

```
1345 0 OUTPUT ACTIVATE VECModelOutput.  
1345 0 M> OUTPUT ACTIVATE VECModelOutput.  
1346 0 TITLE 'VECM Model'.  
1346 0 M> TITLE 'VECM Model'.
```

VECM Model

```
1347 0 GET DATA /TYPE=TXT /FILE='D:\DATA ANALYSIS\N Time Series Tests and Fo
recasting\VECM Model\dataset.csv' /ENCODING='UTF8' /DE
LCASE=LINE /DELIMITERS=', ' /QUALIFIER='"' /ARRANGEMENT=DELIMITED /
FIRSTCASE=2
1347 0 M> GET DATA /TYPE=TXT /FILE='D:\DATA ANALYSIS\N Time Series Tests and
Forecasting\VECM Model\dataset.csv' /ENCODING='UTF8'
/DELCASE=LINE /DELIMITERS=', ' /QUALIFIER='"' /ARRANGEMENT=DELIM
ITED /FIRSTCASE=2
1348 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.
1348 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.
1349 0 DATASET NAME VECModelData.
1349 0 M> DATASET NAME VECModelData.
1350 0 COMPUTE time_index=$CASENUM.
1350 0 M> COMPUTE time_index=$CASENUM.
1351 0 EXECUTE.
1351 0 M> EXECUTE.
1352 0 * BEGIN METHOD-SPECIFIC SPSS WORKFLOW.
1352 0 M> * BEGIN METHOD-SPECIFIC SPSS WORKFLOW.
1353 0 REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT G1 /METHO
D=ENTER G2 G3 /SAVE RESID(ect).
1353 0 M> REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT G1 /ME
THOD=ENTER G2 G3 /SAVE RESID(ect).
```

Regression

VECM Model

Notes

Output Created		18-JUL-2026 15:54:43
Comments		
Input	Data	D:\DATA ANALYSIS\N Time Series Tests and Forecasting\VECM Model\dataset.csv
	Active Dataset	VECMModelData
	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 G1 /METHOD=ENTER G2 G3 /SAVE RESID(ect).
Resources	Processor Time	00:00:00.08
	Elapsed Time	00:00:00.14
	Memory Required	4304 bytes
	Additional Memory Required for Residual Plots	0 bytes
Variables Created or Modified	ect	Unstandardized Residual

[VECMModelData]

VECM Model

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	G3, G2 ^b	.	Enter

a. Dependent Variable: G1

b. All requested variables entered.

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.869 ^a	.755	.754	1.362

a. Predictors: (Constant), G3, G2

b. Dependent Variable: G1

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3685.628	2	1842.814	993.695	.000 ^b
	Residual	1198.012	646	1.855		
	Total	4883.639	648			

a. Dependent Variable: G1

b. Predictors: (Constant), G3, G2

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.948	.219		8.892	.000
	G2	.639	.046	.678	13.748	.000
	G3	.173	.042	.204	4.136	.000

VECM Model

Coefficients^a

Model		95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
1	(Constant)	1.518	2.379
	G2	.547	.730
	G3	.091	.256

a. Dependent Variable: G1

Residuals Statistics^a

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.95	17.37	11.40	2.385	649
Residual	-10.878	7.052	.000	1.360	649
Std. Predicted Value	-3.963	2.505	.000	1.000	649
Std. Residual	-7.988	5.178	.000	.998	649

a. Dependent Variable: G1

```

1354 0 COMPUTE dG1=G1-LAG(G1).
1354 0 M> COMPUTE dG1=G1-LAG(G1).
1355 0 COMPUTE dG2=G2-LAG(G2).
1355 0 M> COMPUTE dG2=G2-LAG(G2).
1356 0 COMPUTE dG3=G3-LAG(G3).
1356 0 M> COMPUTE dG3=G3-LAG(G3).
1357 0 COMPUTE ect_l1=LAG(ect).
1357 0 M> COMPUTE ect_l1=LAG(ect).
1358 0 COMPUTE dG1_l1=LAG(dG1).
1358 0 M> COMPUTE dG1_l1=LAG(dG1).
1359 0 COMPUTE dG2_l1=LAG(dG2).
1359 0 M> COMPUTE dG2_l1=LAG(dG2).
1360 0 COMPUTE dG3_l1=LAG(dG3).
1360 0 M> COMPUTE dG3_l1=LAG(dG3).
1361 0 REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT dG1 /METH
OD=ENTER ect_l1 dG1_l1 dG2_l1 dG3_l1.
1361 0 M> REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT dG1 /M
ETHOD=ENTER ect_l1 dG1_l1 dG2_l1 dG3_l1.

```

VECM Model

Regression

Notes

Output Created		18-JUL-2026 15:54:44
Comments		
Input	Data	D:\DATA ANALYSIS\N Time Series Tests and Forecasting\VECM Model\dataset.csv
	Active Dataset	VECMModelData
	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 dG1 /METHOD=ENTER ect_l1 dG1_l1 dG2_l1 dG3_l1.
Resources	Processor Time	00:00:00.14
	Elapsed Time	00:00:00.13
	Memory Required	5712 bytes
	Additional Memory Required for Residual Plots	0 bytes

VECM Model

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	dG3_l1, ect_l1, dG1_l1, dG2_l1 ^b	.	Enter

a. Dependent Variable: dG1

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.545 ^a	.297	.293	2.78270

a. Predictors: (Constant), dG3_l1, ect_l1, dG1_l1, dG2_l1

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2101.715	4	525.429	67.855	.000 ^b
	Residual	4971.283	642	7.743		
	Total	7072.998	646			

a. Dependent Variable: dG1

b. Predictors: (Constant), dG3_l1, ect_l1, dG1_l1, dG2_l1

VECM Model

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.014	.109		.125	.900
	ect_l1	-.623	.105	-.243	-5.917	.000
	dG1_l1	-.089	.083	-.090	-1.074	.283
	dG2_l1	-.232	.086	-.265	-2.691	.007
	dG3_l1	-.125	.064	-.156	-1.942	.053

Coefficients^a

Model		95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
1	(Constant)	-.201	.229
	ect_l1	-.829	-.416
	dG1_l1	-.252	.074
	dG2_l1	-.401	-.063
	dG3_l1	-.252	.001

a. Dependent Variable: dG1

```
1362 0 REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT dG2 /METHOD=ENTER ect_l1 dG1_l1 dG2_l1 dG3_l1.
```

```
1362 0 M> REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT dG2 /METHOD=ENTER ect_l1 dG1_l1 dG2_l1 dG3_l1.
```

Regression

VECM Model

Notes

Output Created		18-JUL-2026 15:54:44
Comments		
Input	Data	D:\DATA ANALYSIS\N Time Series Tests and Forecasting\VECM Model\dataset.csv
	Active Dataset	VECMModelData
	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 dG2 /METHOD=ENTER ect_l1 dG1_l1 dG2_l1 dG3_l1.
Resources	Processor Time	00:00:00.08
	Elapsed Time	00:00:00.08
	Memory Required	5712 bytes
	Additional Memory Required for Residual Plots	0 bytes

VECM Model

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	dG3_l1, ect_l1, dG1_l1, dG2_l1 ^b	.	Enter

a. Dependent Variable: dG2

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.538 ^a	.289	.285	3.19944

a. Predictors: (Constant), dG3_l1, ect_l1, dG1_l1, dG2_l1

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2672.235	4	668.059	65.263	.000 ^b
	Residual	6571.765	642	10.236		
	Total	9244.000	646			

a. Dependent Variable: dG2

b. Predictors: (Constant), dG3_l1, ect_l1, dG1_l1, dG2_l1

VECM Model

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.003	.126		-.022	.982
	ect_l1	.090	.121	.031	.743	.458
	dG1_l1	.021	.095	.018	.217	.828
	dG2_l1	-.537	.099	-.537	-5.419	.000
	dG3_l1	-.014	.074	-.015	-.185	.853

Coefficients^a

Model		95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
1	(Constant)	-.250	.244
	ect_l1	-.148	.327
	dG1_l1	-.167	.208
	dG2_l1	-.731	-.342
	dG3_l1	-.159	.132

a. Dependent Variable: dG2

```
1363 0 REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT dG3 /METHOD=ENTER ect_l1 dG1_l1 dG2_l1 dG3_l1.
```

```
1363 0 M> REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT dG3 /METHOD=ENTER ect_l1 dG1_l1 dG2_l1 dG3_l1.
```

Regression

VECM Model

Notes

Output Created		18-JUL-2026 15:54:44
Comments		
Input	Data	D:\DATA ANALYSIS\N Time Series Tests and Forecasting\VECM Model\dataset.csv
	Active Dataset	VECMModelData
	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 dG3 /METHOD=ENTER ect_l1 dG1_l1 dG2_l1 dG3_l1.
Resources	Processor Time	00:00:00.08
	Elapsed Time	00:00:00.07
	Memory Required	5712 bytes
	Additional Memory Required for Residual Plots	0 bytes

VECM Model

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	dG3_l1, ect_l1, dG1_l1, dG2_l1 ^b	.	Enter

a. Dependent Variable: dG3

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.533 ^a	.284	.280	3.49506

a. Predictors: (Constant), dG3_l1, ect_l1, dG1_l1, dG2_l1

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3113.671	4	778.418	63.724	.000 ^b
	Residual	7842.329	642	12.215		
	Total	10956.000	646			

a. Dependent Variable: dG3

b. Predictors: (Constant), dG3_l1, ect_l1, dG1_l1, dG2_l1

VECM Model

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.003	.137		-.019	.985
	ect_l1	.119	.132	.037	.901	.368
	dG1_l1	-.023	.104	-.019	-.223	.824
	dG2_l1	.045	.108	.041	.412	.681
	dG3_l1	-.551	.081	-.551	-6.804	.000

Coefficients^a

Model		95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
1	(Constant)	-.272	.267
	ect_l1	-.140	.379
	dG1_l1	-.228	.181
	dG2_l1	-.168	.257
	dG3_l1	-.710	-.392

a. Dependent Variable: dG3

```

1364 0 * END METHOD-SPECIFIC SPSS WORKFLOW.
1364 0 M> * END METHOD-SPECIFIC SPSS WORKFLOW.
1365 0 SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecasting\VE
CM Model\SPSS_Output\sav\vecm-model_spss_ready_data.sa
v' /COMPRESSED.
1365 0 M> SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecasting
\VECM Model\SPSS_Output\sav\vecm-model_spss_ready_data
.sav' /COMPRESSED.
1366 0 ECHO 'VECM Model'.
1366 0 M> ECHO 'VECM Model'.
VECM Model
1367 0 ECHO 'Method type: error_correction_model'.
1367 0 M> ECHO 'Method type: error_correction_model'.
Method type: error_correction_model
1368 0 ECHO 'Design: Rank-one VECM for G1, G2, and G3 with one differenced 1
ag and restricted constant.'.
```

VECM Model

```
1368 0 M> ECHO 'Design: Rank-one VECM for G1, G2, and G3 with one difference
d lag and restricted constant.'.
Design: Rank-one VECM for G1, G2, and G3 with one differenced lag and restrict
ed constant.
1369 0 ECHO 'Formula: Delta Y_t=alpha*beta''Y_(t-1)+Gamma*Delta Y_(t-1)+e_t'
.
1369 0 M> ECHO 'Formula: Delta Y_t=alpha*beta''Y_(t-1)+Gamma*Delta Y_(t-1)+e
_t'.
Formula: Delta Y_t=alpha*beta'Y_(t-1)+Gamma*Delta Y_(t-1)+e_t
1370 0 ECHO 'Series order: source-row order'.
1370 0 M> ECHO 'Series order: source-row order'.
Series order: source-row order
1371 0 ECHO 'cointegration_rank = 1'.
1371 0 M> ECHO 'cointegration_rank = 1'.
cointegration_rank = 1
1372 0 ECHO 'differenced_lags = 1'.
1372 0 M> ECHO 'differenced_lags = 1'.
differenced_lags = 1
1373 0 ECHO 'alpha_G1 = -0.2538631042253738'.
1373 0 M> ECHO 'alpha_G1 = -0.2538631042253738'.
alpha_G1 = -0.2538631042253738
1374 0 ECHO 'alpha_G2 = 0.20429364293386043'.
1374 0 M> ECHO 'alpha_G2 = 0.20429364293386043'.
alpha_G2 = 0.20429364293386043
1375 0 ECHO 'alpha_G3 = 0.5627609186736474'.
1375 0 M> ECHO 'alpha_G3 = 0.5627609186736474'.
alpha_G3 = 0.5627609186736474
1376 0 ECHO 'beta_G2 = 0.18270997236275852'.
1376 0 M> ECHO 'beta_G2 = 0.18270997236275852'.
beta_G2 = 0.18270997236275852
1377 0 ECHO 'beta_G3 = -1.069187082496112'.
1377 0 M> ECHO 'beta_G3 = -1.069187082496112'.
beta_G3 = -1.069187082496112
1378 0 ECHO 'forecast_12_G3 = 10.493300243882775'.
1378 0 M> ECHO 'forecast_12_G3 = 10.493300243882775'.
forecast_12_G3 = 10.493300243882775
1379 0 ECHO 'Cross-check status: pass'.
1379 0 M> ECHO 'Cross-check status: pass'.
Cross-check status: pass
```

VECM Model

```
1380 0 OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecas
ting\VECM Model\SPSS_Output\spv\vecm-model_spss_output
.spv'.
```

```
1380 0 M> OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Fore
casting\VECM Model\SPSS_Output\spv\vecm-model_spss_out
put.spv'.
```

```
1381 0 OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=PRI
NTSETTING /PDF DOCUMENTFILE='D:\DATA ANALYSIS\N Time S
eries Tests and Forecasting\VECM Model\SPSS_Output\pdf\vecm-model_
spss_output.pdf'.
```

```
1381 0 M> OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=
PRINTSETTING /PDF DOCUMENTFILE='D:\DATA ANALYSIS\N Tim
e Series Tests and Forecasting\VECM Model\SPSS_Output\pdf\vecm-
model_spss_output.pdf'.
```