Three Papers on International Relations and Political Methodology

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Overview

1. How did financial markets respond to battles in the American Civil War, and what does that tell us about the effect of military combat on war termination?
2. How did financial markets respond to the initiation American Civil War, and what does that tell us about war initiation?
3. Alternative method for change points and an implementation in Stan

Sections

Data Problems in the Study of Intra-war Events

- Problem:
  - Poor data in limited cases
  - Hard to compare fighting across wars
- Previous recommendation: qualitative case studies (Reiter 2003,2009)
- This paper: financial markets
  - Financial asset prices are expected/predicted values of war termination
  - Determine important (surprising) events

Why the American Civil War

- Extensive data on battles
- U.S. government bonds primarily driven by expectations of the war's cost

Fives of 1874

The effect of battles on U.S. govt bond yields

Outcome Variable: Yields of U.S. govt bond

Explanatory Variables: 42 major battles and their outcomes

Results:

- Avg. Confederate battle: 5%
- Avg. Union battle: 0% to -1%
- All Confederate battles largest magnitude of their point estimates
- Substantive effects not large

What does this mean?

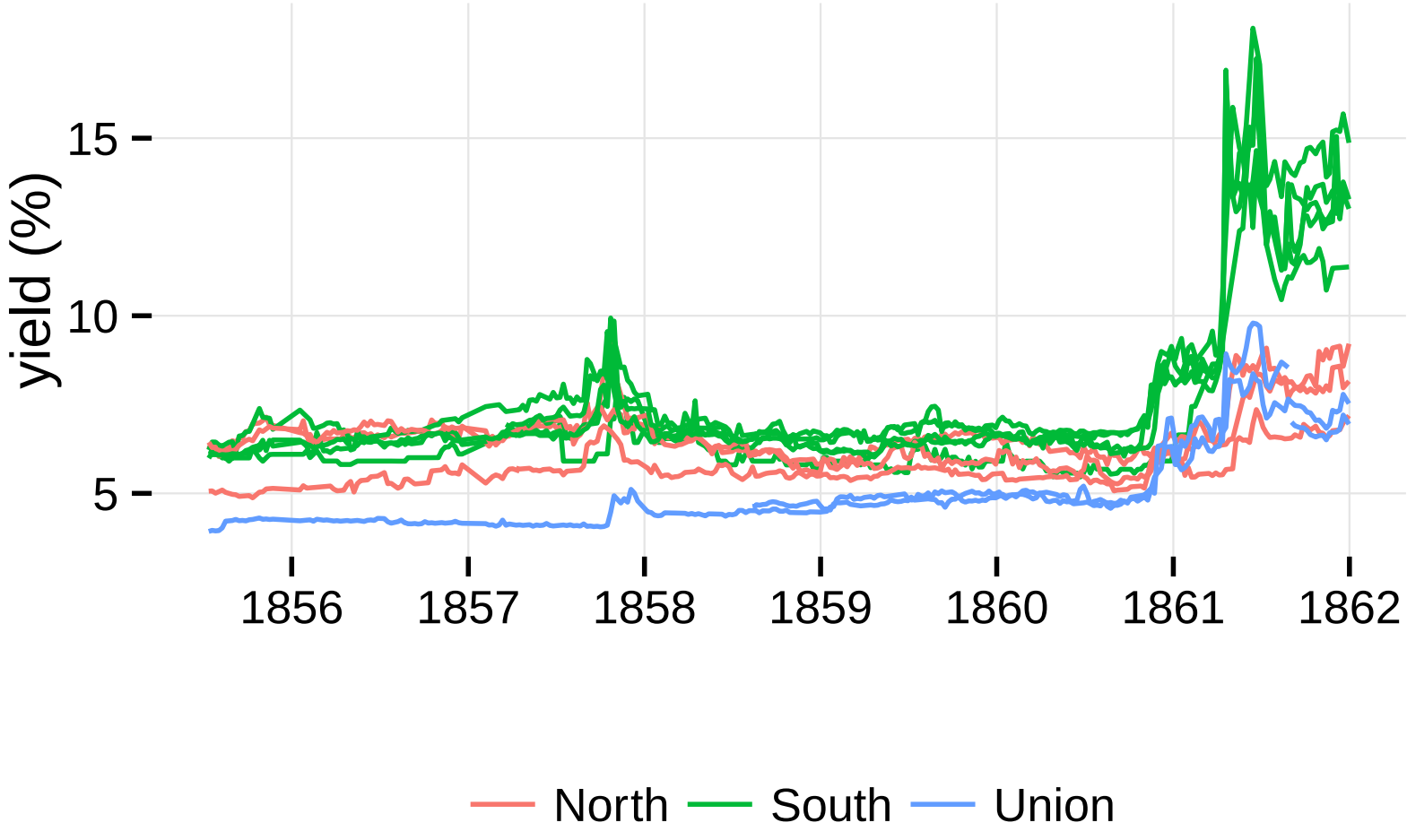
- Method to estimate the effects of battles on war termination within a single war or identify surprising events
- Larger effects late in the war not consistent with a naive information theory of war
- Major battles had little effect on war expectations

Sections

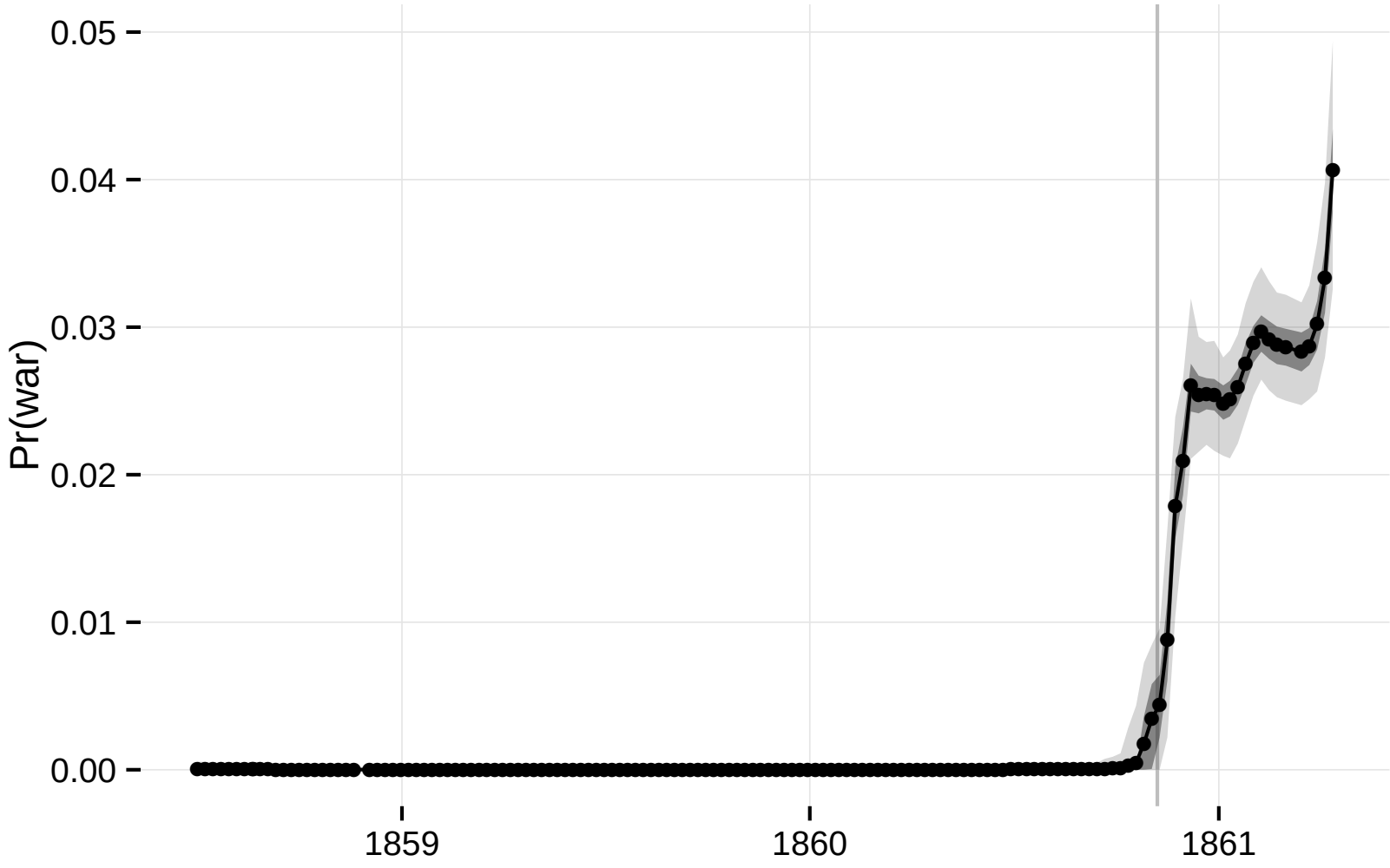
Are markets surprised by war initiation?

- Market prices incorporate present information
- Big jump at start of a war = market surprised
- Why should you care?
  - Rationalist theories of war
    - Private information theories of war: war surprising (Gartzke 1999)
    - Commitment theories: not necessarily
  - Capitalist peace
  - Effectiveness of prediction

State and Government Bond Yields Jump at Fort Sumter



Market Implied Probability of War



The general condition of commercial and financial affairs still turns upon the uncertain political future. The fears of civil war, that at one time were entertained in certain quarters, have subsided, if not altogether disappeared, under the influence of passing events.
— The Bankers' Magazine, April 1861

Sections

Change point Models

Example

Normally distributed $y_1, \ldots, y_n$ with M change points $(\tau 1, \ldots, \tau_M)$ in the mean:

$$
\begin{aligned}
y_1, \ldots, y_{\tau_1 - 1} &\sim \mathcal{N}(\mu_1, \sigma^2), \\
y_2, \ldots, y_{\tau_2 - 1} &\sim \mathcal{N}(\mu_2, \sigma^2), \\
&\ldots, \\
y_{\tau_M}, \ldots, y_n &\sim \mathcal{N}(\mu_M, \sigma^2).
\end{aligned}
$$

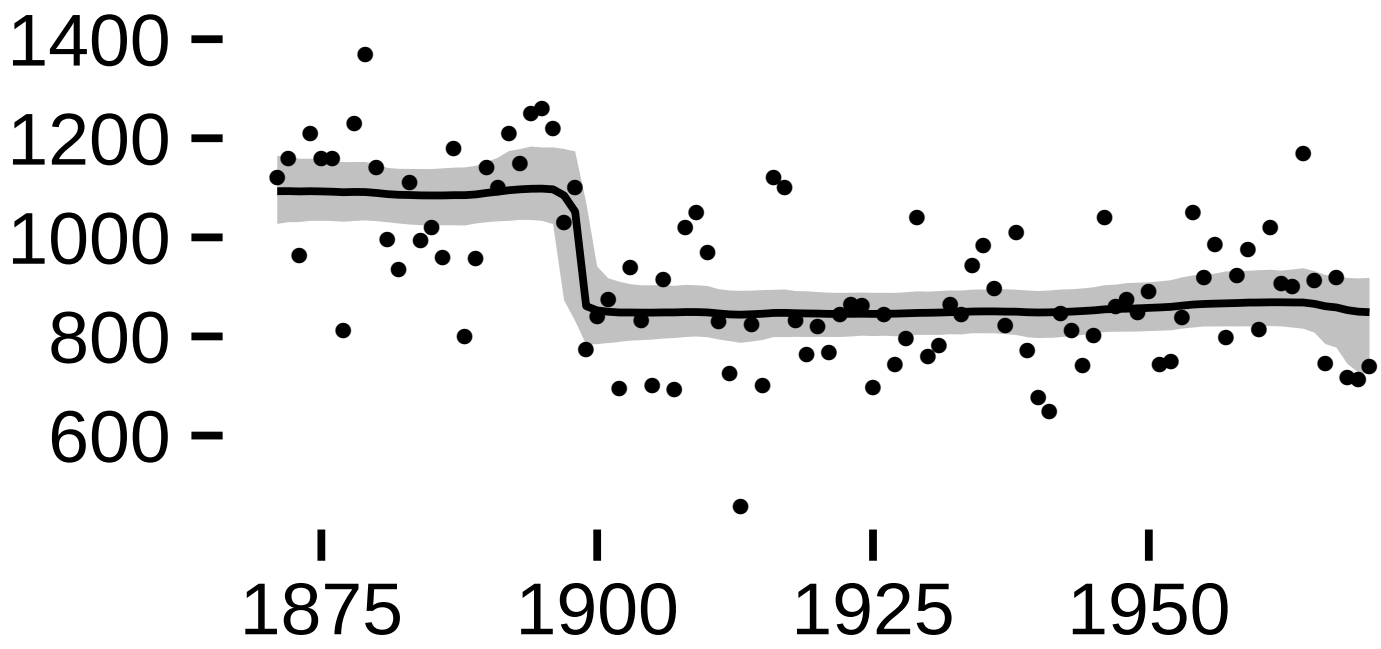
Change point Models as a Variable Selection Problem

Treat μ_t as a time-varying parameter:

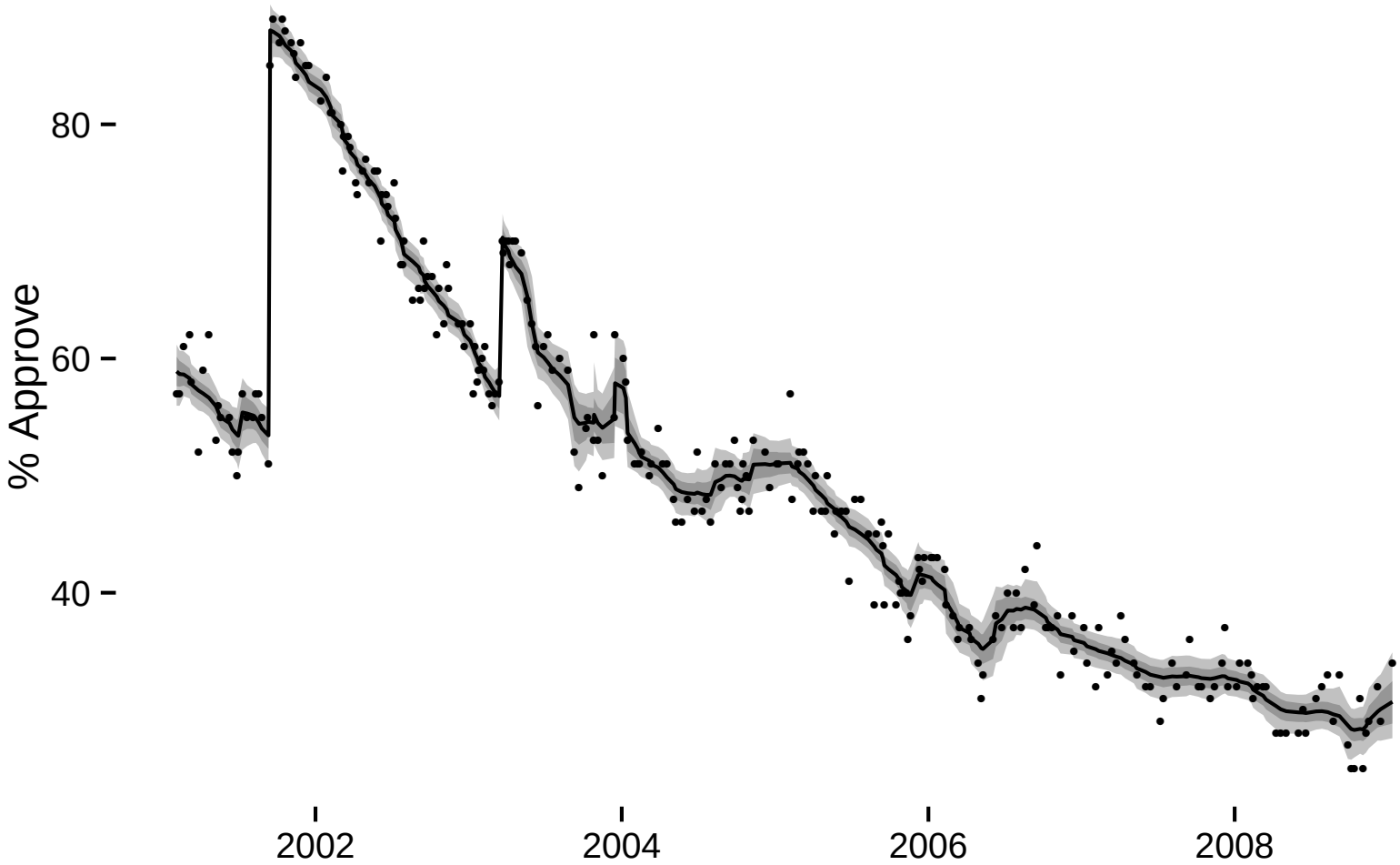
$$y_t \sim \mathcal{N}(\mu_t, \sigma^2),$$
$$\mu_t = \mu_{t-1} + \omega_t.$$

- If change points, then most ω_t are zero (sparse)
- Give ω_t a sparse shrinkage prior, e.g. Horseshoe (Polson, Carvalho et al. 2010)
- Dynamic linear model

Example: Nile



Example: Bush



Implementation in Stan

- Kalman filter / smoother / simulation smoothing in Stan
- Stan is a probabilistic programming language
- Partially collapsed Gibbs sampler
  1. Sample parameters with HMC-NUTS while marginalizing over latent states
  2. Sample latent states using simulation smoother

Implementation and advantages

- Continuous changes most likely more common social science DGPs
- Posterior of the parameter with change points rather than the change points themselves
- Multiple change points, multiple parameters
- Flexible models
- Implemented in Stan

Questions?