

# Topic 7: ERGMs for the alliance network

## Analyzing the data with different variables in the ERGM

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## Data Preparation: Selected Variables

**statea, stateb** the identification number of state a/b

**allies** 1 if the considered states have an alliance and 0 if not

**ff, ef, ee** the number of common

- friends of friends
- enemies of friends
- enemies of enemies

**contig** decodes how geografically near the states are

**majpow\_a, majpow\_b** 1 if state a/b is major power and 0 if not

**igos\_i** number of common intergovernmental organizations

**lncaprat** logarithmic capability ratio

**logtrade** logarithmic trade

**polity\_a, polity\_b** decodes the politic orientation of state a/b

## Data Preparation: New Variables

**mp** 0 if none of the states is a major power  
1 if one of the states is a major power  
2 if both states are major powers

**gov** difference between political orientation of the states

# Data Preparation: Matrices

## SELECTED YEAR

- ALLIANCES

## PREVIOUS YEAR

### Variables

- FF, EF, EE
- CONFLICTS

### Covariates

- CONTIGUITY
- MAJORPOWERS
- IGO MEMBERSHIP
- CAPABILITY RATIO
- TRADE (logarithmic)
- GOVERNMENTAL DIFFERENCE

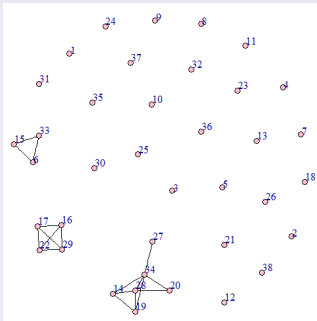
## Data Preparation: Selected years

### Summary of year 1916

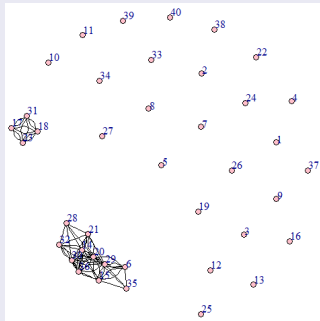
	Min.	Median	Mean	Max.
<u>SELECTED YEAR</u>				
ALLIES	0.0	0.0	0.02	1.0
<u>PREVIOUS YEAR</u>				
CONFLICTS	0.0	0.0	0.02	1.0
FF	0.0	0.0	0.09	3.0
EF	0.0	0.0	0.12	6.0
EE	0.0	0.0	0.07	3.0
CONTIG	1.0	6.0	5.6	6.0
LOGTRADE	NA	NA	NA	NA

## Data Preparation: Selected years

### Alliance network of year 1916



### FF network of year 1915



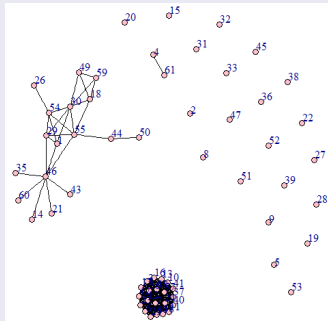
## Data Preparation: Selected years

### Summary of year 1945

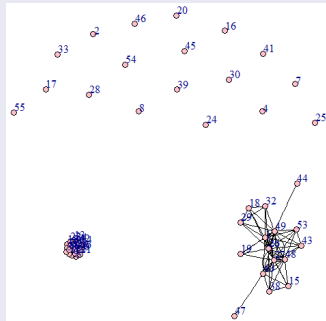
	Min.	Median	Mean	Max.
<u>SELECTED YEAR</u>				
ALLIES	0.0	0.0	0.13	1.0
<u>PREVIOUS YEAR</u>				
CONFLICTS	0.0	0.0	0.01	1.0
FF	0.0	0.0	2.7	19.0
EF	0.0	0.0	0.05	2.0
EE	0.0	0.0	0.02	2.0
CONTIG	1.0	6.0	5.8	6.0
LOGTRADE	NA	NA	NA	NA

## Data Preparation: Selected years

### Alliance network of year 1945



### FF network of year 1944





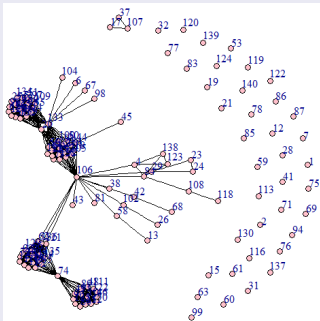
## Data Preparation: Selected years

### Summary of year 1990

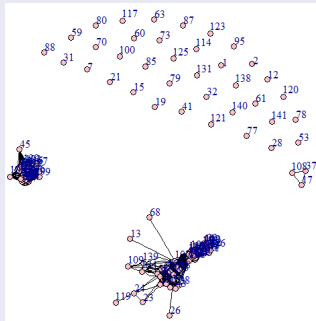
	Min.	Median	Mean	Max.
<u>SELECTED YEAR</u>				
ALLIES	0.0	0.0	0.08	1.0
<u>PREVIOUS YEAR</u>				
CONFLICTS	0.0	0.0	0.0	1.0
FF	0.0	0.0	1.6	44.0
EF	0.0	0.0	0.05	4.0
EE	0.0	0.0	0.0	1.0
CONTIG	1.0	6.0	5.9	6.0
LOGTRADE	0.0	0.7	1.8	12.0

## Data Preparation: Selected years

### Alliance network of year 1990



### FF network of year 1989



# Models

Model 1: edges, ff, ef, ee

Model 2: edges, ff, ef, ee, covariates (partially without trade)

Model 3: edges, ff, ef, ee, covariates, gwesp

Model 4: edges, ff, ef, ee, covariates, gwesp, gwdegree

## Analysis: 1916 ... comparing Model 1 and 2

	Model 1	Model 2
edges	-3.82***	-50.38
	(0.27)	(6981.05)
edgecov.net.ff.1915	1.00	0.95
	(0.72)	(0.74)
edgecov.net.ef.1915	0.70	0.67
	(0.73)	(0.74)
edgecov.net.ee.1915	-0.08	0.02
	(0.89)	(0.91)
edgecov.net.cap.1915		14.89
		(6522.64)
edgecov.net.trade.1915		
edgecov.net.contig.1915		
edgecov.net.gov.1915		15.82
		(1660.56)
edgecov.net.igos.1915		15.99
		(1852.77)
edgecov.net.mp.1915		-0.07
		(0.54)
edgecov.net.conflict.1915		-Inf
AIC	172.08	183.67
BIC	190.30	233.78
Log Likelihood	-82.04	-80.84

## grey cells

- TRADE  
no values available  
⇒ no influence  
measurably
- CONTIG  
mean: 5.6  
⇒ near to max, analysis  
produces NA

## red cells

- CONFLICT  
one edge ⇒ no influence

## Analysis 1916 ... comparing all models

	Model 1	Model 2 (MLE)	Model 3 (MPLE)	Model 4 (MPLE)
edges	-3.82*** (0.27)	-50.38 (6981.05)	-49.01 (11469.59)	-44.35 (18398.04)
edg cov.net.ff.1915	1.00 (0.72)	0.95 (0.74)	1.90 (1.45)	1.63 (1.51)
edg cov.net.ef.1915	0.70 (0.73)	0.67 (0.74)	-0.73 (2.95)	-0.68 (1.72)
edg cov.net.ee.1915	-0.08 (0.89)	0.02 (0.91)	-3.03 (3.34)	-2.14 (2.21)
edg cov.net.cap.1915		14.89 (6522.64)	14.20 (10754.01)	12.31 (17730.37)
edg cov.net.trade.1915				
edg cov.net.contig.1915				
edg cov.net.gov.1915		15.82 (1660.56)	14.35 (2549.14)	14.80 (3083.61)
edg cov.net.igos.1915		15.99 (1852.77)	15.09 (3066.70)	13.90 (3822.72)
edg cov.net.mp.1915		-0.07 (0.54)	-1.58 (1.08)	-1.50 (1.05)
edg cov.net.conflict.1915		-Inf	-Inf	-Inf
gwesp.fixed.0.1			4.11*** (0.59)	2.94*** (0.63)
gwdegree				-2.46 (1.28)
AIC	172.08	183.67	73.55	70.43
BIC	190.30	233.78	128.22	129.65
Log Likelihood	-82.04	-80.84	-24.78	-22.22

## Analysis: 1945 ... comparing Model 1 and 2

	Model 1	Model 2
edges	-2.01*** (0.08)	-2.52* (1.04)
edgecov.net.ff.1944	0.59*** (0.16)	0.61*** (0.18)
edgecov.net.ef.1944	-0.59*** (0.16)	-0.78 (0.51)
edgecov.net.ee.1944	1.07* (0.45)	1.22** (0.46)
edgecov.net.cap.1944		-0.87 (1.07)
edgecov.net.trade.1944		-1.30 (1.12)
edgecov.net.contig.1944		0.48 (0.66)
edgecov.net.gov.1944		0.11 (0.30)
edgecov.net.igos.1944		0.75* (0.30)
edgecov.net.mp.1944		-0.22 (0.24)
edgecov.net.conflict.1944		0.42 (1.85)
AIC	1401.98	1394.75
BIC	1424.03	1455.38
Log Likelihood	-696.99	-686.38

## orange cells

- IGOS  
not as significant as ff/ef
- EE  
not as significant as ff/ef

## yellow cells

- EE  
not as significant as ff and ef, but in Model 2 more significant as in Model 1

## Analysis 1945 ... comparing all models

	Model 1	Model 2 (MLE)	Model 3 (MPLE)	Model 4 (MPLE)
edges	-2.01*** (0.08)	-2.52* (1.04)	-4.43*** (0.64)	-2.75*** (0.81)
edgecov.net.if.1944	0.59*** (0.16)	0.61*** (0.18)	0.32 (0.26)	0.38 (0.28)
edgecov.net.ef.1944	-0.59*** (0.16)	-0.78 (0.51)	-1.69* (0.83)	-1.44 (0.77)
edgecov.net.ee.1944	1.07* (0.45)	1.22** (0.46)	1.50* (0.66)	1.60* (0.77)
edgecov.net.cap.1944		-0.87 (1.07)	0.21 (0.91)	0.88 (1.06)
edgecov.net.trade.1944		-1.30 (1.12)	-0.45 (0.86)	-0.53 (1.03)
edgecov.net.contig.1944		0.48 (0.66)	0.47 (0.97)	0.30 (0.87)
edgecov.net.gov.1944		0.11 (0.30)	-0.29 (0.40)	-0.26 (0.41)
edgecov.net.igos.1944		0.75* (0.30)	0.54 (0.51)	-0.34 (0.67)
edgecov.net.mp.1944		-0.22 (0.24)	-0.61 (0.34)	-0.57 (0.35)
edgecov.net.conflict.1944		0.42 (1.85)	-0.22 (0.75)	-0.46 (0.96)
gwesp.fixed.0.1			3.54*** (0.18)	2.45*** (0.18)
gwdegree				-3.39*** (0.58)
AIC	1401.98	1394.75	751.32	670.42
BIC	1424.03	1455.38	817.46	742.08
Log Likelihood	-696.99	-686.38	-363.66	-322.21

## Analysis: 1990 ... comparing Model 1 and 2

	Model 1	Model 2
edges	-2.87*** (0.05)	-25.95 (350.15)
edgecov.net.ff.1989	1.42*** (0.08)	1.35*** (0.08)
edgecov.net.ef.1989	0.77*** (0.13)	0.72*** (0.13)
edgecov.net.ee.1989	0.50 (0.84)	0.47 (0.84)
edgecov.net.cap.1989		11.39 (241.25)
edgecov.net.trade.1989		0.46*** (0.09)
edgecov.net.contig.1989		
edgecov.net.gov.1989		-0.14 (0.11)
edgecov.net.igos.1989		11.49 (253.78)
edgecov.net.mp.1989		-0.07 (0.14)
edgecov.net.conflict.1989		-Inf
AIC	5116.15	5102.24
BIC	5144.88	5181.25
Log Likelihood	-2554.08	-2540.12

## grey cells

- CONTIG  
mean: 5.9  
⇒ near to max, analysis produces NA

## red cells

- CONFLICT  
one edge ⇒ no influence



## Analysis 1990 ... comparing all models

	Model 1	Model 2 (MLE)	Model 3 (MPLE)	Model 4 (MPLE)
edges	-2.87*** (0.05)	-25.95 (350.15)	-28.25 (550.55)	-15.07 (416.08)
edgecov.net.ff.1989	1.42*** (0.08)	1.35*** (0.08)	0.71*** (0.09)	0.50*** (0.09)
edgecov.net.ef.1989	0.77*** (0.13)	0.72*** (0.13)	1.00*** (0.15)	0.90*** (0.15)
edgecov.net.ee.1989	0.50 (0.84)	0.47 (0.84)	0.34 (0.94)	0.46 (1.13)
edgecov.net.cap.1989		11.39 (241.25)	11.65 (418.78)	-0.15 (314.96)
edgecov.net.trade.1989		0.46*** (0.09)	0.11 (0.10)	0.08 (0.10)
edgecov.net.contig.1989				
edgecov.net.gov.1989		-0.14 (0.11)	-0.06 (0.12)	-0.19 (0.13)
edgecov.net.igos.1989		11.49 (253.78)	12.87 (357.39)	12.51 (271.88)
edgecov.net.mp.1989		-0.07 (0.14)	0.02 (0.16)	-0.12 (0.16)
edgecov.net.conflict.1989		-Inf	-Inf	-Inf
gwesp.fixed.0.1			1.79*** (0.06)	1.49*** (0.07)
gwdegree				-11.27*** (1.31)
AIC	5116.15	5102.24	4058.43	3601.49
BIC	5144.88	5181.25	4144.63	3694.87
Log Likelihood	-2554.08	-2540.12	-2017.22	-1787.74

## Results ... comparing with Maoz et. al.

RH1: Enemies of Enemies are likely to align with each other.

Maoz et. al.

supported

my finding

## Results ... comparing with Maoz et. al.

RH1: Enemies of Enemies are likely to align with each other.

Maoz et. al.

supported

my finding

Enemies of enemies are not as likely to align with each other as friend of friends or enemies of friends.

In some years: not supported.

## Results ... comparing with Maoz et. al.

RH3: Friends of enemies are unlikely to become allies, nor are enemies of friends likely to align with each other.

Maoz et. al.

not supported

my finding

## Results ... comparing with Maoz et. al.

RH3: Friends of enemies are unlikely to become allies, nor are enemies of friends likely to align with each other.

Maoz et. al.

not supported

my finding

Enemies of friends are unlikely to align with each others (in year 1945). In the year 1990 they are (with higher probability) likely to align with each other.