

# A network approach to critical functions assessment using financial market infrastructures data

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**These views are my own and do not necessarily reflect those of the Single Resolution Board**

# Motivation

- Efficient financial intermediation can be a positive contributor to economic growth but financial crises can have severe consequences.
- The post-GFC crisis brought about a major regulatory overhaul aiming not only at mitigating the systemic risk posed by banks while they operate but also in minimizing the impact of their failures via effective resolution measures.
- These resolution measures aim to achieve different objectives, including the continuity of critical functions performed by banks with the ultimate goal of avoiding severe disruptions to the real economy.

# Institutional context

- In the EU, resolution action must be taken only where it is in the public interest and only when winding up of the bank under normal insolvency proceedings would not meet to the same extent certain resolution objectives (e.g. continuity of critical functions).
- Resolution authorities review banks' self-assessment of critical functions included in their recovery plans, which then informs resolution plans. This process consists in a two-step approach:
  1. "bottom-up" view provided by the banks' assessments;
  2. "top-down" view whereby resolution authorities challenge the "bottom-up" assessments.

# Contribution

- The contribution comprises a set of top-down indicators for the impact of the disruptions brought about the inability of the failed bank to continue performing a given function and for the substitutability of the failed bank by others.
- Pros and Cons:
  - Pros:
    - Provide a more granular view, allowing for a better understanding of potential consequences of the disruption;
    - The system-wide view allows to go beyond what each individual agent can observe;
    - Facilitates criticality assessment under system-wide crises;
    - Can accommodate different policy-loss functions.
  - Cons:
    - Partial view;
    - Evolving data quality.

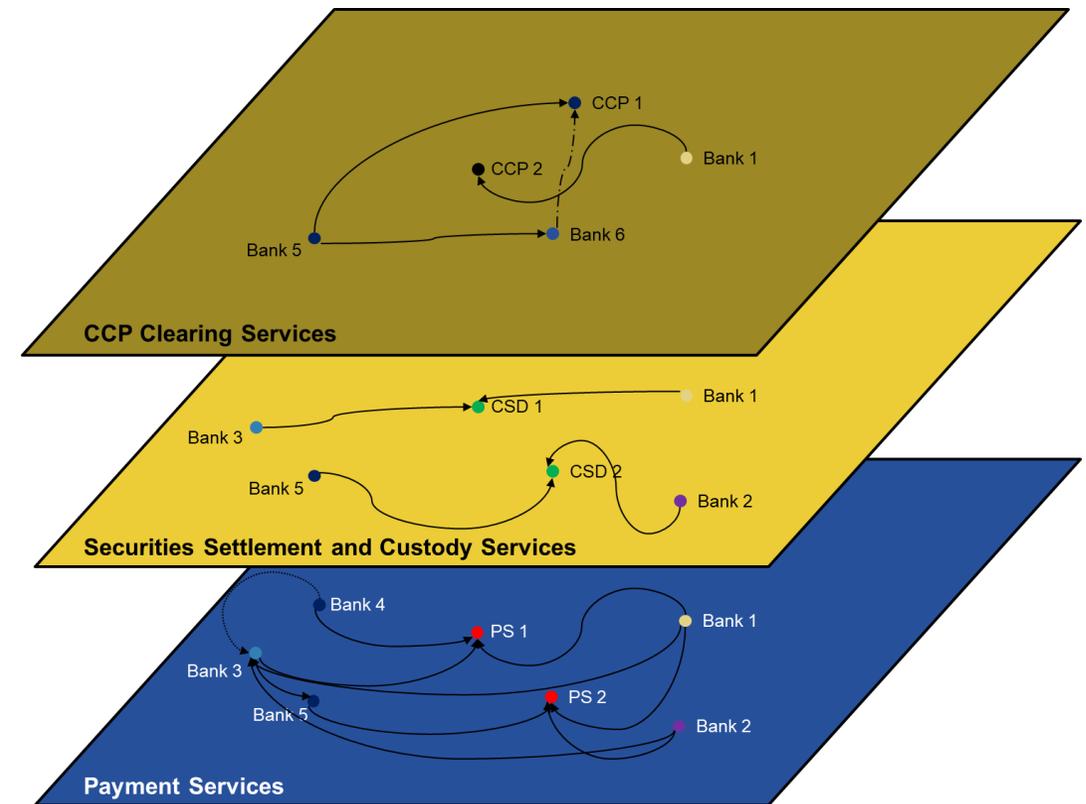
# Literature

- Financial intermediation and economic growth:
  - Beck, Levine, and Loayza (2000);
  - Şendeniz-Yüncü, Akdeniz and Aydoğan (2018);
  - Zhang et al. (2019).
- Systemic risk and FMIs:
  - Soramaki and Cook (2013);
  - Craig, Salakhova and Saldias (2018);
  - Li and Perez-Saiz (2018);
  - Heijmans and Wendt (2020).
- FMIs in a multilayered networks' context:
  - Leon and Perez (2014);
  - Bardoscia, Bianconi and Ferrara (2019)

# Methodological approach

1. Build a system-wide view of FMI access.
2. Based on this view define indicators for impact and substitutability.
3. Map these indicators to a criticality spectrum, via a policy loss function.

*Simplified illustration of the multi-layered network of FMI access*



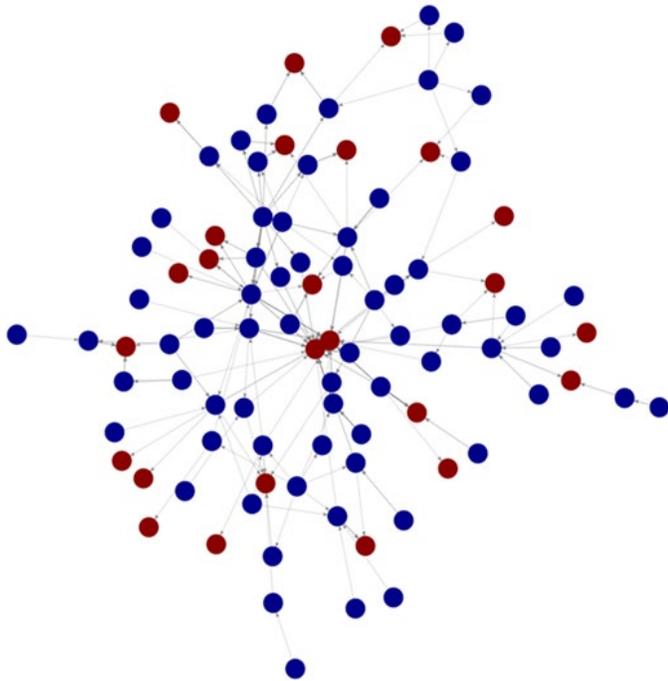
Source: author's depiction.

# Build a system-wide view of FMI access

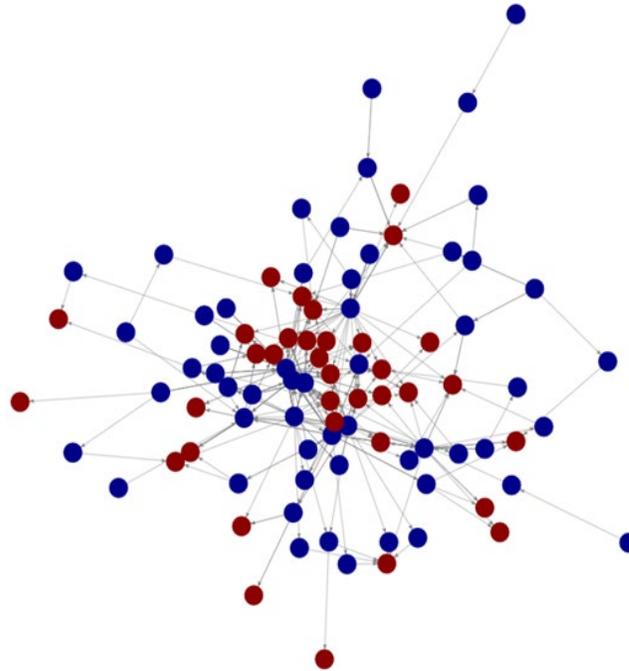
- Data:
  - Sourced from the dataset collected under the Single Resolution Board's Financial Market Infrastructure (FMI) report with reference date 31 December 2019.
  - The report is meant to provide a detailed view of banks' participation in FMIs for resolution planning and execution purposes.
  - Institutions report all direct and indirect participation in payment, clearing and settlement systems, central securities depositories, trading venues as well as trade repositories.
  - It includes thorough information on the institutions' participation in FMIs, such as the number of clients, value of positions/transactions and critical functions performed related to the engagement with a given FMI.
  - The use of intermediaries (such as cash correspondents, custodian or agent banks) is also reported.

# Build a system-wide view of FMI access (cont.)

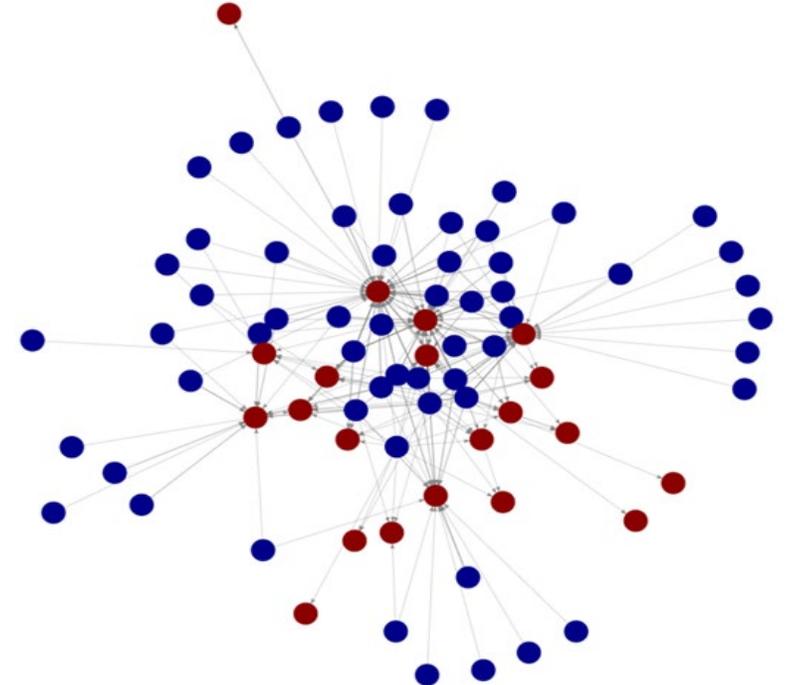
*Payment System layer*



*(I)CSD and SSS layer*



*CCP (derivatives and securities) layer*



**Source:** FMIR and author's calculations.  
**Note:** FMIs displayed in red and banks in blue.

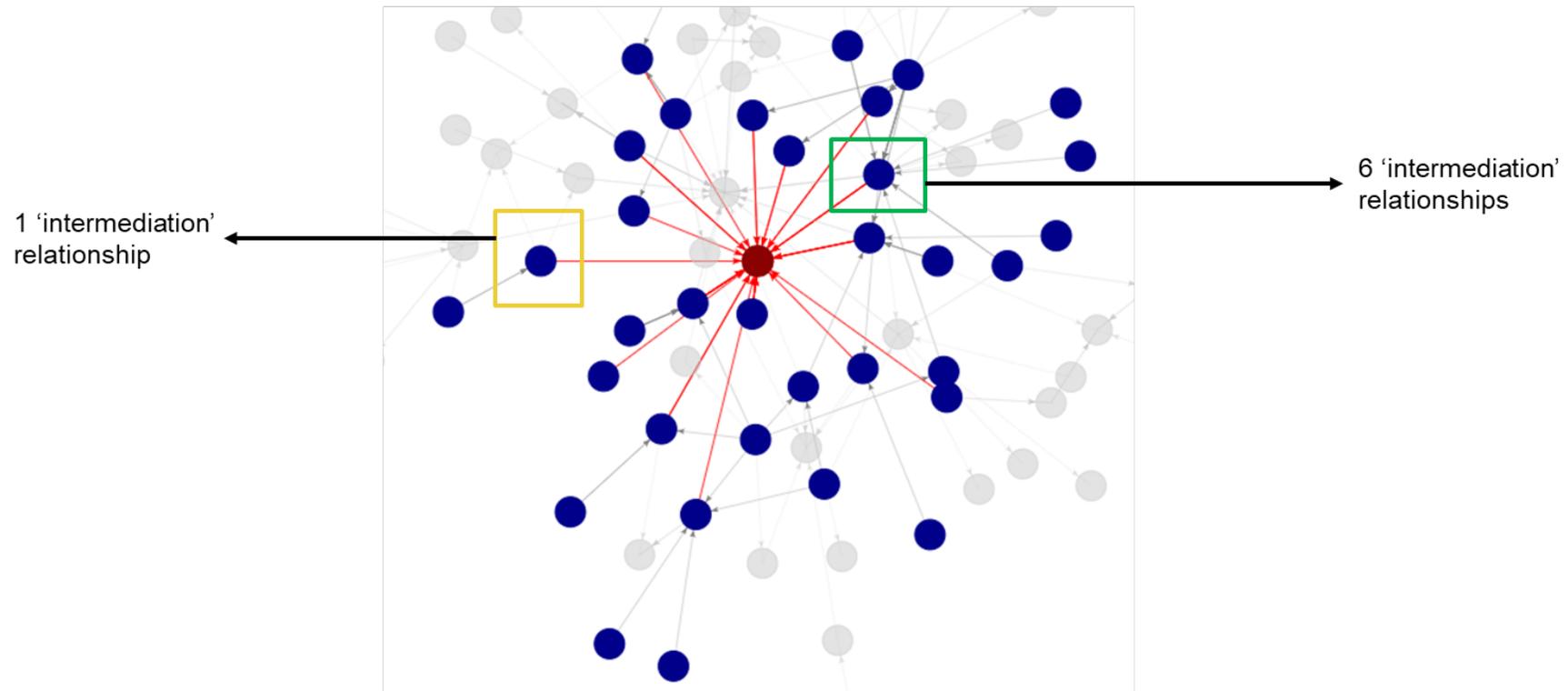
# Define indicators for impact and substitutability

## Impact

**IMP\_01** (in-degree – unweighted): number of clients (either based solely on FMIR data fields or based on multilayer network)

**IMP\_02** (in-degree – weighted): value/transactions (either based solely on FMIR data fields or based on multilayer network)

**IMP\_03**: number of third parties' critical functions disrupted by the failure of the intermediary

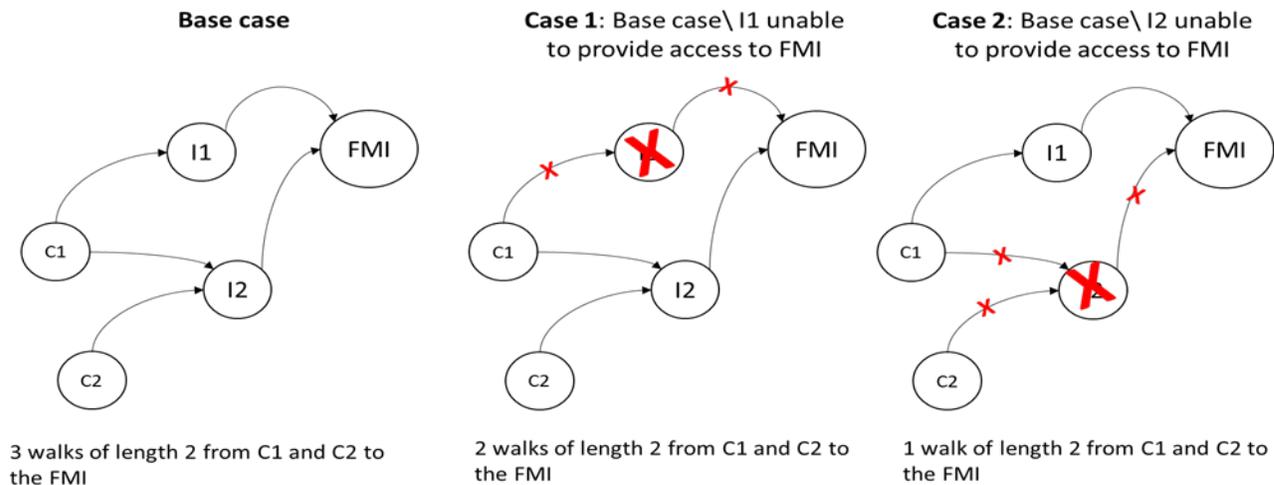


# Define indicators for impact and substitutability (cont.)

## Substitutability

**SUB\_01:** number of intermediaries with the same country of incorporation and that are connected to the same FMIs as the intermediary

**SUB\_02:** a more complex indicator based on existing relationships between the clients of a given intermediary and other intermediaries connected to the same FMIs as the intermediary – see below



# Define indicators for impact and substitutability (cont.)

Direct Participation Mode		
Layer	Pair	Spearman's Correlation Coefficient
PS	IMP01_IMP02	0.254
(I)CSD+SSS	IMP01_IMP02	0.823
CCP	IMP01_IMP02	0.780
TV	IMP01_IMP02	0.404

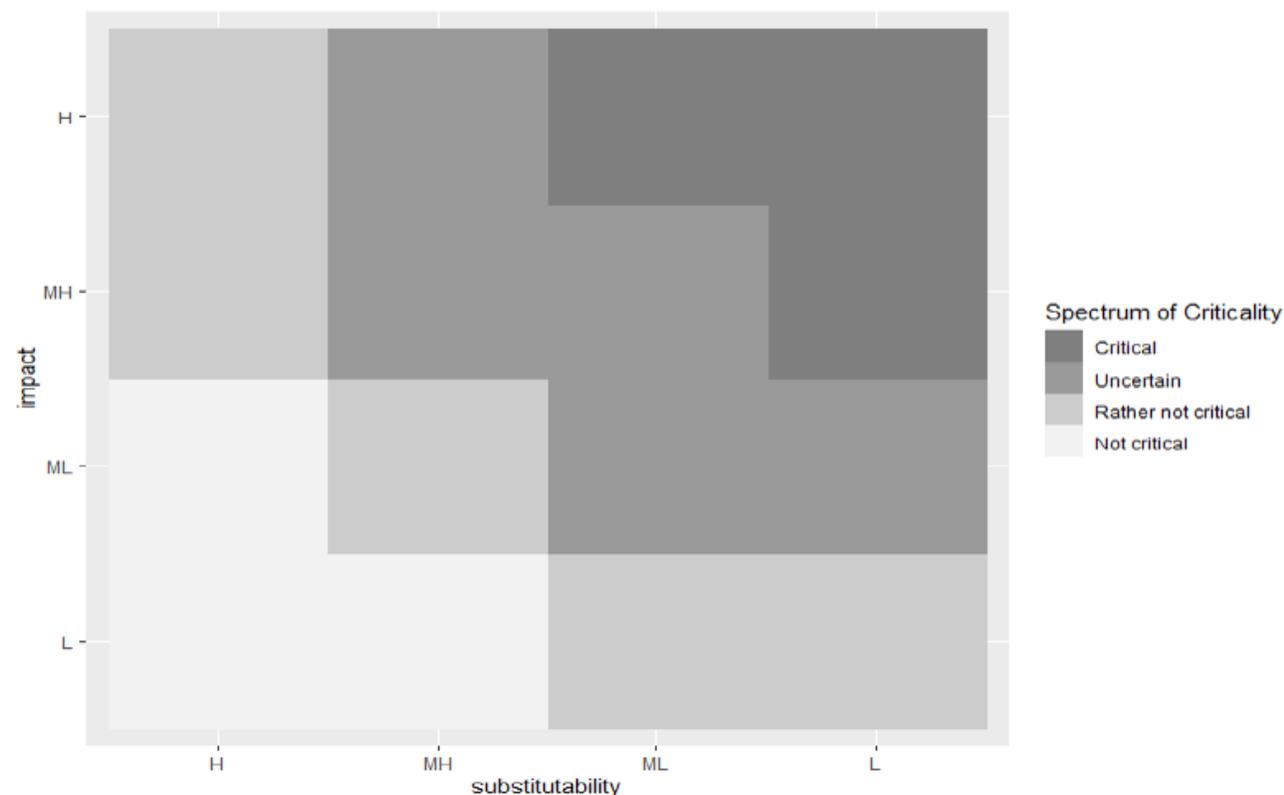
Indirect Participation Mode		
Layer	Pair	Spearman's Correlation Coefficient
PS	IMP01_IMP02	0.496
	IMP01_IMP03	0.659
	IMP02_IMP03	0.088
	SUB01_SUB02	0.085
(I)CSD+SSS	IMP01_IMP02	0.543
	IMP01_IMP03	0.834
	IMP02_IMP03	0.608
	SUB01_SUB02	0.141
CCP	IMP01_IMP02	0.596
	IMP01_IMP03	0.710
	IMP02_IMP03	0.466
	SUB01_SUB02	0.171
TV	IMP01_IMP02	-0.153
	IMP01_IMP03	0.165
	IMP02_IMP03	0.697
	SUB01_SUB02	0.762

- Overall, the results suggest that simply taking the number of intermediaries in the same country provides a substantially different picture of substitutability than that delivered by leveraging on the existing relationships than can be observed from a top-down perspective.

# Map indicators to criticality spectrum

- Criticality is not a binary concept (FSB 2013\*), thus the indicators developed above need to be mapped into the spectrum of criticality.
- Moreover, criticality is inherently a policy assessment and thus no criterion can be deemed objectively 'correct'.

*Illustrative spectrum of criticality*

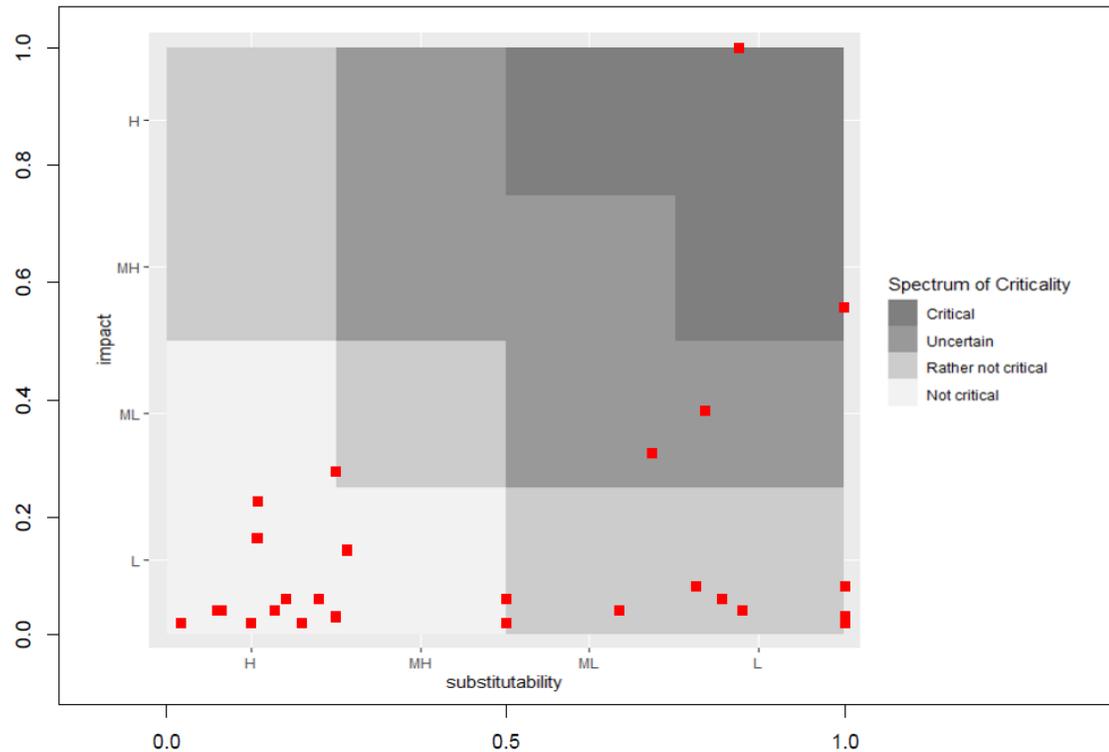


\* FSB – Financial Stability Board, 2013. Guidance on Identification of Critical Functions and Critical Shared Services.

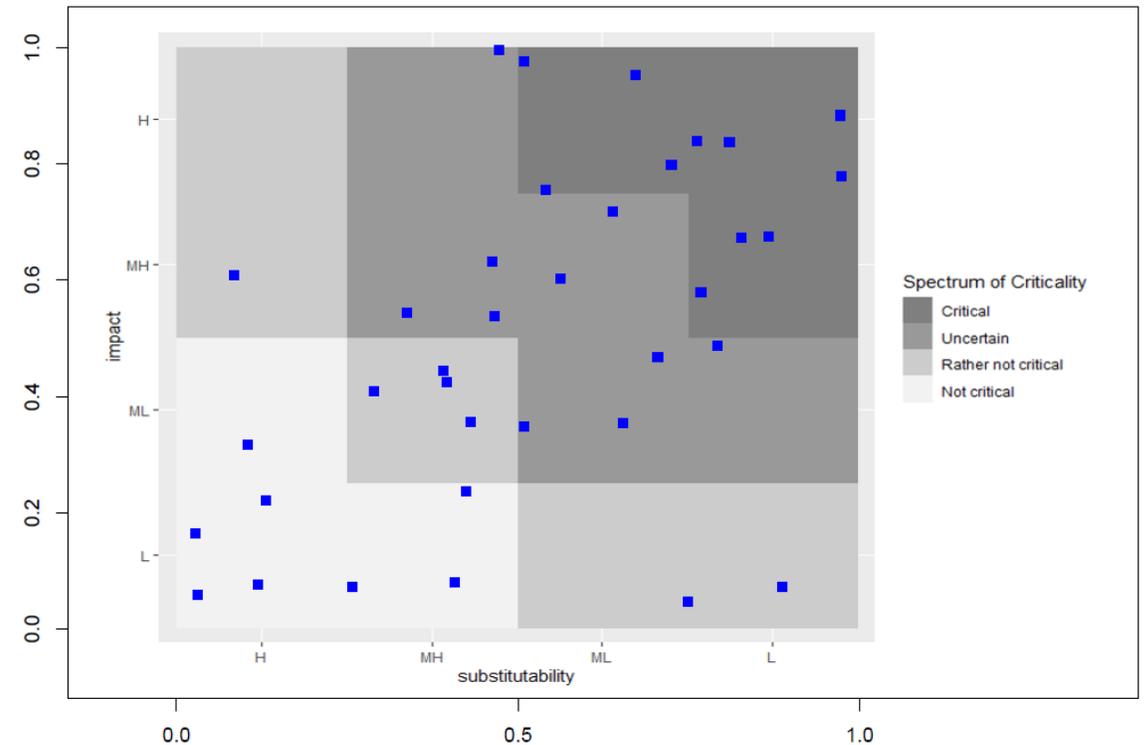
# Map indicators to criticality spectrum (cont.)

## Criticality analysis – (I)CSD and SSS – IMP\_01 and SUB\_02

Mapping based on indicator values only



Mapping based on quartiles of indicator distributions



Source: FMIR and author's calculations.

# Summary

- A top-down approach to criticality assessment leveraging on the FMIR:
  - Provides a more granular view, allowing for a better understanding of potential consequences of disruption;
  - Its system-wide view allows to go beyond what each individual agent can observe;
  - Allows criticality assessment under system-wide crises;
  - Can accommodate different policy-loss functions.
- Importantly:
  - The top-down approach illustrated here can be applied to other granular data sets collected for other supervisory purposes.
  - If these have higher frequency, their use in resolution cases could become invaluable as the FMIR data can become stale.

# References

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