

Uncovering Offshore Finance using Network Science



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CORPNET

- **CORPNET** — Corporate Network Governance: Power, Ownership and Control in Contemporary Global Capitalism
- *What are the features, origins and power political consequences of corporate governance networks in modern economic life?*
 - Nature: map and analyze the network
 - Origins: uncover generating mechanisms
 - Power: understand how it operates
- Work with amongst others Javier Garcia-Bernardo, Jan Fichtner & Eelke Heemskerck <https://corpnet.uva.nl>



Network science

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- **Networks** are the central model of computation
- Branch of data science focusing on network data
- Method in complexity research
- Complex systems approach: the behavior emerging from the network reveals patterns not visible when studying the individuals

Corporate networks

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 - Loans
 - Ownership
 - **Board interlocks**

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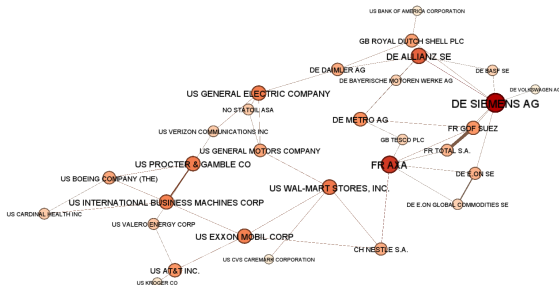


Figure: Board interlock network of 30 firms

Board interlocks

- **Causes** of interlocks:
 - Collusion
 - Cooptation and monitoring
 - Legitimacy
 - Career advancement
 - Social cohesion
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 - Corporate control
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M. Mizruchi, What do interlocks do? An analysis, critique, and assessment of research on interlocking directorates, *Annual review of Sociology* 22: 271–298, 1996.

Corporations



Board interlock network



F.W. Takes and E.M. Heemskerck, Centrality in the Global Network of Corporate Control, *Social Network Analysis and Mining* 6(1): 1-18, 2016.

Community detection

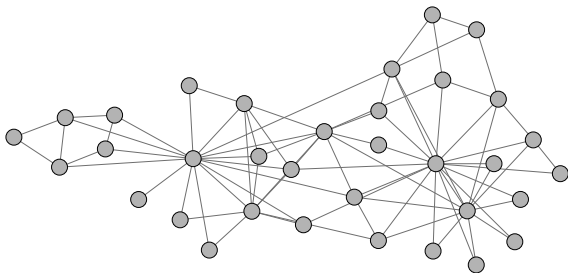


Figure: What communities are visible in this network?

Community detection

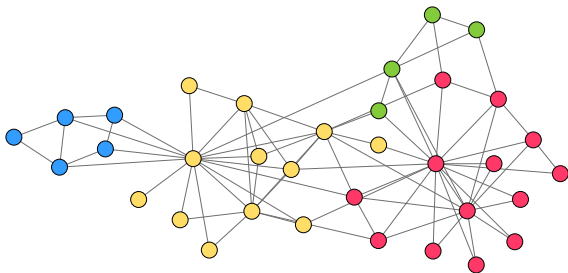
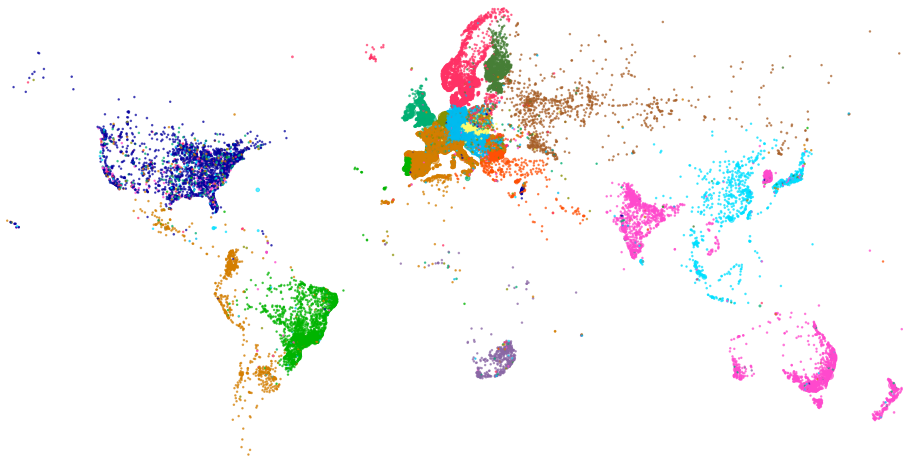


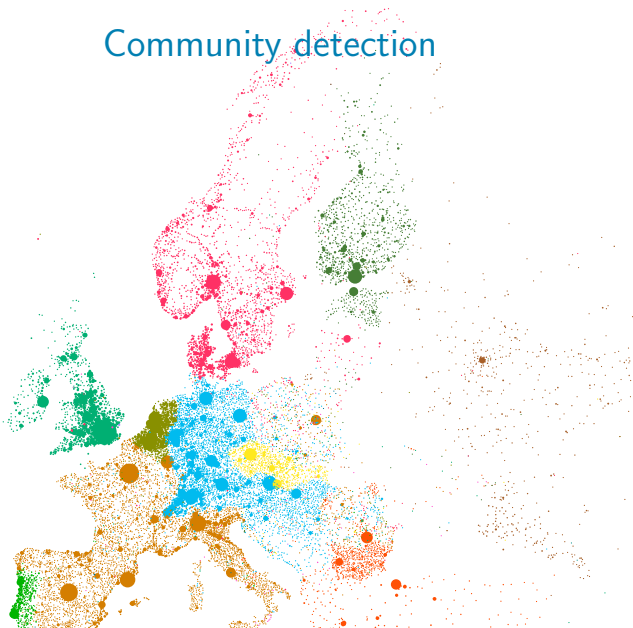
Figure: Communities: node subsets connected more strongly with each other

Community detection



E.M. Heemskerk and F.W. Takes, The Corporate Elite Community Structure of Global Capitalism, *New Political Economy* 21(1): 90-118, 2016.

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E.M. Heemskerk, F.W. Takes, J. Garcia-Bernardo and M.J. Huijzer, Where is the global corporate elite? A large-scale network study of local and nonlocal interlocking directorates, *Sociologica* 2016(2): 1-31, 2016.

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Data

- Orbis database by Bureau van Dijk
- Based on data at different Chambers of Commerce
- Around 60 million firms with financial data
- 71 million ownership links between firms
- 100 million positions of directors at firms
- Better coverage for high-income countries
- The best global corporate database in the world

Global Networks of Offshore Finance

J. Garcia-Bernardo, J. Fichtner, F.W. Takes and E.M. Heemskerk,
Uncovering Offshore Financial Centers: Conduits and Sinks in the Global
Corporate Ownership Network, *Scientific Reports* 7, article 6246, 2017.
<https://www.nature.com/articles/s41598-017-06322-9>

Offshore financial centers

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 - Unnecessary system complexity
 - Accountability
 - Tax avoidance





PHOTO: GETTY IMAGES

Characterizing OFCs

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- Solution: **Networks!**

Ownership network

- Ownership network
- Nodes are firms
 - Have value associated to them
 - Are based in a particular country
- Directed links indicate ownership relation / value flow
 - Have an associated weight in $[0; 1]$
- $w(i, j) = 0.7, R_i = 4000$ gives:

$$N = (V, E)$$

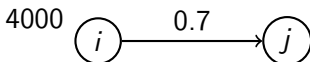
$$i \in V$$

$$R_i$$

$$\phi(i)$$

$$(i, j) \in E$$

$$w(i, j)$$



Ownership paths and value

- Ownership path

$$p = (v_1, v_2, \dots, v_\ell) \text{ with } (v_i, v_{i+1}) \in E \text{ for } 1 \leq i < \ell$$

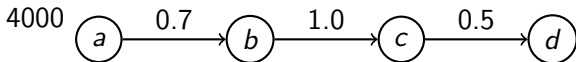
- Multiplicative ownership

$$w_p = \prod_{i=1}^{\ell-1} w(v_i, v_{i+1})$$

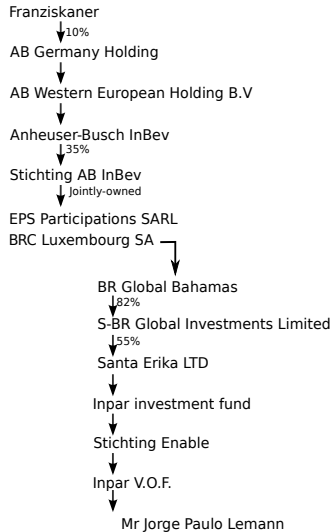
- Path value

$$V_p = R_{v_1} \cdot w_p$$

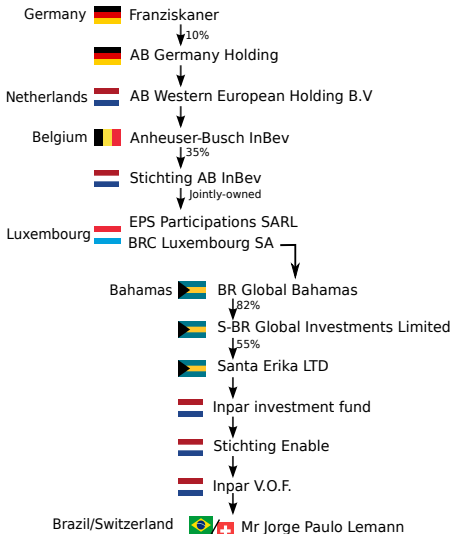
- $p = (a, b, c, d)$ and $w_p = 0.35$ and $V_p = 1400$



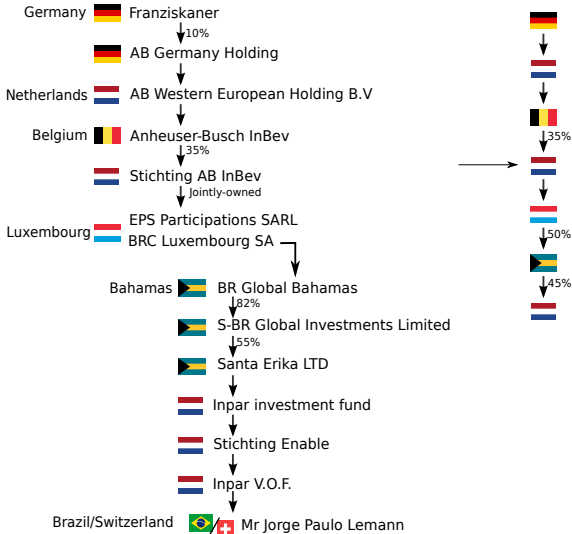
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Sink countries

- A country is a **sink** if less value leaves the country than enters the country, normalized by GDP.

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ISO	Country name	C_S	ISO	Country name	C_S	ISO	Country name	C_S
VG	British Virgin Islands	5235	MH	Marshall Islands	100	BZ	Belize	38
TW	Taiwan	2278	MT	Malta	100	GI	Gibraltar	34
JE	Jersey	397	MU	Mauritius	75	AI	Anguilla	27
BM	Bermuda	374	LU	Luxembourg	71	LR	Liberia	17
KY	Cayman Islands	331	NR	Nauru	67	VC	St. Vincent & Gran.	14
WS	Samoa	277	CY	Cyprus	62	GY	Guyana	14
LI	Lichtenstein	225	SC	Seychelles	60	HK	Hong Kong	14
CW	Curacao	115	BS	Bahamas	40	MC	Monaco	11

Table: List of sink-OFCs, ordered by sink centrality value C_S .

Conduits

- The extent to which a country is a conduit **conduit** is measured by the value flowing from any country, into conduit c , out to a sink-OFC, normalized by GDP.

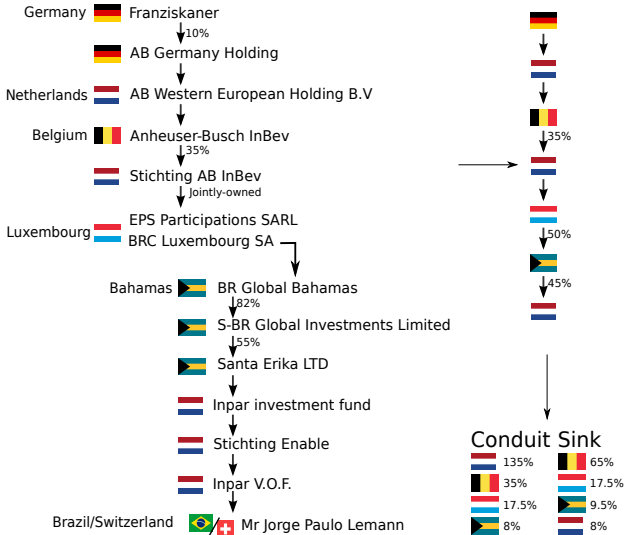
Conduits

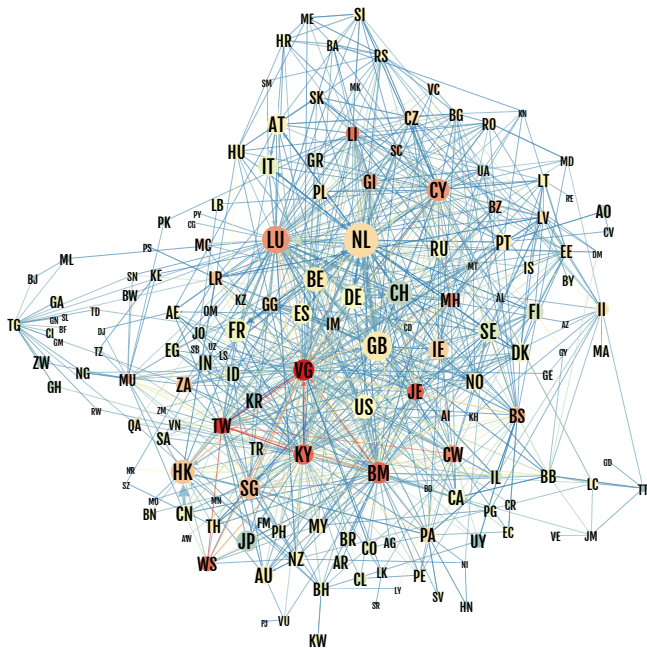
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ISO	Country name	Non-normalized $C_{c_{out}}$	Non-normalized $C_{c_{in}}$	$C_{c_{out}}$	$C_{c_{in}}$
NL	The Netherlands	$7.4 \cdot 10^{11}$	$3.8 \cdot 10^{11}$	18.6	22.5
GB	United Kingdom	$3.8 \cdot 10^{11}$	$1.3 \cdot 10^{11}$	3.1	2.4
CH	Switzerland	$2.2 \cdot 10^{11}$	$2.7 \cdot 10^{10}$	6.9	2.0
SG	Singapore	$7.2 \cdot 10^{10}$	$2.2 \cdot 10^{10}$	5.1	3.8
IE	Ireland	$6.4 \cdot 10^{10}$	$3.3 \cdot 10^{10}$	5.9	7.2

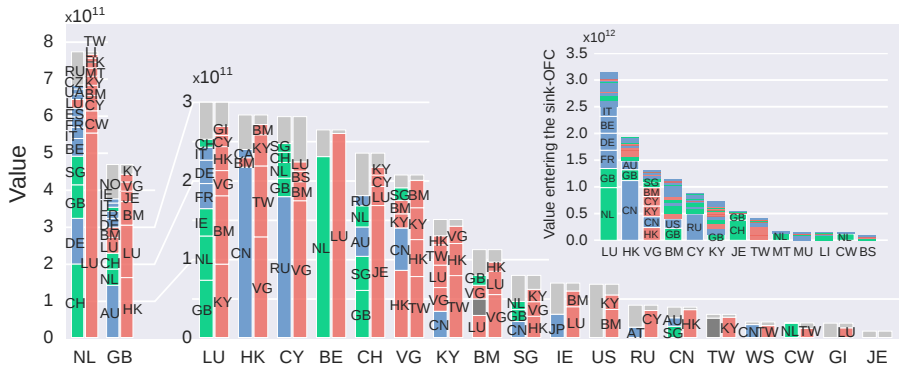
Table: List of conduit-OFCs, ordered by non-normalized $C_{c_{out}}$.

Country chains

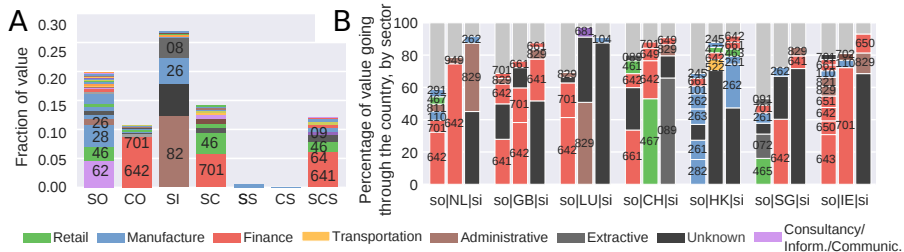




Conduit country specialization



Conduit sector specialization



Findings

- The Netherlands is the conduit between European companies and Luxembourg
- Hong Kong (for China) and Luxembourg (for EU countries) serve as the main countries in the route to typical tax havens
- The United Kingdom is the conduit between European countries and former members of the British Empire, such as Hong Kong, Jersey, Guernsey and Bermuda
- Cyprus is the conduit for Russian firms
- Ireland is prominent in financial leasing and head offices
- Luxembourg specializes in support activities
- Hong Kong and Switzerland are dominant in financial intermediation and derivatives dealing

Conclusions

- **Corporate networks** explicitly and implicitly contain rich information on corporations and jurisdictions
- Offshore financial centers (OFCs) come in two flavors: **conduits** and **sinks**
- OFCs can be detected using **corporate ownership chains**
- Conduits are highly **specialized** in serving particular countries and industrial sectors

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- Offshore financial centers (OFCs) come in two flavors: **conduits** and **sinks**
- OFCs can be detected using **corporate ownership chains**
- Conduits are highly **specialized** in serving particular countries and industrial sectors
- The Netherlands is the largest value conduit in the world



eScience Pathfinder project

- Network dynamics at scale
- Network community division dynamics
- Research engineers
 - Dafne van Kuppevelt
 - Laurens Bogaardt



Thank you!

Thank you!

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- E.M. Heemskerk, K. Young, F.W. Takes, B. Cronin, J. Garcia-Bernardo, V. Popov, W.K. Winecoff, L.F. Henriksen, and A. Laurin-Lamonthe, The promise and perils of using big data in the study of corporate networks: Problems, diagnostics and fixes, *Global Networks* 18(1): 3-22, 2018.
- E.M. Heemskerk and F.W. Takes, The Corporate Elite Community Structure of Global Capitalism, *New Political Economy* 21(1): 90-118, 2016.
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