

2004 MADRID TRAIN BOMBING

Jeffrey Post[†]

[†]RI-SP093 - The Graduate Institute - Geneva, Switzerland

Background, Research, and Hypotheses

March 11th, 2004 saw the deadliest terrorist attack in the history of Spain. Three days before the country's general elections, an Al-Qaeda terrorist cell carried a coordinated attack on the commuter train system of Madrid, Spain. The attack consisted of 10 nearly simultaneous explosions in 4 different locations, killing 193 people and injuring another 2000. [2]

RESEARCH QUESTION

What network configuration emerges in the Madrid terrorist cell?

HYPOTHESES ON NETWORK STRUCTURE

H_1 : The cell exhibits clustering structure

H_2 : The cell exhibits a scale-free network structure

HYPOTHESES ON TERRORISTS' INDIVIDUAL CHARACTERISTICS

H_3 : Terrorists exhibit homophily in role within the cell

H_4 : Terrorists exhibit homophily in arrest status prior to attack

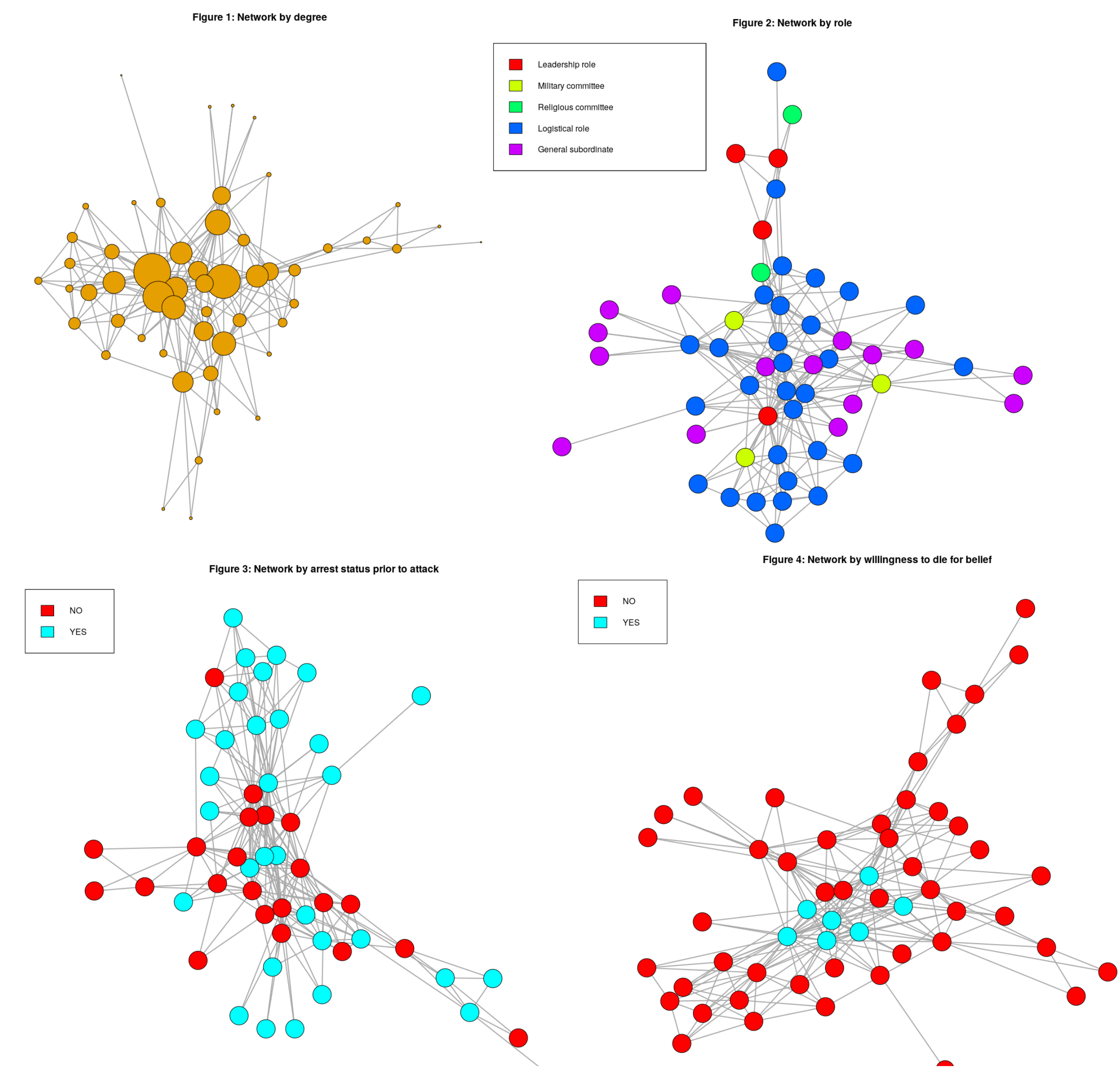
H_5 : Terrorists exhibit homophily among willingness to die for their beliefs

Data collection & Visualization

DATA

- Database: John Jay & ARTIS Transnational Terrorism Database [1]
- Case: Madrid Train Bombings 2004, Spain [1]
- V = 54 individuals with 3 attributes
- E = 452 undirected relations (edges with no discerning attributes)

NETWORK VISUALIZATIONS



Network modelling

MODELING TECHNIQUE

Exponential-Family Random Graph Model (ERGM) [3]

MODEL SPECIFICATION

Structural parameters

- Density ("edges")
- Clustering ("gwesp" geometrically weighted edgewise shared partners)
- Yule process ("gwdegree" geometrically weighted degree)

Individual attributes

- Origin - Place of birth (categorical variable [1:8], 'nodematch')
- Number of operations participated in (categorical variable [1:3], 'nodematch')
- Had been in prison prior to attack in Madrid (binary, 'nodematch')
- Position/Role in the cell (categorical variable [1:5], 'nodematch')
- Willingness to die for belief (binary, 'nodematch')

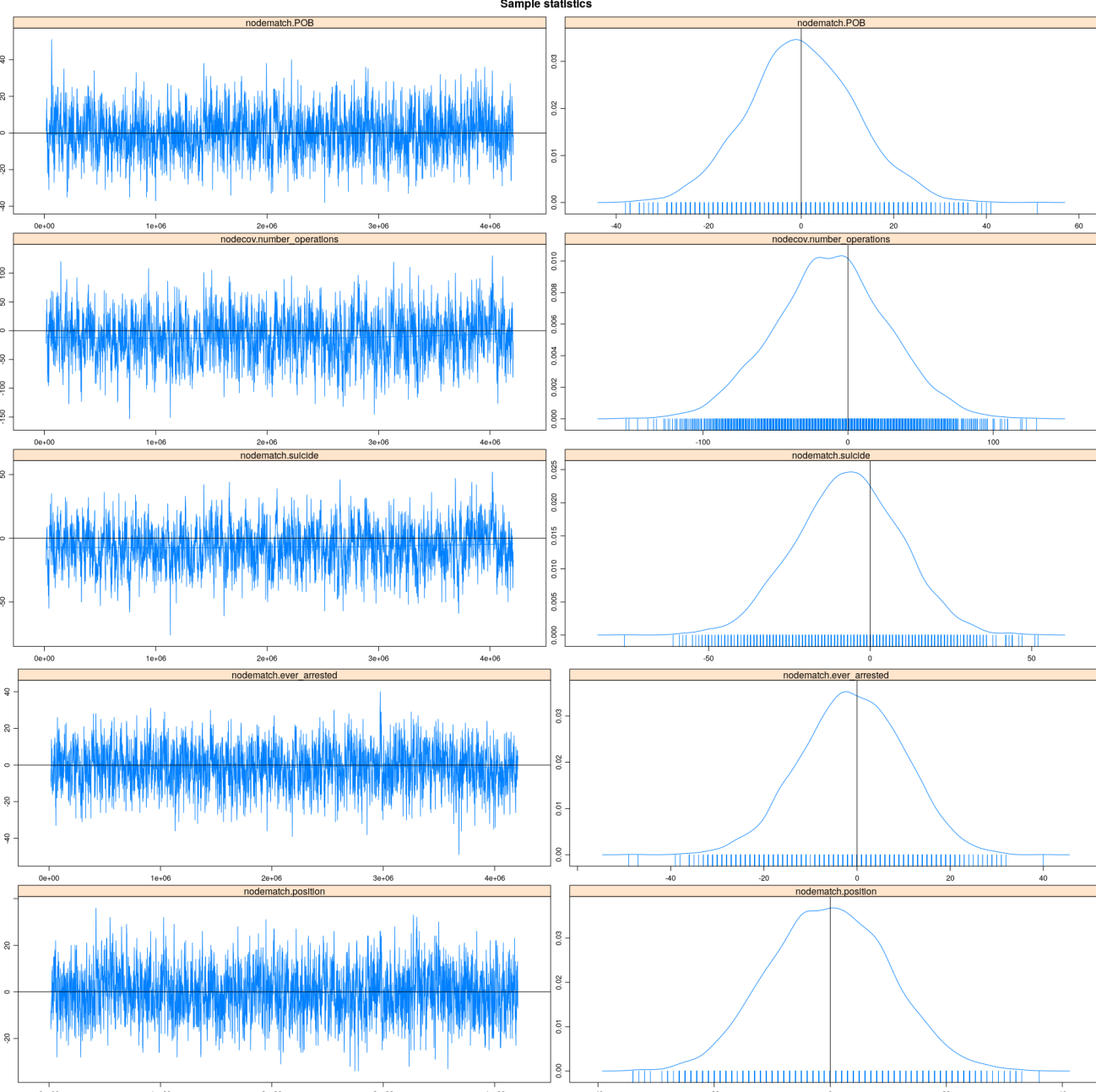
Results

- H_1 : statistically significant only at the $\alpha < 0.1$ level - while difficult to conclusively say, the network exhibits some clustering, by which increase of connections leads to increased probability of forming a tie
- H_2 : statistically significant at the $\alpha < 0.0.1$ level - the network exhibits a Yule process, by which increase of shared connections leads to increased probability of forming a tie
- H_3 : statistically not significant
- H_4 : statistically not significant
- H_5 : statistically significant at the $\alpha < 0.0.1$ level - the network exhibits homophily on the willingness to die for their belief

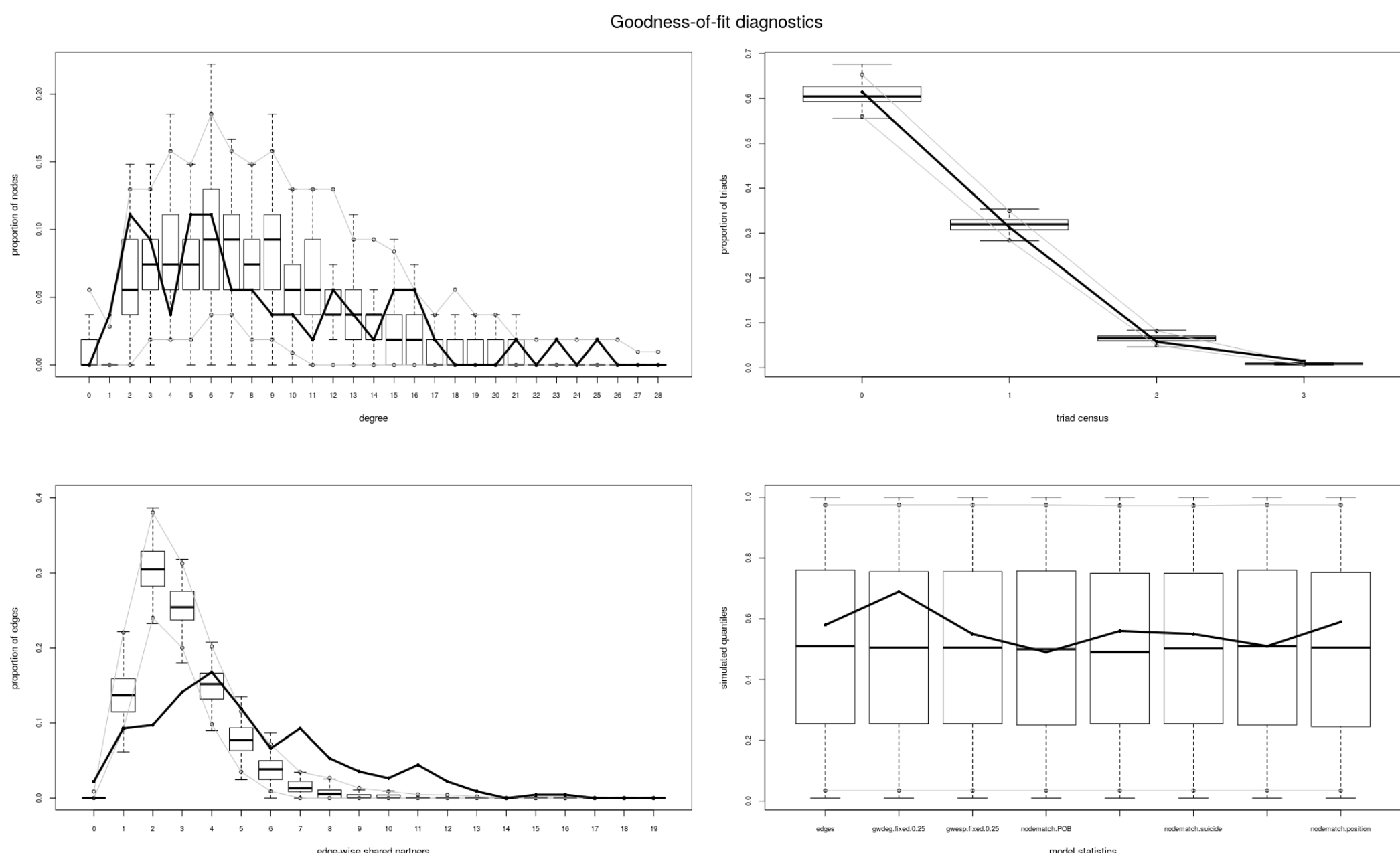
Table 1: Summary of model fit - Monte Carlo MLE Results (log-odds)

| | (Estimate) | (Std. error) |
|---------------------------|------------|--------------|
| Density | -8.31*** | (0.949) |
| Clustering | 3.069* | (1.397) |
| Yule process | 4.266*** | (0.660) |
| Origin | 0.369** | (0.123) |
| Number of operations | 0.739* | (0.295) |
| Willing to die for belief | -0.420*** | (0.115) |
| Ever in prison | 0.158 | (0.134) |
| Role in the cell | 0.071 | (0.14) |

Note: *p<0.1; **p<0.05; ***p<0.01



Comparison - Goodness of fit



The goodness-of-fit comparison reveals some inconsistencies and rather obvious dissimilarities between the observed network and those produced by the ERGM parameters obtained previously.

Limitations and Remarks

- Sparse dataset, and especially sparse node attribute data, leads to inconclusive results
- The Madrid train bombing of 2004 was conducted by an independent terrorist cell with no direct al-Qaeda participation being established. Further studies into these independent cells could have been warranted at the time, to establish similarities between other groups and disrupt their mode of functioning. [4]

References

- [1] John Jay ARTIS Transnational Terrorism Database. *Network Data*. 2009. URL: <http://doitapps.jjay.cuny.edu/jjatt/data.php> (visited on 12/17/2019).
- [2] E. Klein, N. Perelman, and Y. Taylor. "El auto de procesamiento por el 11-M-Documentos". In: *El Mundo* ().
- [3] M. Levy. *ERGM Tutorial*. 2017. URL: <https://michaellevy.name/blog/ERGM-tutorial/#checking-mcmc-chains> (visited on 12/17/2019).
- [4] S. O'Neill. "Spanish indictment on the investigation of 11 March". In: *El Mundo* ().