Cyber-MAR Final and Piraeus Pilot Event

Presentations Overview

16th December 2022

# Wider Econometric Impacts

Agenda

- Econometric model

- Validation of the model

- Econometric impacts on port and the wider area

Partner – VERISK
Time – 15 minutes
Schedule – 14:30-14:45

Econometric Modelling Framework and Supply Chain Risk

- The Econometric Model (EM) developed for Cyber-MAR is a quantitative risk model that emulates major components of global supply chains (and their uncertainties) to estimate the **economic losses resulting from contingent business interruption** (CBI) (in a downtime of days) **caused by disruptions** to a given supply chain node

- The EM builds on the MaCRA model (UoP) to quantify the indirect economic impact of port disruptions (caused by cyber-attacks) on global supply chains
- EM is peril agnostic
- The (EM) is a significant step forward with respect to traditional qualitative supply chain risk assessment methods. It allows users to "proactively" manage supply chain risks by anticipating interdependencies and correlations in supply chains (and their effect on disruption propagation) before disruptions events occur

- The EM will be used to assess the potential economic impact across different value chains due to various cyber-attack scenarios for the Port of Valencia (Spain) and the Port of Piraeus (Greece)

Econometric Modelling Framework and Supply Chain Risk

Framework of the EM consists of five major modules:

1. Product dependency
2. Network definition
3. Disruption input
4. Disruption propagation
5. Econometric loss estimation
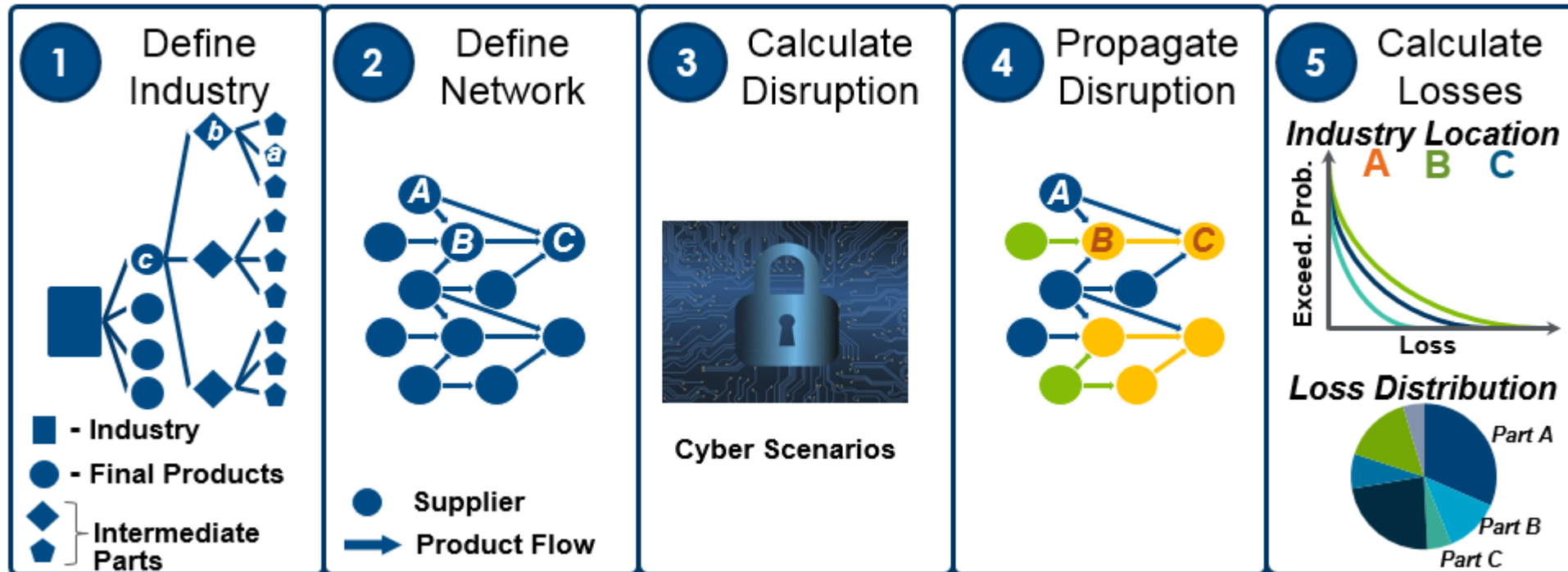
Validation of EM

- Tohoku earthquake and tsunami 2011 (validation completed)
  - Modelled event produces the input disruption (BI)
  - Validation data from Carvalho et al. 2021 and other sources are compared to EM loss results (CBI)
- Thailand floods 2011
- Norsk Hydro cyber-attack 2019 (LockerGoga)

*Validation data for loss results (CBI) is collected from established sources (i.e. news articles, reports, etc.)

Validation: Tohoku Earthquake and Tsunami 2011

- Event is confined to a specific region of a single country (Japan) which has sophisticated manufacturing facilities that produce various goods used globally

- Reliable validation data exists for the 2011 Tohoku event due to detailed reports and case studies
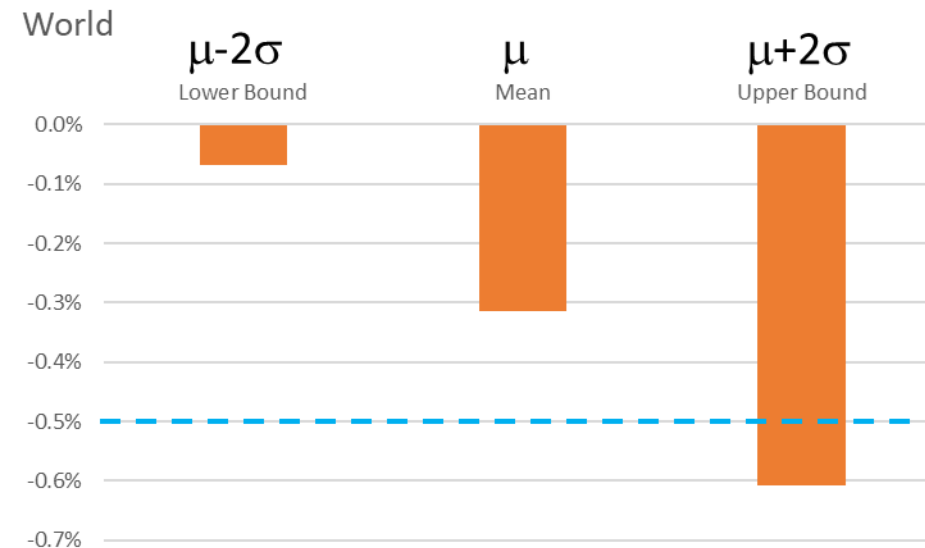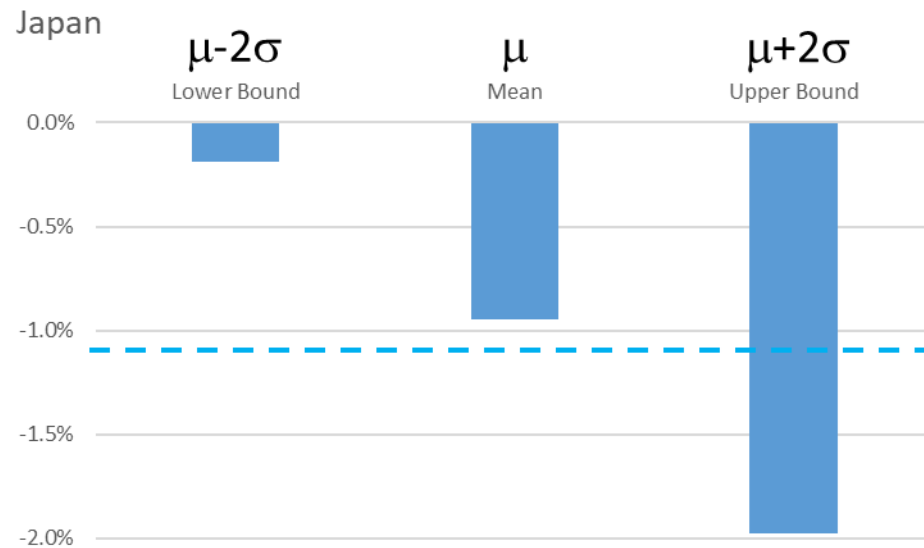

- (left) Comparison of % decrease in trade activity for Japan (blue bars) versus decline in GDP growth rate (light blue dashed line) from Carvalho et al. (2021)

- (right) Comparison of % decrease in trade activity for the World (orange bars) versus decline in GDP growth rate (light blue dashed line) from CRS (2011)
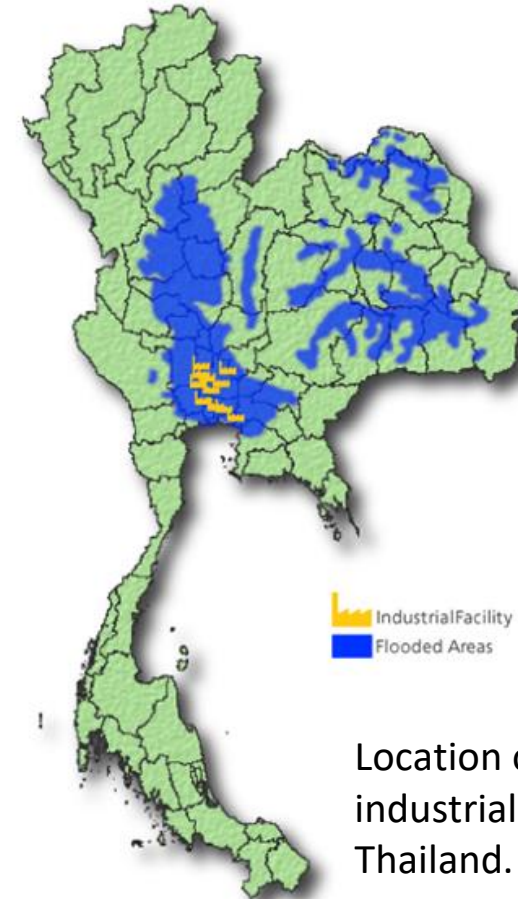
Validation: Thailand Flood 2011

Industry	Average Downtime (days)
Computers & Electronics	47
Automotive & Components	90
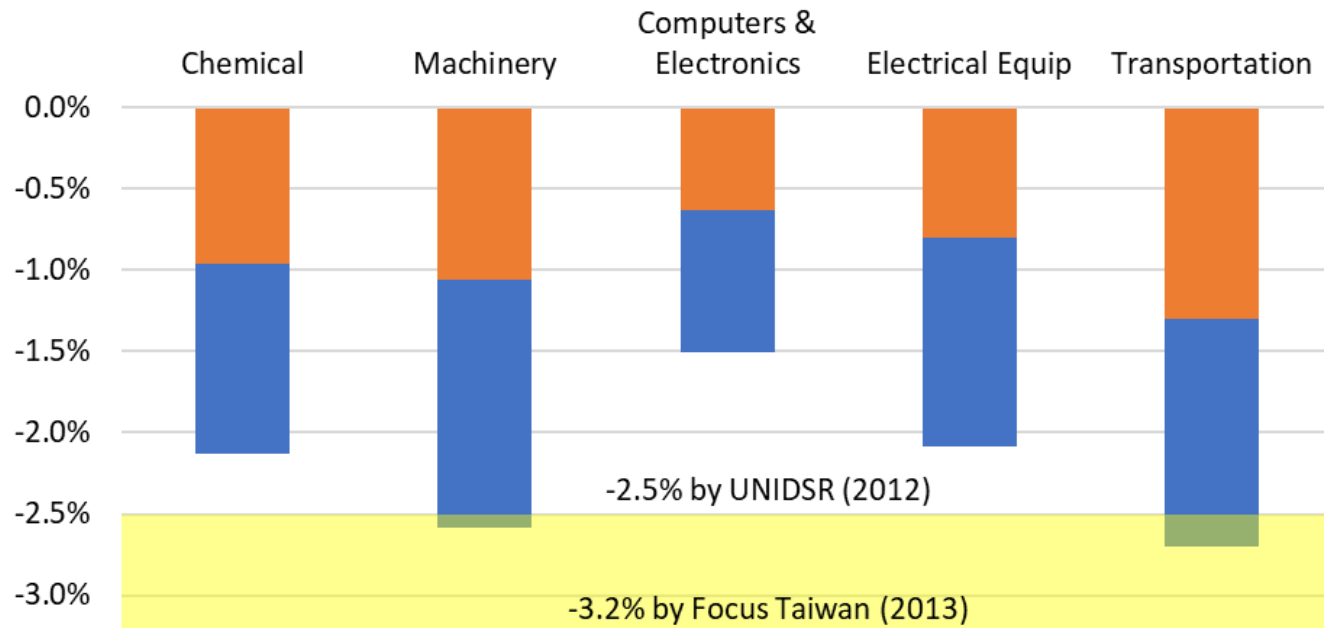
Comparisn of EM mean and upper bound losses to loss estimates by UNISDR (2012) and Focus Taiwan (2013)

Location of major industrial facilities in Thailand. (Source: Verisk)

Limitations

- It has been very challenging to obtain data from the Port of Valencia and especially PCT (Piraeus) for application and validation of the EM results. Limited data is forth coming from official sources.

- A request for information from the Port of Valencia gave the following from the port (M. De Juan Muñoyerro, personal communication, November 26, 2020):
    - A table of port closures from 2015 to 2020 due to disruptions. A summary table is shown in Table 13. The duration of port closure in Table 13 correspond to the MaCRA model outputs of downtime into the EM.
    - "We do not know the exact number of manufacturing companies that use the port of Valencia, for each company there may be total export/import data, without taking into account the port of entry or exit. In addition, the number of companies that use the port of Valencia is considerable, company and shipment details are confidential, and we do not have access to them either. Consequently, having this data is impossible in the framework of the project."
    - General figures from a statistical report released in December 2019.

- A request for information from the Port of Piraeus gave the following statements from the port (M. Kotras, personal communication, September 7, 2021):
    - Port of Piraeus communicated that they are not collecting the annual value of import nor export trade and have no information either monthly or yearly.
    - Port of Piraeus gave a description of product types for the scenarios. (Table 5. Commodities descriptions from the Port of Piraeus).
    - Port of Piraeus stated that they had "not had shutdowns due to cyber-attacks nor disruptions due to natural catastrophe, while machine failures do not cause shutdowns of the port due to the general availability of port equipment."

- Validation events were chosen that did not use data from the Port of Valencia or the Port of Piraeus. This validation methodology "by proxy" was adopted because we did not have access to port specific information for running validation scenarios.
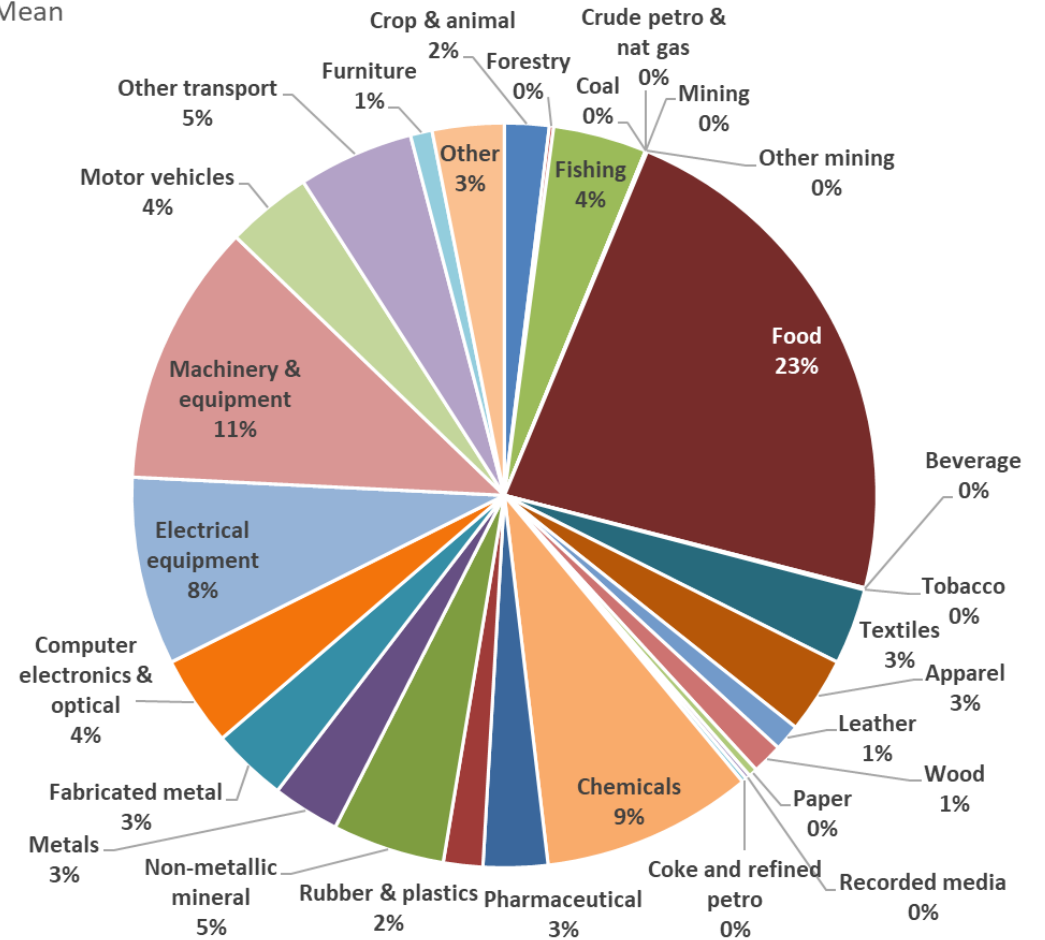
Mean EM output by EU countries
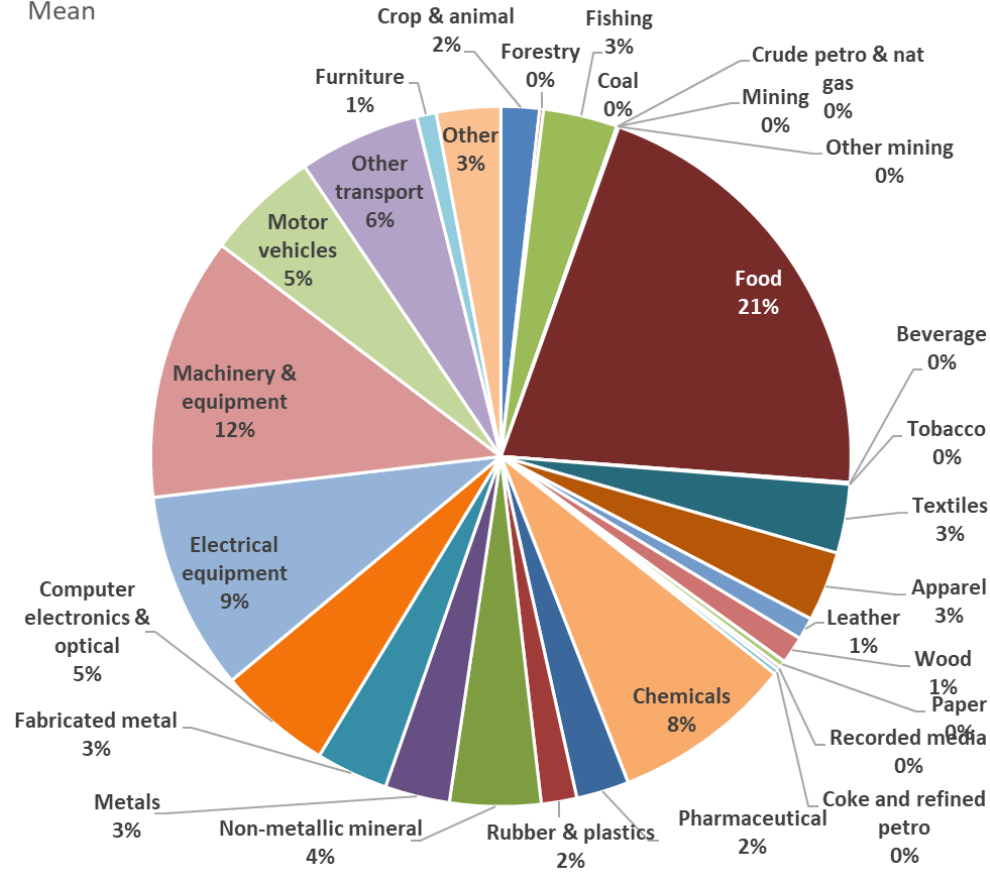
Port of Valencia: Downtime of 5 days.

Port of Piraeus: Downtime of 5 days.

Mean EM outputs by NACE

Port of Valencia: Downtime of 5 days.

Port of Piraeus: Downtime of 5 days.

Conclusion

- Although it was very challenging to obtain data from the port authorities for application and validation of the EM results, alternative validation events were used and sourced from publicly available data for the valuation process. Validation of the EM is demonstrated with three catastrophes: the 2011 Tohoku earthquake and tsunami, the 2011 Thailand floods, and the 2019 Norsk Hydro ransomware attack with LockerGoga.

- Loss results from the EM analyses demonstrate reasonable outcomes of CBI which have been quantified using publicly available information.

- The EM does not exhibit bias for the analysis of large or small disruptions, regional or global disruptions, nor does the type of peril affect the quantification of the loss outcome.

- EM is applicable for analysing natural and/or man-made catastrophes and can quantify CBI losses caused by cyber-attacks to Port of Valencia or Port of Piraeus.

- EM framework is ideally suited for analysing cyber-attack catastrophes and can quantify CBI losses caused by scenario cyber-attacks on Port of Valencia or Port of Piraeus.

- EM loss results can assist to further the understanding of indirect disruptions in the maritime value chain with respect to industries (i.e. Automotive, Consumer Electronics) and add to the state of the art for insurance markets.

- Organizations or government entities may wish to improve their mitigation measures against cyber-attack by studying Cyber-MAR and EM loss results and increasing their resiliency

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