

Generalized Least Squares Regression

Test name: Generalized Least Squares Regression

Dataset: D:/DATA ANALYSIS/H Regression Tests and Models/Generalized Least Squares Regression/dataset.csv

Rows in original dataset: 649

Columns in original dataset: 33

Rows used in GLS model: 649

Outcome variable: G3

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

Categorical predictors: school, sex, address

Formula: $G3 \sim G1 + G2 + \text{studytime} + \text{failures} + \text{absences} + \text{age} + \text{Medu} + \text{school} + \text{sex} + \text{address}$

Main model: feasible generalized least squares using inverse estimated error variance weights.

Baseline model: ordinary least squares.

Breusch-Pagan p-value: $1.2e-05$

White p-value: $4.5e-05$

Durbin-Watson statistic: 1.8723

GLS correction is strongly motivated by heteroscedasticity diagnostics.

Interpretation: compare OLS and GLS/FGLS coefficients, standard errors, p-values, residual spread, and model fit.

Reporting guide: report outcome, predictors, OLS diagnostics, GLS weighting method, coefficient table, model comparison, and residual charts.

Charts generated: 9

GLS model comparison

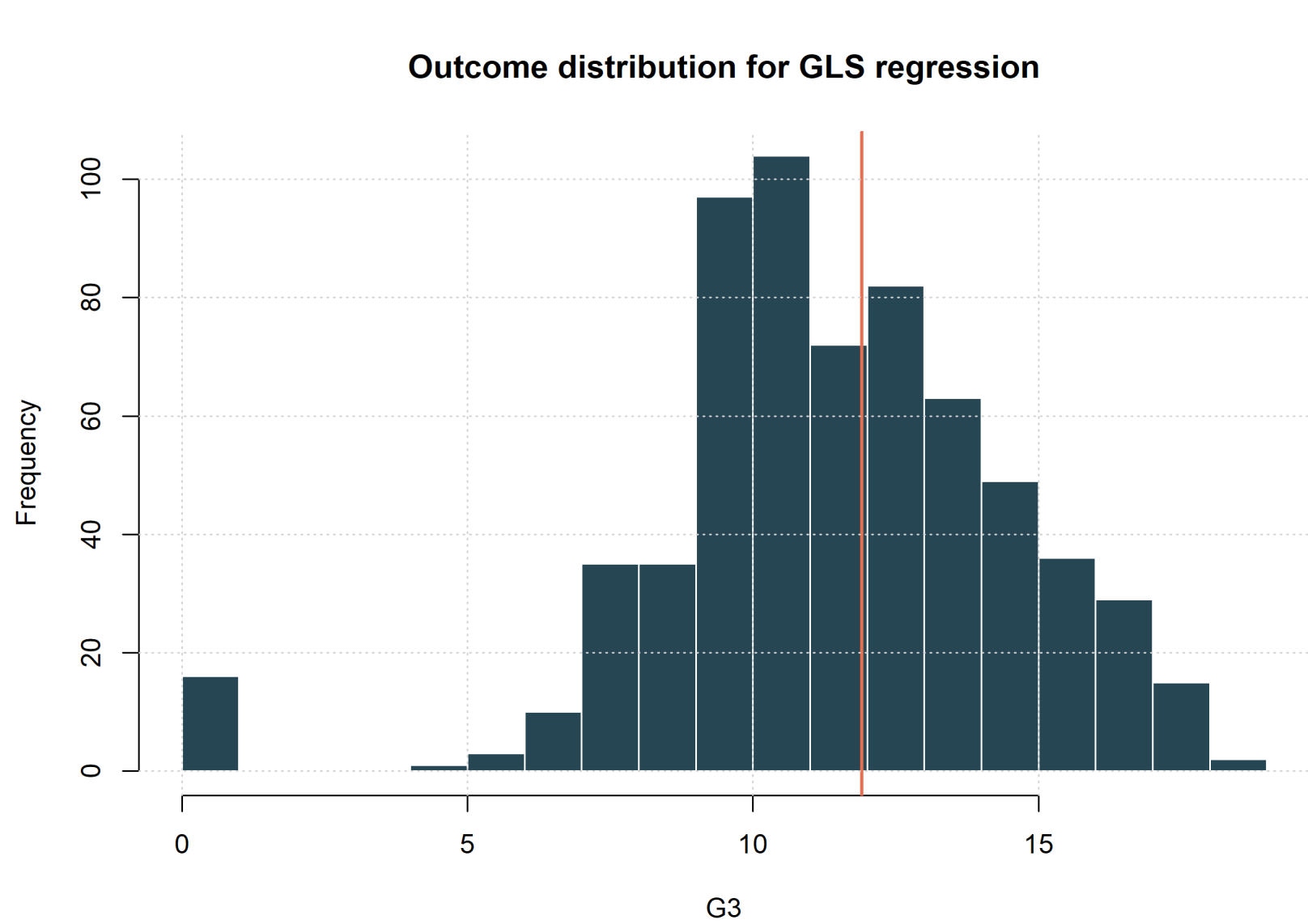
model	n	df_model	df_residual	r_squared	adj_r_squared	aic	bic	rmse	mae
OLS baseline	649	10	638	0.8523746	0.8500607	2145.340	2199.045	1.240328	0.7790877
Feasible GLS / WLS	649	10	638	0.8694957	0.8674502	2039.003	2092.708	1.242313	0.7721485
durbin_watson_residuals						weighting_or_sigma_note			
1.872316						No GLS correction.			
1.871607						Inverse estimated variance weights from OLS residual variance model.			

GLS coefficients

	model	term	coefficient	standard_error	t_value	p_value
	OLS baseline	(Intercept)	-0.16462054	0.78365844	-0.2100667	8.336827e-01
	OLS baseline	G1	0.13373236	0.03679672	3.6343553	3.011152e-04
	OLS baseline	G2	0.88144094	0.03424881	25.7363938	9.919530e-101
	OLS baseline	studytime	0.06407860	0.06331038	1.0121342	3.118576e-01
	OLS baseline	failures	-0.23146545	0.09495124	-2.4377297	1.505183e-02
	OLS baseline	absences	0.01772987	0.01116315	1.5882496	1.127253e-01
	OLS baseline	age	0.02218163	0.04358647	0.5089108	6.109907e-01
	OLS baseline	Medu	-0.03791522	0.04674132	-0.8111714	4.175697e-01
	OLS baseline	schoolMS	-0.17879283	0.11907379	-1.5015297	1.337133e-01
	OLS baseline	sexM	-0.19173870	0.10449423	-1.8349214	6.698274e-02
	OLS baseline	addressU	0.10822644	0.11510505	0.9402406	3.474500e-01
Feasible GLS / WLS inverse-variance weights	(Intercept)		-0.34728215	0.71105665	-0.4884029	6.254323e-01
ci95_lower	ci95_upper	decision_alpha_0_05				
-1.703482171	1.37424110	Not statistically significant				
0.061475036	0.20598969	Statistically significant				
0.814186917	0.94869497	Statistically significant				
-0.060243312	0.18840052	Not statistically significant				
-0.417920178	-0.04501073	Statistically significant				
-0.004191088	0.03965082	Not statistically significant				
-0.063408650	0.10777190	Not statistically significant				
-0.129700636	0.05387020	Not statistically significant				
-0.412616738	0.05503108	Not statistically significant				
-0.396932886	0.01345549	Not statistically significant				
-0.117804106	0.33425698	Not statistically significant				
-1.743576426	1.04901212	Not statistically significant				

OLS diagnostics

diagnostic	statistic_type	statistic	p_value	interpretation
Breusch-Pagan heteroscedasticity	LM statistic	19.096806	1.242527e-05	Evidence of non-constant variance
White heteroscedasticity	LM statistic	20.036579	4.457714e-05	Evidence of non-constant variance
Durbin-Watson residual dependence	DW statistic	1.872316	NA	Values near 2 suggest weak first-order autocorrelation; far below 2 suggests positive autocorrelation
Jarque-Bera normality context	JB statistic	9795.781868	0.000000e+00	Residuals deviate from normality



Observed vs fitted values: OLS and feasible GLS

