

Multiple Linear Regression

Multiple Linear Regression Import data

Host

Notes

Output Created		11-JUL-2026 17:12:44
Comments		
Input	Data	D:\DATA ANALYSIS\H Regression Tests and Models\Moderated Regression\SPSS_Output\sav\Moderated-Regression-results-with-predictions.sav
	Active Dataset	ModeratedRegressionData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Syntax		HOST COMMAND=['cmd /c if not exist "D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\SPSS_Output" mkdir "D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\SPSS_Output"'].
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.14

Host

Multiple Linear Regression Import data

Notes

Output Created		11-JUL-2026 17:12:44
Comments		
Input	Data	D:\DATA ANALYSIS\H Regression Tests and Models\Moderated Regression\SPSS_Output\sav\Moderated-Regression-results-with-predictions.sav
	Active Dataset	ModeratedRegressionData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Syntax		HOST COMMAND=['cmd /c if not exist "D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\SPSS_Output\sav" mkdir "D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\SPSS_Output\sav"'].
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.11

Host

Multiple Linear Regression Import data

Notes

Output Created		11-JUL-2026 17:12:44
Comments		
Input	Data	D:\DATA ANALYSIS\H Regression Tests and Models\Moderated Regression\SPSS_Output\sav\Moderated-Regression-results-with-predictions.sav
	Active Dataset	ModeratedRegressionData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Syntax		HOST COMMAND=['cmd /c if not exist "D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\SPSS_Output\spv" mkdir "D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\SPSS_Output\spv"'].
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.10

Host

Multiple Linear Regression Import data

Notes

Output Created		11-JUL-2026 17:12:44
Comments		
Input	Data	D:\DATA ANALYSIS\H Regression Tests and Models\Moderated Regression\SPSS_Output\sav\Moderated-Regression-results-with-predictions.sav
	Active Dataset	ModeratedRegressionData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Syntax		HOST COMMAND=[cmd /c if not exist "D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\SPSS_Output\pdf" mkdir "D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\SPSS_Output\pdf"].
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.11

Multiple Linear Regression

Multiple Linear Regression

Variable preparation

Multiple Linear Regression

Multiple Linear Regression
Prepared data summary

Frequencies

Notes

Output Created		11-JUL-2026 17:12:45
Comments		
Input	Data	D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\dataset.csv
	Active Dataset	MLRData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data.
Syntax		FREQUENCIES VARIABLES=school_ms sex_male address_urban higher_yes internet_yes schoolsup_yes famsup_yes activities_yes /ORDER=ANALYSIS.
Resources	Processor Time	00:00:00.03
	Elapsed Time	00:00:00.05

[MLRData]

Statistics

		School dummy: 1 = MS, 0 = GP	Sex dummy: 1 = male, 0 = female	Address dummy: 1 = urban, 0 = rural	Higher education intention dummy: yes	Internet access dummy: yes
N	Valid	649	649	649	649	649
	Missing	0	0	0	0	0

Multiple Linear Regression
Prepared data summary

Statistics

		School support dummy: yes	Family support dummy: yes	Activities dummy: yes
N	Valid	649	649	649
	Missing	0	0	0

Frequency Table

School dummy: 1 = MS, 0 = GP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No / reference	423	65.2	65.2	65.2
	Yes / target	226	34.8	34.8	100.0
	Total	649	100.0	100.0	

Sex dummy: 1 = male, 0 = female

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No / reference	383	59.0	59.0	59.0
	Yes / target	266	41.0	41.0	100.0
	Total	649	100.0	100.0	

Address dummy: 1 = urban, 0 = rural

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No / reference	197	30.4	30.4	30.4
	Yes / target	452	69.6	69.6	100.0
	Total	649	100.0	100.0	

Multiple Linear Regression
Prepared data summary

Higher education intention dummy: yes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No / reference	69	10.6	10.6	10.6
	Yes / target	580	89.4	89.4	100.0
	Total	649	100.0	100.0	

Internet access dummy: yes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No / reference	151	23.3	23.3	23.3
	Yes / target	498	76.7	76.7	100.0
	Total	649	100.0	100.0	

School support dummy: yes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No / reference	581	89.5	89.5	89.5
	Yes / target	68	10.5	10.5	100.0
	Total	649	100.0	100.0	

Family support dummy: yes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No / reference	251	38.7	38.7	38.7
	Yes / target	398	61.3	61.3	100.0
	Total	649	100.0	100.0	

Activities dummy: yes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No / reference	334	51.5	51.5	51.5
	Yes / target	315	48.5	48.5	100.0
	Total	649	100.0	100.0	

Multiple Linear Regression
Prepared data summary

Descriptives

Notes

Output Created		11-JUL-2026 17:12:45
Comments		
Input	Data	D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\dataset.csv
	Active Dataset	MLRData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	All non-missing data are used.
Syntax		DESCRIPTIVES VARIABLES=G3 G1 G2 studytime failures absences age Medu Fedu traveltime health /STATISTICS=MEAN STDDEV MIN MAX.
Resources	Processor Time	00:00:00.05
	Elapsed Time	00:00:00.04

Multiple Linear Regression
Prepared data summary

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Final grade outcome	649	0	19	11.91	3.231
First period grade	649	0	19	11.40	2.745
Second period grade	649	0	19	11.57	2.914
Weekly study time group	649	1	4	1.93	.830
Number of past class failures	649	0	3	.22	.593
School absences	649	0	32	3.66	4.641
Age	649	15	22	16.74	1.218
Mother education	649	0	4	2.51	1.135
Father education	649	0	4	2.31	1.100
Home to school travel time	649	1	4	1.57	.749
Current health status	649	1	5	3.54	1.446
Valid N (listwise)	649				

Correlations

Multiple Linear Regression
Prepared data summary

Notes

Output Created		11-JUL-2026 17:12:45
Comments		
Input	Data	D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\dataset.csv
	Active Dataset	MLRData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each pair of variables are based on all the cases with valid data for that pair.
Syntax		CORRELATIONS /VARIABLES=G3 G1 G2 studytime failures absences age Medu Fedu traveltime health /PRINT=TWOTAIL NOSIG /MISSING=PAIRWISE.
Resources	Processor Time	00:00:00.11
	Elapsed Time	00:00:00.10

Multiple Linear Regression
Prepared data summary

Correlations

		Final grade outcome	First period grade	Second period grade
Final grade outcome	Pearson Correlation	1	.826**	.919**
	Sig. (2-tailed)		.000	.000
	N	649	649	649
First period grade	Pearson Correlation	.826**	1	.865**
	Sig. (2-tailed)	.000		.000
	N	649	649	649
Second period grade	Pearson Correlation	.919**	.865**	1
	Sig. (2-tailed)	.000	.000	
	N	649	649	649
Weekly study time group	Pearson Correlation	.250**	.261**	.240**
	Sig. (2-tailed)	.000	.000	.000
	N	649	649	649
Number of past class failures	Pearson Correlation	-.393**	-.384**	-.386**
	Sig. (2-tailed)	.000	.000	.000
	N	649	649	649
School absences	Pearson Correlation	-.091*	-.147**	-.125**
	Sig. (2-tailed)	.020	.000	.001
	N	649	649	649
Age	Pearson Correlation	-.107**	-.174**	-.107**
	Sig. (2-tailed)	.007	.000	.006
	N	649	649	649
Mother education	Pearson Correlation	.240**	.260**	.264**
	Sig. (2-tailed)	.000	.000	.000
	N	649	649	649
Father education	Pearson Correlation	.212**	.218**	.225**
	Sig. (2-tailed)	.000	.000	.000
	N	649	649	649
Home to school travel time	Pearson Correlation	-.127**	-.154**	-.154**
	Sig. (2-tailed)	.001	.000	.000
	N	649	649	649

Multiple Linear Regression
Prepared data summary

Correlations

		Weekly study time group	Number of past class failures	School absences
Final grade outcome	Pearson Correlation	.250**	-.393**	-.091*
	Sig. (2-tailed)	.000	.000	.020
	N	649	649	649
First period grade	Pearson Correlation	.261**	-.384**	-.147**
	Sig. (2-tailed)	.000	.000	.000
	N	649	649	649
Second period grade	Pearson Correlation	.240**	-.386**	-.125**
	Sig. (2-tailed)	.000	.000	.001
	N	649	649	649
Weekly study time group	Pearson Correlation	1	-.147**	-.118**
	Sig. (2-tailed)		.000	.003
	N	649	649	649
Number of past class failures	Pearson Correlation	-.147**	1	.123**
	Sig. (2-tailed)	.000		.002
	N	649	649	649
School absences	Pearson Correlation	-.118**	.123**	1
	Sig. (2-tailed)	.003	.002	
	N	649	649	649
Age	Pearson Correlation	-.008	.320**	.150**
	Sig. (2-tailed)	.831	.000	.000
	N	649	649	649
Mother education	Pearson Correlation	.097*	-.172**	-.009
	Sig. (2-tailed)	.013	.000	.827
	N	649	649	649
Father education	Pearson Correlation	.050	-.166**	.030
	Sig. (2-tailed)	.200	.000	.448
	N	649	649	649
Home to school travel time	Pearson Correlation	-.063	.098*	-.008
	Sig. (2-tailed)	.108	.013	.836
	N	649	649	649

Multiple Linear Regression
Prepared data summary

Correlations

		Age	Mother education	Father education
Final grade outcome	Pearson Correlation	-.107**	.240**	.212**
	Sig. (2-tailed)	.007	.000	.000
	N	649	649	649
First period grade	Pearson Correlation	-.174**	.260**	.218**
	Sig. (2-tailed)	.000	.000	.000
	N	649	649	649
Second period grade	Pearson Correlation	-.107**	.264**	.225**
	Sig. (2-tailed)	.006	.000	.000
	N	649	649	649
Weekly study time group	Pearson Correlation	-.008	.097*	.050
	Sig. (2-tailed)	.831	.013	.200
	N	649	649	649
Number of past class failures	Pearson Correlation	.320**	-.172**	-.166**
	Sig. (2-tailed)	.000	.000	.000
	N	649	649	649
School absences	Pearson Correlation	.150**	-.009	.030
	Sig. (2-tailed)	.000	.827	.448
	N	649	649	649
Age	Pearson Correlation	1	-.108**	-.121**
	Sig. (2-tailed)		.006	.002
	N	649	649	649
Mother education	Pearson Correlation	-.108**	1	.647**
	Sig. (2-tailed)	.006		.000
	N	649	649	649
Father education	Pearson Correlation	-.121**	.647**	1
	Sig. (2-tailed)	.002	.000	
	N	649	649	649
Home to school travel time	Pearson Correlation	.034	-.265**	-.208**
	Sig. (2-tailed)	.380	.000	.000
	N	649	649	649

Multiple Linear Regression
Prepared data summary

Correlations

		Home to school travel time	Current health status
Final grade outcome	Pearson Correlation	-.127**	-.099*
	Sig. (2-tailed)	.001	.012
	N	649	649
First period grade	Pearson Correlation	-.154**	-.052
	Sig. (2-tailed)	.000	.189
	N	649	649
Second period grade	Pearson Correlation	-.154**	-.082*
	Sig. (2-tailed)	.000	.036
	N	649	649
Weekly study time group	Pearson Correlation	-.063	-.056
	Sig. (2-tailed)	.108	.151
	N	649	649
Number of past class failures	Pearson Correlation	.098*	.036
	Sig. (2-tailed)	.013	.365
	N	649	649
School absences	Pearson Correlation	-.008	-.030
	Sig. (2-tailed)	.836	.442
	N	649	649
Age	Pearson Correlation	.034	-.009
	Sig. (2-tailed)	.380	.824
	N	649	649
Mother education	Pearson Correlation	-.265**	.005
	Sig. (2-tailed)	.000	.907
	N	649	649
Father education	Pearson Correlation	-.208**	.045
	Sig. (2-tailed)	.000	.253
	N	649	649
Home to school travel time	Pearson Correlation	1	-.048
	Sig. (2-tailed)		.220
	N	649	649

Multiple Linear Regression
Prepared data summary

Correlations

		Final grade outcome	First period grade	Second period grade
Current health status	Pearson Correlation	-.099*	-.052	-.082*
	Sig. (2-tailed)	.012	.189	.036
	N	649	649	649

Correlations

		Weekly study time group	Number of past class failures	School absences
Current health status	Pearson Correlation	-.056	.036	-.030
	Sig. (2-tailed)	.151	.365	.442
	N	649	649	649

Correlations

		Age	Mother education	Father education
Current health status	Pearson Correlation	-.009	.005	.045
	Sig. (2-tailed)	.824	.907	.253
	N	649	649	649

Correlations

		Home to school travel time	Current health status
Current health status	Pearson Correlation	-.048	1
	Sig. (2-tailed)	.220	
	N	649	649

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Multiple Linear Regression

Multiple Linear Regression
Main multiple linear regression model

Regression

Notes

Output Created		11-JUL-2026 17:12:45
Comments		
Input	Data	D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\dataset.csv
	Active Dataset	MLRData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any variable used.
Syntax		REGRESSION /MISSING LISTWISE /STATISTICS COEFF OUTS R ANOVA COLLIN CI(95) ZPP /CRITERIA=PIN(.05) POUT(.10) TOLERANCE(. 0001) /NOORIGIN /DEPENDENT G3 /METHOD=ENTER G1 G2 studytime failures absences age Medu Fedu traveltime health school_ms sex_male address_urban higher_yes internet_yes /SAVE PRED (Predicted_G3) RESID (Residual_G3) ZPRED (ZPred_G3) ZRESID (ZResid_G3).

Multiple Linear Regression
Main multiple linear regression model

Notes

Resources	Processor Time	00:00:00.16
	Elapsed Time	00:00:00.15
	Memory Required	18080 bytes
	Additional Memory Required for Residual Plots	0 bytes
Variables Created or Modified	Predicted_G3	Unstandardized Predicted Value
	Residual_G3	Unstandardized Residual
	ZPred_G3	Standardized Predicted Value
	ZResid_G3	Standardized Residual

Multiple Linear Regression
Main multiple linear regression model

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	Internet access dummy: yes, Age, Current health status, Weekly study time group, Address dummy: 1 = urban, 0 = rural, School absences, Father education, Sex dummy: 1 = male, 0 = female, Higher education intention dummy: yes, Home to school travel time, Number of past class failures, School dummy: 1 = MS, 0 = GP, Second period grade, Mother education, First period grade ^b	.	Enter

a. Dependent Variable: Final grade outcome

b. All requested variables entered.

Multiple Linear Regression
Main multiple linear regression model

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.924 ^a	.854	.851	1.248

- a. Predictors: (Constant), Internet access dummy: yes, Age, Current health status, Weekly study time group, Address dummy: 1 = urban, 0 = rural, School absences, Father education, Sex dummy: 1 = male, 0 = female, Higher education intention dummy: yes, Home to school travel time, Number of past class failures, School dummy: 1 = MS, 0 = GP, Second period grade, Mother education, First period grade
- b. Dependent Variable: Final grade outcome

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5776.701	15	385.113	247.096	.000 ^b
	Residual	986.565	633	1.559		
	Total	6763.267	648			

- a. Dependent Variable: Final grade outcome
- b. Predictors: (Constant), Internet access dummy: yes, Age, Current health status, Weekly study time group, Address dummy: 1 = urban, 0 = rural, School absences, Father education, Sex dummy: 1 = male, 0 = female, Higher education intention dummy: yes, Home to school travel time, Number of past class failures, School dummy: 1 = MS, 0 = GP, Second period grade, Mother education, First period grade

Multiple Linear Regression
Main multiple linear regression model

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.566	.843		-.671	.502
	First period grade	.133	.037	.113	3.608	.000
	Second period grade	.876	.034	.790	25.489	.000
	Weekly study time group	.055	.064	.014	.858	.391
	Number of past class failures	-.219	.096	-.040	-2.284	.023
	School absences	.016	.011	.023	1.454	.146
	Age	.031	.044	.012	.709	.479
	Mother education	-.047	.060	-.017	-.786	.432
	Father education	.027	.059	.009	.448	.654
	Home to school travel time	.143	.073	.033	1.973	.049
	Current health status	-.049	.035	-.022	-1.399	.162
	School dummy: 1 = MS, 0 = GP	-.206	.121	-.030	-1.704	.089
	Sex dummy: 1 = male, 0 = female	-.191	.106	-.029	-1.809	.071
	Address dummy: 1 = urban, 0 = rural	.164	.119	.023	1.374	.170
	Higher education intention dummy: yes	.189	.179	.018	1.055	.292
	Internet access dummy: yes	.070	.124	.009	.565	.573

Multiple Linear Regression
Main multiple linear regression model

Coefficients^a

Model		95.0% Confidence Interval for B		Correlations		
		Lower Bound	Upper Bound	Zero-order	Partial	Part
1	(Constant)	-2.220	1.089			
	First period grade	.061	.205	.826	.142	.055
	Second period grade	.808	.943	.919	.712	.387
	Weekly study time group	-.070	.179	.250	.034	.013
	Number of past class failures	-.407	-.031	-.393	-.090	-.035
	School absences	-.006	.038	-.091	.058	.022
	Age	-.056	.118	-.107	.028	.011
	Mother education	-.165	.071	.240	-.031	-.012
	Father education	-.090	.143	.212	.018	.007
	Home to school travel time	.001	.286	-.127	.078	.030
	Current health status	-.117	.020	-.099	-.056	-.021
	School dummy: 1 = MS, 0 = GP	-.443	.031	-.284	-.068	-.026
	Sex dummy: 1 = male, 0 = female	-.398	.016	-.129	-.072	-.027
	Address dummy: 1 = urban, 0 = rural	-.070	.398	.168	.055	.021
	Higher education intention dummy: yes	-.163	.541	.332	.042	.016
	Internet access dummy: yes	-.173	.313	.150	.022	.009

a. Dependent Variable: Final grade outcome

Multiple Linear Regression
Main multiple linear regression model

Collinearity Diagnostics^a

Model	Dimension	Eigenvalue	Condition Index	(Constant)	Variance Proportions	
					First period grade	Second period grade
1	1	11.844	1.000	.00	.00	.00
	2	1.024	3.400	.00	.00	.00
	3	.809	3.827	.00	.00	.00
	4	.590	4.482	.00	.00	.00
	5	.508	4.827	.00	.00	.00
	6	.259	6.756	.00	.00	.00
	7	.231	7.159	.00	.00	.00
	8	.193	7.842	.00	.00	.00
	9	.146	8.993	.00	.00	.00
	10	.133	9.425	.00	.00	.00
	11	.096	11.082	.00	.01	.02
	12	.071	12.945	.00	.03	.04
	13	.060	14.098	.00	.00	.00
	14	.025	21.605	.04	.03	.04
	15	.008	39.284	.00	.87	.88
	16	.002	76.944	.95	.04	.02

Multiple Linear Regression
Main multiple linear regression model

Collinearity Diagnostics^a

Model	Dimension	Variance Proportions				
		Weekly study time group	Number of past class failures	School absences	Age	Mother education
1	1	.00	.00	.00	.00	.00
	2	.00	.44	.01	.00	.00
	3	.00	.08	.17	.00	.00
	4	.00	.00	.23	.00	.00
	5	.01	.24	.47	.00	.00
	6	.02	.00	.00	.00	.01
	7	.01	.02	.00	.00	.08
	8	.00	.00	.01	.00	.03
	9	.07	.01	.00	.00	.01
	10	.48	.01	.03	.00	.00
	11	.32	.05	.00	.00	.01
	12	.03	.00	.00	.00	.00
	13	.00	.00	.00	.00	.86
	14	.04	.13	.07	.08	.00
	15	.00	.00	.00	.00	.00
	16	.00	.03	.00	.92	.00

Multiple Linear Regression
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Collinearity Diagnostics^a

Model	Dimension	Variance Proportions				Sex dummy: 1 = male, 0 = female
		Father education	Home to school travel time	Current health status	School dummy: 1 = MS, 0 = GP	
1	1	.00	.00	.00	.00	.00
	2	.00	.00	.00	.07	.00
	3	.00	.01	.00	.29	.03
	4	.00	.00	.00	.00	.64
	5	.00	.00	.00	.10	.15
	6	.01	.15	.01	.33	.00
	7	.11	.03	.01	.00	.01
	8	.08	.01	.01	.00	.00
	9	.00	.07	.75	.00	.04
	10	.03	.42	.00	.03	.09
	11	.04	.13	.06	.00	.00
	12	.00	.02	.00	.00	.00
	13	.71	.01	.01	.00	.01
	14	.00	.14	.14	.16	.01
	15	.00	.00	.01	.00	.00
	16	.00	.01	.01	.00	.01

Multiple Linear Regression
Main multiple linear regression model

Collinearity Diagnostics^a

Model	Dimension	Variance Proportions		
		Address dummy: 1 = urban, 0 = rural	Higher education intention dummy: yes	Internet access dummy: yes
1	1	.00	.00	.00
	2	.01	.00	.00
	3	.01	.00	.00
	4	.00	.00	.00
	5	.02	.00	.00
	6	.36	.00	.02
	7	.35	.00	.09
	8	.00	.00	.80
	9	.02	.00	.01
	10	.09	.00	.00
	11	.05	.29	.01
	12	.02	.64	.02
	13	.00	.00	.01
	14	.05	.01	.03
	15	.00	.00	.00
	16	.00	.05	.00

a. Dependent Variable: Final grade outcome

Residuals Statistics^a

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-.15	19.43	11.91	2.986	649
Residual	-8.984	5.189	.000	1.234	649
Std. Predicted Value	-4.037	2.520	.000	1.000	649
Std. Residual	-7.196	4.157	.000	.988	649

a. Dependent Variable: Final grade outcome

Multiple Linear Regression

Multiple Linear Regression
Model comparison with core grade predictors only

Regression

Notes

Output Created		11-JUL-2026 17:12:45
Comments		
Input	Data	D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\dataset.csv
	Active Dataset	MLRData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any variable used.
Syntax		REGRESSION /MISSING LISTWISE /STATISTICS COEFF OUTS R ANOVA CHANGE CI(95) /CRITERIA=PIN(.05) POUT(.10) TOLERANCE(. 0001) /NOORIGIN /DEPENDENT G3 /METHOD=ENTER G1 G2 /METHOD=ENTER studytime failures absences age Medu Fedu travelttime health school_ms sex_male address_urban higher_yes internet_yes.
Resources	Processor Time	00:00:00.08
	Elapsed Time	00:00:00.08

Multiple Linear Regression
Model comparison with core grade predictors only

Notes

	Memory Required	18240 bytes
	Additional Memory Required for Residual Plots	0 bytes

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	Second period grade, First period grade ^b	.	Enter
2	Current health status, Internet access dummy: yes, School absences, Sex dummy: 1 = male, 0 = female, Address dummy: 1 = urban, 0 = rural, Age, Father education, Weekly study time group, Home to school travel time, Higher education intention dummy: yes, Number of past class failures, School dummy: 1 = MS, 0 = GP, Mother education ^b	.	Enter

Multiple Linear Regression
Model comparison with core grade predictors only

- a. Dependent Variable: Final grade outcome
b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
					R Square Change	F Change	df1
1	.921 ^a	.848	.847	1.262	.848	1798.671	2
2	.924 ^b	.854	.851	1.248	.006	2.125	13

Model Summary

Model	Change Statistics	
	df2	Sig. F Change
1	646	.000
2	633	.011

- a. Predictors: (Constant), Second period grade, First period grade
b. Predictors: (Constant), Second period grade, First period grade, Current health status, Internet access dummy: yes, School absences, Sex dummy: 1 = male, 0 = female, Address dummy: 1 = urban, 0 = rural, Age, Father education, Weekly study time group, Home to school travel time, Higher education intention dummy: yes, Number of past class failures, School dummy: 1 = MS, 0 = GP, Mother education

Multiple Linear Regression
Model comparison with core grade predictors only

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5733.637	2	2866.819	1798.671	.000 ^b
	Residual	1029.629	646	1.594		
	Total	6763.267	648			
2	Regression	5776.701	15	385.113	247.096	.000 ^c
	Residual	986.565	633	1.559		
	Total	6763.267	648			

a. Dependent Variable: Final grade outcome

b. Predictors: (Constant), Second period grade, First period grade

c. Predictors: (Constant), Second period grade, First period grade, Current health status, Internet access dummy: yes, School absences, Sex dummy: 1 = male, 0 = female, Address dummy: 1 = urban, 0 = rural, Age, Father education, Weekly study time group, Home to school travel time, Higher education intention dummy: yes, Number of past class failures, School dummy: 1 = MS, 0 = GP, Mother education

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.171	.215		-.796	.426
	First period grade	.149	.036	.127	4.136	.000
	Second period grade	.897	.034	.809	26.448	.000
2	(Constant)	-.566	.843		-.671	.502
	First period grade	.133	.037	.113	3.608	.000
	Second period grade	.876	.034	.790	25.489	.000
	Weekly study time group	.055	.064	.014	.858	.391
	Number of past class failures	-.219	.096	-.040	-2.284	.023
	School absences	.016	.011	.023	1.454	.146
	Age	.031	.044	.012	.709	.479
	Mother education	-.047	.060	-.017	-.786	.432
	Father education	.027	.059	.009	.448	.654
	Home to school travel time	.143	.073	.033	1.973	.049

Multiple Linear Regression
Model comparison with core grade predictors only

Coefficients^a

Model		95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
1	(Constant)	-.594	.251
	First period grade	.078	.220
	Second period grade	.831	.964
2	(Constant)	-2.220	1.089
	First period grade	.061	.205
	Second period grade	.808	.943
	Weekly study time group	-.070	.179
	Number of past class failures	-.407	-.031
	School absences	-.006	.038
	Age	-.056	.118
	Mother education	-.165	.071
	Father education	-.090	.143
	Home to school travel time	.001	.286

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	Current health status	-.049	.035	-.022	-1.399	.162
	School dummy: 1 = MS, 0 = GP	-.206	.121	-.030	-1.704	.089
	Sex dummy: 1 = male, 0 = female	-.191	.106	-.029	-1.809	.071
	Address dummy: 1 = urban, 0 = rural	.164	.119	.023	1.374	.170
	Higher education intention dummy: yes	.189	.179	.018	1.055	.292
	Internet access dummy: yes	.070	.124	.009	.565	.573

Multiple Linear Regression
Model comparison with core grade predictors only

Coefficients^a

Model		95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
	Current health status	-.117	.020
	School dummy: 1 = MS, 0 = GP	-.443	.031
	Sex dummy: 1 = male, 0 = female	-.398	.016
	Address dummy: 1 = urban, 0 = rural	-.070	.398
	Higher education intention dummy: yes	-.163	.541
	Internet access dummy: yes	-.173	.313

a. Dependent Variable: Final grade outcome

Excluded Variables^a

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance
1	Weekly study time group	.024 ^b	1.500	.134	.059	.931
	Number of past class failures	-.039 ^b	-2.321	.021	-.091	.841
	School absences	.029 ^b	1.859	.064	.073	.978
	Age	.002 ^b	.147	.883	.006	.962
	Mother education	-.007 ^b	-.436	.663	-.017	.926
	Father education	.002 ^b	.142	.887	.006	.947
	Home to school travel time	.018 ^b	1.144	.253	.045	.974
	Current health status	-.026 ^b	-1.692	.091	-.066	.992
	School dummy: 1 = MS, 0 = GP	-.032 ^b	-1.981	.048	-.078	.913
	Sex dummy: 1 = male, 0 = female	-.032 ^b	-2.086	.037	-.082	.988
	Address dummy: 1 = urban, 0 = rural	.023 ^b	1.498	.135	.059	.974

Multiple Linear Regression
Model comparison with core grade predictors only

Excluded Variables^a

Model	Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance
Higher education intention dummy: yes	.022 ^b	1.354	.176	.053	.875
Internet access dummy: yes	.013 ^b	.833	.405	.033	.978

a. Dependent Variable: Final grade outcome

b. Predictors in the Model: (Constant), Second period grade, First period grade

Multiple Linear Regression

Multiple Linear Regression
Residual diagnostics and saved prediction variables

Descriptives

Notes

Output Created		11-JUL-2026 17:12:45
Comments		
Input	Data	D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\dataset.csv
	Active Dataset	MLRData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	All non-missing data are used.
Syntax		DESCRIPTIVES VARIABLES=Predicted_G 3 Residual_G3 ZPred_G3 ZResid_G3 /STATISTICS=MEAN STDDEV MIN MAX.
Resources	Processor Time	00:00:00.05
	Elapsed Time	00:00:00.04

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Unstandardized Predicted Value	649	-.14689	19.43140	11.9060092	2.98574323
Unstandardized Residual	649	-8.98396	5.18945	.0000000	1.23388700
Standardized Predicted Value	649	-4.03682	2.52044	.0000000	1.00000000
Standardized Residual	649	-7.19626	4.15681	.0000000	.98835816
Valid N (listwise)	649				

Multiple Linear Regression
Residual diagnostics and saved prediction variables

Explore

Notes

Output Created		11-JUL-2026 17:12:46
Comments		
Input	Data	D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\dataset.csv
	Active Dataset	MLRData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Missing Value Handling	Definition of Missing	User-defined missing values for dependent variables are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any dependent variable or factor used.
Syntax		EXAMINE VARIABLES=G3 Predicted_G3 Residual_G3 ZResid_G3 /PLOT BOXPLOT STEMLEAF NPLOT HISTOGRAM /COMPARE GROUPS /STATISTICS DESCRIPTIVES EXTREME /CINTERVAL 95 /MISSING LISTWISE...
Resources	Processor Time	00:00:05.34
	Elapsed Time	00:00:04.82

Multiple Linear Regression
Residual diagnostics and saved prediction variables

Case Processing Summary

	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
Final grade outcome	649	100.0%	0	0.0%	649	100.0%
Unstandardized Predicted Value	649	100.0%	0	0.0%	649	100.0%
Unstandardized Residual	649	100.0%	0	0.0%	649	100.0%
Standardized Residual	649	100.0%	0	0.0%	649	100.0%

Descriptives

		Statistic	Std. Error
Final grade outcome	Mean	11.91	.127
	95% Confidence Interval for Mean	Lower Bound	11.66
		Upper Bound	12.16
	5% Trimmed Mean	12.06	
	Median	12.00	
	Variance	10.437	
	Std. Deviation	3.231	
	Minimum	0	
	Maximum	19	
	Range	19	
	Interquartile Range	4	
	Skewness	-.913	.096
	Kurtosis	2.712	.192
Unstandardized Predicted Value	Mean	11.9060092	.11720067
	95% Confidence Interval for Mean	Lower Bound	11.6758703
		Upper Bound	12.1361482
	5% Trimmed Mean	11.9394359	
	Median	11.7088001	
	Variance	8.915	
	Std. Deviation	2.98574323	
	Minimum	-.14689	
	Maximum	19.43140	
	Range	19.57829	

Multiple Linear Regression
Residual diagnostics and saved prediction variables

Descriptives

			Statistic	Std. Error
	Interquartile Range		3.75938	
	Skewness		-.317	.096
	Kurtosis		1.178	.192
Unstandardized Residual	Mean		.0000000	.04843430
	95% Confidence Interval for Mean	Lower Bound	-.0951071	
		Upper Bound	.0951071	
	5% Trimmed Mean		.0704875	
	Median		-.0124981	
	Variance		1.522	
	Std. Deviation		1.23388700	
	Minimum		-8.98396	
	Maximum		5.18945	
	Range		14.17341	
	Interquartile Range		1.11366	
	Skewness		-2.880	.096
	Kurtosis		18.233	.192
Standardized Residual	Mean		.0000000	.03879645
	95% Confidence Interval for Mean	Lower Bound	-.0761819	
		Upper Bound	.0761819	
	5% Trimmed Mean		.0564613	
	Median		-.0100111	
	Variance		.977	
	Std. Deviation		.98835816	
	Minimum		-7.19626	
	Maximum		4.15681	
	Range		11.35307	
	Interquartile Range		.89205	
	Skewness		-2.880	.096
	Kurtosis		18.233	.192

Multiple Linear Regression
Residual diagnostics and saved prediction variables

Extreme Values

			Case Number	Value
Final grade outcome	Highest	1	339	19
		2	637	19
		3	114	18
		4	182	18
		5	186	18 ^a
	Lowest	1	641	0
		2	640	0
		3	638	0
		4	627	0
		5	611	0 ^b
Unstandardized Predicted Value	Highest	1	339	19.43140
		2	333	18.74512
		3	595	18.63574
		4	350	18.57562
		5	607	18.46621
	Lowest	1	568	-.14689
		2	564	.55019
		3	611	.55932
		4	604	.59219
		5	606	.65897
Unstandardized Residual	Highest	1	62	5.18945
		2	308	2.81055
		3	401	2.61047
		4	170	2.29885
		5	390	2.25311
	Lowest	1	173	-8.98396
		2	164	-8.93125
		3	587	-8.12863
		4	640	-7.35290
		5	520	-7.22311
Standardized Residual	Highest	1	62	4.15681
		2	308	2.25129

Multiple Linear Regression
Residual diagnostics and saved prediction variables

Extreme Values

		Case Number	Value
	3	401	2.09102
	4	170	1.84141
	5	390	1.80477
	Lowest	1	-7.19626
		2	-7.15403
		3	-6.51113
		4	-5.88976
		5	-5.78579

- a. Only a partial list of cases with the value 18 are shown in the table of upper extremes.
b. Only a partial list of cases with the value 0 are shown in the table of lower extremes.

Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Final grade outcome	.124	649	.000	.926	649	.000
Unstandardized Predicted Value	.031	649	.200*	.980	649	.000
Unstandardized Residual	.141	649	.000	.765	649	.000
Standardized Residual	.141	649	.000	.765	649	.000

*. This is a lower bound of the true significance.

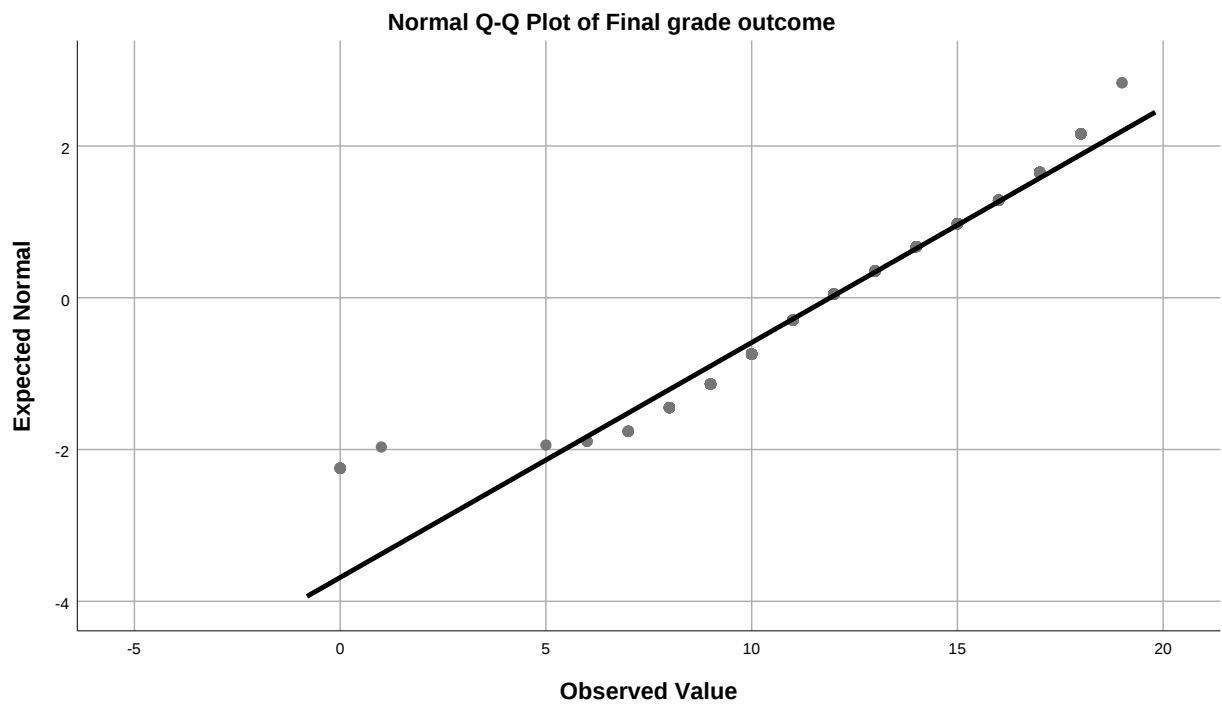
- a. Lilliefors Significance Correction

Final grade outcome

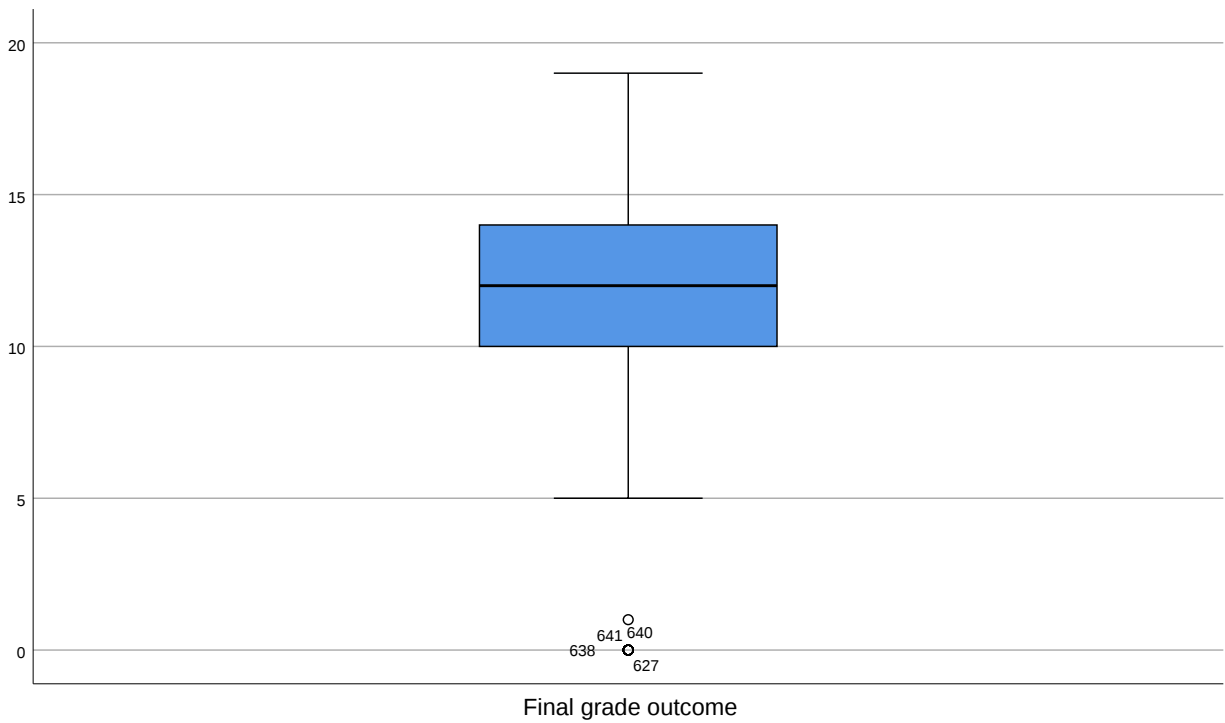
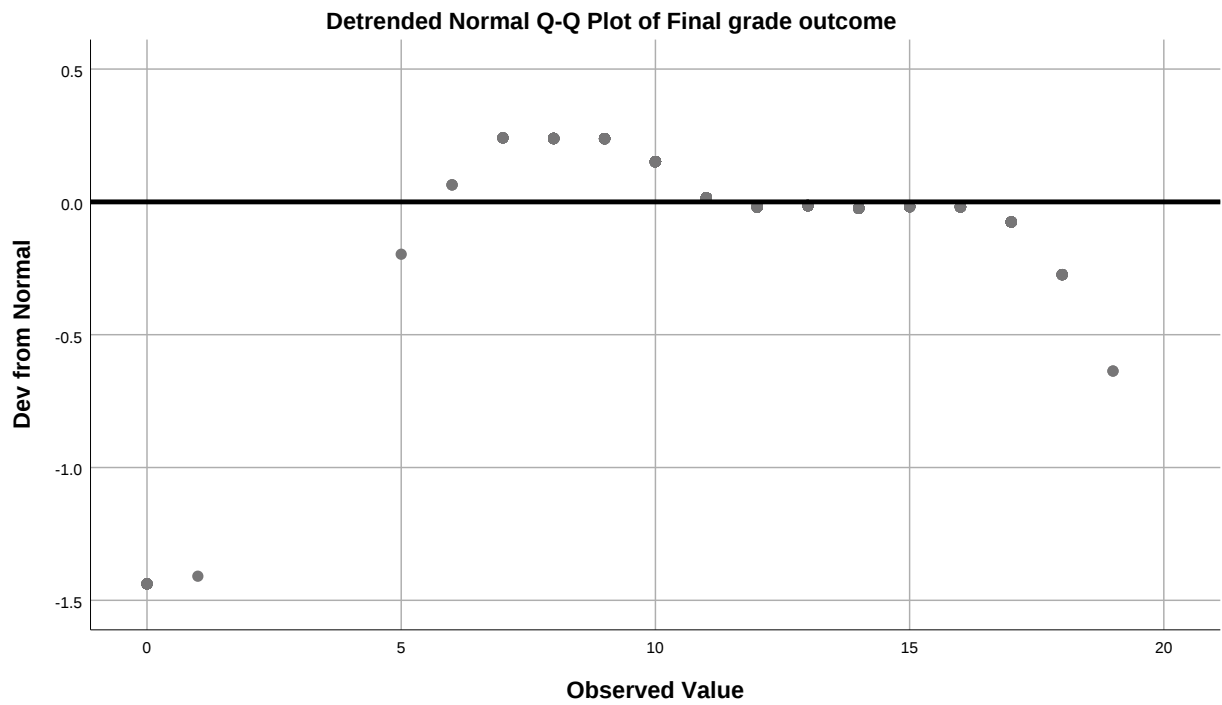
Multiple Linear Regression
Residual diagnostics and saved prediction variables

Stem width: 1
Each leaf: 2 case(s)

& denotes fractional leaves.

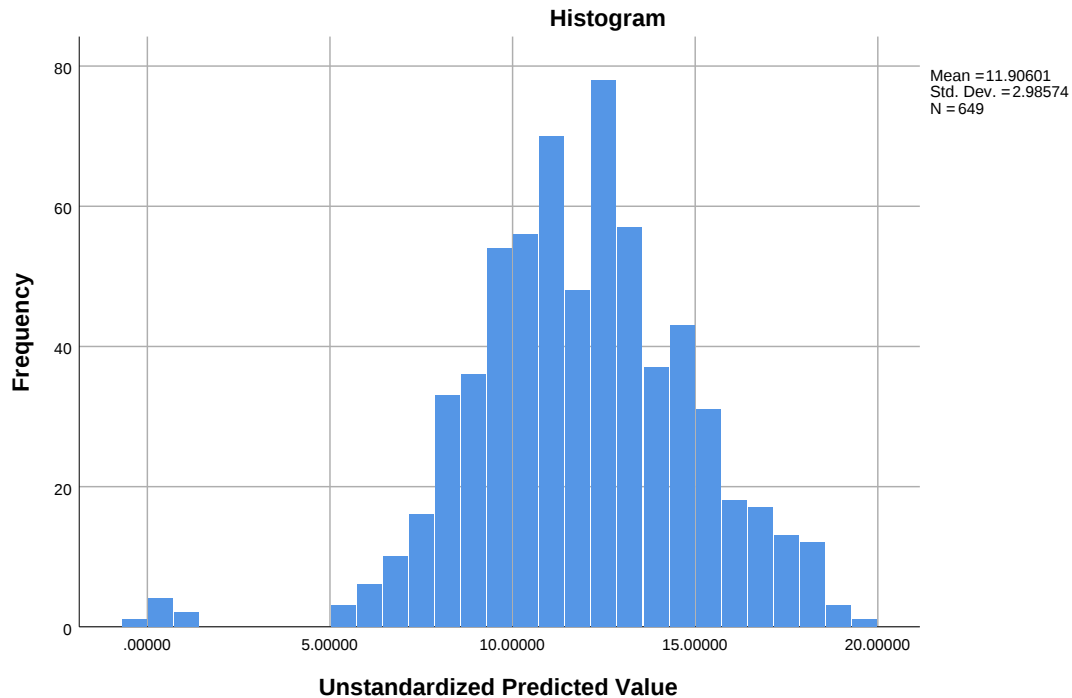


Multiple Linear Regression
Residual diagnostics and saved prediction variables



Multiple Linear Regression
Residual diagnostics and saved prediction variables

Unstandardized Predicted Value



Unstandardized Predicted Value Stem-and-Leaf Plot

Frequency	Stem &	Leaf
7.00	Extremes	(=<1.3)
5.00	5 .	&&
12.00	6 .	0689&&
21.00	7 .	12456779&
45.00	8 .	0112223334455688999&
75.00	9 .	000111122333344445566777778889999
77.00	10 .	00001111122333444455555666888899999&
94.00	11 .	0000111112222223333344444445555556666777899
88.00	12 .	011122222333344444455555566666777788999
75.00	13 .	000122333333444444555556666677889
55.00	14 .	1122222333344445555667889&
36.00	15 .	01223344455566689&
25.00	16 .	0123344559&
19.00	17 .	0123445&

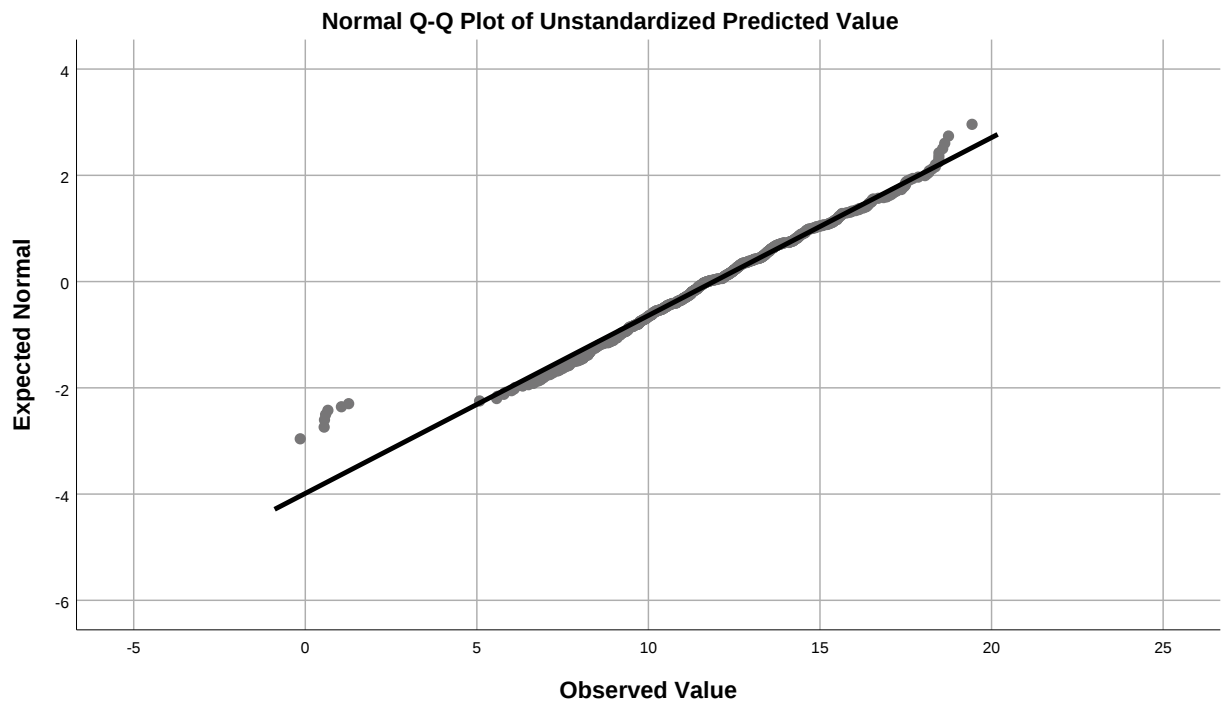
Multiple Linear Regression

Residual diagnostics and saved prediction variables

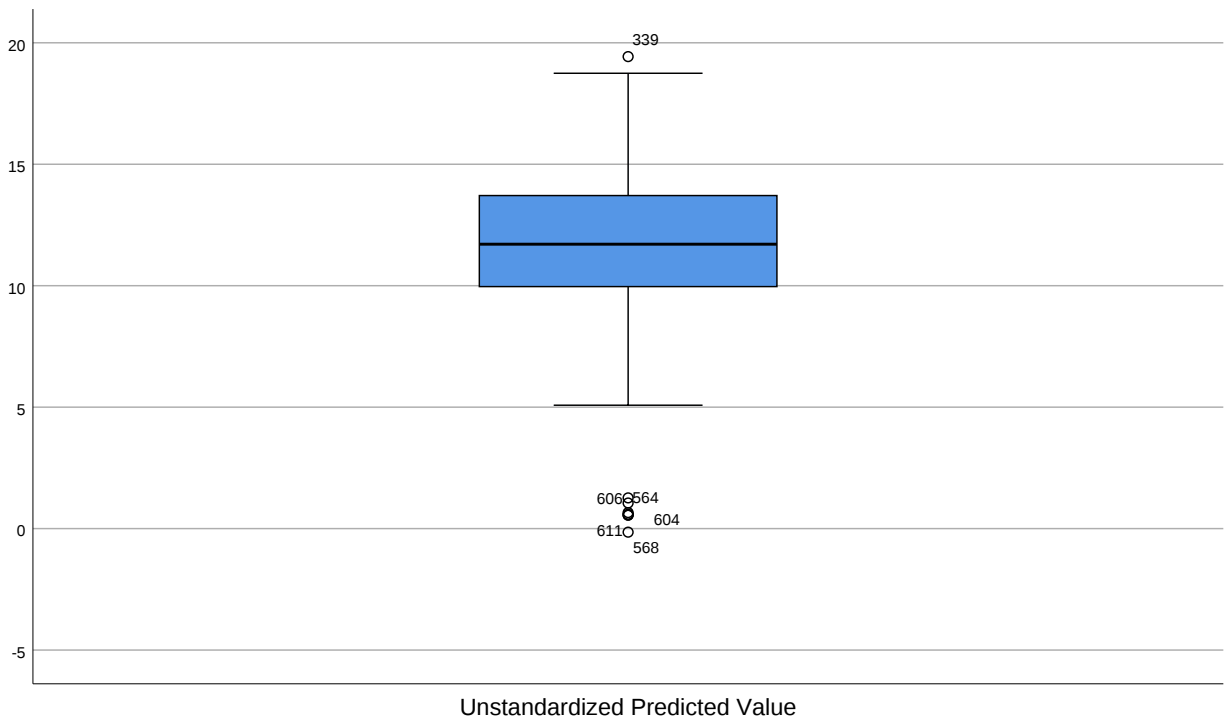
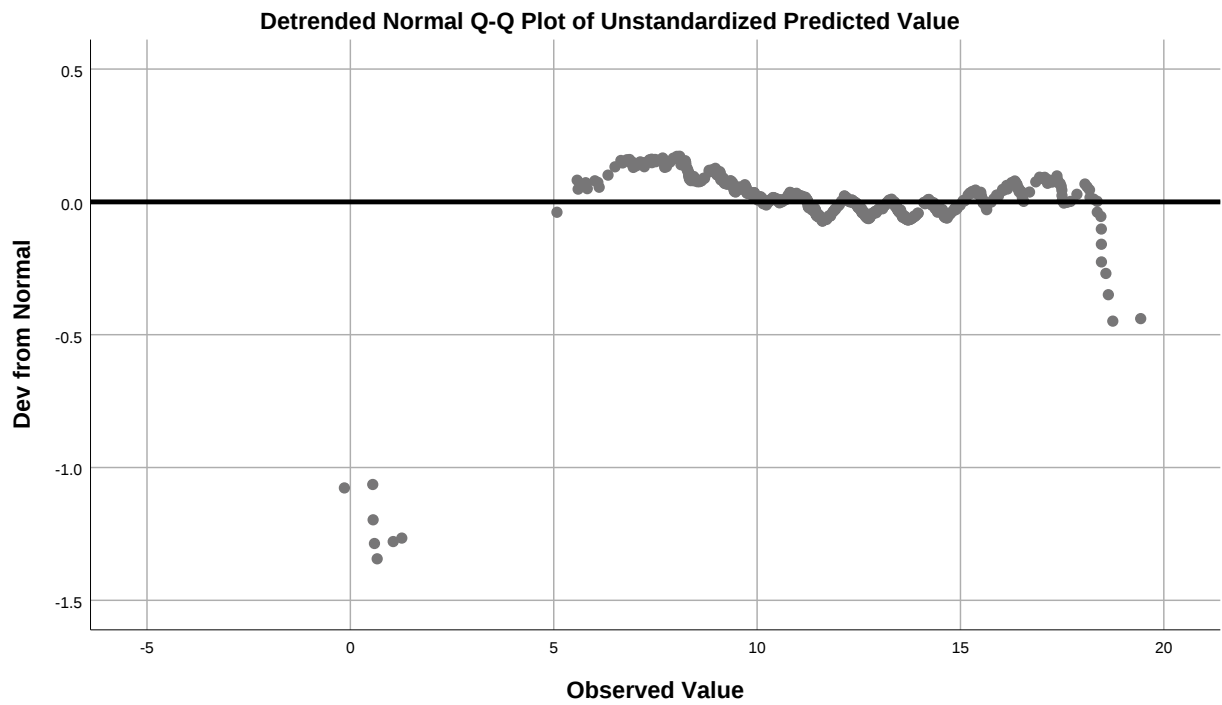
```
14.00      18 . 1344&&
1.00 Extremes    (>=19.4)
```

```
Stem width: 1.00000
Each leaf: 2 case(s)
```

& denotes fractional leaves.



Multiple Linear Regression
Residual diagnostics and saved prediction variables



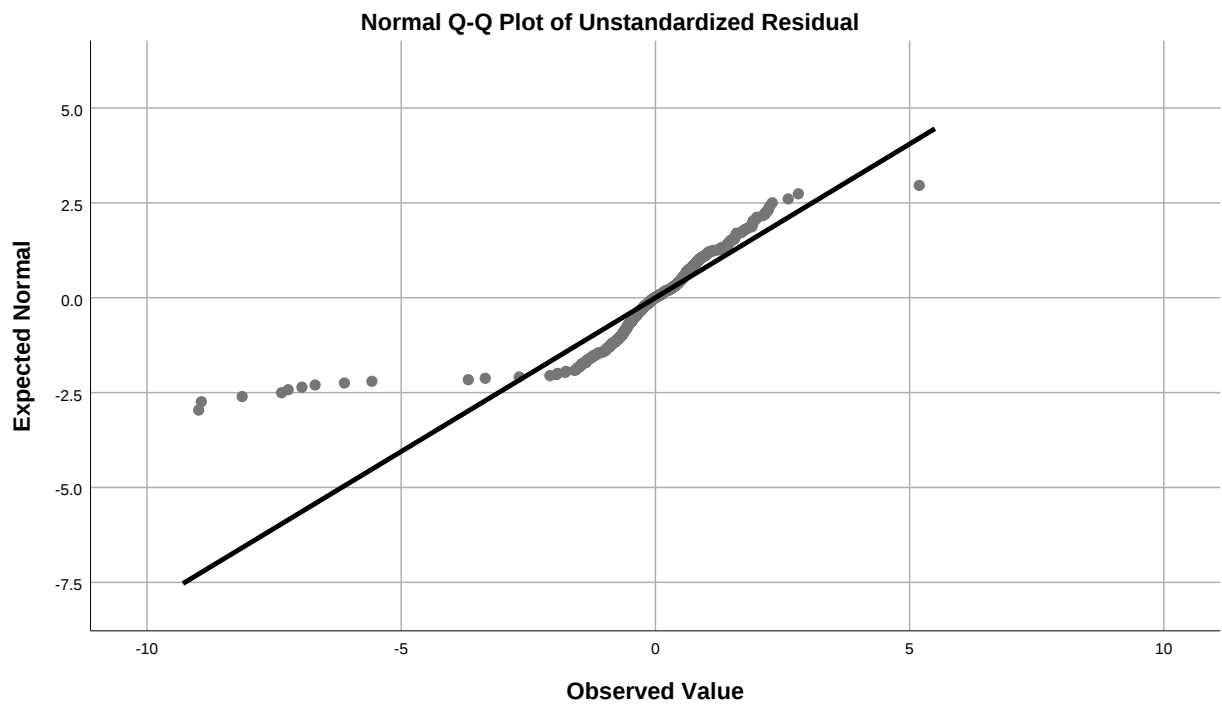
Multiple Linear Regression
Residual diagnostics and saved prediction variables

4.00 Extremes (>=2.3)

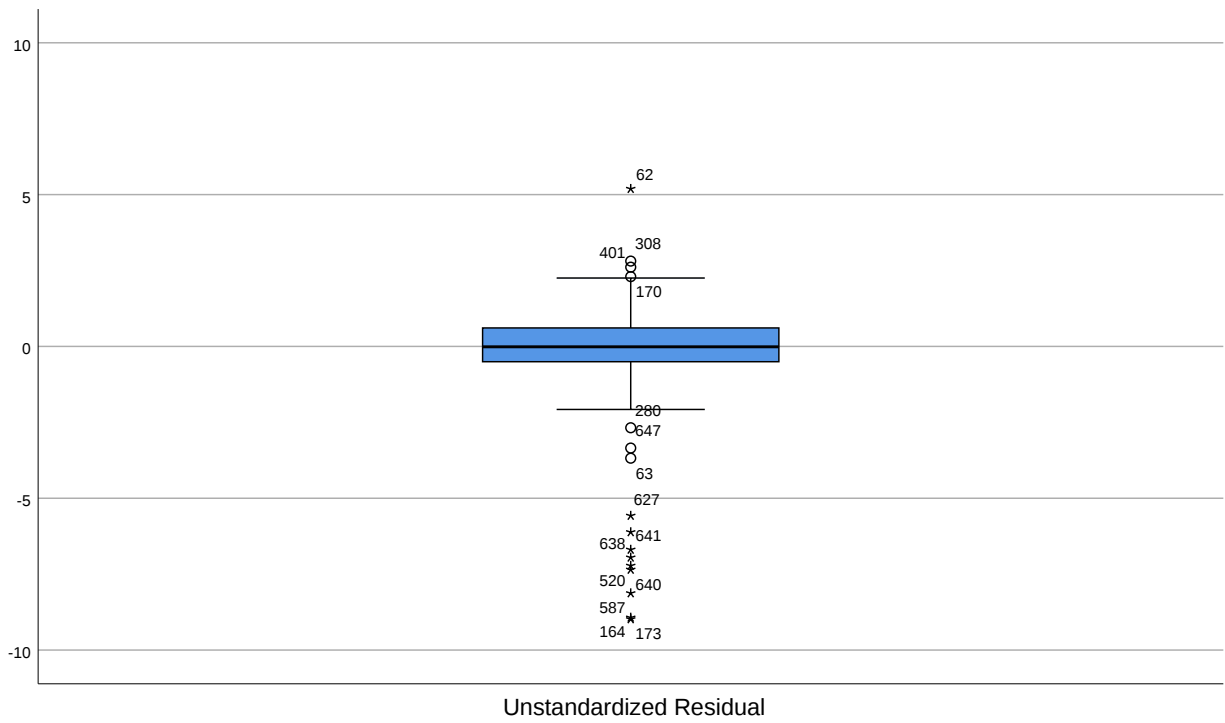
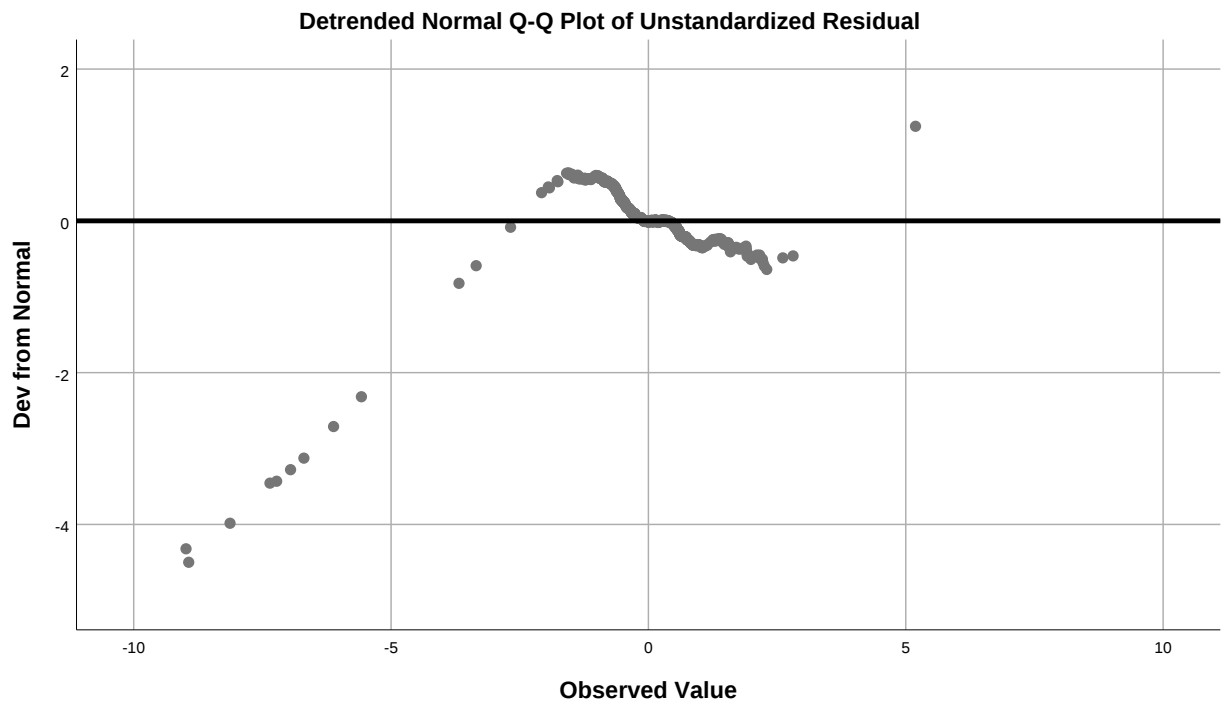
Stem width: 1.00000

Each leaf: 2 case(s)

& denotes fractional leaves.



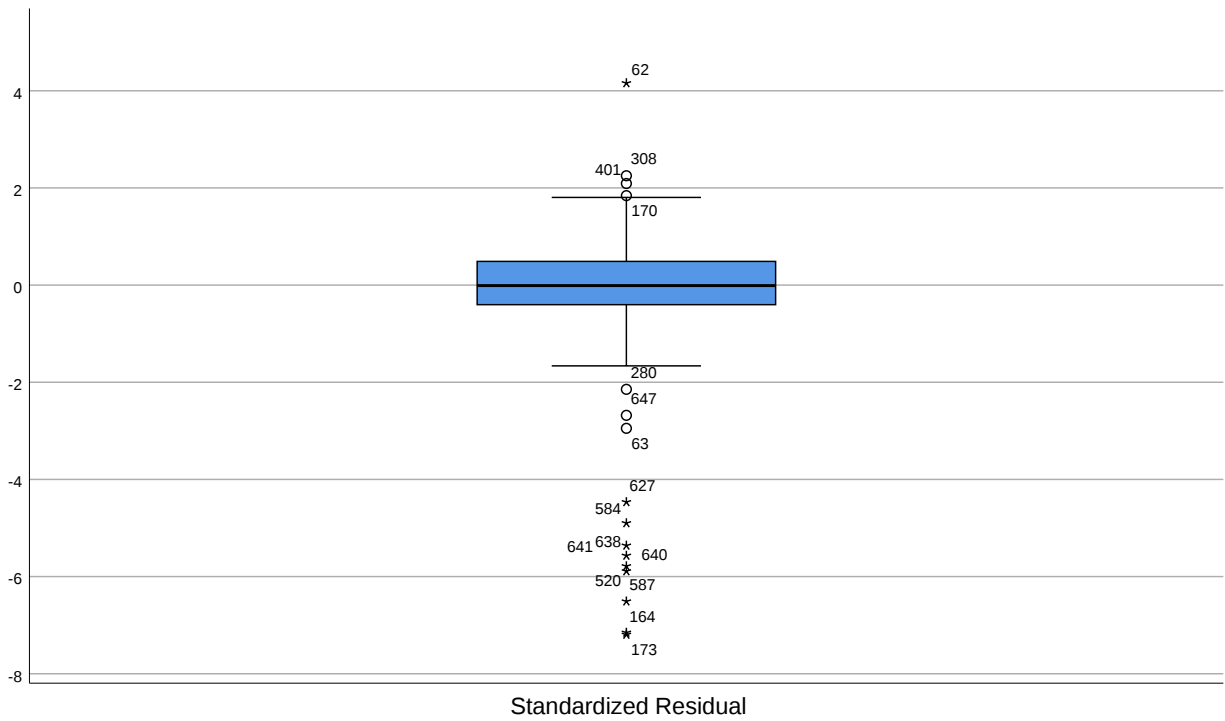
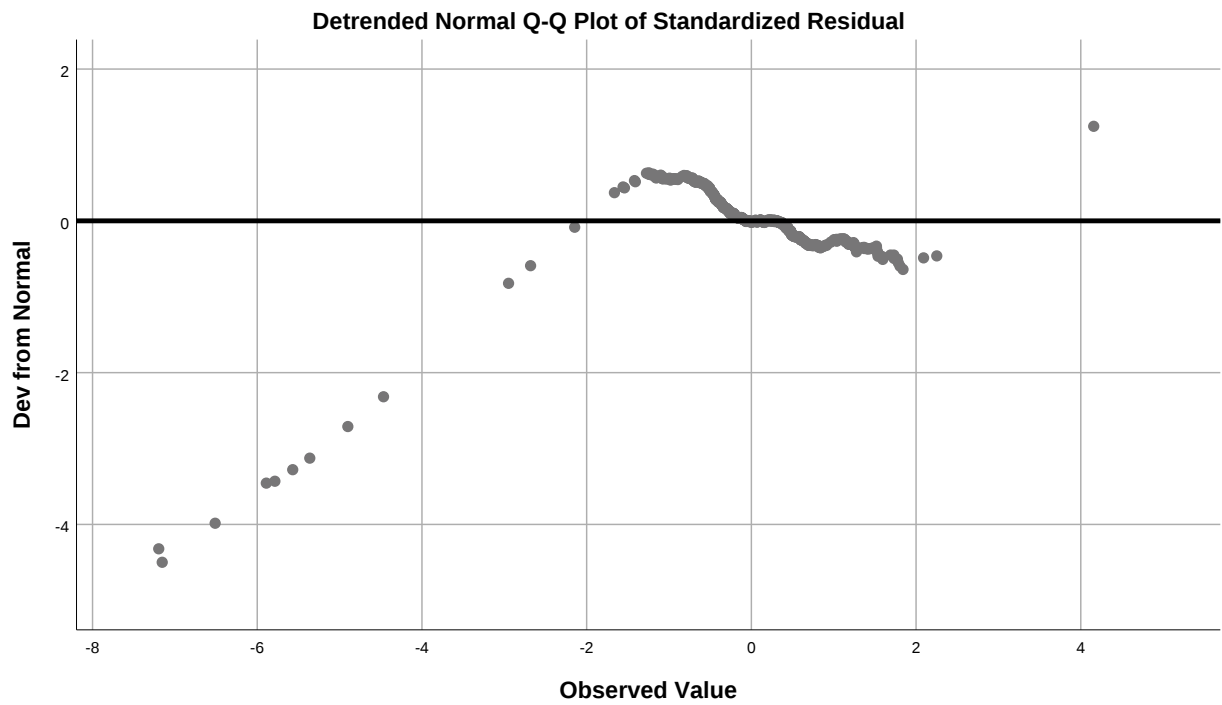
Multiple Linear Regression
Residual diagnostics and saved prediction variables



[illegible]

A Normal Q-Q Plot of Standardized Residual. The x-axis is labeled 'Observed Value' and ranges from -8 to 4. The y-axis is labeled 'Expected Normal' and ranges from -7.5 to 5.0. A solid diagonal line represents the expected normal distribution. Data points are plotted as grey circles. Most points follow the line, but there is a distinct horizontal cluster of points between observed values of -7 and -4, indicating a deviation from normality in the lower tail.

Multiple Linear Regression
Residual diagnostics and saved prediction variables



Multiple Linear Regression
Residual diagnostics and saved prediction variables

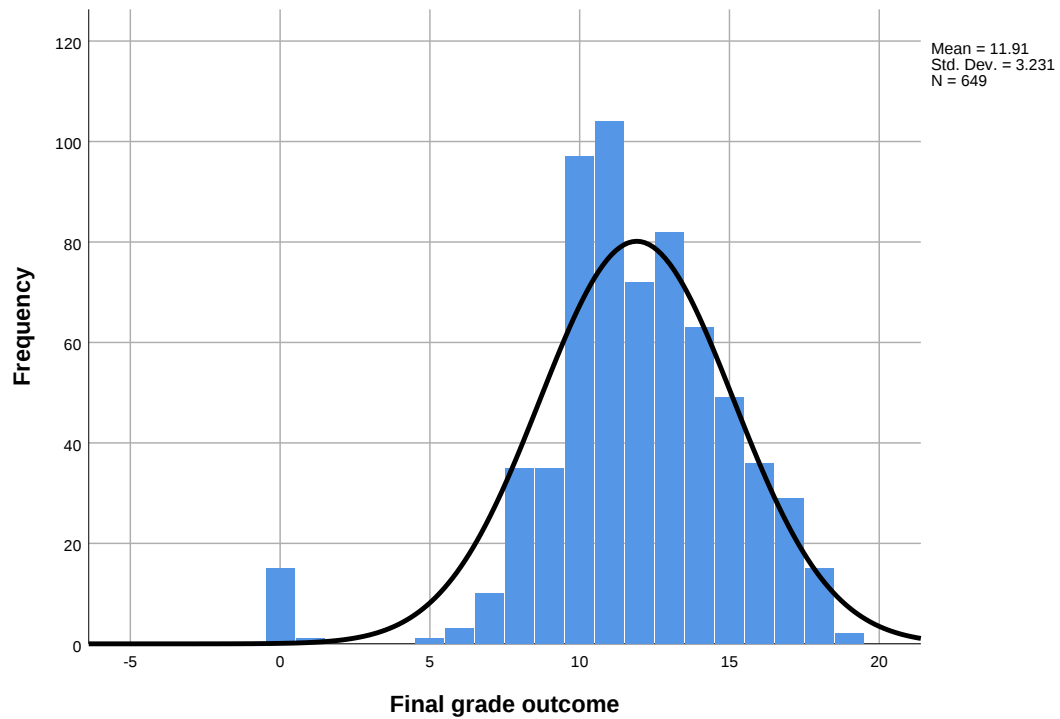
Graph

Notes

Output Created		11-JUL-2026 17:12:50
Comments		
Input	Data	D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\dataset.csv
	Active Dataset	MLRData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Syntax		GRAPH /HISTOGRAM(NORMAL) =G3.
Resources	Processor Time	00:00:00.42
	Elapsed Time	00:00:00.41

Multiple Linear Regression

Residual diagnostics and saved prediction variables



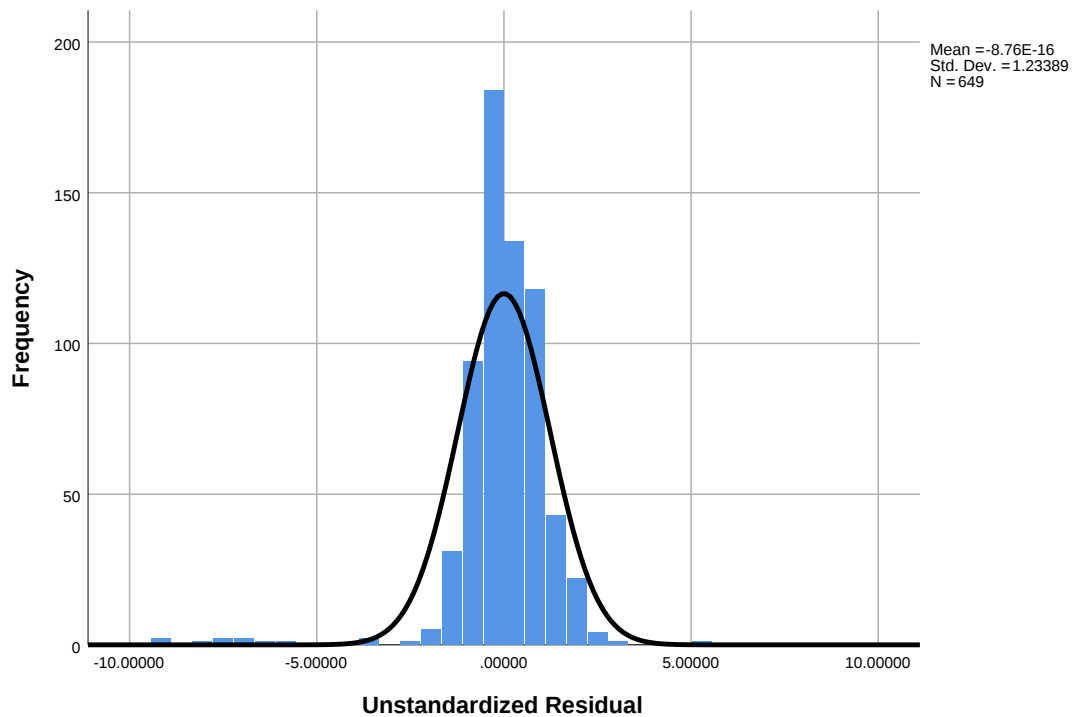
Graph

Multiple Linear Regression

Residual diagnostics and saved prediction variables

Notes

Output Created		11-JUL-2026 17:12:51
Comments		
Input	Data	D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\dataset.csv
	Active Dataset	MLRData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Syntax		GRAPH /HISTOGRAM(NORMAL) =Residual_G3.
Resources	Processor Time	00:00:00.37
	Elapsed Time	00:00:00.45



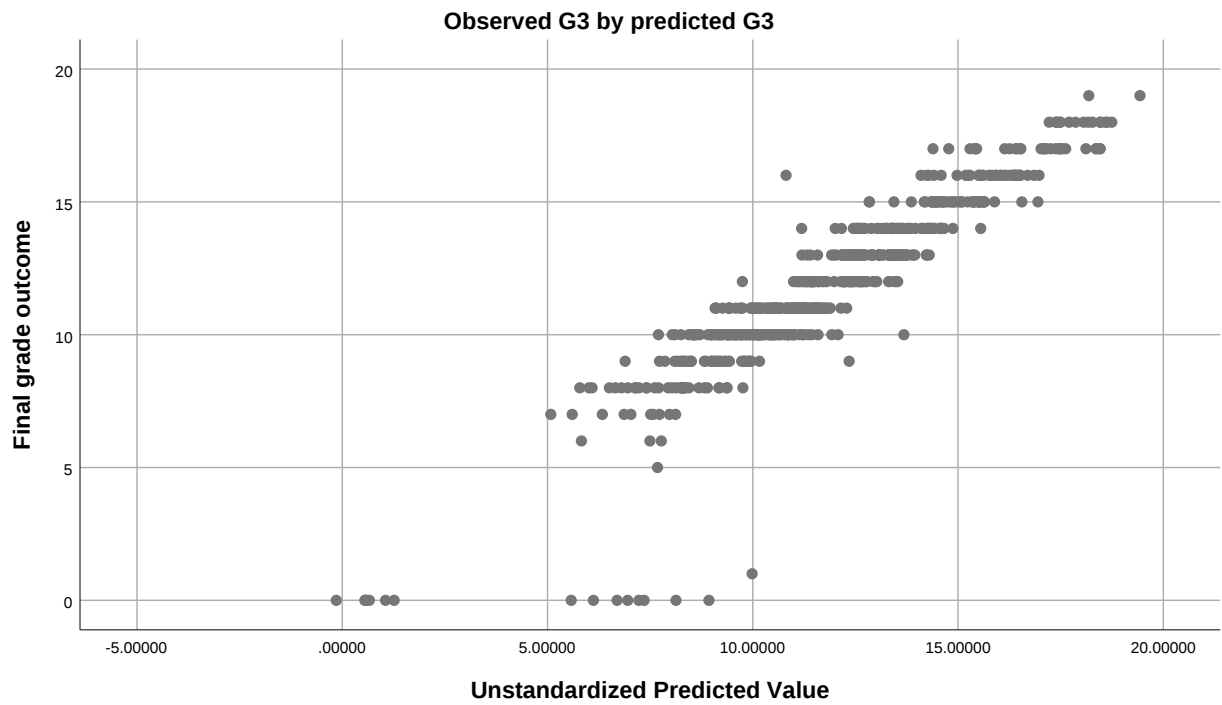
Multiple Linear Regression
Residual diagnostics and saved prediction variables

Graph

Notes

Output Created		11-JUL-2026 17:12:51
Comments		
Input	Data	D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\dataset.csv
	Active Dataset	MLRData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Syntax		GRAPH /SCATTERPLOT(BIVAR) =Predicted_G3 WITH G3 /TITLE='Observed G3 by predicted G3'.
Resources	Processor Time	00:00:00.39
	Elapsed Time	00:00:00.41

Multiple Linear Regression
Residual diagnostics and saved prediction variables



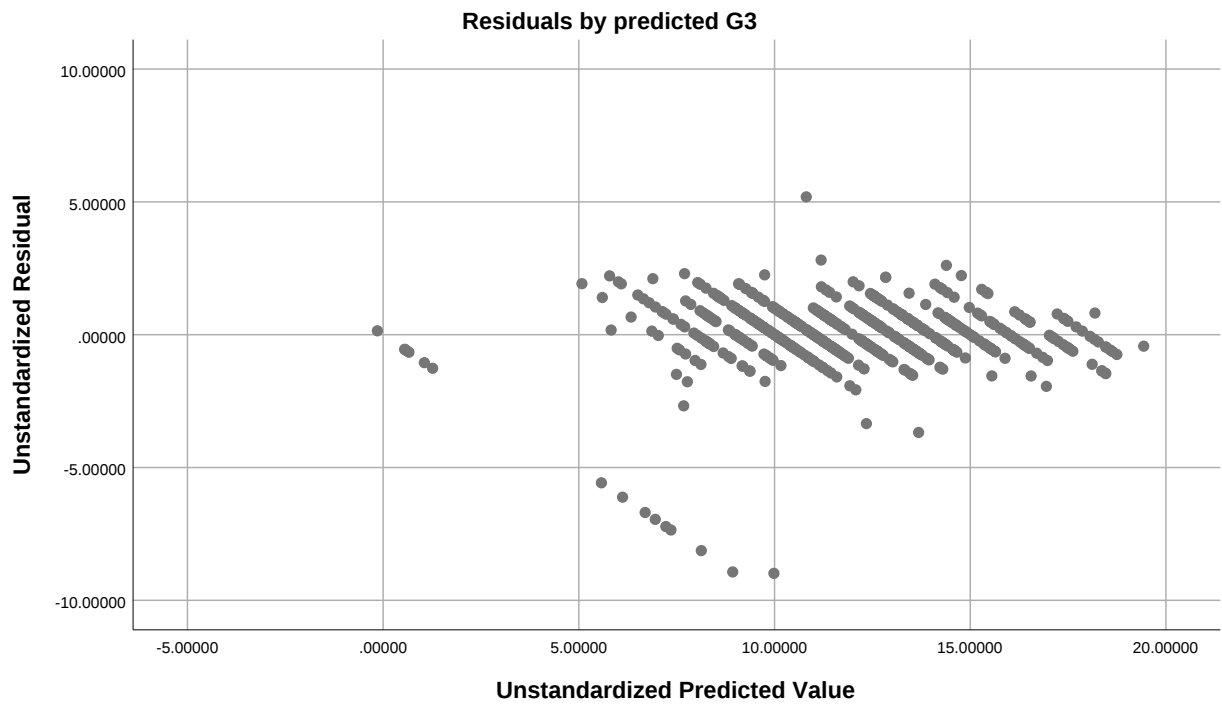
Graph

Multiple Linear Regression
Residual diagnostics and saved prediction variables

Notes

Output Created		11-JUL-2026 17:12:52
Comments		
Input	Data	D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\dataset.csv
	Active Dataset	MLRData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Syntax		GRAPH /SCATTERPLOT(BIVAR) =Predicted_G3 WITH Residual_G3 /TITLE='Residuals by predicted G3'.
Resources	Processor Time	00:00:00.44
	Elapsed Time	00:00:00.44

Multiple Linear Regression
Residual diagnostics and saved prediction variables



Graph

Multiple Linear Regression
Residual diagnostics and saved prediction variables

Notes

Output Created		11-JUL-2026 17:12:52
Comments		
Input	Data	D:\DATA ANALYSIS\H Regression Tests and Models\Multiple Linear Regression\dataset.csv
	Active Dataset	MLRData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Syntax		GRAPH /SCATTERPLOT(BIVAR) =G2 WITH G3 /TITLE='Final grade by second period grade'.
Resources	Processor Time	00:00:00.42
	Elapsed Time	00:00:00.42

Multiple Linear Regression
Residual diagnostics and saved prediction variables

