Alliance Participation and Military Spending

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August 19, 2019

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How alliance participation affects military spending depends on treaty scope and state capability.

1: Though alliance participation usually increases major power military spending, growth is lower in broad treaties.

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2: Though alliance participation usually decreases non-major power military spending, growth is higher in broad treaties.

Does alliance participation increase military spending?

Does alliance participation increase military spending? Or decrease it?

Competing Results

	Decrease	Increase	Null
Most & Siverson 1987			X
Conybeare 1994	X		
Diehl 1994		X	
Goldsmith 2003			X
Morgan & Palmer 2006		X	
Quiroz-Flores 2011		X	
Digiuseppe & Poast 2016	X		
Horowitz et al 2017		X	

- Alliances can *increase or decrease* military spending.

Omission: Alliance Heterogeneity

- Alliances can *increase or decrease* military spending.
- Depends on alliance characteristics and what states use alliances for.

Treaty scope and state capability are two key sources of differences between alliances.

Outline

I make my claim about alliance participation and military spending in three ways:

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1. Argument: Treaty Scope and State Capability

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1. Argument: Treaty Scope and State Capability
2. Statistical Analysis
3. Apply Argument and Statistical Model to NATO

Argument

Assumptions

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- Security and influence are the two main foreign policy goods, which states get through alliances and military spending.
- Military spending has opportunity costs, which decrease with state size.
- Alliances are a costly signal of shared foreign policy interests: reduced freedom of action.

Enforcement Problems in Alliance Politics

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1. Abandonment
2. Free-riding

Treaty Scope

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1. Canonical example is trade.
2. Creates issue linkages.

In a broad alliance, opportunistic behavior risks more than support in war.

1. Issue linkages increase the costs of opportunism.

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2. Sharpen the tradeoff between:

Implications of Treaty Scope

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    2.1 Foreign policy gains.

Implications of Treaty Scope

1. Issue linkages increase the costs of opportunism.
2. Sharpen the tradeoff between:
   2.1 Foreign policy gains.
   2.2 Freedom of action.

The implications of treaty scope depend on state capability.

Capability in General

Capability/Power Status shapes:

Capability in General

Capability/Power Status shapes:

1. Goals.

Capability in General

Capability/Power Status shapes:

1. Goals.
2. Constraints.

Capability in General

Capability/Power Status shapes:

1. Goals.
2. Constraints.
3. Prevalent Opportunism.

1. Goal: External Influence.

State Capability: Major Powers

1. Goal: External Influence.
2. Constraint: Foreign entanglements.

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State Capability: Major Powers

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4. Alliance participation usually *increases military spending*.

Treaty Scope and Major Powers

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Treaty Scope and Major Powers

- Broad treaties ↑ influence without ↑ spending.
- Issue linkages reassure allies of commitment.
- Greater entanglement abroad.

Hypothesis 1: As alliance treaty scope increases, growth in major power military spending from alliance participation will decrease.

- Goal: Security.

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- Constraint: Opportunity Costs of Military Spending.

State Capability: Non-Major Powers

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State Capability: Non-Major Powers

- Goal: Security.
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- Alliance participation usually *decreases* military spending.

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- Alliance is more valuable.

Treaty Scope and Non-Major Powers

- Broad treaties restrict freedom of action.
- Alliance is more valuable.
- Allies have more influence through issue linkages.

Hypothesis 2: As alliance treaty scope increases, growth in non-major power military spending from alliance participation will increase.

Empirical Analysis

I need two things to test these predictions:

Research Design

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1. Measure of treaty scope— economic cooperation.

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1. Measure of treaty scope— economic cooperation.
2. Connect alliance-level variation with state-level outcomes— multilevel analysis.

I use a latent variable model to infer treaty scope from observed promises.

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My measure of scope for each alliance is the posterior mean of a latent factor.

Details of Measure

- Multiple observed indicators of scope (ATOP):
  - *Military Support*: offense, defense, neutrality, consultation, non-aggression, unconditional military support.
  - *Other Cooperation*: bases, integrated command, economic aid, military aid, IO formation, conclude multiple other agreements, no other alliances.

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- Semiparametric mixed factor analysis. (Murray et al 2013)
- Generates a posterior distribution of scope for each alliance.

Latent Measure of Treaty Scope
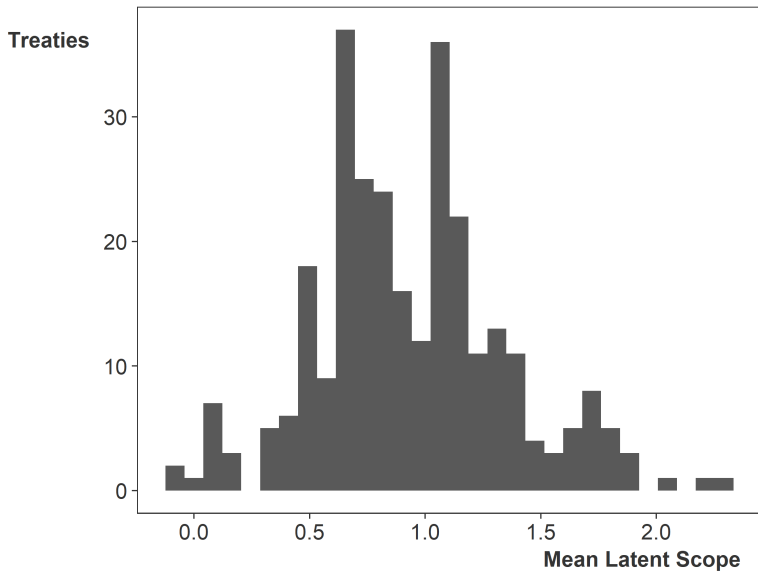
Latent Measure of Treaty Scope: Narrow
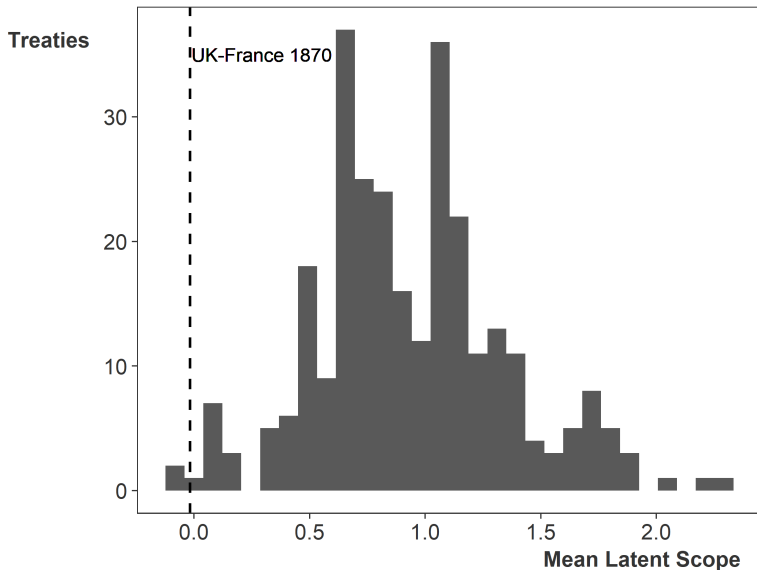
Latent Measure of Treaty Scope: Typical
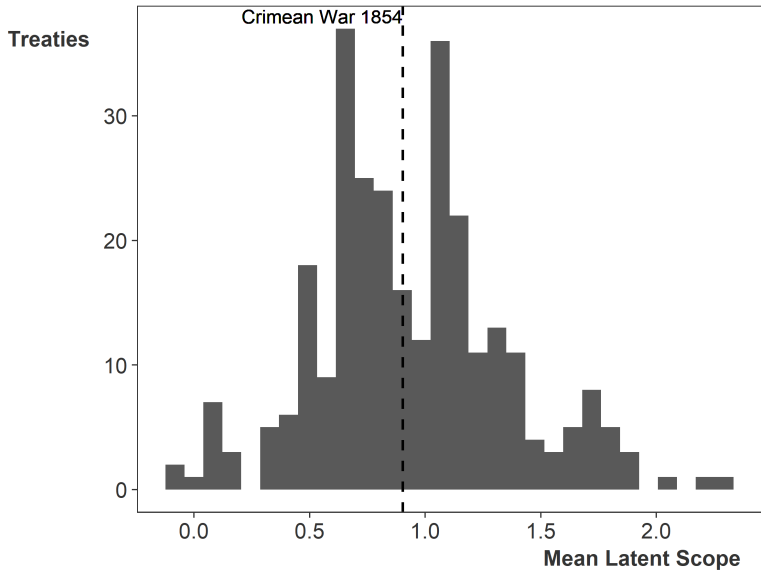
Latent Measure of Treaty Scope: Broad
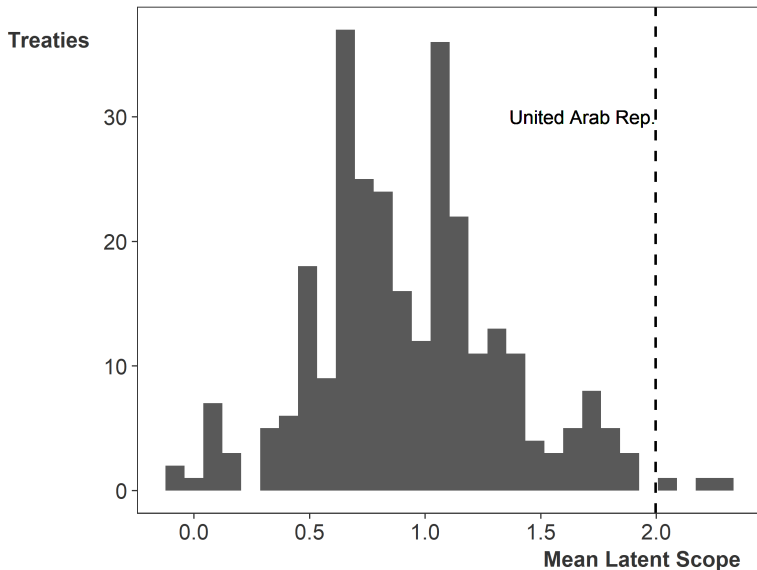
Empirical Analysis: Multilevel Model

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- Two connected regressions: alliance and state-level.
- Alliance characteristics modify the association between alliance membership and spending growth.

ML Model

Growth = Varying + State + Alliance
Mil. Ex. Intercepts Vars. Participation

ML Model

$$\text{Growth} = \underset{\text{Mil. Ex.}}{} \quad \underset{\text{Intercepts}}{\text{Varying}} \quad + \quad \underset{\text{Vars.}}{\text{State}} \quad + \quad \overset{\underset{\downarrow}{\text{Alliance}}}{\underset{\text{Participation}}{\text{Alliance}}}$$

Alliance
Characteristics

↓

Growth =   Varying   + State   +   Alliance
Mil. Ex.   Intercepts   Vars.   Participation

ML Model

$$\text{Alliance}$$
$$\text{Characteristics}$$
$$\lambda = \alpha_{all} + \beta_1 \text{Scope} + \mathbf{X}\beta$$
$$\downarrow$$

Growth =	Varying	+	State	+	Alliance
Mil. Ex.	Intercepts		Vars.		Participation
$y =$	$\alpha + \alpha^{st} + \alpha^{yr}$	+	$\mathbf{W}\gamma$	+	$\mathbf{Z}\lambda$

ML Model Specification

$$y \sim student_t(\nu, \mu, \sigma) \qquad (1)$$

$$\mu = \alpha + \alpha^{st} + \alpha^{yr} + \mathbf{W}_{n \times k}\gamma + \mathbf{Z}_{n \times a}\lambda \qquad (2)$$

$$\lambda_a \sim N(\theta_a, \sigma_{all}) \qquad (3)$$

$$\theta_a = \alpha_{all} + \beta_1 \text{Treaty Scope} + \mathbf{X}_{a \times l}\beta \qquad (4)$$

Example

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

Example year:

Argentina 1955 = Overall mean

+ Argentine Intercept + 1955 Intercept

+ Argentine Characteristics

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

$$\lambda_{Rio} = \alpha_{all} + \beta_1 0.717 + \text{Controls}$$

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

Sample and Key Variables

- **Split Sample**: major and non-major power states—
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- **Alliance-Level IV**: Mean Treaty Scope

Controls

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- **Alliance-Level Controls**: Share of Democracies, Number of Members, wartime, asymmetric obligations, US member (Cold War), USSR member.

Association Between Treaty Scope and Growth in Military Spending
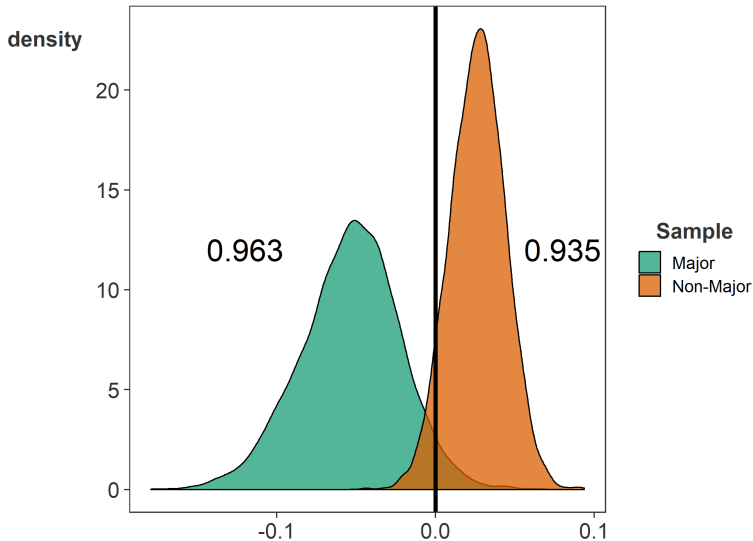
Importance

Sample	Post. Mean	Median Growth
Major	-0.05	0.04

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Major	-0.05	0.04
Non-major	0.03	0.06

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Major	-0.05	0.04
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US spent $36.0 billion on NATO in 2018, or 5.5% of the total defense spending.

Treaty Scope and λ

Alliance Part. Impact

Latent Treaty Scope

Treaty Scope and λ: Non-major Powers
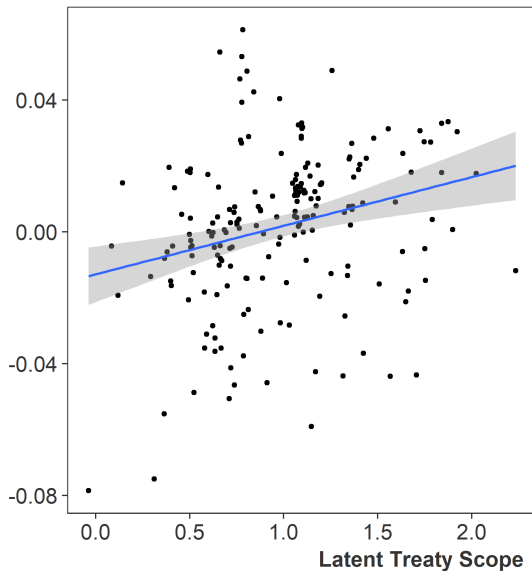
NATO

"The Parties agree that an armed attack against one or more of them in Europe or North America shall be considered an attack against them all..."

"assist the Party or Parties so attacked by taking forthwith, individually and in concert with the other Parties, such action as it deems necessary, including the use of armed force"

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NATO Scope
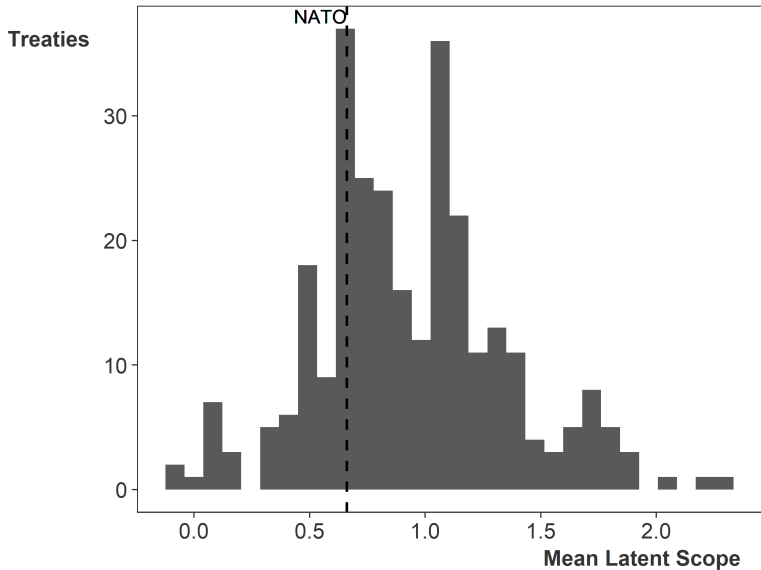
Impact of NATO on Growth in US Military Spending
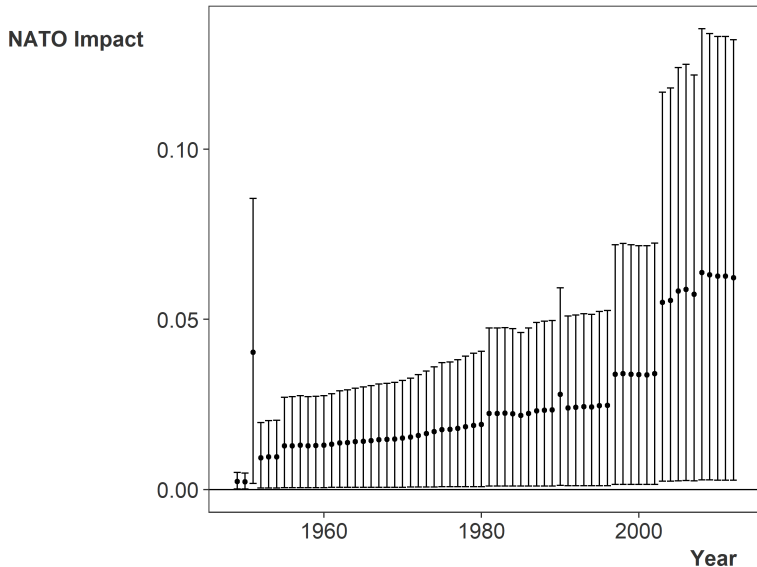
US defense pacts, 1947–2014

● OAS ● NATO ● ANZUS ● Bilateral
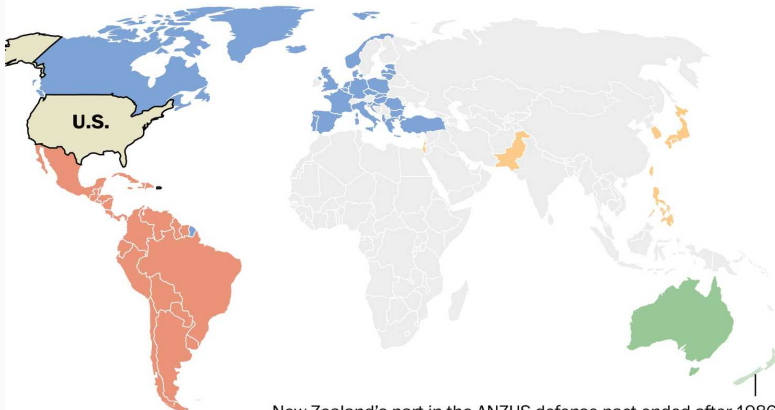
New Zealand's part in the ANZUS defense pact ended after 1986.

Note: OAS stands for Organization of American States; NATO for North Atlantic Treaty Organization; and ANZUS for Australian, New Zealand, United States Security Treaty.

Source: Belfer Center of Harvard University, CIA

THE WASHINGTON POST
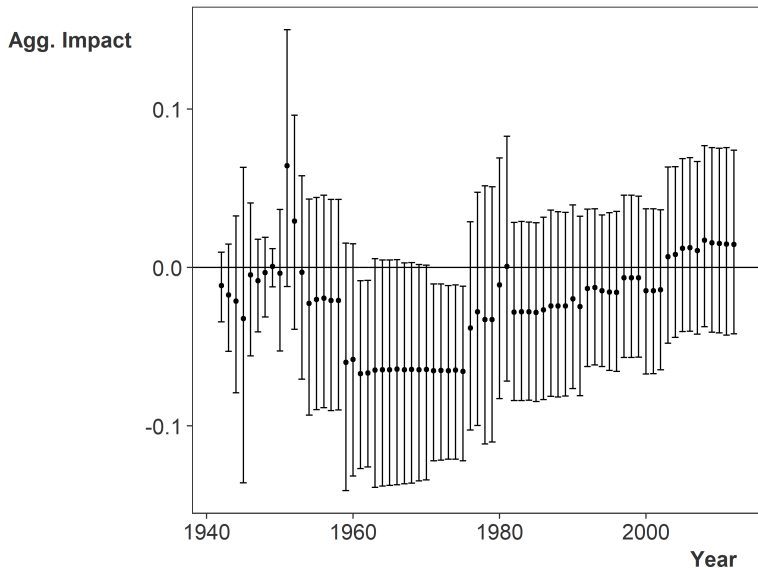
Conclusion

How alliance participation affects military spending depends on state capability and treaty scope.

1: **Though alliance participation usually increases major power military spending, growth is lower in broad treaties.**

1: Though alliance participation usually increases major power military spending, growth is lower in broad treaties.

2: Though alliance participation usually decreases non-major power military spending, growth is higher in broad treaties.

Looking Ahead

My dissertation articulates and tests a more general theory of alliance participation and military spending.

My Research Agenda

The political economy of security, with a focus on formal institutions.

International Security

- Alliance Participation and Military Spending

- Reassessing the Public Goods Theory of Alliances

Intra-State Conflict

- Conflict Management Institutions and FDI

- Sanctioning Terrorist Groups: Can it Work?

- Weapon of the Weak?: Rebel Groups' International Law Talk, 1974-2011
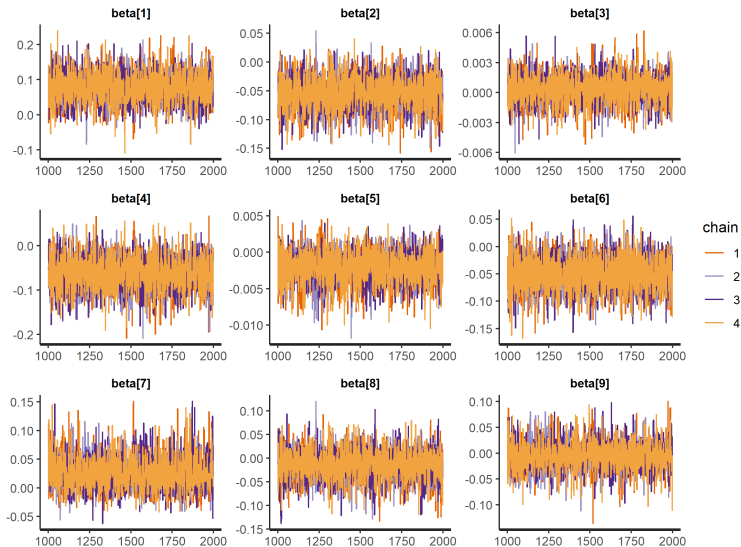
Thank you!

jkalley14@tamu.edu

Limitations

1. Domestic political economy of military spending.
2. Measurement error and missing data.
3. Strategic alliance design

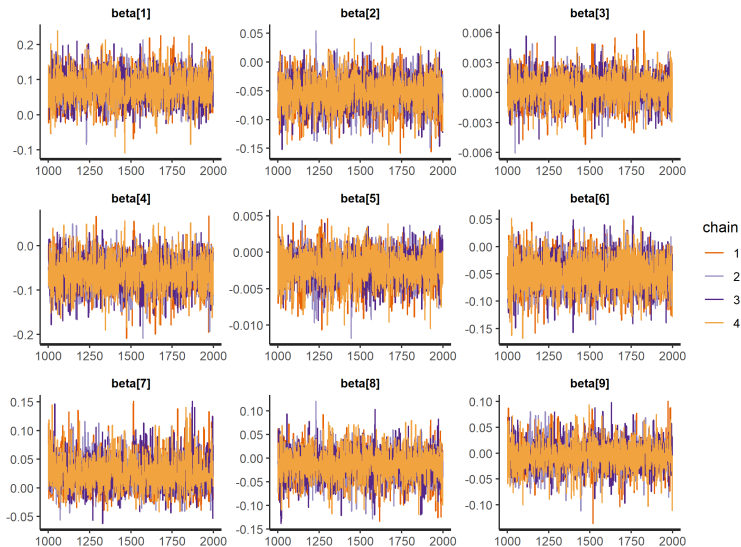# Spending Growth and the Hypotheses
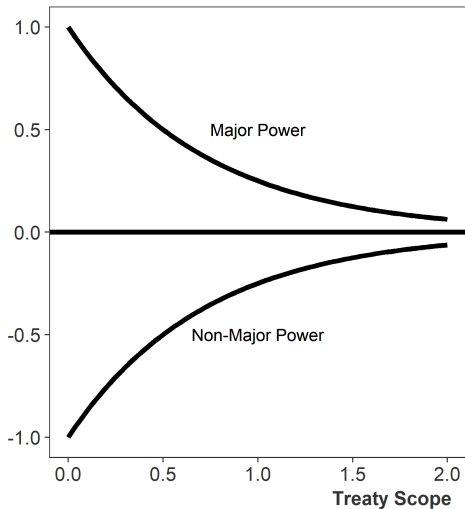
Trace plots: Major

Trace plots: Non-Major

Model Check: Recovering Known Parameters

Another way to check complicated models is simulating fake data with known parameters, then using the model to recover said parameters.

To check my model, I simulated a fake dataset of 2,000 observations with 50 states, 200 years, 100 alliances and 2 variables at each level.

The 90% credible intervals contain the known value for all regression parameters. 93 of 100 alliance specific parameter intervals contain the known value.

Simulated Parameters and Credible Intervals
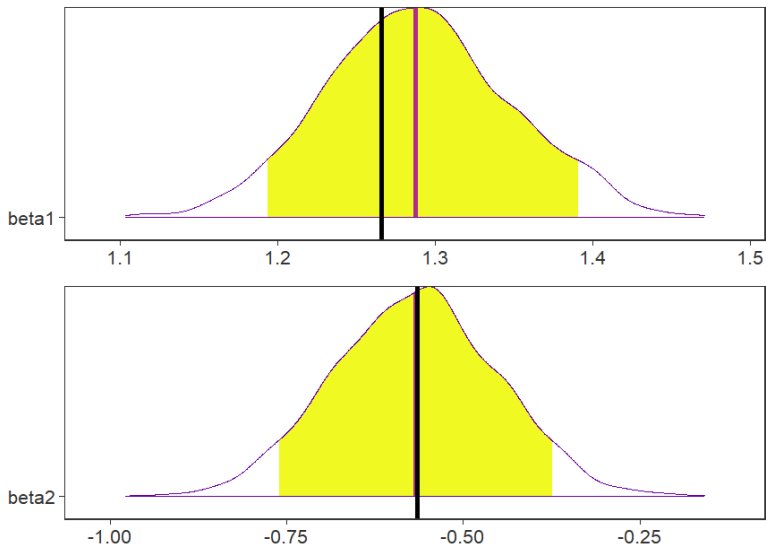
Alliance-Level Regression Table: Major Powers

930 observations, with 130 alliances.

	mean	S.D.	5%	95%	n_eff	$\hat{R}$
Constant	0.038	0.038	-0.025	0.102	3380.954	1.000
Latent Str.	-0.054	0.031	-0.107	-0.005	3278.923	1.000
Number Members	0.000	0.002	-0.003	0.003	4000.000	0.999
Democratic Membership	-0.009	0.033	-0.065	0.042	4000.000	1.000
Wartime	-0.057	0.035	-0.115	-0.001	4000.000	1.001
Asymmetric	0.053	0.035	0.001	0.115	2218.509	1.000
US Member	0.002	0.031	-0.051	0.051	4000.000	1.000
USSR Member	0.023	0.033	-0.028	0.079	4000.000	1.000
σ Alliances	0.066	0.029	0.019	0.117	599.081	1.007

Alliance-Level Regression Table: Non-Major Powers

8,668 observations and 192 alliances.

	mean	sd	5%	95%	n_eff	$\hat{R}$
Constant	-0.018	0.018	-0.047	0.012	2211.374	1.000
Latent Str.	0.026	0.017	-0.002	0.054	2191.382	1.000
Number Members	0.000	0.001	-0.001	0.001	4000.000	1.000
Democratic Membership	-0.031	0.015	-0.056	-0.009	3213.621	1.000
Wartime	0.041	0.023	0.002	0.078	4000.000	1.000
Asymmetric	-0.031	0.021	-0.065	0.003	4000.000	0.999
US Member	0.013	0.018	-0.016	0.042	2895.419	1.000
USSR Member	0.011	0.031	-0.041	0.062	4000.000	1.000
σ Alliances	0.014	0.009	0.002	0.030	1254.268	1.001

Priors

4 Chains with 2,000 samples and 1,000 warmup iterations.

$$p(\alpha) \sim N(0, 1)$$
$$p(\sigma) \sim \text{half-}N(0, 1)$$
$$p(\alpha^{yr}) \sim N(0, \sigma^{yr})$$
$$p(\sigma^{yr}) \sim N(0, 1)$$
$$p(\alpha^{st}) \sim N(0, \sigma^{st})$$
$$p(\sigma^{st}) \sim \text{half-}N(0, 1)$$
$$p(\sigma^{all}) \sim \text{half-}N(0, 1)$$
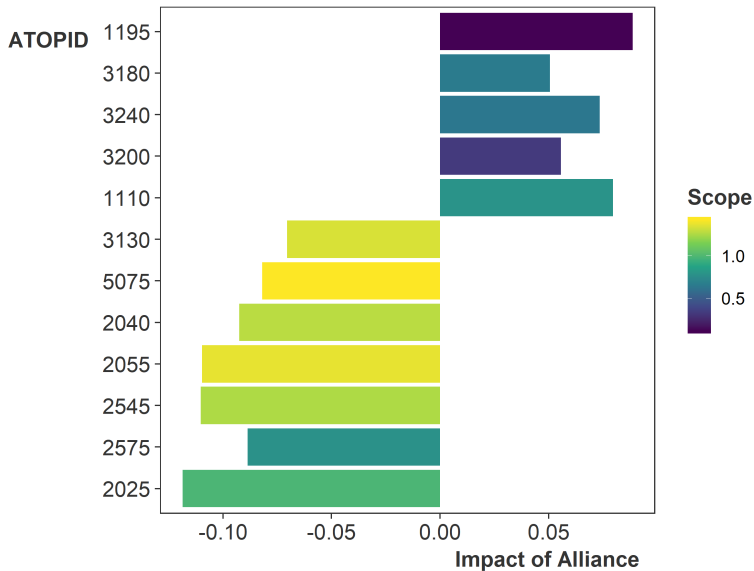$$p(\beta) \sim N(0, 1)$$
$$p(\gamma) \sim N(0, 1)$$
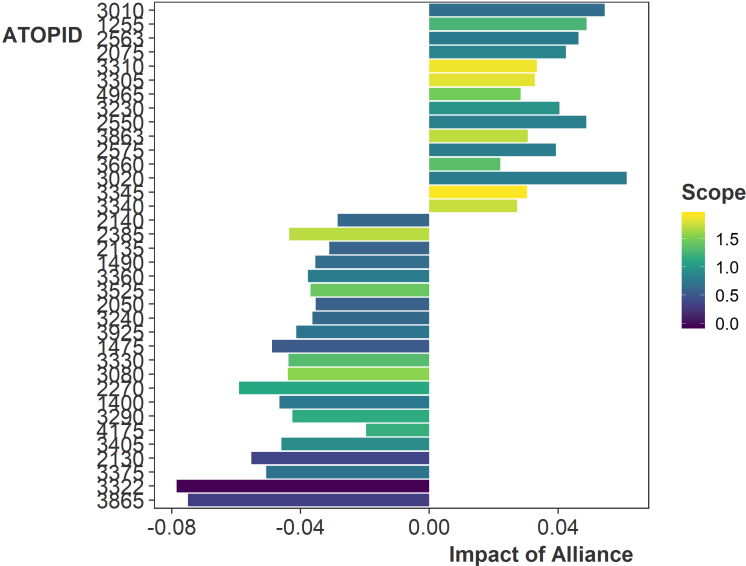$$p(\nu) \sim gamma(2, 0.1)$$

Details of Measurement Model

- Bayesian Gaussian Copula Factor Model: for mixed data.
- Uses copulas to break dependence between latent factors and marginal distributions.
- Treats marginals as unknown and keeps them free of dependence.
- IMH proposal, 10,000 iteration warmup, 20,000 samples, thinned every 20 draws.
- Generalized double Pareto prior for the factor loading— flexible generalized Laplace distribution with a spike at zero and heavy tails.
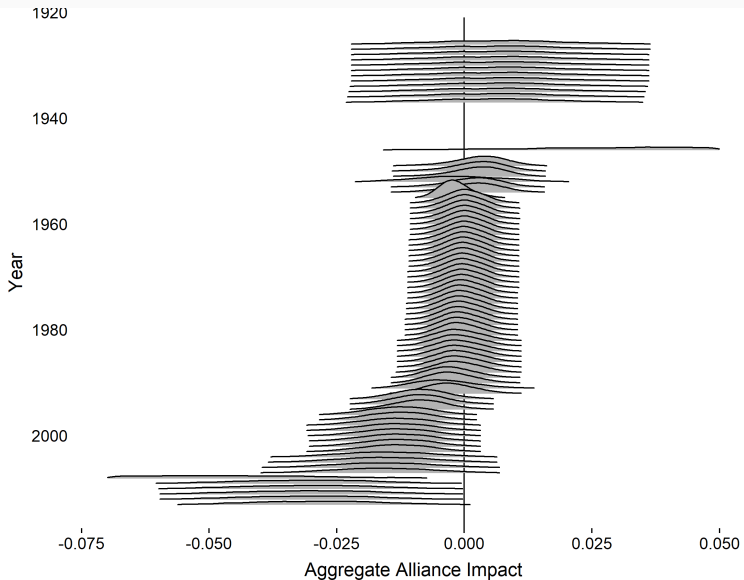
Notable Major Power Alliances

ATOPID

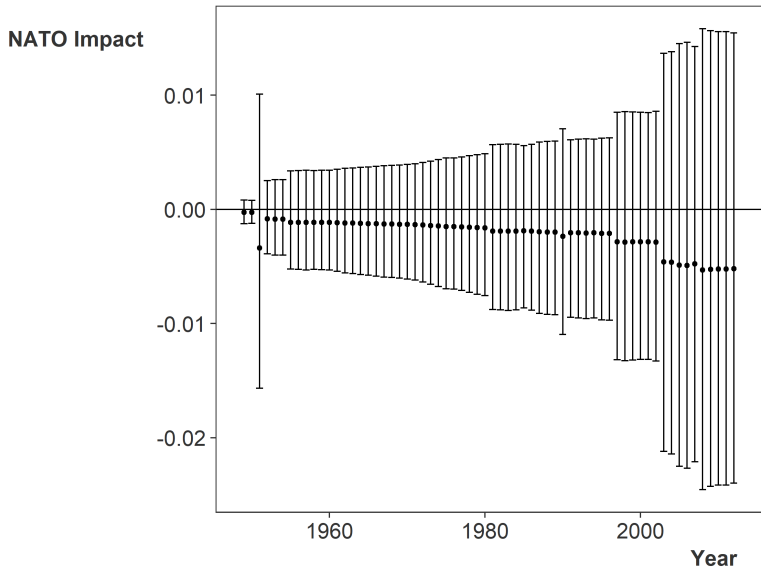| ATOPID |
|--------|
| 1195 |
| 3180 |
| 3240 |
| 3200 |
| 1110 |
| 3130 |
| 5075 |
| 2040 |
| 2055 |
| 2545 |
| 2575 |
| 2025 |

Impact of Alliance
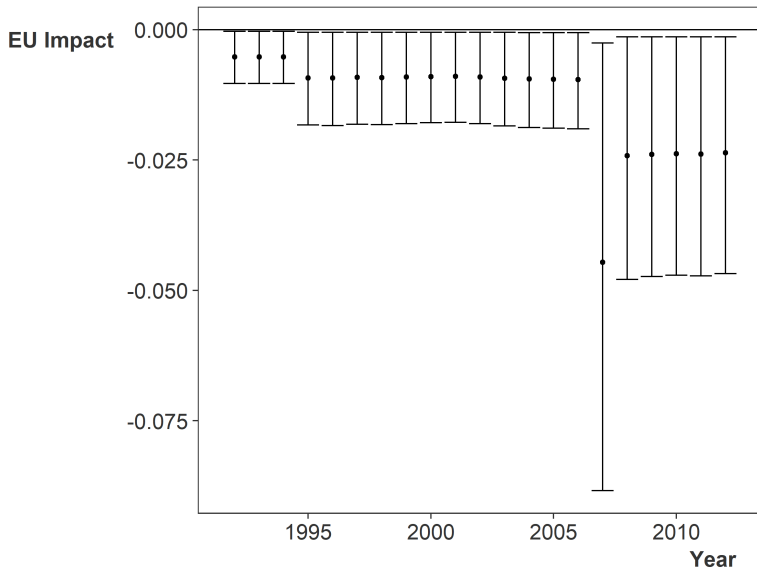
Scope
1.0
0.5

Notable Non-Major Power Alliances

Non-Major Powers in NATO: Belgium

Impact of NATO on Belgium

Impact of EU on Belgium

Varying Slopes Model

Within each of the j groups of state capability, for i in $1...n_j$:

$$y_i \sim student_t(\nu_j, \alpha_j + \alpha^{st} + \alpha^{yr} + \mathbf{W}_i\gamma + \mathbf{Z}_{ji}\lambda_j, \sigma_j)$$
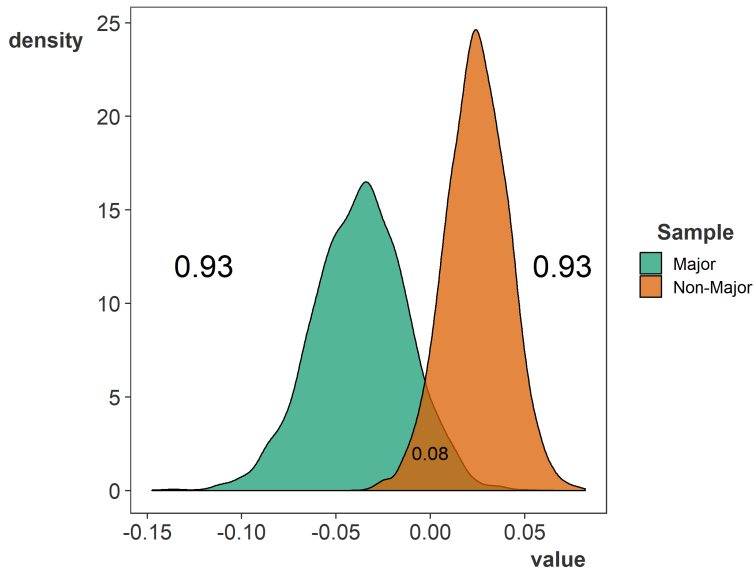
$$\lambda_j \sim N(\theta_j, \sigma_j^{all})$$
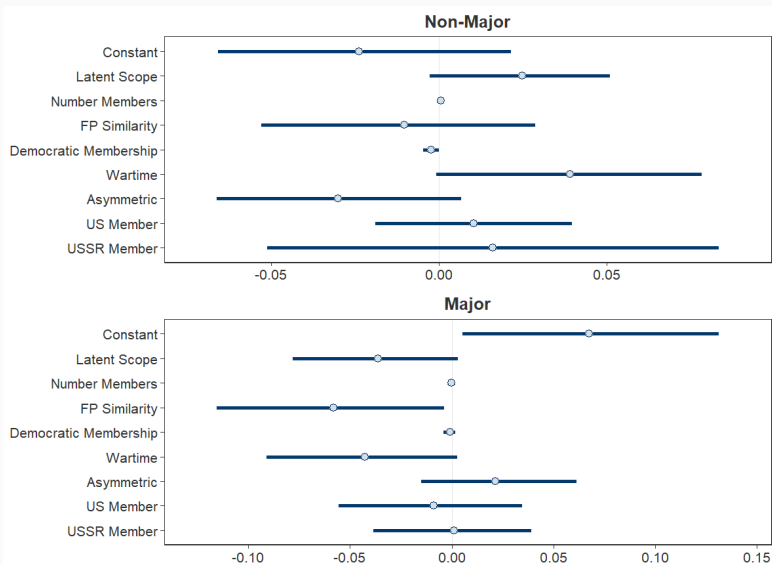
$$\theta_j = \alpha_j^{all} + \mathbf{X}\beta_j$$

I give β_j a multivariate normal prior with prior scale τ:
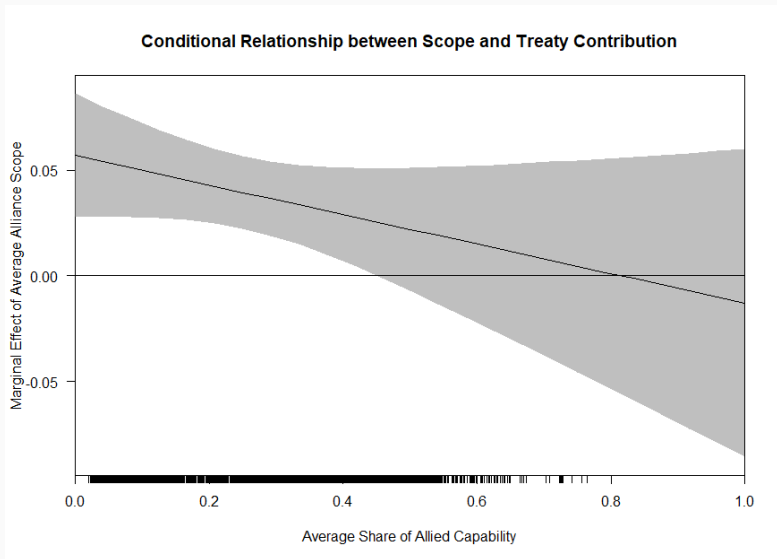
$$\beta_j \sim MVN(\mu_{\beta_j}, \Sigma_\beta)$$

Varying Slopes Results: Scope

Full Varying Slopes Results

Single-Level Robust Regression

Conditional Relationship between Scope and Treaty Contribution

Binning Estimator Check of Interaction