Bargaining, Information Networks and Interstate Conflict

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Research Question

- Why do states fight if conflict is inefficient and costly?

Argument in a Nutshell

- Uncertainty and informational problems are a major source of interstate conflict
- International networks (e.g. diplomatic exchange, alliances, arms transfers) are a mechanism through which states can obtain strategic information about their opponents
- Networks can moderate uncertainty and informational problems
- Reduced odds of fighting

Outline

1. Theory
2. EITM framework
3. Model
4. Methods & Measurement
5. Results
6. Conclusions

Bargaining Model of War

- Two states, A and B, bargain over an issue $X = [0, 1]$ (e.g. territory)
- A prefers resolutions closer to 1, B prefers resolutions that approximate 0
- A's utility for a resolution $x \in X$ is $u_A(x)$, B's utility is given by $u_B(1 - x)$
- If A and B choose to fight to settle their disagreement, A prevails with probability $p \in [0, 1]$. The winner gets to choose its favorite x
- A's and B's expected utility for war can therefore be expressed as follows:

$$U_A = pu_A(x) - C_A \qquad \text{and} \qquad U_B = (1 - p)u_B(x) - C_B$$

Bargaining Model of War

- Existing formal work shows that there exists a subset of X where both states strictly prefer peaceful ex ante agreement to fighting
- However, states have difficulties identifying this subset (and therefore go to war) because they miscalculate there expected utilities for war
- State A knows its own costs of fighting, C_A, but has only incomplete information about C_B and p
- Overestimate chances of winning (e.g. inacurate assessment of distribution of power)
- Inacurate beliefs about opponent's willingness to fight
- Argument we develop speaks to these informational problems and uncertainties

Bargaining, Networks and Conflict

- Networks are part of the environment in which bargaining takes place
- **Non-battlefield-related** channels of information transmission (less costly alternative to the "means of war")
- States can use their direct and indirect relationships to obtain strategically valuable information about their opponent's preferences, capabilities, resolve
- **Updating of beliefs** about opponent's private information and reduction in miscalculations increases the odds of peaceful settlement
- States' positions in international networks other than the conflict network should therefore have an impact on the probability of conflict

Monadic Centrality

- States with many direct connections to others have broader access to strategic information about their opponents' private information
- Form more accurate beliefs about other parties' military capabilities, costs of conflict, resolve
- Due to their more accurate beliefs central states will make offers that are more likely to fall within the range of possible agreements

Hypothesis 1: States in central network positions are less likely to engage in conflict.

Centrality Difference

- It may be that the extent to which two states match in terms of their centrality makes conflict less likely
- Imbalance of network centralities implies different levels of information and diverging beliefs
- If it is ultimately the convergence of beliefs (see Wagner, 2000 and Slantchev, 2003) about the expected costs and outcomes of war that enables states to strike bargains, variance in expectations increases the probability of conflict.

Hypothesis 2: Dyads that are balanced in terms of states' individual network centralities are less likely to engage in conflict.

EITM Framework

Theoretical concepts

- Decision-making
- Strategic interaction
- Bargaining
- Networks

Statistical concepts

- Interdependent/social choice

EITM Framework

Behavioral analogues

- Utility maximization
- Uncertainty
- Interdependence

Statistical analogues

- Exponential random graph modeling

Exponential Random Graph Models

- Exponential random graph models (ERGMs) are a family of models for statistical inference with network data
- Dependent variable: probability of the observed pattern of ties ($P(\mathbf{\Omega}_m)$)
- Allow to examine the network generating process by modelling the observed collection of ties as a function of exogenous actor and dyad covariates as well as endogenous structural effects in the dependent variable

$$P(\mathbf{\Omega}_m) = \frac{exp(-\sum_{j=1}^{k} \mathbf{\Gamma}_{mj}\psi_j)}{\sum_{m=1}^{M} exp(-\sum_{j=1}^{k} \mathbf{\Gamma}_{mj}\psi_j)}$$

Dependent Variable

- Dependent Variable: pattern of conflict relationships among states that emerges from their engagement in MIDs in a given year t
- Let $\boldsymbol{\Omega}$ be an $n \times n$ matrix, where the element ω_{ijt} represents the relation directed from state i to state j, $(i, j = 1, \ldots, n)$ in year t and n is the number of states in the network:

$$\boldsymbol{\Omega}_{n,n} = \begin{pmatrix} \omega_{1,1} & \omega_{1,2} & \cdots & \omega_{1,n} \\ \omega_{2,1} & \omega_{2,2} & \cdots & \omega_{2,n} \\ \omega_{3,1} & \omega_{3,2} & \cdots & \omega_{3,n} \\ \vdots & \vdots & \ddots & \vdots \\ \omega_{n,1} & \omega_{n,2} & \cdots & \omega_{n,n} \end{pmatrix}.$$

Dependent Variable

- Non-directed conflict relationships:

$$\omega_{ijt} = \omega_{jit} = \begin{cases} 1 & \text{if state } i \text{ and state } j \text{ were engaged in a} \\ & \text{MID in a given year } t \\ 0 & \text{otherwise.} \end{cases}$$

- Data on MIDs between 1955 and 1960 is pooled into a single observation of the international conflict network to "thicken" the network and increase the reliability of ERGM estimates
- Data on dyadic MIDs comes from Maoz (2005)

Independent Variables: Centrality

- $Cent_i$ is an exogenous node covariate that measures state i's point centrality in an international network, $\boldsymbol{\Theta}$ other than the conflict network (e.g. alliances)
- We compute $Cent_i$ using states' degree, eigenvector, and betweenness centrality scores in the network constituted by states' formal alliance relationships as of 1954 (Leeds et al., 2002)
- Degree centrality describes the number of direct connections state i has with others in a network

$$Degree_i = \frac{\sum_{i=1}^{n} \sum_{\forall i \neq j} \theta_{ij}}{(n-1)},$$

where θ_{ij} denotes the presence of a tie in a network $\boldsymbol{\Theta}$ different from the international conflict network, i.e. alliances in our case, and n is the number of nodes in $\boldsymbol{\Theta}$

Independent Variables: Centrality

- Eigenvector centrality measures how far state i is directly connected to other central nodes. Thus, it takes into account that a node's centrality depends on the centrality of its neighbors, its neighbors' neighbors, etc. Technically, it is a centrality measure in which a unit's centrality is its summed connections to others weighted by their centralities

$$\lambda e_i = \sum_{i \neq j} \mathbf{\Theta}_{ij} e_j,$$

where e_i and e_j are the *ith* and *jth* elements of an eigenvector of $\mathbf{\Theta}$, and λ is the eigenvalue associated with this eigenvector

Independent Variables: Centrality

- Betweenness centrality calculates the number of shortest paths or geodesics that connect node j and k and go through node i. In a general sense, betweenness centrality measures the extent to which node i is pivotal for transactions between every other two nodes in a network and can be understood as a global measure of brokerage

$$Between_i = \sum_{\forall j \neq k, j \neq i \neq k} \frac{g_{jik}}{g_{jk}} \left(\frac{(n-1)(n-2)}{2} \right)^{-1},$$

where g_{jk} is the number of geodesics in $\boldsymbol{\Theta}$ connecting nodes j and k and g_{jik} is the number of geodesics between j and k that contain i. The second term is a normalizing constant that refers to the maximum number of possible non-directional connections in a network

Independent Variables: Centrality Difference

- *Centrality Difference* ($CentDiff_{ij}$) is an exogenous dyad covariate measuring the absolute difference between state i's and j's centrality scores (degree, eigenvector, betweenness) in the international network $\mathbf{\Theta}$

$$CentDiff_{ij} = |Cent_i - Cent_j|$$

- We compute $CentDiff_{ij}$ using states' degree, eigenvector, and betweenness centrality scores in the network constituted by states' formal alliance relationships in 1954 (Leeds et al., 2002)

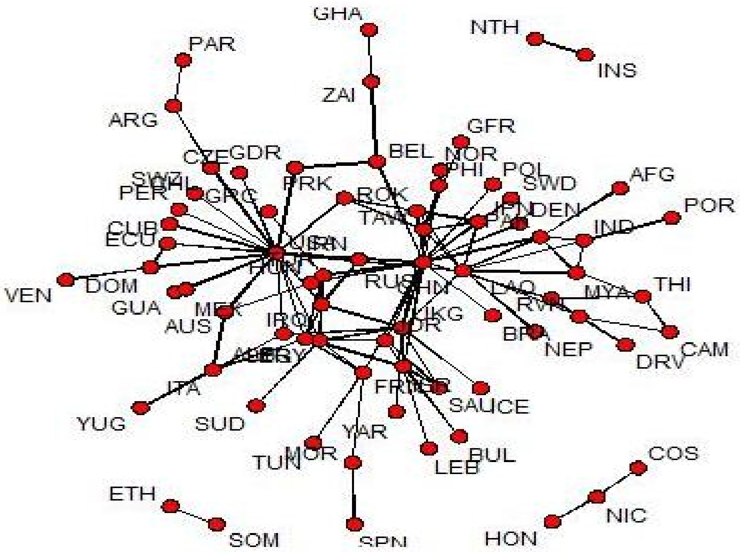
Endogenous Controls

- Node popularity
  - Variable that captures the number of times where two states, i and j, are at war with the same third party k
  - ERGM term that captures number of 2-stars in the MID network
- Triadic closure
  - Variable that captures the number of times where state i fights with state j, j fights with k, and k with i
  - ERGM term that captures the number of closed triads in the MID network
- Density
  - Control for the overall level of conflict activity among states

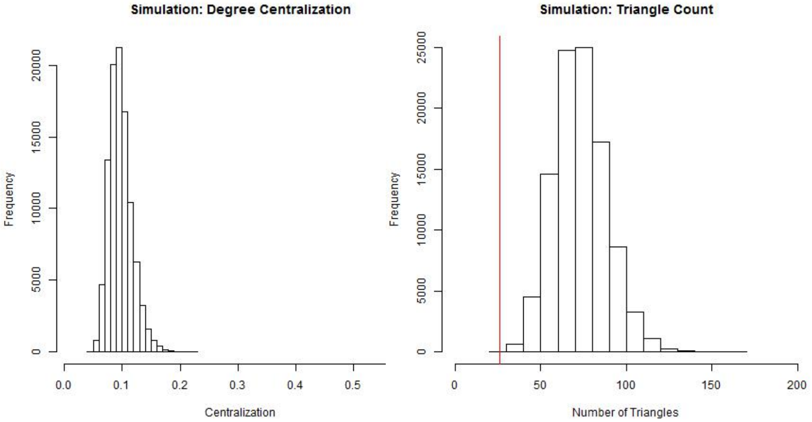
Exogenous Controls

- The “kitchen sink” set of conflict controls
  - Military capabilities
  - Capability difference
  - Regime type
  - Difference in regime type
  - Major power status
- All exogenous actor and dyad covariates are measured based on data from 1955

Network of Interstate Disputes, 1955-1960



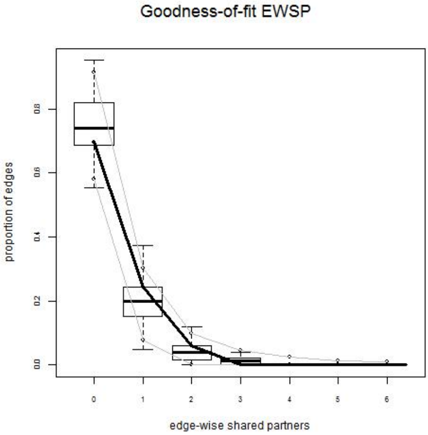
Different from Random Process?

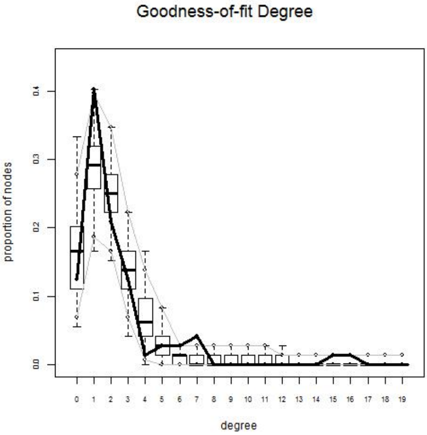


ERGM Results

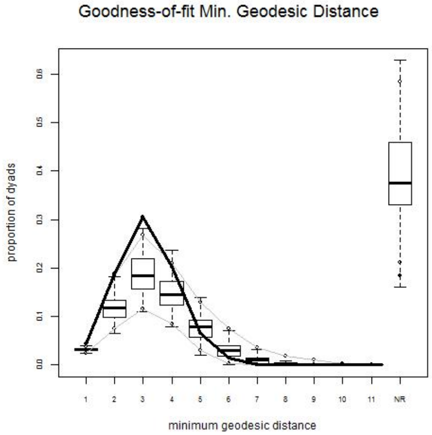
	Model 1	Model 2	Model 3
Edges	-3.939***	-4.066***	-4.298***
	(0.3128)	(0.2828)	(0.2550)
Degree	-1.1637		
	(0.7133)		
Degree Diff.	**-6.8369*** **		
	(2.0523)		
Eigen		0.5586	
		(1.077)	
Eigen Diff.		**-4.398*** **	
		(0.3307)	
Between			-0.9786
			(1.417)
Between Diff.			**2.950*** **
			(0.4194)
Controls	✓	✓	✓

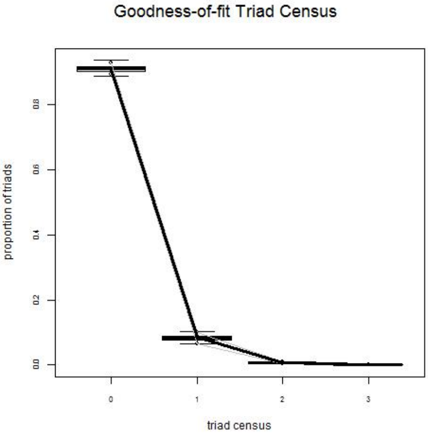
Model Fit: EWSP & Degree





Model Fit: Geodesic Distance & Triad Census





Conclusions

- Good model fit but only partial support for our hypotheses
- Larger differences in states' centralities in the alliance network increase the probability of conflict when centrality is measured as betweenness. Opposite effect for degree and eigenvector centrality
- What would be a way to formalize our argument?
- How could the linkage between theory and empirical test be further strengthened?