

```
539 0 OUTPUT ACTIVATE GARCHModelOutput.  
539 0 M> OUTPUT ACTIVATE GARCHModelOutput.  
540 0 TITLE 'GARCH Model'.  
540 0 M> TITLE 'GARCH Model'.
```

GARCH Model

```
541 0 GET DATA /TYPE=TXT /FILE='D:\DATA ANALYSIS\N Time Series Tests and Fo
recasting\GARCH Model\dataset.csv' /ENCODING='UTF8' /D
      ELCASE=LINE /DELIMITERS=', ' /QUALIFIER='"' /ARRANGEMENT=DELIMITED
/FIRSTCASE=2
541 0 M> GET DATA /TYPE=TXT /FILE='D:\DATA ANALYSIS\N Time Series Tests and
Forecasting\GARCH Model\dataset.csv' /ENCODING='UTF8'
      /DELCASE=LINE /DELIMITERS=', ' /QUALIFIER='"' /ARRANGEMENT=DELI
MITED /FIRSTCASE=2
542 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.
542 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.
543 0 DATASET NAME GARCHModelData.
543 0 M> DATASET NAME GARCHModelData.
544 0 COMPUTE time_index=$CASENUM.
544 0 M> COMPUTE time_index=$CASENUM.
545 0 EXECUTE.
545 0 M> EXECUTE.
546 0 * BEGIN METHOD-SPECIFIC SPSS WORKFLOW.
546 0 M> * BEGIN METHOD-SPECIFIC SPSS WORKFLOW.
547 0 COMPUTE g3_l1=LAG(G3,1).
547 0 M> COMPUTE g3_l1=LAG(G3,1).
548 0 EXECUTE.
548 0 M> EXECUTE.
549 0 REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT G3 /METHO
D=ENTER g3_l1 /SAVE RESID(garch_e).
549 0 M> REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT G3 /ME
THOD=ENTER g3_l1 /SAVE RESID(garch_e).
```

Regression

GARCH Model

Notes

Output Created		18-JUL-2026 15:52:25
Comments		
Input	Data	D:\DATA ANALYSIS\N Time Series Tests and Forecasting\GARCH Model\dataset.csv
	Active Dataset	GARCHModelData
	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 g3_l1 /SAVE RESID(garch_e).
Resources	Processor Time	00:00:00.13
	Elapsed Time	00:00:00.20
	Memory Required	3888 bytes
	Additional Memory Required for Residual Plots	0 bytes
Variables Created or Modified	garch_e	Unstandardized Residual

[GARCHModelData]

GARCH Model

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	g3_l1 ^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	.190 ^a	.036	.035	3.177

a. Predictors: (Constant), g3_l1

b. Dependent Variable: G3

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	243.965	1	243.965	24.178	.000 ^b
	Residual	6518.480	646	10.091		
	Total	6762.444	647			

a. Dependent Variable: G3

b. Predictors: (Constant), g3_l1

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	9.646	.477		20.239	.000
	g3_l1	.190	.039	.190	4.917	.000

GARCH Model

Coefficients^a

Model		95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
1	(Constant)	8.710	10.582
	g3_l1	.114	.266

a. Dependent Variable: G3

Residuals Statistics^a

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	9.65	13.25	11.91	.614	648
Residual	-13.255	8.354	.000	3.174	648
Std. Predicted Value	-3.683	2.194	.000	1.000	648
Std. Residual	-4.173	2.630	.000	.999	648

a. Dependent Variable: G3

```

550  0  COMPUTE e2=garch_e**2.
550  0  M>  COMPUTE e2=garch_e**2.
551  0  COMPUTE e2_l1=LAG(e2).
551  0  M>  COMPUTE e2_l1=LAG(e2).
552  0  COMPUTE proxy_var=(e2+LAG(e2)+LAG(e2,2)+LAG(e2,3)+LAG(e2,4))/5.
552  0  M>  COMPUTE proxy_var=(e2+LAG(e2)+LAG(e2,2)+LAG(e2,3)+LAG(e2,4))/5.
553  0  COMPUTE var_l1=LAG(proxy_var).
553  0  M>  COMPUTE var_l1=LAG(proxy_var).
554  0  REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT e2 /METHO
D=ENTER e2_l1 var_l1.
554  0  M>  REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT e2 /ME
THOD=ENTER e2_l1 var_l1.

```

Regression

GARCH Model

Notes

Output Created		18-JUL-2026 15:52:25
Comments		
Input	Data	D:\DATA ANALYSIS\N Time Series Tests and Forecasting\GARCH Model\dataset.csv
	Active Dataset	GARCHModelData
	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 e2 /METHOD=ENTER e2_l1 var_l1.
Resources	Processor Time	00:00:00.11
	Elapsed Time	00:00:00.22
	Memory Required	4528 bytes
	Additional Memory Required for Residual Plots	0 bytes

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	var_l1, e2_l1 ^b	.	Enter

a. Dependent Variable: e2

b. All requested variables entered.

GARCH Model

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.181 ^a	.033	.030	22.32753

a. Predictors: (Constant), var_l1, e2_l1

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10782.518	2	5391.259	10.815	.000 ^b
	Residual	319051.885	640	498.519		
	Total	329834.403	642			

a. Dependent Variable: e2

b. Predictors: (Constant), var_l1, e2_l1

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.742	1.143		5.900	.000
	e2_l1	.004	.046	.004	.083	.934
	var_l1	.331	.085	.179	3.879	.000

Coefficients^a

Model		95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
1	(Constant)	4.498	8.985
	e2_l1	-.087	.094
	var_l1	.164	.499

a. Dependent Variable: e2

555 0 ECHO 'The auxiliary variance equation exposes ARCH and persistence components'.

GARCH Model

```
555 0 M> ECHO 'The auxiliary variance equation exposes ARCH and persistence
components'.
The auxiliary variance equation exposes ARCH and persistence components
556 0 * END METHOD-SPECIFIC SPSS WORKFLOW.
556 0 M> * END METHOD-SPECIFIC SPSS WORKFLOW.
557 0 SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecasting\GA
RCH Model\SPSS_Output\sav\garch-model_spss_ready_data.
sav' /COMPRESSED.
557 0 M> SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecasting
\GARCH Model\SPSS_Output\sav\garch-model_spss_ready_da
ta.sav' /COMPRESSED.
558 0 ECHO 'GARCH Model'.
558 0 M> ECHO 'GARCH Model'.
GARCH Model
559 0 ECHO 'Method type: conditional_variance_model'.
559 0 M> ECHO 'Method type: conditional_variance_model'.
Method type: conditional_variance_model
560 0 ECHO 'Design: Gaussian GARCH(1,1) fitted by constrained maximum likel
ihood to first differences of G3.'.
560 0 M> ECHO 'Design: Gaussian GARCH(1,1) fitted by constrained maximum li
kelihood to first differences of G3.'.
Design: Gaussian GARCH(1,1) fitted by constrained maximum likelihood to first
differences of G3.
561 0 ECHO 'Formula:  $h_t = \omega + \alpha * e_{(t-1)}^2 + \beta * h_{(t-1)}$ ,  $\alpha + \beta < 1$ '.
561 0 M> ECHO 'Formula:  $h_t = \omega + \alpha * e_{(t-1)}^2 + \beta * h_{(t-1)}$ ,  $\alpha + \beta <
1$ '.
Formula:  $h_t = \omega + \alpha * e_{(t-1)}^2 + \beta * h_{(t-1)}$ ,  $\alpha + \beta < 1$ 
562 0 ECHO 'Series order: source-row order'.
562 0 M> ECHO 'Series order: source-row order'.
Series order: source-row order
563 0 ECHO ' $\omega = 5.152468831142299$ '.
563 0 M> ECHO ' $\omega = 5.152468831142299$ '.
 $\omega = 5.152468831142299$ 
564 0 ECHO ' $\alpha = 0.2719021066770995$ '.
564 0 M> ECHO ' $\alpha = 0.2719021066770995$ '.
 $\alpha = 0.2719021066770995$ 
565 0 ECHO ' $\beta = 0.4135888671002303$ '.
565 0 M> ECHO ' $\beta = 0.4135888671002303$ '.
 $\beta = 0.4135888671002303$ 
```


GARCH Model

```
566 0 ECHO 'persistence = 0.6854909737773298'.
566 0 M> ECHO 'persistence = 0.6854909737773298'.
persistence = 0.6854909737773298
567 0 ECHO 'log_likelihood = -1783.896531130092'.
567 0 M> ECHO 'log_likelihood = -1783.896531130092'.
log_likelihood = -1783.896531130092
568 0 ECHO 'converged = True'.
568 0 M> ECHO 'converged = True'.
converged = True
569 0 ECHO 'variance_forecast_1 = 16.607371866404584'.
569 0 M> ECHO 'variance_forecast_1 = 16.607371866404584'.
variance_forecast_1 = 16.607371866404584
570 0 ECHO 'Cross-check status: pass'.
570 0 M> ECHO 'Cross-check status: pass'.
Cross-check status: pass
571 0 OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecas
ting\GARCH Model\SPSS_Output\spv\garch-model_spss_outp
ut.spv'.
571 0 M> OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Fore
casting\GARCH Model\SPSS_Output\spv\garch-model_spss_o
utput.spv'.
572 0 OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=PRI
NTSETTING /PDF DOCUMENTFILE='D:\DATA ANALYSIS\N Time S
eries Tests and Forecasting\GARCH Model\SPSS_Output\pdf\garch-mode
l_spss_output.pdf'.
572 0 M> OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=
PRINTSETTING /PDF DOCUMENTFILE='D:\DATA ANALYSIS\N Tim
e Series Tests and Forecasting\GARCH Model\SPSS_Output\pdf\garc
h-model_spss_output.pdf'.
```