A Quantitative Bargaining Theory of War

Brenton Kenkel Kristopher W. Ramsay

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Introduction

Key concepts in bargaining model of war:

- Military strength
- Resolve/cost of fighting
- Prior beliefs/uncertainty

How can we measure these theoretical quantities in terms of observable characteristics of states?

Approach

1. Write down bargaining model of war
2. Model exogenous parameters as functions of data
3. Assume data generated by equilibrium behavior
4. Structurally estimate

Bargaining model

Sides A and B, each with ≥ 1 constituent states

1. Side A offers $x \in \mathbb{R}$
2. Side B accepts or rejects
    - Accept $\rightarrow$ A gets x, B gets $1 - x$
    - Reject $\rightarrow$ each pays θ_k, war occurs

War costs θ_A, θ_B i.i.d. Exponential(λ)

War-fighting model

Each state expends effort $e_i \geq 0$

Probability Side A wins:

$$p_A = \frac{\sum_{j \in A} m_j e_j}{\sum_{j \in A} m_j e_j + \sum_{j \in B} m_j e_j}$$

War payoffs:

$$u_A = p_A - \theta_A - \sum_{j \in A} c_j e_j$$

$$u_B = 1 - p_A - \theta_B - \sum_{j \in B} c_j e_j$$

Empirical parameterization

Crisis level

- Shape of prior beliefs: λ

State level

- Military effectiveness: m_i

- Marginal cost of effort: c_i

Empirical parameterization

Crisis level

- Shape of prior beliefs: $\lambda = \exp(W\alpha)$

State level

- Military effectiveness: m_i

- Marginal cost of effort: c_i

Empirical parameterization

Crisis level

- Shape of prior beliefs: $\lambda = \exp(W\alpha)$
  - Contiguity
  - Preference Similarity
  - Rivalry
  - Major Power Involvement
  - Peace Years

State level

- Military effectiveness: m_i

- Marginal cost of effort: c_i

Empirical parameterization

Crisis level

- Shape of prior beliefs: $\lambda = \exp(W\alpha)$
  - Contiguity
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  - Major Power Involvement
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State level

- Military effectiveness: $m_i = \exp(X_i\beta)$

- Marginal cost of effort: c_i

Empirical parameterization

Crisis level

- Shape of prior beliefs: $\lambda = \exp(W\alpha)$
  - Contiguity
  - Preference Similarity
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State level

- Military effectiveness: $m_i = \exp(X_i\beta)$
  - GDP
  - Population
  - Military Quality
- Marginal cost of effort: c_i

Empirical parameterization

Crisis level

- Shape of prior beliefs: $\lambda = \exp(W\alpha)$
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State level

- Military effectiveness: $m_i = \exp(X_i\beta)$
  - GDP
  - Population
  - Military Quality
- Marginal cost of effort: $c_i = \exp(Z_i\gamma)$

Empirical parameterization

Crisis level

- Shape of prior beliefs: $\lambda = \exp(W\alpha)$
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  - Peace Years

State level

- Military effectiveness: $m_i = \exp(X_i\beta)$
  - GDP
  - Population
  - Military Quality
- Marginal cost of effort: $c_i = \exp(Z_i\gamma)$
  - Imports/GDP
  - Democracy

Data

Militarized Interstate Disputes, 1816–2001

- $N = 2{,}295$ disputes, with 5,451 total participants
- War: 0 or 1
- Winner: *A*, *B*, or censored

Data structure

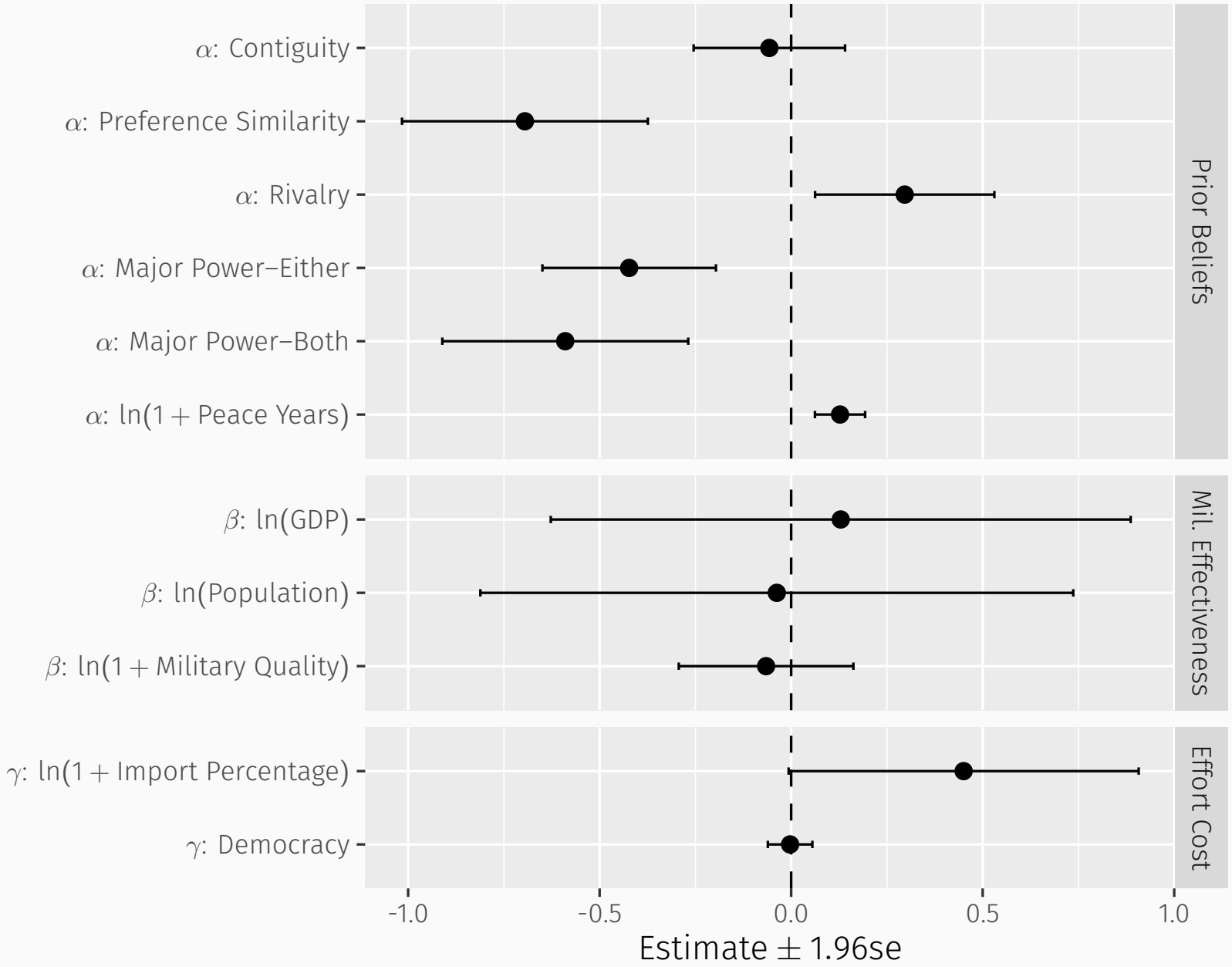
Crisis level

Dispute	War	Winner	Contiguity	Rivalry	...
1	0	.	0	0	
2	1	A	1	0	
3	0	.	0	1	
...					

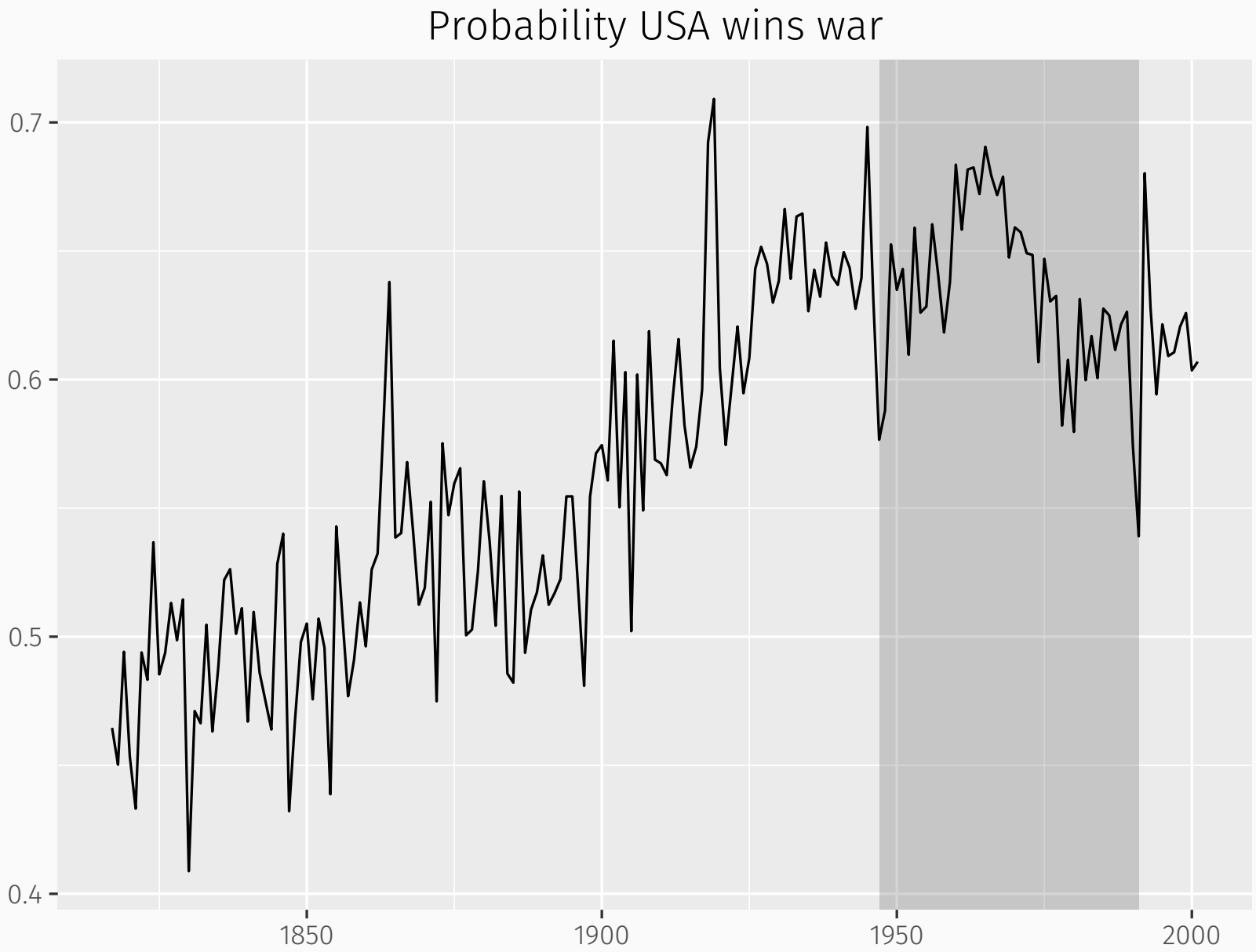
State level

Dispute	Side	GDP	Population	...
1	A	0.4	6.4	
1	B	7.8	3.1	
2	A	0.8	5.6	
2	A	4.2	6.4	
2	B	6.2	8.6	
3	A	1.3	2.0	
3	B	7.9	8.4	
...				

Parameter estimates



Equilibrium quantities: USA vs. Russia



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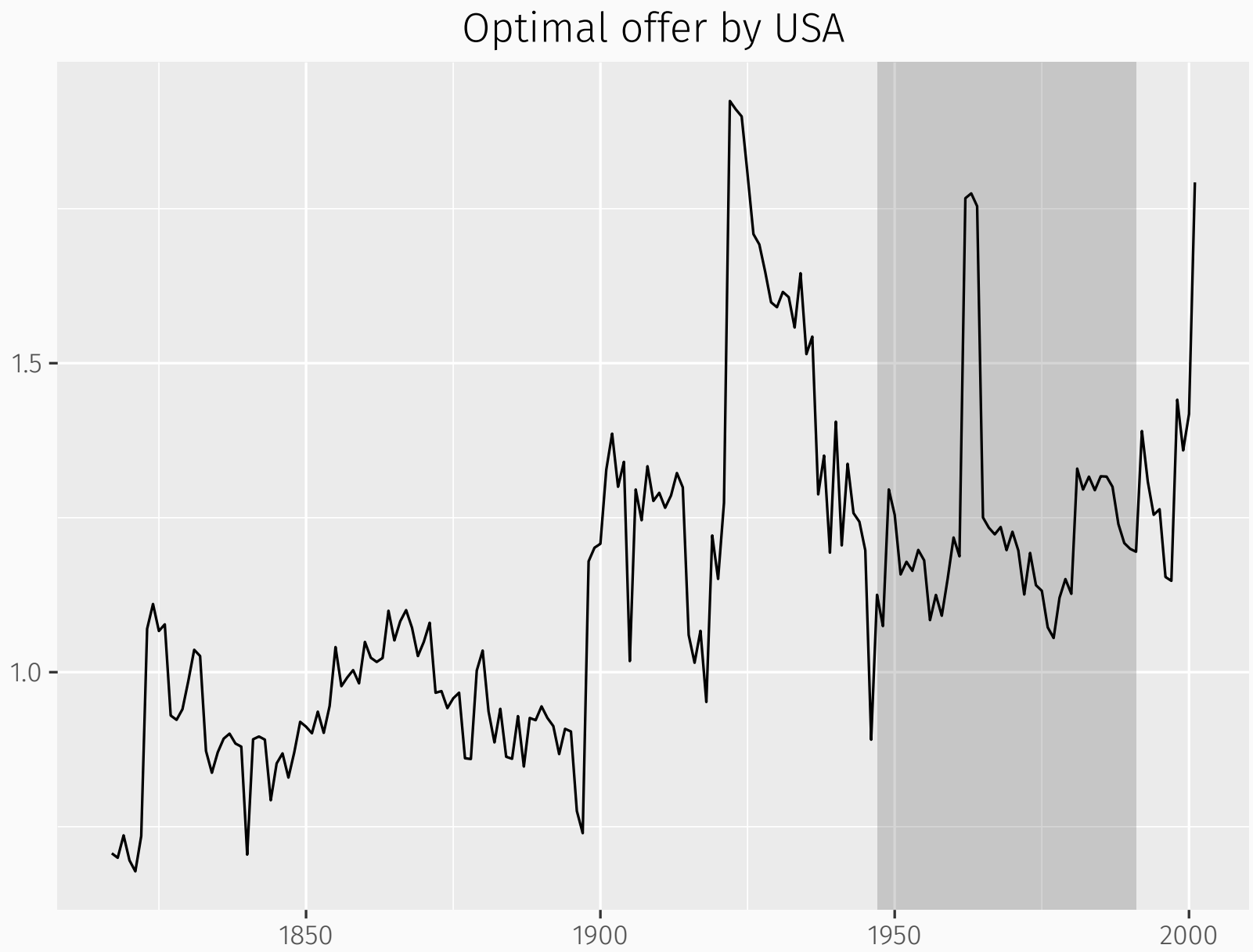

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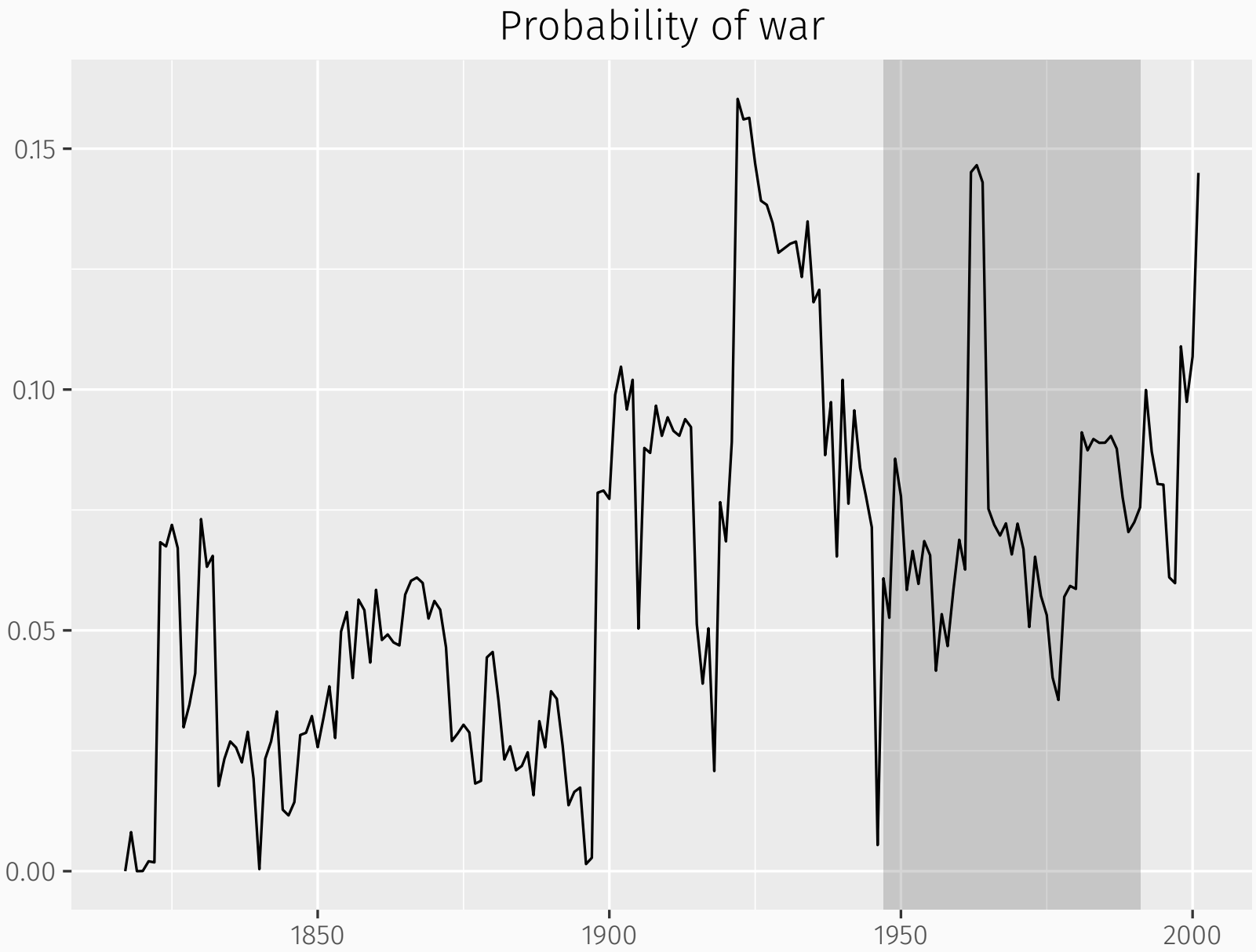

Conclusions and next steps

Conclusions

- Bargaining model has empirical content
- Major powers, similar preferences $\rightarrow$ more uncertainty
- Rivals, long time at peace $\rightarrow$ less uncertainty
- No discernible effects of economic/political characteristics on states' ability and willingness to wage war

Next steps

- Different variables in the effectiveness/cost equations?
- Benchmark models for predictive comparison?
- Other substantive applications of estimator?