

Interconnectedness and Networks

Financial Stability: Markets and Spillovers
Washington DC, November 29-30, 2018



BANCO DE MÉXICO
DGEF

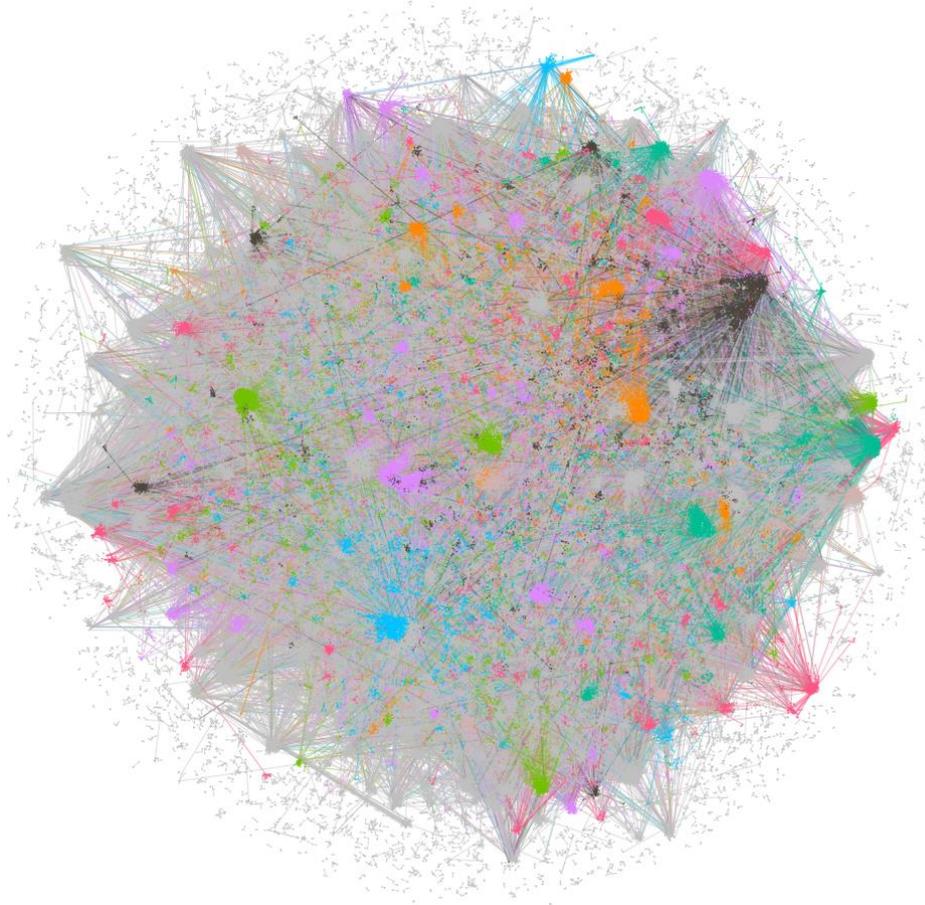
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Payment systems information

(joint work with Fabrizio López-Gallo and Luis Escobar-Farfán)

- SPEI (Sistema de Pagos Electrónicos Interbancarios®) is run by Banco de México

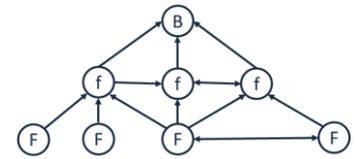
	August 2017	September 2017	October 2017
• No. of transactions:	42,207,091	42,473,998	40,172,877
• Amount (millions pesos):	22,005,722	21,881,177	22,509,386



- 105.2K nodes & 182.8K links
- links > 100K MXP
- Weakly connected components of size 2 removed.
- Node color according to Gephi modularity test

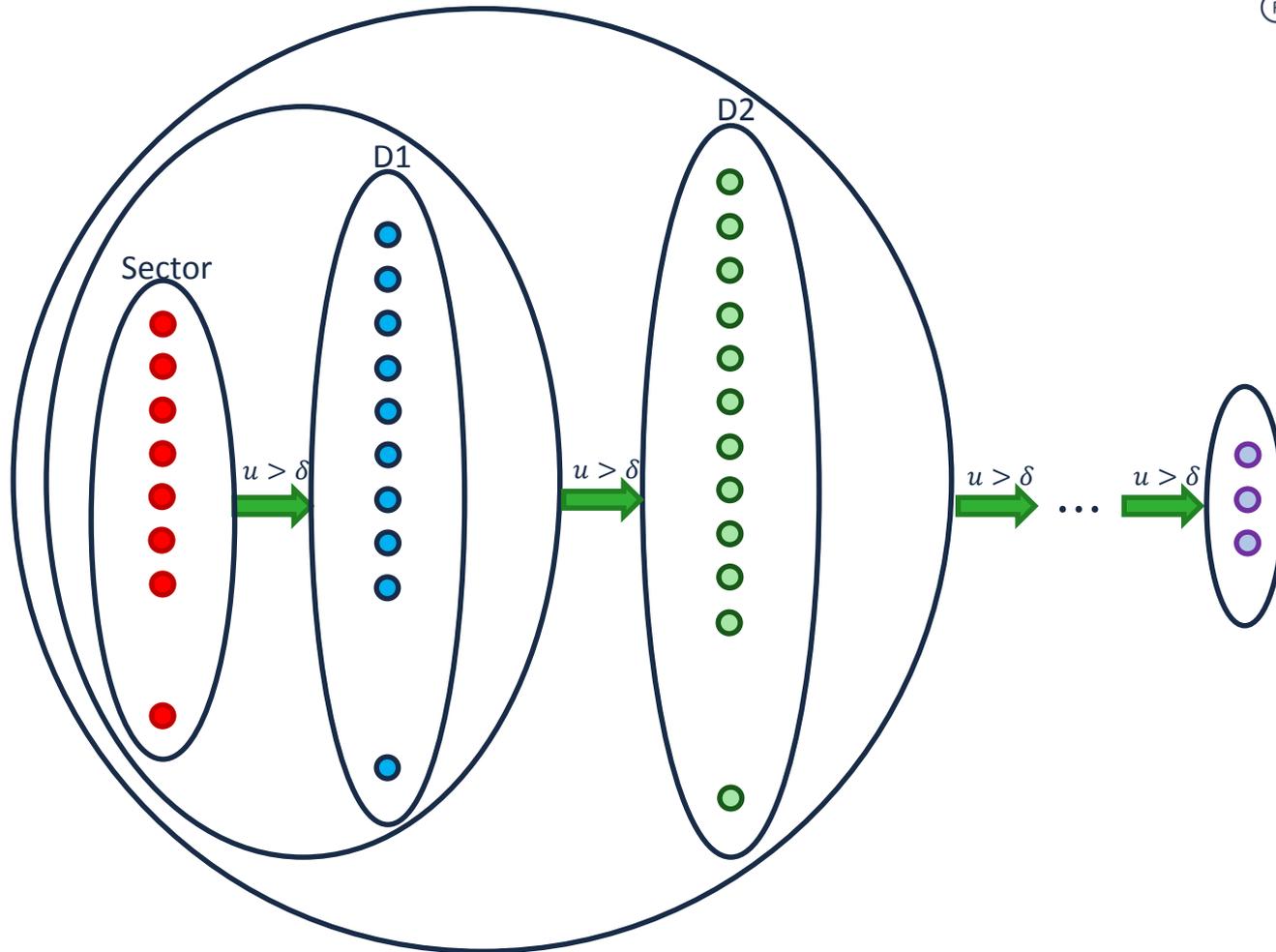
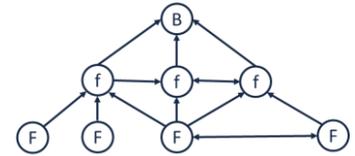
What can be done with the firms' payments data?

- Total inflows and outflows of cash in the payment system can be used as a proxy for income and expenses for firms (including other financial institutions) and natural persons. We will focus on firms.
- We can obtain the total amount sent/received between any pair of firms/financial institutions.
- In order to be able to assess the impact on the financial system, we also need the amount of money borrowed by a firm i from a bank k , and the payment due from i to k at each time t , which can be found on regulatory reports.
- The same can be done to obtain aggregated amounts for whole economic sectors.
- If the relation between any pair of firms is persistent in time, the network structure matters and can potentiate the contagion process, causing indirect effects (spillovers).

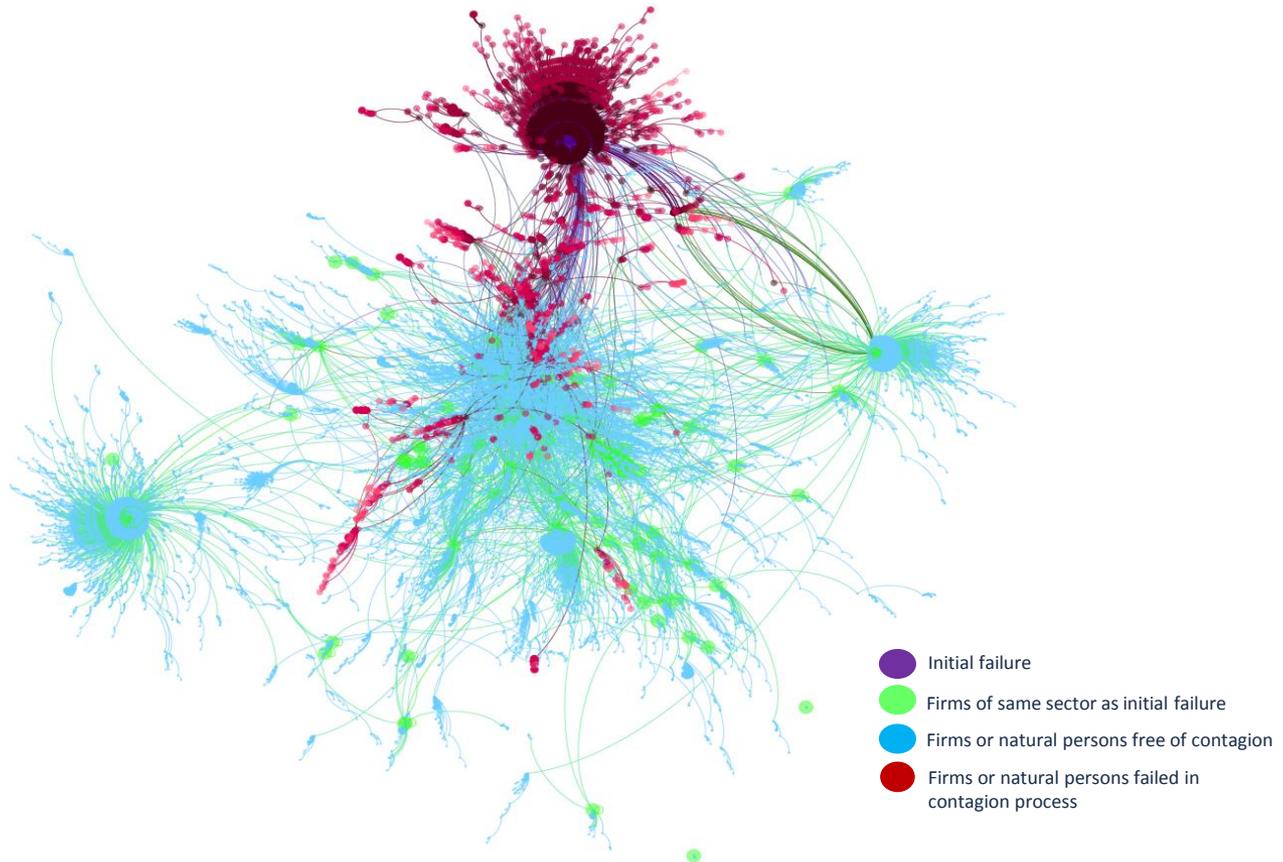
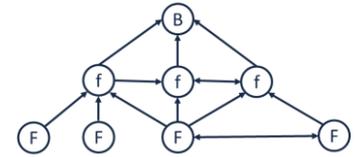


- The network is built by using all the payments performed during June 2017
- 87 manufacturers
- 6,934 incoming links (one link resumes several payments during a month) to such manufacturers, from immediate neighbors.
- 14,807 outgoing links from manufacturers to other entities
- 653,162 incoming links from neighbors of distance 2 to neighbors of distance 1
- 1,701,188 outgoing links from immediate outgoing neighbors to neighbors of distance 2

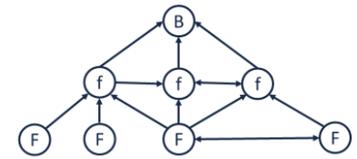
Example 1: A sector's network



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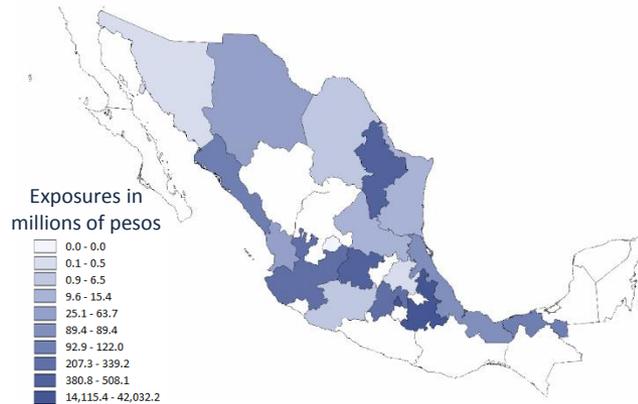


Example 1: A sector's network

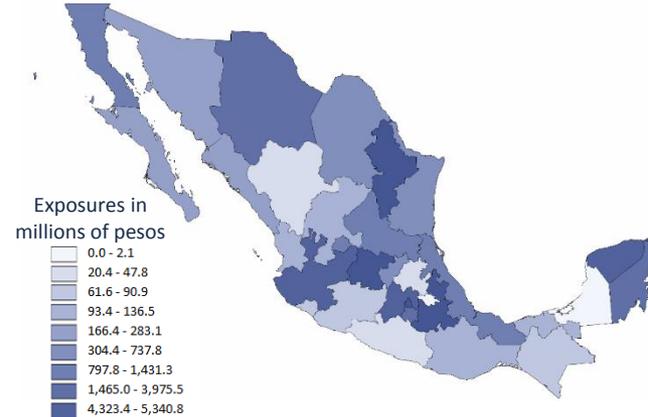


Manufacturers suppliers

Exposure to final manufacturers:
Dec 2016

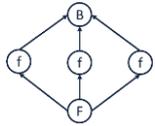


Exposure to suppliers of final
manufacturers : Dec 2016



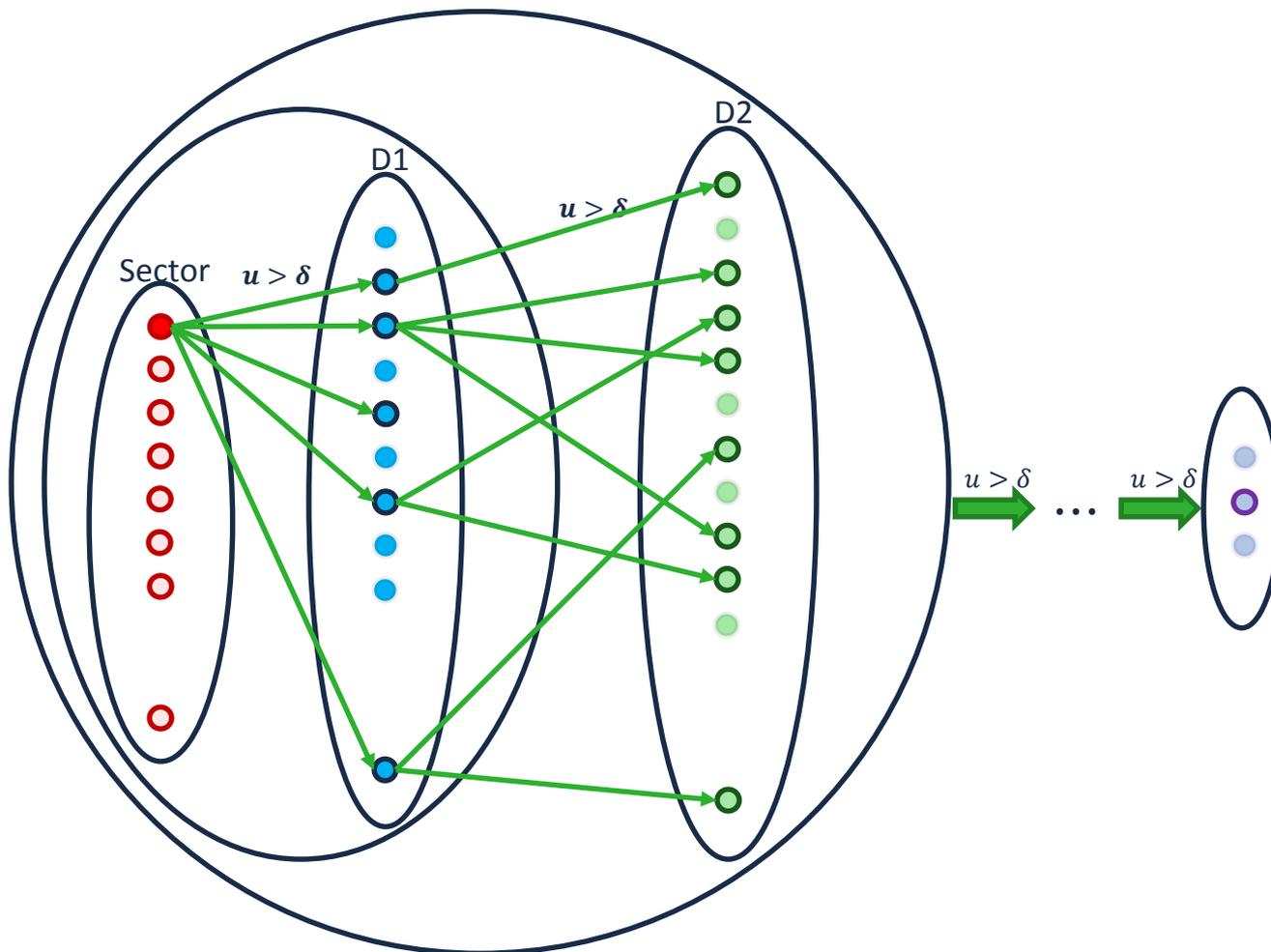
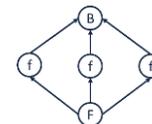
Source: Banco de Mexico's computation with CNBV data
Information as of December 2016

Example 2: A large borrower and its network

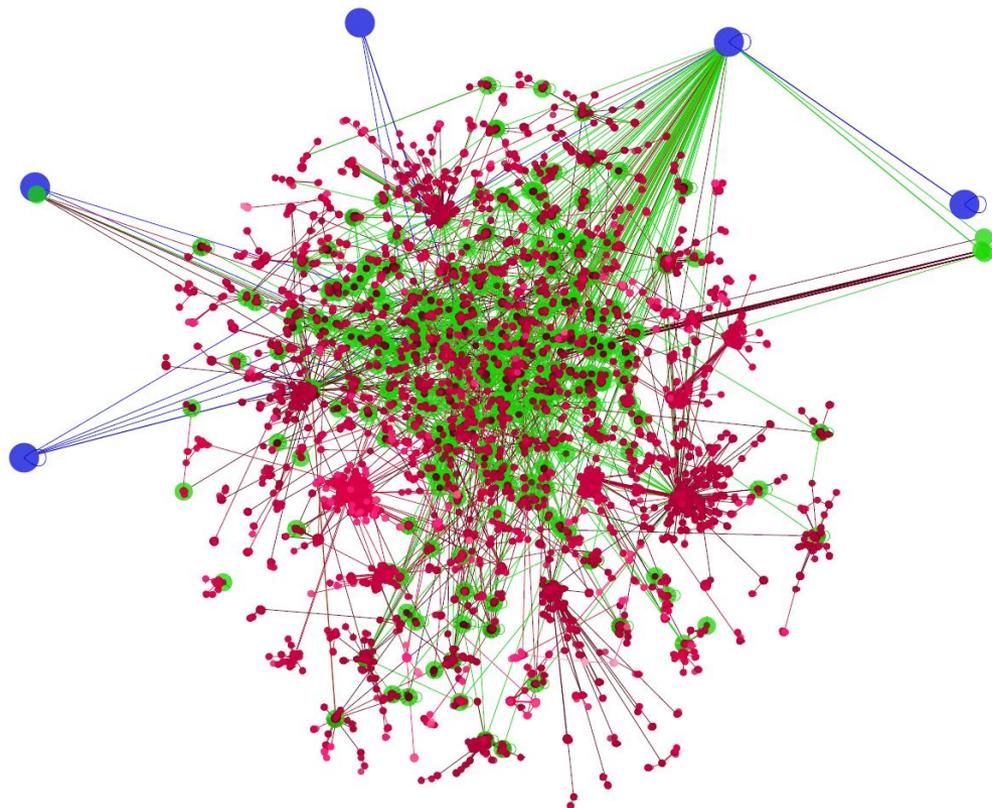
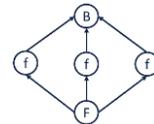


- In addition to the direct exposure of borrower's to Banks, its chain of suppliers could also be considered part of the exposure network beyond first round effects considering both direct suppliers as well as suppliers' suppliers.
- Using a combination of regulatory reports, accounting information and payments data it was possible to identify firms likely to be part of the *supply chain*
 - Remark: some assumptions were made and there is room for improvement.
- Firms that have a bank credit and that received transfers larger than 30% of their total bank debt were considered part of the supply chain.
- Some statistics:
 - **Direct suppliers:** X number of firms, and look for the ones which also have a bank credit.
 - **Supply chain, second order:** firms which received payments greater than 30% of their bank credits.
 - **Overall,** firms receiving payments (whatever amount) from first order suppliers were and look to the ones which had bank credit.

Example 2: A large borrower and its network

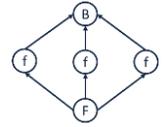


Example 2: A large borrower and its network

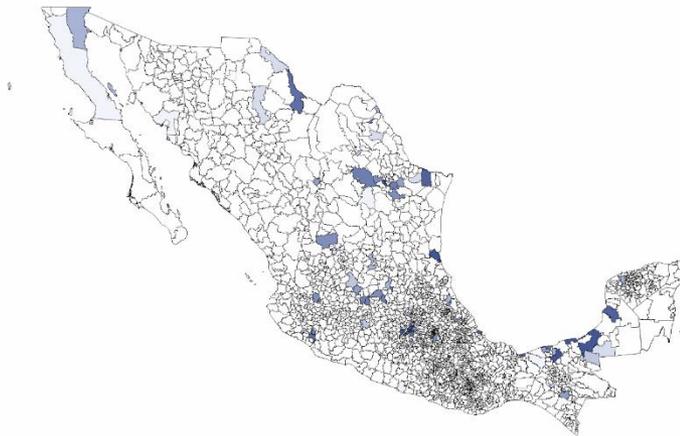


- Large borrowers
- Direct suppliers
- Firms or natural persons failed in contagion process

Example 2: A large borrower and its network

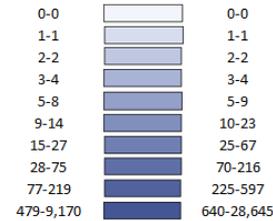
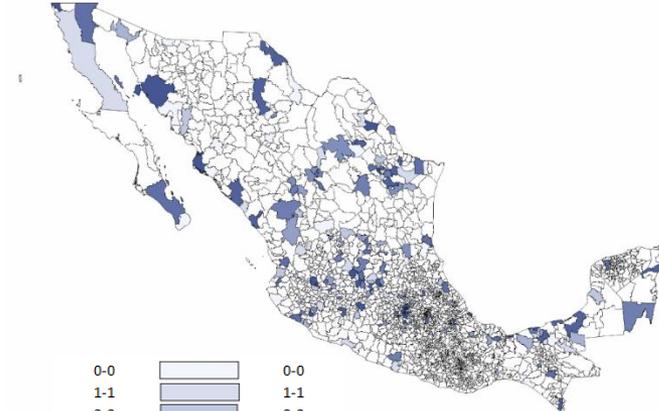


Bank exposure to direct suppliers



Source: Banco de Mexico's computation with CNBV data
Information as of June 2016

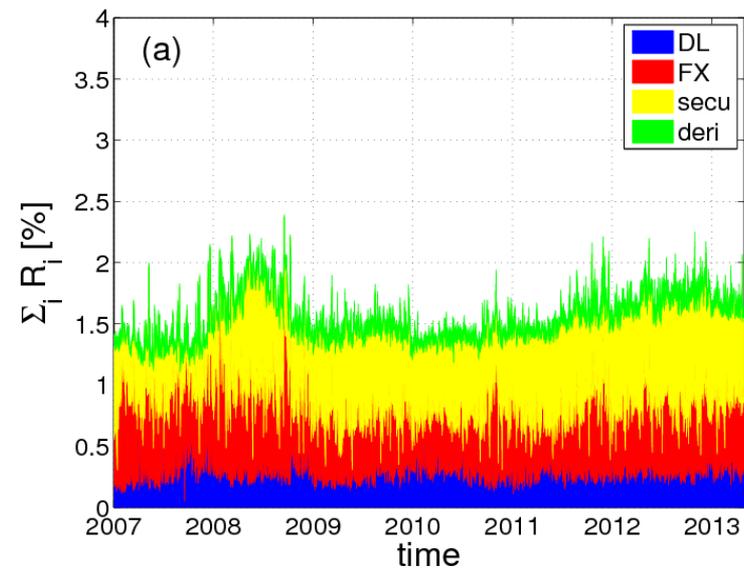
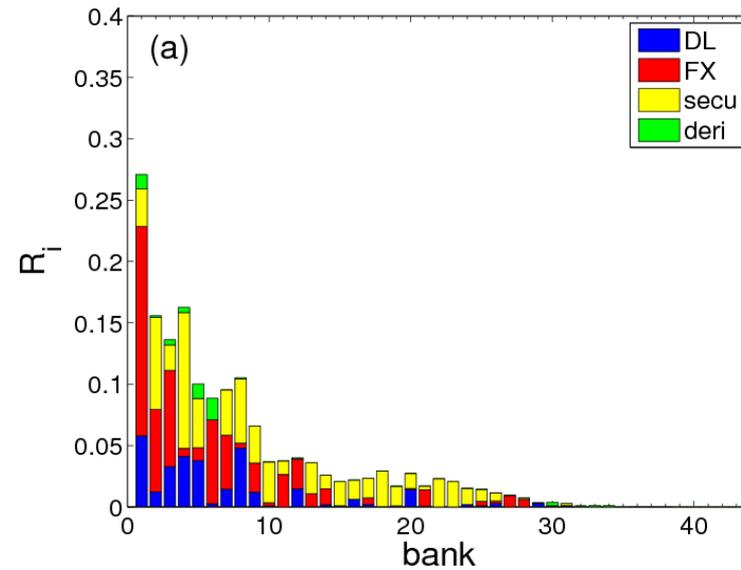
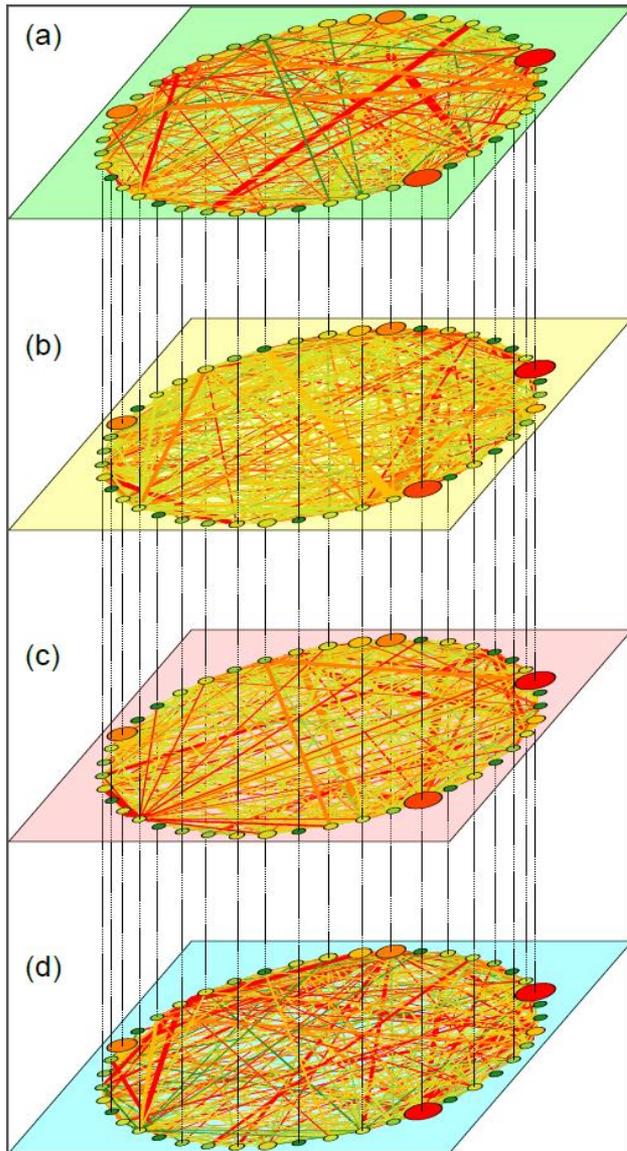
Bank exposure to suppliers' suppliers



Exposure in millions of pesos

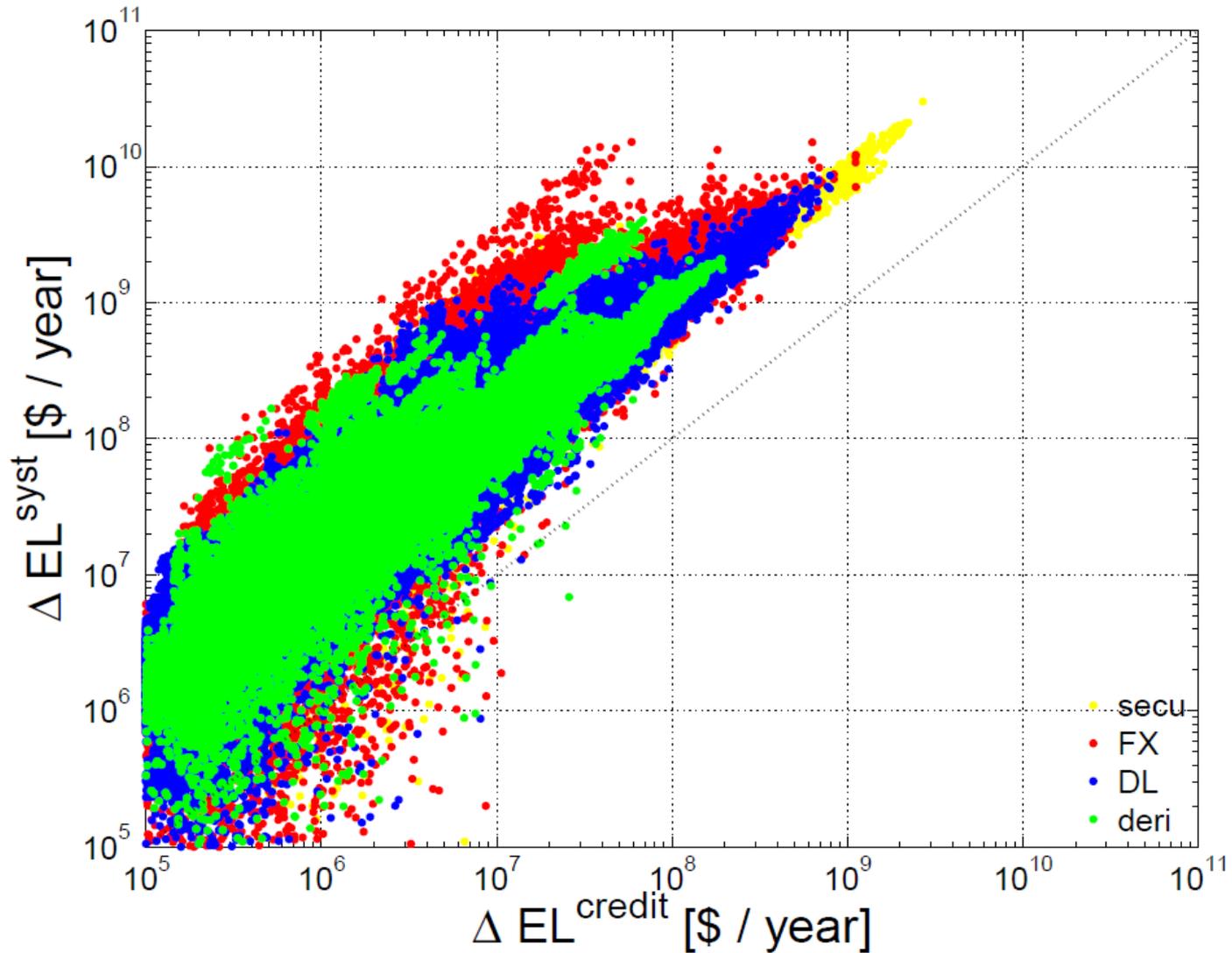
The banking system as a multiplex network

(joint work with Sebastian Poledna, Jose Luis Molina, Stefan Thurner and Marco van der Leij)



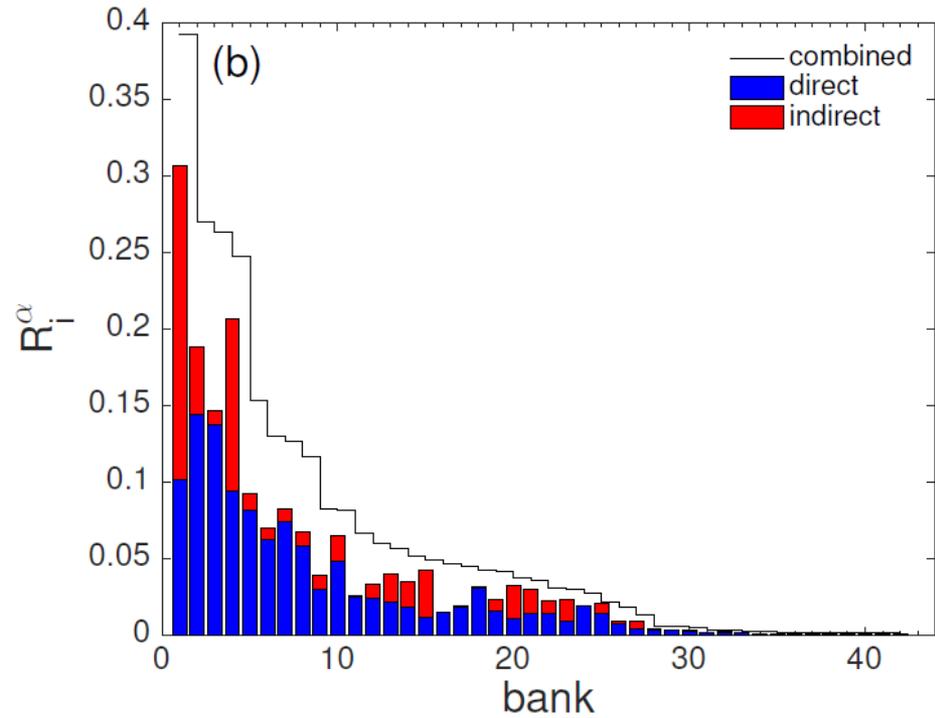
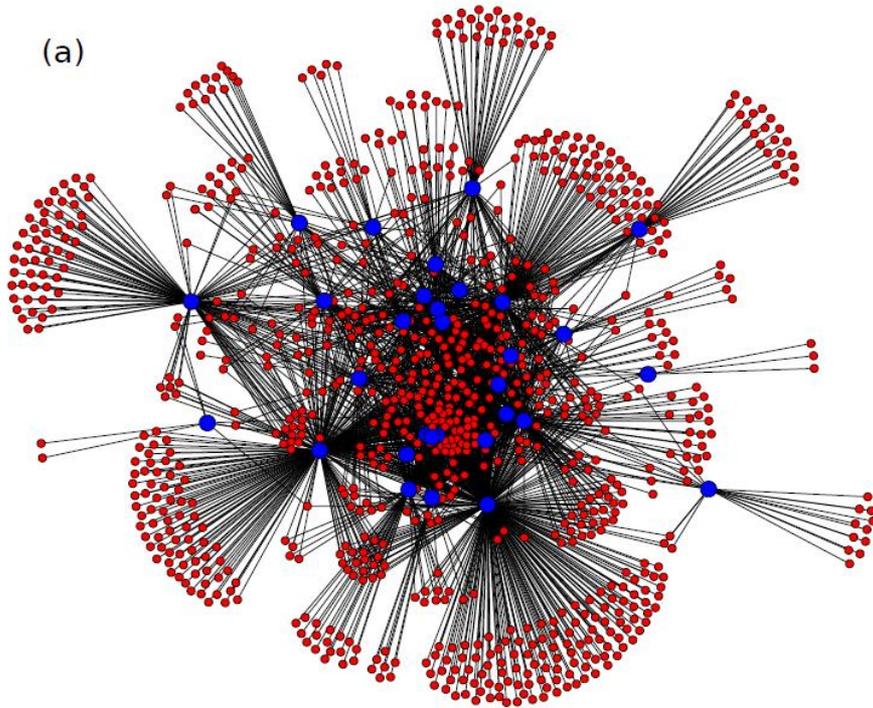
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Overlapping portfolios

(joint work with Stefan Thurner, Sebastian Poledna and Fabio Caccioli)



Overlap of Banks' largest clients (January 2018)

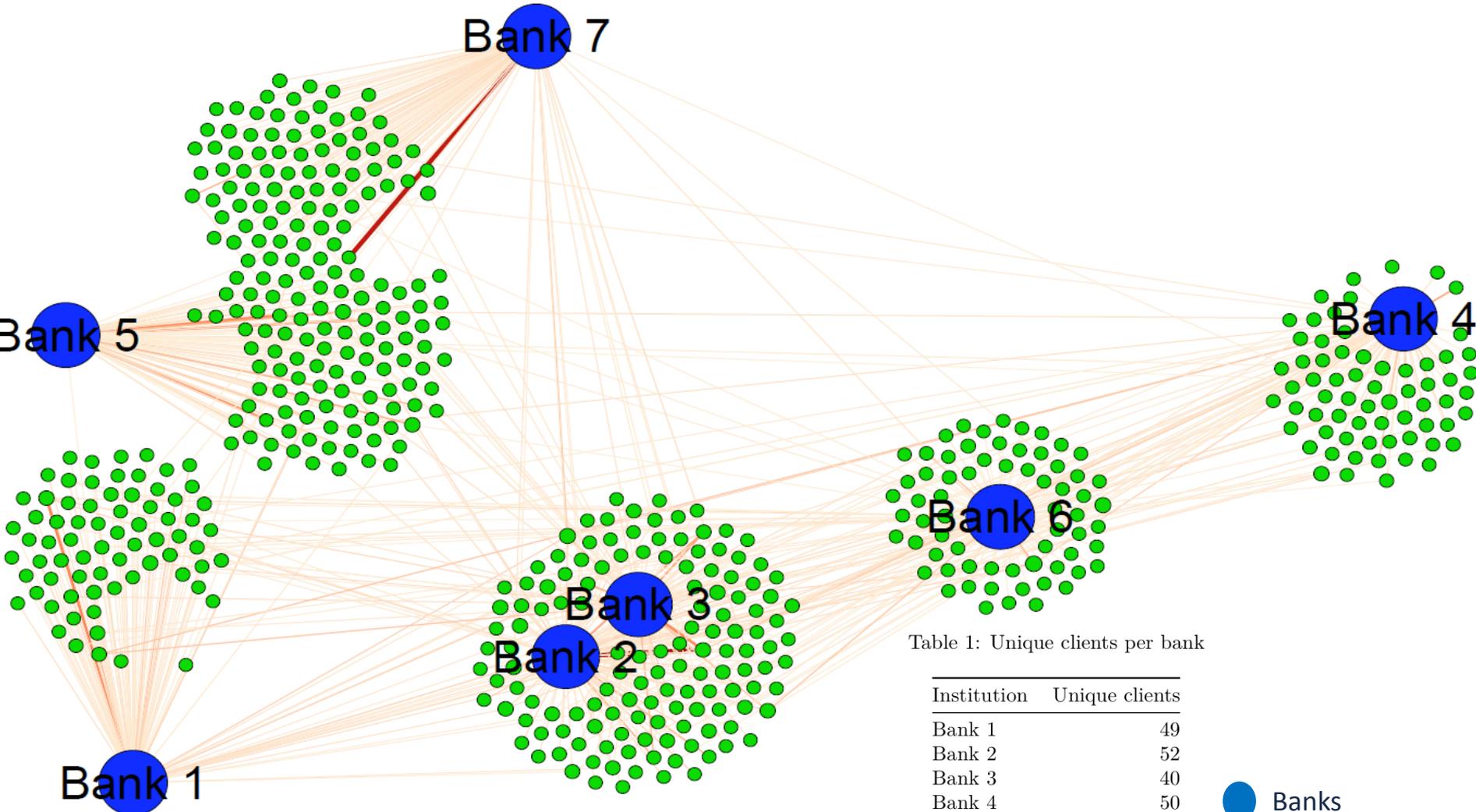


Table 1: Unique clients per bank

Institution	Unique clients
Bank 1	49
Bank 2	52
Bank 3	40
Bank 4	50
Bank 5	88
Bank 6	57
Bank 7	71

- Banks
- Banks' clients



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