



NATIONAL AGRICULTURAL RESEARCH AND INNOVATION CENTRE
FOOD SCIENCE RESEARCH INSTITUTE

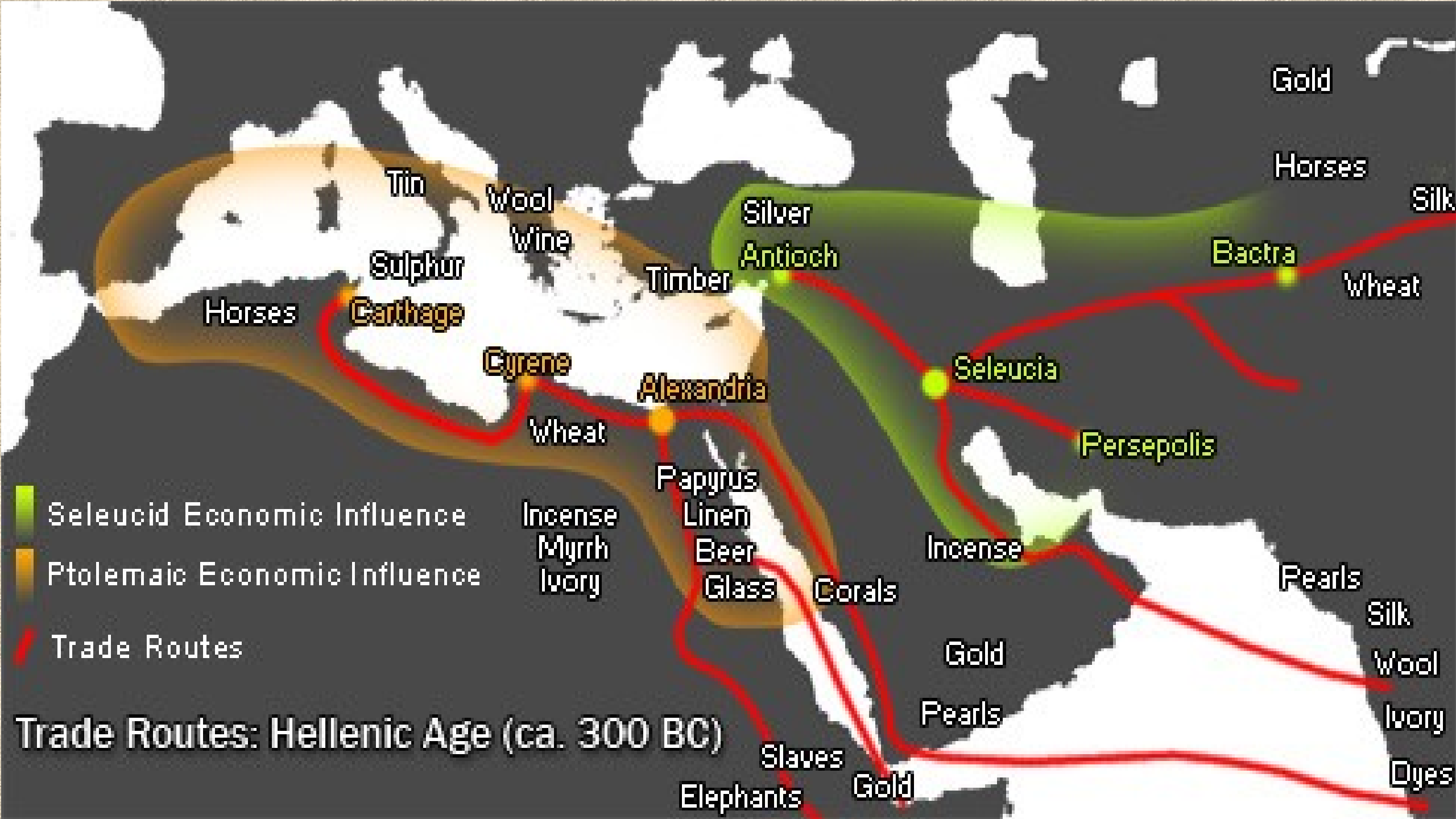


Trade network analysis for safer food

Dr Zoltán Lakner

Dr Erzsébet Szabó





Beyond these places, the fierce winters and great ice formations make travelling hard, and by the powers of the gods, these places are unexplored



Periplus of the Erythraean Sea

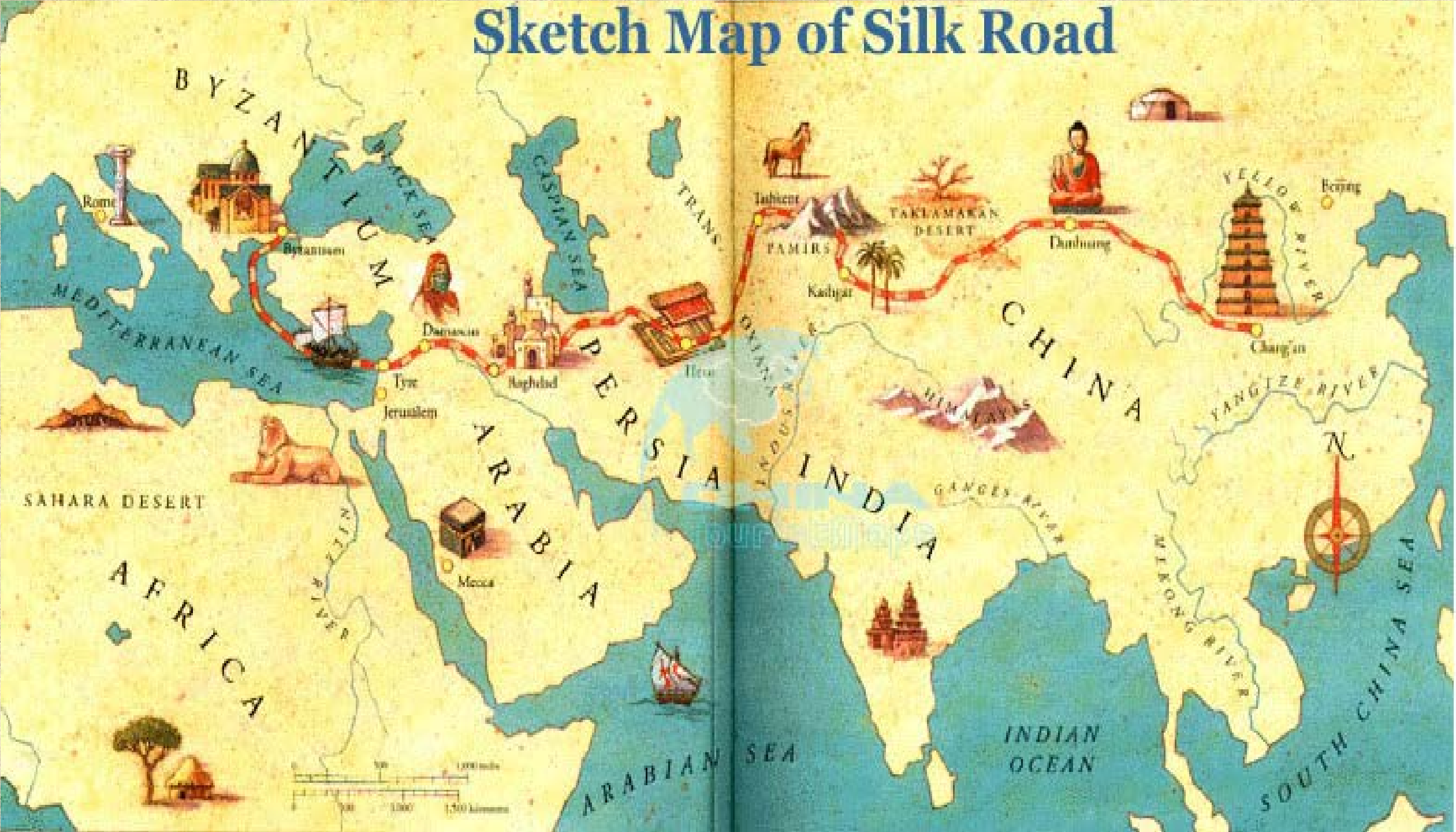
Περίπλους τῆς Ἐρυθρᾶς Θαλάσσης

1st century AD

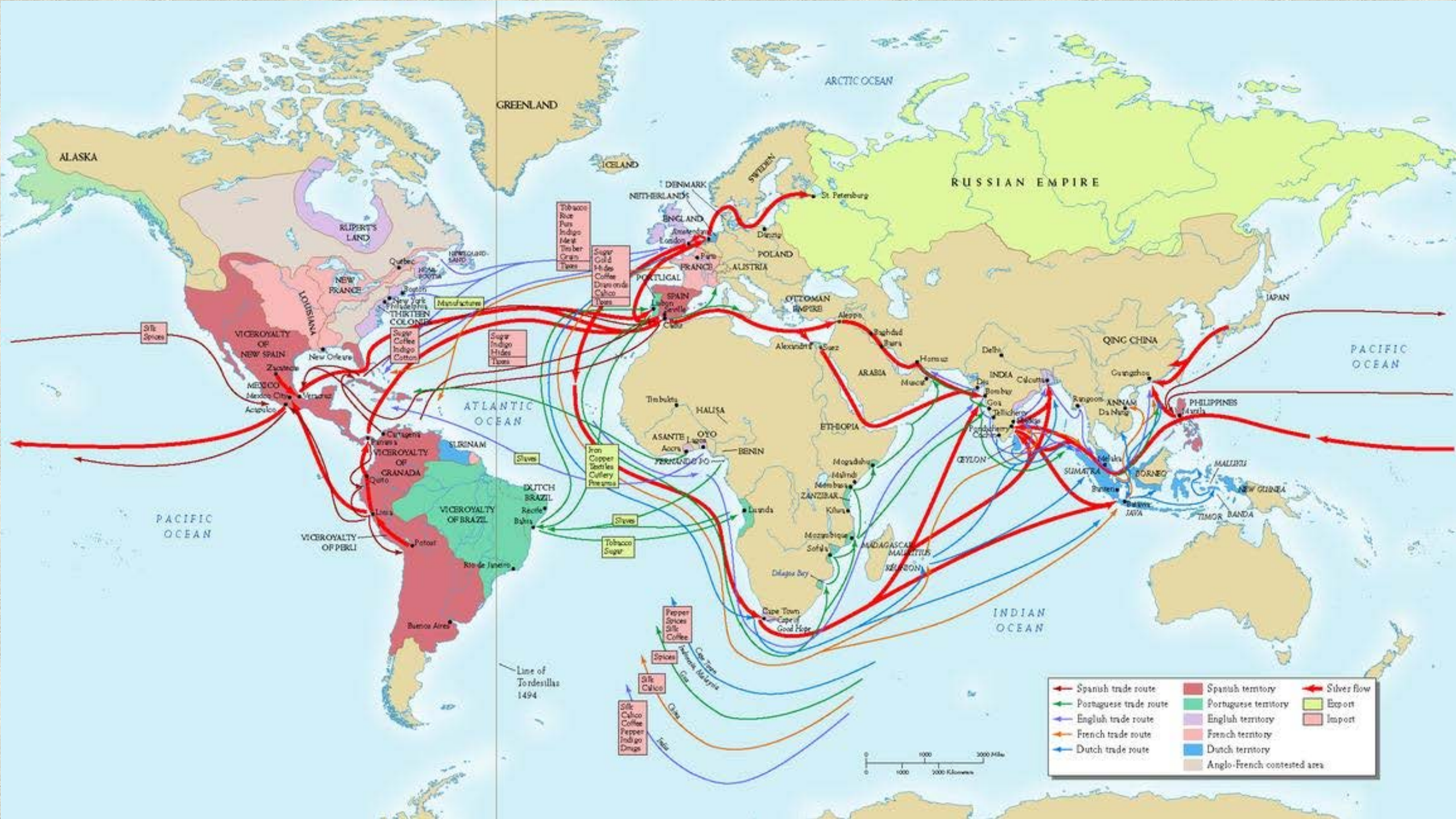
Beyond these places, the unexplored ocean curves around towards the west and mingles with the western sea

- ■ ■ ■ ■ Periplus
- ■ ■ ■ ■ Land route
- Roman Empire
- Himyarite Kingdom
King Charibael
- Indo-Scythian Kingdom
King Nambanus
- Pandian
- Parthian Empire
- Kingdom of Aksum
King Zoscales
- Nabataean kingdom
King Eleazus
- Cheras
- Damirica
- Others
- Spices
- Wine
- Gold
- Ivory
- Metals
- Cloth
- Aromatic flowers
- Silk
- Precious stones

Sketch Map of Silk Road







	Spanish trade route		Spanish territory		Silver flow
	Portuguese trade route		Portuguese territory		Export
	English trade route		English territory		Import
	French trade route		French territory		
	Dutch trade route		Dutch territory		
			Anglo-French contested area		



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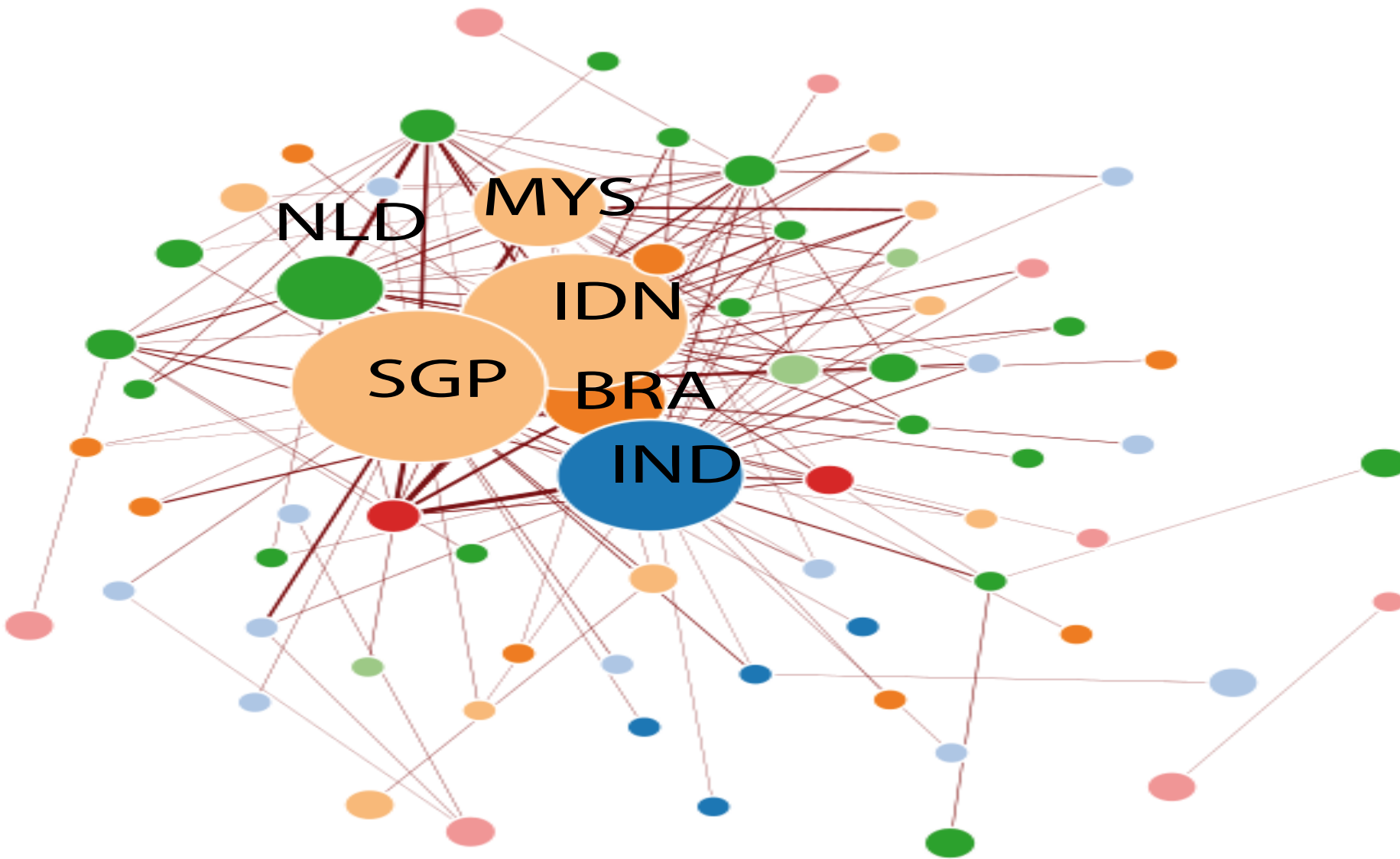
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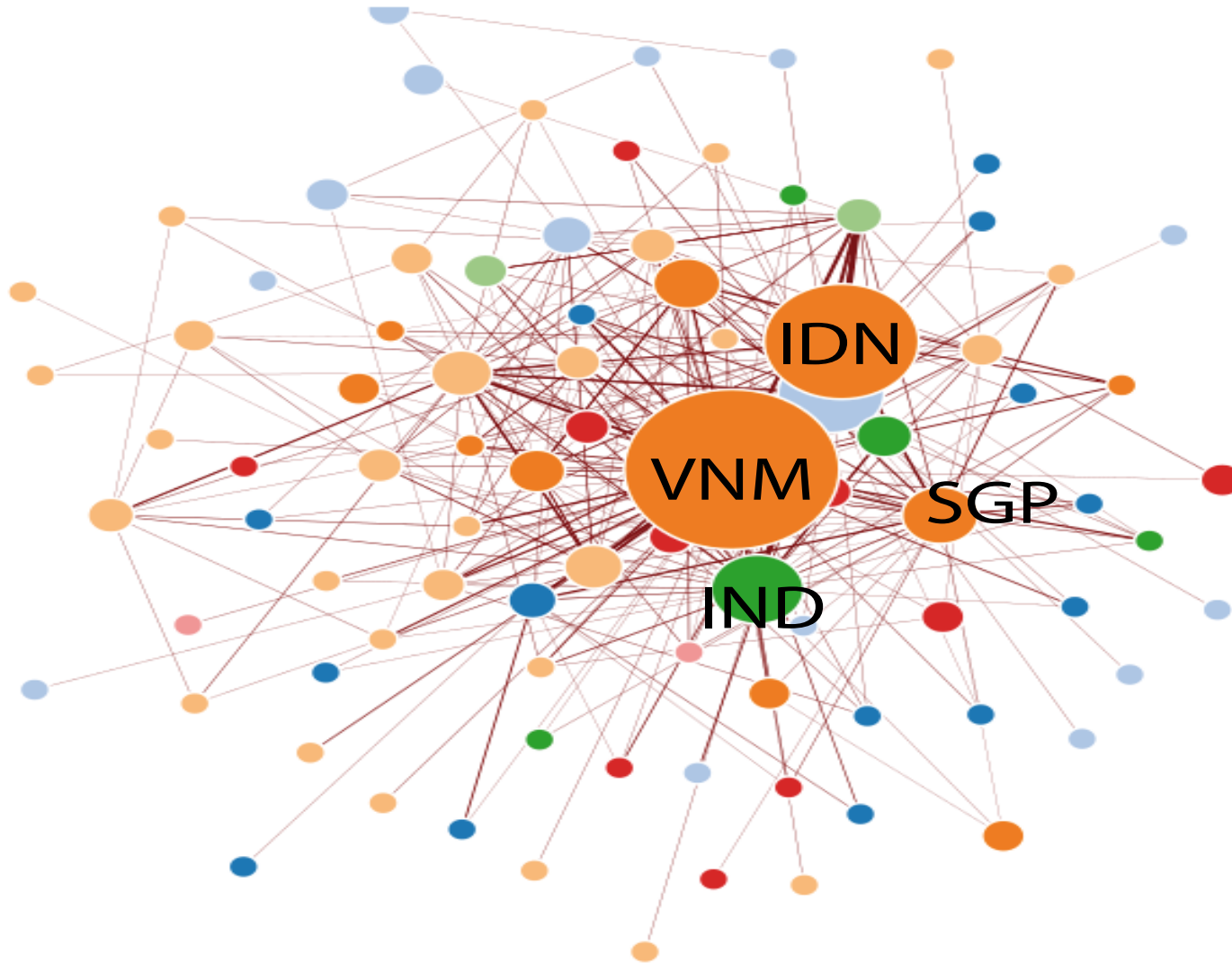
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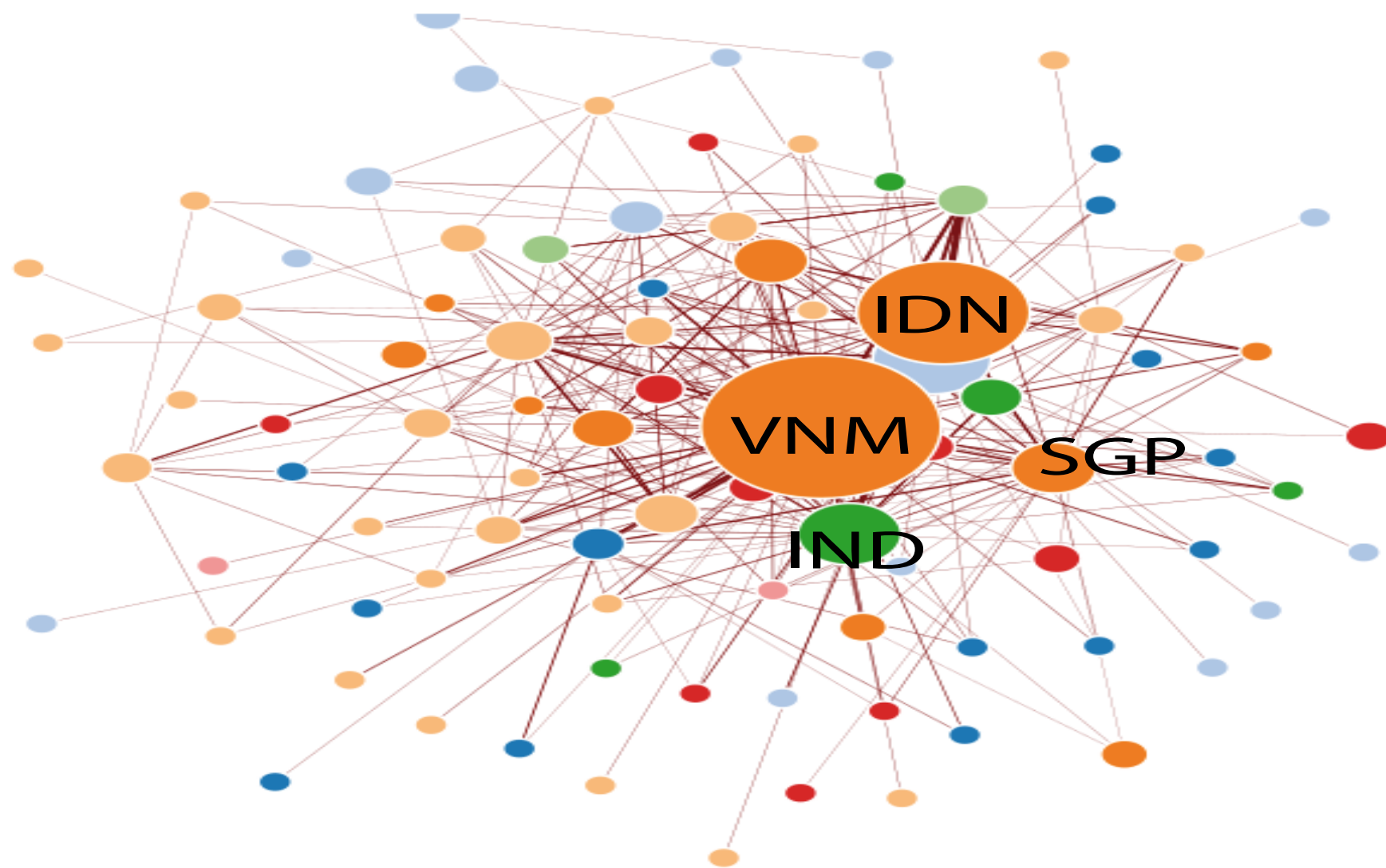
Global trade network of dried papper, 1998



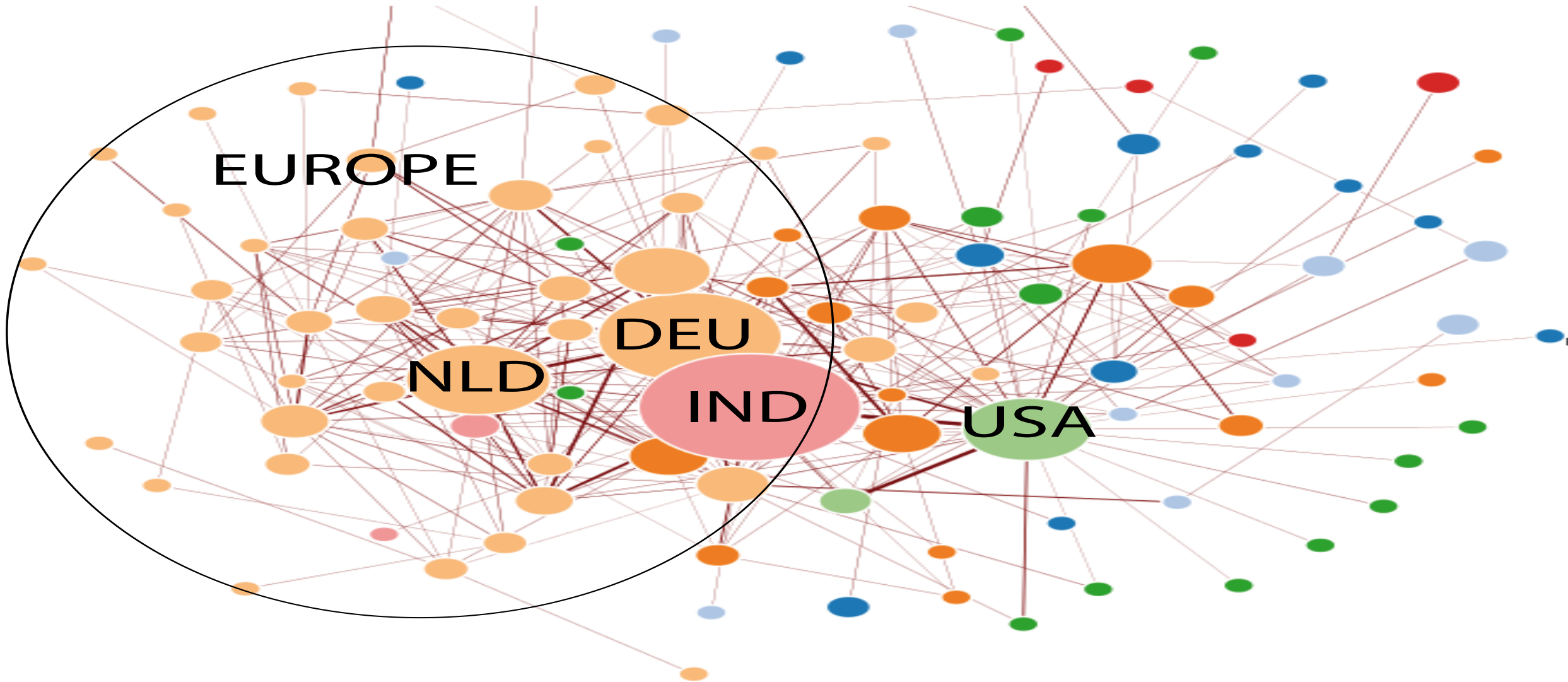
Dried pepper trade 2003



Dried pepper trade, 2014



Crushed pepper trade, 2014



Research problem

How can be characterised the vulnerability of spice-trade networks?

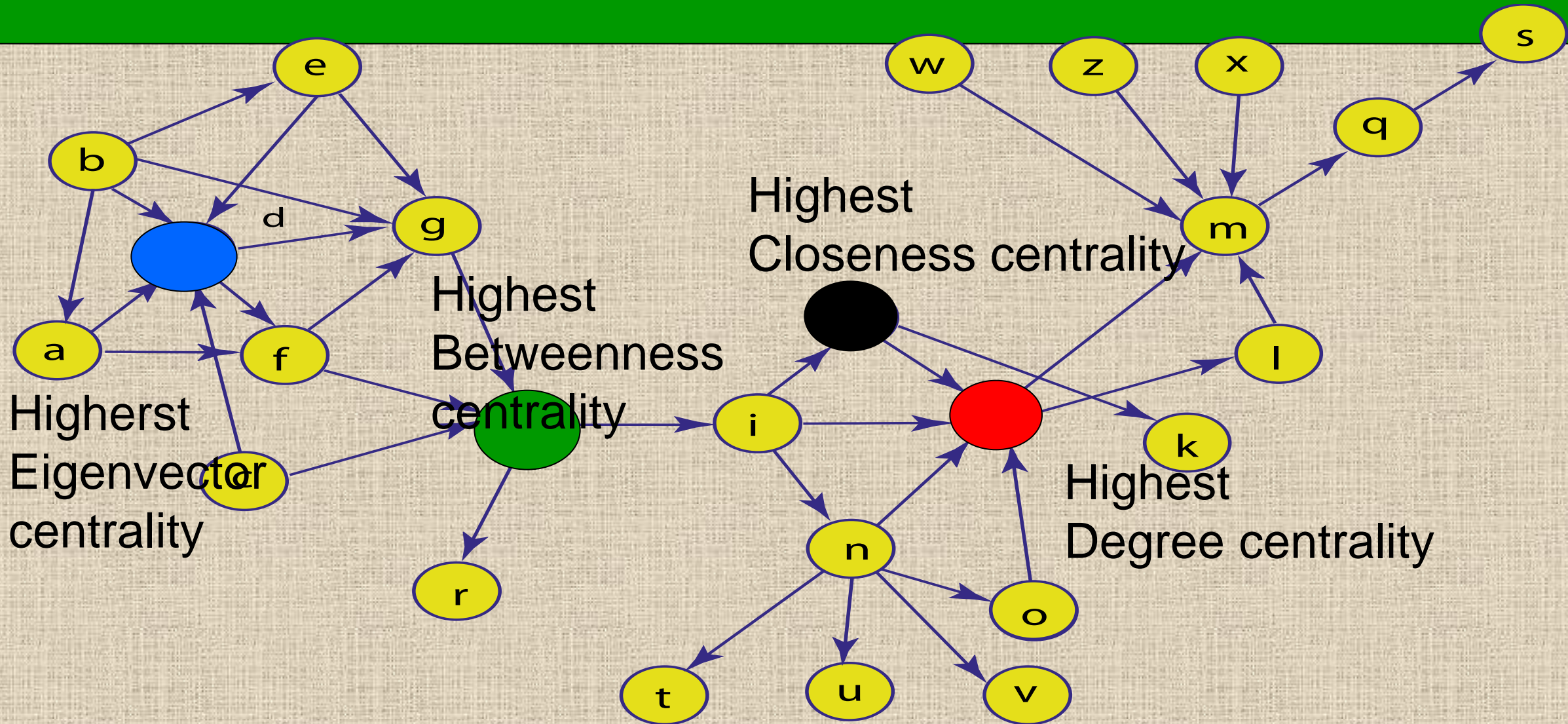
Research agenda

1. Network analysis of spice trade network of the European Union;
2. Based on different centrality measures determination of most vulnerable network components

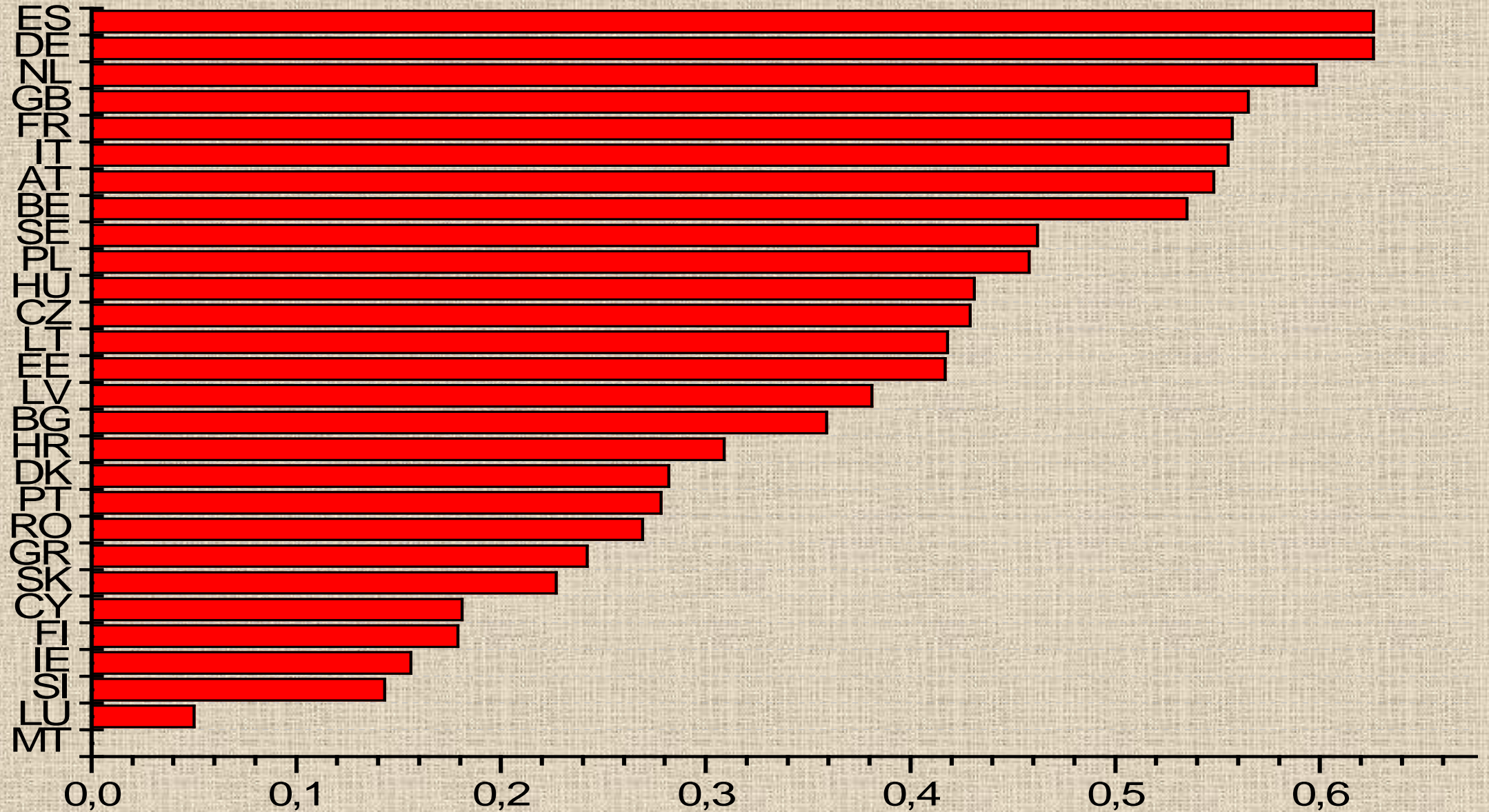
Methodology

- Data source: Comtrade and Eurostat databases;
- Dinamic network analysis;
- Network simulation
 - Directed, weighted network
 - Anylogic? R?
 - ORA!

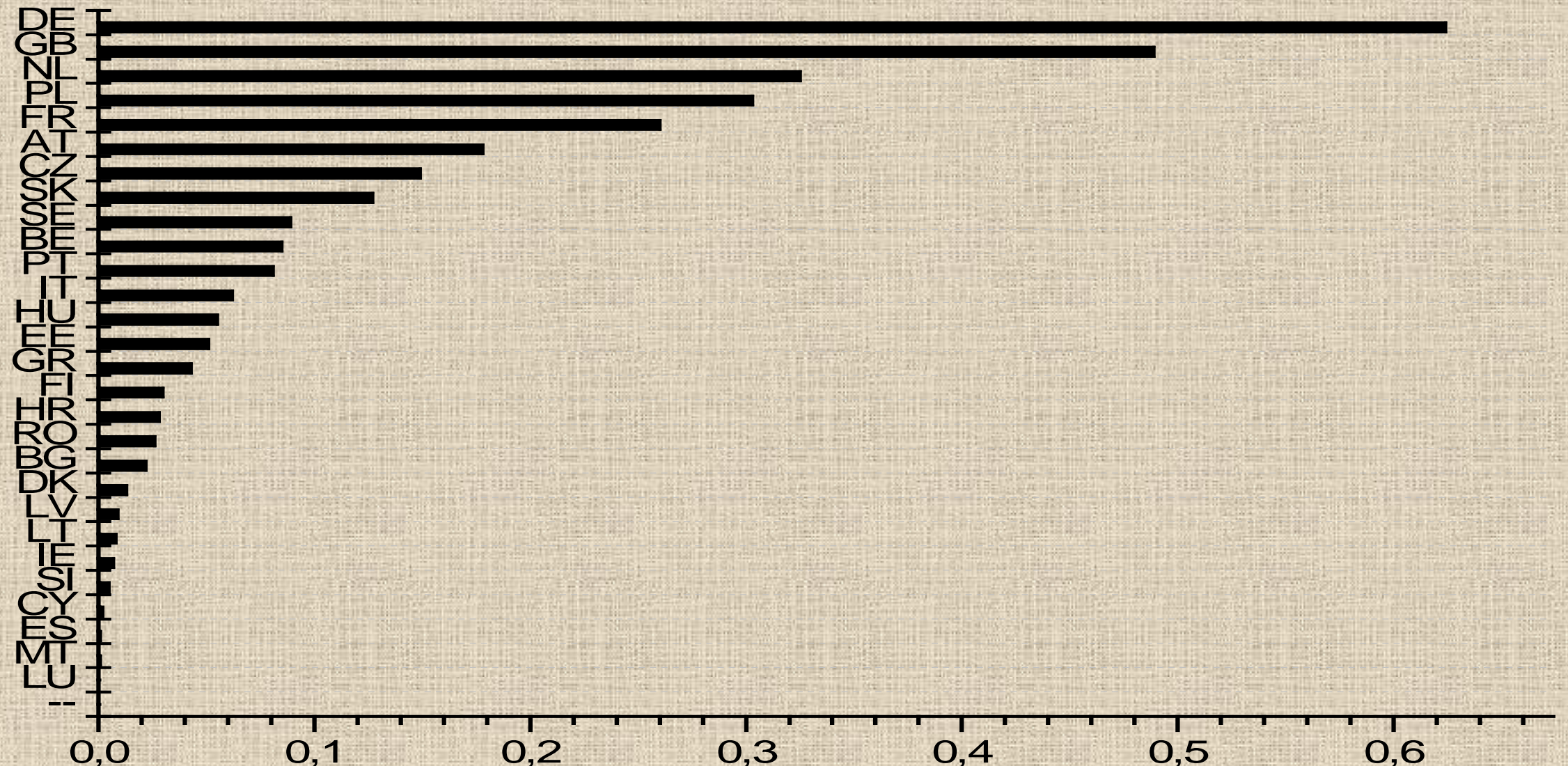
Who is in the center?



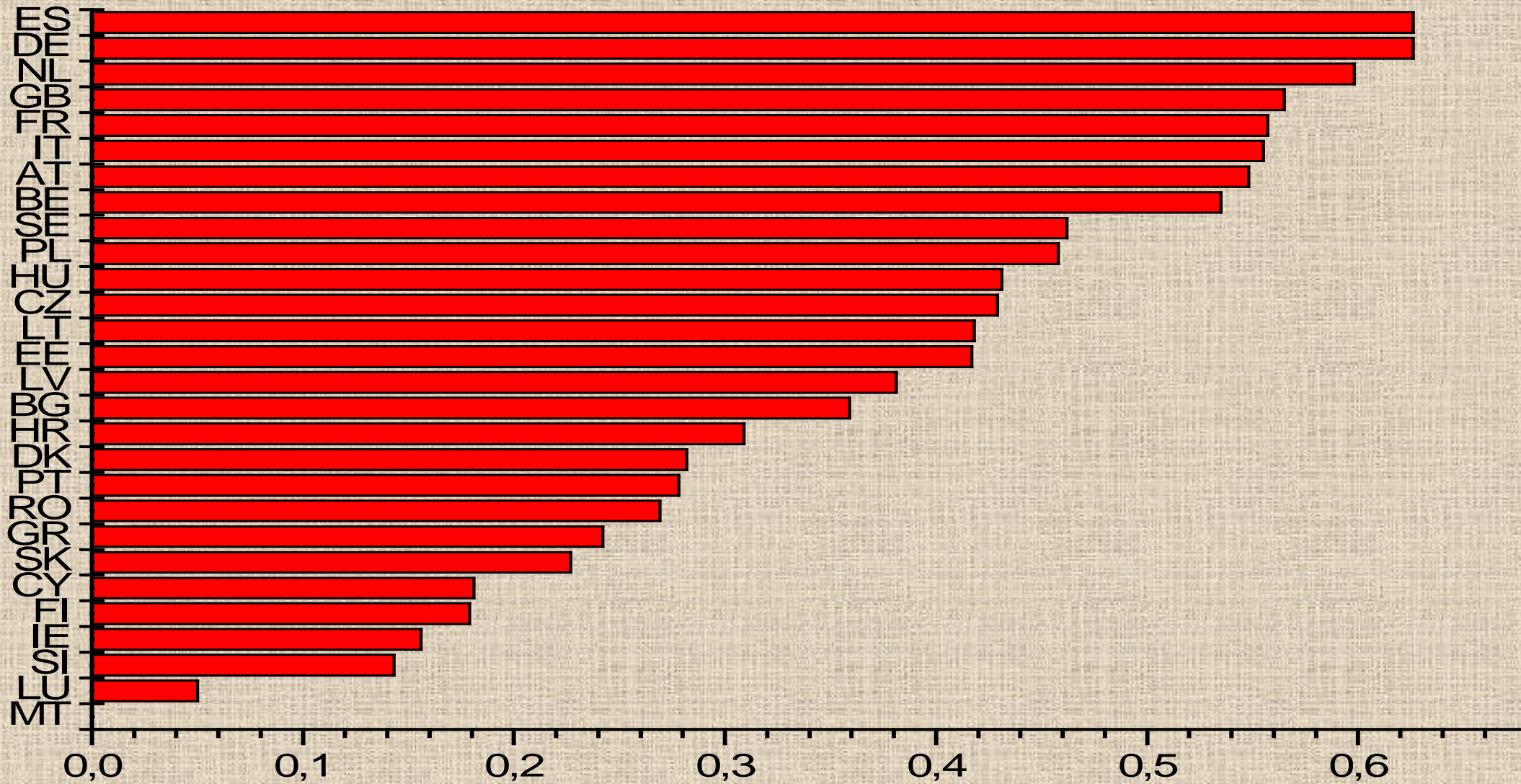
Brokerage role of actors in European paprika powder trade network



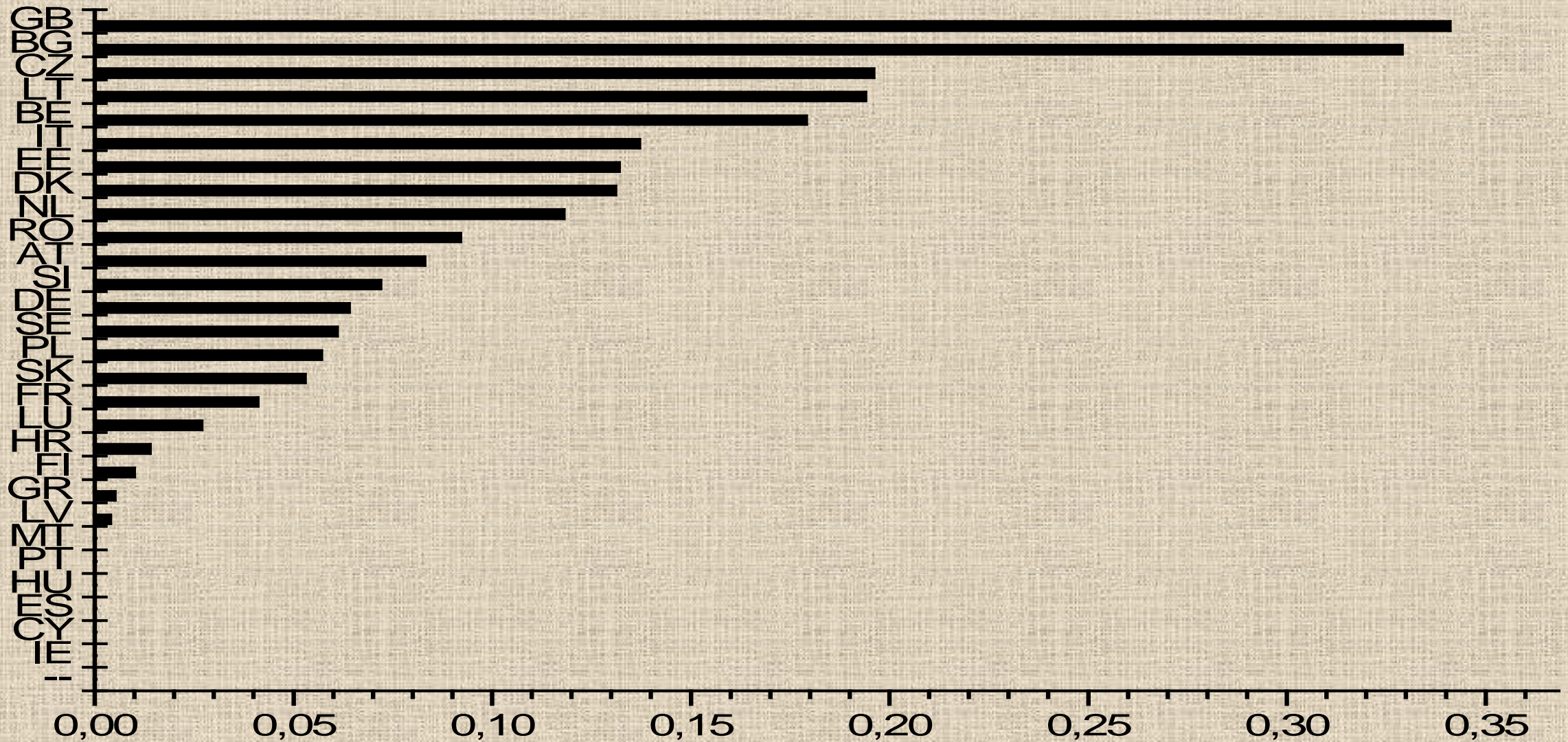
Authority centrality



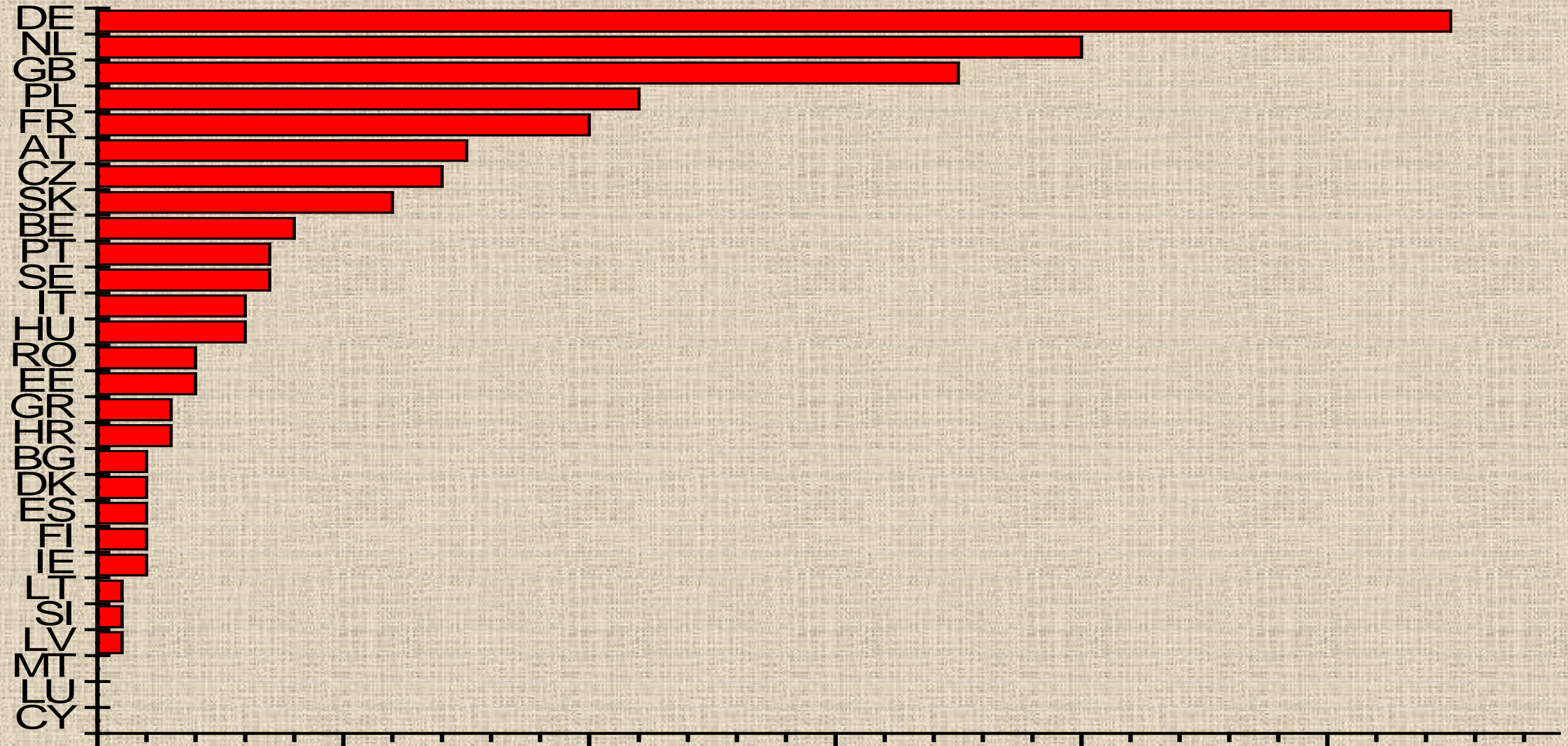
Eigenvector-centrality



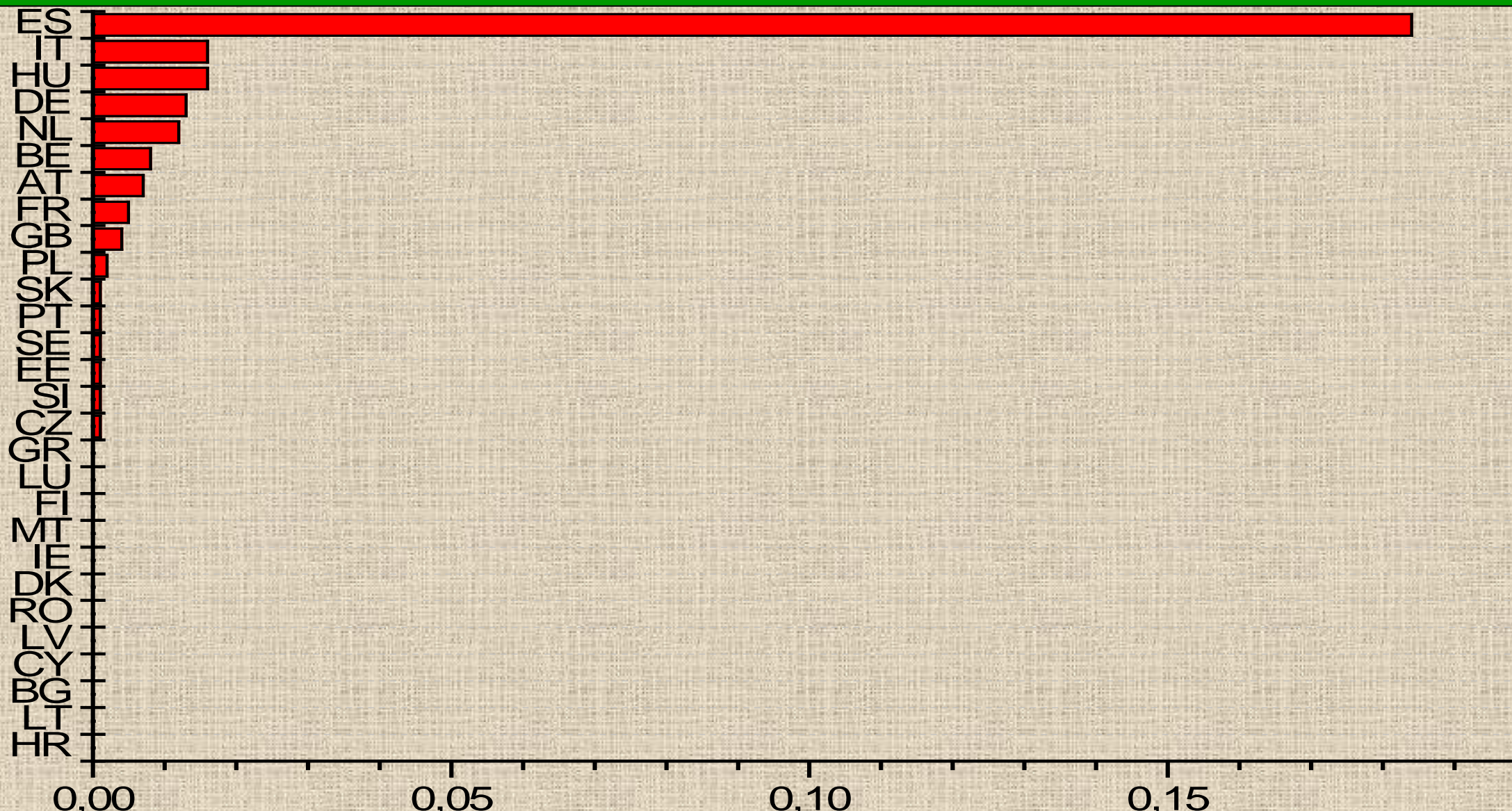
Betweenness centrality



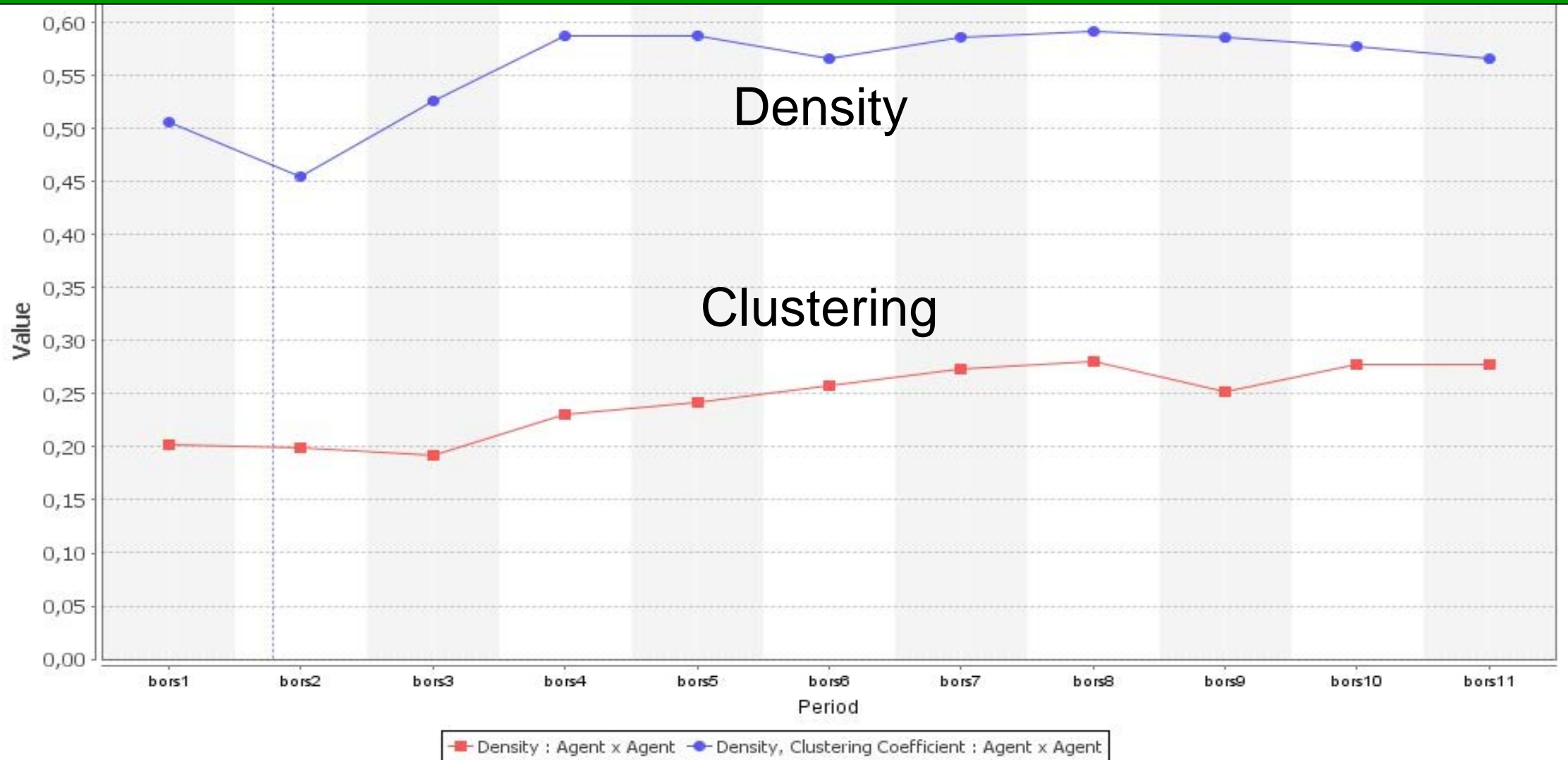
In-degree centrality

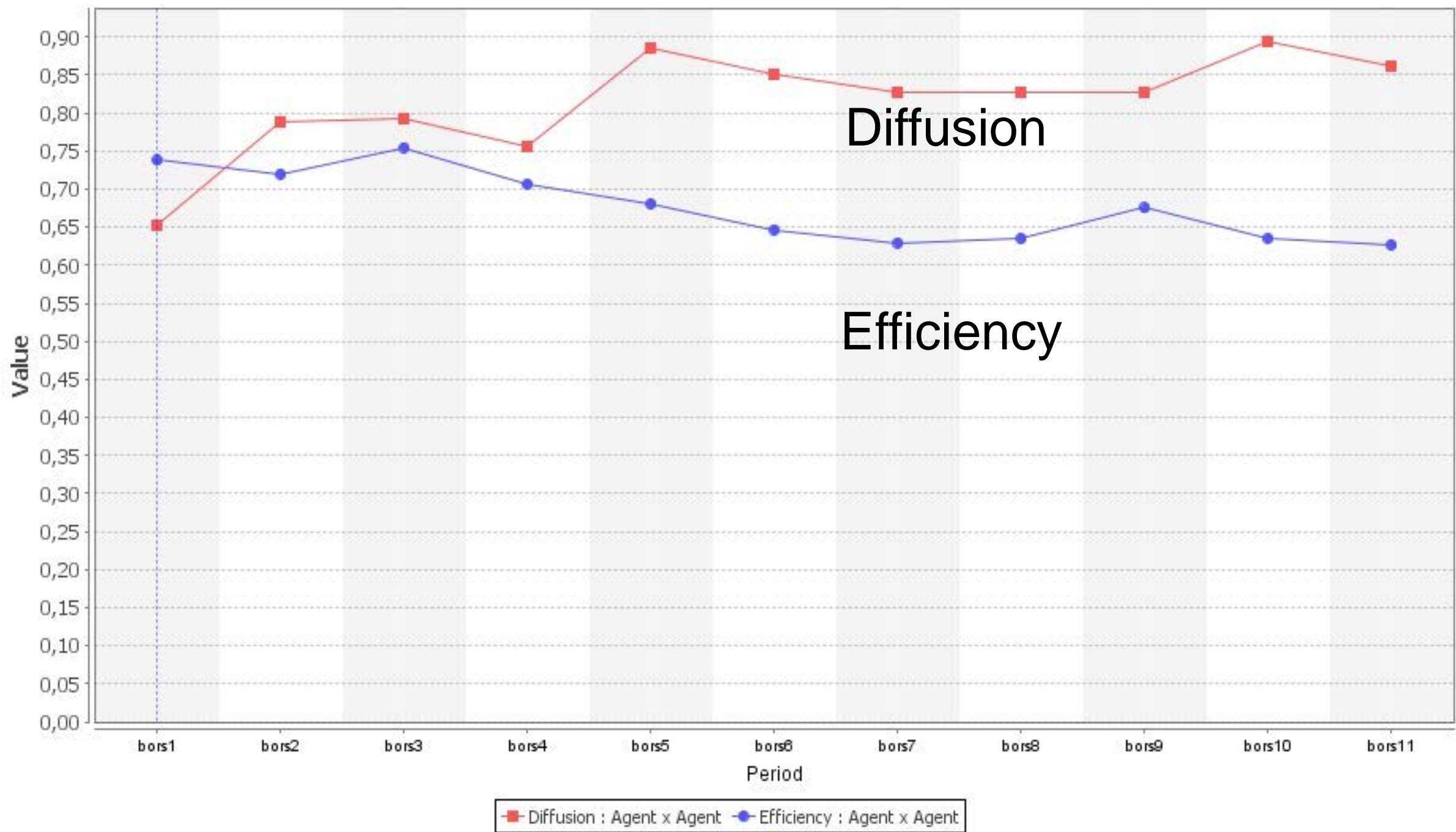


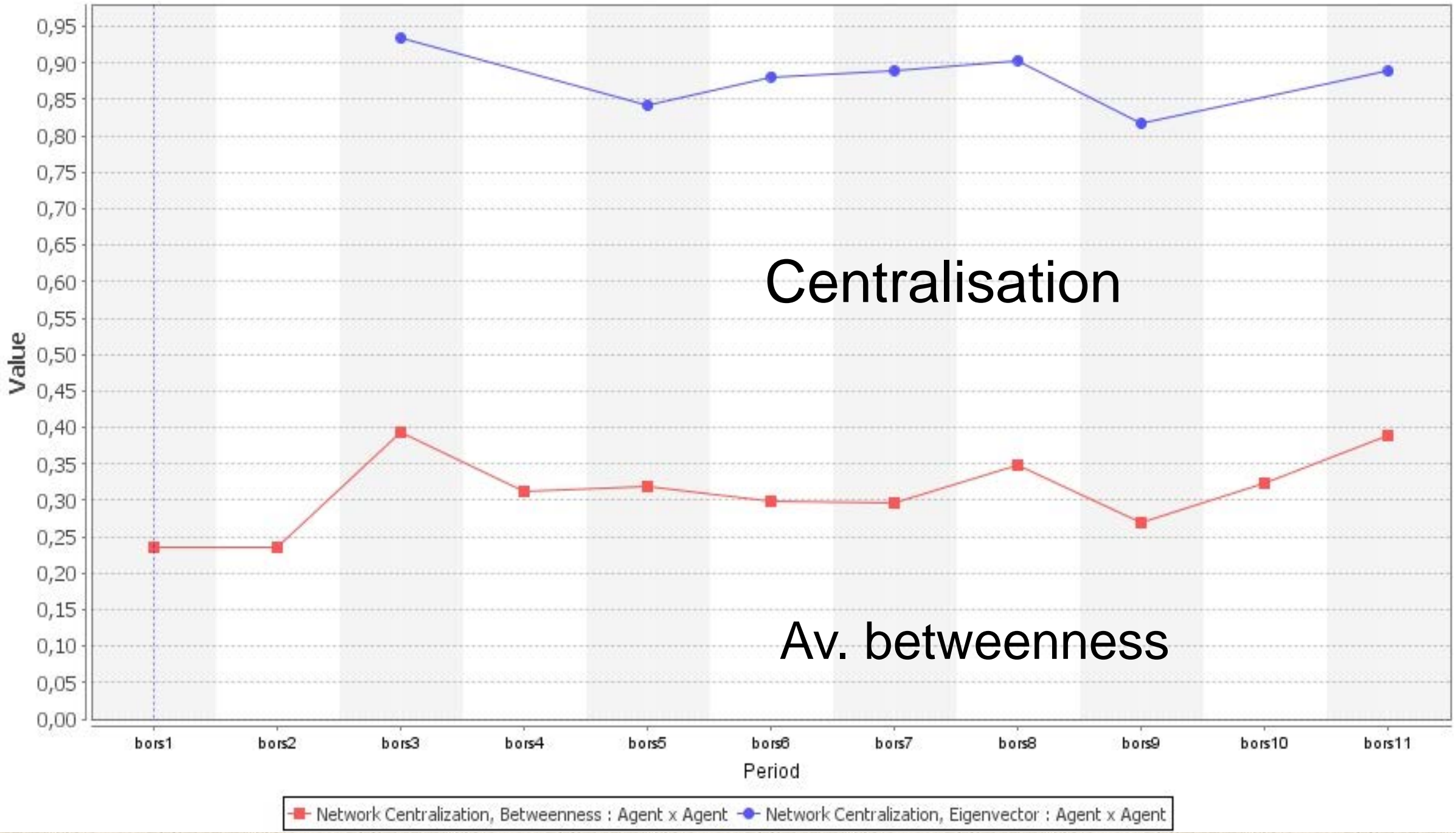
Out-degree centrality



Black pepper trade in EU(28)



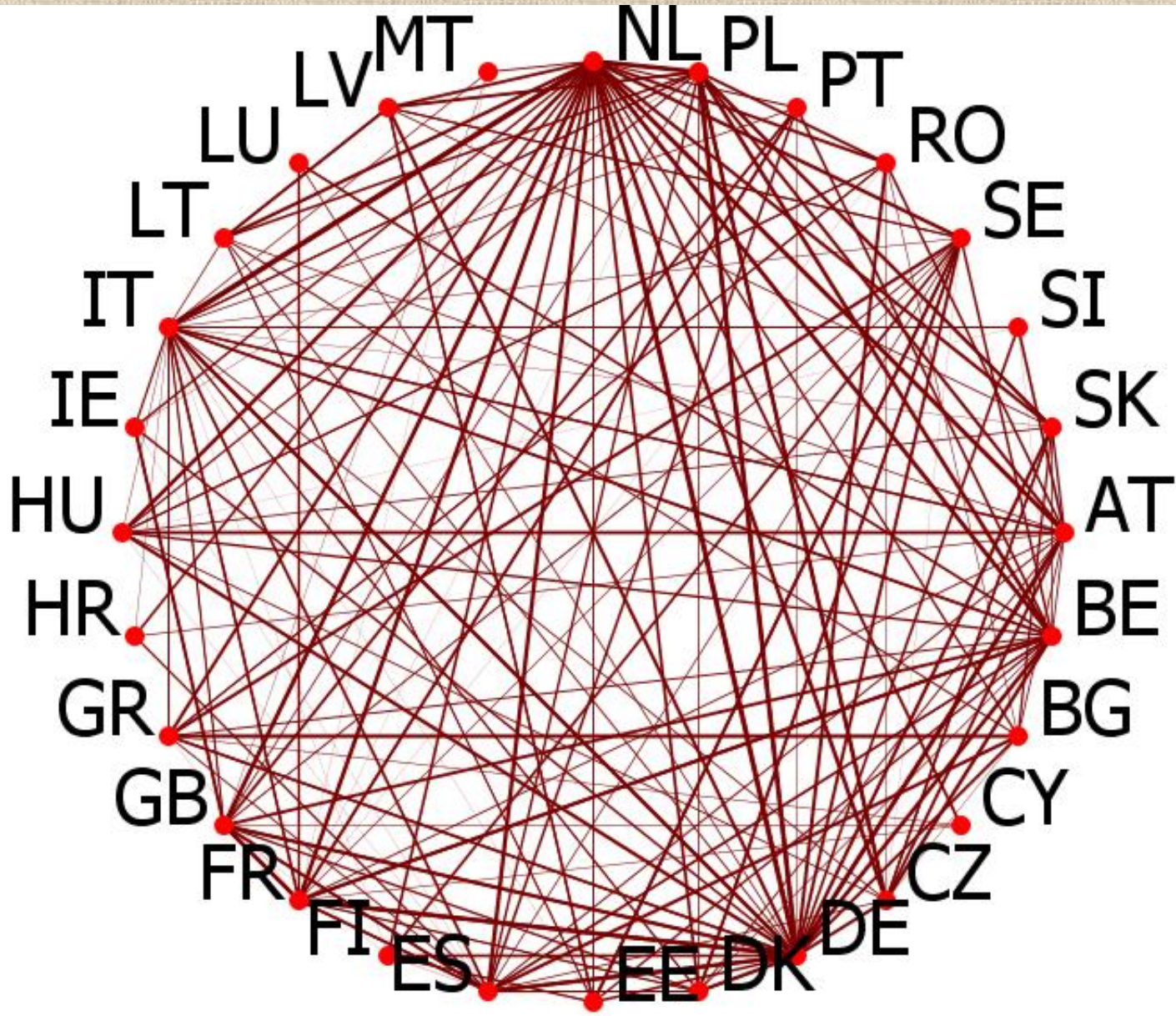




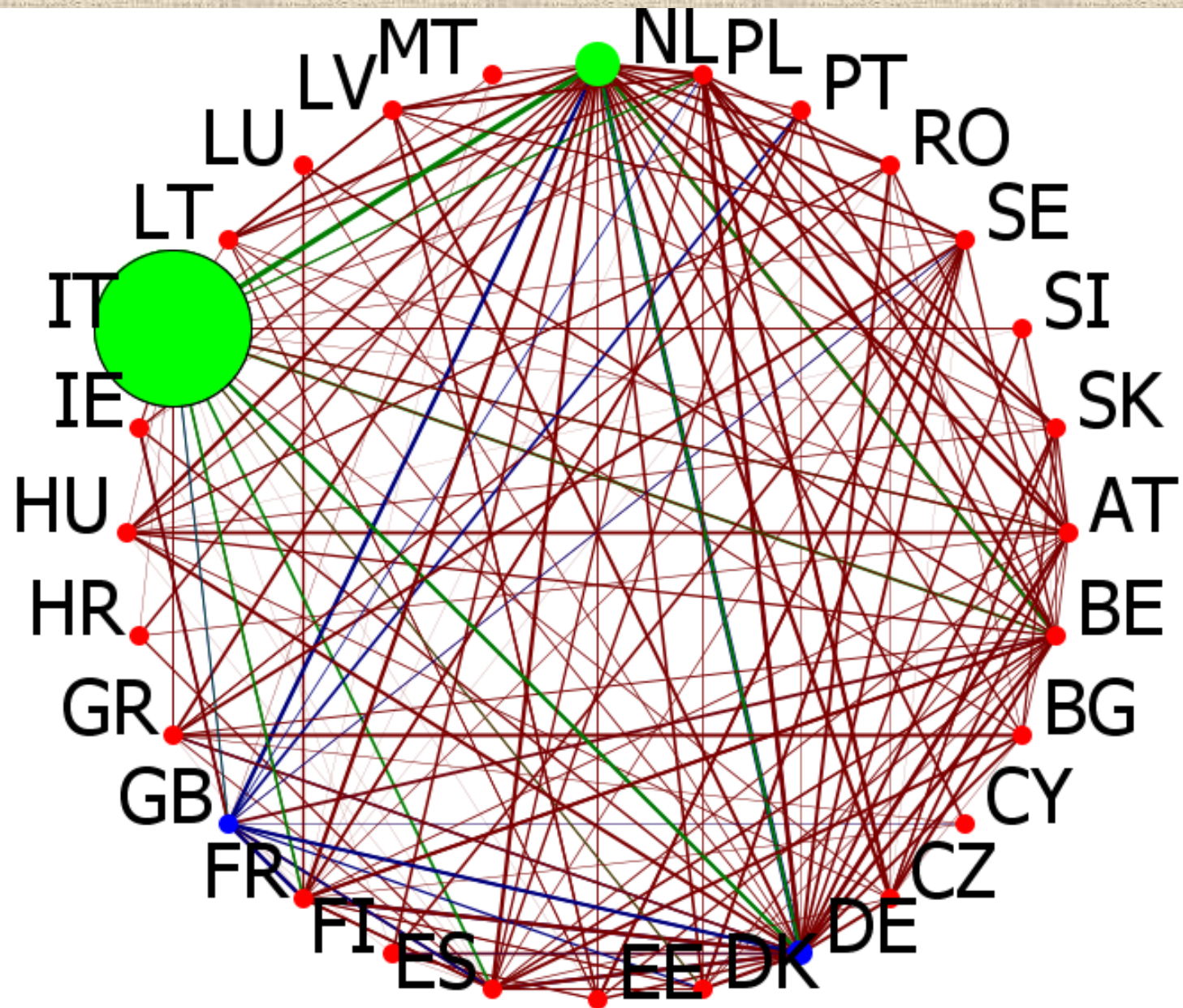
Centralisation

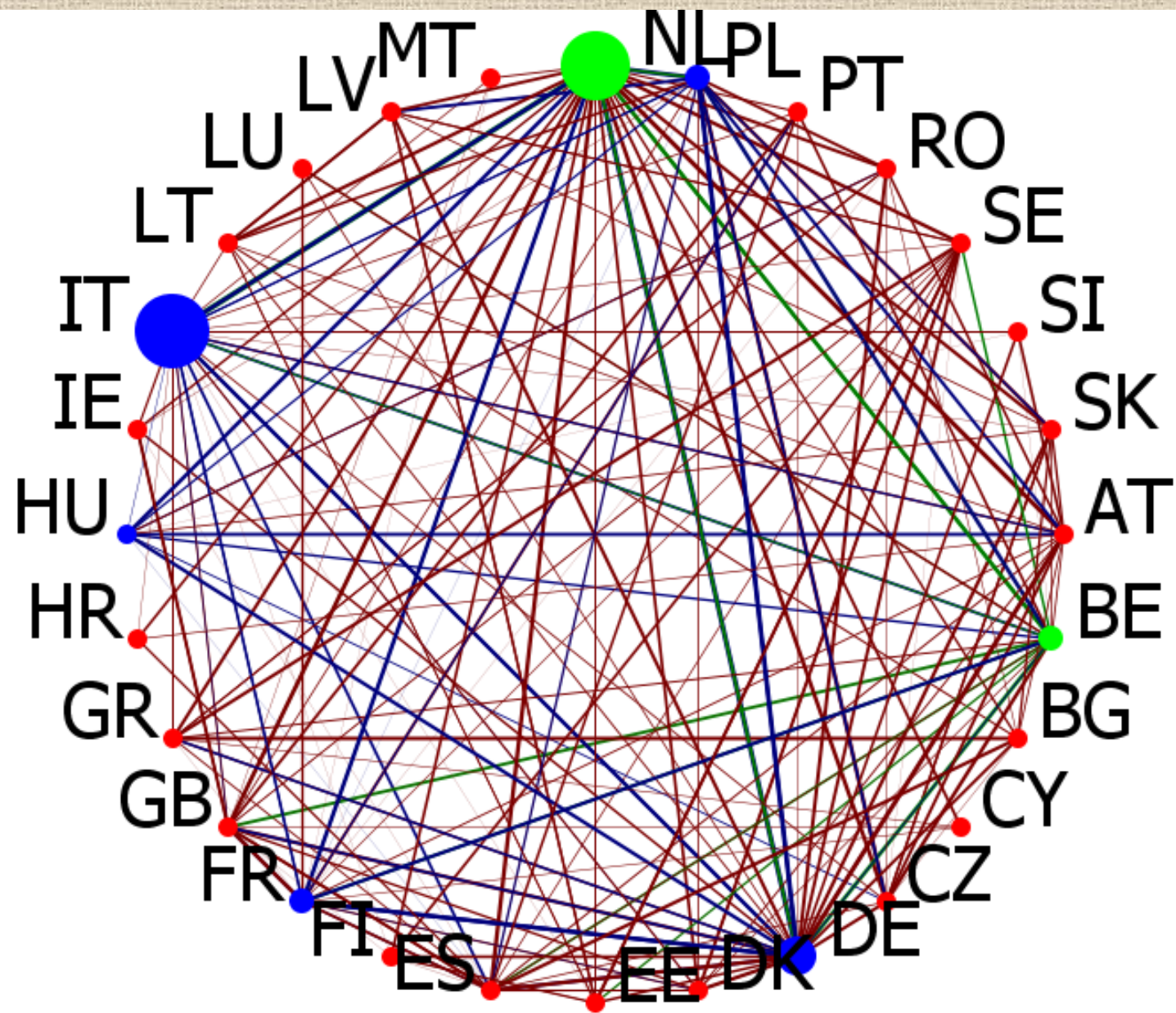
Av. betweenness

■ Network Centralization, Betweenness : Agent x Agent ● Network Centralization, Eigenvector : Agent x Agent



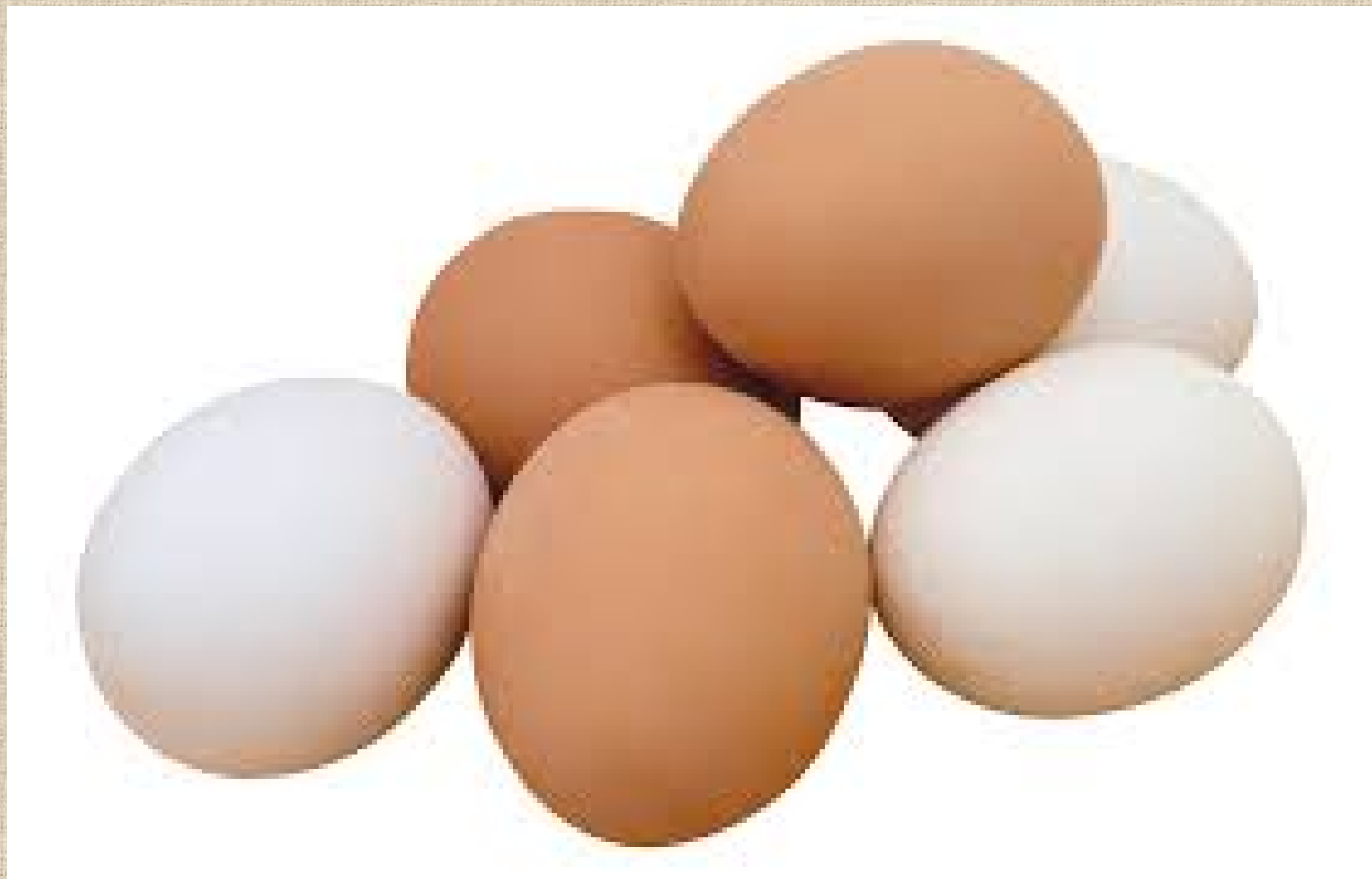
borsos





Take-home message

- There is no omnipotent centrality measure;
- Simulations are the most efficient way to determine the system-behaviour;
- The most vulnerable parts are the logistic centers





Policy implications

- Improvement of information sharing and collaboration;
- Harmonisation of different organisational cultures
 - -between institutions;
 - -between countries