

```
173 0 OUTPUT ACTIVATE TimeSeriesAnalysisOutput.  
173 0 M> OUTPUT ACTIVATE TimeSeriesAnalysisOutput.  
174 0 TITLE 'Time Series Analysis'.  
174 0 M> TITLE 'Time Series Analysis'.
```

Time Series Analysis

```
175 0 GET DATA /TYPE=TXT /FILE='D:\DATA ANALYSIS\N Time Series Tests and Fo
recasting\Time Series Analysis\dataset.csv' /ENCODING=
      'UTF8' /DELCASE=LINE /DELIMITERS=', ' /QUALIFIER='"' /ARRANGEMENT=D
ELIMITED /FIRSTCASE=2
175 0 M> GET DATA /TYPE=TXT /FILE='D:\DATA ANALYSIS\N Time Series Tests and
Forecasting\Time Series Analysis\dataset.csv' /ENCODI
      NG='UTF8' /DELCASE=LINE /DELIMITERS=', ' /QUALIFIER='"' /ARRANGE
MENT=DELIMITED /FIRSTCASE=2
176 0 /VARIABLES=school A8 sex A8 age F8.0 address A8 famsize A8 Pstatus A
8 Medu F8.0 Fedu F8.0 Mjob A16 Fjob A16 reason A16 gua
      rdian A16 traveltime F8.0 studytime F8.0 failures F8.0 schoolsup A
8 famsup A8 paid A8 activities A8 nursery A8 higher A8
      internet A8 romantic A8 famrel F8.0 freetime F8.0 goout F8.0 Dalc
F8.0 Walc F8.0 health F8.0 absences F8.0 G1 F8.0 G2 F
      8.0 G3 F8.0.
176 0 M> /VARIABLES=school A8 sex A8 age F8.0 address A8 famsize A8 Pstatu
s A8 Medu F8.0 Fedu F8.0 Mjob A16 Fjob A16 reason A16
      guardian A16 traveltime F8.0 studytime F8.0 failures F8.0 schoo
lsup A8 famsup A8 paid A8 activities A8 nursery A8 hig
      her A8 internet A8 romantic A8 famrel F8.0 freetime F8.0 goout
F8.0 Dalc F8.0 Walc F8.0 health F8.0 absences F8.0 G1
      F8.0 G2 F8.0 G3 F8.0.
177 0 DATASET NAME TimeSeriesAnalysisData.
177 0 M> DATASET NAME TimeSeriesAnalysisData.
178 0 COMPUTE time_index=$CASENUM.
178 0 M> COMPUTE time_index=$CASENUM.
179 0 EXECUTE.
179 0 M> EXECUTE.
180 0 * BEGIN METHOD-SPECIFIC SPSS WORKFLOW.
180 0 M> * BEGIN METHOD-SPECIFIC SPSS WORKFLOW.
181 0 COMPUTE change=G3-LAG(G3).
181 0 M> COMPUTE change=G3-LAG(G3).
182 0 COMPUTE g3_l1=LAG(G3,1).
182 0 M> COMPUTE g3_l1=LAG(G3,1).
183 0 COMPUTE g3_l2=LAG(G3,2).
183 0 M> COMPUTE g3_l2=LAG(G3,2).
184 0 COMPUTE g3_l3=LAG(G3,3).
184 0 M> COMPUTE g3_l3=LAG(G3,3).
185 0 COMPUTE g3_l4=LAG(G3,4).
```

Time Series Analysis

```
185  0 M> COMPUTE g3_l4=LAG(G3,4).
186  0 COMPUTE g3_l5=LAG(G3,5).
186  0 M> COMPUTE g3_l5=LAG(G3,5).
187  0 COMPUTE g3_l6=LAG(G3,6).
187  0 M> COMPUTE g3_l6=LAG(G3,6).
188  0 COMPUTE g3_l7=LAG(G3,7).
188  0 M> COMPUTE g3_l7=LAG(G3,7).
189  0 COMPUTE g3_l8=LAG(G3,8).
189  0 M> COMPUTE g3_l8=LAG(G3,8).
190  0 COMPUTE g3_l9=LAG(G3,9).
190  0 M> COMPUTE g3_l9=LAG(G3,9).
191  0 COMPUTE g3_l10=LAG(G3,10).
191  0 M> COMPUTE g3_l10=LAG(G3,10).
192  0 COMPUTE g3_l11=LAG(G3,11).
192  0 M> COMPUTE g3_l11=LAG(G3,11).
193  0 COMPUTE g3_l12=LAG(G3,12).
193  0 M> COMPUTE g3_l12=LAG(G3,12).
194  0 EXECUTE.
194  0 M> EXECUTE.
195  0 REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT G3 /METHO
D=ENTER time_index /SAVE PRED(trend_fit) RESID(ts_resi
d).
195  0 M> REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT G3 /ME
THOD=ENTER time_index /SAVE PRED(trend_fit) RESID(ts_r
esid).
```

Regression

Time Series Analysis

Notes

Output Created		18-JUL-2026 16:01:19
Comments		
Input	Data	D:\DATA ANALYSIS\N Time Series Tests and Forecasting\Time Series Analysis\dataset.csv
	Active Dataset	TimeSeriesAnalysisData
	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 /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT G3 /METHOD=ENTER time_index /SAVE PRED (trend_fit) RESID (ts_resid).
Resources	Processor Time	00:00:00.03
	Elapsed Time	00:00:00.15
	Memory Required	4368 bytes
	Additional Memory Required for Residual Plots	0 bytes
Variables Created or Modified	trend_fit	Unstandardized Predicted Value
	ts_resid	Unstandardized Residual

[TimeSeriesAnalysisData]

Time Series Analysis

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	time_index ^b	.	Enter

a. Dependent Variable: G3

b. All requested variables entered.

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.177 ^a	.031	.030	3.182

a. Predictors: (Constant), time_index

b. Dependent Variable: G3

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	211.509	1	211.509	20.887	.000 ^b
	Residual	6551.757	647	10.126		
	Total	6763.267	648			

a. Dependent Variable: G3

b. Predictors: (Constant), time_index

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	12.896	.250		51.562	.000
	time_index	-.003	.001	-.177	-4.570	.000

Time Series Analysis

Coefficients^a

Model		95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
1	(Constant)	12.405	13.387
	time_index	-.004	-.002

a. Dependent Variable: G3

Residuals Statistics^a

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	10.92	12.89	11.91	.571	649
Residual	-12.397	8.045	.000	3.180	649
Std. Predicted Value	-1.728	1.728	.000	1.000	649
Std. Residual	-3.896	2.528	.000	.999	649

a. Dependent Variable: G3

```
196 0 CORRELATIONS /VARIABLES=G3 g3_l1 g3_l2 g3_l3 g3_l4 g3_l5 g3_l6 g3_l7
g3_l8 g3_l9 g3_l10 g3_l11 g3_l12.
196 0 M> CORRELATIONS /VARIABLES=G3 g3_l1 g3_l2 g3_l3 g3_l4 g3_l5 g3_l6 g3_
l7 g3_l8 g3_l9 g3_l10 g3_l11 g3_l12.
```

Correlations

Time Series Analysis

Notes

Output Created		18-JUL-2026 16:01:19
Comments		
Input	Data	D:\DATA ANALYSIS\N Time Series Tests and Forecasting\Time Series Analysis\dataset.csv
	Active Dataset	TimeSeriesAnalysisData
	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 g3_l1 g3_l2 g3_l3 g3_l4 g3_l5 g3_l6 g3_l7 g3_l8 g3_l9 g3_l10 g3_l11 g3_l12.
Resources	Processor Time	00:00:00.09
	Elapsed Time	00:00:00.17

Time Series Analysis

Correlations

		G3	g3_l1	g3_l2	g3_l3	g3_l4	g3_l5
G3	Pearson Correlation	1	.190	.242	.184	.152	.181
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	649	648	647	646	645	644
g3_l1	Pearson Correlation	.190	1	.190	.241	.184	.152
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	648	648	647	646	645	644
g3_l2	Pearson Correlation	.242	.190	1	.189	.243	.184
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	647	647	647	646	645	644
g3_l3	Pearson Correlation	.184	.241	.189	1	.191	.242
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	646	646	646	646	645	644
g3_l4	Pearson Correlation	.152	.184	.243	.191	1	.193
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	645	645	645	645	645	644
g3_l5	Pearson Correlation	.181	.152	.184	.242	.193	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	644	644	644	644	644	644
g3_l6	Pearson Correlation	.181	.181	.152	.183	.244	.192
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000
	N	643	643	643	643	643	643
g3_l7	Pearson Correlation	.149	.181	.180	.151	.184	.244
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000
	N	642	642	642	642	642	642
g3_l8	Pearson Correlation	.129	.150	.182	.182	.150	.185
	Sig. (2-tailed)	.001	.000	.000	.000	.000	.000
	N	641	641	641	641	641	641
g3_l9	Pearson Correlation	.061	.128	.148	.179	.191	.148
	Sig. (2-tailed)	.121	.001	.000	.000	.000	.000
	N	640	640	640	640	640	640
g3_l10	Pearson Correlation	.009	.060	.126	.145	.188	.190
	Sig. (2-tailed)	.817	.127	.001	.000	.000	.000
	N	639	639	639	639	639	639

Time Series Analysis

Correlations

		g3_l6	g3_l7	g3_l8	g3_l9	g3_l10	g3_l11
G3	Pearson Correlation	.181	.149	.129	.061	.009	.179
	Sig. (2-tailed)	.000	.000	.001	.121	.817	.000
	N	643	642	641	640	639	638
g3_l1	Pearson Correlation	.181	.181	.150	.128	.060	.010
	Sig. (2-tailed)	.000	.000	.000	.001	.127	.806
	N	643	642	641	640	639	638
g3_l2	Pearson Correlation	.152	.180	.182	.148	.126	.062
	Sig. (2-tailed)	.000	.000	.000	.000	.001	.120
	N	643	642	641	640	639	638
g3_l3	Pearson Correlation	.183	.151	.182	.179	.145	.128
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.001
	N	643	642	641	640	639	638
g3_l4	Pearson Correlation	.244	.184	.150	.191	.188	.142
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000
	N	643	642	641	640	639	638
g3_l5	Pearson Correlation	.192	.244	.185	.148	.190	.190
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000
	N	643	642	641	640	639	638
g3_l6	Pearson Correlation	1	.192	.245	.184	.146	.192
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	643	642	641	640	639	638
g3_l7	Pearson Correlation	.192	1	.193	.246	.184	.147
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	642	642	641	640	639	638
g3_l8	Pearson Correlation	.245	.193	1	.200	.254	.183
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	641	641	641	640	639	638
g3_l9	Pearson Correlation	.184	.246	.200	1	.183	.265
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	640	640	640	640	639	638
g3_l10	Pearson Correlation	.146	.184	.254	.183	1	.193
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	639	639	639	639	639	638

Time Series Analysis

Correlations

		g3_l12
G3	Pearson Correlation	.084
	Sig. (2-tailed)	.035
	N	637
g3_l1	Pearson Correlation	.179
	Sig. (2-tailed)	.000
	N	637
g3_l2	Pearson Correlation	.006
	Sig. (2-tailed)	.873
	N	637
g3_l3	Pearson Correlation	.057
	Sig. (2-tailed)	.150
	N	637
g3_l4	Pearson Correlation	.138
	Sig. (2-tailed)	.000
	N	637
g3_l5	Pearson Correlation	.141
	Sig. (2-tailed)	.000
	N	637
g3_l6	Pearson Correlation	.188
	Sig. (2-tailed)	.000
	N	637
g3_l7	Pearson Correlation	.192
	Sig. (2-tailed)	.000
	N	637
g3_l8	Pearson Correlation	.154
	Sig. (2-tailed)	.000
	N	637
g3_l9	Pearson Correlation	.164
	Sig. (2-tailed)	.000
	N	637
g3_l10	Pearson Correlation	.248
	Sig. (2-tailed)	.000
	N	637

Time Series Analysis

Correlations

		G3	g3_l1	g3_l2	g3_l3	g3_l4	g3_l5
g3_l11	Pearson Correlation	.179	.010	.062	.128	.142	.190
	Sig. (2-tailed)	.000	.806	.120	.001	.000	.000
	N	638	638	638	638	638	638
g3_l12	Pearson Correlation	.084	.179	.006	.057	.138	.141
	Sig. (2-tailed)	.035	.000	.873	.150	.000	.000
	N	637	637	637	637	637	637

Correlations

		g3_l6	g3_l7	g3_l8	g3_l9	g3_l10	g3_l11
g3_l11	Pearson Correlation	.192	.147	.183	.265	.193	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	638	638	638	638	638	638
g3_l12	Pearson Correlation	.188	.192	.154	.164	.248	.203
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000
	N	637	637	637	637	637	637

Correlations

		g3_l12
g3_l11	Pearson Correlation	.203
	Sig. (2-tailed)	.000
	N	637
g3_l12	Pearson Correlation	1
	Sig. (2-tailed)	
	N	637

```
197 0 DESCRIPTIVES VARIABLES=G3 change trend_fit ts_resid /STATISTICS=MEAN
STDDEV MIN MAX.
```

```
197 0 M> DESCRIPTIVES VARIABLES=G3 change trend_fit ts_resid /STATISTICS=ME
AN STDDEV MIN MAX.
```

Descriptives

Time Series Analysis

Notes

Output Created		18-JUL-2026 16:01:19
Comments		
Input	Data	D:\DATA ANALYSIS\N Time Series Tests and Forecasting\Time Series Analysis\dataset.csv
	Active Dataset	TimeSeriesAnalysisData
	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 change trend_fit ts_resid /STATISTICS=MEAN STDDEV MIN MAX.
Resources	Processor Time	00:00:00.03
	Elapsed Time	00:00:00.08

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
G3	649	0	19	11.91	3.231
change	648	-19.00	18.00	.0000	4.11504
Unstandardized Predicted Value	649	10.91874	12.89327	11.9060092	.57131734
Unstandardized Residual	649	-12.39659	8.04469	.0000000	3.17973839
Valid N (listwise)	648				

```

198 0 * END METHOD-SPECIFIC SPSS WORKFLOW.
198 0 M> * END METHOD-SPECIFIC SPSS WORKFLOW.
199 0 SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecasting\Time Series Analysis\SPSS_Output\sav\time-series-analysis'

```

Time Series Analysis

```
s_spss_ready_data.sav' /COMPRESSED.
199 0 M> SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecasting
\Time Series Analysis\SPSS_Output\sav\time-series-anal
ysis_spss_ready_data.sav' /COMPRESSED.
200 0 ECHO 'Time Series Analysis'.
200 0 M> ECHO 'Time Series Analysis'.
Time Series Analysis
201 0 ECHO 'Method type: descriptive_time_series_workflow'.
201 0 M> ECHO 'Method type: descriptive_time_series_workflow'.
Method type: descriptive_time_series_workflow
202 0 ECHO 'Design: Integrated descriptive workflow for ordered G3: level,
change, trend, and serial dependence.'.
202 0 M> ECHO 'Design: Integrated descriptive workflow for ordered G3: leve
l, change, trend, and serial dependence.'.
Design: Integrated descriptive workflow for ordered G3: level, change, trend,
and serial dependence.
203 0 ECHO 'Formula: y_t summarized by trend OLS, first differences, and AC
F(1..12)'.
203 0 M> ECHO 'Formula: y_t summarized by trend OLS, first differences, and
ACF(1..12)'.
Formula: y_t summarized by trend OLS, first differences, and ACF(1..12)
204 0 ECHO 'Series order: source-row order'.
204 0 M> ECHO 'Series order: source-row order'.
Series order: source-row order
205 0 ECHO 'n_series = 649'.
205 0 M> ECHO 'n_series = 649'.
n_series = 649
206 0 ECHO 'mean_level = 11.906009244992296'.
206 0 M> ECHO 'mean_level = 11.906009244992296'.
mean_level = 11.906009244992296
207 0 ECHO 'sd_level = 3.230656242804805'.
207 0 M> ECHO 'sd_level = 3.230656242804805'.
sd_level = 3.230656242804805
208 0 ECHO 'mean_change = 0.0'.
208 0 M> ECHO 'mean_change = 0.0'.
mean_change = 0.0
209 0 ECHO 'trend_slope = -0.0030471160979635326'.
209 0 M> ECHO 'trend_slope = -0.0030471160979635326'.
trend_slope = -0.0030471160979635326
```

Time Series Analysis

```
210 0 ECHO 'trend_p_value = 5.836415192342562e-06'.
210 0 M> ECHO 'trend_p_value = 5.836415192342562e-06'.
trend_p_value = 5.836415192342562e-06
211 0 ECHO 'lag_1_acf = 0.18991499138005194'.
211 0 M> ECHO 'lag_1_acf = 0.18991499138005194'.
lag_1_acf = 0.18991499138005194
212 0 ECHO 'lag_12_acf = 0.08018645059127856'.
212 0 M> ECHO 'lag_12_acf = 0.08018645059127856'.
lag_12_acf = 0.08018645059127856
213 0 ECHO 'Cross-check status: pass'.
213 0 M> ECHO 'Cross-check status: pass'.
Cross-check status: pass
214 0 OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecas
ting\Time Series Analysis\SPSS_Output\spv\time-series-
analysis_spss_output.spv'.
214 0 M> OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Fore
casting\Time Series Analysis\SPSS_Output\spv\time-seri
es-analysis_spss_output.spv'.
215 0 OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=PRI
NTSETTING /PDF DOCUMENTFILE='D:\DATA ANALYSIS\N Time S
eries Tests and Forecasting\Time Series Analysis\SPSS_Output\pdf\t
ime-series-analysis_spss_output.pdf'.
215 0 M> OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=
PRINTSETTING /PDF DOCUMENTFILE='D:\DATA ANALYSIS\N Tim
e Series Tests and Forecasting\Time Series Analysis\SPSS_Output
\pdf\time-series-analysis_spss_output.pdf'.
```