

Robust Regression

Test name: Robust Regression

Dataset: D:/DATA ANALYSIS/H Regression Tests and Models/Robust Regression/dataset.csv

Complete cases: 649

Outcome: G3

Predictors: G1, G2, studytime, failures, absences, age, Medu, Fedu

Primary robust estimator: Huber M-estimation.

Huber tuning constant: 1.345

Huber scale estimate: 0.76163092

Huber iterations: 8

OLS RMSE: 1.2470202

Huber RMSE: 1.2622353

OLS MAE: 0.78001889

Huber MAE: 0.77173015

Minimum Huber weight: 0.10814784

Cases with Huber weight below 0.80: 103

Cases with Huber weight below 0.50: 24

Robust regression downweights cases with large residuals instead of automatically deleting them.

Compare OLS and robust coefficients to assess sensitivity to unusual observations.

Robust-model p-values and confidence intervals use large-sample normal approximations.

Model summary

test_name	outcome	predictors	n_complete_cases		
Robust Regression	G3 G1, G2, studytime, failures, absences, age, Medu, Fedu		649		
number_of_predictors	primary_robust_method	huber_tuning_constant	huber_scale_estimate	huber_iterations	
8	Huber M-estimation	1.345	0.7616309	8	
tukey_scale_estimate	ols_r_squared	ols_adjusted_r_squared	ols_aic	ols_bic	huber_minimum_weight
0.7515027	0.8507772	0.8489119	2148.325	2193.079	0.1081478
huber_median_weight	huber_cases_weight_below_0_80	huber_cases_weight_below_0_50			
1	103	24			

Model performance

model	n	rmse	mae	median_absolute_error	r_squared_descriptive
Ordinary least squares	649	1.247020	0.7800189	0.5421667	0.8507772
Huber robust M-estimator	649	1.262235	0.7717301	0.5136480	0.8471136
Tukey biweight robust M-estimator	649	1.273269	0.7701714	0.5067798	0.8444291

Coefficients

	model	term	coefficient	standard_error	z_or_t_value	p_value	ci95_lower
	Ordinary least squares	(Intercept)	-0.50115470	0.77395037	-0.6475282	5.175223e-01	-2.020943673
	Ordinary least squares	G1	0.14339666	0.03667185	3.9102656	1.020384e-04	0.071384979
	Ordinary least squares	G2	0.88480738	0.03436950	25.7439712	7.355488e-101	0.817316763
	Ordinary least squares	studytime	0.09663180	0.06209078	1.5562987	1.201314e-01	-0.025294474
	Ordinary least squares	failures	-0.23536120	0.09523444	-2.4713874	1.371819e-02	-0.422370939
	Ordinary least squares	absences	0.02276203	0.01091928	2.0845722	3.750404e-02	0.001320082
	Ordinary least squares	age	0.02268549	0.04366788	0.5195005	6.035914e-01	-0.063064155
	Ordinary least squares	Medu	-0.04495115	0.05793762	-0.7758543	4.381216e-01	-0.158721956
	Ordinary least squares	Fedu	0.02202534	0.05931553	0.3713250	7.105183e-01	-0.094451233
	Huber robust M-estimator	(Intercept)	-0.62619575	0.50084721	-1.2502730	2.111998e-01	-1.607838250
	Huber robust M-estimator	G1	0.12279266	0.02373149	5.1742509	2.288272e-07	0.076279805
	Huber robust M-estimator	G2	0.86498055	0.02224157	38.8902735	0.000000e+00	0.821387880
	Huber robust M-estimator	studytime	0.04534543	0.04018086	1.1285331	2.590949e-01	-0.033407613
	Huber robust M-estimator	failures	-0.16120069	0.06162915	-2.6156565	8.905609e-03	-0.281991610
ci95_upper	reference_distribution	decision_alpha_0_05					
1.01863427	Student t	Not statistically significant					
0.21540835	Student t	Statistically significant					
0.95229799	Student t	Statistically significant					
0.21855808	Student t	Not statistically significant					
-0.04835147	Student t	Statistically significant					
0.04420398	Student t	Statistically significant					
0.10843513	Student t	Not statistically significant					
0.06881965	Student t	Not statistically significant					
0.13850192	Student t	Not statistically significant					
0.35544675	Normal approximation	Not statistically significant					
0.16930552	Normal approximation	Statistically significant					
0.90857321	Normal approximation	Statistically significant					
0.12409848	Normal approximation	Not statistically significant					
-0.04040977	Normal approximation	Statistically significant					

Weight summary

method	minimum_weight	first_quartile_weight	median_weight	mean_weight	third_quartile_weight
Huber M-estimation	0.1081478	1.0000000	1.0000000	0.9308328	1.0000000
Tukey biweight	0.0000000	0.9072043	0.9589748	0.8882240	0.9801633
maximum_weight	cases_below_0.80	cases_below_0.50			
1.0000000	103	24			
0.9999951	128	24			

Lowest Huber weights

case_number	G3	G1	G2	studytime	failures	absences	age	Medu	Fedu	ols_fitted	ols_residual	huber_fitted
164	0	11	9	1	2	0	18	1	1	9.050797	-9.050797	9.472397
173	1	10	10	2	1	0	16	3	3	10.032978	-9.032978	10.267843
587	0	8	8	2	0	0	17	4	2	8.167641	-8.167641	8.539148
640	0	5	8	1	1	0	19	1	1	7.563657	-7.563657	8.101164
520	0	8	7	2	0	0	16	2	1	7.328025	-7.328025	7.607703
638	0	7	7	1	0	0	18	2	1	7.133367	-7.133367	7.578170
641	0	7	7	1	1	0	18	4	2	6.830129	-6.830129	7.414131
584	0	8	6	1	1	0	18	2	2	6.178621	-6.178621	6.662937
627	0	7	5	2	0	0	18	4	4	5.436558	-5.436558	5.867026
62	16	10	10	1	0	0	16	1	1	10.217559	5.782441	10.398381
647	9	11	12	2	0	6	18	1	1	12.409146	-3.409146	12.448219
63	10	13	13	2	0	0	16	1	2	13.420829	-3.420829	13.395201
280	5	7	8	1	3	12	22	3	1	7.631026	-2.631026	8.267530
559	10	8	13	1	0	0	17	2	2	12.584948	-2.584948	12.809699
huber_residual	huber_weight	tukey_fitted	tukey_residual	tukey_weight	absolute_ols_residual							
-9.472397	0.1081478	9.619116	-9.619116	0.000000e+00	9.050797							
-9.267843	0.1105332	10.337394	-9.337394	0.000000e+00	9.032978							
-8.539148	0.1199659	8.655150	-8.655150	0.000000e+00	8.167641							
-8.101164	0.1264519	8.252440	-8.252440	0.000000e+00	7.563657							
-7.607703	0.1346544	7.692425	-7.692425	0.000000e+00	7.328025							
-7.578170	0.1351794	7.713307	-7.713307	0.000000e+00	7.133367							
-7.414131	0.1381713	7.598497	-7.598497	0.000000e+00	6.830129							
-6.662937	0.1537508	6.828319	-6.828319	0.000000e+00	6.178621							
-5.867026	0.1746083	6.024135	-6.024135	0.000000e+00	5.436558							
5.601619	0.1828726	10.436932	5.563068	0.000000e+00	5.782441							
-3.448219	0.2970793	12.463012	-3.463012	1.058517e-03	3.409146							
-3.395201	0.3017180	13.377800	-3.377800	6.331775e-03	3.420829							
-3.267530	0.3135315	8.505055	-3.505055	8.177333e-05	2.631026							
-2.809699	0.3645809	12.835297	-2.835297	1.234955e-01	2.584948							
absolute_huber_residual	low_huber_weight_below_0.80	strongly_downweighted_below_0.50										
9.472397			TRUE									
				TRUE								



















