Nonlinear Regression

Test name: Nonlinear Regression

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

Rows in original dataset: 649

Columns in original dataset: 33

Rows used in nonlinear regression: 649

Outcome variable: G3

Main nonlinear predictor: G2

Additional numeric covariates: G1, studytime, failures

Categorical covariates: school, sex

Models fitted: linear comparison, quadratic polynomial, cubic polynomial, saturation nonlinear curve.

Best model by AIC: Saturation nonlinear curve

Best model adjusted R squared: 0.8439

Best model RMSE: 1.2725

Best model MAE: 0.8078

Best model AIC: 318.8138

Interpretation: nonlinear terms are useful when the fitted curve improves prediction over a straight-line model.

Decision guide: compare adjusted R squared and AIC; inspect residual plots for curve adequacy.

Reporting guide: report outcome, nonlinear predictor, fitted curve form, adjusted R squared, AIC, RMSE, and residual diagnostics.

Charts generated: 8

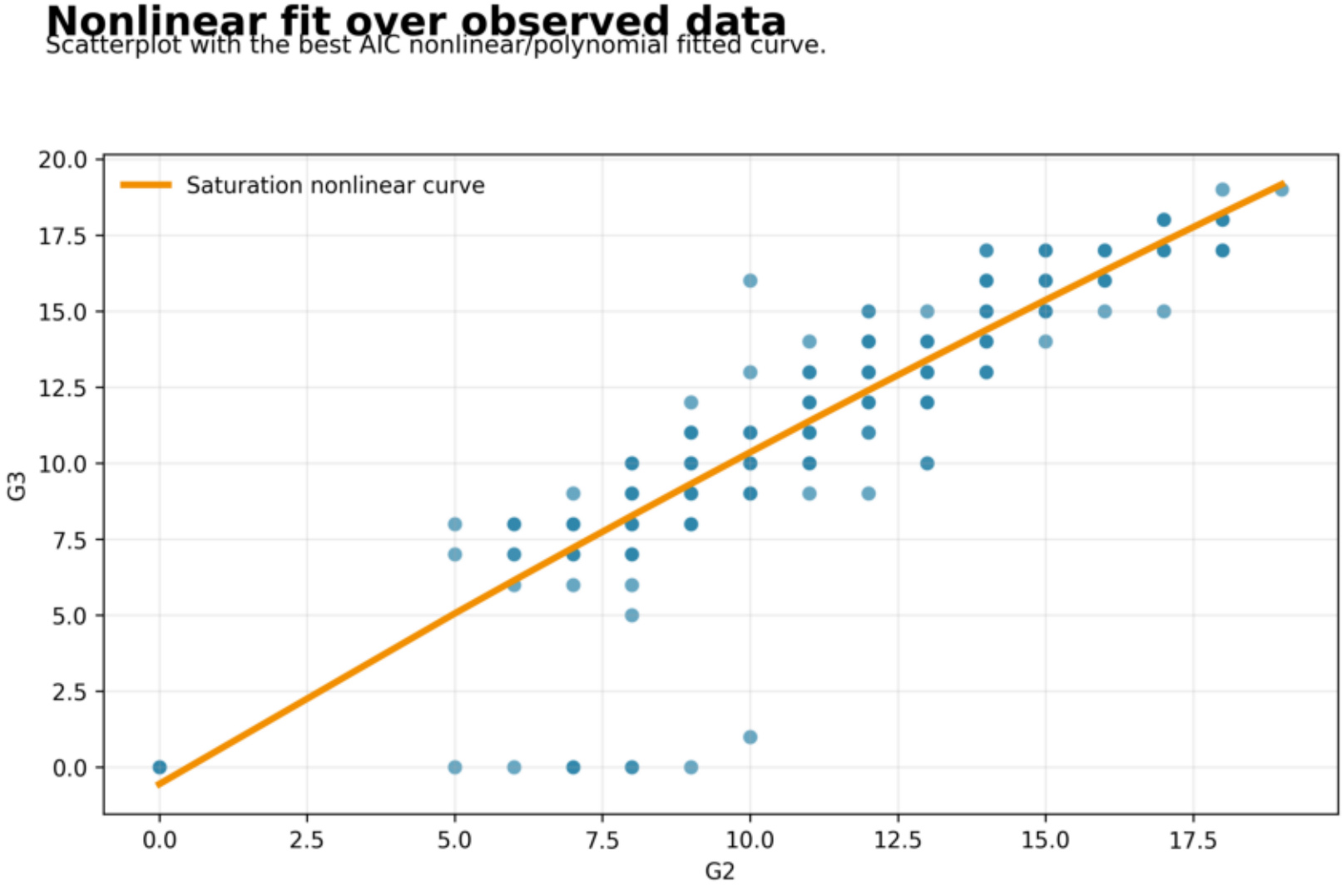
Nonlinear model fit statistics

model	n	parameters	r_squared	adjusted_r_squ	aic	bic	rmse	mae	f_statistic	f_p_value
Linear compar	649.0000	7.0000	0.8513	0.8499	2139.9849	2171.3129	1.2448	0.7835	612.6383	0.0000
Quadratic non	649.0000	8.0000	0.8534	0.8518	2132.8308	2168.6342	1.2360	0.7677	533.0490	0.0000
Cubic nonlinea	649.0000	9.0000	0.8536	0.8517	2134.1461	2174.4250	1.2354	0.7698	466.2662	0.0000
Saturation nor	649.0000	3.0000	0.8446	0.8439	318.8138	332.2401	1.2725	0.8078		

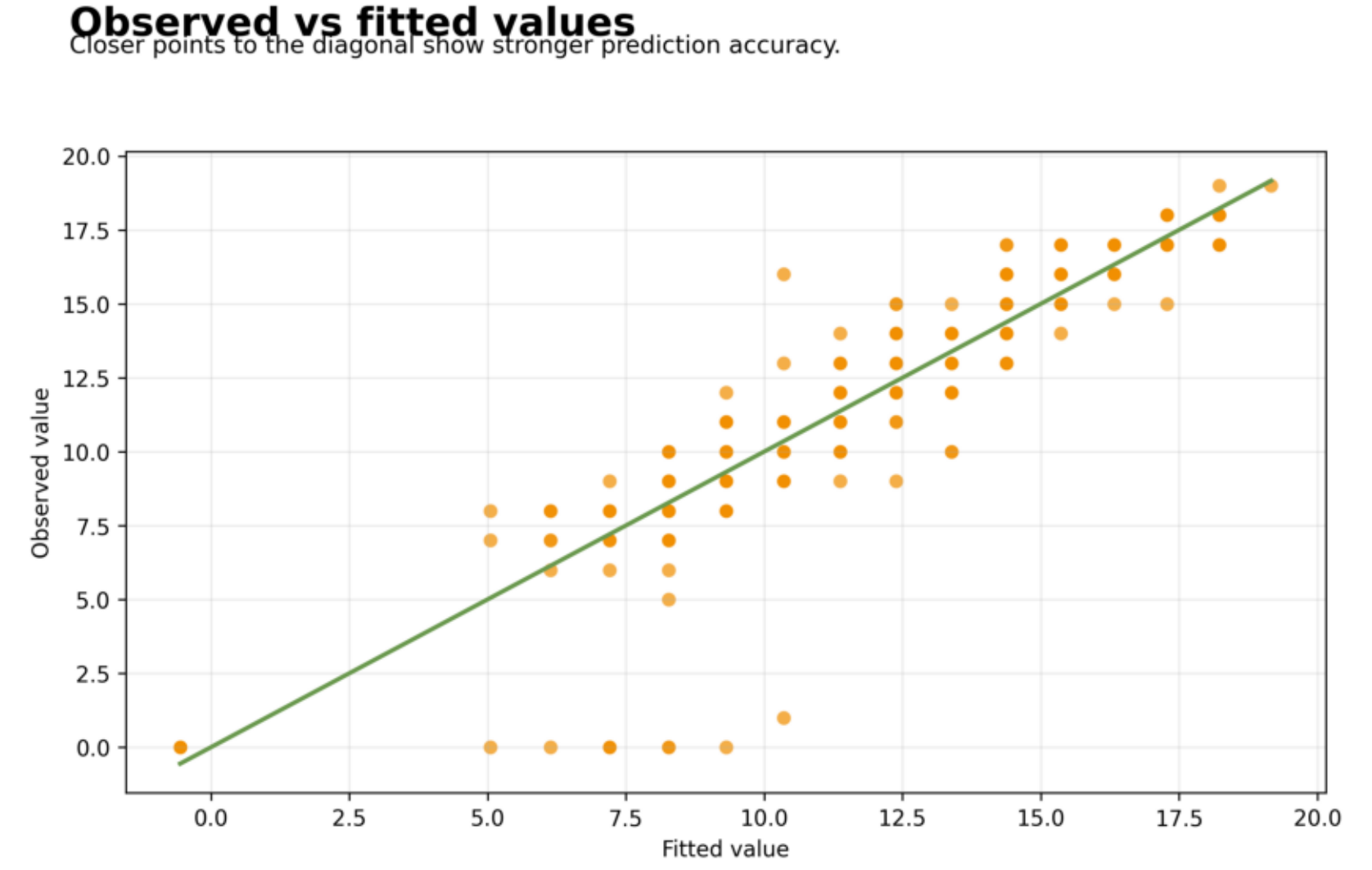
Nonlinear regression coefficients

model	term	coefficient	standard_error	t_value	p_value	ci95_lower	ci95_upper	decision_alpha_0_0
Linear compariso	intercept	0.3778	0.2852	1.3245	0.1858	-0.1823	0.9379	Not statistically sign
Linear compariso	G2	0.8830	0.0339	26.0532	0.0000	0.8164	0.9496	Statistically significa
Linear compariso	G1	0.1250	0.0363	3.4387	0.0006	0.0536	0.1963	Statistically significa
Linear compariso	studytime	0.0529	0.0628	0.8416	0.4003	-0.0705	0.1763	Not statistically sign
Linear compariso	failures	-0.2010	0.0905	-2.2202	0.0268	-0.3787	-0.0232	Statistically significa
Linear compariso	school_MS	-0.2373	0.1091	-2.1740	0.0301	-0.4516	-0.0230	Statistically significa
Linear compariso	sex_M	-0.2138	0.1032	-2.0714	0.0387	-0.4166	-0.0111	Statistically significa
Quadratic nonline	intercept	-0.9595	0.5261	-1.8240	0.0686	-1.9925	0.0735	Not statistically sign
Quadratic nonline	G2	1.0780	0.0729	14.7910	0.0000	0.9349	1.2212	Statistically significa
Quadratic nonline	G2_squared	-0.0101	0.0033	-3.0175	0.0026	-0.0167	-0.0035	Statistically significa
Quadratic nonline	G1	0.1663	0.0386	4.3048	0.0000	0.0904	0.2421	Statistically significa
Quadratic nonline	studytime	0.0627	0.0625	1.0027	0.3164	-0.0601	0.1855	Not statistically sign

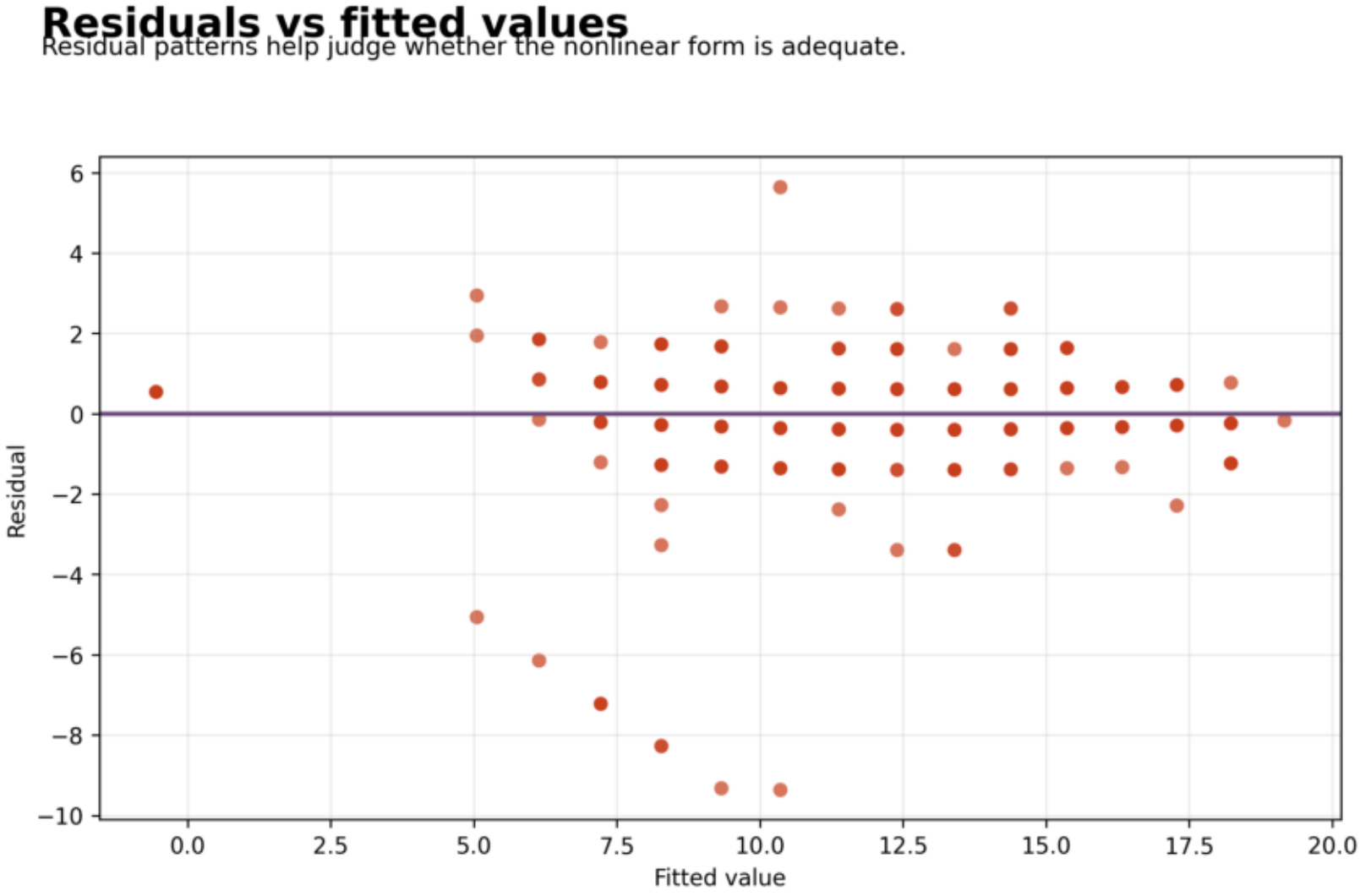
01_nonlinear_fit_scatter_curve.png



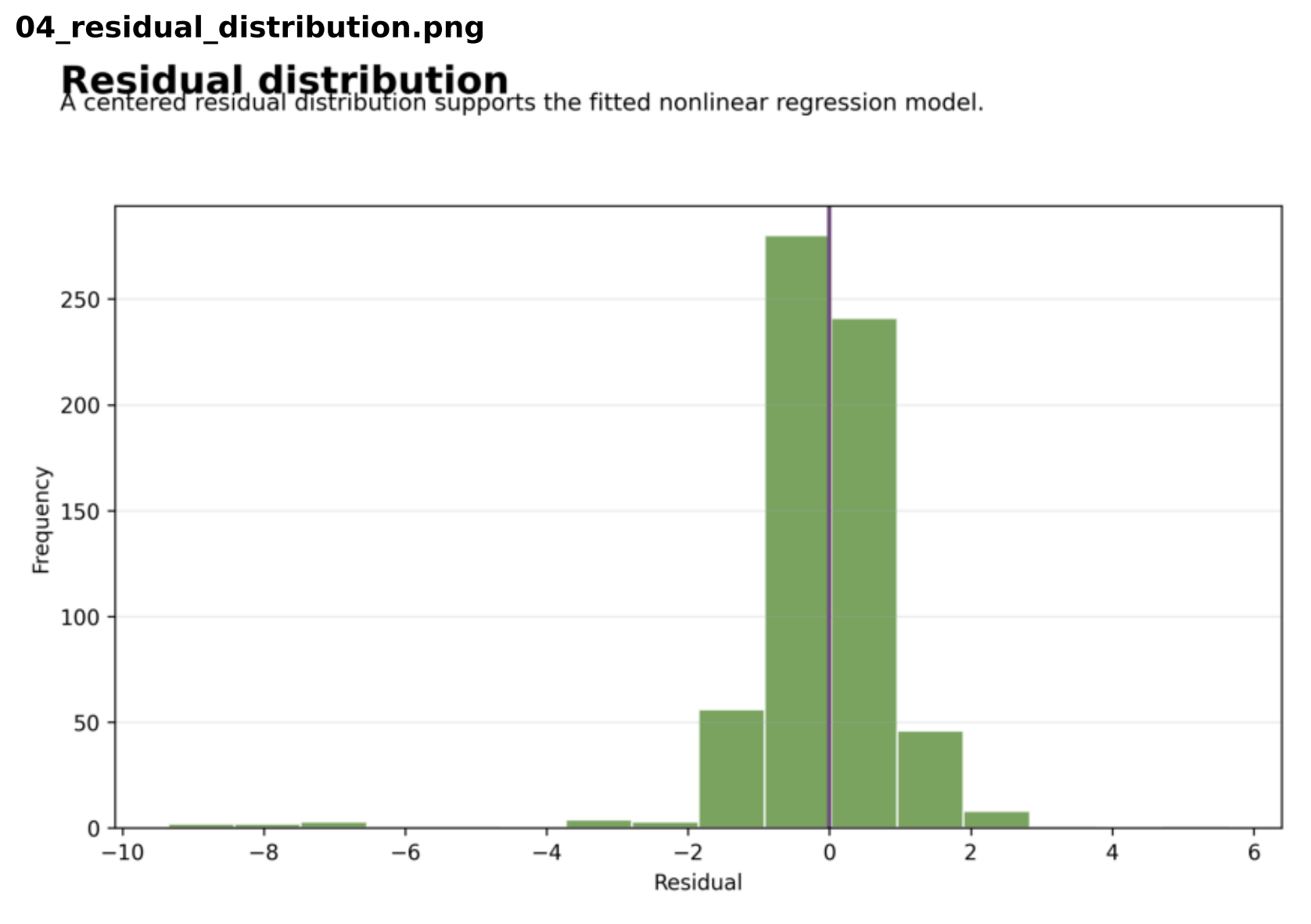
02_observed_vs_fitted.png



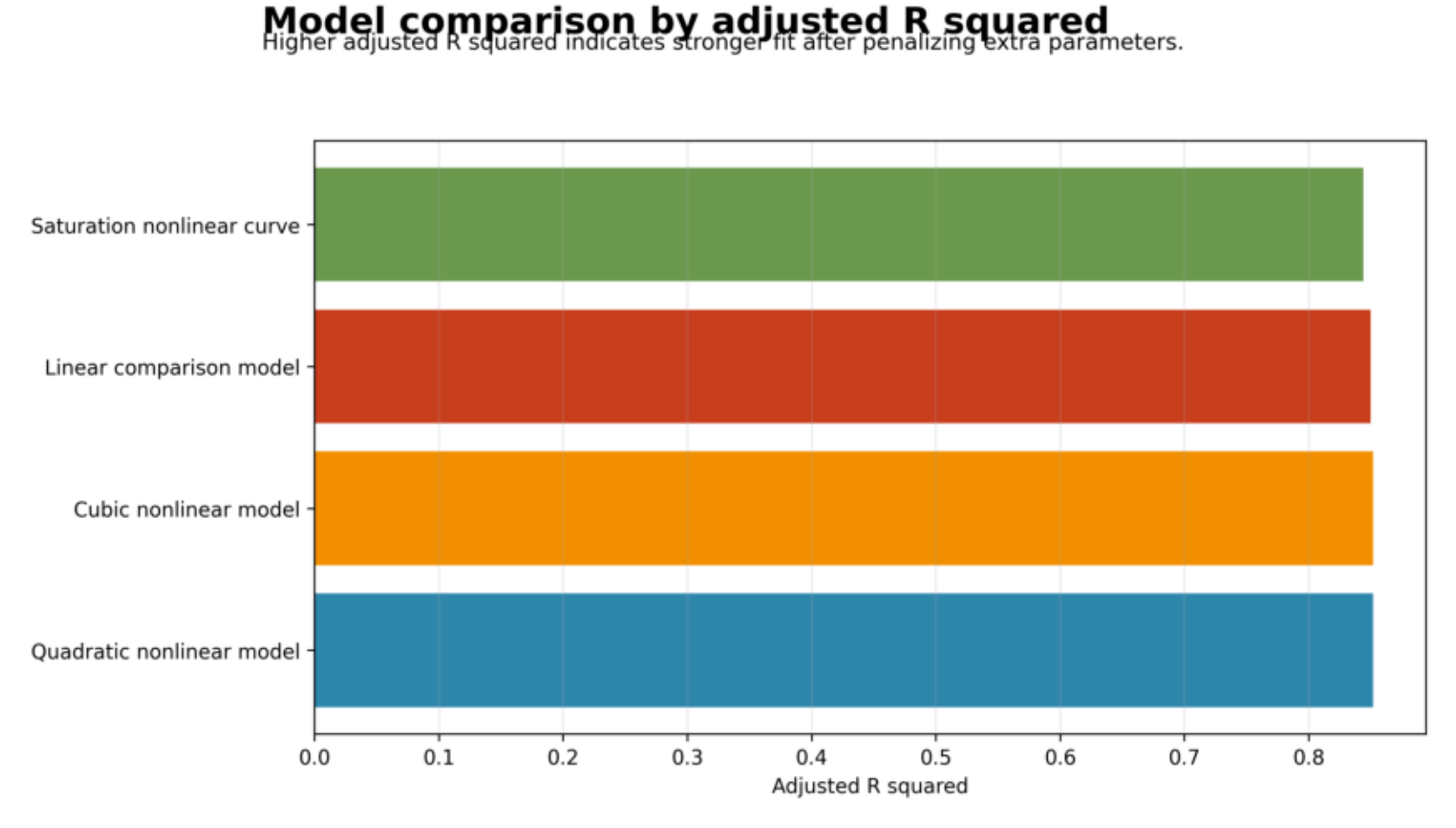
03_residuals_vs_fitted.png



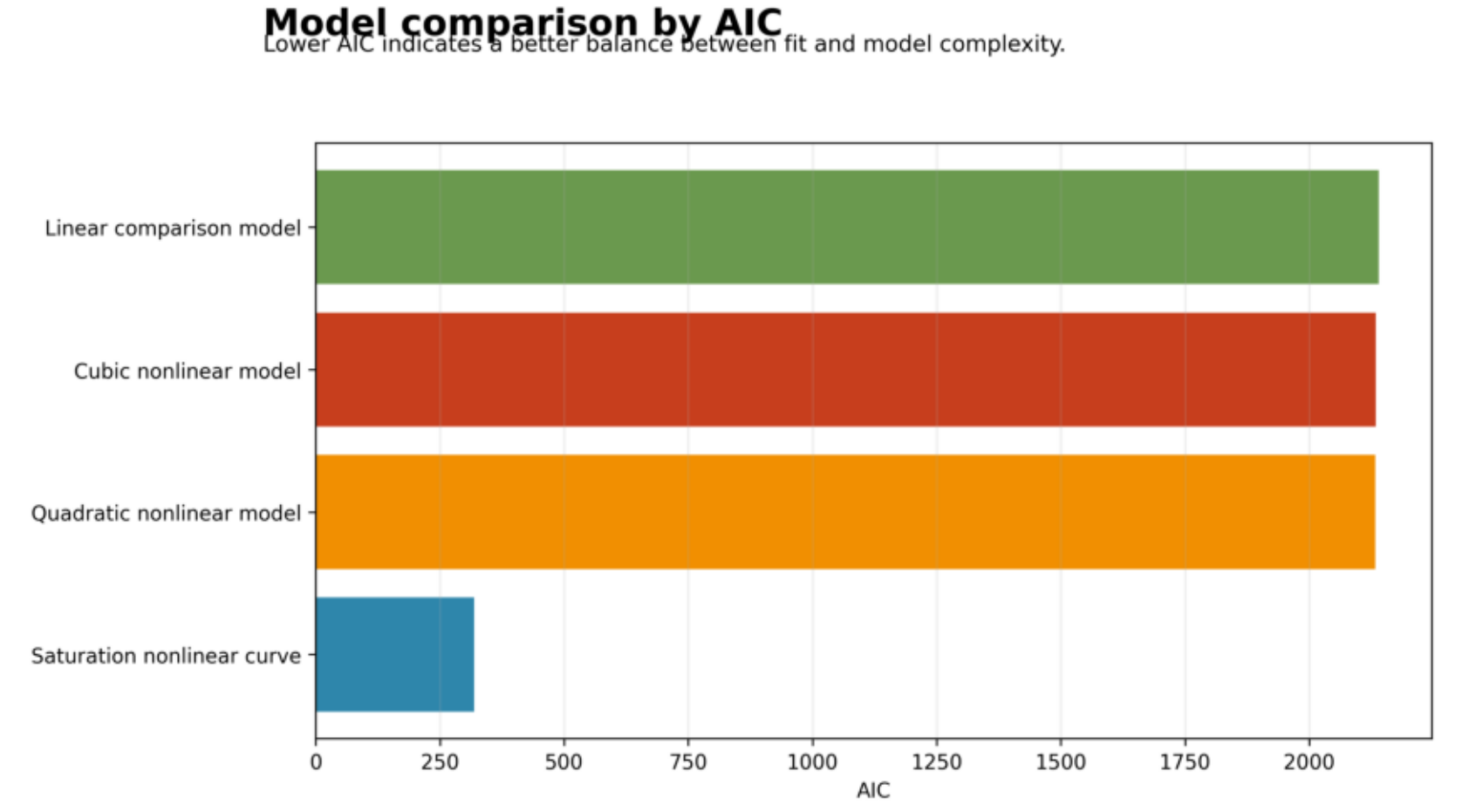
04_residual_distribution.png



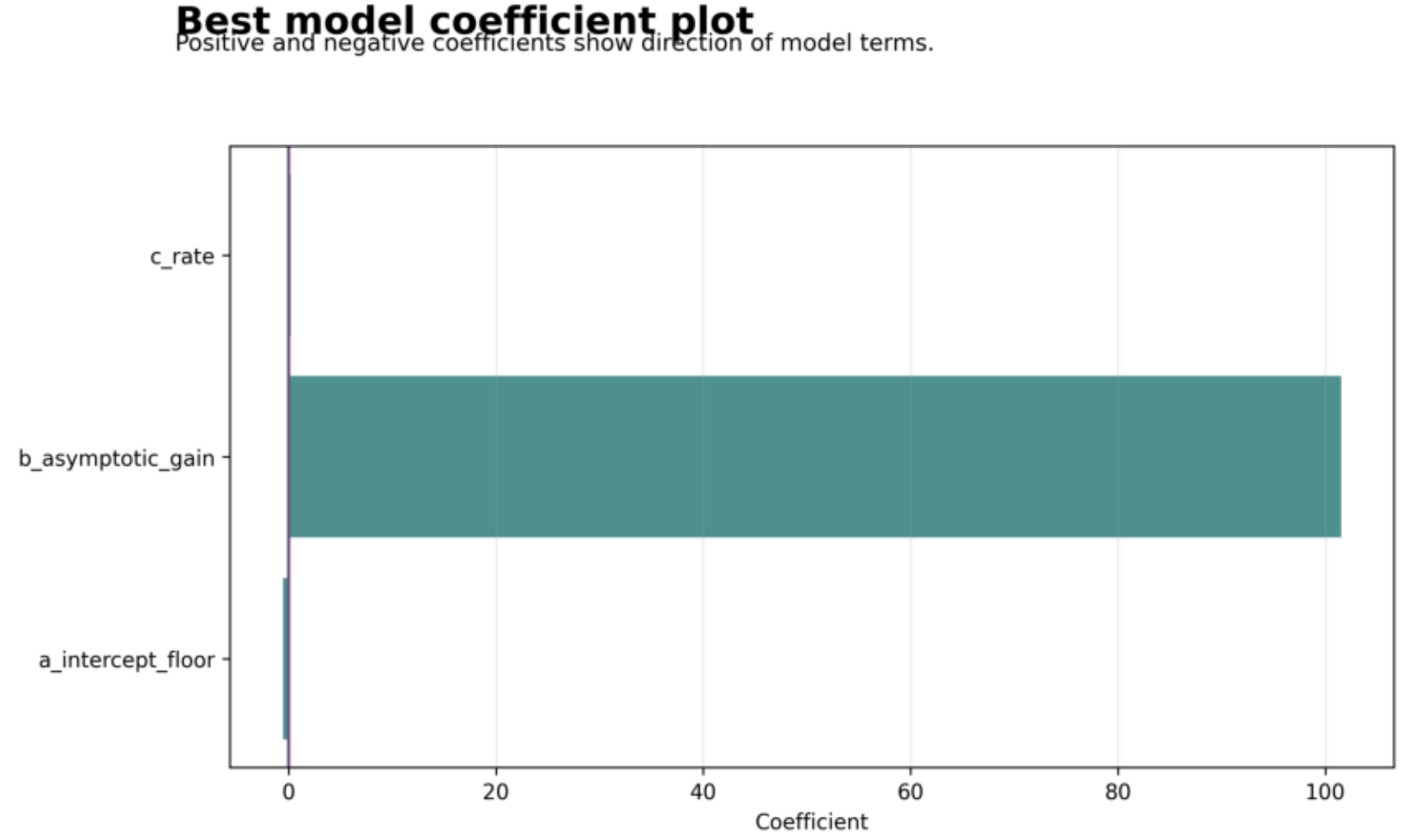
05_model_comparison_adjusted_r_squared.png



06_model_comparison_aic.png



07_best_model_coefficients.png



08_absolute_residuals_by_predictor.png