

```
149 0 OUTPUT ACTIVATE ARMAModelOutput.  
149 0 M> OUTPUT ACTIVATE ARMAModelOutput.  
150 0 TITLE 'ARMA Model'.  
150 0 M> TITLE 'ARMA Model'.
```

ARMA Model

```
151 0 GET DATA /TYPE=TXT /FILE='D:\DATA ANALYSIS\N Time Series Tests and Fo
recasting\ARMA Model\dataset.csv' /ENCODING='UTF8' /DE
LCASE=LINE /DELIMITERS=', ' /QUALIFIER='"' /ARRANGEMENT=DELIMITED /
FIRSTCASE=2
151 0 M> GET DATA /TYPE=TXT /FILE='D:\DATA ANALYSIS\N Time Series Tests and
Forecasting\ARMA Model\dataset.csv' /ENCODING='UTF8'
/DELCASE=LINE /DELIMITERS=', ' /QUALIFIER='"' /ARRANGEMENT=DELIM
ITED /FIRSTCASE=2
152 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.
152 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.
153 0 DATASET NAME ARMAModelData.
153 0 M> DATASET NAME ARMAModelData.
154 0 COMPUTE time_index=$CASENUM.
154 0 M> COMPUTE time_index=$CASENUM.
155 0 EXECUTE.
155 0 M> EXECUTE.
156 0 * BEGIN METHOD-SPECIFIC SPSS WORKFLOW.
156 0 M> * BEGIN METHOD-SPECIFIC SPSS WORKFLOW.
157 0 COMPUTE g3_l1=LAG(G3,1).
157 0 M> COMPUTE g3_l1=LAG(G3,1).
158 0 EXECUTE.
158 0 M> EXECUTE.
159 0 REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT G3 /METHO
D=ENTER time_index g3_l1 /SAVE RESID(arma_stage1).
159 0 M> REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT G3 /ME
THOD=ENTER time_index g3_l1 /SAVE RESID(arma_stage1).
```

Regression

ARMA Model

Notes

Output Created		18-JUL-2026 15:50:13
Comments		
Input	Data	D:\DATA ANALYSIS\N Time Series Tests and Forecasting\ARMA Model\dataset.csv
	Active Dataset	ARMAModelData
	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 g3_l1 /SAVE RESID(arma_stage1).
Resources	Processor Time	00:00:00.16
	Elapsed Time	00:00:00.21
	Memory Required	4352 bytes
	Additional Memory Required for Residual Plots	0 bytes
Variables Created or Modified	arma_stage1	Unstandardized Residual

[ARMAModelData]

ARMA Model

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	g3_l1, 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	.240 ^a	.058	.055	3.143

a. Predictors: (Constant), g3_l1, time_index

b. Dependent Variable: G3

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	389.681	2	194.841	19.720	.000 ^b
	Residual	6372.763	645	9.880		
	Total	6762.444	647			

a. Dependent Variable: G3

b. Predictors: (Constant), g3_l1, time_index

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	10.798	.559		19.320	.000
	time_index	-.003	.001	-.149	-3.840	.000
	g3_l1	.164	.039	.164	4.213	.000

ARMA Model

Coefficients^a

Model		95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
1	(Constant)	9.700	11.895
	time_index	-.004	-.001
	g3_l1	.087	.240

a. Dependent Variable: G3

Residuals Statistics^a

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	9.14	13.55	11.91	.776	648
Residual	-12.280	8.766	.000	3.138	648
Std. Predicted Value	-3.561	2.121	.000	1.000	648
Std. Residual	-3.907	2.789	.000	.998	648

a. Dependent Variable: G3

```

160  0  COMPUTE e_l1=LAG(arma_stage1).
160  0  M>  COMPUTE e_l1=LAG(arma_stage1).
161  0  EXECUTE.
161  0  M>  EXECUTE.
162  0  REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT G3 /METHO
D=ENTER time_index g3_l1 e_l1 /SAVE PRED(arma_fit) RES
      ID(arma_resid).
162  0  M>  REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT G3 /ME
THOD=ENTER time_index g3_l1 e_l1 /SAVE PRED(arma_fit)
      RESID(arma_resid).

```

Regression

ARMA Model

Notes

Output Created		18-JUL-2026 15:50:14
Comments		
Input	Data	D:\DATA ANALYSIS\N Time Series Tests and Forecasting\ARMA Model\dataset.csv
	Active Dataset	ARMAModelData
	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 g3_l1 e_l1 /SAVE PRED(arma_fit) RESID(arma_resid).
Resources	Processor Time	00:00:00.11
	Elapsed Time	00:00:00.22
	Memory Required	4960 bytes
	Additional Memory Required for Residual Plots	0 bytes
Variables Created or Modified	arma_fit	Unstandardized Predicted Value
	arma_resid	Unstandardized Residual

ARMA Model

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	e_l1, time_index, 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	.306 ^a	.094	.090	3.087

a. Predictors: (Constant), e_l1, time_index, g3_l1

b. Dependent Variable: G3

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	634.672	3	211.557	22.202	.000 ^b
	Residual	6126.948	643	9.529		
	Total	6761.620	646			

a. Dependent Variable: G3

b. Predictors: (Constant), e_l1, time_index, g3_l1

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-4.188	3.019		-1.387	.166
	time_index	.001	.001	.056	1.003	.316
	g3_l1	1.325	.233	1.325	5.684	.000
	e_l1	-1.194	.236	-1.159	-5.053	.000

ARMA Model

Coefficients^a

Model		95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
1	(Constant)	-10.117	1.741
	time_index	-.001	.003
	g3_l1	.867	1.783
	e_l1	-1.658	-.730

a. Dependent Variable: G3

Residuals Statistics^a

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	7.35	14.00	11.91	.991	647
Residual	-13.129	8.618	.000	3.080	647
Std. Predicted Value	-4.594	2.109	.000	1.000	647
Std. Residual	-4.253	2.792	.000	.998	647

a. Dependent Variable: G3

```

163 0 * END METHOD-SPECIFIC SPSS WORKFLOW.
163 0 M> * END METHOD-SPECIFIC SPSS WORKFLOW.
164 0 SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecasting\AR
MA Model\SPSS_Output\sav\arma-model_spss_ready_data.sa
      v' /COMPRESSED.
164 0 M> SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecasting
\ARMA Model\SPSS_Output\sav\arma-model_spss_ready_data
      .sav' /COMPRESSED.
165 0 ECHO 'ARMA Model'.
165 0 M> ECHO 'ARMA Model'.
ARMA Model
166 0 ECHO 'Method type: stationary_time_series_model'.
166 0 M> ECHO 'Method type: stationary_time_series_model'.
Method type: stationary_time_series_model
167 0 ECHO 'Design: ARMA(1,1), represented as ARIMA(1,0,1), fitted to the l
evel G3 series.'.
167 0 M> ECHO 'Design: ARMA(1,1), represented as ARIMA(1,0,1), fitted to th
e level G3 series.'.

```


ARMA Model

Design: ARMA(1,1), represented as ARIMA(1,0,1), fitted to the level G3 series.

168 0 ECHO 'Formula: $y_t = c + \phi y_{(t-1)} + e_t + \theta e_{(t-1)}$ '.

168 0 M> ECHO 'Formula: $y_t = c + \phi y_{(t-1)} + e_t + \theta e_{(t-1)}$ '.

Formula: $y_t = c + \phi y_{(t-1)} + e_t + \theta e_{(t-1)}$

169 0 ECHO 'Series order: source-row order'.

169 0 M> ECHO 'Series order: source-row order'.

Series order: source-row order

170 0 ECHO 'n_series = 649'.

170 0 M> ECHO 'n_series = 649'.

n_series = 649

171 0 ECHO 'ar_order = 1'.

171 0 M> ECHO 'ar_order = 1'.

ar_order = 1

172 0 ECHO 'ma_order = 1'.

172 0 M> ECHO 'ma_order = 1'.

ma_order = 1

173 0 ECHO 'ar_1 = 0.927875839374076'.

173 0 M> ECHO 'ar_1 = 0.927875839374076'.

ar_1 = 0.927875839374076

174 0 ECHO 'ma_1 = -0.8159067808228099'.

174 0 M> ECHO 'ma_1 = -0.8159067808228099'.

ma_1 = -0.8159067808228099

175 0 ECHO 'aic = 3293.4588705550486'.

175 0 M> ECHO 'aic = 3293.4588705550486'.

aic = 3293.4588705550486

176 0 ECHO 'bic = 3315.836034138569'.

176 0 M> ECHO 'bic = 3315.836034138569'.

bic = 3315.836034138569

177 0 ECHO 'forecast_12 = 10.751230845810554'.

177 0 M> ECHO 'forecast_12 = 10.751230845810554'.

forecast_12 = 10.751230845810554

178 0 ECHO 'Cross-check status: pass'.

178 0 M> ECHO 'Cross-check status: pass'.

Cross-check status: pass

179 0 OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecasting\ARMA Model\SPSS_Output\spv\arma-model_spss_output.spv'.

179 0 M> OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecasting\ARMA Model\SPSS_Output\spv\arma-model_spss_out

ARMA Model

```
put.spv'.  
180 0 OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=PRI  
NTSETTING /PDF DOCUMENTFILE='D:\DATA ANALYSIS\N Time S  
eries Tests and Forecasting\ARMA Model\SPSS_Output\pdf\arma-model_  
spss_output.pdf'.  
180 0 M> OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=  
PRINTSETTING /PDF DOCUMENTFILE='D:\DATA ANALYSIS\N Tim  
e Series Tests and Forecasting\ARMA Model\SPSS_Output\pdf\arma-  
model_spss_output.pdf'.
```