Alliance Participation and Military Spending

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Whether alliance treaty participation increases or decreases military spending depends on alliance treaty strength and state capability.

1: Strong alliance treaties decrease growth in military spending from alliance participation for major powers.

2: Strong alliance treaties increase growth in military spending from alliance participation for non-major powers.

Scholarly Importance: Competing Expectations and Results

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Expectations: Force Multiplier

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Expectations: Force Multiplier or Foreign Entanglement?

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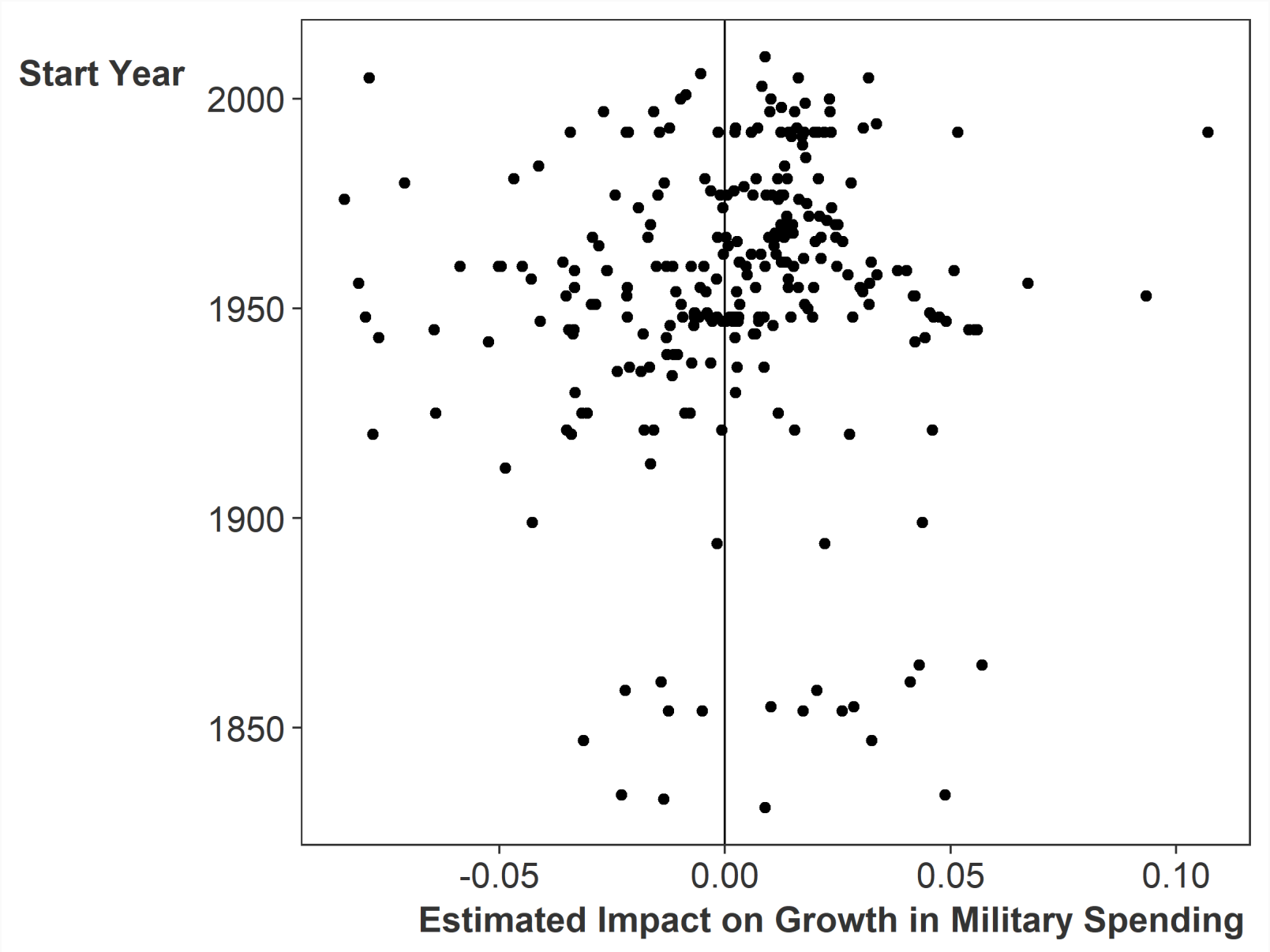
Expectations: Force Multiplier or Foreign Entanglement?

	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	

Alliance Heterogeneity



Relevance

Outline

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

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1. Argument: Treaty Strength and State Capability

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

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2. Statistical Analysis

Argument

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- Strong/deep formal commitments increase foreign policy gains from alliance participation.

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- Potential Costs: honoring or breaking promises of support.
- Sunk costs promises: commitment to take costly action.
- Strong/deep formal commitments increase foreign policy gains from alliance participation.
- But the same hands tying limits freedom of action for members.

State Capability

Major Powers

Non-Major Powers

State Capability

Major Powers

- Alliances & Spending: External Influence

Non-Major Powers

State Capability

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- Influence =
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- Replace domestic expenditure with allied capability.

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Non-Major Powers

- Alliances & Spending: Territorial Security
- Replace domestic expenditure with allied capability.
- Strong treaties restrict freedom of action: alliance value and allied influence.

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

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

Empirical Analysis

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2. Connect alliance-level variation with state-level outcomes— Multilevel Analysis.

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I use a latent variable model (semiparametric mixed factor analysis) to infer formal treaty strength from observed promises.

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For each alliance, the posterior mean of the latent factor is my measure of strength.

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

ML Model

$$\begin{array}{ccccccc} \text{Growth} = & \text{Varying} & + & \text{State} & + & \text{Alliance} \\ \text{Mil. Ex.} & \text{Intercepts} & & \text{Vars.} & & \text{Participation} \end{array}$$

ML Model

$$\text{Growth in Mil. Ex.} = \text{Varying Intercepts} + \text{State Vars.} + \text{Alliance Participation}$$

Alliance Characteristics

↓

ML Model

$$\lambda = \begin{array}{c}\text{Alliance} \\ \text{Characteristics} \\ \alpha_{all} + \beta_1 \text{Str.} + \mathbf{X}\beta \\ \downarrow\end{array}$$

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Sample and Controls

- **Split Sample**: major and non-major power states—1816-2007. Alliances with military support.

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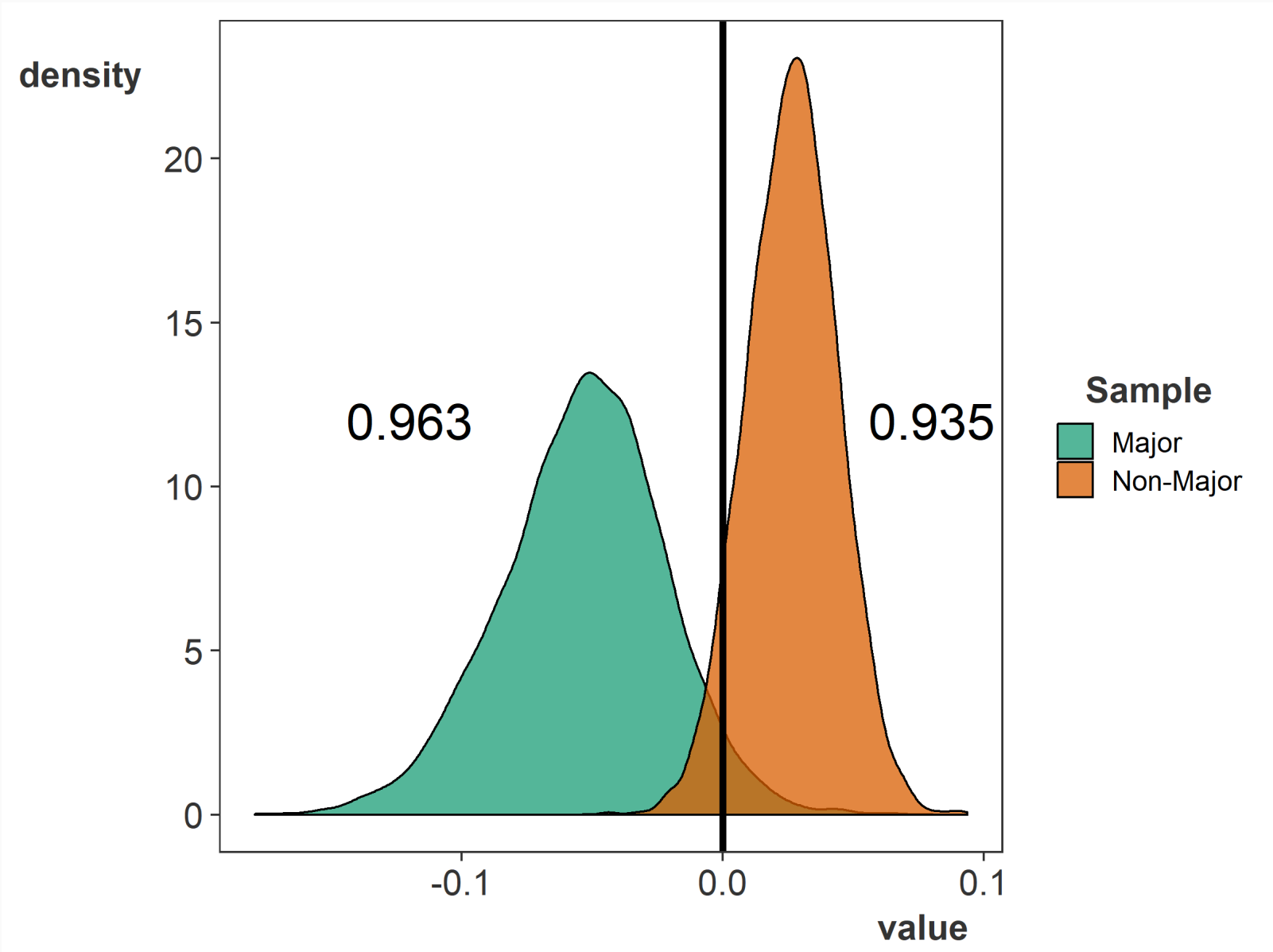
- **Alliance-Level Controls**: Share of Democracies, Number of Members, wartime, asymmetric obligations, US member (Cold War), USSR member.

Results

Association Between Treaty Strength and Growth in Military Spending



Conclusion

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Whether alliance treaty participation increases or decreases military spending depends on state capability and alliance treaty strength.

Thank you!

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Limitations

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3. Strategic alliance design

Importance

Sample	Posterior Mean	Median Ex. Growth
Major	-0.05	0.04
Non-major	0.03	0.06

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

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

ML Model Specification

$$y \sim \mathit{student}_t(\mu, \nu, \sigma) \tag{1}$$

$$\mu = \alpha + \alpha^{\mathit{st}} + \alpha^{\mathit{yr}} + \mathbf{W}\gamma + \mathbf{Z}\lambda \tag{2}$$

$$\lambda \sim N(\theta, \sigma_{\mathit{all}}) \tag{3}$$

$$\theta = \alpha_{\mathit{all}} + \beta_1 \text{Treaty Strength} + \mathbf{X}\beta \tag{4}$$

Example

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

Example year:

$$\begin{aligned}\text{Argentina 1955} &= \text{Overall mean} \\ &+ \text{Argentine Intercept} + \text{1955 Intercept} \\ &+ \text{Argentine Characteristics} \\ &+ \lambda_{OAS} * \text{OAS Expenditure} + \lambda_{Rio} * \text{Rio Pact Expenditure}\end{aligned}$$

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

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Z

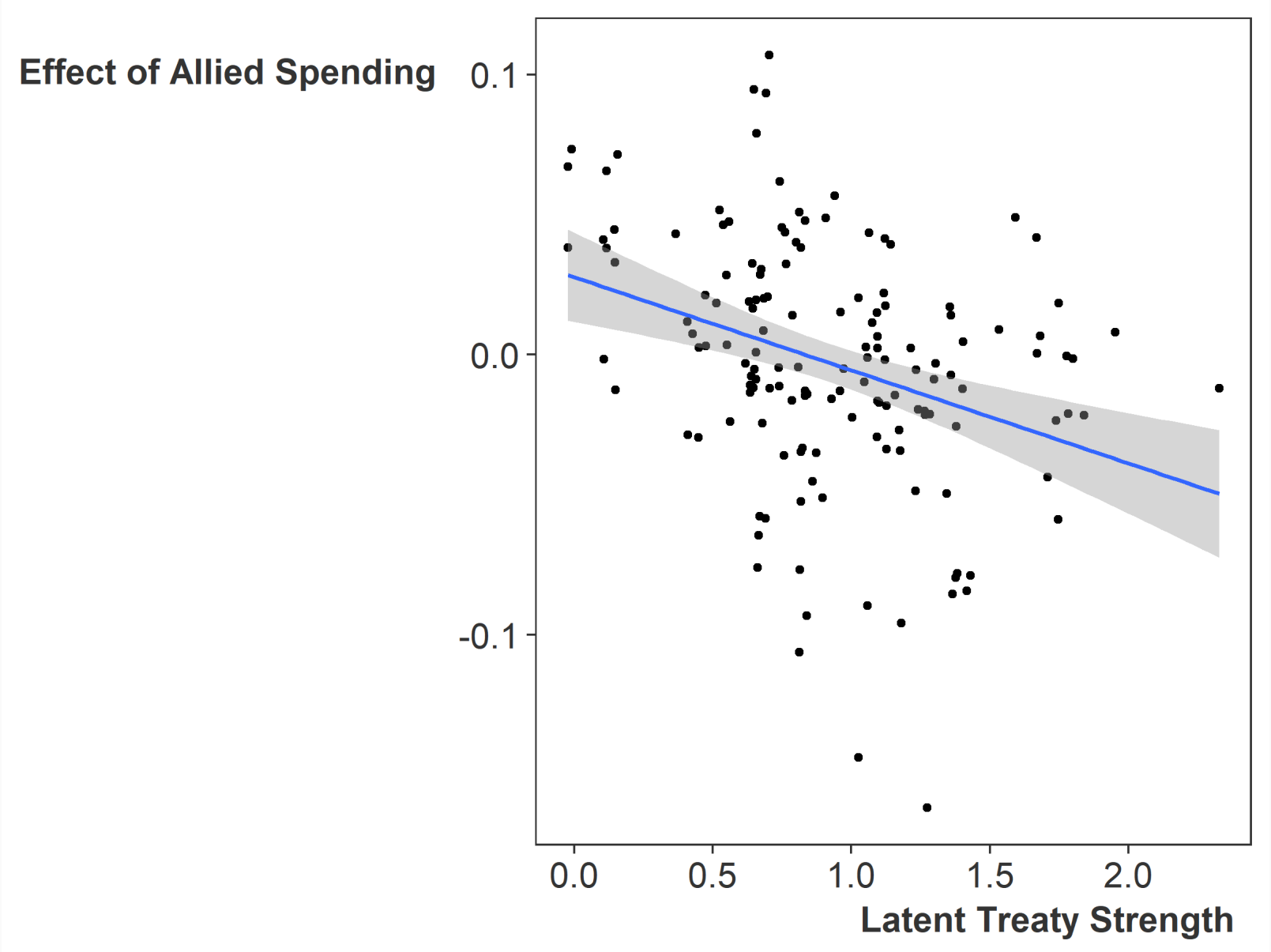
State-Year	Rio Pact	Warsaw Pact	...
Argentina 1954	.347	0	...
Argentina 1955	.418	0	...
⋮	⋮	⋮	...

Priors

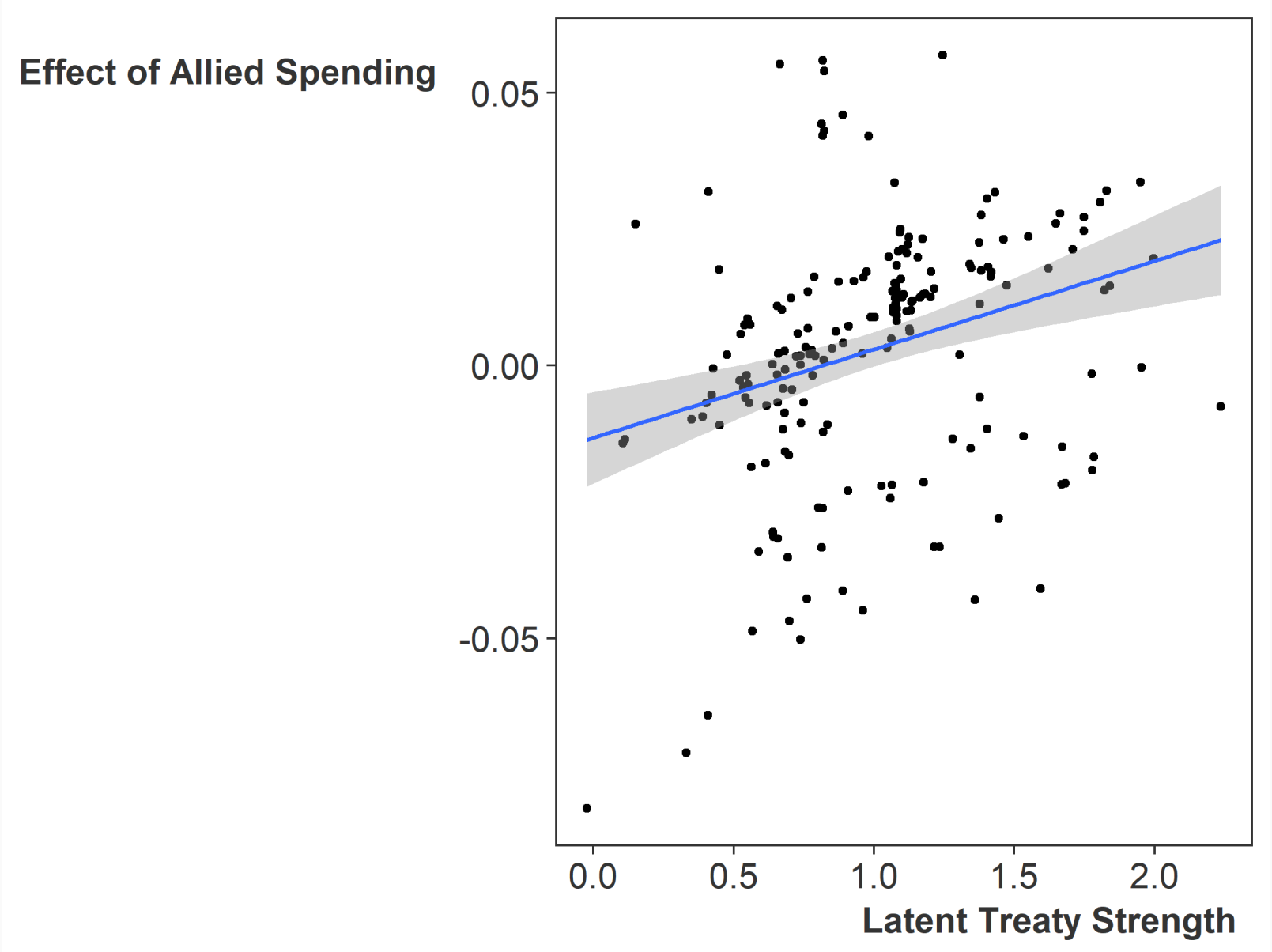
4 Chains with 2,000 samples and 1,000 warmup iterations.

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

Treaty Strength and λ: Major Powers



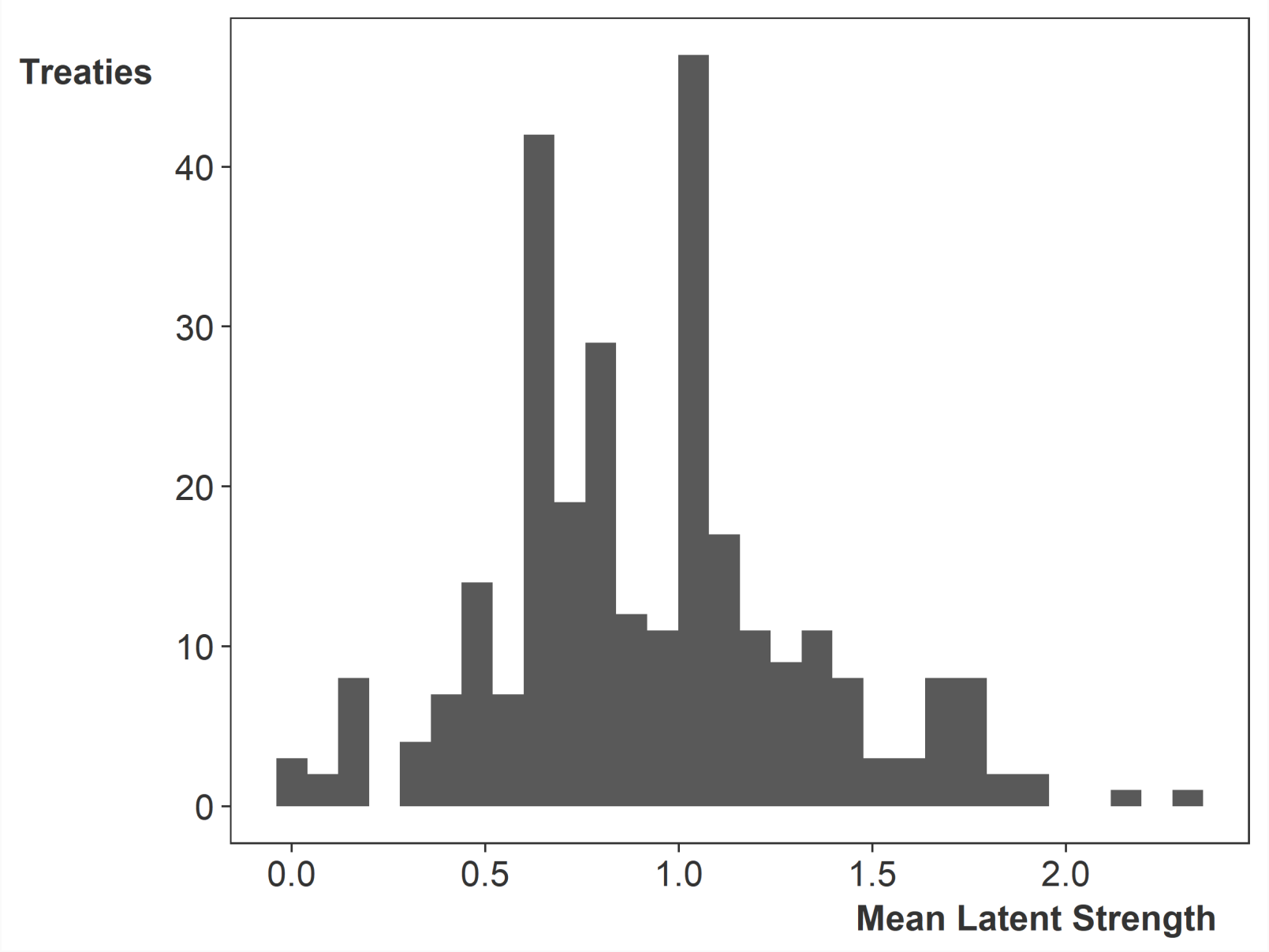
Treaty Strength and λ: Non-major Powers



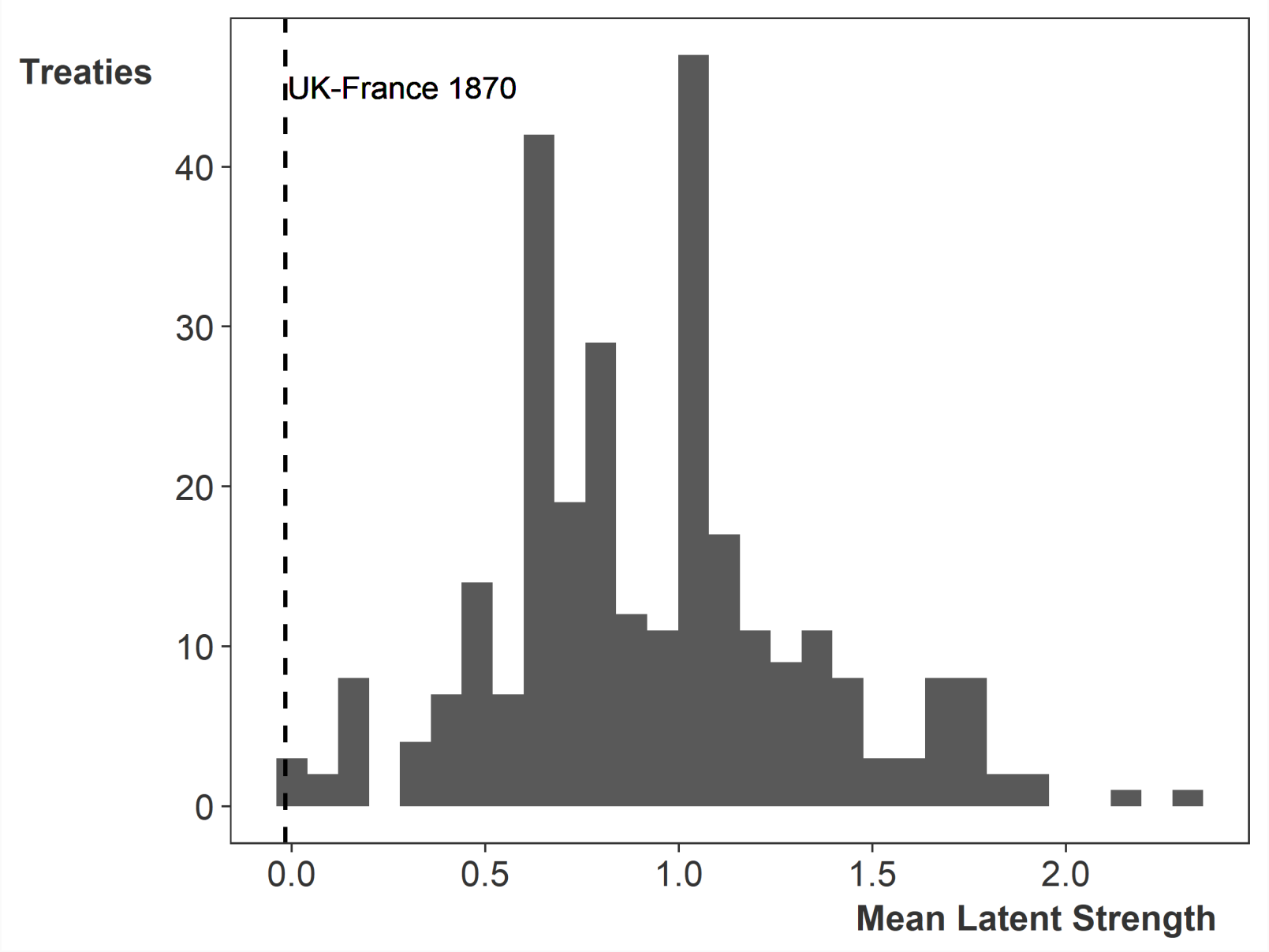
Details of Measurement Model

- 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.

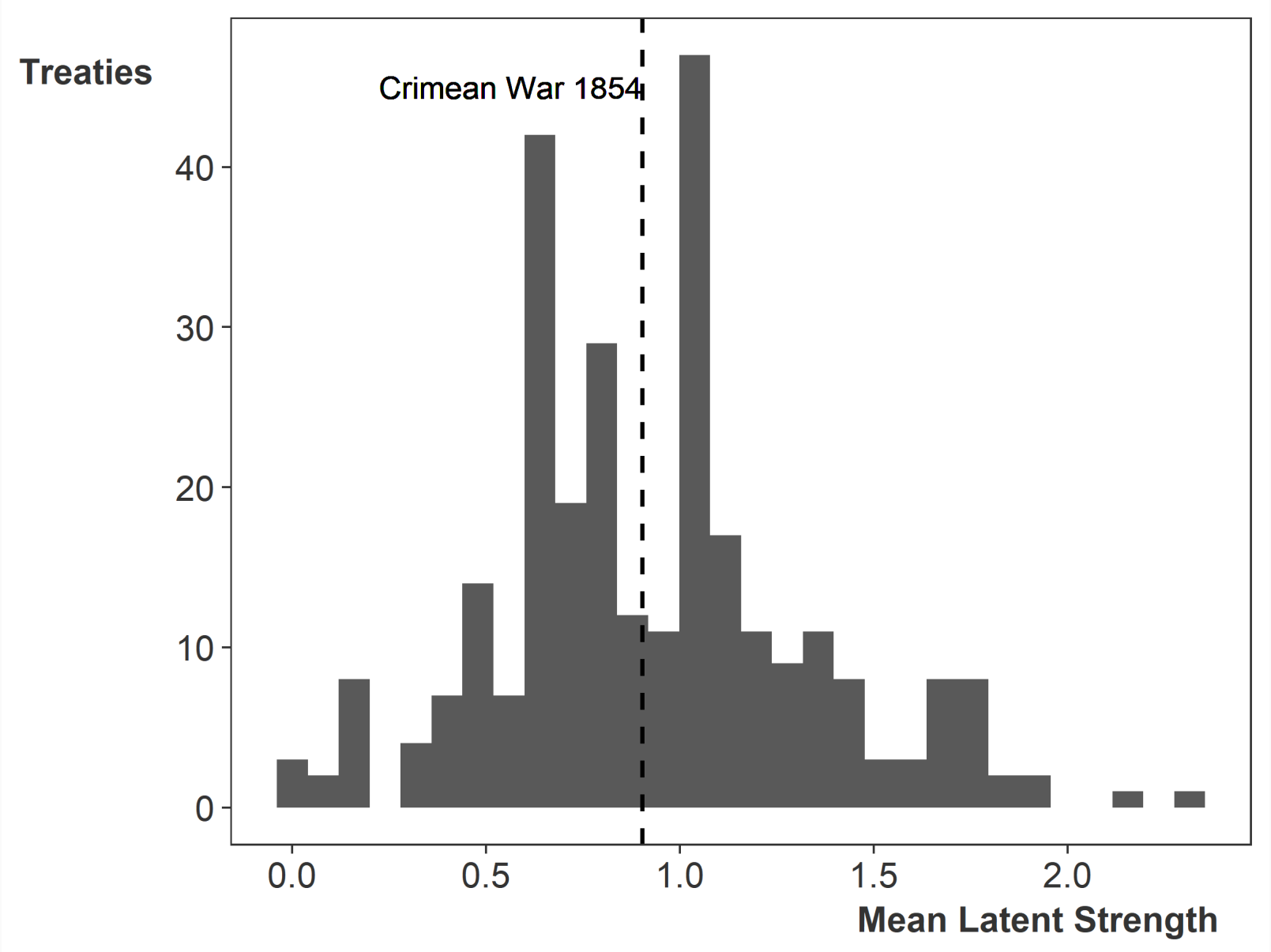
Latent Measure of Treaty Strength



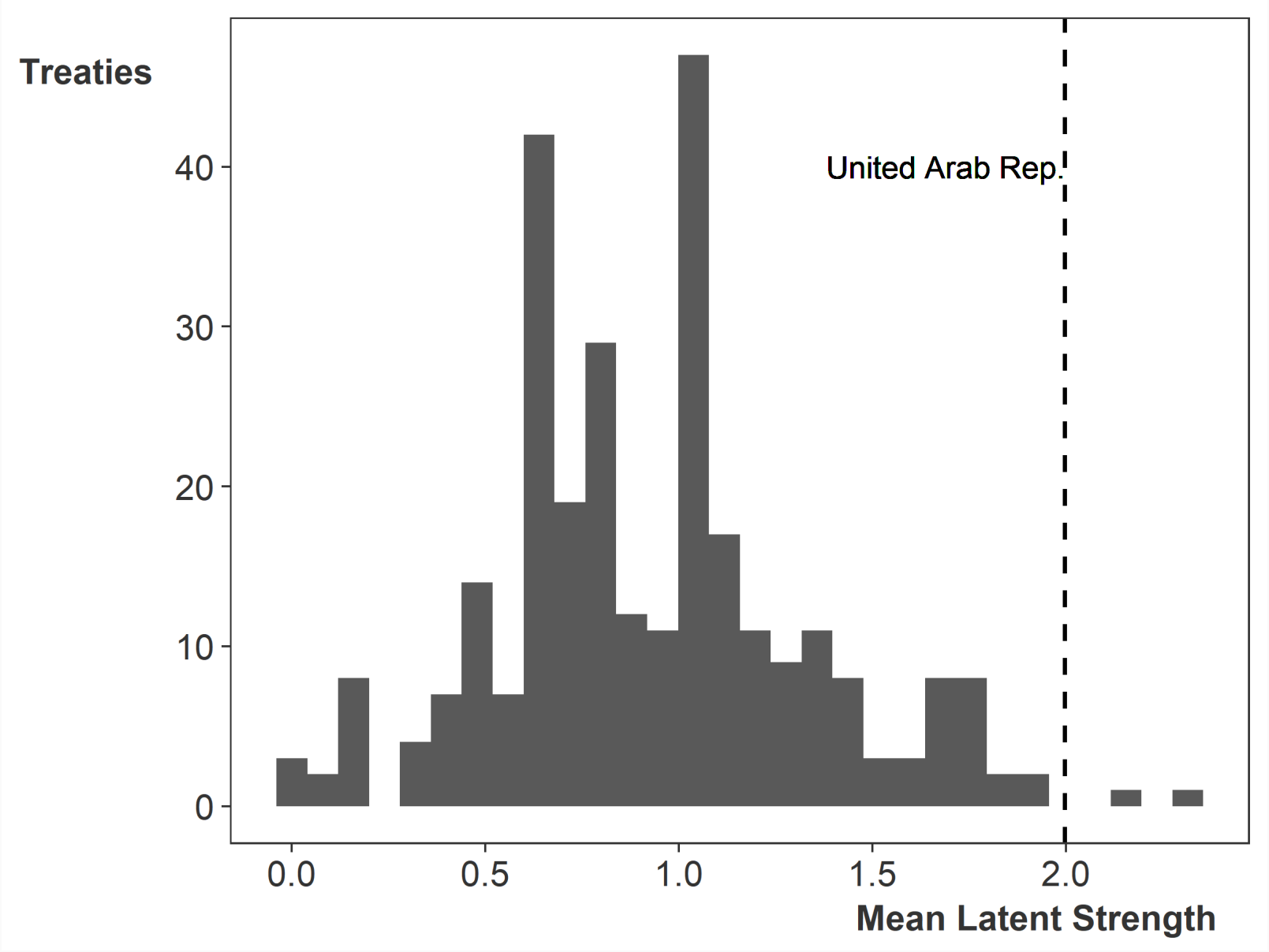
Latent Measure of Treaty Strength: Weak



Latent Measure of Treaty Strength: Typical



Latent Measure of Treaty Strength: Strong



Single-Level Robust Regression