Alliance Participation and Military Spending

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

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 (1): Competing Expectations

Debate between two views of alliance participation and military spending:

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- **Force Multiplier**- Alliance participation decreases military spending.
- **Foreign Entanglement**- Alliance participation increases military spending.

Scholarly Importance (2): Mixed Empirical 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	

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I provide two pieces of evidence for my claims about alliance participation and military spending:

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2. Statistical Analysis

Argument

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- Alliances are a costly signal of shared foreign policy interests: credible commitment to intervene.

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- Sunk costs promises: commitment to take costly action.
- More foreign policy gains with stronger treaty.
- But hands tying limits freedom of action for members.

State Capability

Major Powers

Non-Major Powers

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Non-Major Powers

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- Replace domestic expenditure with allied capability.

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Non-Major Powers

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- Replace domestic expenditure with allied capability.
- Strong treaties restrict freedom of action.

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

Empirical Analysis

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

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- Multiple observed indicators of strength (ATOP):
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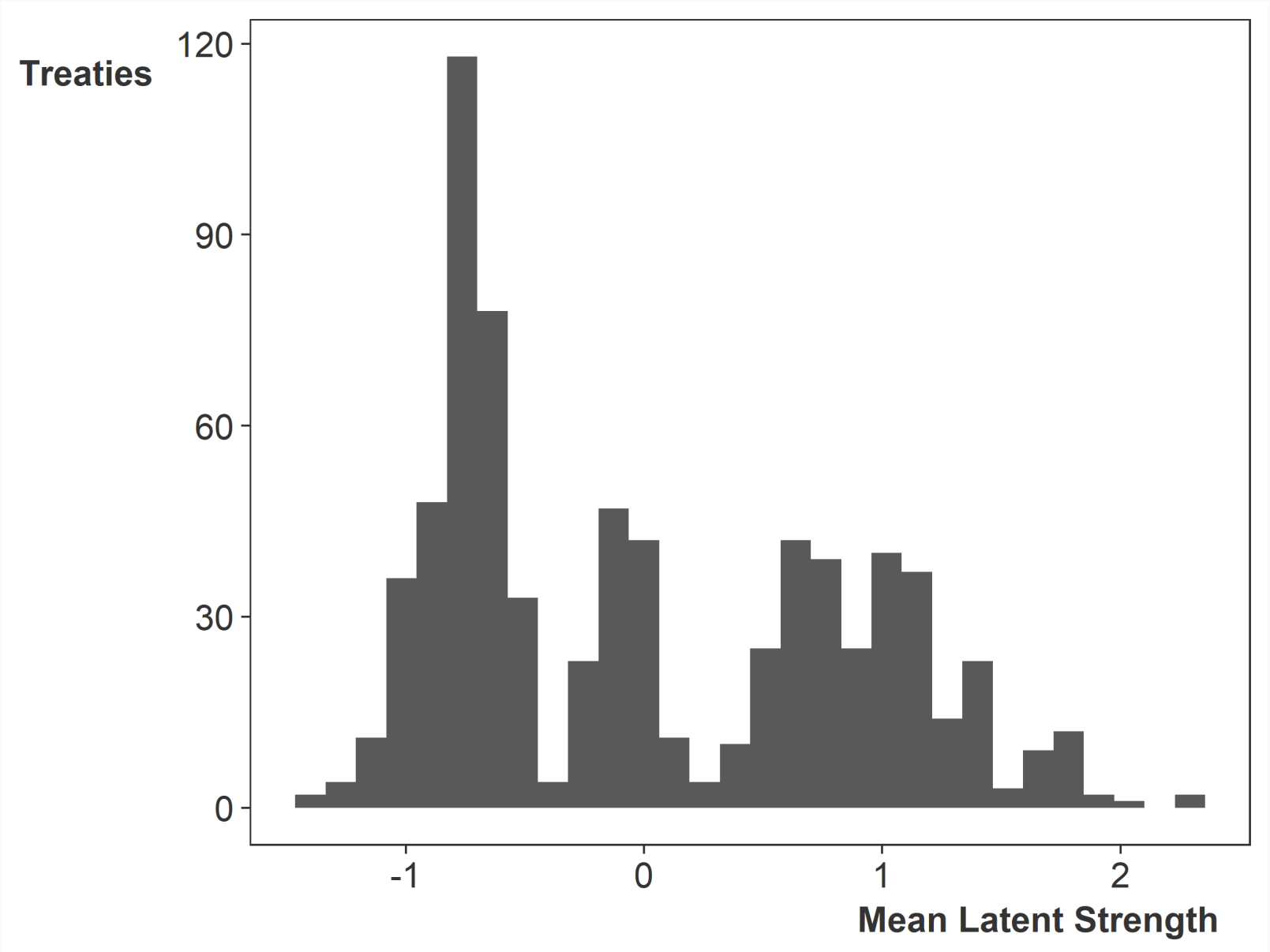
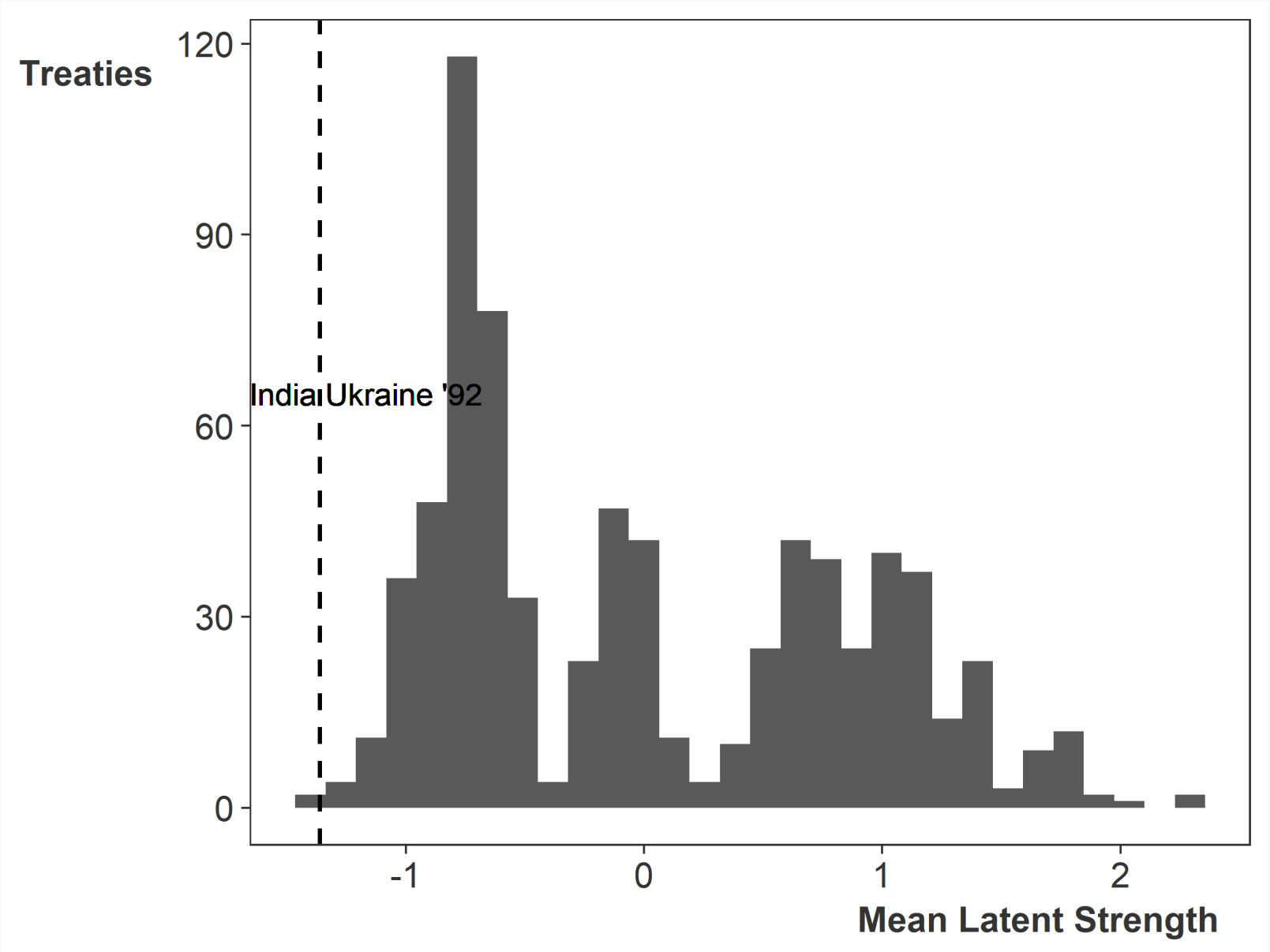
- Semiparametric mixed factor analysis. (Murray et al 2013)
- Mean of the latent factor for each alliance.

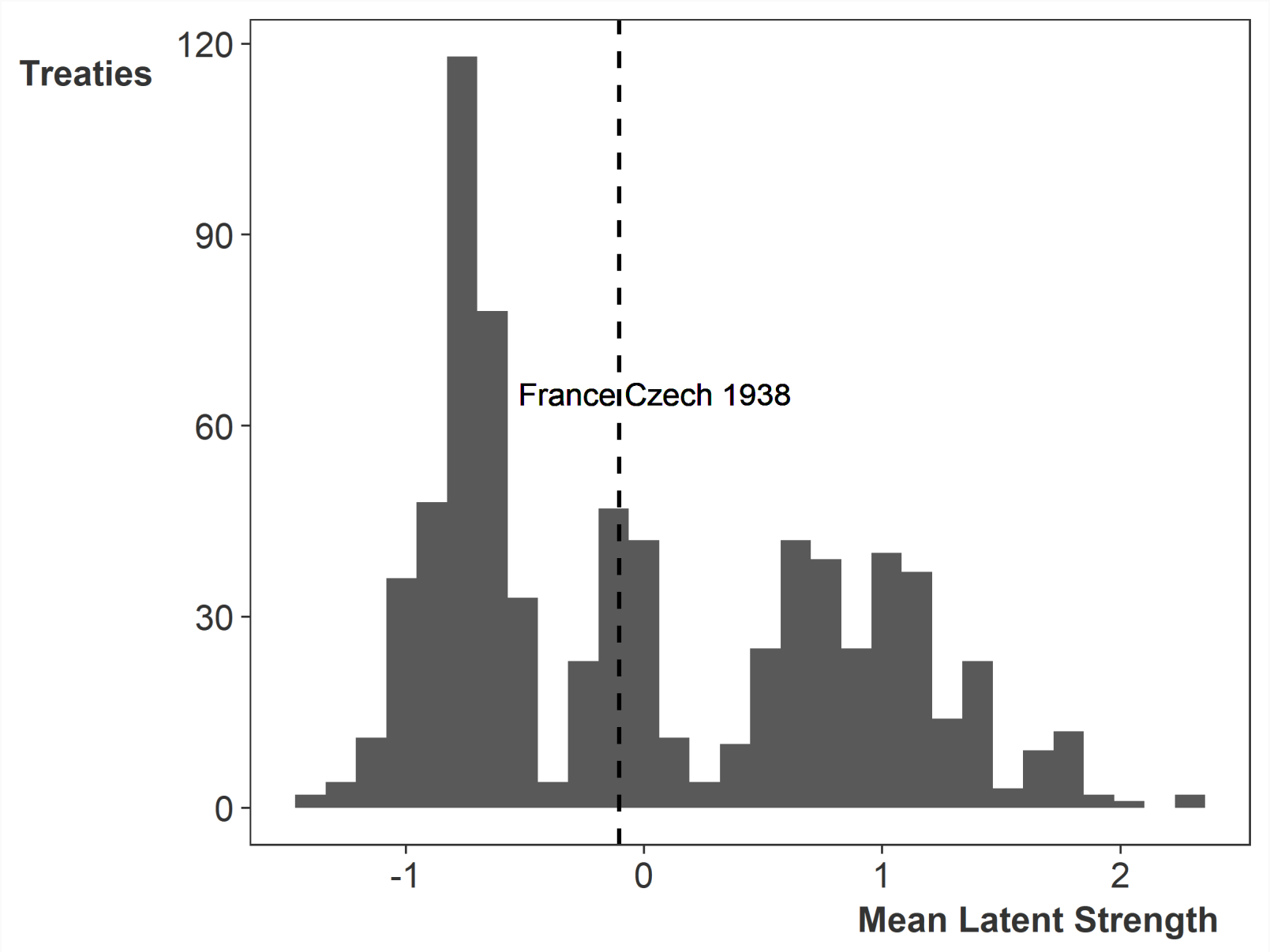
Latent Measure of Treaty Strength



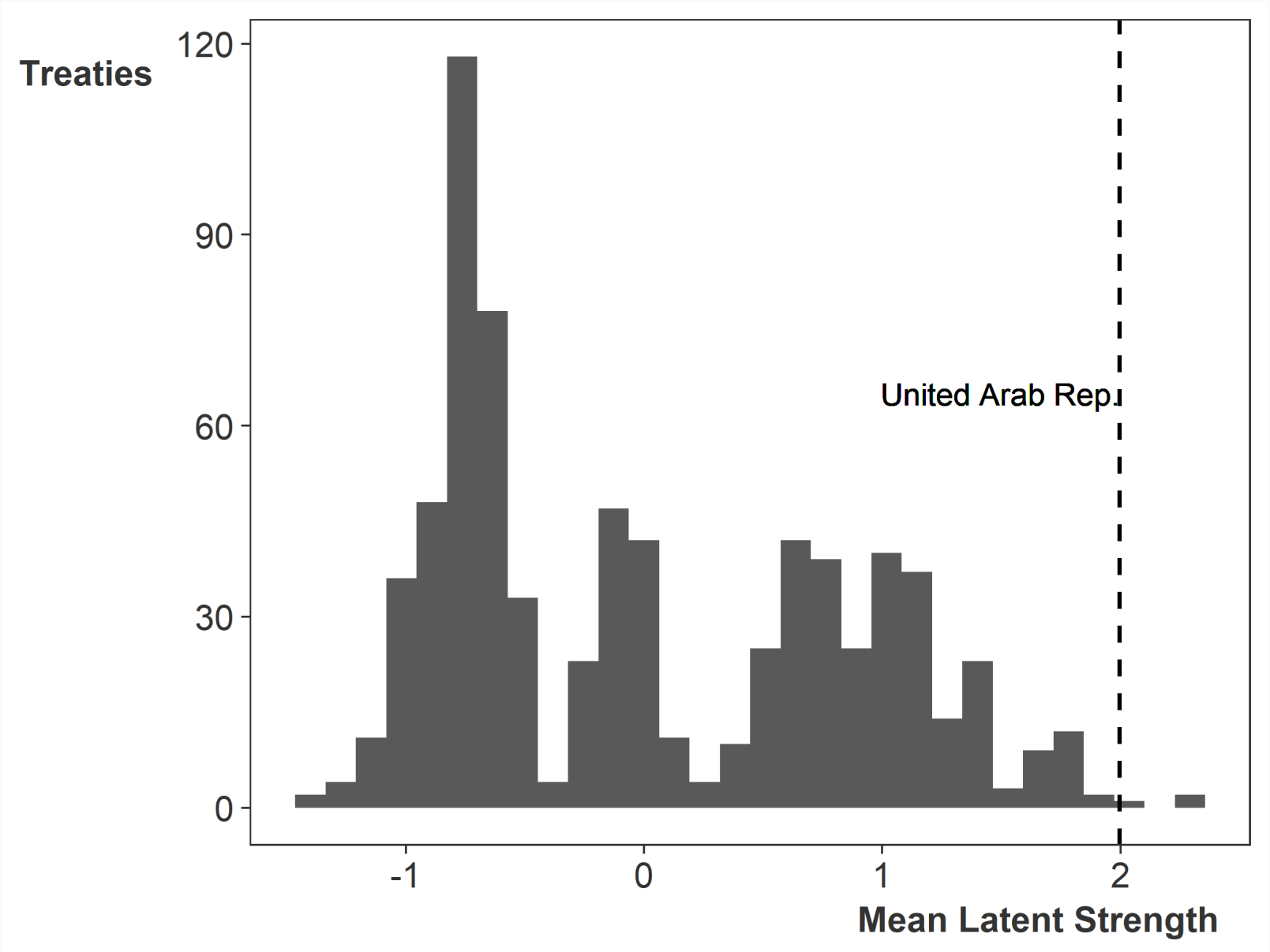
Latent Measure of Treaty Strength: Weak



Latent Measure of Treaty Strength: Typical



Latent Measure of Treaty Strength: Strong



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

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

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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ML Model Specification

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

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

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

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

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

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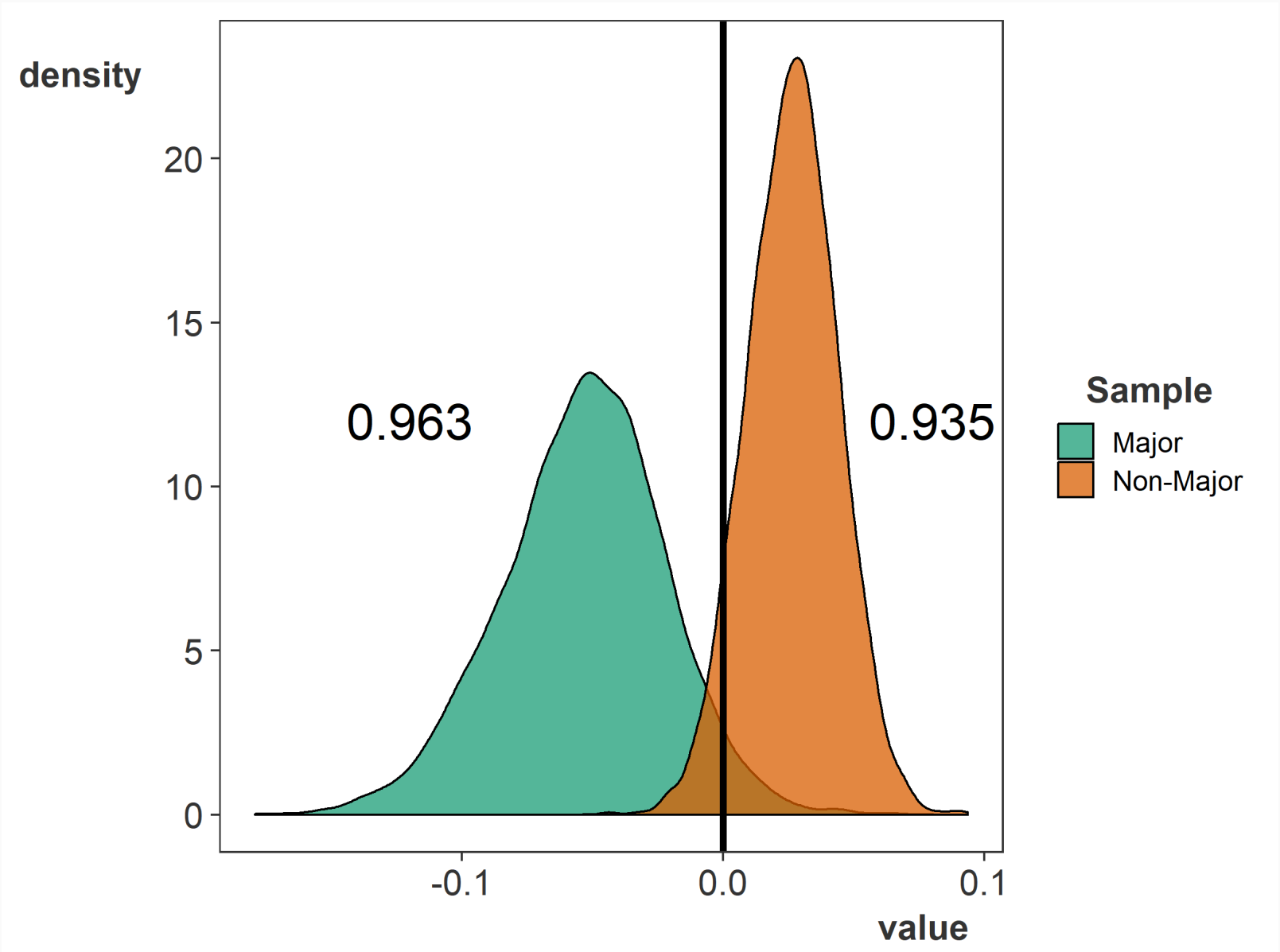
- **Alliance-Level Controls**: Share of Democracies, Number of Members, wartime, asymmetric obligations, US member (Cold War), USSR member.

Results

Association Between Treaty Strength and Growth in Military Spending



Importance

Sample	Posterior Mean	Median Ex. Growth
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.

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- Non-major Powers: Greater treaty strength increases growth in spending.

Thank you! Questions?

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Limitations

1. Domestic political economy of military spending.

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2. Measurement error and missing data.
3. Strategic alliance design

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

Example

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

Example year:

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

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Z

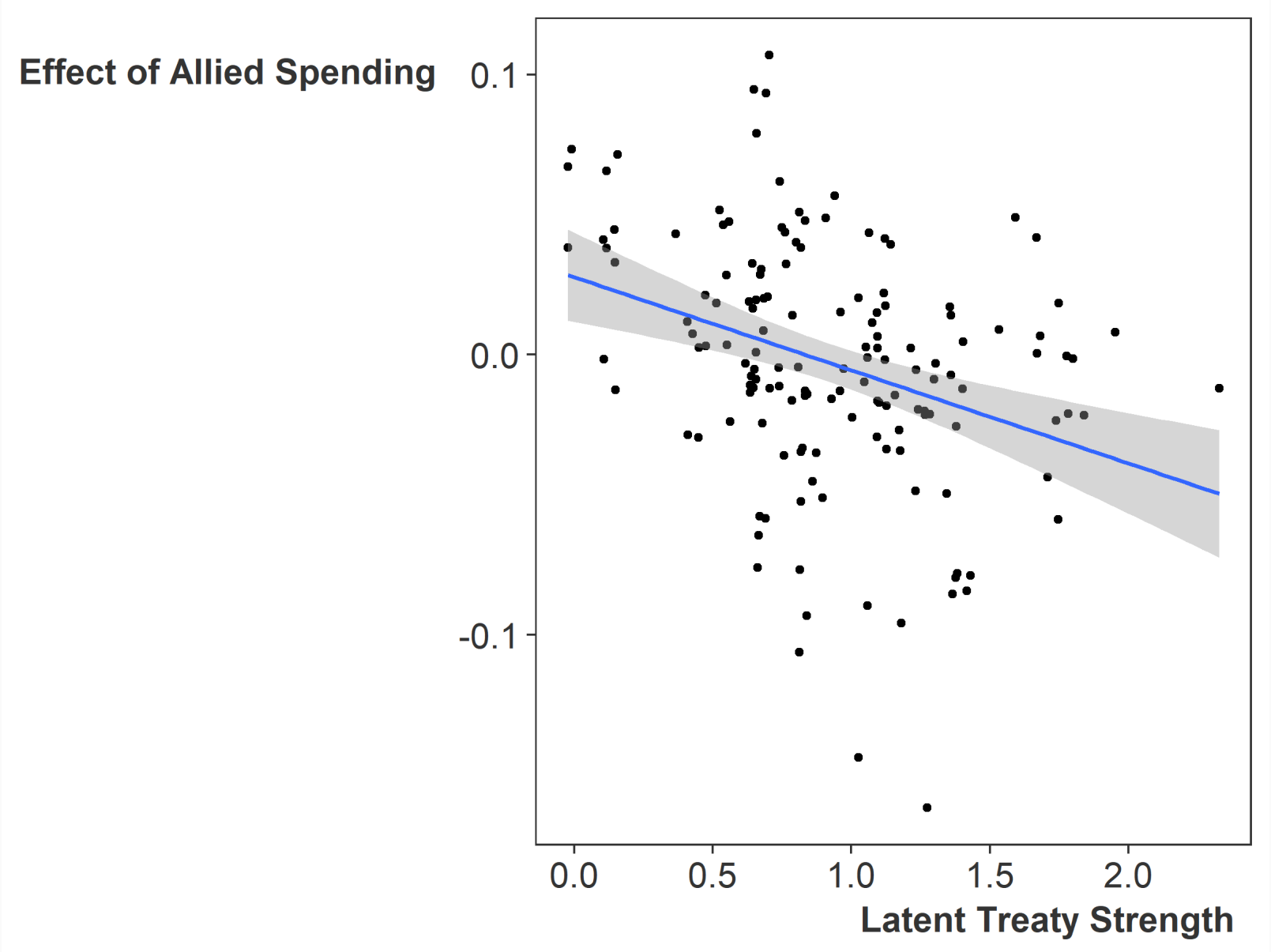
State-Year	Rio Pact	Warsaw Pact	...
Argentina 1954	.347	0	...
Argentina 1955	.418	0	...
⋮	⋮	⋮	...

Priors

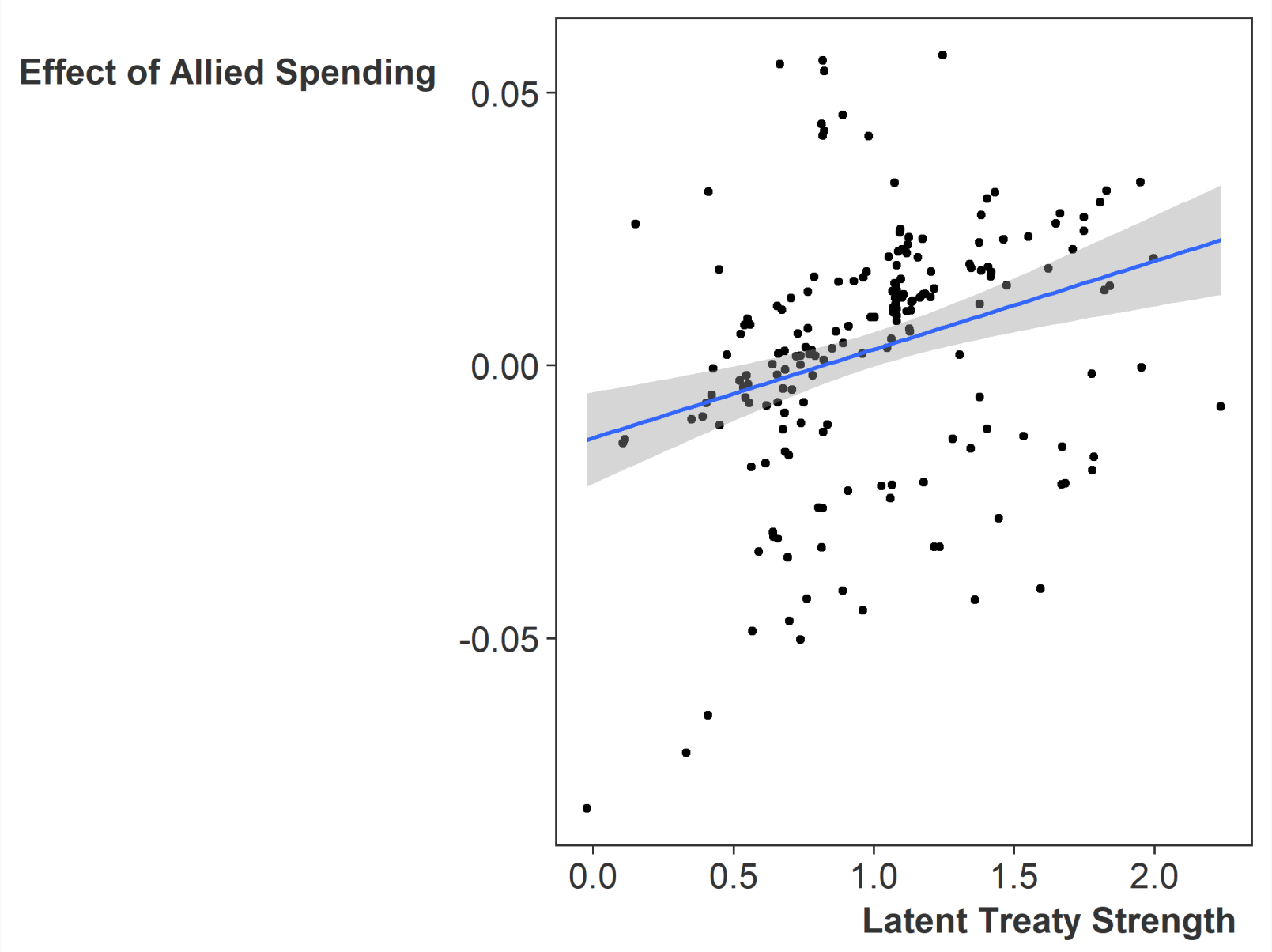
4 Chains with 2,000 samples and 1,000 warmup iterations.

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

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.

Single-Level Robust Regression