Winningness in War and State Power

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In the context of international relations, translating definitions of power into empirical observables has been anything but straightforward. Taking a cue from the theoretical literature on bargaining, I suggest treating power as the value of the outside option of war in a bargaining process. Thus, state winningness (ability) in war, and hence power, is an actor-specific latent quantity to be estimated from the data available. I propose a generalized version of the Bradley-Terry model for paired comparisons that models coalitions and ties explicitly. This method produces a measure of winningness that is (1) transitive and (2) a function of covariates. I apply this technique to all wars fought from 1816-1991 and find that regime indicators, but not necessarily material capabilities indicators, influence winningness in war.

A Definition of Power

- Power is *the ability to convince agents to do what they otherwise would not* (Dahl, 1957)
- Often, scholars equate material capabilities with power and neglect outcomes
- State power in international crises is bounded below by the value of the outside option of war; winningness in war is a kind of bargaining power

Model: Coalitions and Ties

- N will denote individual agents, here states
- At any time, two subsets of N may form into coalitions and fight each other in a war
- For the k^{th} observation, denote these coalitions by $\mathcal{C}_A^k, \mathcal{C}_B^k \subset N$ such that $\mathcal{C}_A^k \neq \emptyset, \mathcal{C}_B^k \neq \emptyset$ and $\mathcal{C}_A^k \cap \mathcal{C}_B^k = \emptyset$
- Parameterize the i^{th} state's winningness in war as $\exp\{\pi_i(x_i)\}$. Assume the probability of a tie is proportional to the geometric mean of winningness:

$$\theta\sqrt{\sum_{i\in\mathcal{C}_A^k}\exp\{\pi_i(x_i)\}\sum_{i\in\mathcal{C}_B^k}\exp\{\pi_i(x_i)\}}$$

- Then $p(\mathcal{C}_A^k$ defeats $\mathcal{C}_B^k)$ is:

$$\frac{\sum_{i\in\mathcal{C}_A^k}\exp\{\pi_i(x_i)\}}{\sum_{i\in\mathcal{C}_A^k}\exp\{\pi_i(x_i)\}+\sum_{i\in\mathcal{C}_B^k}\exp\{\pi_i(x_i)\}+\theta\sqrt{G}}$$

and $p(\mathcal{C}_A^k$ ties $\mathcal{C}_B^k)$ is:

$$\frac{\theta\sqrt{G}}{\sum_{i\in\mathcal{C}_A^k}\exp\{\pi_i(x_i)\}+\sum_{i\in\mathcal{C}_B^k}\exp\{\pi_i(x_i)\}+\theta\sqrt{G}}$$

where

$$G = \sum_{i\in\mathcal{C}_A^k}\exp\{\pi_i(x_i)\}\sum_{i\in\mathcal{C}_B^k}\exp\{\pi_i(x_i)\}$$

$$\pi_i(x_i) = \sum_{m=1}^{M} x_i^m\beta_m$$

- Assuming that the outcomes of each war are independent of the remaining wars, we have a multinomial model that can be estimated via MLE or Bayesian simulation

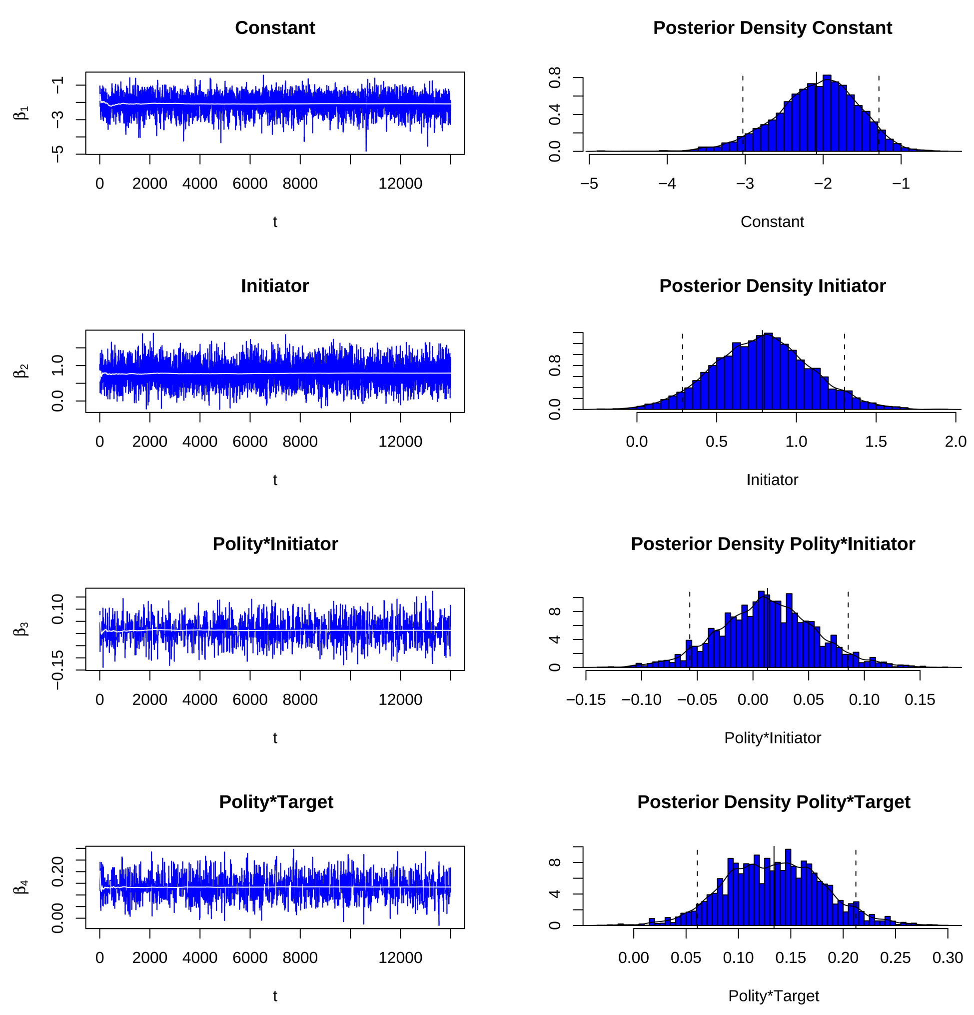
Data

- Universe of cases: 79 Wars involving 275 (a total of 81 *distinct*) states, 1816-1991
- 36% of these involved coalitions of states (dependence of outcome across dyadic observations)
- 72 of 79 ended with a clear winner and loser while 7 ended in a tie
- Dependent variable: war outcome (win, lose, tie)

Results

We can split the analysis up into two components: non-material components (initiative, regime indicators) vs material components (soldiers, expenditure, long term strength)

Figure 2. Time Series of Posterior Draws, Table 3a.



- Thus, we can compute the probability that a democratic defender state (D) prevails in war against an autocratic aggressor (A), $p(D$ defeats A$)$, as:

$$\frac{\exp\{\pi_D(x_D)\}}{\exp\{\pi_A(x_A)\}+\exp\{\pi_D(x_D)\}+\theta\sqrt{G}} \approx 0.57$$

and the probability of a tie, $p(D$ ties $A)$, as:

$$\frac{\theta\sqrt{G}}{\exp\{\pi_A(x_A)\}+\exp\{\pi_D(x_D)\}+\theta\sqrt{G}} \approx 0.06$$

where: $\pi_D(x_D) = 9 * 0.1346$, $\pi_A(x_A) = 0.7959 + 1 * 0.0158$, $\theta = \exp\{-2.0794\}$, and $G = \exp\{\pi_A(x_A)\}\exp\{\pi_D(x_D)\}$

- Analogous calculations for the Great War: Entente powers would have won w/ prob 0.768, tied w/ prob 0.047, and lost w/ prob 0.185.

Figure 3. Posterior Density of Posterior draws, Table 4a.

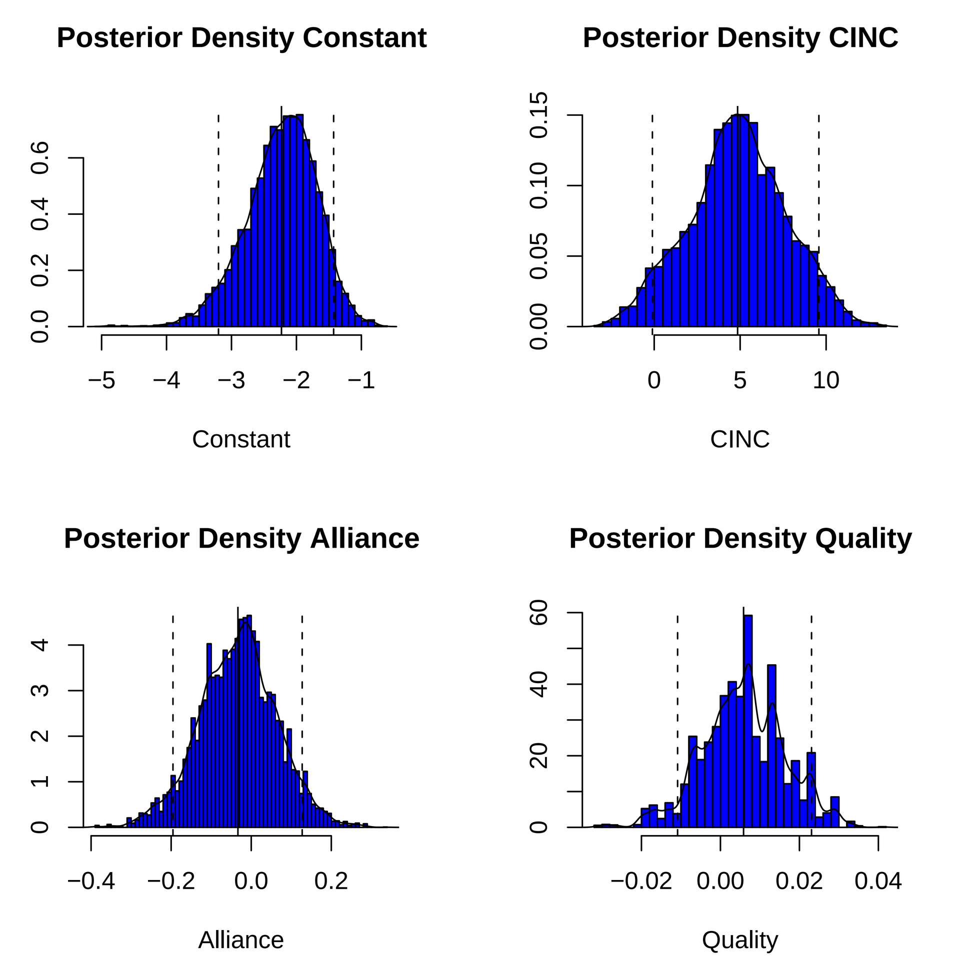
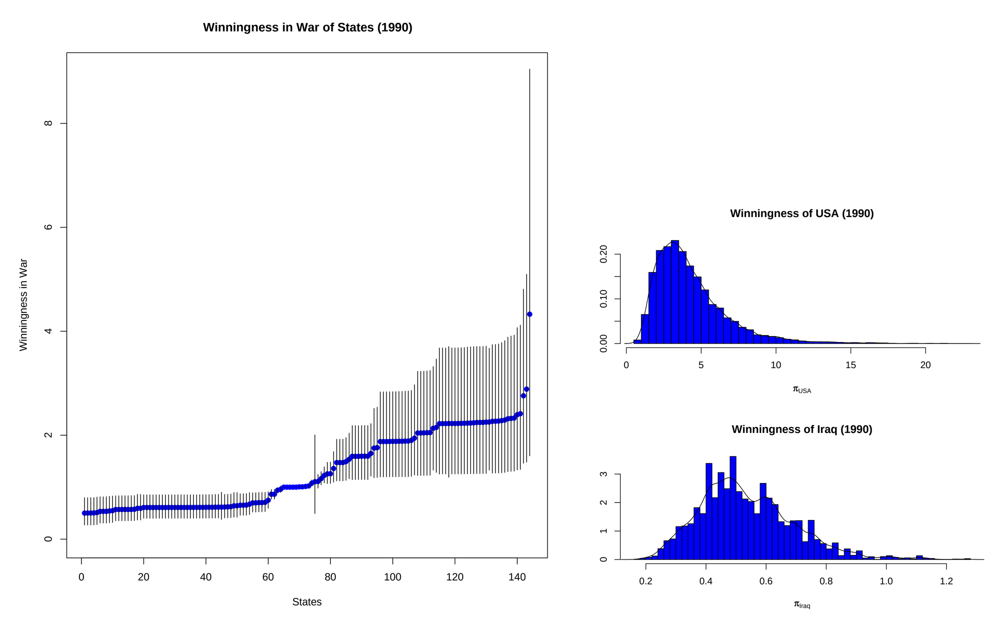


Table 5a: Structured Estimates: Individual Political Components

Coefficient	Mean	$\widehat{R}$
Constant	-2.2214 $[-3.2066, -1.4151]$	1.000
CINC	4.1331 $[-0.7104, 8.8965]$	1.000
Polity	0.07443 $[0.0226, 0.1303]$	1.002

Table 5a. Point estimates of parameter effect are given by the posterior mean. The interval below the point estimates is the empirical 95% region of highest posterior density.

Figure 4. A Ranking of Winningness in War.



Conclusions

The method I propose allows us to model the dynamics of power naturally as functions of covariates, and thereby determine its causes, while at the same time avoiding some of the dependence across observations that would be induced by treating the data as dyads. Causes include regime characteristics (particularly executive constraints and freedom of competition) and initiative (initiator states). Once these are controlled for, material indicators have ambiguous effects.