Interconnectedness

2025 RiskLab/BoF/ESRB Conference on AI and Systemic Risk Analytics

Iman van Lelyveld

DNB, VU Amsterdam, EUI

DeNederlandscheBank
EUROSYSTEEM

DataScience Hub

DNB Data Science Hub

The DSH is the bank-wide place for advice, guidance and implementation of data science projects

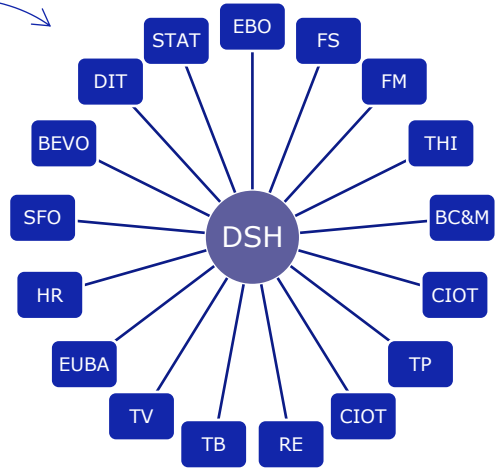
Characteristics

Together: innovative data science and machine learning projects with active participation of business

Efficient: DSH focuses on the core of the project in order to develop quickly and flexibly

Quality: more than meets Way of Working (WoW)

Successful: customers are satisfied



Out of scope

DNB has specialist teams for topics such as RPA/Power Automate, Power BI, maintenance, BizDevOps.

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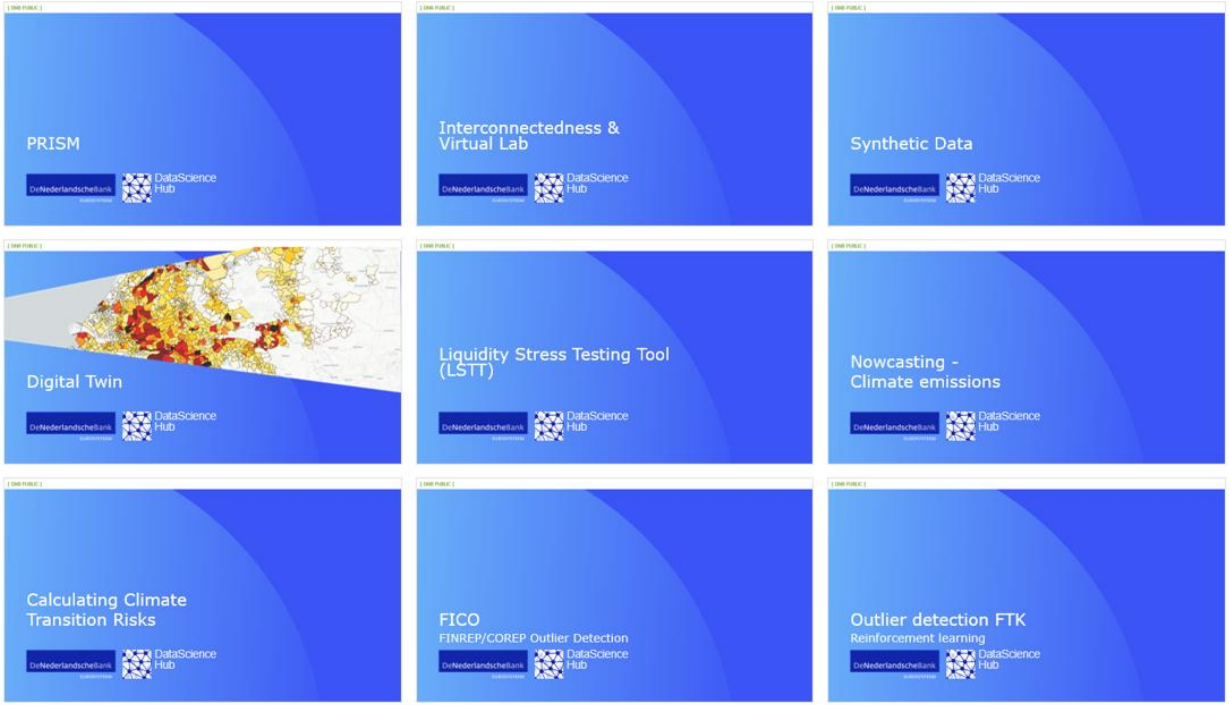
Selected projects



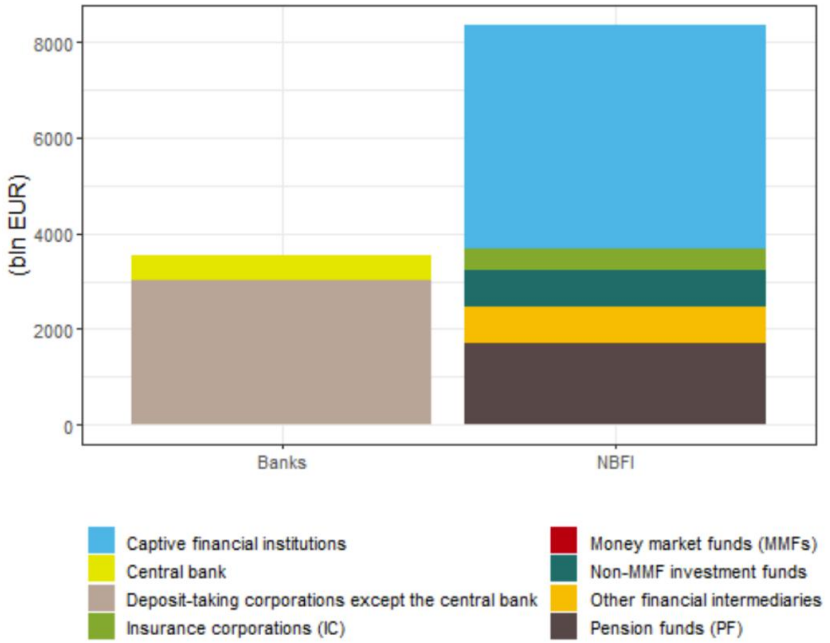
Link: various Annual Reports on DNB website

Why we are interested in NBFIs

With **total assets of EUR 8,346 billion** in the Netherlands (2023 Q1), the size of the 'broad' NBFI sector is more than double the size of the total assets of the banks

Strong demand from the FSB and more recently the **IMF** for greater inclusion of the impact of NBFIs on financial stability (FSAP 2024)

Figure 1: Total assets of the financial sector for 2023 Q1 (in EUR billion)



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Project Summary

Goal

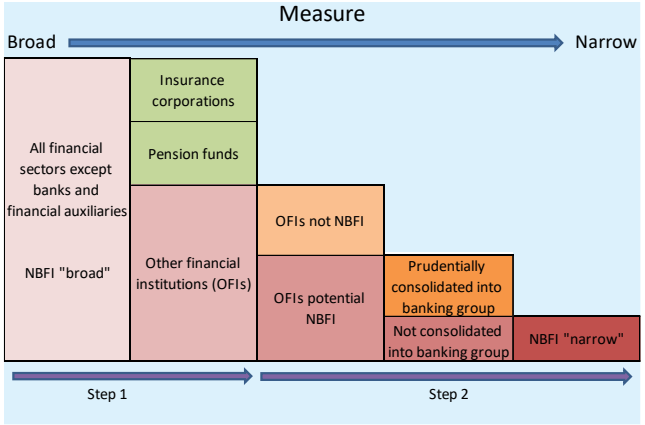
Improve the understanding of how **shadow banks** (NBFIs) are **interconnected** with the Dutch banking sector.

- Looking further than the traditional single data source analysis
- Connecting granular datasets together
  - loan data
  - derivatives
  - money market instruments
  - securities holding & transactions

Granular datasets

In the granular datasets an institution reports their assets on the level of a single transaction or asset

NBFI definitions



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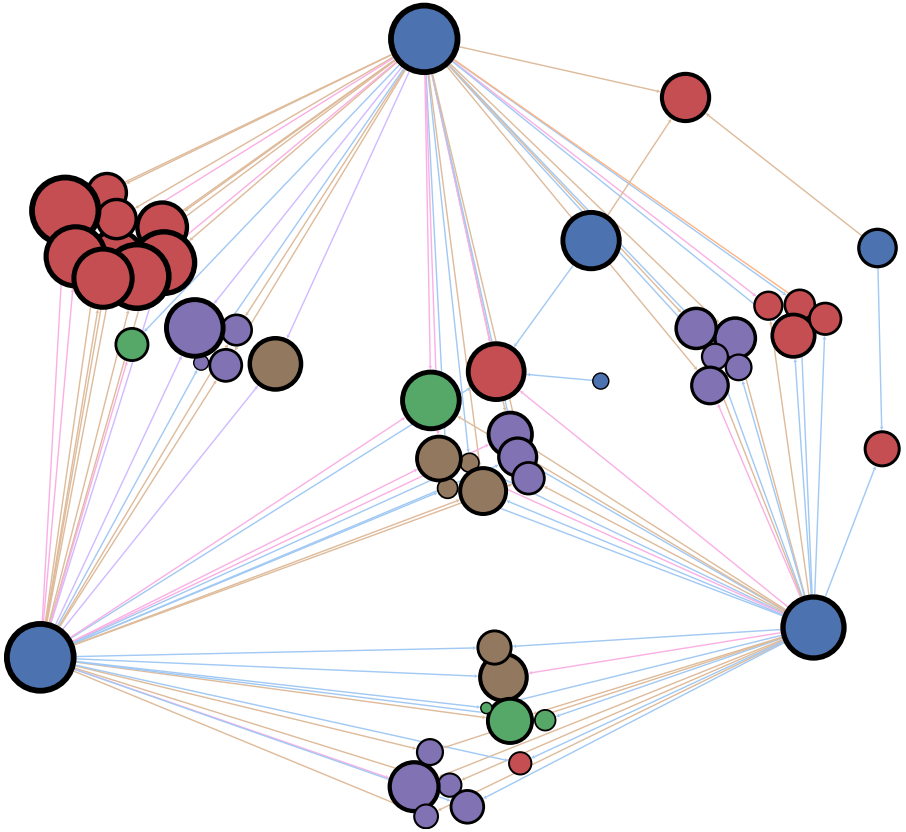
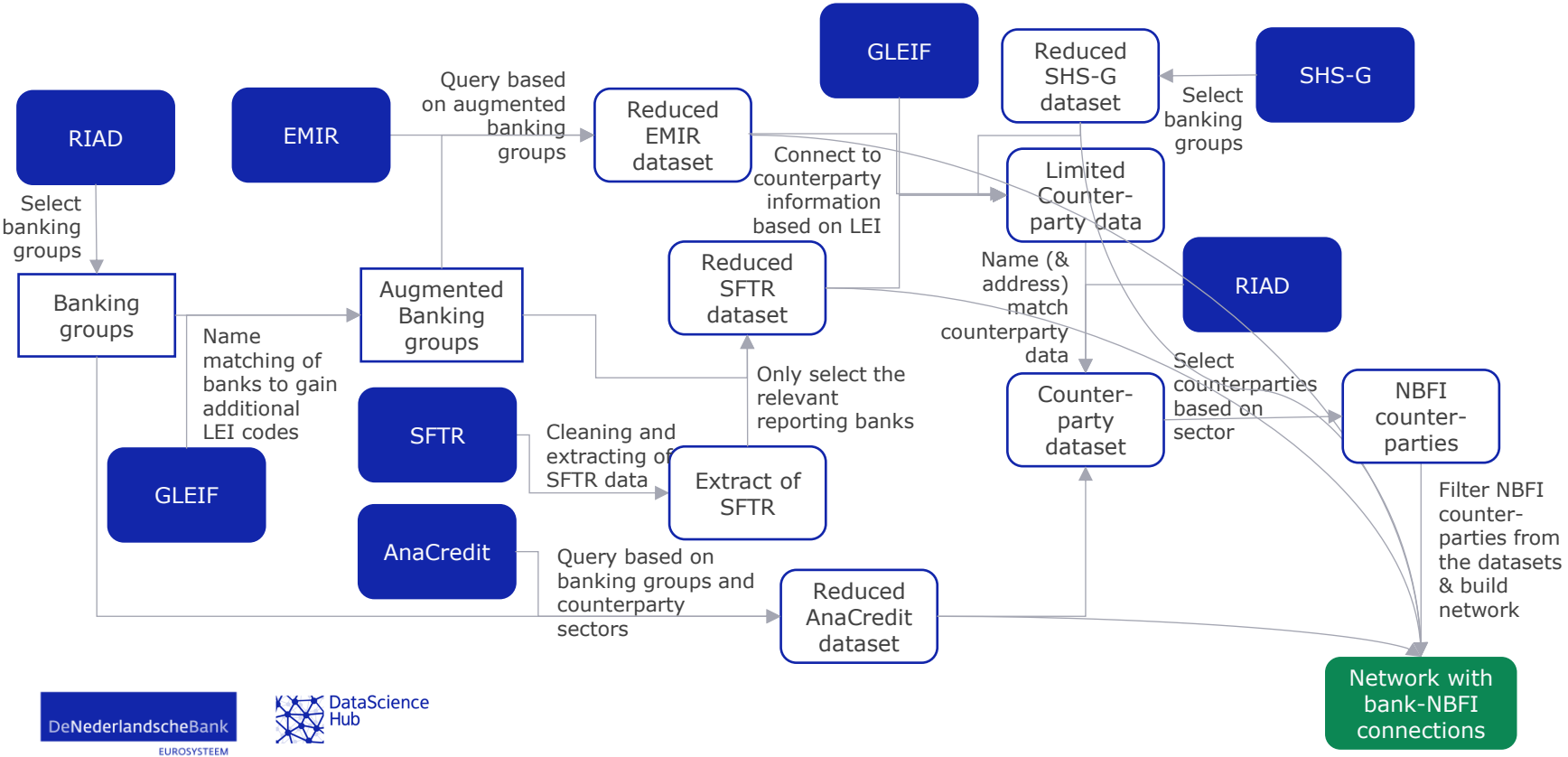
Application: Network Analysis

- Outlier identification
- Consistent aggregates
- Monitoring the systemic nature of issuers trough overlapping portfolios



Most common sectors:
S125 – Other financial intermediaries, except insurance corporations and pension funds
S126 – Financial auxiliaries
S127 – Captive financial institutions

Connecting the data



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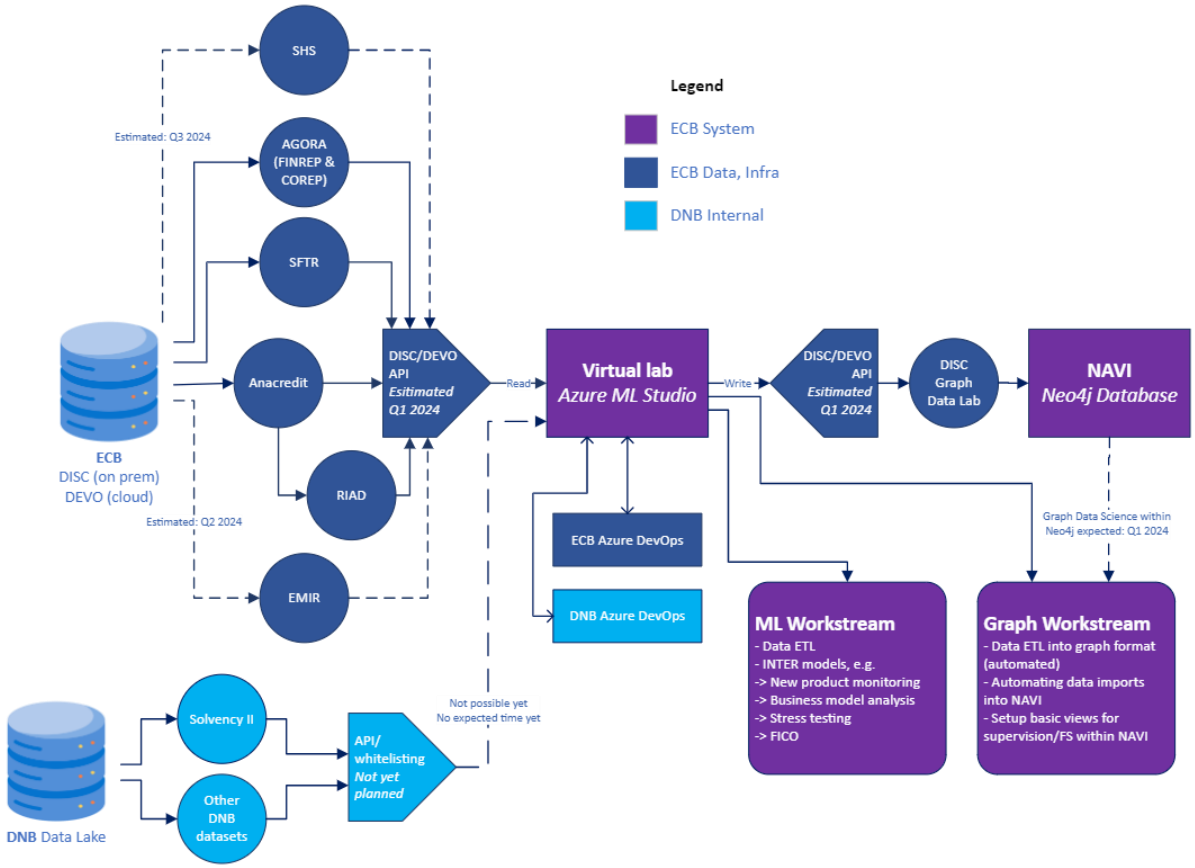
We use ECB scalable compute environments: Virtual Lab & NAVI

Next steps:
Broadening scope outside Bank - NBFI



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Depending on the definition, NBFIs matter or not

To determine if a counterparty is an NBFI, the RIAD dataset is used, as this dataset contains the most exhaustive counterparty information.

Broad	Intermediate	Narrow
The broad definition consist of all financial corporations expect for deposit taking corporations and central banks. This is inline with the broad definition of the FSB and relates to institutional sector codes S123-S129	All the institutions of the broad definition expect for the insurers and pension funds. This relates to institutional sector codes S123-S127. The Orbis database is used to double check for banks, insurers and pension funds.	The narrow definition consist of the following subgroups: - Money market funds (S123) - Open ended investment funds (S124B) - Financial Vehicle Corporations (S125A) - Security and derivative dealers (S125B) - Financial corporations engaged in lending (S125C)

RIAD NBFI	171.168	168.126	5.889
Within same postal code as a GLEIF counterparty	136.187	133.410	5.729
With a lei code	55.481	53.184	3.481
Name matched with high confidence	3.480	3.437	455
Possible counterparties	58.961	56.621	3.936

Number of companies for each of the definitions

Difficulties

Selecting NBFIs

No clear NBFI definition, data features are broad categories.

IT systems

Datasets are not in a single place. This makes it more difficult to combine the data.

It can only be connected on a small scale (e.g. a single day, limited set of counterparties).

Consolidating entities

Selecting the same banking groups in the datasets can be challenging.

Consolidating counterparties, e.g. with GLEIF relations is also imperfect.

Matching counterparties: name matching

RIAD based on EU bank loans, contains many small firms with a focus on EU firms contains 7.3 mln counterparties

GLEIF based on financial trading regulations contains larger firms with worldwide coverage contains 2.3 mln counterparties

	EMIR	SHS	SFTR	AnaCredit
LEI Code	100%	94.30%	100%	20.20%
RIAD Code	0%	0%	50.80%	100%

GitHub - DeNederlandscheBank/name_matching

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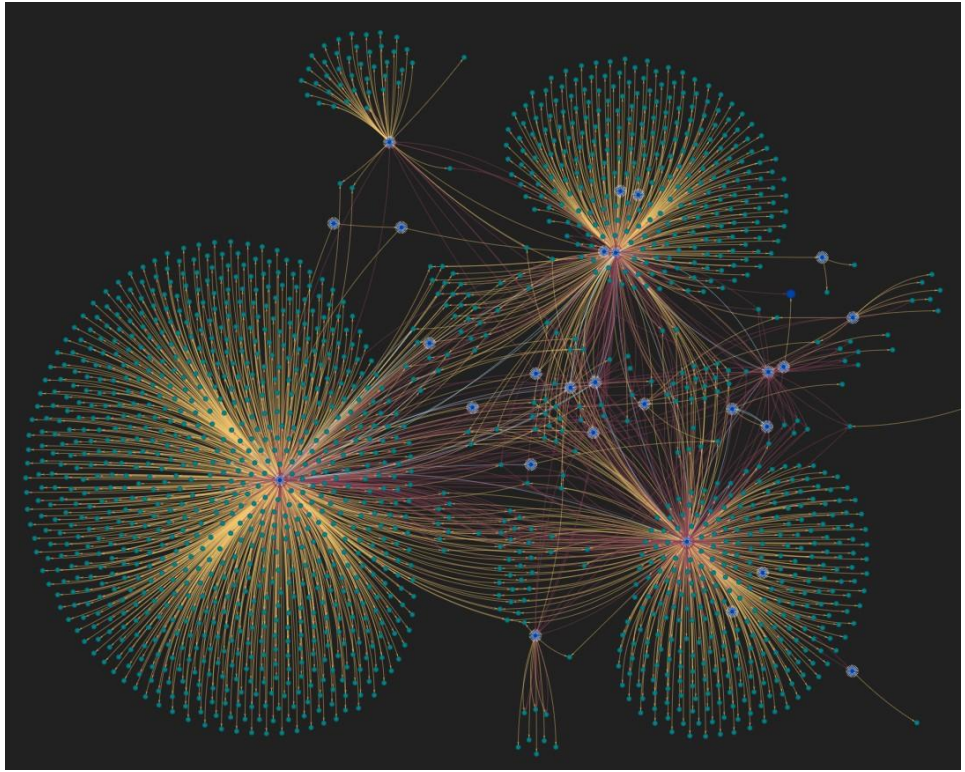
NAVI allows for easy drill-down for adhoc analysis



No free lunch …

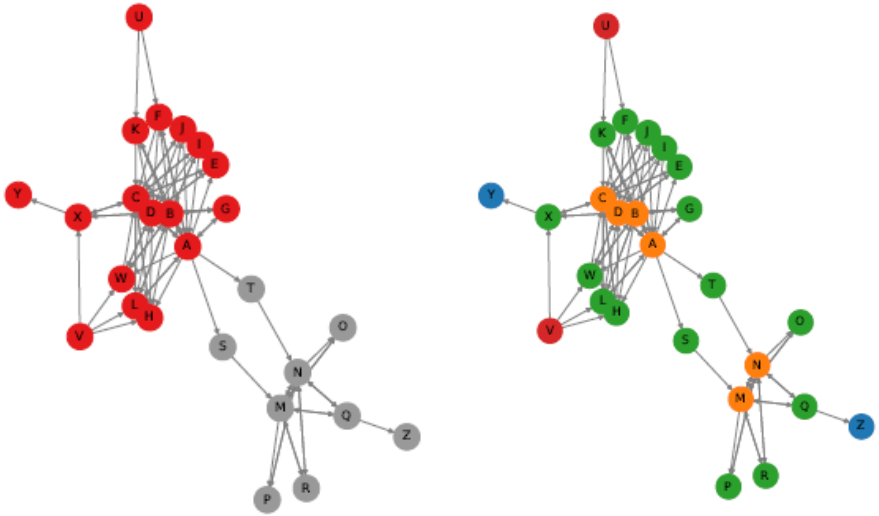
So, how about AI? – the bright side

- AI support for supervisors in digesting information.
  - **Digesting text**; Search, summarize, or gather sentiment from e.g. reports and socials
  - **Dimension reduction in unlabelled numerical information**: finding the 'normal' allows for outlierdetection for identifying noteworthy developments. At first mostly to catch data quality issues,but over time hopefully more useful
  - **EWS in labelled data**: Studies have shown that financial distress and failure of banks can bepredicted using ML methods on the firms' financial information (Carmona, Climent, and Mompar-ler (2019); Gogas, Papadimitriou, and Agrapetidou (2018); Suss and Treitel (2019)). It can alsobe useful in finding illicit behaviour (e.g., "spoofing" or VAT fraud)
  - **Making sense of the network**: as Jackson and Pernoud (2024) show, relative network position of a failing bank is important in ELA/resolution decisions. AI can be useful in dimension reduction of the massive granular multi-layer transaction data we have available.

For actionable insigths, we need better measures

- Rich literature on network contagion

- Less so for papers on the *roles* performed by various players
- "Substitutability" is e.g. important in determining G-SIB status but measured rather coarsely
- In Franssen *et. al* we propose a measure of the role – also in multiple markets



Source: A Practical Guide to Interpretable Role-Based Clustering in Multi-Layer Financial Networks, Christian Franssen, Iman van Lelyveld, and Bernd Heidergott, Working Paper

New measure allows for richer understanding of importance

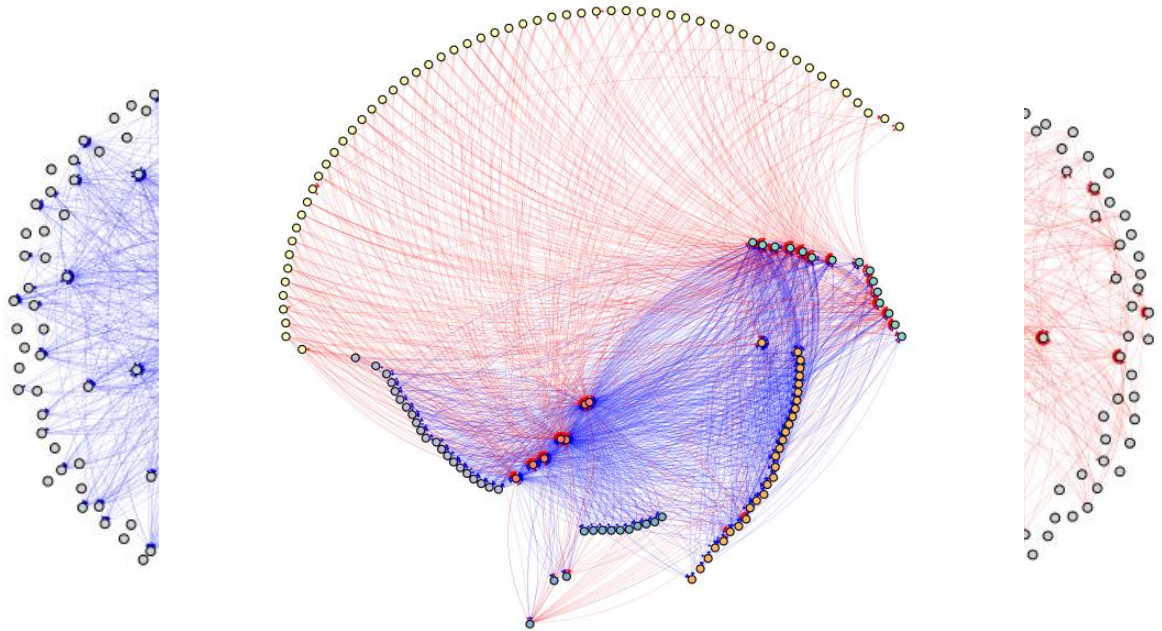


Fig 3. MMSR **Fig 7.** Optimal role-based clustering for the network in Figure 3. Outgoing edges have a counter-clockwise curve.

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AI – the dark side

- Costly to train (energy and RLHF)
- Scale economies imply
    - Serious market concentration issues
    - Geopolitical concerns
- Amplyfing existing biases
- Financial stability (cf Danielsson and Uthemann (2024))
    - Malicious or Misaligned AI Behavior
    - Wrong-Way Risk
    - Synchronization and Monoculture
    - Speed and Crisis Amplification

Interested? Questions?

Mail us at data_science@dnb.nl