```
428  0  OUTPUT ACTIVATE EngleGrangerCointegrationTestOutput.
428  0 M>  OUTPUT ACTIVATE EngleGrangerCointegrationTestOutput.
429  0  TITLE 'Engle Granger Cointegration Test'.
429  0 M>  TITLE 'Engle Granger Cointegration Test'.
```

```
 430  0  GET DATA /TYPE=TXT /FILE='D:\DATA ANALYSIS\N Time Series Tests and Fo
recasting\Engle Granger Cointegration Test\dataset.csv
            ' /ENCODING='UTF8' /DELCASE=LINE /DELIMITERS=',' /QUALIFIER='"' /A
RRANGEMENT=DELIMITED /FIRSTCASE=2
 430  0 M>  GET DATA /TYPE=TXT /FILE='D:\DATA ANALYSIS\N Time Series Tests and
 Forecasting\Engle Granger Cointegration Test\dataset.
              csv' /ENCODING='UTF8' /DELCASE=LINE /DELIMITERS=',' /QUALIFIER=
'"' /ARRANGEMENT=DELIMITED /FIRSTCASE=2
 431  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.
 431  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.
 432  0  DATASET NAME EngleGrangerCointegrationTestData.
 432  0 M>  DATASET NAME EngleGrangerCointegrationTestData.
 433  0  COMPUTE time_index=$CASENUM.
 433  0 M>  COMPUTE time_index=$CASENUM.
 434  0  EXECUTE.
 434  0 M>  EXECUTE.
 435  0  * BEGIN METHOD-SPECIFIC SPSS WORKFLOW.
 435  0 M>  * BEGIN METHOD-SPECIFIC SPSS WORKFLOW.
 436  0  REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT G3 /METHO
D=ENTER time_index G2 /SAVE RESID(eg_resid).
 436  0 M>  REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT G3 /ME
THOD=ENTER time_index G2 /SAVE RESID(eg_resid).
```

Regression

Notes

Output Created		18-JUL-2026 15:52:02
Comments		
Input	Data	D:\DATA ANALYSIS\N Time Series Tests and Forecasting\Engle Granger Cointegration Test\dataset.csv
	Active Dataset	EngleGrangerCointegratio nTestData
	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 G2 /SAVE RESID(eg_resid).
Resources	Processor Time	00:00:00.11
	Elapsed Time	00:00:00.99
	Memory Required	4304 bytes
	Additional Memory Required for Residual Plots	0 bytes
Variables Created or Modified	eg_resid	Unstandardized Residual

[EngleGrangerCointegrationTestData]

Engle Granger Cointegration Test

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	G2, 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	.919[a]	.844	.844	1.277

a. Predictors: (Constant), G2, time_index

b. Dependent Variable: G3

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5710.056	2	2855.028	1751.167	.000[b]
	Residual	1053.211	646	1.630		
	Total	6763.267	648			

a. Dependent Variable: G3

b. Predictors: (Constant), G2, time_index

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.305	.239		1.278	.202
	time_index	.000	.000	-.024	-1.503	.133
	G2	1.014	.017	.915	58.074	.000

Coefficients[a]

Model		95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
1	(Constant)	-.164	.774
	time_index	-.001	.000
	G2	.980	1.048

a. Dependent Variable: G3

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	.06	19.43	11.91	2.968	649
Residual	-9.376	5.579	.000	1.275	649
Std. Predicted Value	-3.992	2.536	.000	1.000	649
Std. Residual	-7.343	4.369	.000	.998	649

a. Dependent Variable: G3

```
 437  0  COMPUTE dres=eg_resid-LAG(eg_resid).
 437  0 M>  COMPUTE dres=eg_resid-LAG(eg_resid).
 438  0  COMPUTE res_l1=LAG(eg_resid).
 438  0 M>  COMPUTE res_l1=LAG(eg_resid).
 439  0  COMPUTE dr_l1=LAG(dres,1).
 439  0 M>  COMPUTE dr_l1=LAG(dres,1).
 440  0  COMPUTE dr_l2=LAG(dres,2).
 440  0 M>  COMPUTE dr_l2=LAG(dres,2).
 441  0  COMPUTE dr_l3=LAG(dres,3).
 441  0 M>  COMPUTE dr_l3=LAG(dres,3).
 442  0  EXECUTE.
 442  0 M>  EXECUTE.
 443  0  REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT dres /MET
HOD=ENTER res_l1 dr_l1 dr_l2 dr_l3.
 443  0 M>  REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT dres /
METHOD=ENTER res_l1 dr_l1 dr_l2 dr_l3.
```

Regression

Notes

Output Created		18-JUL-2026 15:52:03
Comments		
Input	Data	D:\DATA ANALYSIS\N Time Series Tests and Forecasting\Engle Granger Cointegration Test\dataset.csv
	Active Dataset	EngleGrangerCointegratio nTestData
	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 dres /METHOD=ENTER res_l1 dr_l1 dr_l2 dr_l3.
Resources	Processor Time	00:00:00.06
	Elapsed Time	00:00:00.20
	Memory Required	5632 bytes
	Additional Memory Required for Residual Plots	0 bytes

Engle Granger Cointegration Test

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	dr_l3, res_l1, dr_l2, dr_l1[b]	.	Enter

a. Dependent Variable: dres

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.695[a]	.483	.480	1.25434

a. Predictors: (Constant), dr_l3, res_l1, dr_l2, dr_l1

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	940.117	4	235.029	149.379	.000[b]
	Residual	1006.961	640	1.573		
	Total	1947.078	644			

a. Dependent Variable: dres

b. Predictors: (Constant), dr_l3, res_l1, dr_l2, dr_l1

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.003	.049		.065	.948
	res_l1	-.666	.067	-.489	-9.897	.000
	dr_l1	-.293	.062	-.293	-4.703	.000
	dr_l2	-.155	.054	-.155	-2.850	.005
	dr_l3	-.061	.040	-.061	-1.551	.121

Coefficients[a]

Model		95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
1	(Constant)	-.094	.100
	res_l1	-.798	-.534
	dr_l1	-.415	-.171
	dr_l2	-.262	-.048
	dr_l3	-.139	.016

a. Dependent Variable: dres

```
 444  0  * END METHOD-SPECIFIC SPSS WORKFLOW.
 444  0 M>  * END METHOD-SPECIFIC SPSS WORKFLOW.
 445  0  SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecasting\En
gle Granger Cointegration Test\SPSS_Output\sav\engle-g
           ranger-cointegration-test_spss_ready_data.sav' /COMPRESSED.
 445  0 M>  SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecasting
\Engle Granger Cointegration Test\SPSS_Output\sav\engl
              e-granger-cointegration-test_spss_ready_data.sav' /COMPRESSED.
 446  0  ECHO 'Engle Granger Cointegration Test'.
 446  0 M>  ECHO 'Engle Granger Cointegration Test'.
Engle Granger Cointegration Test
 447  0  ECHO 'Method type: hypothesis_test'.
 447  0 M>  ECHO 'Method type: hypothesis_test'.
Method type: hypothesis_test
 448  0  ECHO 'Design: Two-step Engle-Granger cointegration test of G3 and G2
with constant and trend.'.
 448  0 M>  ECHO 'Design: Two-step Engle-Granger cointegration test of G3 and
G2 with constant and trend.'.
Design: Two-step Engle-Granger cointegration test of G3 and G2 with constant a
nd trend.
 449  0  ECHO 'Formula: G3_t=a+b*t+beta*G2_t+u_t; ADF(u_t) tests no cointegrat
ion'.
 449  0 M>  ECHO 'Formula: G3_t=a+b*t+beta*G2_t+u_t; ADF(u_t) tests no cointeg
ration'.
Formula: G3_t=a+b*t+beta*G2_t+u_t; ADF(u_t) tests no cointegration
 450  0  ECHO 'Series order: source-row order'.
 450  0 M>  ECHO 'Series order: source-row order'.
```

```
Series order: source-row order
 451  0  ECHO 'engle_granger_statistic = -6.209619716865916'.
 451  0 M>  ECHO 'engle_granger_statistic = -6.209619716865916'.
engle_granger_statistic = -6.209619716865916
 452  0  ECHO 'p_value = 3.324896613644558e-06'.
 452  0 M>  ECHO 'p_value = 3.324896613644558e-06'.
p_value = 3.324896613644558e-06
 453  0  ECHO 'critical_1_percent = -4.351530123742569'.
 453  0 M>  ECHO 'critical_1_percent = -4.351530123742569'.
critical_1_percent = -4.351530123742569
 454  0  ECHO 'critical_5_percent = -3.795275606043286'.
 454  0 M>  ECHO 'critical_5_percent = -3.795275606043286'.
critical_5_percent = -3.795275606043286
 455  0  ECHO 'critical_10_percent = -3.5072561120066714'.
 455  0 M>  ECHO 'critical_10_percent = -3.5072561120066714'.
critical_10_percent = -3.5072561120066714
 456  0  ECHO 'cointegrating_slope = 1.0140954112815521'.
 456  0 M>  ECHO 'cointegrating_slope = 1.0140954112815521'.
cointegrating_slope = 1.0140954112815521
 457  0  ECHO 'n_series = 649'.
 457  0 M>  ECHO 'n_series = 649'.
n_series = 649
 458  0  ECHO 'Cross-check status: pass'.
 458  0 M>  ECHO 'Cross-check status: pass'.
Cross-check status: pass
 459  0  OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecas
ting\Engle Granger Cointegration Test\SPSS_Output\spv\
            engle-granger-cointegration-test_spss_output.spv'.
 459  0 M>  OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Fore
casting\Engle Granger Cointegration Test\SPSS_Output\s
               pv\engle-granger-cointegration-test_spss_output.spv'.
 460  0  OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=PRI
NTSETTING /PDF DOCUMENTFILE='D:\DATA ANALYSIS\N Time S
            eries Tests and Forecasting\Engle Granger Cointegration Test\SPSS_
Output\pdf\engle-granger-cointegration-test_spss_outpu
            t.pdf'.
 460  0 M>  OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=
PRINTSETTING /PDF DOCUMENTFILE='D:\DATA ANALYSIS\N Tim
```

```
               e Series Tests and Forecasting\Engle Granger Cointegration Test
\SPSS_Output\pdf\engle-granger-cointegration-test_spss
               _output.pdf'.
```