero exposure

- Absence of a cyber keyword mention does not mean no risk!
  - Typical earnings conference call lasts 35-45 mins.
  - Cyber risk could be overlooked due to more salient risks (e.g., banks).
  - Conference call discussions may only happen after salient cyber events.
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- Understanding and comparing magnitudes:
  - Florackis, Louca, Michaely, and Weber (2020) is an alternative text based measure using 10Ks. [FLMW]

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4. Asset pricing tests

- Is CyberExposure priced?
  - This paper: Yes, consistent with FLMW.
  - Highlight the difference: aggregate factor (this paper) vs. firm specific measure (FLMW). There is a factor structure.
  - Other interesting avenues: what does the common factor relate to, e.g., business cycle, geo-political factors?
  - Questions: How to construct the aggregate factor? How to go from quarterly to monthly? Only US? Do you control for industries, MOM, QMJ...

- Evidence: Returns of unaffected and unexposed firm decline when a peer is attacked.
- Not entirely convincing yet.
- Are unaffected firms indeed unexposed? CyberExposure $\Rightarrow$ no risk, or do we learn about exposures?
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- Is there potential for systemic risk?
  - This paper: Yes (new).
  - Evidence: Returns of unaffected and *unexposed firm* decline when a peer is attacked.
  - Not entirely convincing yet. *Are unaffected firms indeed unexposed?* *CyberExposure* = 0 → no risk, or do we learn about exposures?
Important topic and interesting paper!

Impressive amount of data work.

Focus on sharpening the measure and tightening the asset pricing findings going forward.