

Moderated Regression

Test name: Moderated Regression

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

Rows in original dataset: 649

Columns in original dataset: 33

Rows used in moderated regression: 649

Outcome variable: G3

Focal predictor: G1 centered as moderator_predictor_c

Moderator: studytime centered as moderator_variable_c

Interaction term: moderation_interaction = moderator_predictor_c * moderator_variable_c

Numeric controls: G2, failures, absences, age, Medu, Fedu

Categorical controls: school, sex, address

Main-effects formula: $G3 \sim \text{moderator_predictor_c} + \text{moderator_variable_c} + G2_c + \text{failures_c} + \text{absences_c} + \text{age_c} + \text{Medu_c} + \text{Fedu_c} + C(\text{school}) + C(\text{sex}) + C(\text{address})$

Moderated formula: $G3 \sim \text{moderator_predictor_c} + \text{moderator_variable_c} + \text{moderation_interaction} + G2_c + \text{failures_c} + \text{absences_c} + \text{age_c} + \text{Medu_c} + \text{Fedu_c} + C(\text{school}) + C(\text{sex}) + C(\text{address})$

Main-effects adjusted R squared: 0.8499

Moderated adjusted R squared: 0.8507

R squared change from interaction: 0.0010

F-change p-value: 0.034043

Interaction p-value: 0.034043

Moderation is supported by the interaction term.

Interpretation guide: the interaction coefficient shows whether the predictor slope changes across moderator levels.

Reporting guide: report the main-effects model, moderated model, interaction coefficient, R² change, simple slopes, and interaction plot.

Charts generated: 8

Moderated regression coefficients

model	term	coefficient	standard_error	t_value	p_value	ci95_lower	ci95_upper	decision_alpha_0.05
Moderated regres	Intercept	12.0031	0.1222	98.2333	0.0000	11.7631	12.2430	Statistically significant
Moderated regres	C(school)[T.MS]	-0.1744	0.1189	-1.4670	0.1429	-0.4079	0.0591	Not statistically significant
Moderated regres	C(sex)[T.M]	-0.1866	0.1043	-1.7892	0.0741	-0.3915	0.0182	Not statistically significant
Moderated regres	C(address)[T.U]	0.0972	0.1150	0.8450	0.3985	-0.1286	0.3230	Not statistically significant
Moderated regres	moderator_predictor	0.1351	0.0367	3.6775	0.0003	0.0629	0.2072	Statistically significant
Moderated regres	moderator_variable	0.0805	0.0636	1.2649	0.2064	-0.0445	0.2055	Not statistically significant
Moderated regres	moderation_interaction	-0.0464	0.0218	-2.1241	0.0340	-0.0892	-0.0035	Statistically significant
Moderated regres	G2_c	0.8832	0.0342	25.8140	0.0000	0.8160	0.9503	Statistically significant
Moderated regres	failures_c	-0.2191	0.0950	-2.3073	0.0214	-0.4056	-0.0326	Statistically significant
Moderated regres	absences_c	0.0167	0.0112	1.4968	0.1349	-0.0052	0.0386	Not statistically significant
Moderated regres	age_c	0.0299	0.0437	0.6842	0.4941	-0.0559	0.1157	Not statistically significant
Moderated regres	Medu_c	-0.0464	0.0586	-0.7922	0.4286	-0.1615	0.0686	Not statistically significant

Model fit comparison

model	n	df_model	df_resid	r_squared	adjusted_r_sq	f_statistic	f_p_value	aic	bic	rmse
Main-effects model	649.0000	11.0000	637.0000	0.8524	0.8499	334.4298	0.0000	2145.2267	2198.9319	1.2402
Moderated model	649.0000	12.0000	636.0000	0.8534	0.8507	308.6268	0.0000	2142.6387	2200.8193	1.2358

Interaction change test

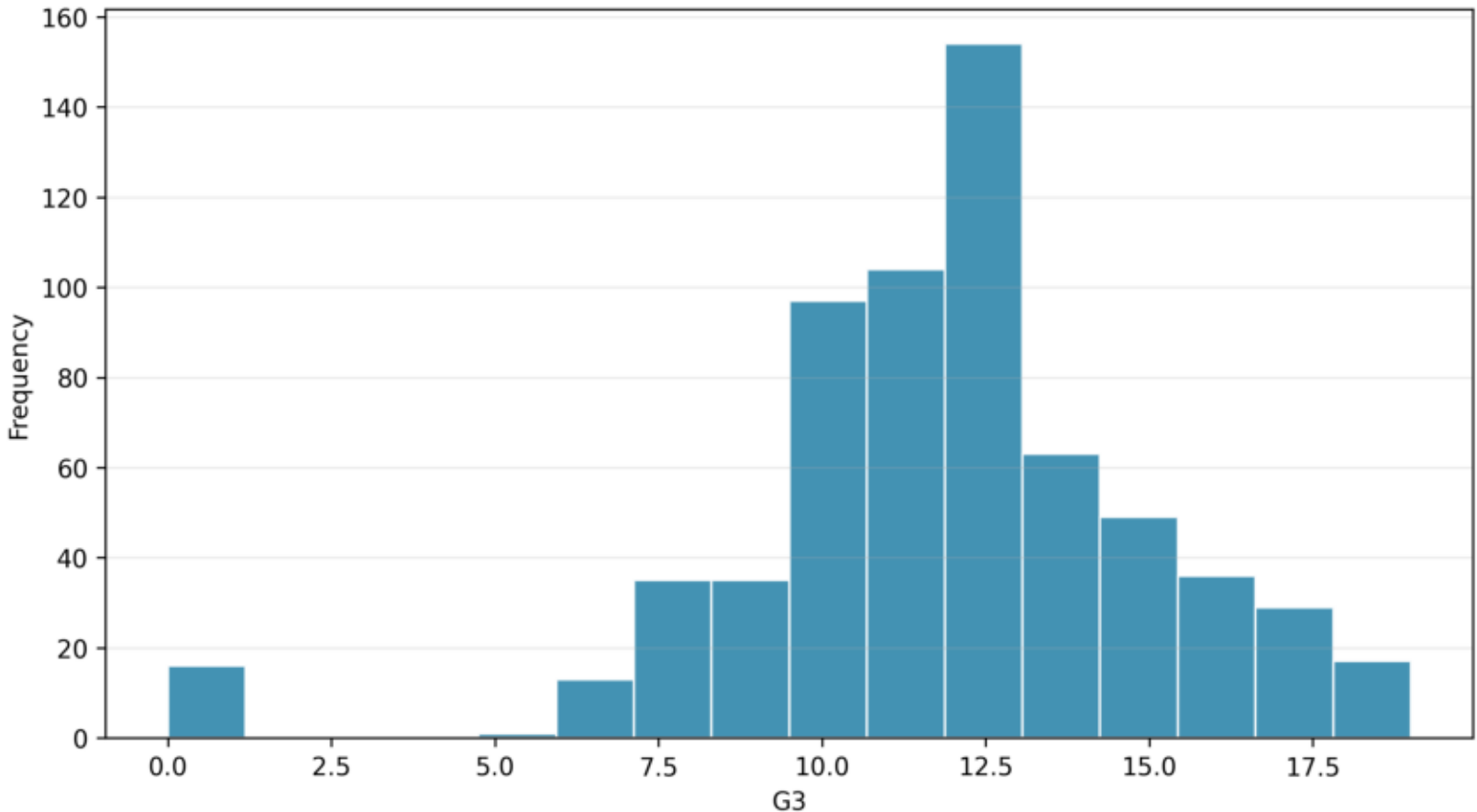
comparison	r_squared_baseline	r_squared_model	r_squared_change	df_change	df_residual_model	f_change	p_value_change	decision_alpha_0.05
Moderated model	0.8524	0.8534	0.0010	1.0000	636.0000	4.5120	0.0340	Interaction improves

Simple slopes

moderator_level	moderator_cente	simple_slope_of_t	standard_error	t_value	p_value	ci95_lower	ci95_upper	decision_alpha_0
Low moderator (-	-0.8295	0.1735	0.0412	4.2099	0.0000	0.0926	0.2545	Statistically signifi
Mean moderator	0.0000	0.1351	0.0367	3.6775	0.0003	0.0629	0.2072	Statistically signifi
High moderator (	0.8295	0.0966	0.0407	2.3747	0.0179	0.0167	0.1765	Statistically signifi

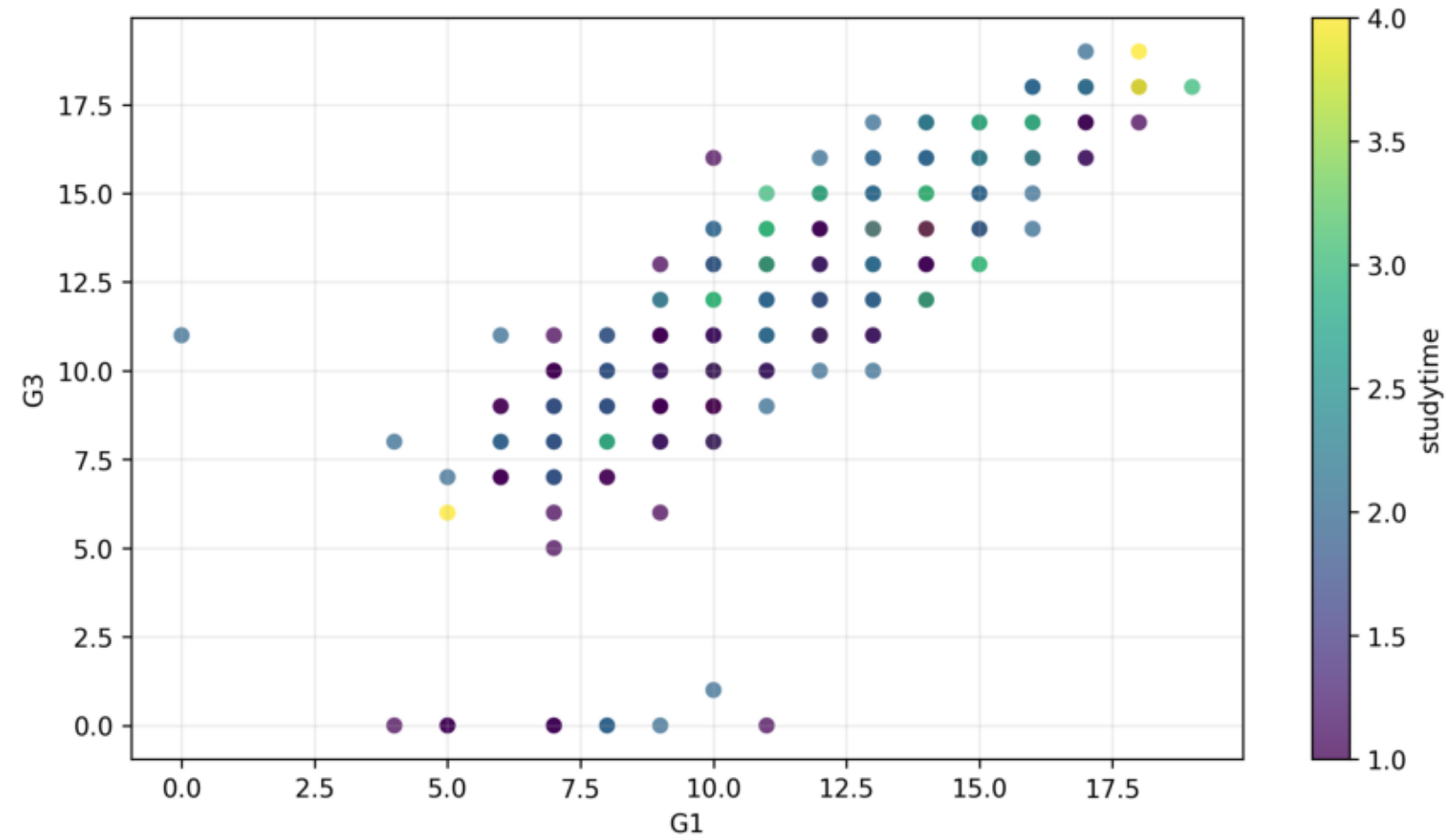
Outcome distribution

Distribution of G3 before moderated regression modeling.



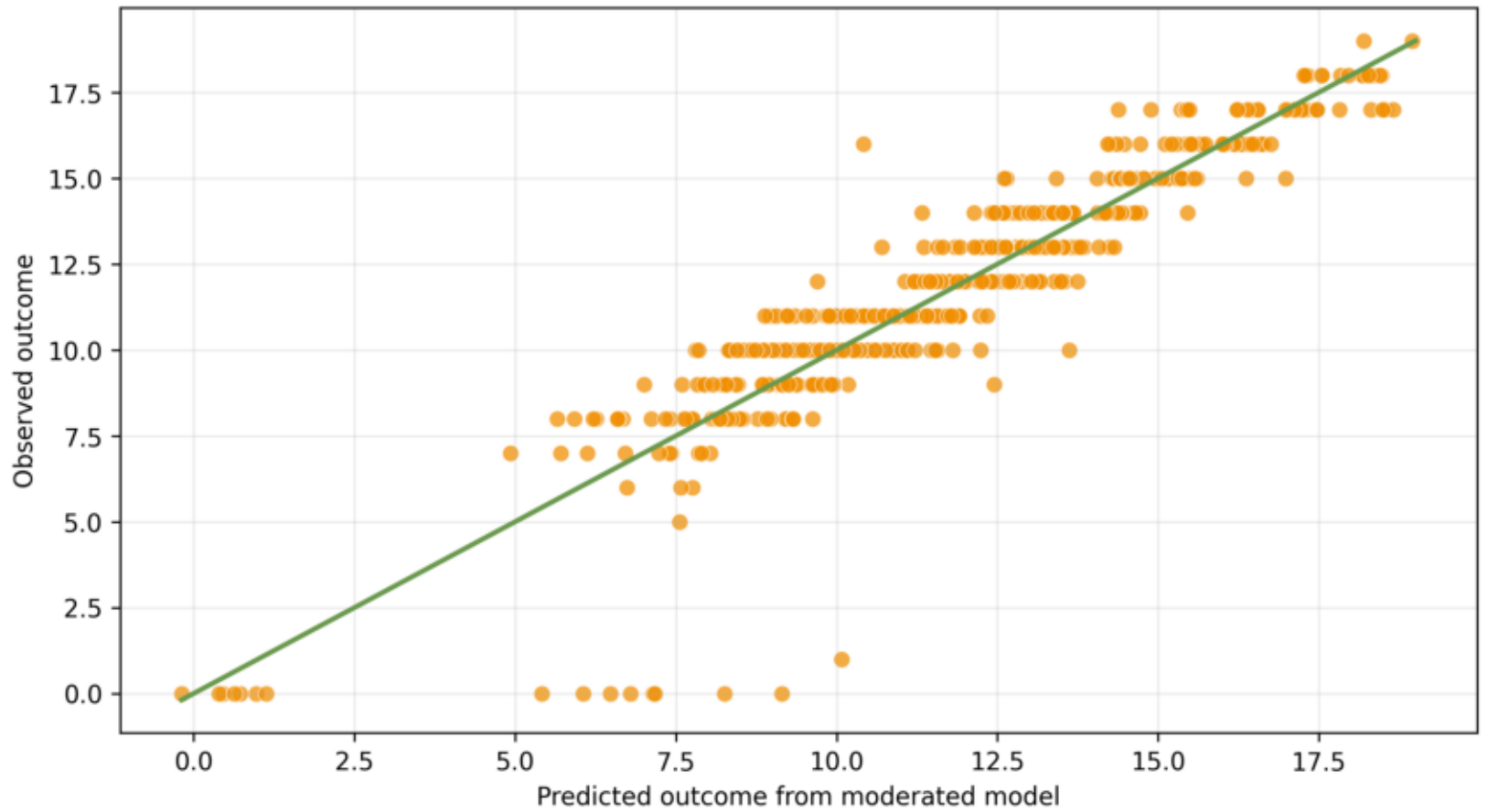
Predictor-outcome scatter by moderator

Color shows studytime; moderation tests whether the G1 slope changes by moderator level.



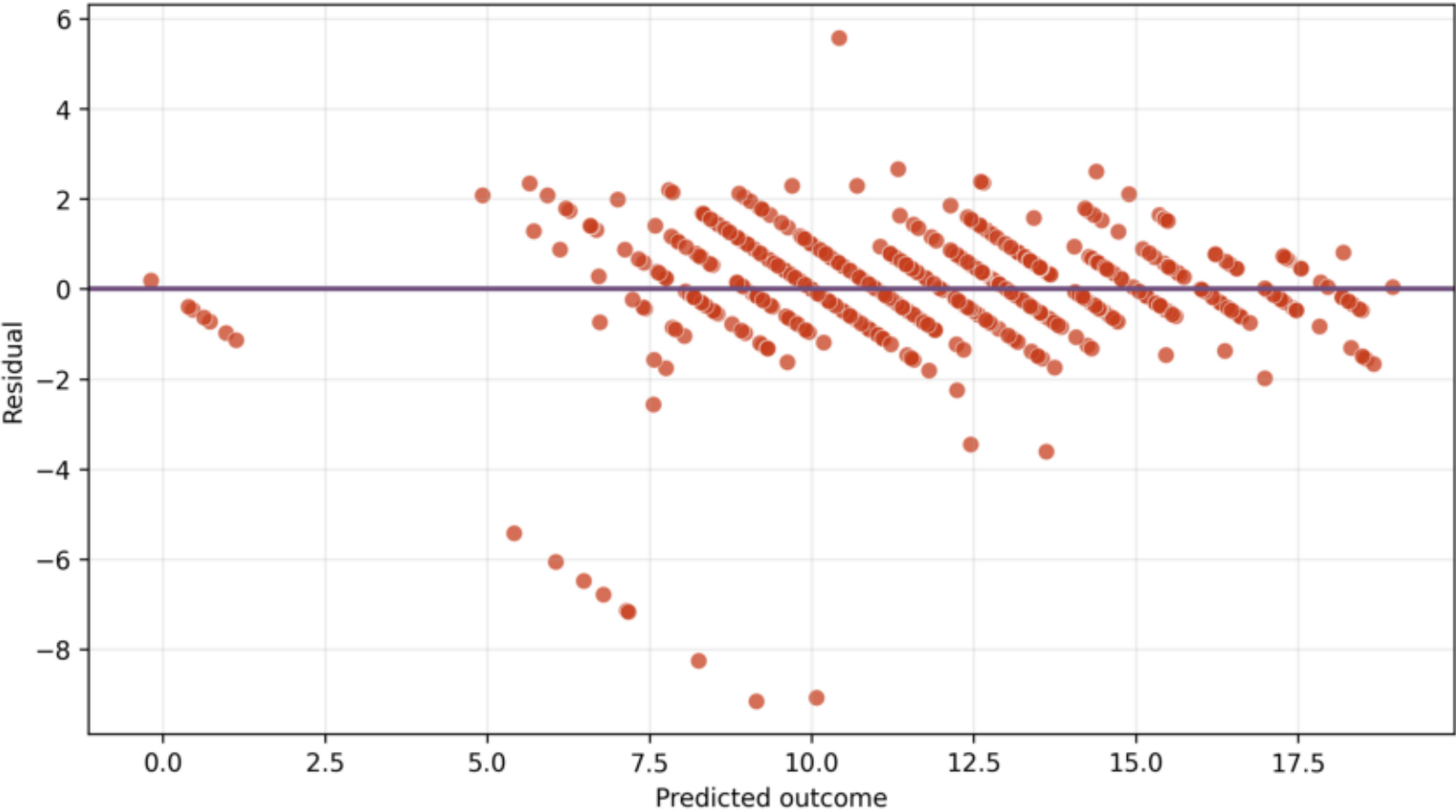
Observed vs predicted values

Points closer to the diagonal represent better model prediction.



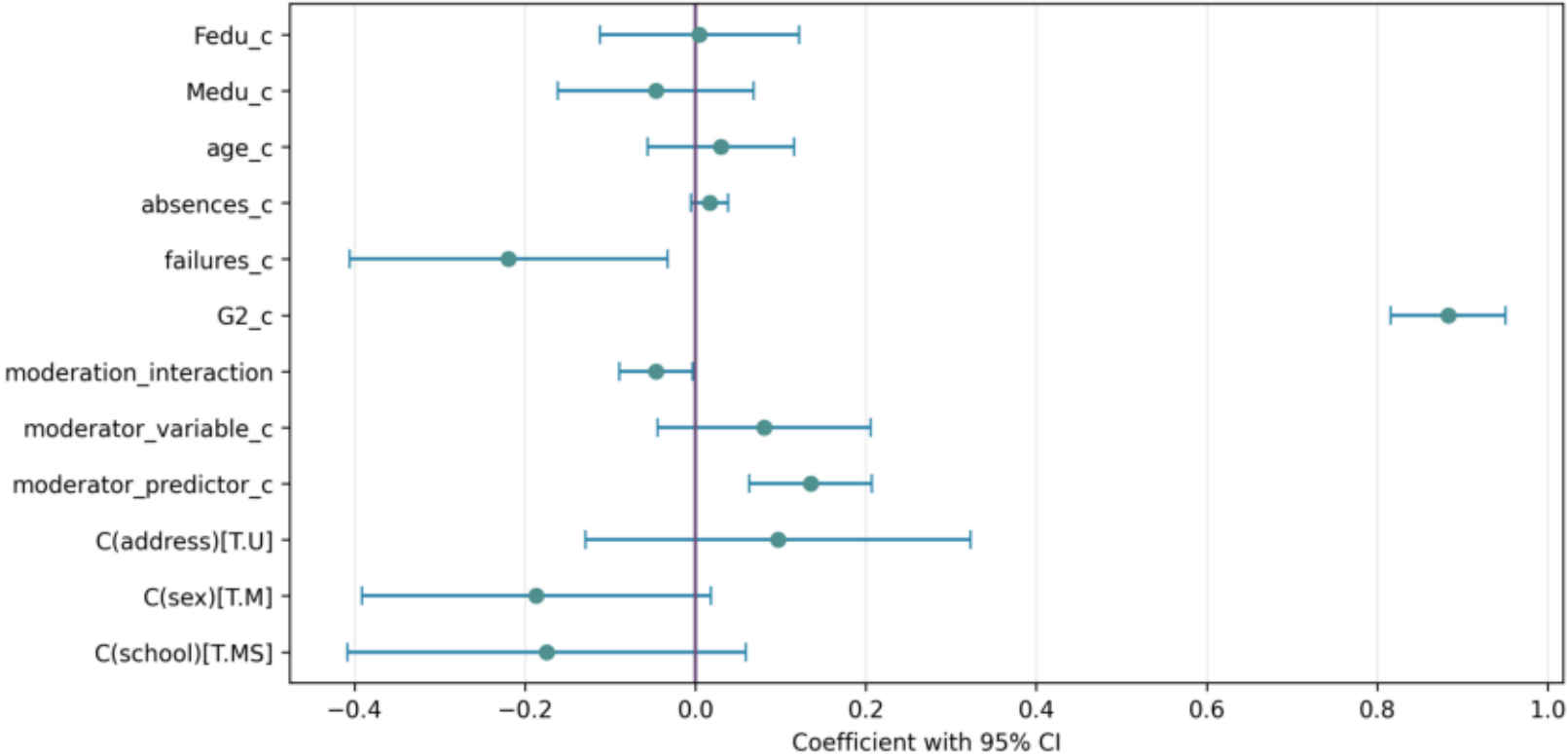
Residuals vs predicted values

Residuals should be centered around zero without a strong curve or funnel pattern.



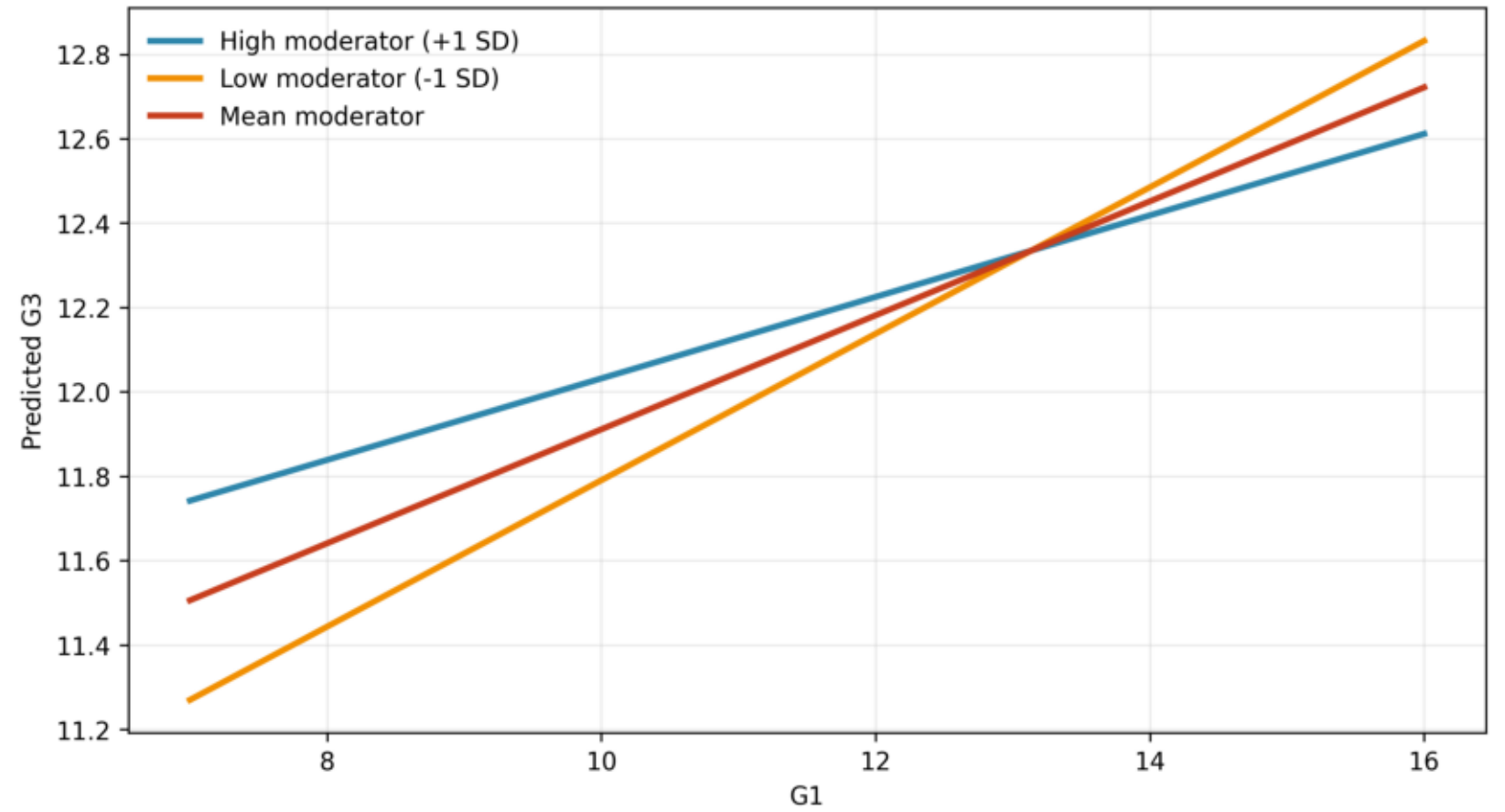
Moderated regression coefficient plot

The interaction term is the key test of moderation.



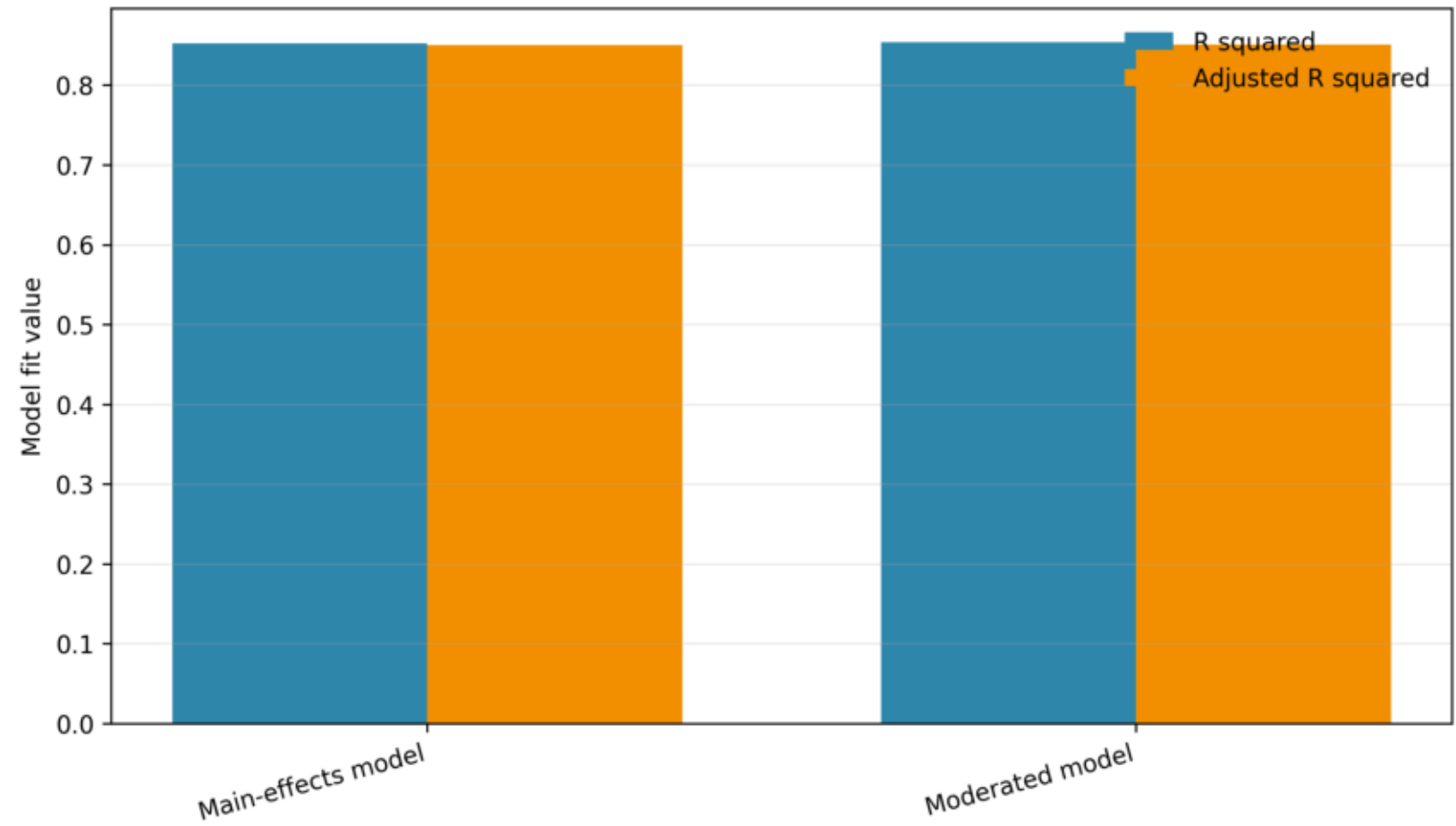
Moderation interaction plot

Predicted G3 by G1 at low, mean, and high studytime.



Model fit comparison

The moderated model should be judged by R^2 change and the interaction coefficient.



Simple slopes by moderator level

The slope of G1 is evaluated at low, mean, and high studytime.

