Coursework and financial network examples

LEARNING OUTCOMES

To learn about how I want you to do the coursework so you don’t get disappointed

Real-world applications of network science in finance

ACADEMIC MISCONDUCT

Please remember the good scholarly practice requirements of the University regarding work for credit. You can find guidance at the School page

https://web.inf.ed.ac.uk/infweb/admin/policies/academic-misconduct

This also has links to the relevant University pages.

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READ THIS VERY WELL!!!

https://web.inf.e[illegible]mic-misconduct

This also has links to the relevant University pages.

SUBMISSION

-All the analysis **must** be done in Python.
-You **must** submit all your code in a single zip file (even if it is just a single python file, it must be zipped).
-You also **must** submit a pdf in which you report the results and discuss them.

Example:
S123456789.zip
S123456789.pdf

HOW IT WORKS

Your boss/manager/customers will **not tell you what to do**, step by step

You need to learn how to become **independent** in the analysis of networks

You will be able to stay up to date and provide useful insights only if you **know what you are doing**

USEFUL TIPS (from myself)

Cheating (including copying) is **easy to spot**.
Analysis done with **chatGPT** is easy to spot too.

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Try to have **fun**.

USEFUL TIPS (from past students)

Start as early as possible.

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Use critical thinking.

USEFUL TIPS (from past students)

Start as early as possible.

Use critical thinking.

No, seriously. Start as early as possible.

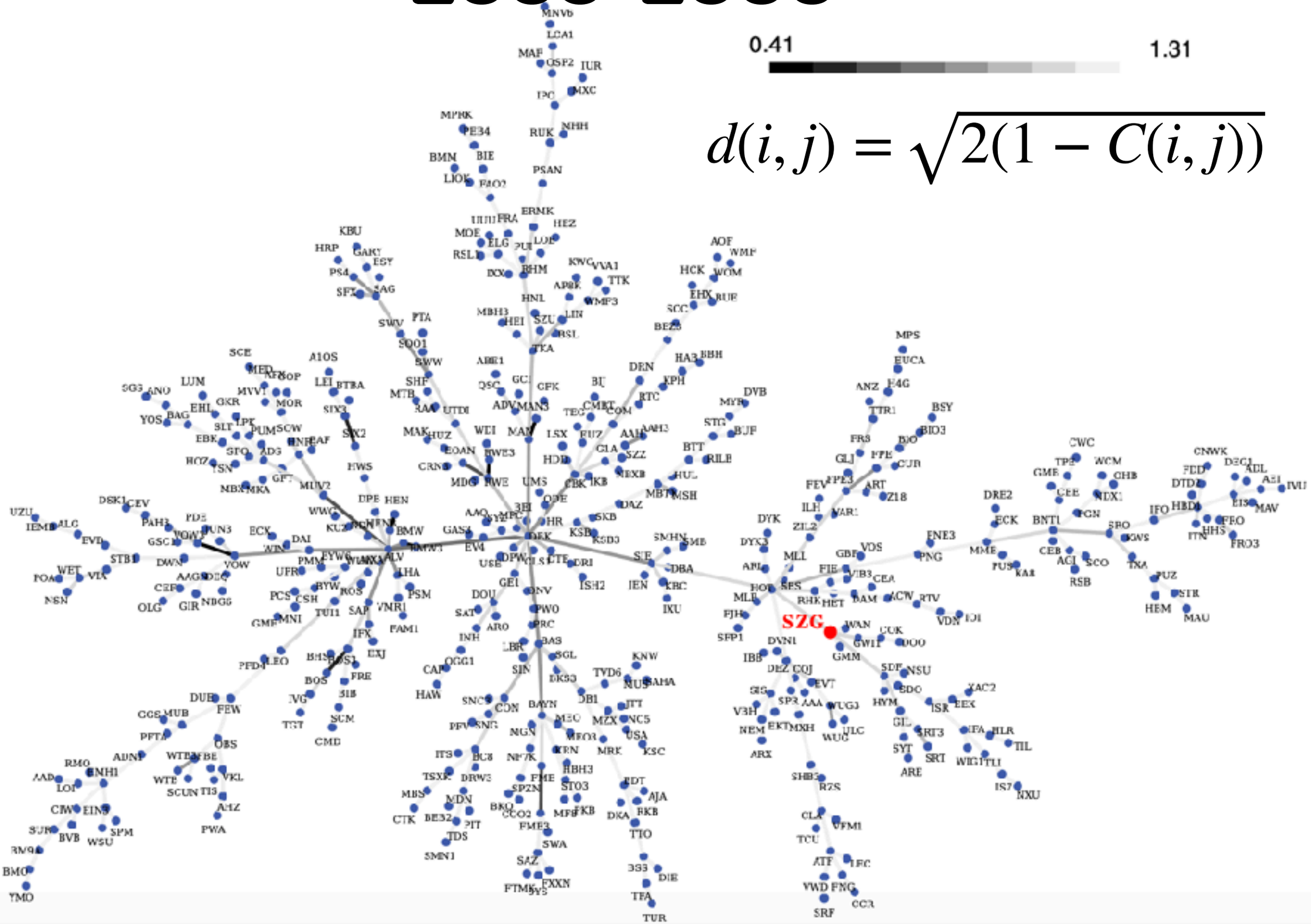
INTERNSHIP OPPORTUNITIES

CASE STUDY I – HOW TO BECOME MILLIONAIRES WITH NETWORKS

THIS PAPER STUDIES THE TOPOLOGICAL FEATURES OF THE **CORRELATION NETWORK** OF THE FRANKFURT STOCK EXCHANGE (FSE)
THE AUTHORS SHOW THAT THERE ARE **PHASE TRANSITIONS**
BEFORE AND AFTER THE 2008 **CRISIS**

M. WILINSKI ET AL. **"STRUCTURAL AND TOPOLOGICAL PHASE TRANSITIONS ON THE GERMAN EXCHANGE STOCK MARKET"** https://arxiv.org/pdf/1301.2530.pdf

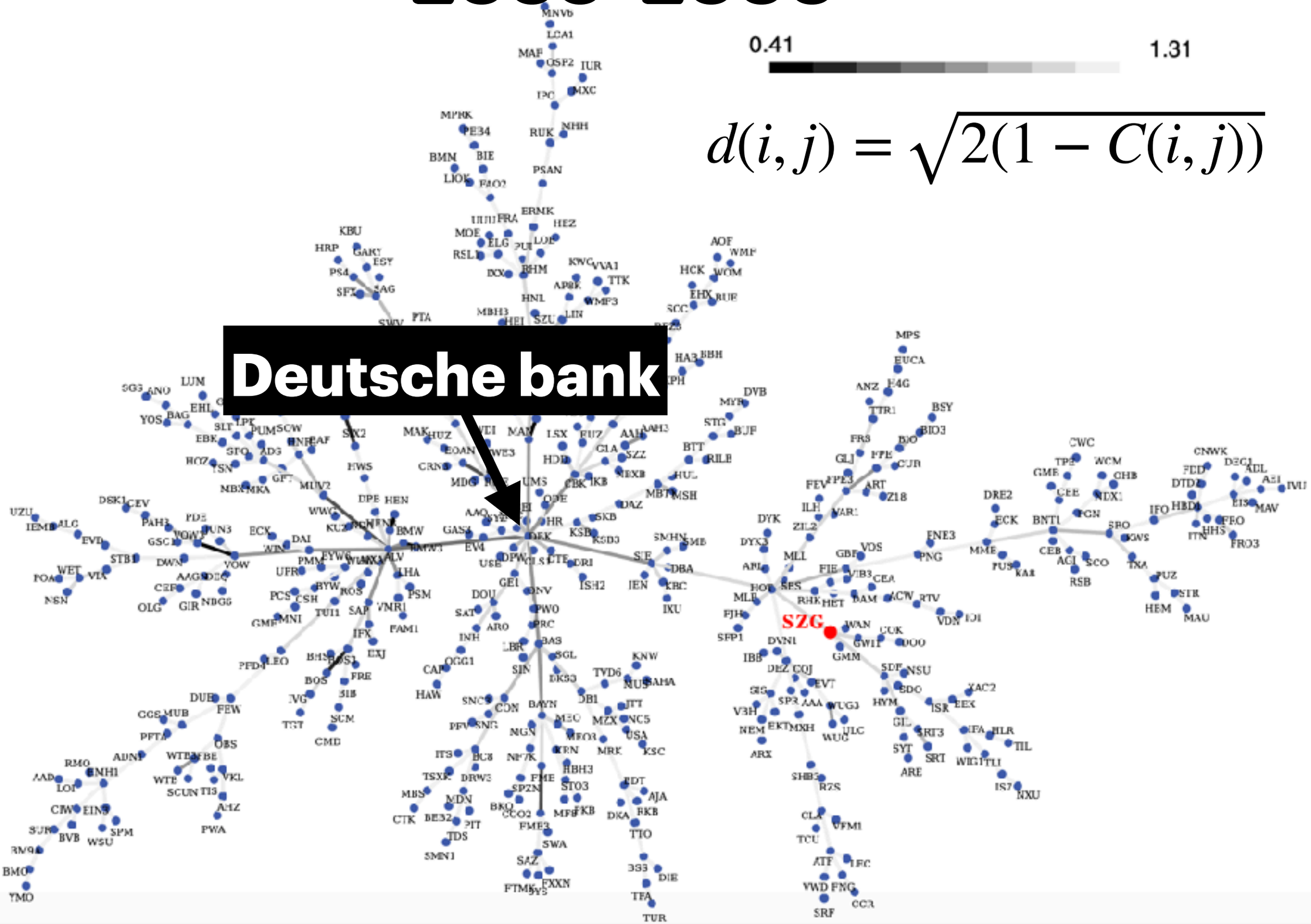
2005-2006



$$d(i,j) = \sqrt{2(1 - C(i,j))}$$

M. WILINSKI ET AL. **“STRUCTURAL AND TOPOLOGICAL PHASE TRANSITIONS ON THE GERMAN EXCHANGE STOCK MARKET”** https://arxiv.org/pdf/1301.2530.pdf

2005-2006



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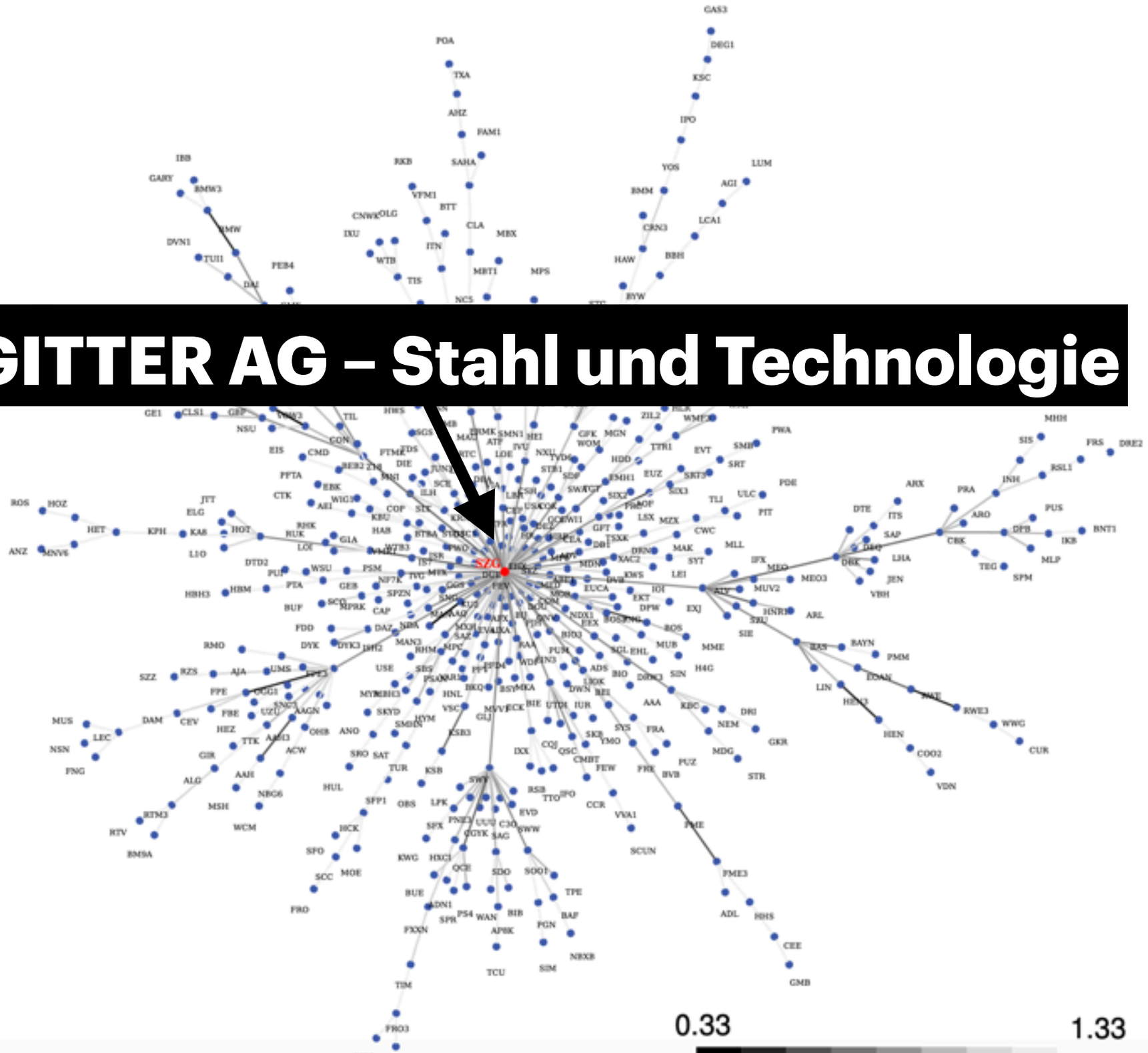

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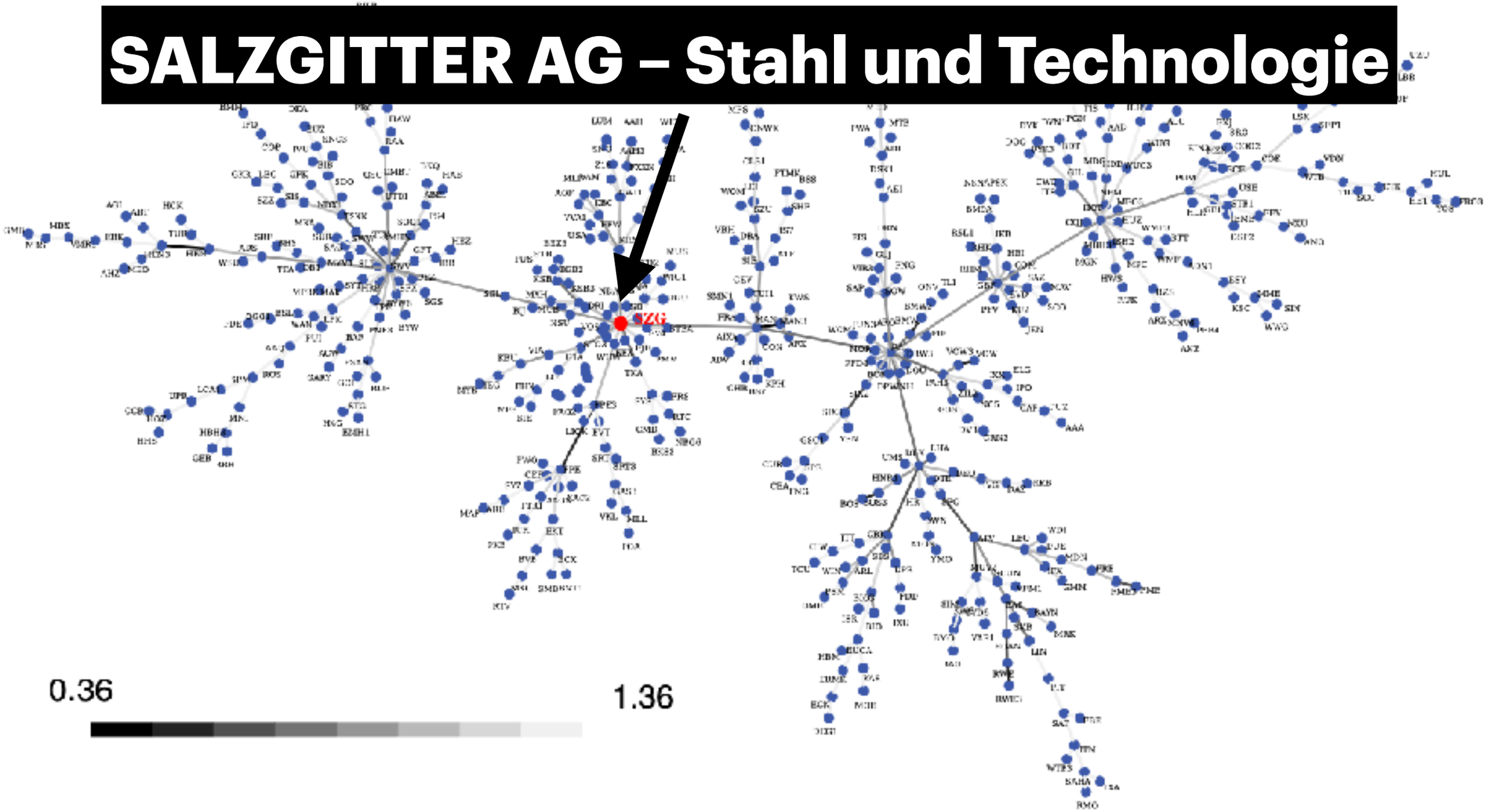
2007-2008



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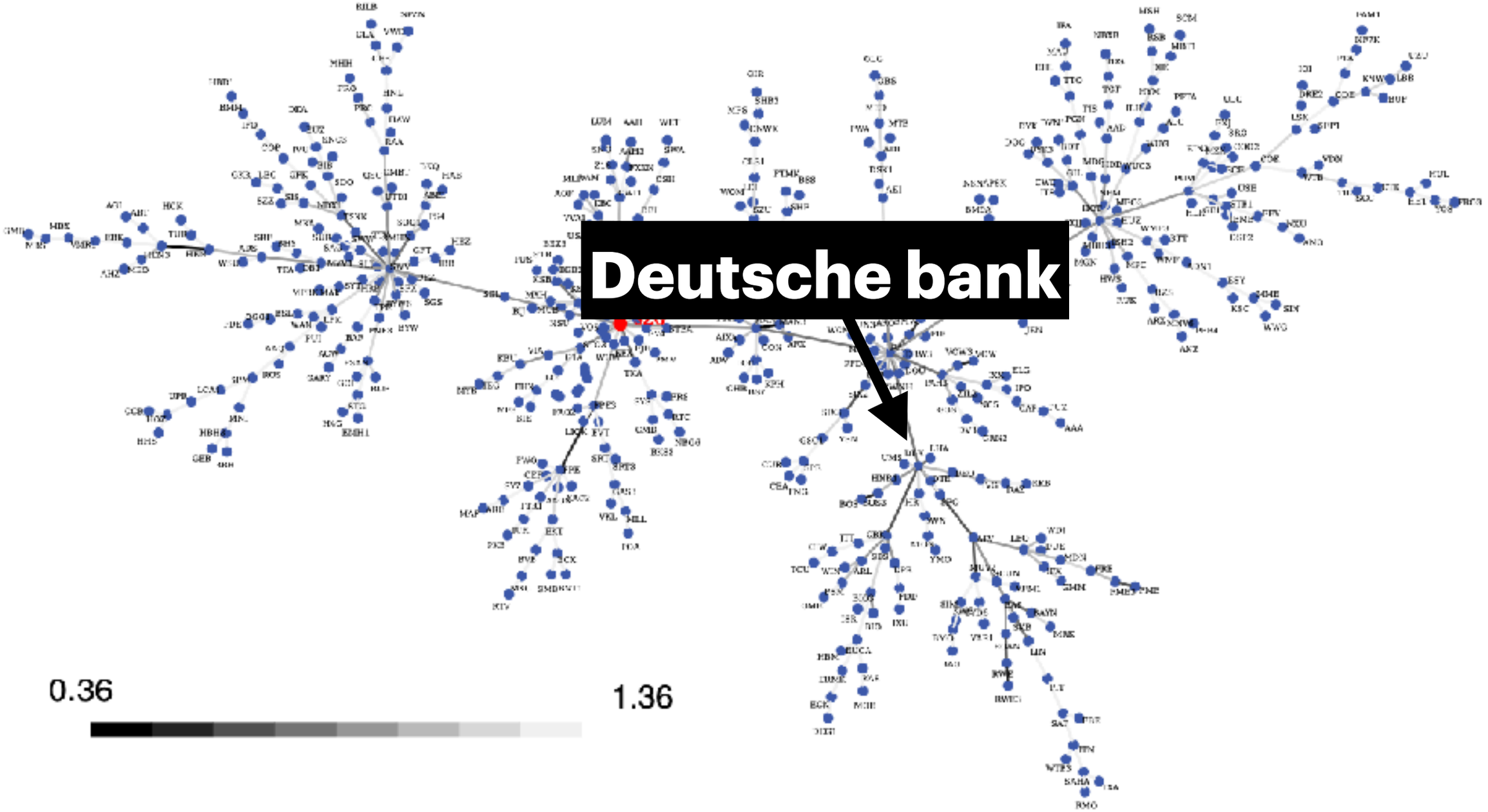

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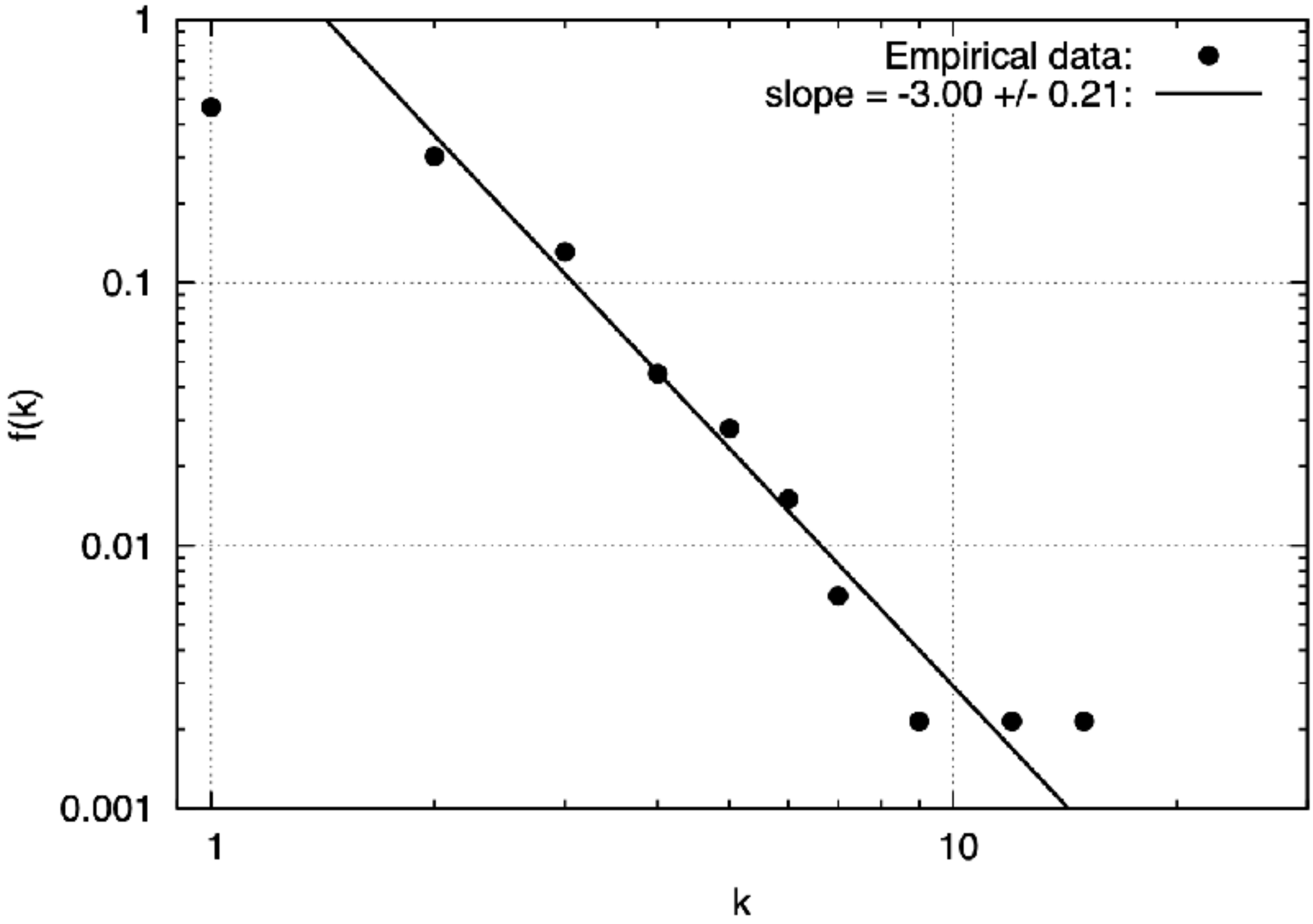

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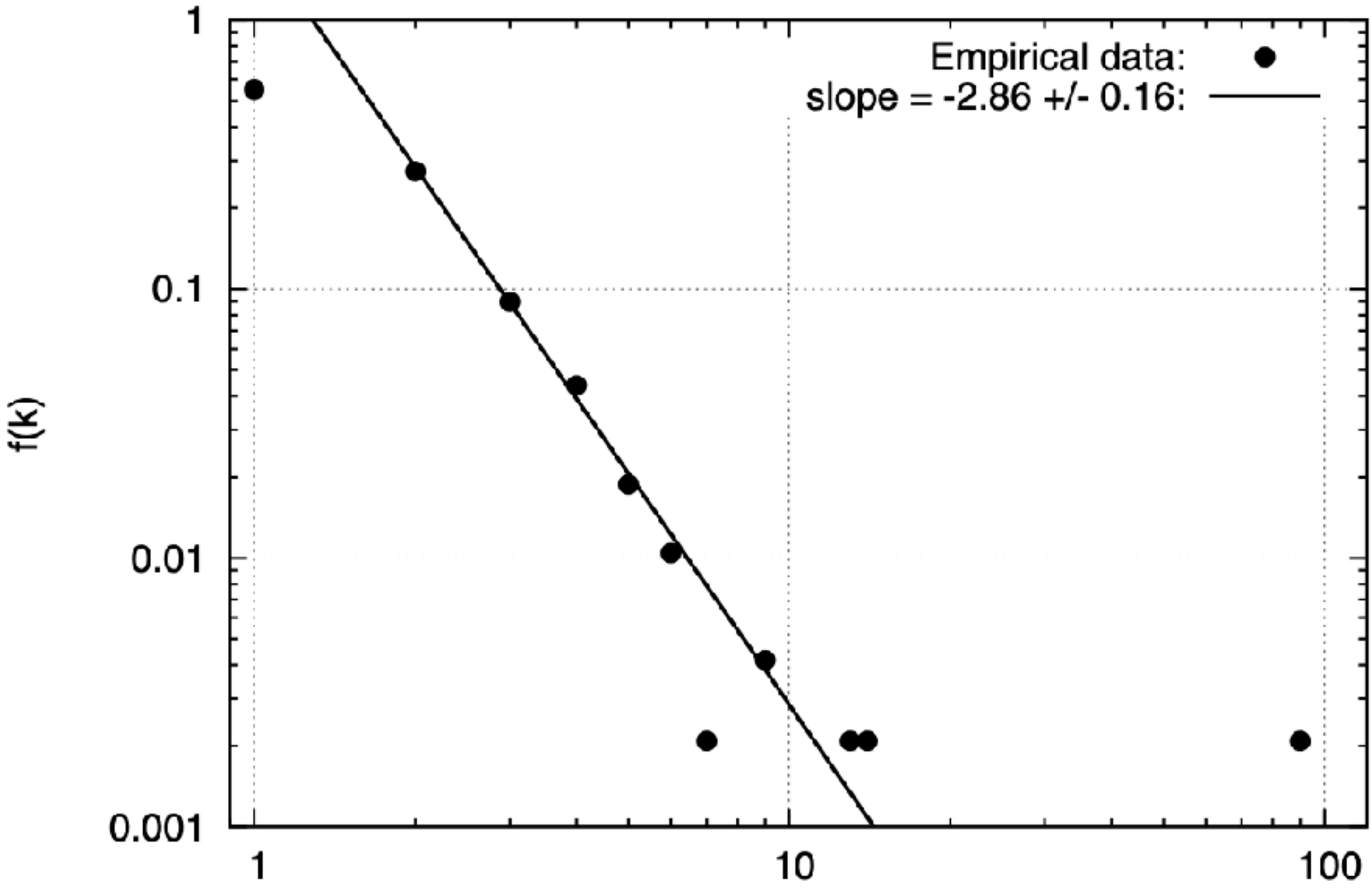

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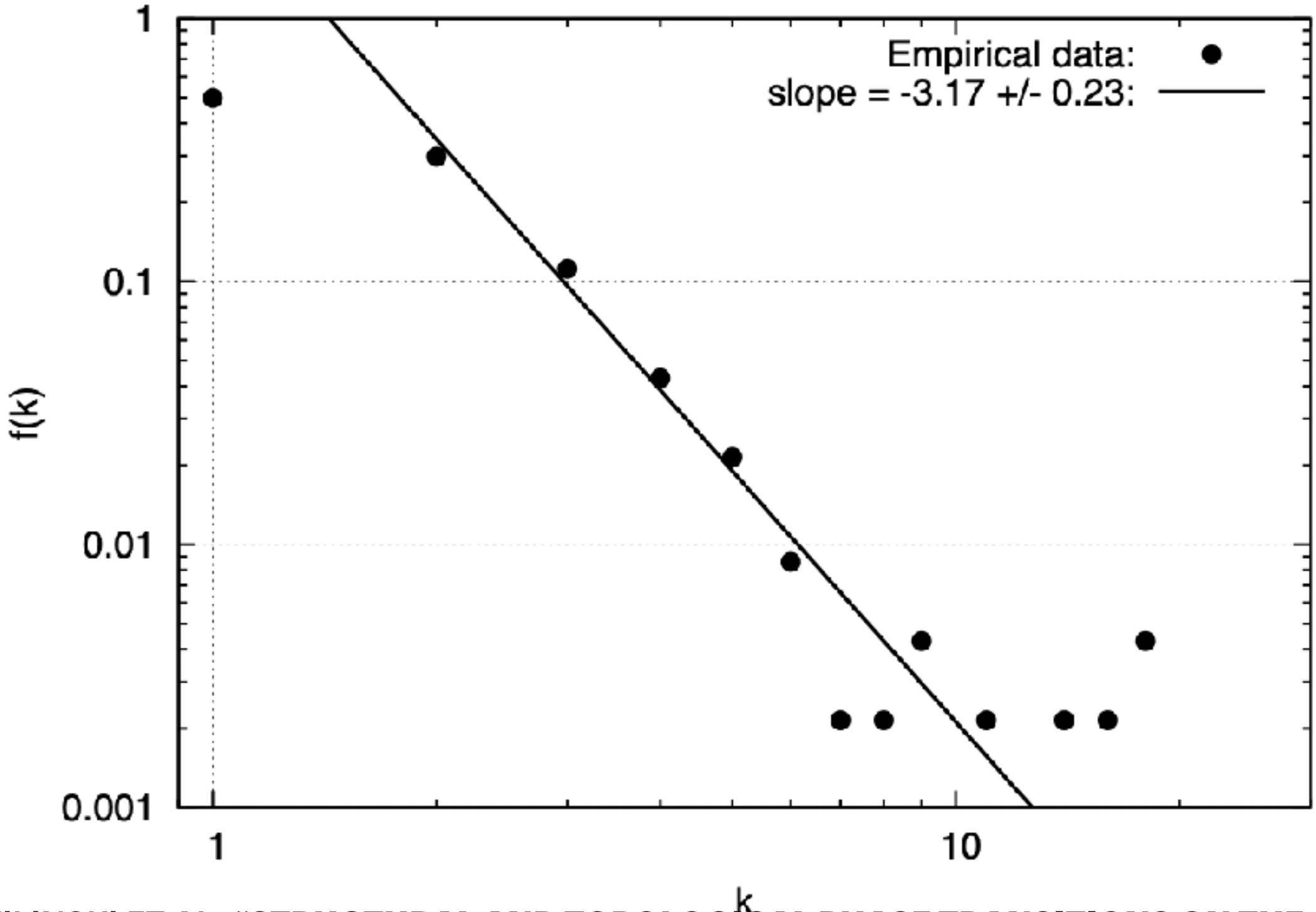

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05/06: Phase of scale-free MST - a (relatively) stable stock market state

06/07: Phase of the superstar-like MST - a transient market state

07/08: Phase of scale-free MST decorated by few local star-like trees - a (relatively) stable stock market state

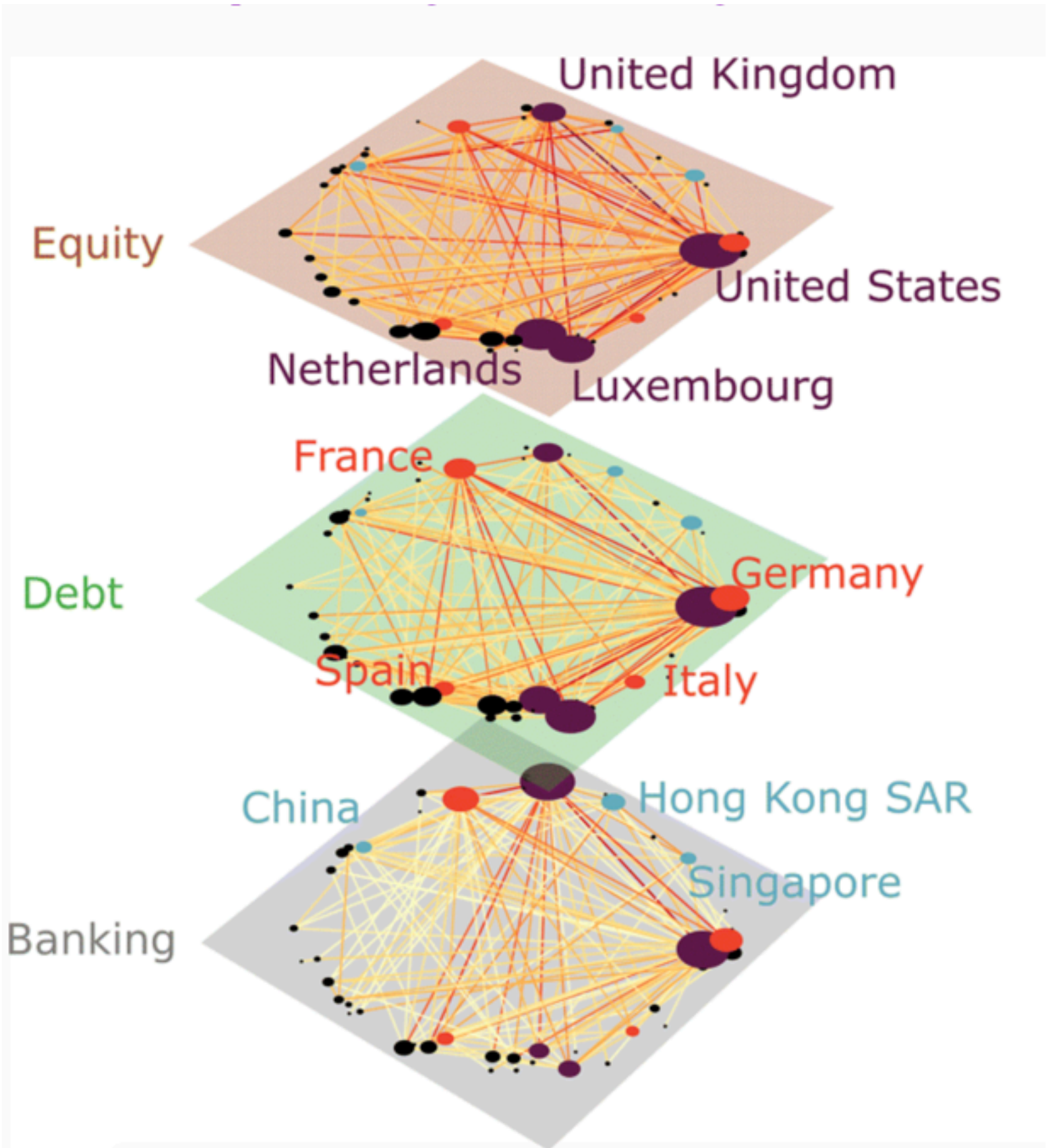
M. WILINSKI ET AL. **"STRUCTURAL AND TOPOLOGICAL PHASE TRANSITIONS ON THE GERMAN EXCHANGE STOCK MARKET"** https://arxiv.org/pdf/1301.2530.pdf

CASE STUDY II - FINANCIAL CONTAGION

The authors analyse financial contagion using **multilayer networks**

They find that using multilayer networks, they can find up to **2x important countries for contagion**

M. DEL RIO-CHANONA ET AL. **"THE MULTIPLEX NATURE OF GLOBAL FINANCIAL CONTAGIONS"**
https://appliednetsci.springeropen.com/articles/10.1007/s41109-020-00301-2



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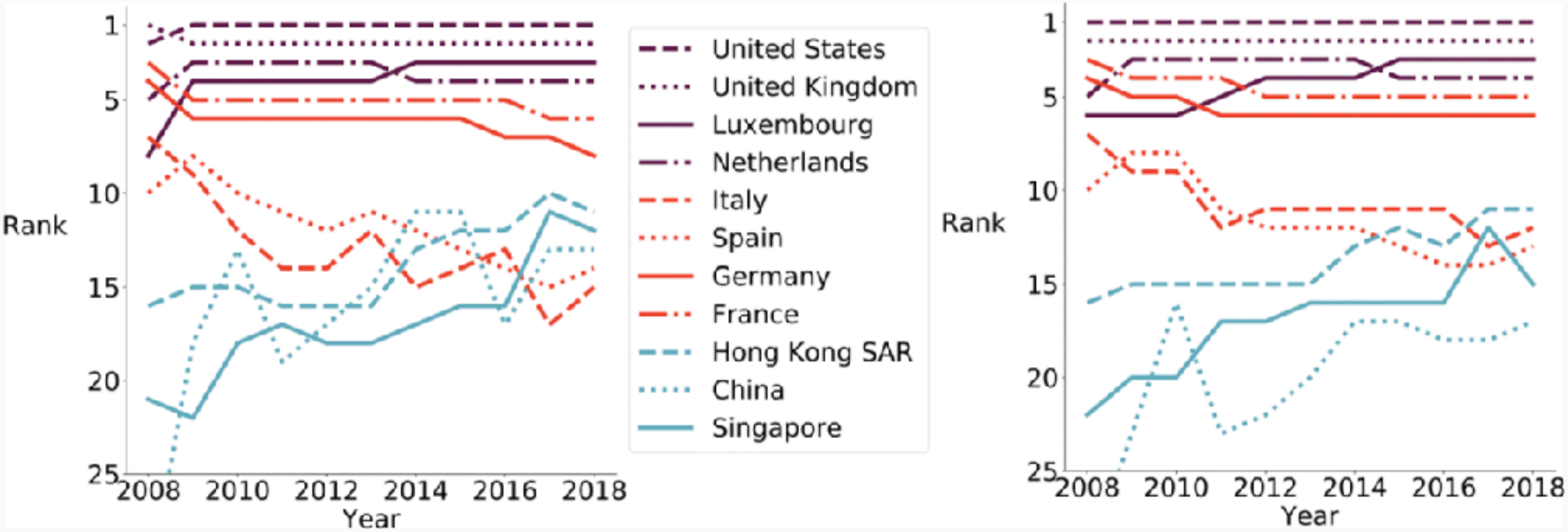

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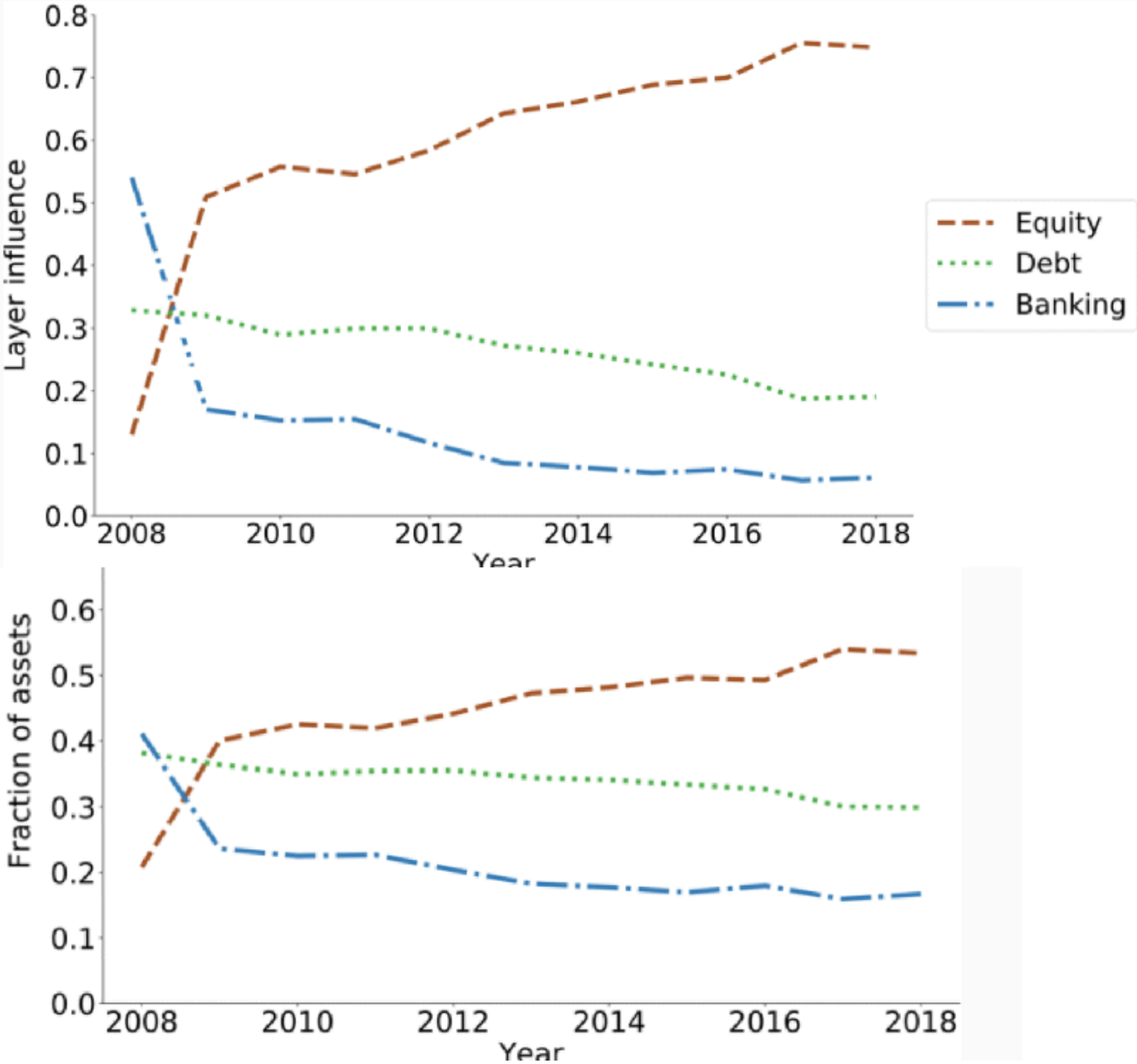
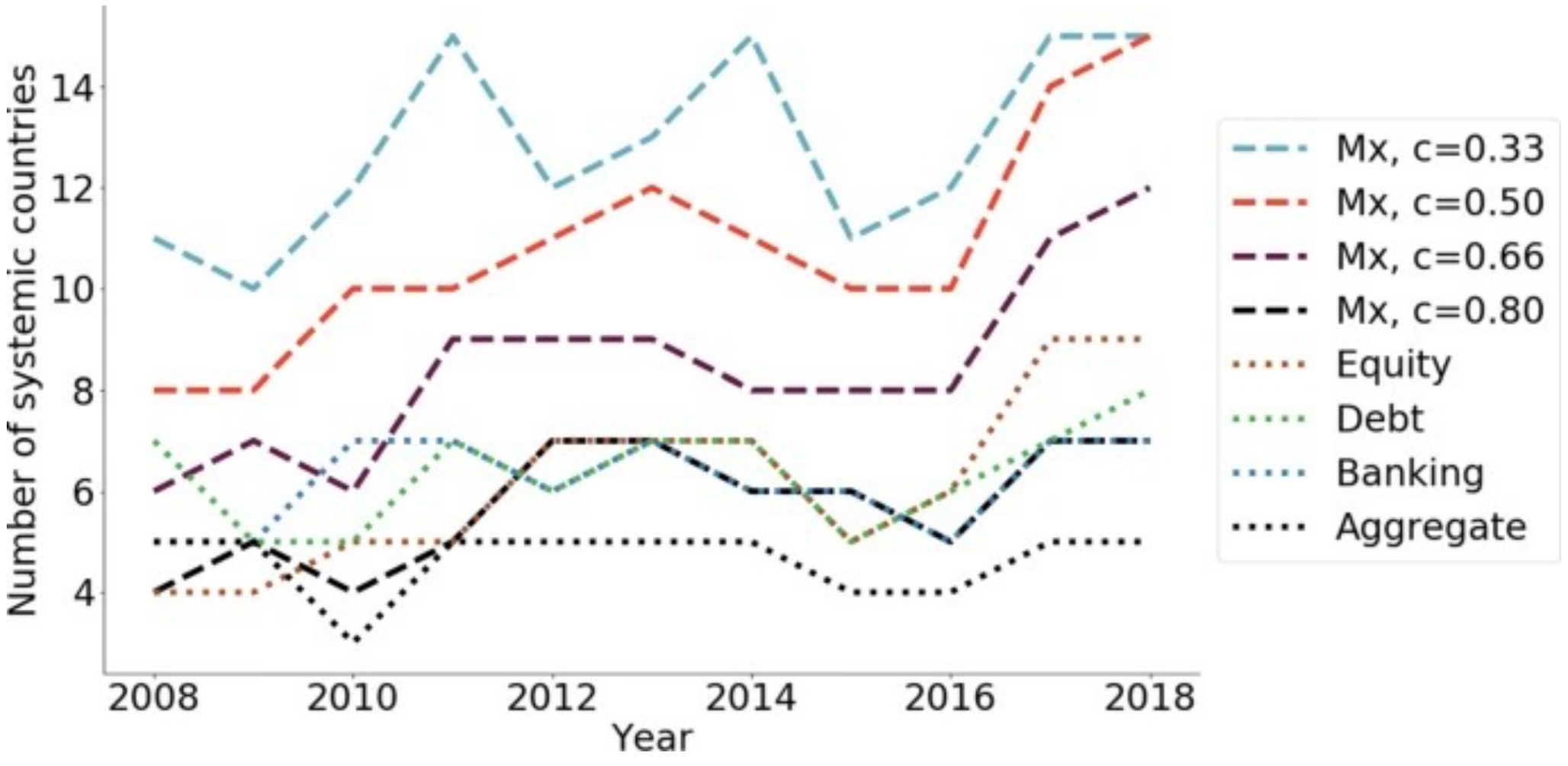
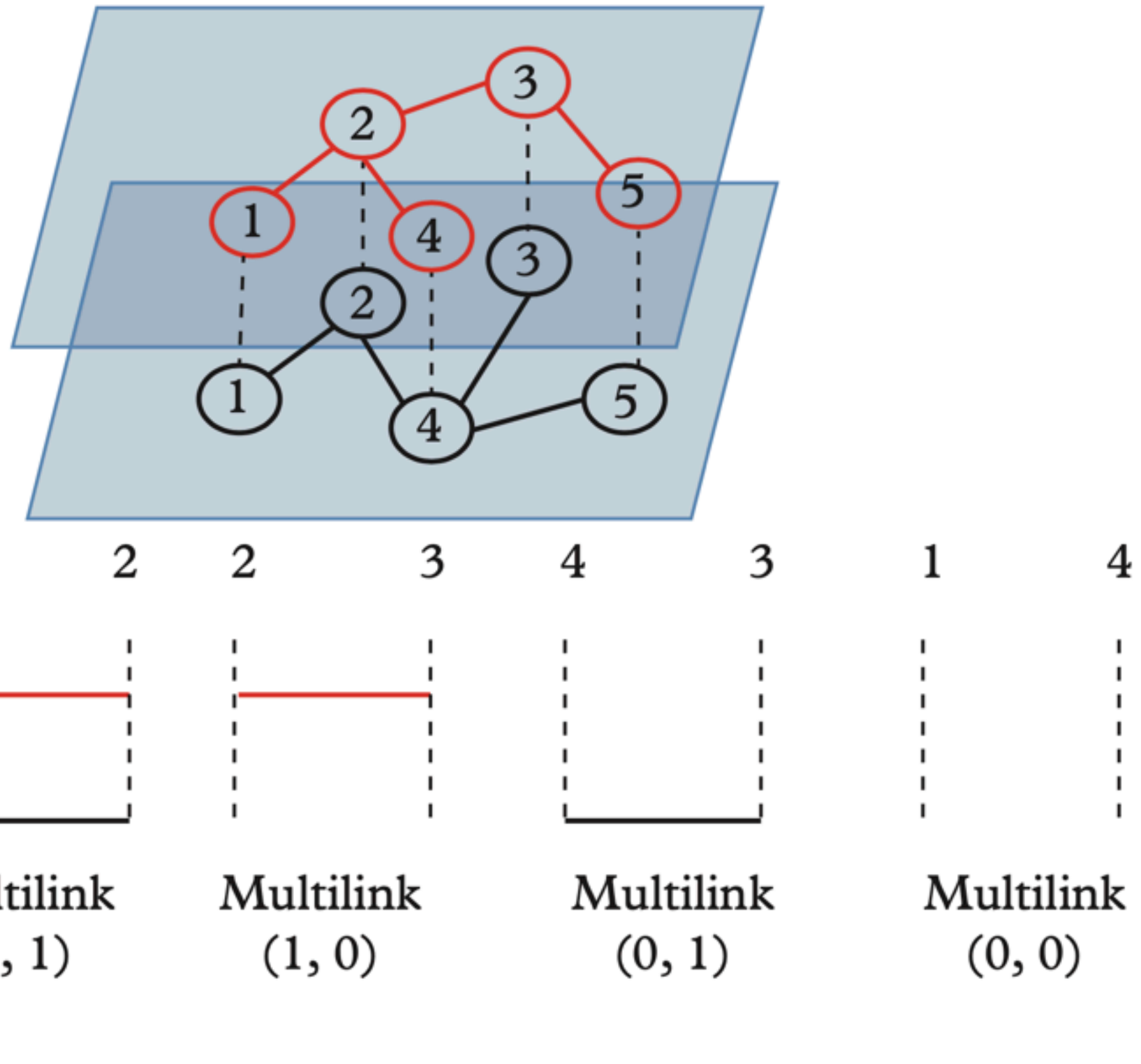

Layer influence
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
2008
2010
2012
2014
2016
2018
Year
Equity
Debt
Banking
Fraction of assets
0.0
0.1
0.2
0.3
0.4
0.5
0.6
2008
2010
2012
2014
2016
2018
Year

A single-layer approach underestimates risk



CASE STUDY II.b – Multiplex trees



Multilinks

$$z^{(1,0)} = \sin\theta\cos\phi,$$

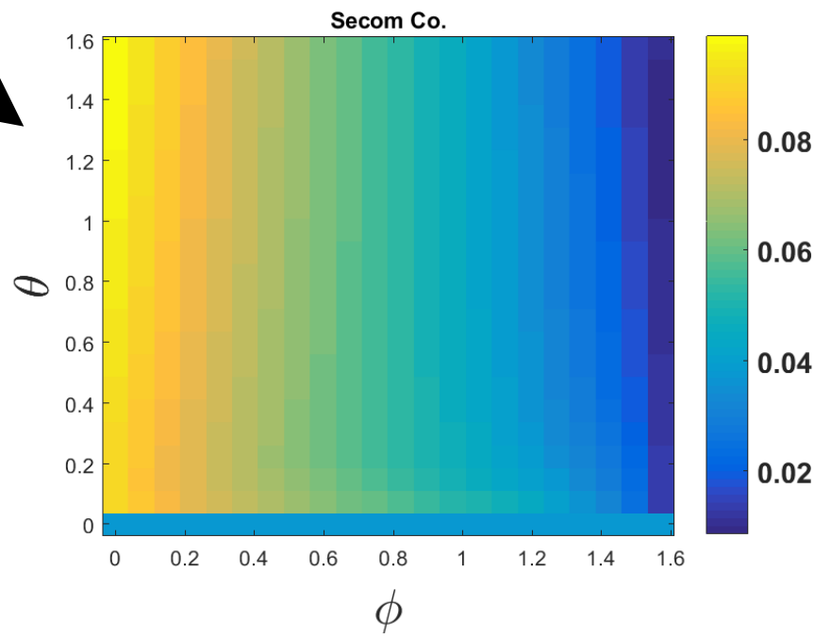
$$z^{(0,1)} = \sin\theta\sin\phi,$$

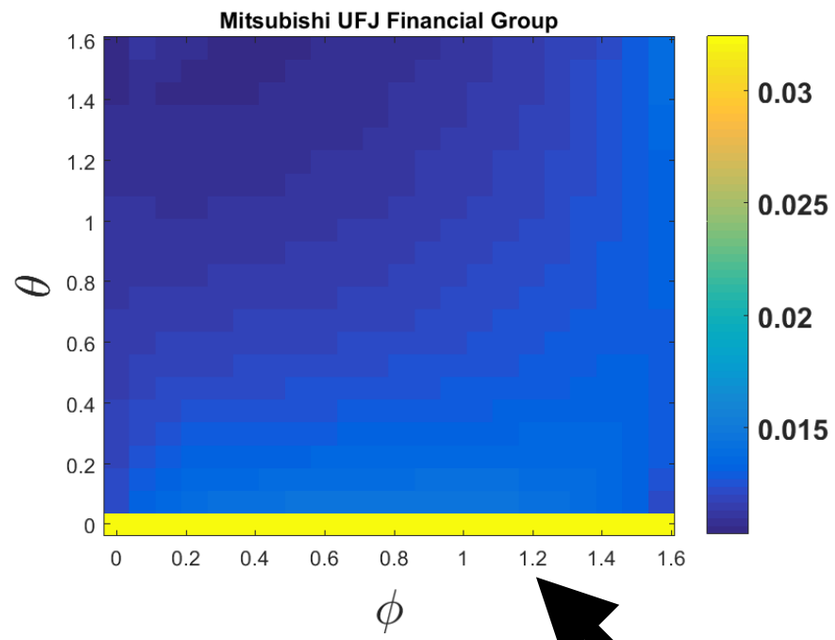
$$z^{(1,1)} = \cos\theta,$$

$$\theta, \phi \in [0, \pi/2]$$

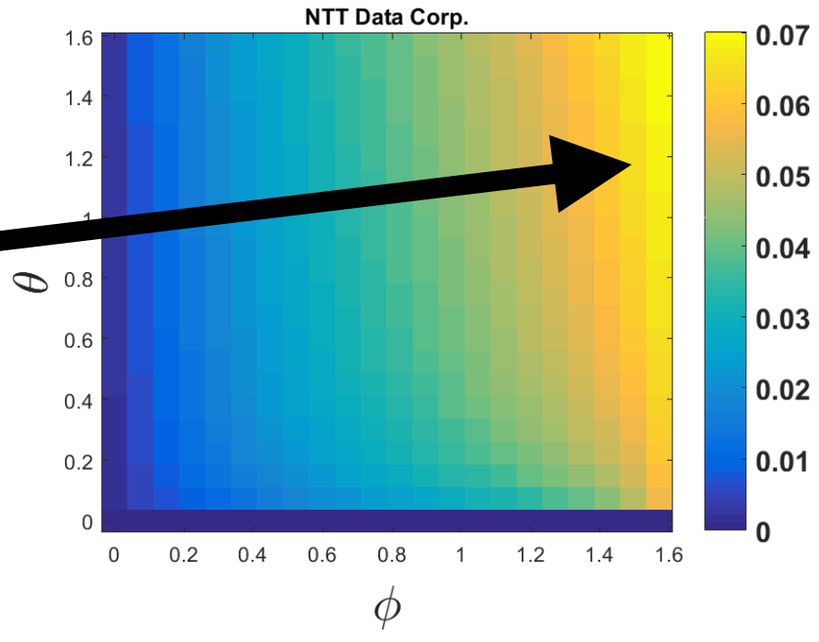
Centrality maps

Price





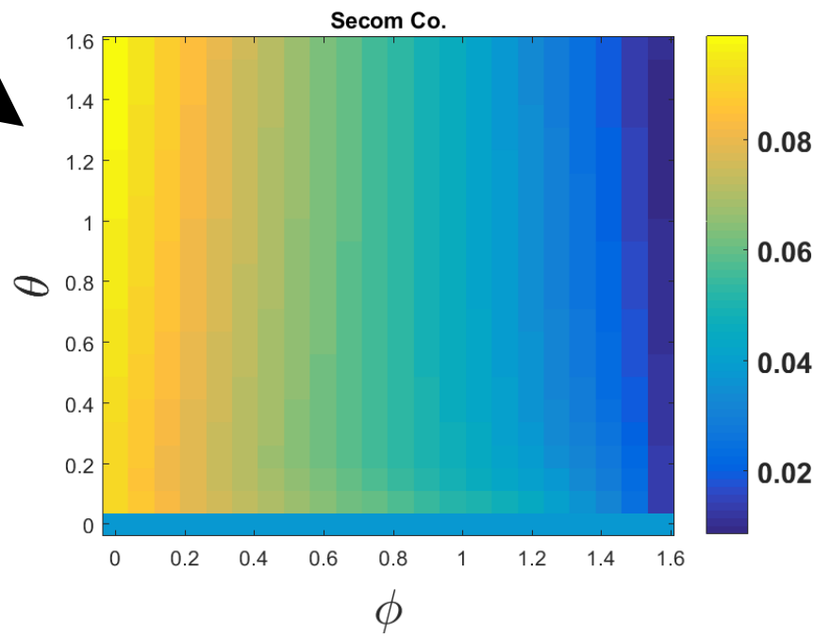
Volume

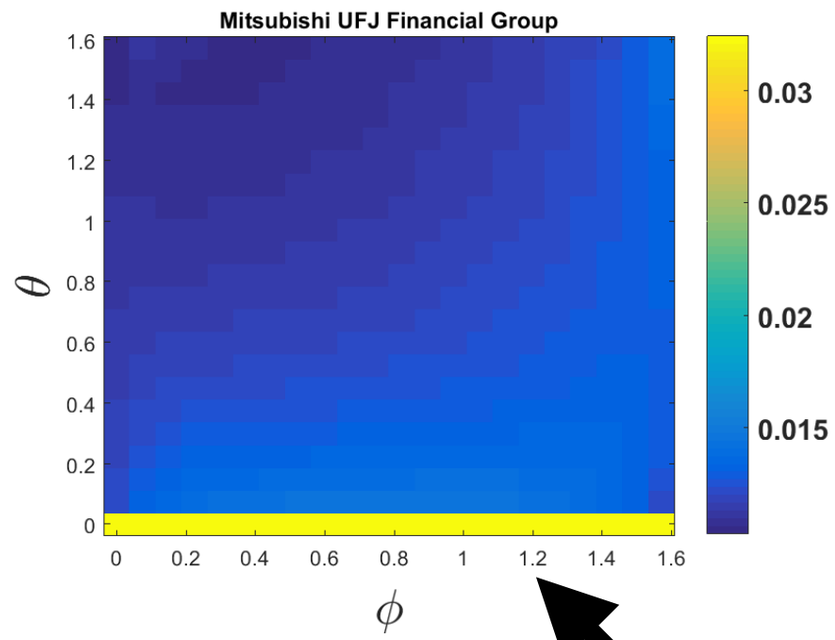


Both layers Only

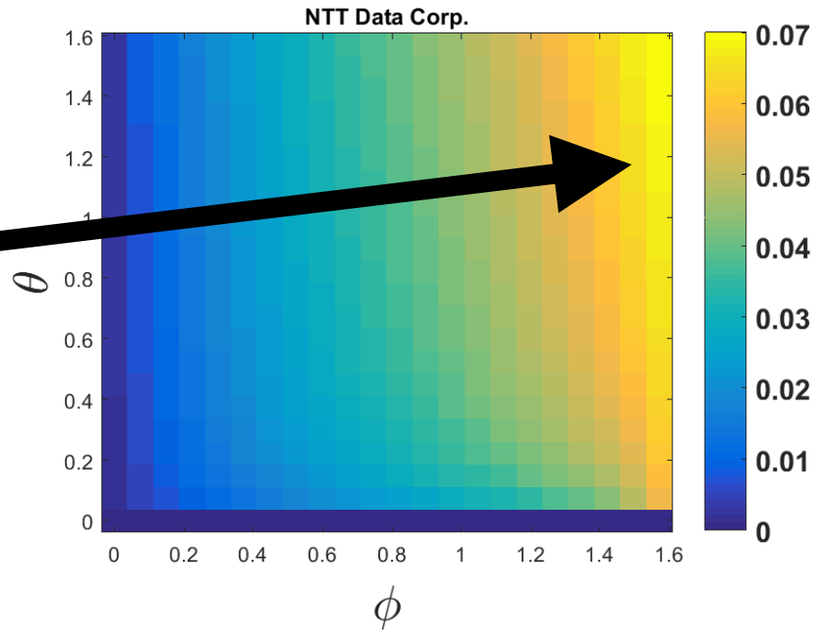
Centrality maps

Price





Volume



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