

Alliance Treaty Design and the Arms-Alliances Tradeoff

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Why study the arms-alliances tradeoff: Part 1



Why study the arms-alliances tradeoff: Part 1

“Nations apparently willing and eager for American taxpayers to assume the growing security burden left by reductions in European defense budgets.” *Robert Gates*

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DiGiuseppe and Poast 2016	—
Horowitz et al 2017	+

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Theory

Substitution

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**More reliable alliances are a better substitute
for domestic arms.**

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2. Promises to fight $\uparrow \text{Value}$

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- *Conditional Alliances* promise military support if particular conditions are met.
- *Probabilistic Deterrent Alliances* do not guarantee military support or intervention.

HYPOTHESIS: *Unconditional alliances will be associated with decreases in defense spending by member states.*

Empirical Analysis

Political Science Examples: Steenbergen and Jones 2002, Gelman and Hill 2007, Hee Park and Jensen 2007, Rainey 2015

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- Direct test of theory
- Retain alliance-level variation
- Partial pooling for alliance comparisons

Multilevel & Multiple Membership Model

$$y_{it} \sim \text{student}_t(\nu, \mu, \sigma)$$

$$\mu_{it} = \alpha + \alpha^{st} + \alpha^{yr} + \eta y_{it-1} + W_{it}\gamma + Z_{it}\lambda$$

$$\lambda_k \sim N(\theta_k, \sigma^{all})$$

$$\theta = X\beta$$

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Example year:

Argentina 1955 = Overall mean

+ Argentine Intercept + 1955 Intercept

+ 1954 Spending + Argentine Characteristics

+ λ_{OAS} * OAS Expenditure + λ_{Rio} * Rio Pact Expenditure

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State-Year	Rio Pact	Warsaw Pact	...
Argentina 1954	.347	0	...
Argentina 1955	.418	0	...
⋮	⋮	⋮	...

$$\lambda_k \sim N(\theta_k, \sigma^{all})$$

$$\theta = X\beta$$

Example:

$$\lambda_{Rio} = \beta_1 + \beta_2 \text{Unconditional} + \beta_3 \text{Conditional} + \beta_4 \text{Prob. Det.} + \text{Controls}$$

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Sample and Key Variables

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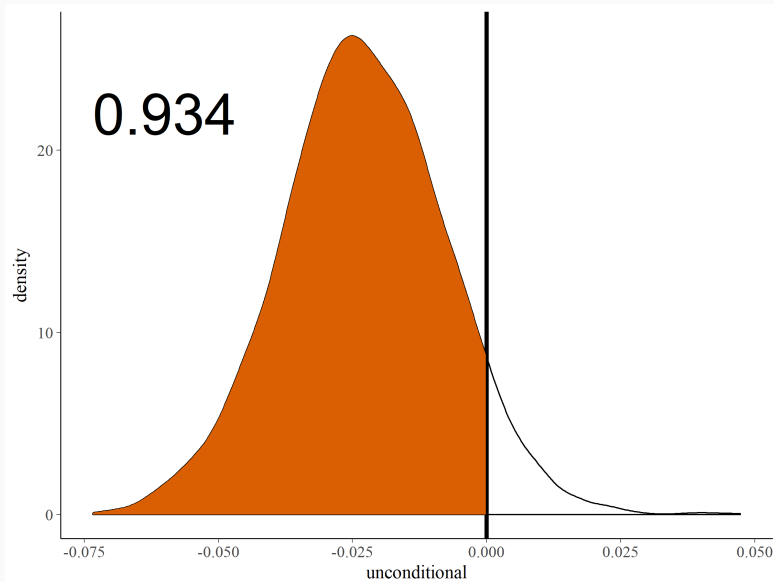
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- **State-level Controls:** Interstate war, Civil War, GDP, POLITY, Cold War, Rival military expenditures

Results

Posterior of Unconditional Coefficient



Long

Run

Multiplier

Variable	Posterior Mean	$Pr(X < 0)$
Unconditional	-0.75	.934

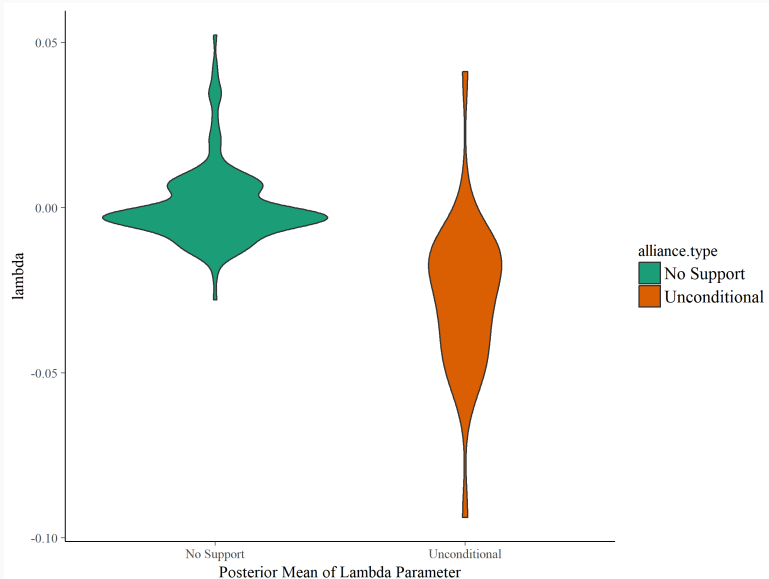
Long

Run

Multiplier

Variable	Posterior Mean	$Pr(X < 0)$
Unconditional	-0.75	.934
POLITY	-0.68	.99

Violin Plot of Weight Parameters



Discussion and Conclusion

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2. Strategic Alliance Design: addressed through controls
3. No time-varying alliance characteristics

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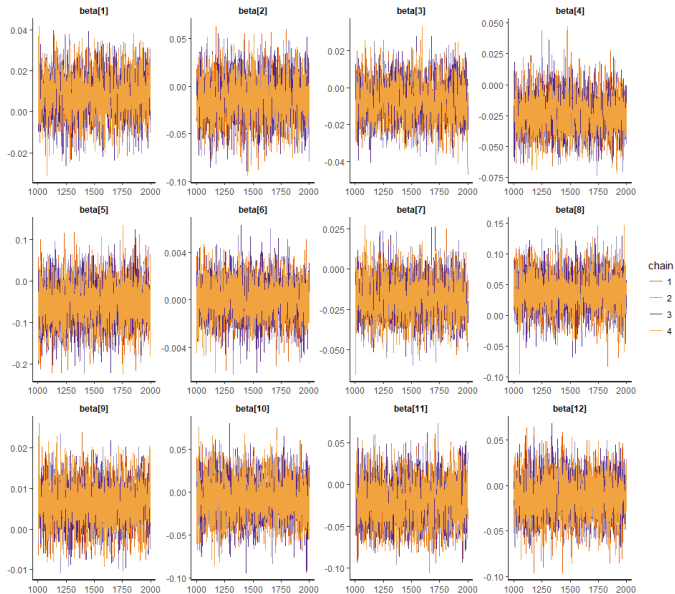
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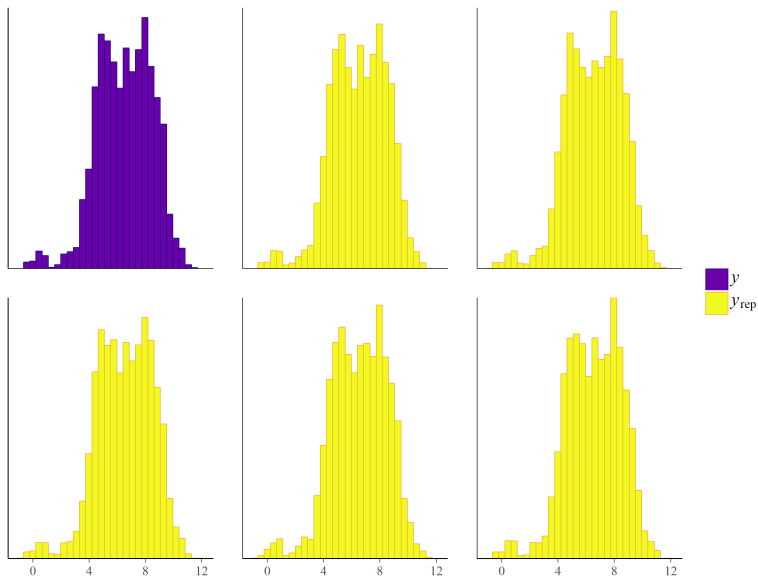
Implications and Extensions:

- Arms and allies as complements
- Domestic arms development and substitution
- Political economy of international security

Trace Plots for β



Posterior Predictive Check



Priors

$$p(\alpha) \sim N(0, 3)$$

$$p(\sigma) \sim \text{half-}N(0, 1)$$

$$p(\alpha^{yr}) \sim N(0, \sigma^{yr})$$

$$p(\sigma^{yr}) \sim N(0, 1)$$

$$p(\alpha^{st}) \sim N(0, \sigma^{st})$$

$$p(\sigma^{st}) \sim \text{half-}N(0, 1)$$

$$p(\sigma^{all}) \sim \text{half-}N(0, 1)$$

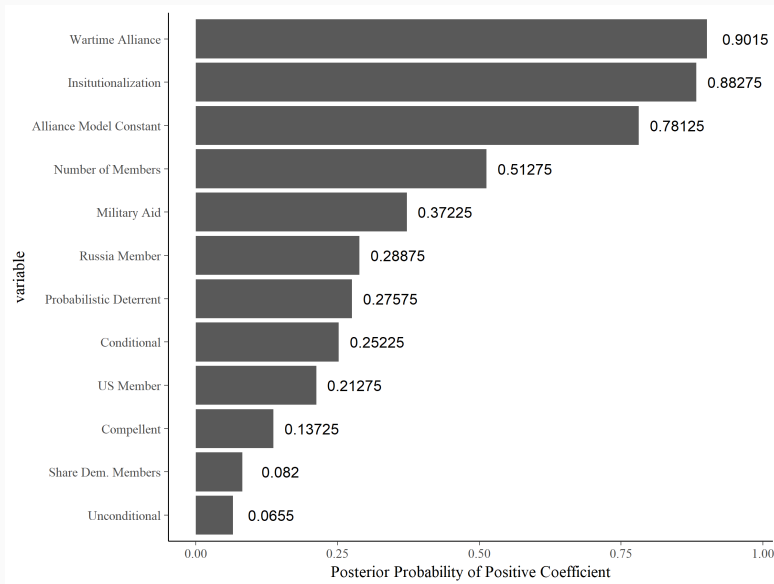
$$p(\eta) \sim \text{half-}N(0, 1)$$

$$p(\beta) \sim N(0, 1)$$

$$p(\gamma) \sim N(0, 1)$$

$$p(\nu) \sim \text{gamma}(2, 0.1)$$

Positive Posterior Probability of all Coefficients



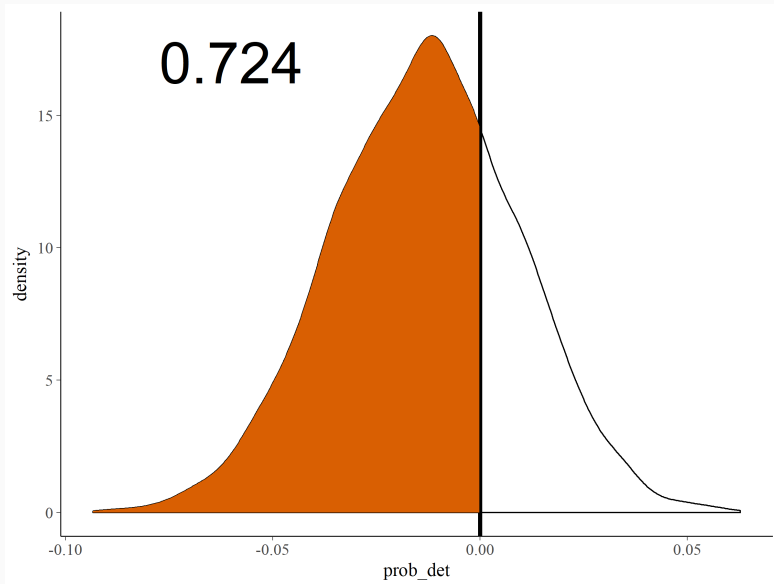
90% Credible Intervals for Alliance Covariates

	mean	sd	5%	95%	n_eff
Constant	0.008	0.010	-0.009	0.025	2503.930
Prob. Det.	-0.013	0.023	-0.051	0.023	4000.000
Conditional	-0.007	0.011	-0.025	0.011	2278.851
Uncond. Det.	-0.023	0.015	-0.048	0.002	3009.267
Compellent	-0.054	0.050	-0.137	0.031	4000.000
Num. Members	0.000	0.002	-0.003	0.003	4000.000
Dem. Share	-0.018	0.012	-0.037	0.003	2618.817
Wartime	0.038	0.030	-0.011	0.087	4000.000
Institutionalization	0.006	0.005	-0.002	0.015	4000.000
Military aid	-0.008	0.024	-0.046	0.033	4000.000
US Member	-0.020	0.025	-0.062	0.021	3091.589
Russia Member	-0.013	0.022	-0.050	0.024	4000.000

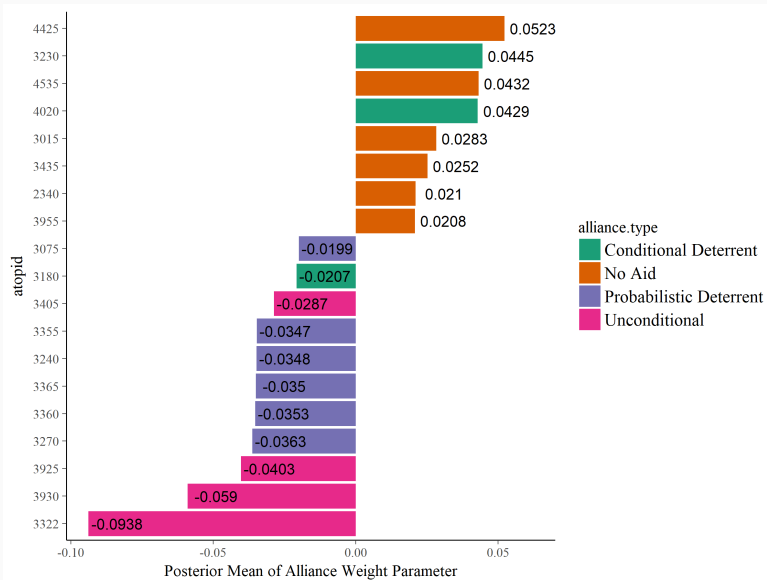
90% Credible Intervals for State Covariates

	mean	sd	5%	95%	n_eff
Lagged Expenditures	0.97	0.00	0.96	0.98	747.65
Wartime	0.07	0.01	0.04	0.09	4000.00
Civil War	0.04	0.01	0.02	0.06	4000.00
Rival Mil. Expenditure	-0.01	0.01	-0.02	0.00	4000.00
ln(GDP)	0.11	0.02	0.09	0.14	830.46
Polity	-0.02	0.01	-0.03	-0.01	4000.00
Cold War	0.04	0.01	0.02	0.06	1292.56
σ State	0.02	0.01	0.01	0.03	486.70
α	0.20	0.03	0.14	0.26	789.97

Posterior of Probabilistic Deterrent Coefficient



Non-zero alliances



Violin Plot of Mean λ for all alliances

