

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 a curved function 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_squared	aic	bic	rmse	mae
	Linear comparison model	649	7 0.8513142	0.8499246	2141.9849	2177.7884	1.244774	0.7834953
	Quadratic nonlinear model	649	8 0.8533967	0.8517957	2134.8308	2175.1097	1.236027	0.7677490
	Cubic nonlinear model	649	9 0.8535513	0.8517207	2136.1461	2180.9005	1.235375	0.7698172
	Saturation nonlinear curve	649	3 0.8446128	0.8438900	318.8138	332.2401	1.272517	0.8078291
f_statistic	f_p_value							
			612.6383	7.502172e-262				
			533.0490	2.120523e-262				
			466.2662	3.624085e-261				
			NA	NA				

Nonlinear regression coefficients

	model	term	coefficient	standard_error	t_value	p_value	ci95_lower	ci95_upper
Linear comparison model	(Intercept)		0.37777131	0.285227667	1.324455	1.858231e-01	-0.18232055	0.937863172
Linear comparison model		G2	0.88299772	0.033892162	26.053154	1.189788e-102	0.81644483	0.949550602
Linear comparison model		G1	0.12497757	0.036344655	3.438678	6.223785e-04	0.05360880	0.196346330
Linear comparison model		studytime	0.05287705	0.062831362	0.841571	4.003415e-01	-0.07050276	0.176256858
Linear comparison model		failures	-0.20095591	0.090510883	-2.220240	2.675088e-02	-0.37868905	-0.023222772
Linear comparison model		schoolMS	-0.23727121	0.109142706	-2.173954	3.007323e-02	-0.45159102	-0.022951390
Linear comparison model		sexM	-0.21384013	0.103236816	-2.071355	3.872451e-02	-0.41656275	-0.011117504
Quadratic nonlinear model	(Intercept)		-0.95952207	0.526067754	-1.823951	6.862487e-02	-1.99254646	0.073502322
Quadratic nonlinear model		G2	1.07803766	0.072884716	14.790998	8.345836e-43	0.93491600	1.221159318
Quadratic nonlinear model		I(G2^2)	-0.01010705	0.003349468	-3.017508	2.649677e-03	-0.01668431	-0.003529792
Quadratic nonlinear model		G1	0.16625543	0.038621138	4.304778	1.933101e-05	0.09041619	0.242094670
Quadratic nonlinear model		studytime	0.06269072	0.062523094	1.002681	3.163931e-01	-0.06008411	0.185465556

decision_alpha_0_05

Not statistically significant

Statistically significant

Statistically significant

Not statistically significant

Statistically significant

Statistically significant

Statistically significant

Not statistically significant

Statistically significant

Statistically significant

Statistically significant

Not statistically significant















