GOVERNANCE ROBUSTNESS & RESILIENCE

TALK DELIVERED AT THE INTERNATIONAL INSTITUTE FOR APPLIED SYSTEMS ANALYSIS - IIASA, LAXENBURG, 12 DECEMBER 2017

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Theoretical background in
"**Governance Networks in Politics**" in
Hollstein, Matiaske & Schnapp (eds), 2017
Networked Governance, Springer

www.dimitriscc.wordpress.com

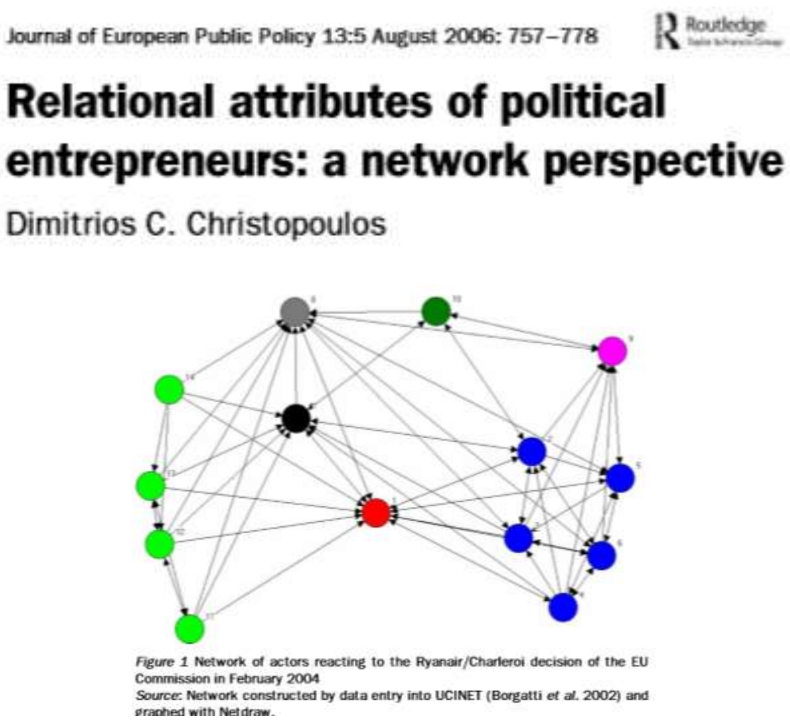
?

- Can we predict how a policy impacts a governance system?
  - Or framed in relational terms: is the probability of policy success/failure reflected in the structural properties of governance networks?

Governance process and outcomes can be associated to:

- The capacity of a political system to sustain predictable shocks – **structural core robustness**
- The capacity of a political system to sustain low probability shocks – **contingency robustness & integrity resilience**
- Systemic flexibility dealing with challenges of change across the policy cycle – **adaptive resilience**

Relations & Political Networks


Journal of European Public Policy 13:5 August 2006: 757–778

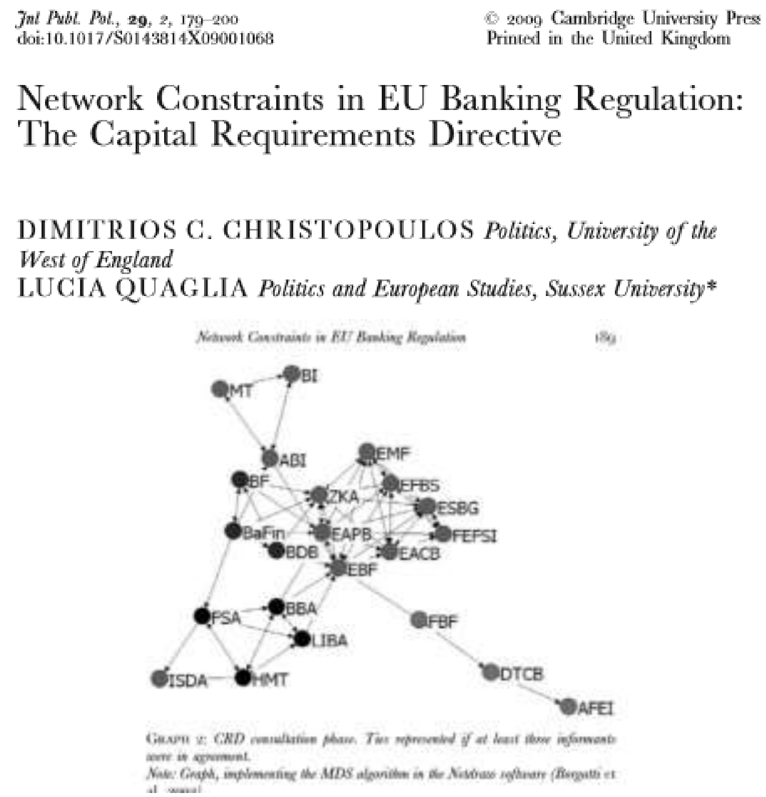
Relational attributes of political entrepreneurs: a network perspective

Dimitrios C. Christopoulos

Figure 1 Network of actors reacting to the Ryanair/Charleroi decision of the EU Commission in February 2004
Source: Network constructed by data entry into UCINET (Borgatti *et al.* 2002) and graphed with Netdraw.

Political entrepreneurs outsmart the EU Commission

Political Agency & Institutional Structure


Jnl Publ. Pol., **29**, 2, 179–200 doi:10.1017/S0143814X09001068

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Network Constraints in EU Banking Regulation: The Capital Requirements Directive

DIMITRIOS C. CHRISTOPOULOS *Politics, University of the West of England*
LUCIA QUAGLIA *Politics and European Studies, Sussex University**

Network Constraints in EU Banking Regulation 189

Graph 2: CRD consultation phase. Ties represented if at least three informants were in agreement.
Note: Graph, implementing the MDS algorithm in the Netdraw software (Borgatti et al.

Political brokers engineer a compromise facilitating the 2007 financial crisis

Governance


Regional and Federal Studies Vol. 16, No. 4, 363–383, December 2006

Governance Capacity and Regionalist Dynamics

DIMITRIOS C. CHRISTOPOULOS

Governance Capacity and Regionalist Dynamics

Figure 1. Scatterplot of economic relevance with institutional autonomy

Economic development is associated to governance capacity

CROSS SECTIONAL ANALYSIS

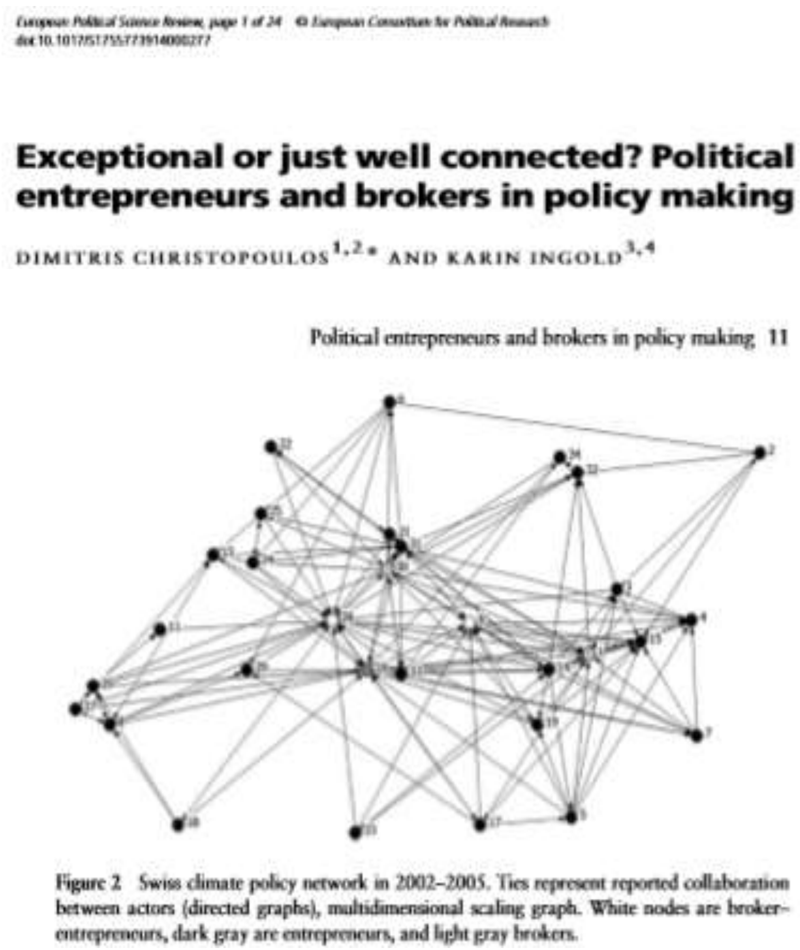
SYSTEMIC ANALYSIS: OSCILLATING POLITICAL AGENTS

Integrating structure and agency in environmental policy

Exceptional agents appear to oscillate between roles to suit

- the audience,
- the nature of the policy challenge and
- the shifting dynamics of the policy cycle (i.e. governance states).

Exceptional agents can be assumed to facilitate systemic resilience.


Exceptional or just well connected? Political entrepreneurs and brokers in policy making

DIMITRIS CHRISTOPOULOS[1,2]* AND KARIN INGOLD[3,4]

Political entrepreneurs and brokers in policy making 11

Figure 2 Swiss climate policy network in 2002–2005. Ties represent reported collaboration between actors (directed graphs), multidimensional scaling graph. White nodes are broker-entrepreneurs, dark gray are entrepreneurs, and light gray brokers.

- Policy entrepreneurs are **oscillating** between centrality and brokerage roles
- Mixed methods design indicates **centrality** is linked to power when there is low contestation (i.e. issue **salience** determines whether centrality matters)
- **Policy volatility** is associated to the inability of political actors to estimate political influence in a clustered political space (linked to information asymmetry)

& AGENT PREFERENCES

Altruistic economic behaviour entails political imperatives

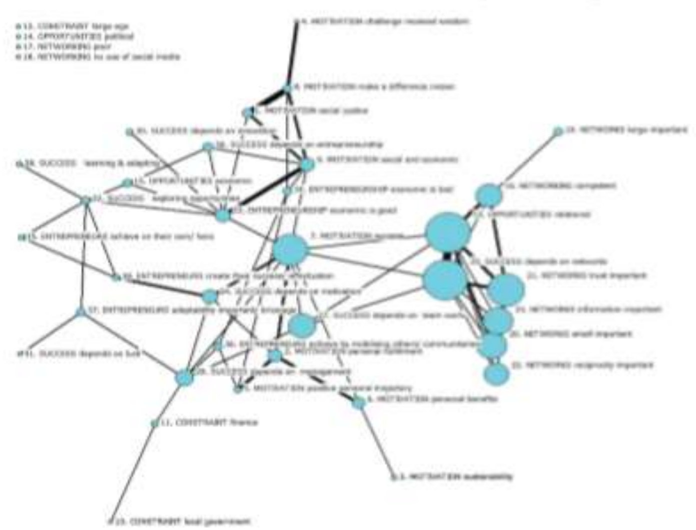
Political volatility a key concern for economic actors who recognise that they also have political agency

Journal of Social Entrepreneurship, 2015
Vol. 6, No. 1, 1–30, http://dx.doi.org/10.1080/19420676.2014.954254

Routledge

The Motivation of Social Entrepreneurs: The Roles, Agendas and Relations of Altruistic Economic Actors

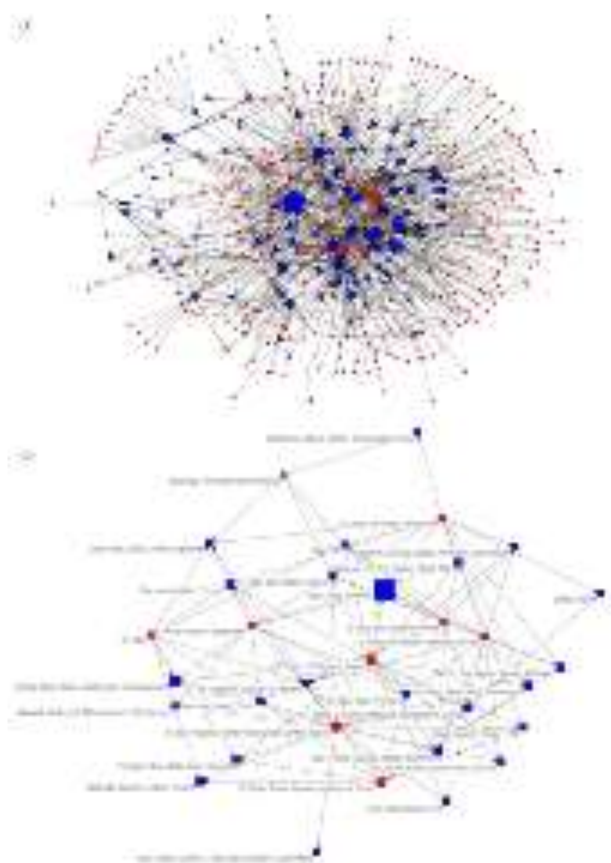
DIMITRIS CHRISTOPOULOS* & SUSANNE VOGL**†



Graph 1. Semantic network. Nodes weighted by eigenvector centrality.

- Actors who in pursuit of sustainable economic outcomes combine multidimentional agency:
  - Economic
  - Political
  - Civic/ social
- Semantic Network Analysis

Socio-ecological systems and political governance



Ecology of Games, Lubell, 2013

Sustainability and systemic robustness

- Robustness to shock
- Viability under stress
- Resource flow disruptions
- Natural ecological disasters
- Challenges of collective action

Future Work? :

- Inverse Tragedy of the Commons
- Prevalence of pro-social behavior
- Multiplexity & Complexity

SUSTAINABILITY & RESILIENCE

DEFINING ROBUSTNESS AND RESILIENCE I/III

- These are perceived as properties of systems of political governance
- We aim to assess the impact of shocks (whether internal or external)
- Ideally we should distinguish between systemic
  - process
  - state
  - outcome
- Shocks associated to:
  - Adaptation & anticipated change
  - Risk from unanticipated change
    - known-unknowns and
    - unknown-unknowns

DEFINING ROBUSTNESS AND RESILIENCE II/III

- These are perceived as properties of systems of political governance
- We aim to assess the impact of shocks (whether internal or external)
- Ideally we should distinguish between systemic
  - process
  - state
  - outcome
- Shocks associated to:
  - Adaptation & anticipated change
  - Risk from unanticipated change
    - known-unknowns and
    - unknown-unknowns

Robustness: Systemic ability to withstand shock, i.e. how thick are the castle walls

- Linked to estimable risk
- Reflects structural integrity of a system in maintaining its core functions under duress

DEFINING ROBUSTNESS AND RESILIENCE III/III

- These are perceived as properties of systems of political governance
- We aim to assess the impact of shocks (whether internal or external)
- Ideally we should distinguish between systemic
  - process
  - state
  - outcome
- Shocks associated to:
  - Adaptation & anticipated change
  - Risk from unanticipated change
    - known-unknowns and
    - unknown-unknowns

Resilience: Systemic ability to deal with drastic failure/change as a result of shock, i.e. what happens after the collapse of the first line of defence

- Linked to risk that cannot be estimated
- Reflects structural effectiveness in maintaining systemic functions and
- Ability to adapt to change

THOUGHT EXPERIMENT

BACKGROUND

Given a unified political system (a single net component) with evidence for the prevalence for a key network theoretical claim (i.e. brokerage, clustering etc)

EVENT

an external shock <u>eliminates</u> a non-trivial number of ties and/or nodes.

OUTCOME

Will the surviving network structure (i.e. largest component) be able to efficiently diffuse information and/or allow for the execution of coordination tasks? (i.e. level of fragmentation, path length etc)

Comparing theories: which are the best at identifying robust and resilient systems?

THEORIZING

Theorizing Political Governance Robustness and Resilience I/II

Theory	Key network concept	Locus of Power
T1. Granovetter's **weak ties**	➢serendipitous access to information	○ access to information
T2. Burt's **structural holes**	➢agents strategize to occupy advantageous positions	○ brokers
T3. Eisenhardt's **principal-agent theory**	➢mediating political agents act in the name of the principal	○ information asymmetry
T4. Ostrom's **collective action** model (cf Lubel)	➢agents may have diverging interests from principals	○ agent roles
T5. Simmel's cliques (cf Krackhardt)	➢embedded transitive ties	○ *tertium gaudens*
T6. Keyplayer	➢network fragmentation contingent to elimination of certain nodes	○ keynodes

Theorizing Political Governance Resilience II/II

Theory	Systemic Power Assumption	Governance Resilience	Governance Robustness
T1. weak ties	➢mediators do not exact rents for valuable information	○ in evidence of diffuse ties	○ In ability to disrupt
T2. structural holes	➢mediators exact rents and actively attempt to maintain structural holes	○ measure of bridge decay	○ on level of fragmentation
T3. principal agent	➢mediators exploit principals by taking advantage of an information advantage	○ uncertain	○ evident in embeddedness
T4. collective action	➢informed principals can optimise common resource use	○ uncertain	○ evident in cohesion
T5. cliques T6. keyplayer	➢*tertium gaudens*, a mediator can benefit from the conflict of their alters ➢maintaining cohesion	○ path length ○ ratio of fragmentation to distance attenuation	○ clique overlap ○ fragmentation

STUDY DESIGN A: LONGITUDINAL
The Stability Risk Of Political Ecosystems

- **Key assumption: resilience and robustness can be assessed through the persistence of systemic functions**
  - but also via attrition in multi-modal ties
- Theory: Prevalence of Simmelian ties will impact robustness
- Operationalisation: Relations can be examined as multi-layered and combine:
  - Mandated, formal and directed networks
  - Affiliation and multi-mode relations
  - Affective and preference ties
  - Personal and organisational ties
- Caveat: Compatibility of underlying assumptions
- Measure:
  - bridge decay (agency),
  - oscillation bridge-bond (agency, resilience),
  - **maximum path length does not increase (resilience)**
  - **Simmelian clique prevalence (robustness)**

Some limitations with studying governance networks:

- Distinct state and process dynamics
- Distinct process and outcome drivers
- A system of agents
  - Subject to state transitions: i.e. a punctuated equilibrium system:
- Each is unique
  - Case study
- Power unequally distributed among agents
  - Power is often latent
- Actors often hierarchically constrained

STUDY DESIGN A: LONGITUDINAL
The Stability Risk Of Political Eco-systems

- **Key assumption: resilience and robustness can be assessed through the persistence of systemic functions**
  - but also via attrition of multi-modal ties
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  - Personal and organisational ties
- Caveat: Compatibility of underlying assumptions
- Measure:
  - bridge decay (agency),
  - oscillation bridge-bond (agency, resilience),
  - **maximum path length does not increase (resilience)**
  - **Simmelian clique survival (robustness)**

AIM is to optimise network structure towards robust and/or resilient governance

- path redundancy
- power-law distribution of ties
- scale-free networks (cf. self-healing nets)

STUDY DESIGN B: KEYNODE DETECTION
The Stability Risk Of Political Eco-systems

- Hypotheses:

  [Assuming evidence of a shock]

  - **Systemic robustness evident in level of fragmentation**
  - **Systemic resilience evident in degree to which fragmentation and distance is concentrated on the same actors**

$H = 1 - \sum_k \left(\frac{s_k}{n} \right)^2$

STUDY DESIGN B: KEYNODE METRICS

Keynode is optimising a network fragmentation statistic and calculating the value of each node to overall cohesion (Everett and Borgatti, 1999; Borgatti, 2006)

Implemented in R by An and Liu (2016) as an iterative algorithm optimized for group centrality

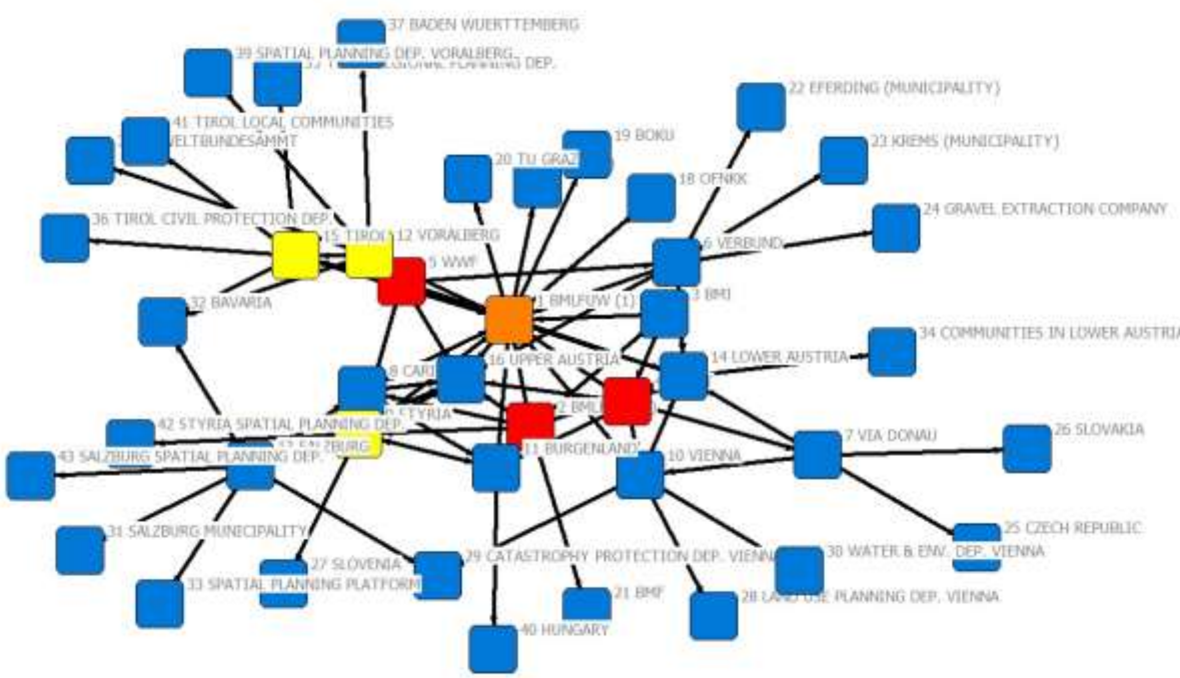
Herfindahl index: $H = 1 - \sum_k \left(\frac{s_k}{n} \right)^2$

Information entropy: $E = -\sum_k \frac{s_k}{n} \ln \left(\frac{s_k}{n} \right)$

STUDY DESIGN B: CLUSTER ANALYSIS & KEYNODE DETECTION COMBINED PHASE 1: AUSTRIAN FLOOD POLICY

JRC-EC FUND TO CEDDIA, & CHRISTOPOULOS 2015-2016

HERNANDEZ-GONZALEZ ET AL, 2016 & CEDIA ET AL 2017 ENVIRONMENTAL SCIENCE & POLICY



Keynode detection by combining cluster analysis, with alpha and beta ranked actors
1,2,4,5 alpha - distance
1,9,12,15 beta - fragmentation

Clustering

Groups	Actors		
Group 1	**1, 2, 8, 9, 11, 13, 16**		
Group 2	**3, 4, 7, 10, 14, 29**		
Group 3	**5, 6, 12, 15, 32**		
Density	**Group 1**	**Group 2**	**Group 3**
Group 1	0.48	0.10	0.06
Group 2	0.12	0.27	0.00
Group 3	0.20	0.07	0.25

CLIQUES: Hierarchical Clustering of Overlap Matrix (16)

```
        1 1 1 2 2 2 2 2 2 2 2 2 2 3 3 1     1 1     1           1 1 1 3 3 3 3 3 3 3 3 4 4 4 4
Level   7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 1 7 4 0 4 2 3 3 6 8 9 1 5 6 2 5 2 3 4 5 6 7 8 9 0 1 2 3
-----   - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
4.000   . . . . . . . . . . . . . . . . . . . . . . . . . . XXX . . . . . . . . . . . . . . .
3.000   . . . . . . . . . . . . . . . . . . . . . . . . XXX XXX . . . . . . . . . . . . . . .
2.700   . . . . . . . . . . . . . . . . . . . . . . . . XXX XXXXX . . . . . . . . . . . . . .
2.100   . . . . . . . . . . . . . . . . . . . . . . . . XXXXXXXXX . . . . . . . . . . . . . .
2.000   . . . . . . . . . . . . . . . . . XXXXX . . . . XXXXXXXXX XXX . . . . . . . . . . . .
1.000   . . . . . . . . . . . . . . . . XXXXXXX XXX . XXXXXXXXXXX XXXXX . . . . . . . . . . .
0.610   . . . . . . . . . . . . . . . . XXXXXXX XXX XXXXXXXXXXXXX XXXXX . . . . . . . . . . .
0.480   . . . . . . . . . . . . . . . XXXXXXXXX XXX XXXXXXXXXXXXX XXXXX . . . . . . . . . . .
0.350   . . . . . . . . . . . . . . . XXXXXXXXX XXXXXXXXXXXXXXXXX XXXXX . . . . . . . . . . .
0.310   . . . . . . . . . . . . . . . XXXXXXXXXXXXXXXXXXXXXXXXXXX XXXXX . . . . . . . . . . .
0.052   . . . . . . . . . . . . . . . XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX . . . . . . . . . . .
0.000   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
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STUDY DESIGN B: RESEARCH DESIGN

Research design for a longitudinal field-experiment:

$\mathcal{G}_{t1}$-$\mathcal{G}_{t2}$-**SHOCK**-$\mathcal{G}_{t3}$

Effect of shock: $\mathcal{G}_{t3}-\mathcal{G}_{t2}=E$

Control for network stability rate:

$\mathcal{G}_{t2}-\mathcal{G}_{t1}=ST_{t2-t1}$

F: subset of ranked alpha fragmentation nodes

D: subset of ranked beta distance nodes

HYPOTHESES

Robustness E_B

$\max(E_B) \leftrightarrow F_{t2} - F_{t1} \approx 0$

i.e. robust structure evident in small change of fragmentation metric

Resilience E_S

$\max(E_S) \leftrightarrow \{F_{t2} \wedge D_{t2}\} = \{F_{t1} \wedge D_{t1}\}$

i.e. resilient structure evident when intersection of top ranked nodes in alpha and beta, is stable across time

!

- *Governance as the product* of political exchange is associated to the quality of interaction between political agents. Jones et al. (1997) and Robins et al. (2011) term this to be governance embeddedness.
- *Governance as a process* is associated to changes in the patterns of interaction between political agents. For instance, the degree to which there are changes in core-periphery, the multiplicity of clusters, the persistence of cliques, prevalence of brokers or the skewness in the distribution of ties. All these relational properties affect the agency of political actors (Christopoulos and Ingold, 2015). This is the focus of governance robustness and resilience as examined here.
- Furthermore, governance research designs should ideally capture the multiple dimensions of political agency with a contingent capture of (meso-level) structure. This can be achieved with dynamic, multi-level and multi-mode analysis (Knoke, Diani & Christopoulos, forthcoming, CUP).
- Research design decision: agents, systems or both?

! !

Estimating governance resilience and robustness can be instrumental in identifying :

- the effectiveness & efficiency of governance systems
- the risk of process failure
- the risk of outcome failure
- & the capacity of systems to adapt

Ultimately this is associated to the study of policy governance & political risk

Thank you for your attention.

Look forward to your questions….

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LEADERSHIP NETWORKS IN BANKING

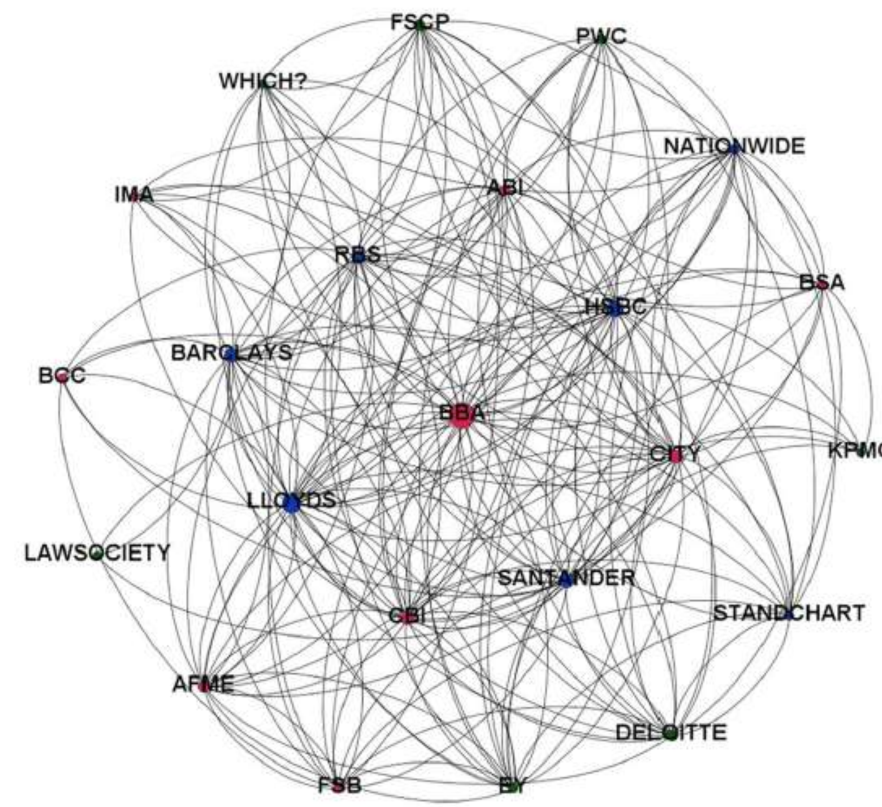
European Journal of Political Research ●●: ●●–●●, 2017
doi: 10.1111/1475-6765.12237

Reputational leadership and preference similarity: Explaining organisational collaboration in bank policy networks

SCOTT JAMES[1] & DIMITRIS CHRISTOPOULOS[2]
[1] *King's College London, UK;* [2] *MODUL University Vienna, Austria*

European Journal of Political Research, 2017

Funder by the UK ESRC.



ERGMs are Monte Carlo Markov Chain simulations that allow model testing that combine network structural characteristics (i.e. reciprocity) with attributes of nodes (i.e. leadership) with variables associated to tie formation at the dyadic level (i.e. reputation).

Table 2. Estimation results for the ERGM

	Model A	Model B	Model C	Model D	Model E	Model F
Arc	−0.8566* (0.149)	−5.091* (0.783)	−8.115* (1.041)	−7.7239* (1.054)	−9.3769* (1.177)	−8.8902* (1.167)
Reciprocity	1.3988* (0.267)	1.2977* (0.305)	1.058* (0.342)	1.029* (0.309)	0.9531* (0.328)	0.9597* (0.346)
Path closure (ATA-T)		1.7986* (0.375)	0.8491 (0.432)	0.8647 (0.465)	0.8018 (0.415)	0.8438 (0.427)
Cyclic closure (ATA-C)		−0.4233 (0.254)	−0.0605 (0.277)	−0.0605 (0.257)	−0.1145 (0.276)	−0.1283 (0.266)
Popularity closure (ATA-D)		0.2524 (0.324)	0.7208* (0.358)	0.6247 (0.346)	0.7009* (0.338)	0.5988 (0.392)
Activity closure (ATA-U)		0.1314 (0.308)	−0.5662 (0.302)	−0.5546 (0.285)	−0.4826 (0.304)	−0.4309 (0.304)
Reputational leadership (outgoing)			−0.0918 (0.175)	−0.1263 (0.179)	−0.083 (0.178)	
Reputational leadership (incoming)			0.7132* (0.263)	0.6495* (0.286)	0.6827* (0.282)	
Organisational salience (outgoing)			0.1044 (0.107)	0.1494 (0.108)	0.1749 (0.109)	0.1746 (0.121)
Organisational salience (incoming)			0.8507* (0.136)	0.8423* (0.141)	0.8825* (0.136)	0.942* (0.145)
Organisational type				−0.422 (0.242)	−0.4349 (0.241)	−0.5458* (0.229)
Preference similarity					0.3163* (0.108)	0.2602* (0.108)
Reputational leadership (dyadic)						0.4418* (0.122)
Mahalanobis distance	−1770263	−5943	1213	2413	4283	−5543

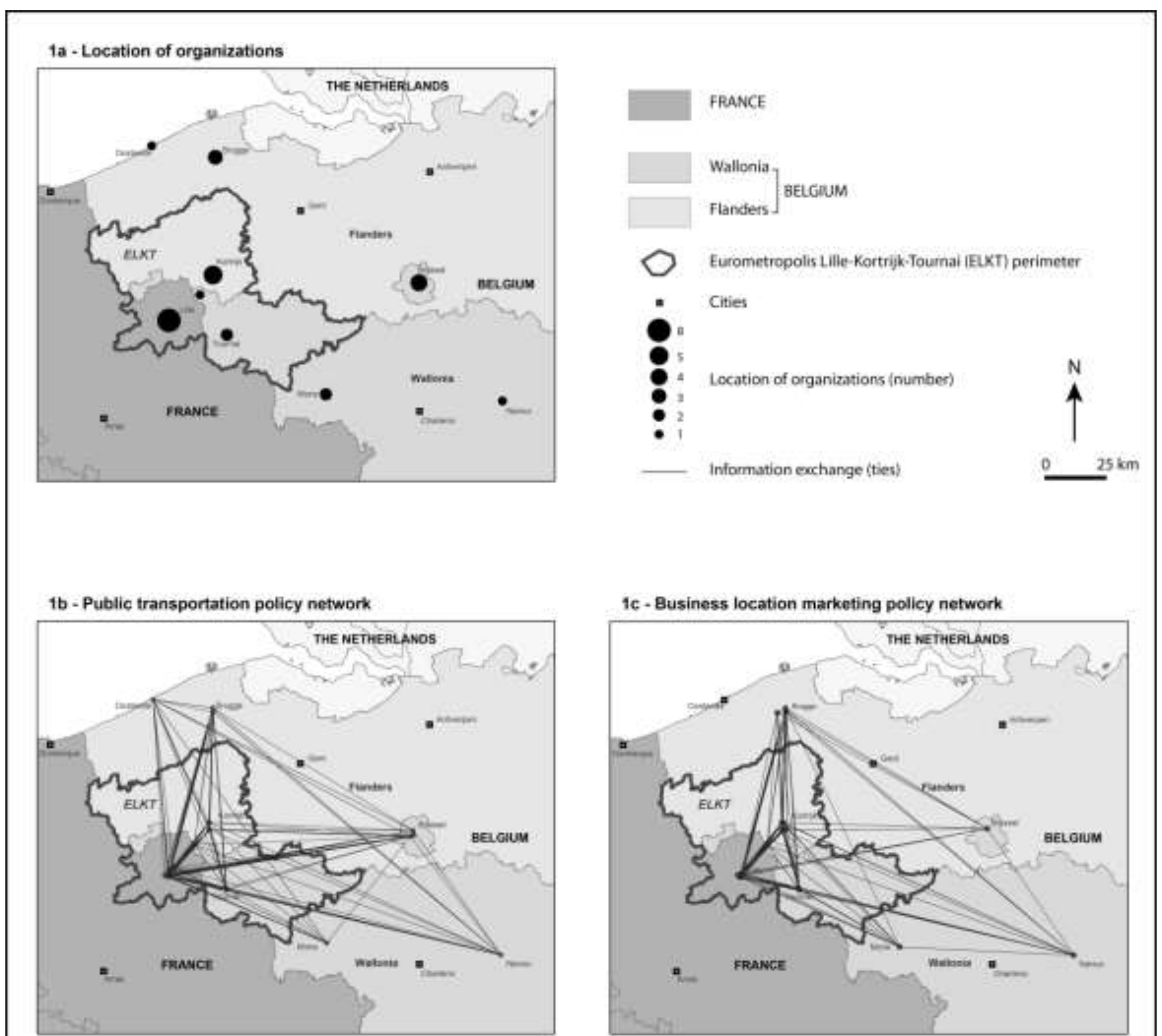
Notes: Parameters with standard errors in parentheses. *Statistically significant at the 0.05 level. Reciprocity refers to the tendency to return cooperative behaviour in kind when forming ties (i.e., actor A will form a tie to B if a tie already exists from B to A). The four measures of transitivity examine whether network ties are partly closed and clique-like in structure (see Online Appendix 5 for a description of these terms).

Estimates for the Lille and Basel Models

CROSS-BORDER POLICY NETWORKS
SOHN, CHRISTOPOULOS & KOSKINEN

METRONET PROJECT, funded by the Luxembourg National Fund for Research.

Five case studies in Europe.



	Lille						Basel					
	Estimates (SEs)						Estimates (SEs)					
Parameter	Model A		Model B		Model C		Model A		Model B		Model C	
Structural effects												
Arc	1.521*	(0.703)	−0.337	(1.107)	0.360	(1.232)	0.756	(0.587)	−2.596*	(0.830)	−3.91*	(1.169)
Reciprocity	1.069*	(0.292)	1.033*	(0.350)	0.681	(0.347)	0.699*	(0.271)	1.413*	(0.464)	1.018*	(0.488)
In2Star			0.023	(0.116)	−0.113	(0.148)			0.296*	(0.075)	0.321*	(0.092)
Out2Star			0.0002	(0.120)	−0.101	(0.139)			−0.034	(0.154)	0.121	(0.224)
In3Star			−0.012	(0.011)	−0.002	(0.013)			−0.011	(0.007)	−0.012	(0.007)
Out3Star			−0.01	(0.011)	0.001	(0.012)			0.001	(0.018)	−0.01	(0.027)
Transitive-Triad			0.210*	(0.044)	0.216*	(0.051)			0.057	(0.045)	0.041	(0.050)
Cyclic-Triad			−0.269*	(0.054)	−0.263*	(0.064)			−0.164*	(0.072)	−0.171*	(0.077)
Actor attribute effects												
Important actors Sender					0.536	(0.299)					0.807*	(0.352)
Important actors Receiver					1.063*	(0.37)					0.346	(0.249)
Important actors Interaction					−0.517	(0.428)					0.342	(0.542)
Other contextual effect												
Cross-border cooperation					0.327*	(0.164)					−0.164	(0.210)
Spatial effects												
Distance	−0.198*	(0.064)	−0.121*	(0.053)	−0.110*	(0.055)	−0.126*	(0.057)	−0.036	(0.034)	0.051	(0.051)
Territorial border					−0.499*	(0.193)					−1.27*	(0.278)

Geography has a U shaped effect on the creation and maintenance of a tie.

Administrative borders sometimes act as catalysts to Policy Networks.

THE ROLES ACTORS PLAY IN POLICY NETWORKS: CENTRAL POSITIONS IN STRONGLY INSTITUTIONALIZED FIELDS

INGOLD, FISHER & CHRISTOPOULOS, FORTHCOMING IN NETWORK SCIENCE

Centralities are a widely studied phenomenon in network science. In policy networks, central actors are of interest because they are assumed to control information flows, to link opposing coalitions and, finally, to directly impact upon decision-making. We study what type of actor (e.g. state representative; interest group) is able to occupy central positions in the highly institutionalized context of a policy network. We then ask whether **bonding or bridging centralities** are more stable over time, and how these types of centrality influence actors' positions in the network over time. We therefore adopt a **longitudinal perspective** and run Exponential Random Graph Models, including **lagged central network positions** at t1 as the main independent variable for actors' activity and popularity at t2. Results confirm that only very few actors are able to maintain central positions over time.

	Bridging Centrality					
	Model 1 Effective size		Model 2 Pure HB		Model 3 Degree other coalition	
	t1-2	t2-3	t1-2	t2-3	t1-2	t2-3
Activity (Effective size)	0.06	0.04				
	(0.03)	(0.03)				
Popularity (Effective size)	0.13	0.09				
	(0.03)	(0.02)				
Activity (Pure HB)			0.02	0.03		
			(0.01)	(0.02)		
Popularity (Pure HB)			0.05	0.08		
			(0.01)	(0.02)		
Activity (Degree other coalition)					2.35	-3.14
					(1.34)	(1.11)
Popularity (Degree other coalition)					-1.93	1.48
					(1.36)	(0.92)
Activity (Constraint)						
Popularity (Constraint)						
Activity (Degree own coalition)						
Popularity (Degree own coalition)						
Activity (Betweenness)						
Popularity (Betweenness)						
State authorities activity	0.09	0.98	0.15	1.10	-0.02	1.27
	(0.23)	(0.39)	(0.23)	(0.40)	(0.24)	(0.45)
State authorities popularity	0.08	-0.51	0.21	-0.09	0.26	-0.86
	(0.23)	(0.44)	(0.21)	(0.45)	(0.24)	(0.42)
Admin. entities activity	-0.22	0.62	-0.13	0.70	-0.48	0.62
	(0.26)	(0.41)	(0.26)	(0.43)	(0.31)	(0.46)
Admin entities popularity	0.42	1.24	0.38	0.78	1.02	1.26
	(0.25)	(0.44)	(0.23)	(0.44)	(0.29)	(0.37)
Pro-economy IG activity	0.06	0.46	0.15	0.56	0.04	0.61
	(0.23)	(0.41)	(0.21)	(0.42)	(0.22)	(0.45)
Pro-economy IG popularity	0.36	0.12	0.46	0.20	0.64	-0.02
	(0.23)	(0.47)	(0.21)	(0.47)	(0.23)	(0.39)
Pro-environment IG activity	0.20	-0.56	0.26	-0.47	0.14	-0.29
	(0.23)	(0.54)	(0.23)	(0.54)	(0.23)	(0.54)
Pro-environment IG popularity	-0.25	-0.22	-0.09	0.21	-0.02	0.06
	(0.25)	(0.53)	(0.22)	(0.52)	(0.25)	(0.44)
Preference similarity	1.29	2.05	1.29	2.11	1.24	2.16
	(0.15)	(0.27)	(0.16)	(0.27)	(0.16)	(0.27)
Edges	-3.59	-4.69	-3.23	-4.43	-3.59	-4.22
	(0.39)	(0.61)	(0.38)	(0.59)	(0.40)	(0.55)
Reciprocity	1.14	1.25	1.21	1.29	1.22	1.43
	(0.27)	(0.46)	(0.27)	(0.46)	(0.27)	(0.45)
Transitivity (GWESP, 0.1)	1.11	0.89	1.12	0.94	1.35	1.11
	(0.24)	(0.25)	(0.25)	(0.25)	(0.23)	(0.24)
Transitivity (GWDSP, 0.1)	-0.17	-0.20	-0.19	-0.22	-0.13	-0.12
	(0.04)	(0.07)	(0.04)	(0.07)	(0.04)	(0.07)
AIC	840.34	408.67	832.67	402.36	865.19	414.42
BIC	915.68	484.01	908.02	477.70	940.53	489.76
Log Likelihood	-405.17	-189.33	-401.34	-186.18	-417.60	-192.21