

Fixed Effects Regression

Test name: Fixed Effects Regression

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

Rows in original dataset: 649

Columns in original dataset: 33

Rows used in fixed effects models: 649

Outcome variable: G3

Numeric predictors: G1, G2, studytime, failures, absences, age, Medu, Fedu

Fixed effect variables: school, sex, address, higher

Pooled formula: $G3 \sim G1 + G2 + studytime + failures + absences + age + Medu + Fedu$

One-way fixed effects formula: $G3 \sim G1 + G2 + studytime + failures + absences + age + Medu + Fedu + C(school)$

Multi-way fixed effects formula: $G3 \sim G1 + G2 + studytime + failures + absences + age + Medu + Fedu + C(school) + C(sex) + C(address) + C(higher)$

Best adjusted R squared model: Multi-way fixed effects (0.8499)

Nested F-test p-value for multi-way fixed effects comparison: 0.089644.

Multi-way fixed effects R squared: 0.8527

Multi-way fixed effects adjusted R squared: 0.8499

Multi-way fixed effects RMSE: 1.2392

Interpretation: numeric coefficients estimate within-model outcome change after controlling for fixed effect groups.

Decision guide: compare adjusted R squared and nested F-test p-values to decide whether fixed effects improve model fit.

Reporting guide: state outcome, numeric predictors, fixed effect variables, model comparison, adjusted R squared, F-test, and key coefficients.

Charts generated: 8

Model comparison

model	n	df_model	df_residual	r_squared	adjusted_r_sq	rmse	mae	f_statistic	f_p_value	aic	bic
Pooled OLS	649.0000	8.0000	640.0000	0.8508	0.8489	1.2470	0.7800	456.1111	0.0000	2146.3247	2186.6036
One-way fixed	649.0000	9.0000	639.0000	0.8514	0.8493	1.2444	0.7789	406.8187	0.0000	2145.5751	2190.3294
Multi-way fixed	649.0000	12.0000	636.0000	0.8527	0.8499	1.2392	0.7774	306.6924	0.0000	2146.1196	2204.3002

Nested fixed effects tests

smaller_model	larger_model	f_value	df_difference	p_value	decision_alpha_0_05
Pooled OLS	One-way fixed effects	2.7129	1.0000	0.1000	No significant improvement
One-way fixed effects	Multi-way fixed effects	1.7896	3.0000	0.1479	No significant improvement
Pooled OLS	Multi-way fixed effects	2.0229	4.0000	0.0896	No significant improvement

Multi-way fixed effects coefficients

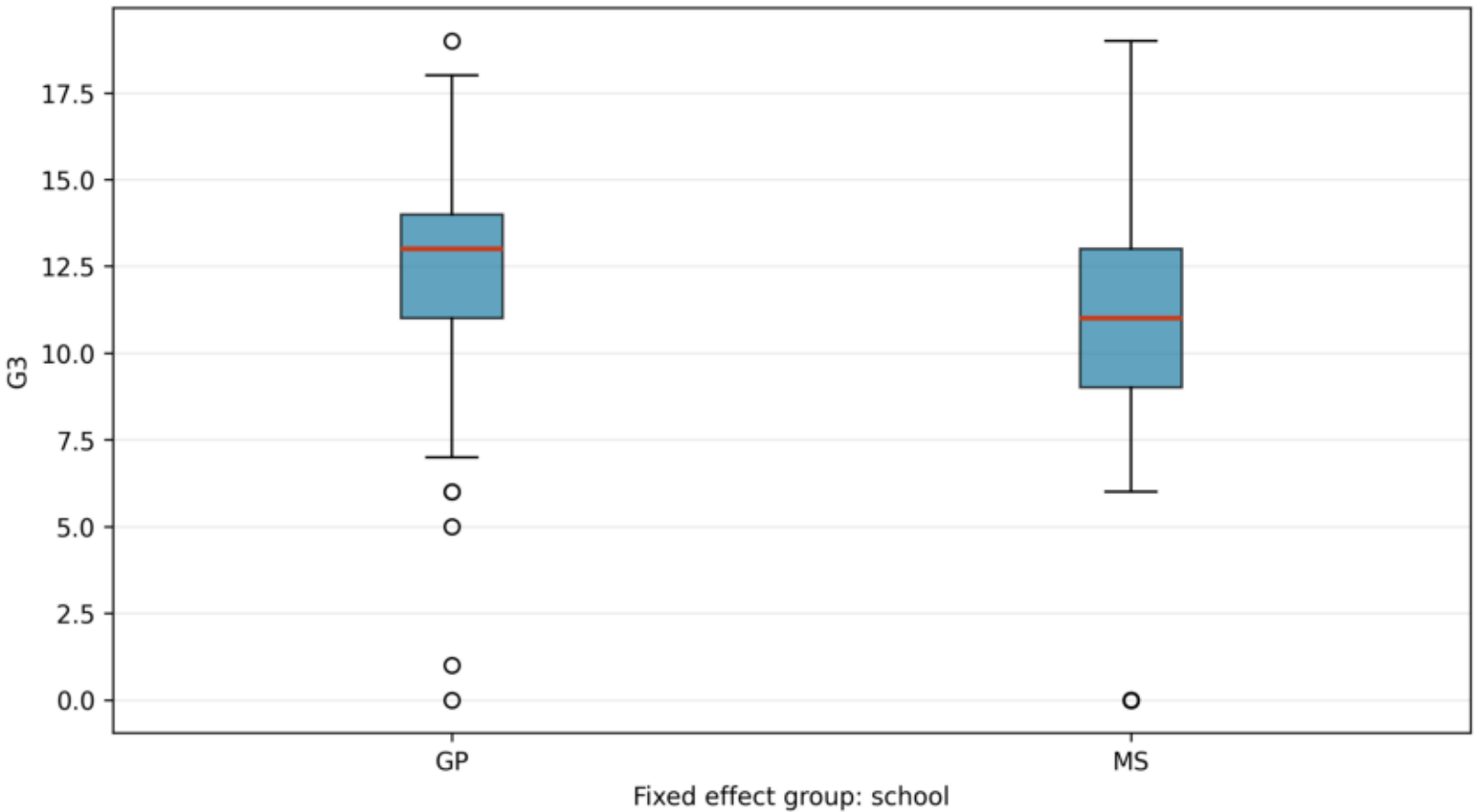
model	term	coefficient	standard_error	t_value	p_value	ci95_lower	ci95_upper	term_type	decision_alpha_0_05
Multi-way fixed	Intercept	-0.4214	0.8185	-0.5149	0.6068	-2.0288	1.1859	Numeric/intercept	Not statistically significant
Multi-way fixed	C(school)[T.MS]	-0.1759	0.1192	-1.4758	0.1405	-0.4100	0.0582	Fixed effect	Not statistically significant
Multi-way fixed	C(sex)[T.M]	-0.1887	0.1046	-1.8041	0.0717	-0.3942	0.0167	Fixed effect	Not statistically significant
Multi-way fixed	C(address)[T.U]	0.1077	0.1152	0.9352	0.3500	-0.1185	0.3339	Fixed effect	Not statistically significant
Multi-way fixed	C(higher)[T.yes]	0.1870	0.1795	1.0420	0.2978	-0.1654	0.5394	Fixed effect	Not statistically significant
Multi-way fixed	G1	0.1313	0.0369	3.5576	0.0004	0.0588	0.2037	Numeric/intercept	Statistically significant
Multi-way fixed	G2	0.8792	0.0343	25.6035	0.0000	0.8117	0.9466	Numeric/intercept	Statistically significant
Multi-way fixed	studytime	0.0584	0.0637	0.9176	0.3592	-0.0666	0.1834	Numeric/intercept	Not statistically significant
Multi-way fixed	failures	-0.2178	0.0958	-2.2734	0.0233	-0.4060	-0.0297	Numeric/intercept	Statistically significant
Multi-way fixed	absences	0.0182	0.0112	1.6208	0.1055	-0.0038	0.0402	Numeric/intercept	Not statistically significant
Multi-way fixed	age	0.0311	0.0444	0.7000	0.4842	-0.0561	0.1182	Numeric/intercept	Not statistically significant
Multi-way fixed	Medu	-0.0536	0.0588	-0.9106	0.3629	-0.1691	0.0620	Numeric/intercept	Not statistically significant

Fixed effect group summary

school	n	outcome_mean	fitted_mean	residual_mean	outcome_sd
GP	423.0000	12.5768	12.5768	-0.0000	2.6256
MS	226.0000	10.6504	10.6504	-0.0000	3.8340

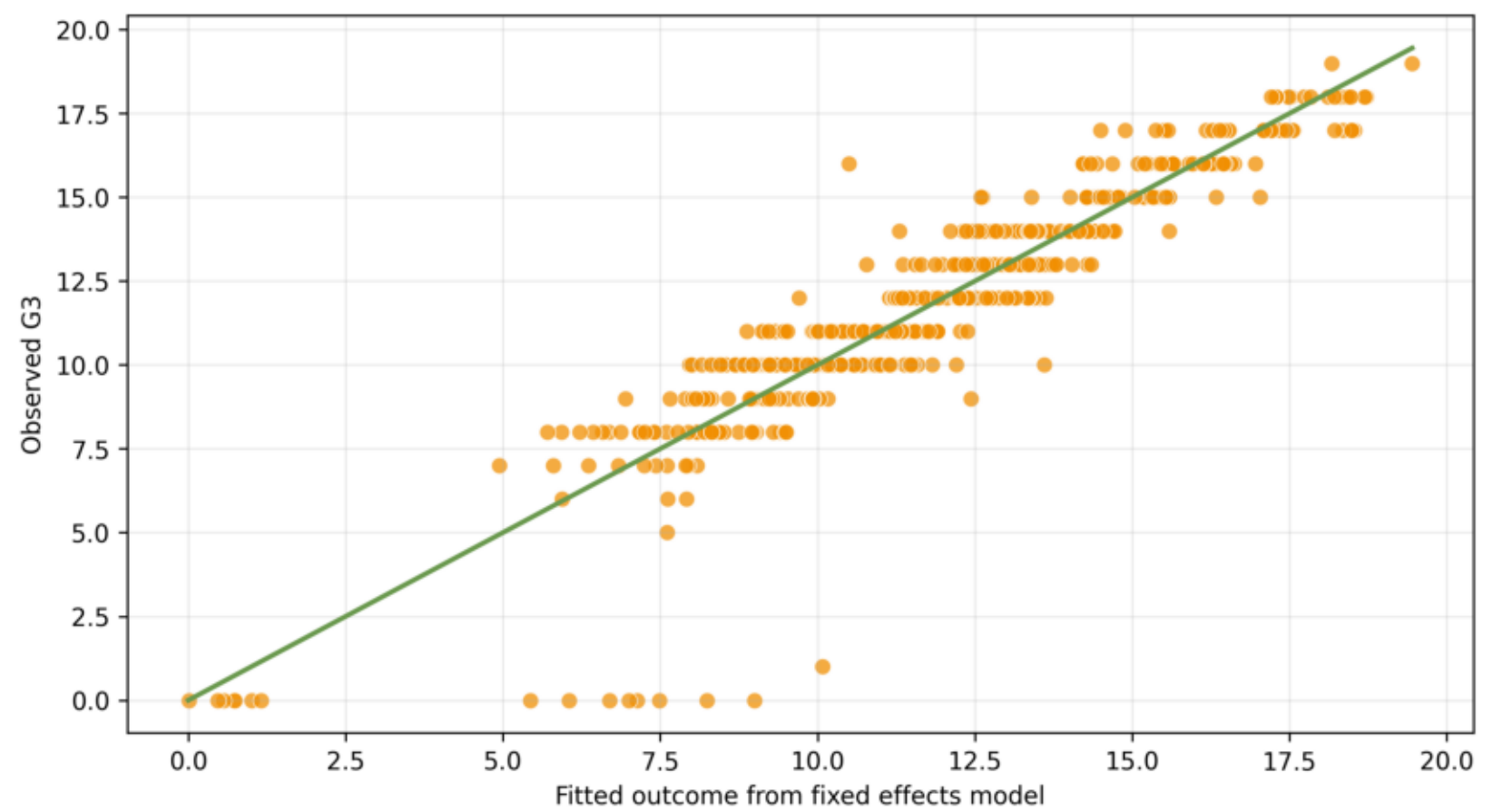
Outcome distribution by fixed effect group

This chart shows whether group-level differences exist before fixed effects are controlled.



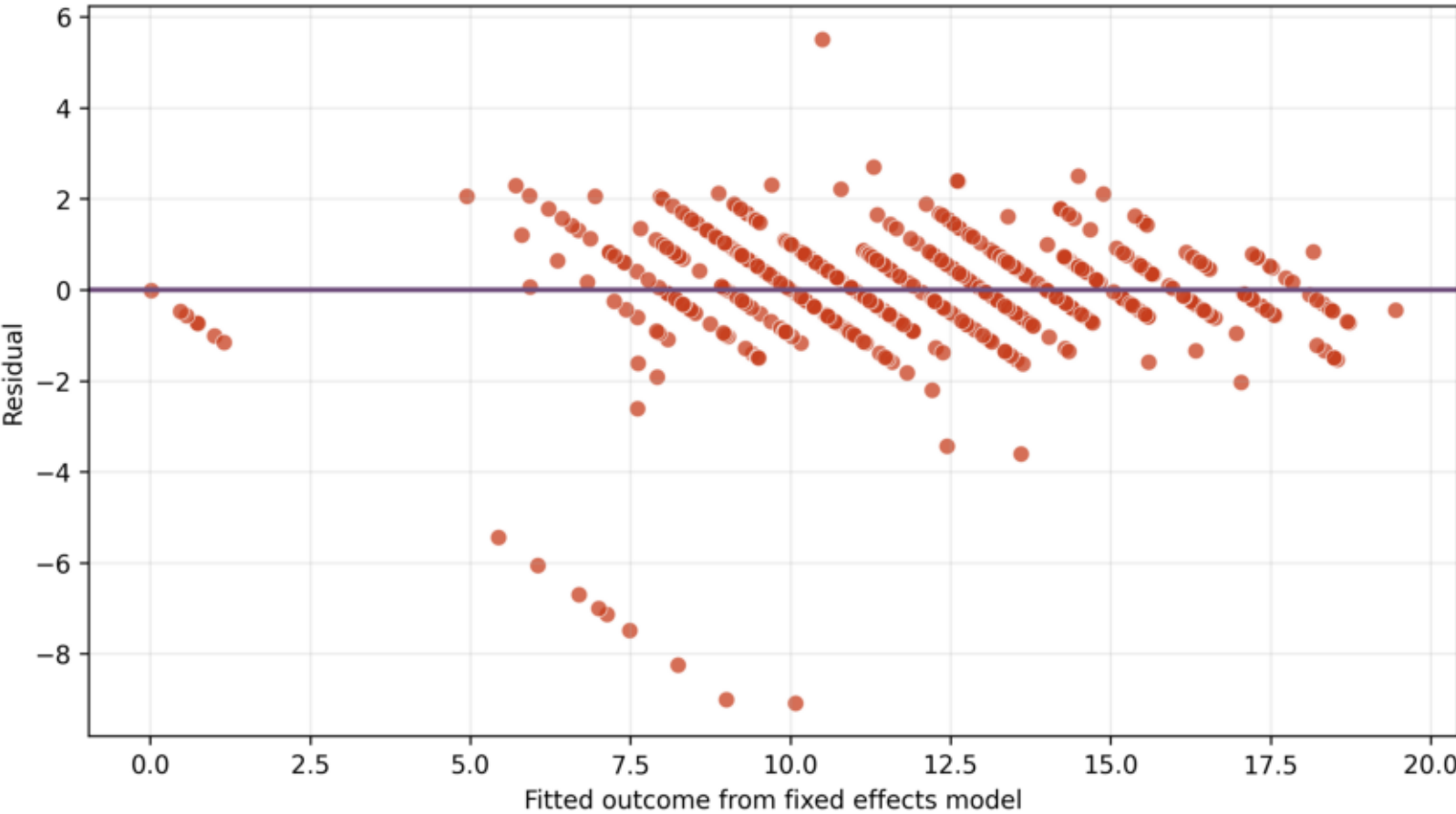
Observed vs fitted values

Points near the diagonal indicate stronger fitted-value accuracy for the fixed effects model.



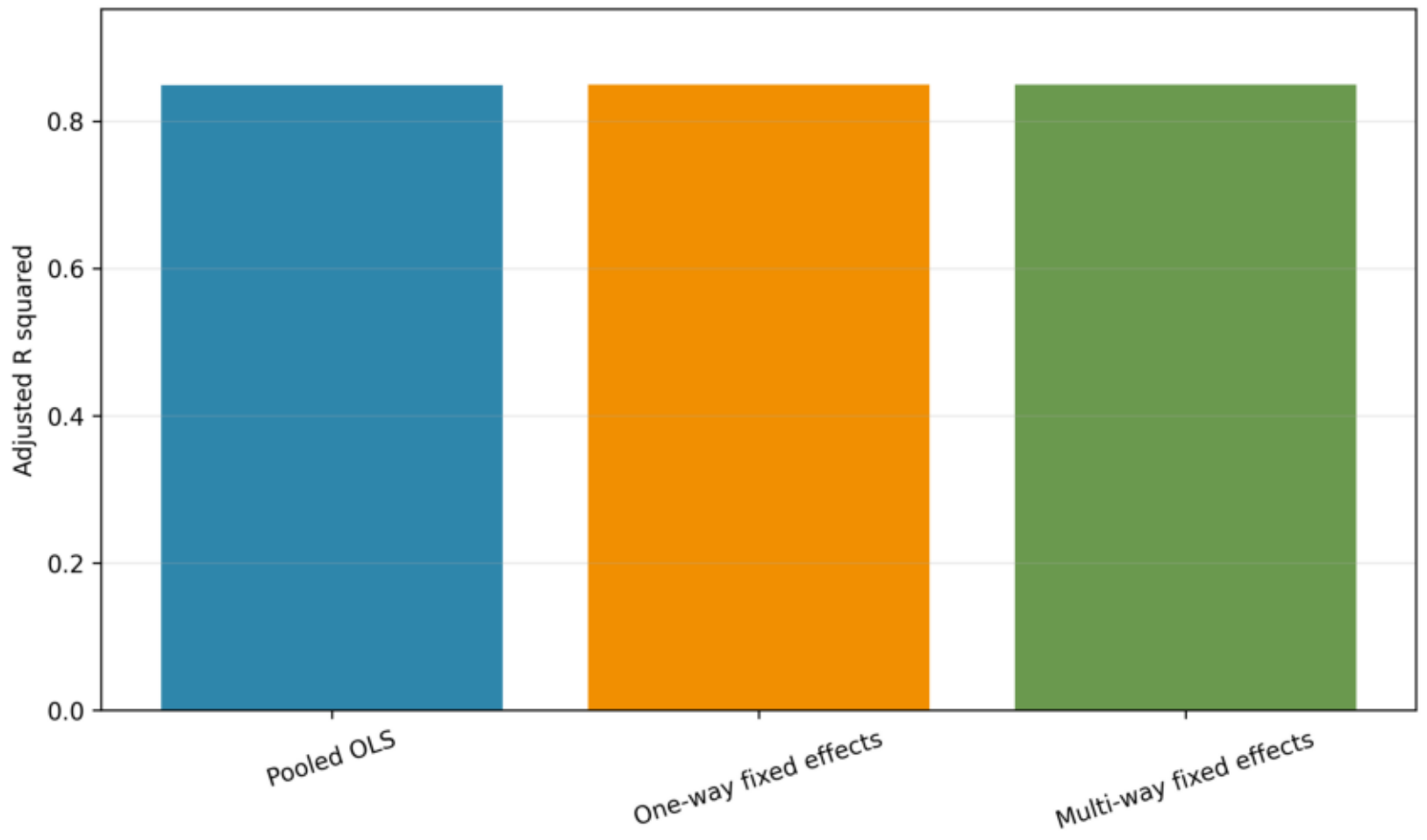
Residuals vs fitted values

A random cloud around zero supports the linear fixed effects model fit.



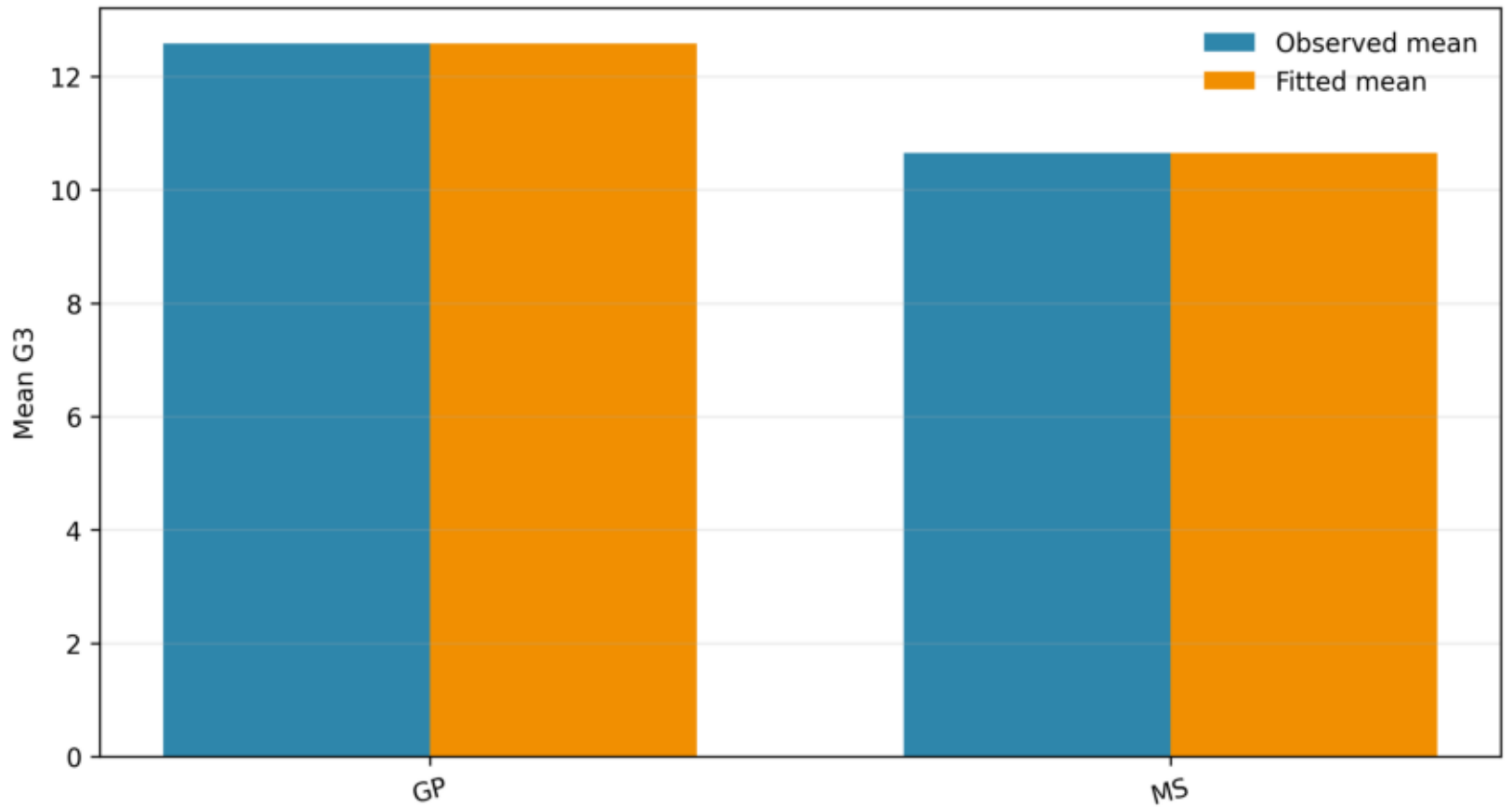
Model fit comparison

Adjusted R squared compares pooled OLS, one-way fixed effects, and multi-way fixed effects.



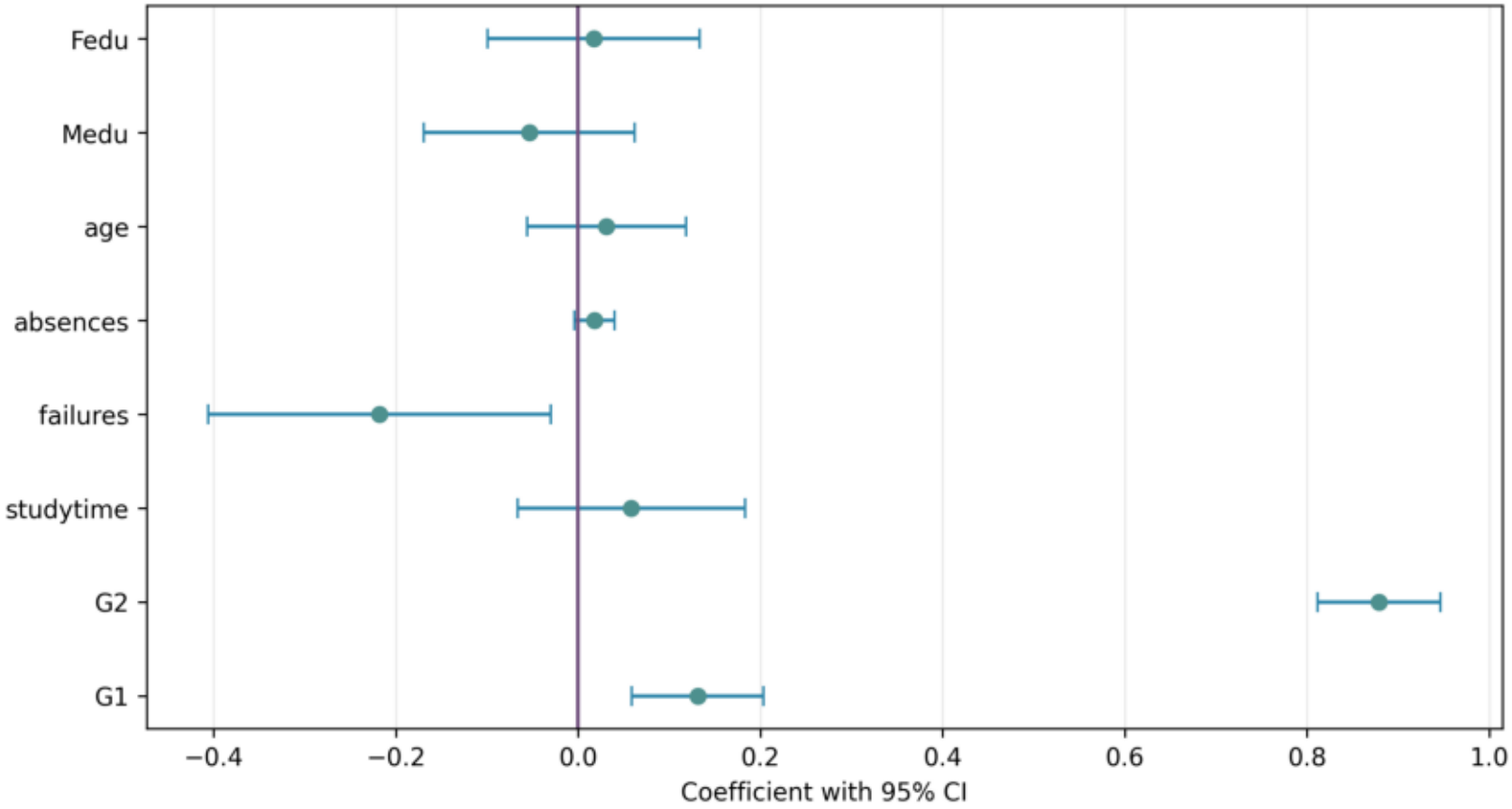
Observed and fitted means by fixed effect group

This chart summarizes how the fitted model tracks group-level outcome means.



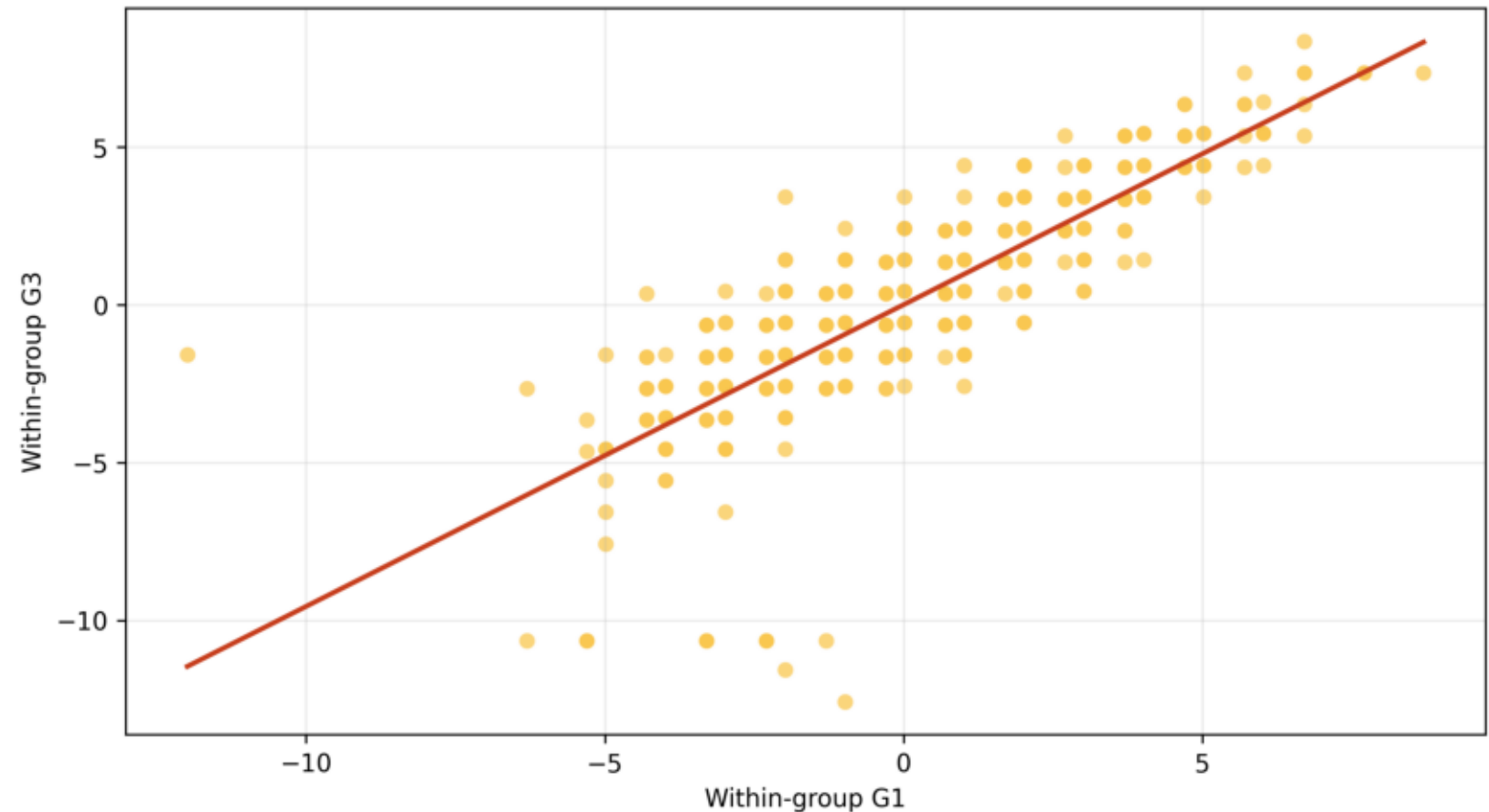
Numeric predictor coefficients

Intervals crossing zero indicate weaker evidence after fixed effects are controlled.



Within-transformed relationship

Values are demeaned within school, showing the within-group relationship used by fixed effects logic.



Fixed effect coefficient context

These coefficients represent group offsets relative to reference groups in the dummy-variable model.

