

Bayesian Regression

Test name: Bayesian Regression

Dataset: D:\DATA ANALYSIS\H Regression Tests and Models\Bayesian Regression\dataset.csv

Rows in original dataset: 649

Columns in original dataset: 33

Rows used in Bayesian regression model: 649

Outcome variable: G3

Numeric predictors standardized: G1, G2, studytime, failures, absences, age

Categorical predictors dummy-coded: school, sex, address

Formula using standardized/dummy predictors: $G3 \sim z_G1 + z_G2 + z_studytime + z_failures + z_absences + z_age + school_MS + sex_M + address_U$

Likelihood: Normal outcome model with identity link.

Prior: $\beta \mid \sigma^2 \sim \text{Normal}(0, \sigma^2 V_0)$; $\sigma^2 \sim \text{Inverse-Gamma}(a_0, b_0)$.

Prior variance: intercept=1000.0, slopes=100.0; $a_0=2.0$, $b_0=2.0$.

Posterior draws generated: 6000

Posterior σ^2 mean: 1.5404

Bayesian R-squared mean: 0.8527

Bayesian R-squared 95% credible interval: 0.8363 to 0.8678

Predictor credible effects excluding intercept: 4

Decision guide: a coefficient is treated as a credible effect when its 95% credible interval does not cross zero.

Reporting guide: report posterior mean, posterior SD, 95% credible interval, probability of direction, Bayesian R-squared, and posterior predictive check.

Charts generated: 8

Bayesian coefficient posterior summary

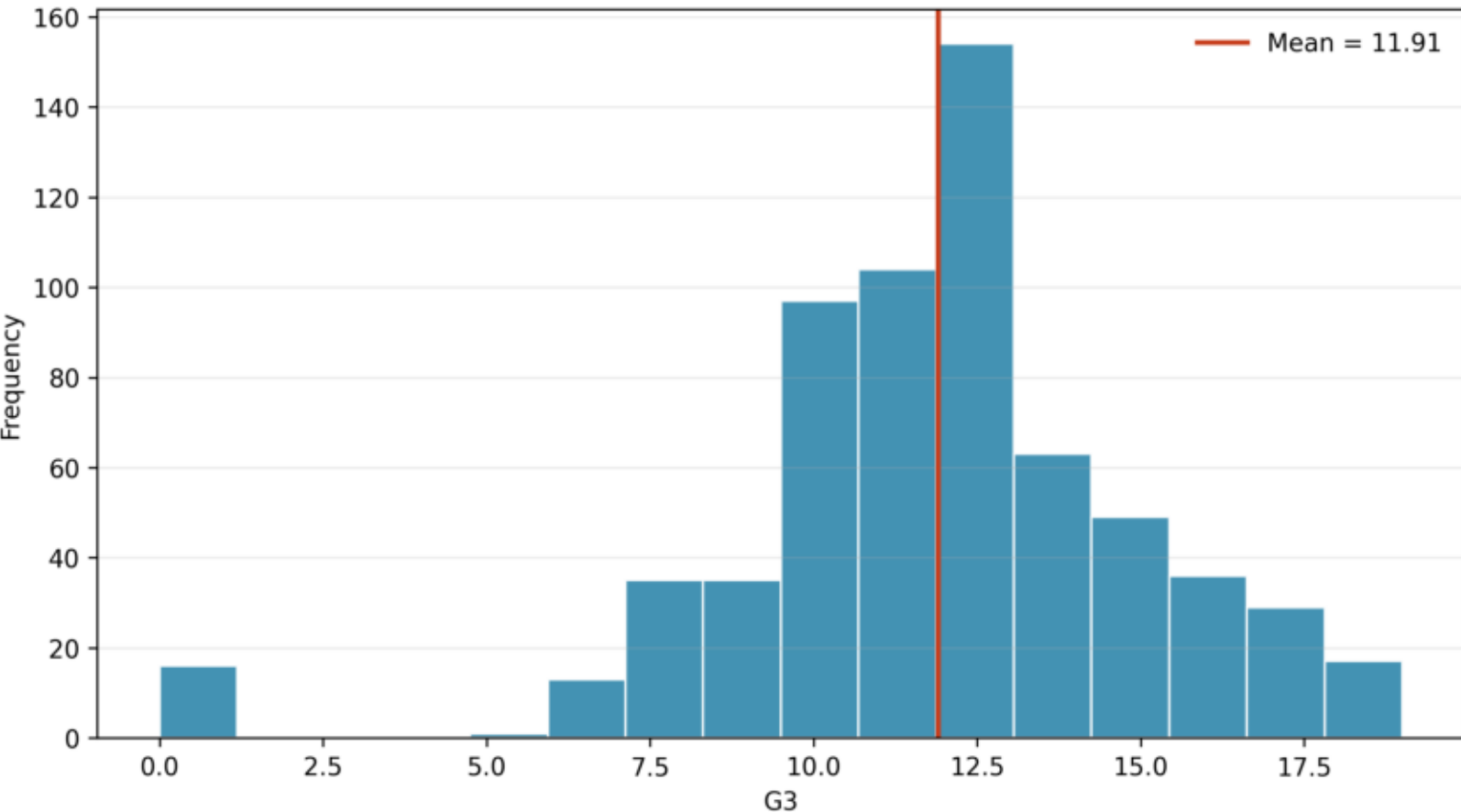
term	posterior_mean	posterior_sd	ci95_lower	posterior_med	ci95_upper	probability_positive	probability_negative	probability_direction	credible_interval	decision_alpha_05
Intercept	11.9774	0.1202	11.7401	11.9773	12.2129	1.0000	0.0000	1.0000	0.0000	Credible effect
z_G1	0.3654	0.0971	0.1771	0.3658	0.5535	1.0000	0.0000	1.0000	0.0000	Credible effect
z_G2	2.5623	0.0965	2.3715	2.5631	2.7479	1.0000	0.0000	1.0000	0.0000	Credible effect
z_studytime	0.0522	0.0520	-0.0487	0.0526	0.1547	0.8405	0.1595	0.8405	1.0000	Credible interval
z_failures	-0.1343	0.0560	-0.2445	-0.1343	-0.0238	0.0100	0.9900	0.9900	0.0000	Credible effect
z_absences	0.0831	0.0509	-0.0169	0.0834	0.1813	0.9492	0.0508	0.9492	1.0000	Credible interval
z_age	0.0283	0.0524	-0.0743	0.0279	0.1316	0.7043	0.2957	0.7043	1.0000	Credible interval
school_MS	-0.1647	0.1151	-0.3905	-0.1646	0.0599	0.0793	0.9207	0.9207	1.0000	Credible interval
sex_M	-0.2052	0.1033	-0.4077	-0.2037	-0.0032	0.0237	0.9763	0.9763	0.0000	Credible effect
address_U	0.1009	0.1134	-0.1192	0.1012	0.3277	0.8150	0.1850	0.8150	1.0000	Credible interval

Bayesian regression fit statistics

model	outcome	n	p_param	posterior	prior_int	prior_std	prior_a0	prior_b0	posterior	posterior	posterior	posterior	bayesian	bayesian	bayesian	rmse_us	mae_us	waic_gains
Conjugate	G3	649.000	10.0000	6000.00	1000.00	100.000	2.0000	2.0000	326.500	501.835	1.5404	1.5368	0.8527	0.8363	0.8678	1.2410	0.7801	2155.0685

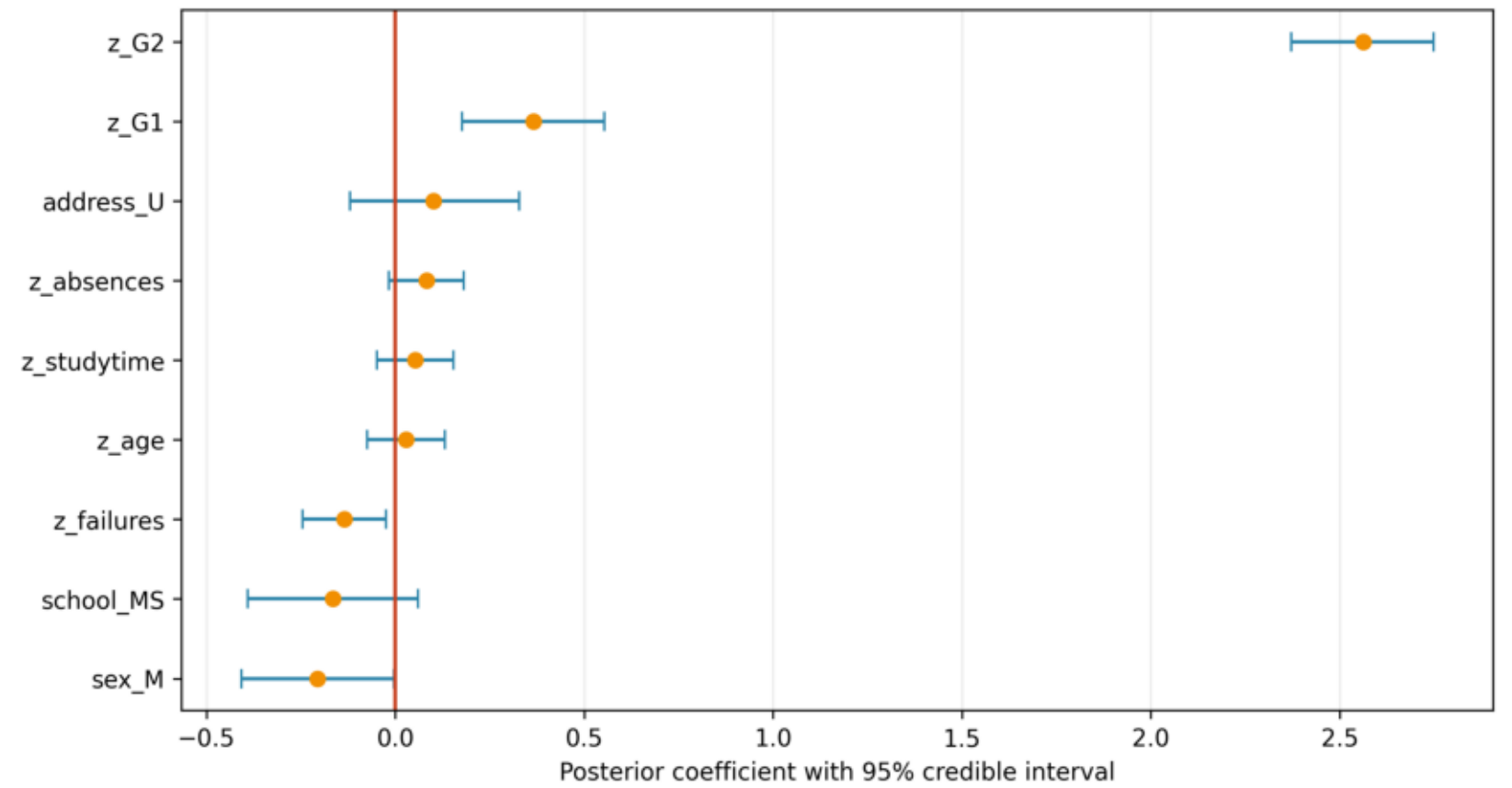
Outcome distribution for Bayesian regression

The continuous outcome is modeled with a normal likelihood and Bayesian posterior inference.



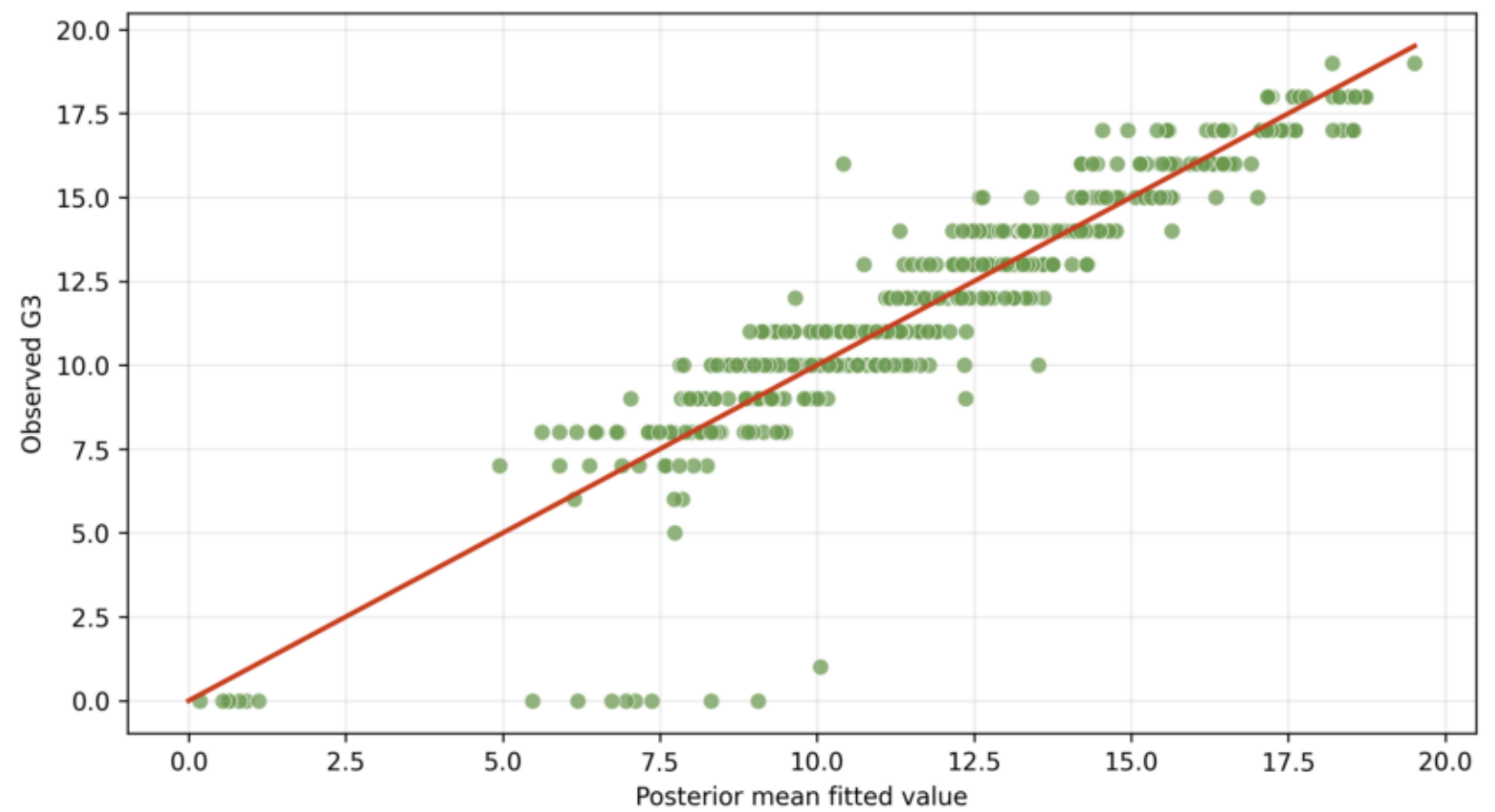
Bayesian coefficient credible intervals

Intervals that do not cross zero indicate stronger posterior evidence for an effect.



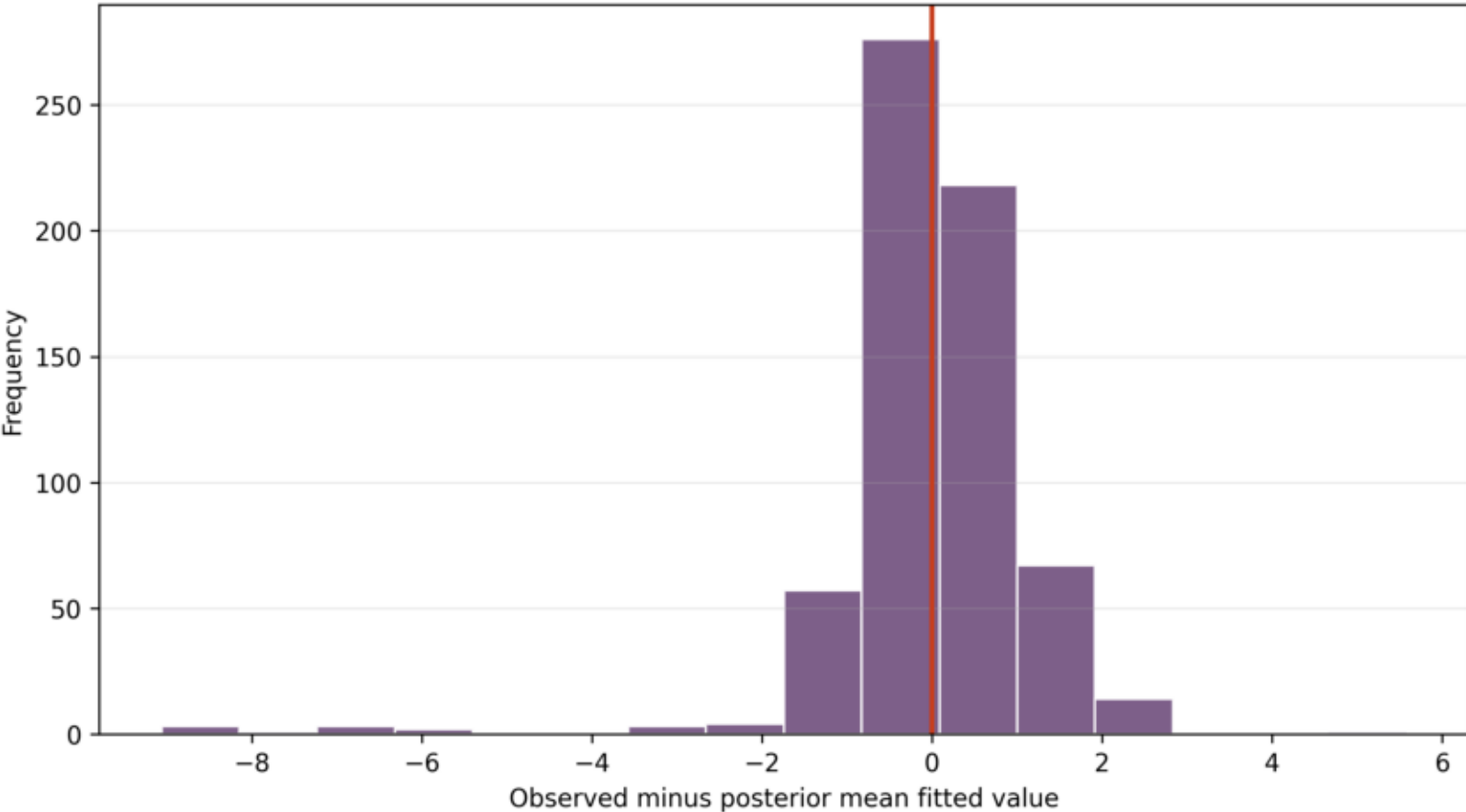
Observed vs posterior fitted values

Points near the diagonal show stronger agreement between observed and posterior mean fitted values.



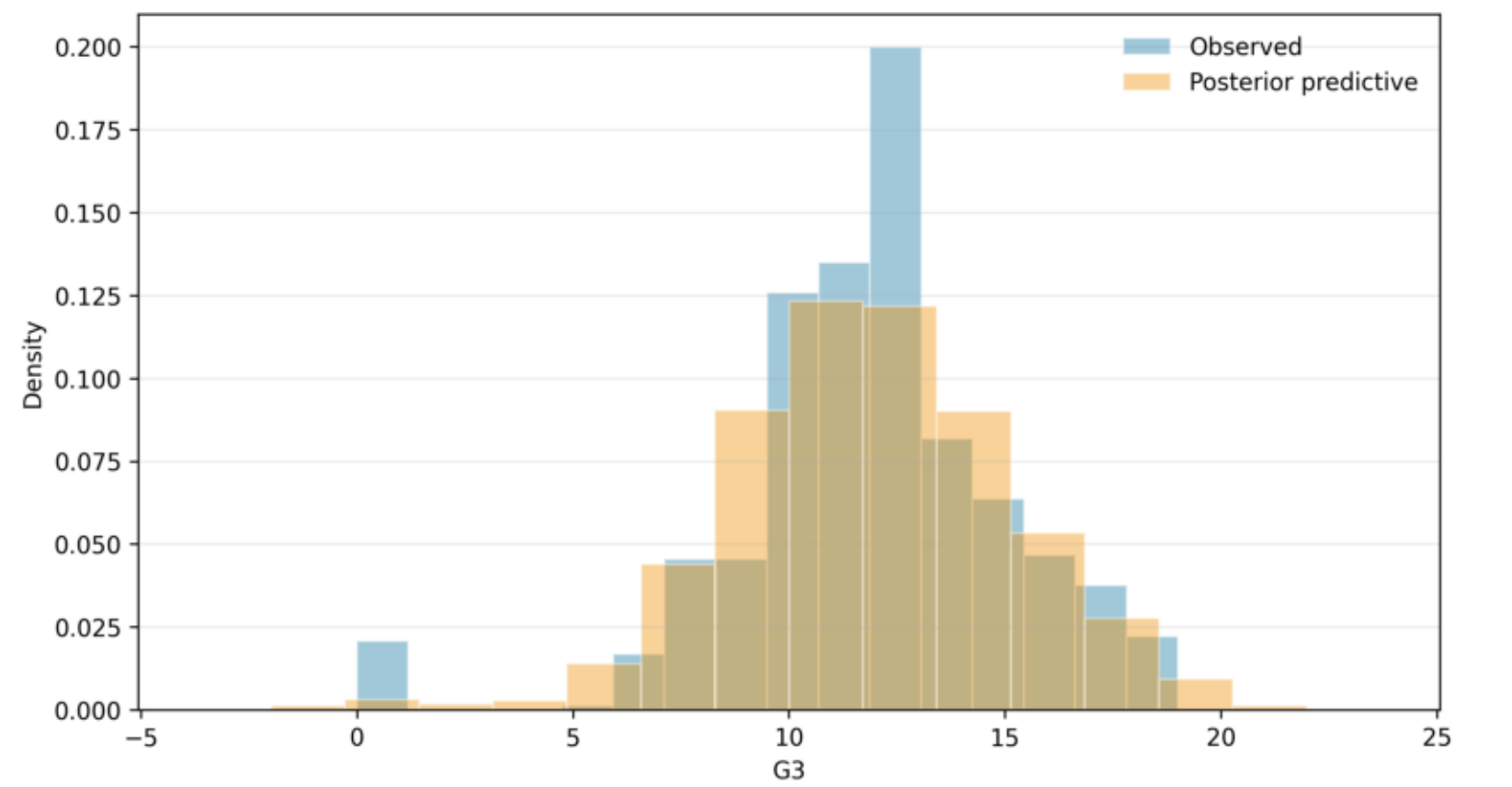
Posterior mean residual distribution

Residuals centered near zero support the model's average fitted-value calibration.



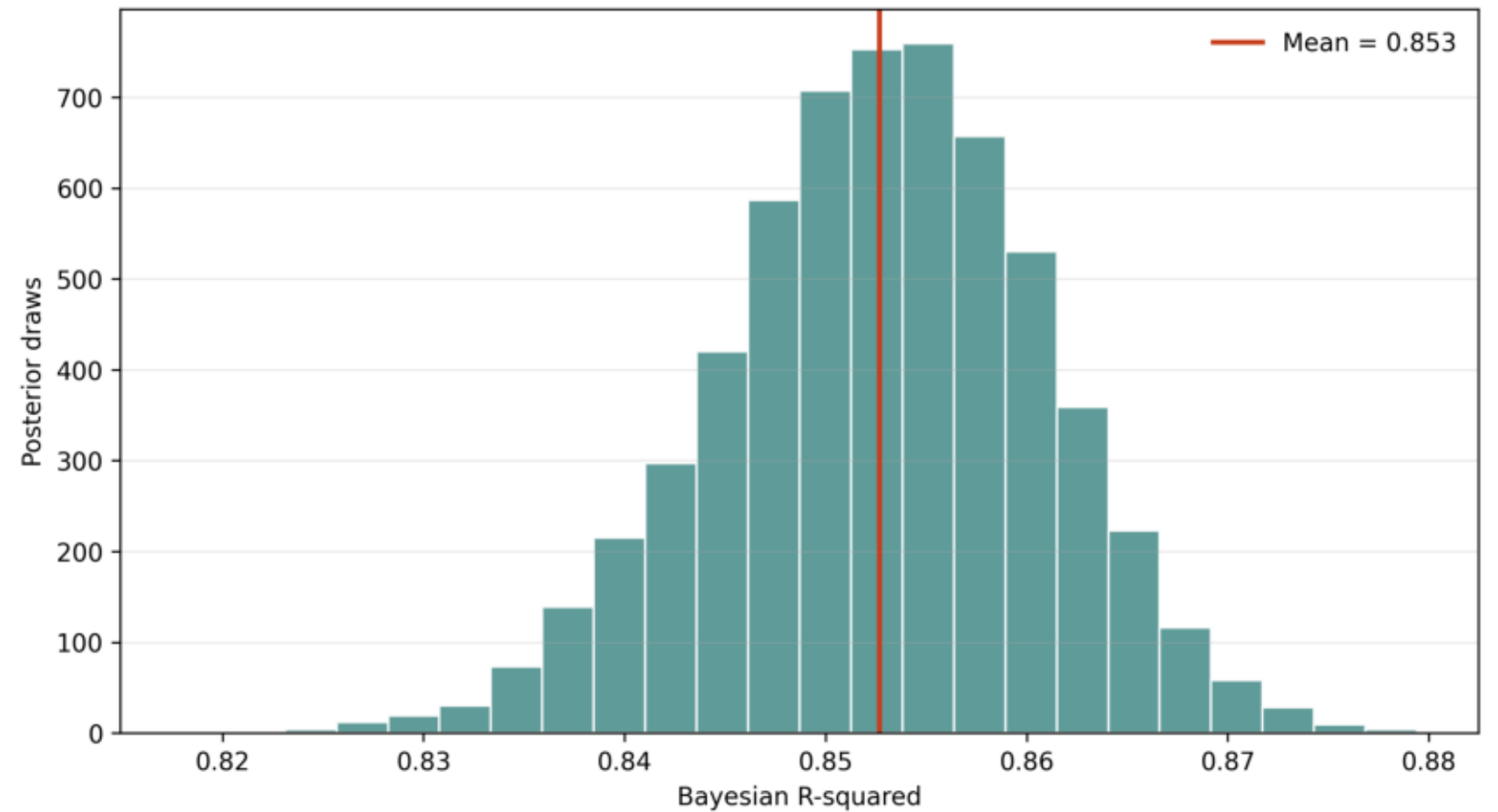
Posterior predictive check

The predictive distribution should resemble the observed outcome distribution when model fit is reasonable.



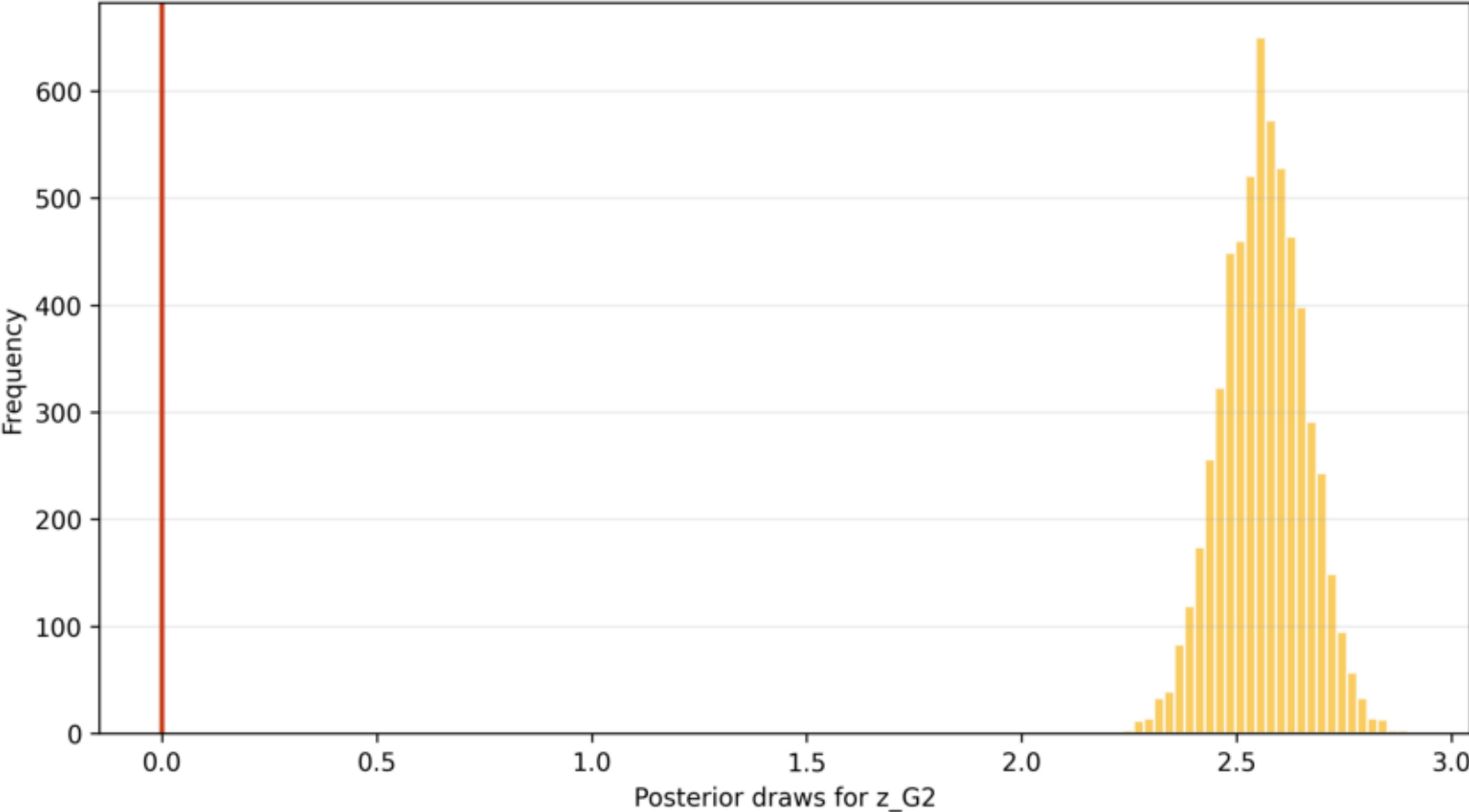
Bayesian R-squared posterior distribution

This summarizes the posterior uncertainty in explained outcome variation.



Posterior distribution for z_G2

This shows the full posterior uncertainty for the strongest selected coefficient.



Posterior probability of coefficient direction

Values closer to 1 indicate greater posterior certainty that the effect is positive or negative.

