

# **ERGMs for the conflict network**

Re-analyzing Social Network Studies:  
What is the enemy of my enemy?

# Outline

- (1) First steps of the data analysis**
  - **Data preparation**
  - **Selected years & some data insights**
- (2) Network analysis with ERGMs**
  - **Comparison of different models**
- (3) Results**

# Data Analysis: Data preparation

- ▶ selected years:

1920

1942

1988

- ▶ for each year:

- (1) conflict adjacency matrix (AM) for the selected year
- (2) matrices with information from the previous year  
trade, common IGO-memberships, distance, conflicts & alliances, number of common allies and enemies,...

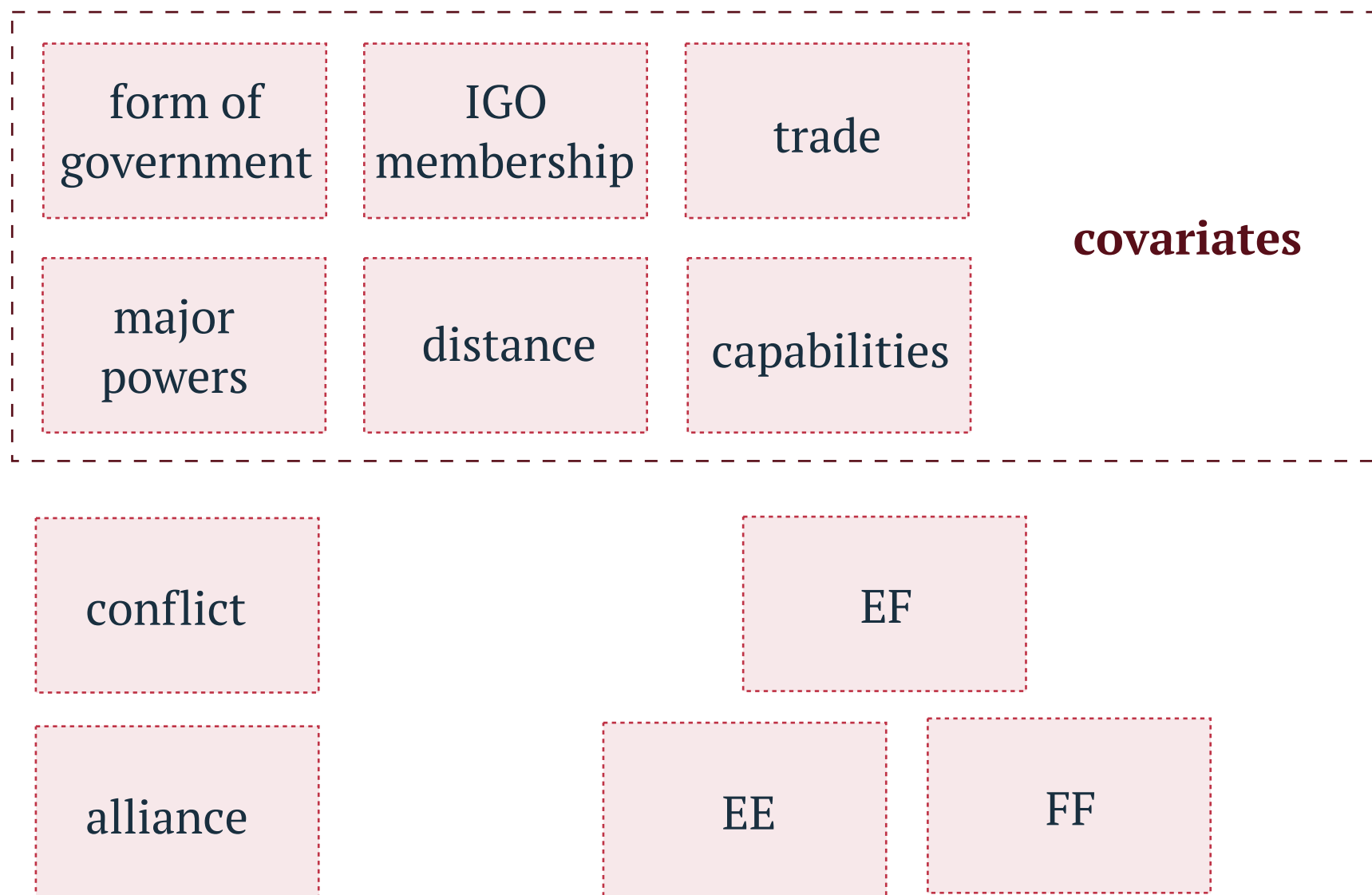
# Data Analysis: Data preparation (1)

- conflict adjacency matrix (AM) for the selected year

	Germany	USA	Poland	France
Germany	0	1	1	1
USA	1	0	0	0
Poland	1	0	0	0
France	1	0	0	0

# Data Analysis: Data preparation (2)

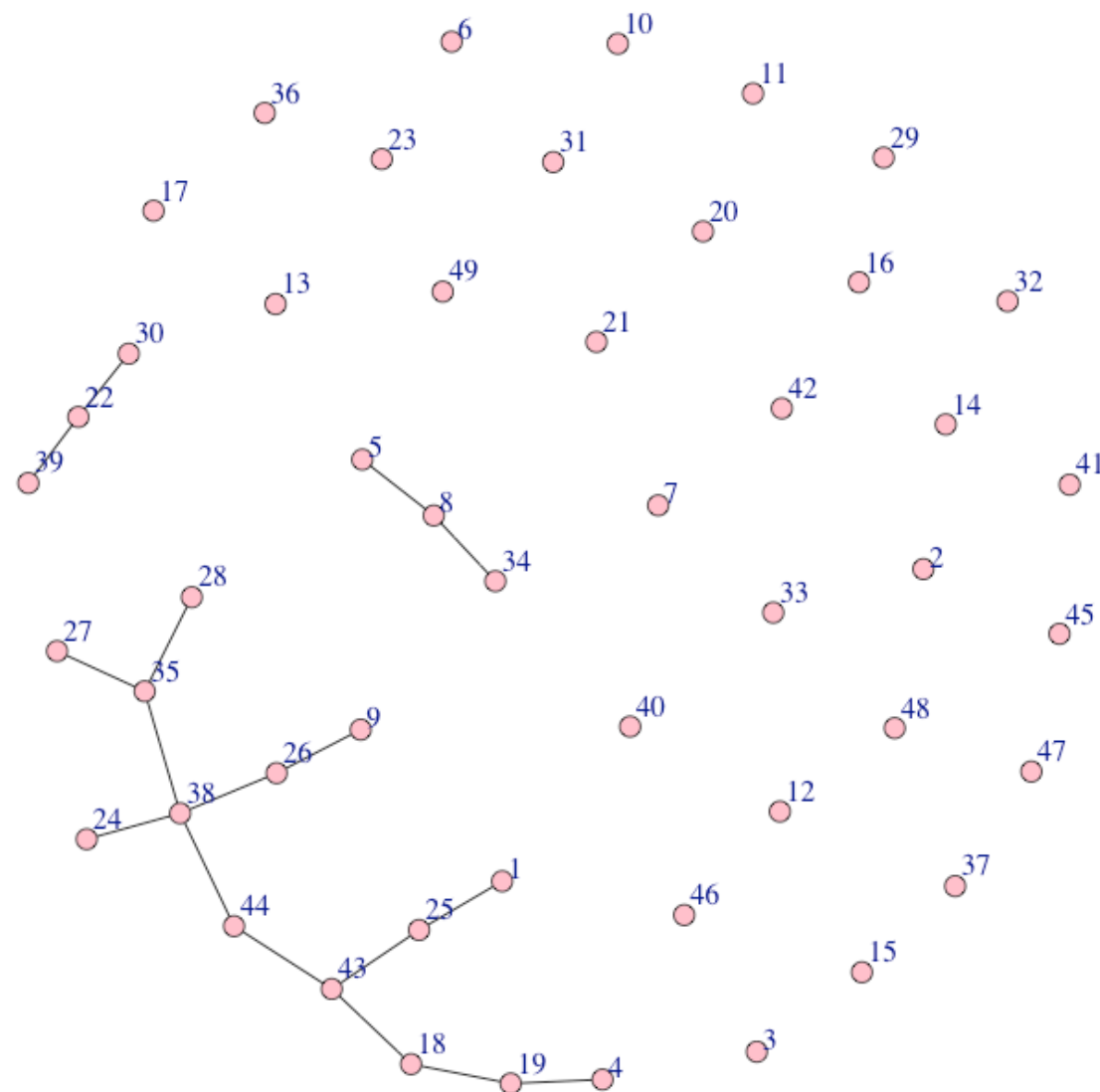
- ▶ 1 matrix for each of the following information from the previous year



1920

# Some data insights

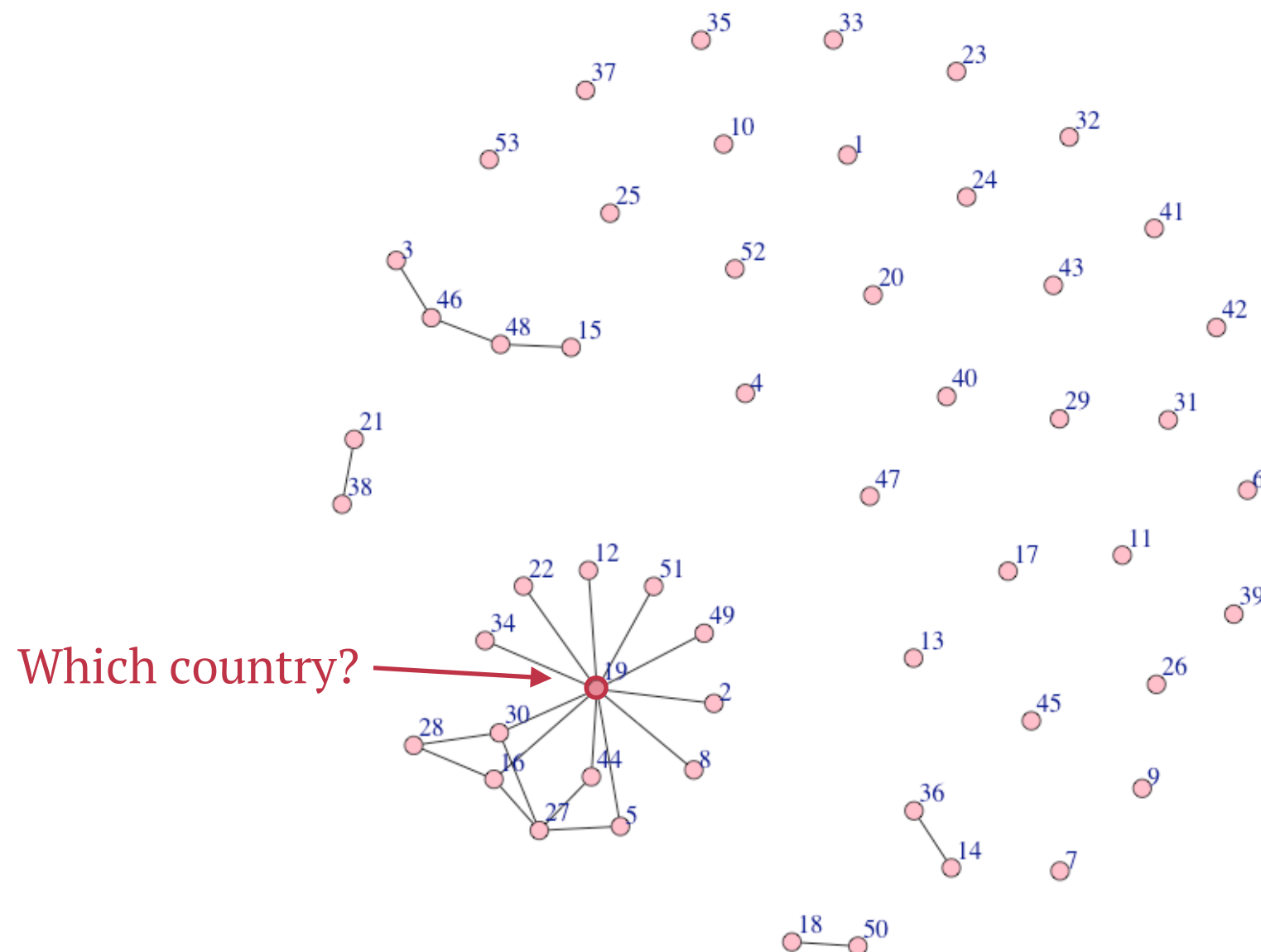
- conflict network based on the conflict adjacency matrix for 1920



1942

# Some data insights

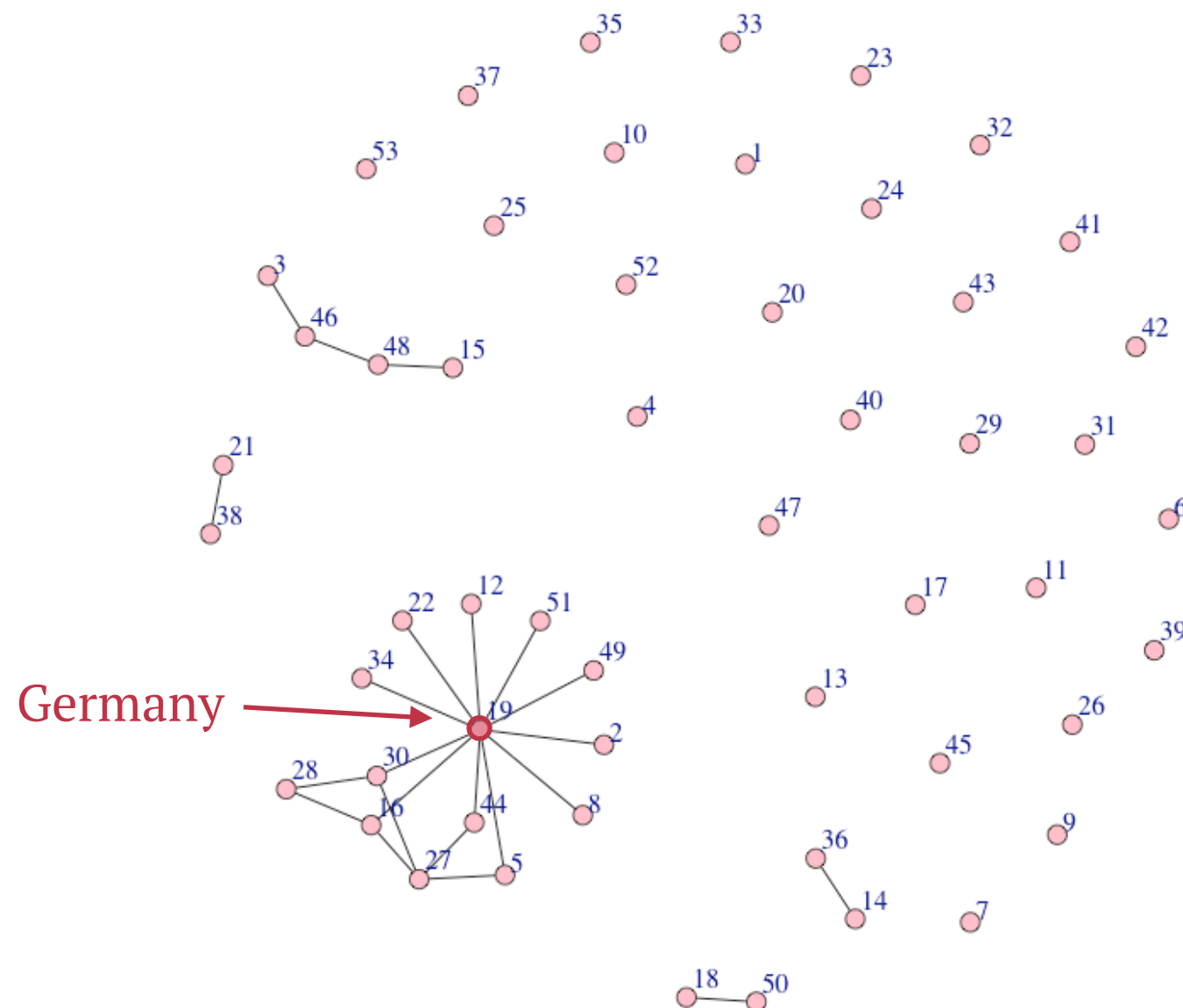
- conflict network based on the conflict adjacency matrix for 1942



1942

# Some data insights

- conflict network based on the conflict adjacency matrix for 1942

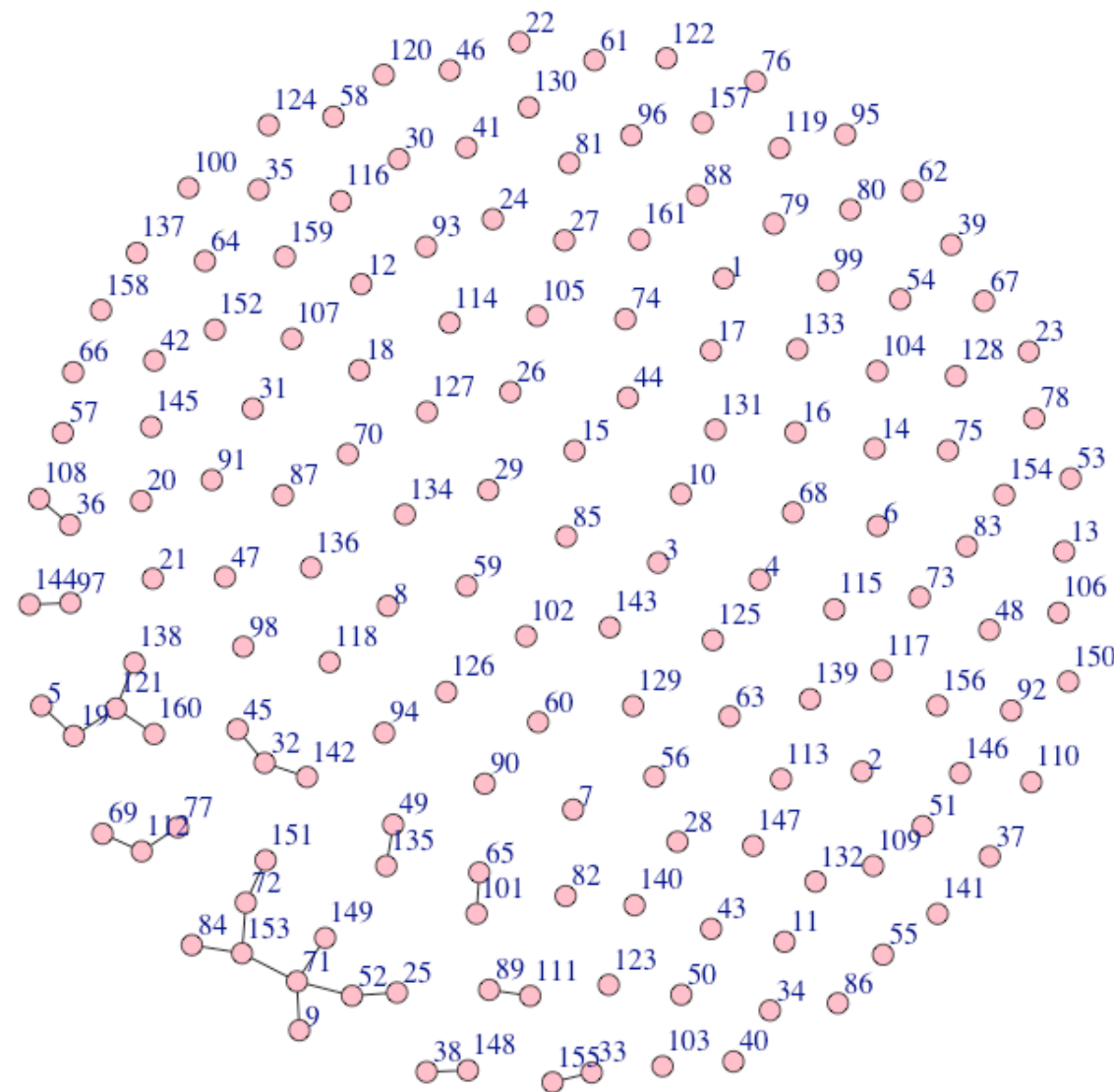




1988

# Some data insights

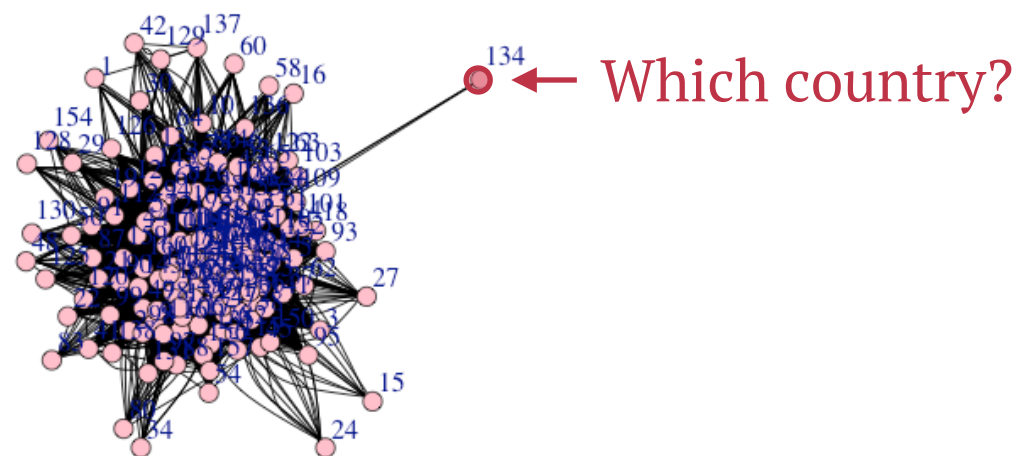
- conflict network based on the conflict adjacency matrix for 1988



1988

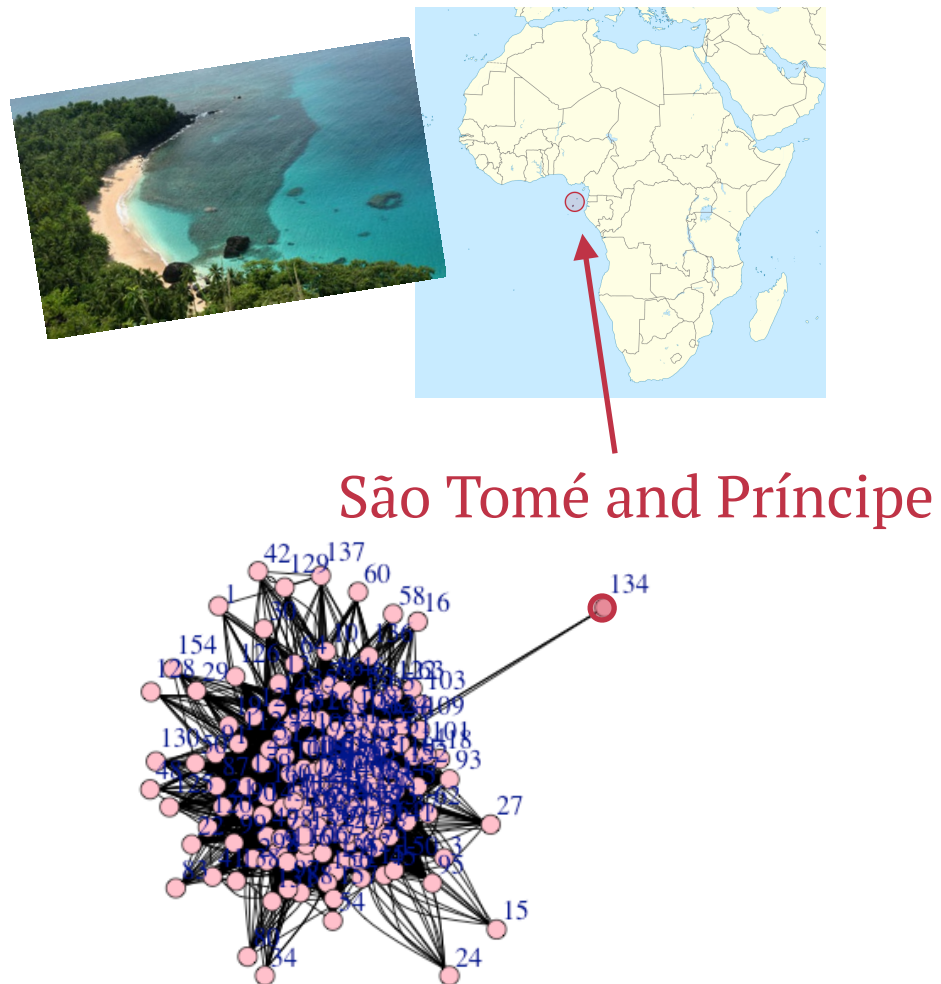
# Some data insights

- ▶ trade network based on the trade matrix for 1987



# Some data insights

- trade network based on the trade matrix for 1987



1988



# Network analysis with ERGMs

1942

**Model 1:**  
ERGM only with FF EF EE

```
model1.final <- ergm(net1941 ~ edges
+ edgecov(Mat_year1941_preproc_ffValues)
+ edgecov(Mat_year1941_preproc_efValues)
+ edgecov(Mat_year1941_preproc_eeValues)
)
```

**Model 2:**  
ERGM with FF EF EE  
and additional covariates

```
model2.final <- ergm(net1941 ~ edges
+ edgecov(Mat_year1941_preproc_ffValues)
+ edgecov(Mat_year1941_preproc_efValues)
+ edgecov(Mat_year1941_preproc_eeValues)
+ edgecov(Mat_year1941_preproc_distValues)
+ edgecov(Mat_year1941_preproc_polityValues)
+ edgecov(adjMat_year1941_preproc_majPow)
+ edgecov(Mat_year1941_preproc_igoValues)
+ edgecov(Mat_year1941_preproc_capValues)
+ edgecov(adjMat_year1941_preproc_trade)
+ edgecov(adjMat_year1941_preproc_mid)
+ edgecov(adjMat_year1941_preproc_allies)
)
```

# Network analysis with ERGMs

1942

**Model 1:**  
ERGM only with FF EF EE

**Model 2:**  
ERGM with FF EF EE  
and additional covariates

	Model 1	Model 2
edges	-4.67*** (0.33)	-2.61 (3.31)
edgecov.Mat_year1941_preproc_ffValues	-0.03 (0.06)	-0.17* (0.09)
edgecov.Mat_year1941_preproc_efValues	0.28*** (0.04)	0.33*** (0.07)
edgecov.Mat_year1941_preproc_eeValues	-0.33 (0.39)	-0.46 (0.37)
edgecov.Mat_year1941_preproc_distValues		-0.42 (0.36)
edgecov.Mat_year1941_preproc_polityValues		-0.01 (0.04)
edgecov.adjMat_year1941_preproc_majPow		-Inf
edgecov.Mat_year1941_preproc_igoValues		0.10* (0.05)
edgecov.Mat_year1941_preproc_capValues		0.21 (0.16)
edgecov.adjMat_year1941_preproc_trade		
edgecov.adjMat_year1941_preproc_mid		-0.90 (0.72)
edgecov.adjMat_year1941_preproc_allies		1.03 (1.17)
AIC	201.49	223.60
BIC	222.41	286.34
Log Likelihood	-96.75	-99.80

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$



# Comparison of different models

1942

**Model 1:**  
ERGM only with FF EF EE

**Model 2:**  
ERGM with FF EF EE  
and additional covariates

**Model 3:**  
ERGM with FF EF EE  
and additional covariates  
and gwdegree, gwesp and  
MPLE

	Model 1	Model 2	Model 3
edges	-4.67*** (0.33)	-2.61 (3.31)	1.73 (3.58)
edgecov.Mat_year1941_preproc_ffValues	-0.03 (0.06)	-0.17* (0.09)	-0.15 (0.09)
edgecov.Mat_year1941_preproc_efValues	0.28*** (0.04)	0.33*** (0.07)	0.22** (0.07)
edgecov.Mat_year1941_preproc_eeValues	-0.33 (0.39)	-0.46 (0.37)	-0.48 (0.35)
edgecov.Mat_year1941_preproc_distValues		-0.42 (0.36)	-0.45 (0.37)
edgecov.Mat_year1941_preproc_polityValues		-0.01 (0.04)	-0.00 (0.04)
edgecov.adjMat_year1941_preproc_majPow		-Inf	-Inf
edgecov.Mat_year1941_preproc_igoValues		0.10* (0.05)	0.05 (0.05)
edgecov.Mat_year1941_preproc_capValues		0.21 (0.16)	0.14 (0.16)
edgecov.adjMat_year1941_preproc_trade			
edgecov.adjMat_year1941_preproc_mid		-0.90 (0.72)	-0.61 (0.70)
edgecov.adjMat_year1941_preproc_allies		1.03 (1.17)	1.43 (1.21)
gwdegree			-2.38** (0.73)
gwesp.fixed.1			-5.00 (431.18)
AIC	201.49	223.60	216.25
BIC	222.41	286.34	289.45
Log Likelihood	-96.75	-99.80	-94.12

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$

# Comparison of different models

1920

**Model 1:**  
ERGM only with FF EF EE

**Model 2:**  
ERGM with FF EF EE  
and additional covariates

**Model 3:**  
ERGM with FF EF EE  
and additional covariates  
and gwdegree, gwesp and  
MPLE

	Model 1	Model 2	Model 3
edges	-4.52*** (0.28)	2.70 (1.96)	6.56** (2.52)
edgecov.Mat_year1919_preproc_ffValues	-Inf	-Inf	-Inf
edgecov.Mat_year1919_preproc_efValues	2.65** (0.90)	3.45** (1.20)	3.15* (1.31)
edgecov.Mat_year1919_preproc_eeValues	1.34** (0.42)	0.42 (0.51)	-0.10 (0.59)
edgecov.Mat_year1919_preproc_distValues		-0.93*** (0.28)	-1.21*** (0.32)
edgecov.Mat_year1919_preproc_polityValues		-0.12 (0.08)	-0.10 (0.08)
edgecov.adjMat_year1919_preproc_majPow		-Inf	-Inf
edgecov.Mat_year1919_preproc_igoValues		-0.03 (0.04)	-0.03 (0.04)
edgecov.Mat_year1919_preproc_capValues		0.00 (0.20)	-0.10 (0.21)
edgecov.Mat_year1919_preproc_tradeValues			
edgecov.adjMat_year1919_preproc_mid		2.69*** (0.63)	2.27*** (0.68)
edgecov.adjMat_year1919_preproc_allies		-Inf	-Inf
gwdegree			-1.59** (0.55)
gwesp.fixed.1			-5.65 (487.86)
AIC	171.92	162.69	155.54
BIC	192.20	223.53	226.52
Log Likelihood	-81.96	-69.35	-63.77

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$

# Comparison of different models

1988

**Model 1:**  
ERGM only with FF EF EE

**Model 2:**  
ERGM with FF EF EE  
and additional covariates

**Model 3:**  
ERGM with FF EF EE  
and additional covariates  
and gwdegree, gwesp and  
MPLE

	Model 1	Model 2	Model 3
edges	-6.72*** (0.26)	-2.95 (1.94)	-1.52 (2.28)
edgecov.Mat_year1987_preproc_ffValues	0.02 (0.02)	-0.00 (0.05)	-0.01 (0.05)
edgecov.Mat_year1987_preproc_efValues	1.23*** (0.17)	0.79** (0.24)	0.68** (0.26)
edgecov.Mat_year1987_preproc_eeValues	-Inf	-Inf	-Inf
edgecov.Mat_year1987_preproc_distValues		-0.58* (0.22)	-0.66** (0.24)
edgecov.Mat_year1987_preproc_polityValues		0.06 (0.04)	0.05 (0.04)
edgecov.adjMat_year1987_preproc_majPow		-Inf	-Inf
edgecov.Mat_year1987_preproc_igoValues		-0.03 (0.03)	-0.03 (0.03)
edgecov.Mat_year1987_preproc_capValues		0.05 (0.14)	0.04 (0.14)
edgecov.Mat_year1987_preproc_tradeValues		0.24* (0.11)	0.22* (0.11)
edgecov.adjMat_year1987_preproc_mid		4.59*** (0.55)	4.40*** (0.57)
edgecov.adjMat_year1987_preproc_allies		0.80 (1.11)	0.87 (1.11)
gwdegree			-0.50 (0.43)
gwesp.fixed.1			-4.25 (400.13)
AIC	389.76	319.15	321.72
BIC	419.61	408.71	426.21
Log Likelihood	-190.88	-147.57	-146.86

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$



# Results

**Hypotheses from the paper of Maoz et al (2007):**

**RH2** Enemies of enemies (EE) are unlikely to fight each other.

**RH4** Indirect enemies (EF) are more likely to fight each other than states that are not indirect enemies.

# Results

Results from the paper of Maoz et al (2007):

**RH2** Enemies of enemies (EE) are unlikely to fight each other.

not supported

**RH4** Indirect enemies (EF) are more likely to fight each other than states that are not indirect enemies.

supported

# Results

**My analysis for the years 1920, 1942 and 1988:**

**RH2** Enemies of enemies (EE) are unlikely to fight each other.

*My finding:* nothing significant

**RH4** Indirect enemies (EF) are more likely to fight each other than states that are not indirect enemies.

*My finding:* if 2 states are in an EF-relation, they are significantly likely to fight each other

# Results

## **Additional findings for the years 1920 and 1988:**

### *distance:*

increasing distance between 2 states, smaller probability for conflicts

→ countries that are close to each other get more often in conflicts

### *conflicts in previous year:*

MID in previous year, higher probability for MID in next year

## **Additional findings for the year 1988:**

### *trade:*

increasing trade, higher probability for conflicts

**Thanks for listening!**  
**... questions?**