

```
38 0 OUTPUT ACTIVATE ARModelOutput.  
38 0 M> OUTPUT ACTIVATE ARModelOutput.  
39 0 TITLE 'AR Model'.  
39 0 M> TITLE 'AR Model'.
```

AR Model

```
40 0 GET DATA /TYPE=TXT /FILE='D:\DATA ANALYSIS\N Time Series Tests and Fo
recasting\AR Model\dataset.csv' /ENCODING='UTF8' /DELC
ASE=LINE /DELIMITERS=', ' /QUALIFIER='"' /ARRANGEMENT=DELIMITED /FI
RSTCASE=2
40 0 M> GET DATA /TYPE=TXT /FILE='D:\DATA ANALYSIS\N Time Series Tests and
Forecasting\AR Model\dataset.csv' /ENCODING='UTF8' /D
ELCASE=LINE /DELIMITERS=', ' /QUALIFIER='"' /ARRANGEMENT=DELIMIT
ED /FIRSTCASE=2
41 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.
41 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.
42 0 DATASET NAME ARModelData.
42 0 M> DATASET NAME ARModelData.
43 0 COMPUTE time_index=$CASENUM.
43 0 M> COMPUTE time_index=$CASENUM.
44 0 EXECUTE.
44 0 M> EXECUTE.
45 0 * BEGIN METHOD-SPECIFIC SPSS WORKFLOW.
45 0 M> * BEGIN METHOD-SPECIFIC SPSS WORKFLOW.
46 0 COMPUTE g3_l1=LAG(G3,1).
46 0 M> COMPUTE g3_l1=LAG(G3,1).
47 0 COMPUTE g3_l2=LAG(G3,2).
47 0 M> COMPUTE g3_l2=LAG(G3,2).
48 0 COMPUTE g3_l3=LAG(G3,3).
48 0 M> COMPUTE g3_l3=LAG(G3,3).
49 0 EXECUTE.
49 0 M> EXECUTE.
```

AR Model

```
50 0 REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT G3 /METHOD=ENTER time_index g3_l1 g3_l2 g3_l3 /SAVE PRED(ar3_fit) RESID(ar3_resid).
```

```
50 0 M> REGRESSION /STATISTICS=COEFF OUTS R ANOVA CI(95) /DEPENDENT G3 /METHOD=ENTER time_index g3_l1 g3_l2 g3_l3 /SAVE PRED(ar3_fit) RESID(ar3_resid).
```

Regression

Notes

Output Created		18-JUL-2026 15:49:52
Comments		
Input	Data	D:\DATA ANALYSIS\N Time Series Tests and Forecasting\AR Model\dataset.csv
	Active Dataset	ARModelData
	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 g3_l2 g3_l3 /SAVE PRED (ar3_fit) RESID(ar3_resid).
Resources	Processor Time	00:00:00.13
	Elapsed Time	00:00:00.11

AR Model

Notes

	Memory Required	5552 bytes
	Additional Memory Required for Residual Plots	0 bytes
Variables Created or Modified	ar3_fit	Unstandardized Predicted Value
	ar3_resid	Unstandardized Residual

[ARModelData]

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	g3_l3, time_index, g3_l2, 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	.322 ^a	.104	.098	3.075

a. Predictors: (Constant), g3_l3, time_index, g3_l2, g3_l1

b. Dependent Variable: G3

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	700.410	4	175.103	18.518	.000 ^b
	Residual	6061.201	641	9.456		
	Total	6761.611	645			

a. Dependent Variable: G3

b. Predictors: (Constant), g3_l3, time_index, g3_l2, g3_l1

AR Model

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.813	.768		10.172	.000
	time_index	-.002	.001	-.110	-2.835	.005
	g3_l1	.111	.039	.111	2.822	.005
	g3_l2	.182	.039	.182	4.674	.000
	g3_l3	.104	.039	.103	2.635	.009

Coefficients^a

Model		95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
1	(Constant)	6.304	9.321
	time_index	-.003	-.001
	g3_l1	.034	.188
	g3_l2	.105	.258
	g3_l3	.026	.181

a. Dependent Variable: G3

Residuals Statistics^a

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	8.25	14.20	11.91	1.042	646
Residual	-13.621	9.526	.000	3.065	646
Std. Predicted Value	-3.514	2.197	.000	1.000	646
Std. Residual	-4.430	3.098	.000	.997	646

a. Dependent Variable: G3

```

51 0 * END METHOD-SPECIFIC SPSS WORKFLOW.
51 0 M> * END METHOD-SPECIFIC SPSS WORKFLOW.
52 0 SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecasting\AR
Model\SPSS_Output\sav\ar-model_spss_ready_data.sav' /
      COMPRESSED.

```

AR Model

```
52  0 M>  SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecasting
\AR Model\SPSS_Output\sav\ar-model_spss_ready_data.sav
      ' /COMPRESSED.

53  0  ECHO 'AR Model'.
53  0 M>  ECHO 'AR Model'.
AR Model
54  0  ECHO 'Method type: autoregressive_model'.
54  0 M>  ECHO 'Method type: autoregressive_model'.
Method type: autoregressive_model
55  0  ECHO 'Design: AR(3) with intercept and linear trend fitted to the ord
ered G3 series.'.
55  0 M>  ECHO 'Design: AR(3) with intercept and linear trend fitted to the
ordered G3 series.'.
Design: AR(3) with intercept and linear trend fitted to the ordered G3 series.
56  0  ECHO 'Formula:  $y_t=c+\delta*t+\phi_1*y_{(t-1)}+\phi_2*y_{(t-2)}+\phi_3*y_{(t-3)}+e_t$ '.
56  0 M>  ECHO 'Formula:  $y_t=c+\delta*t+\phi_1*y_{(t-1)}+\phi_2*y_{(t-2)}+\phi_3*y_{(t-3)}+e_t$ '.
Formula:  $y_t=c+\delta*t+\phi_1*y_{(t-1)}+\phi_2*y_{(t-2)}+\phi_3*y_{(t-3)}+e_t$ 
57  0  ECHO 'Series order: source-row order'.
57  0 M>  ECHO 'Series order: source-row order'.
Series order: source-row order
58  0  ECHO 'n_series = 649'.
58  0 M>  ECHO 'n_series = 649'.
n_series = 649
59  0  ECHO 'ar_lags = 3'.
59  0 M>  ECHO 'ar_lags = 3'.
ar_lags = 3
60  0  ECHO 'phi_1 = 0.11085476472010096'.
60  0 M>  ECHO 'phi_1 = 0.11085476472010096'.
phi_1 = 0.11085476472010096
61  0  ECHO 'phi_2 = 0.18164769837872252'.
61  0 M>  ECHO 'phi_2 = 0.18164769837872252'.
phi_2 = 0.18164769837872252
62  0  ECHO 'phi_3 = 0.10350793347554388'.
62  0 M>  ECHO 'phi_3 = 0.10350793347554388'.
phi_3 = 0.10350793347554388
63  0  ECHO 'in_sample_rmse = 3.0631135596172396'.
63  0 M>  ECHO 'in_sample_rmse = 3.0631135596172396'.
```

AR Model

```
in_sample_rmse = 3.0631135596172396
64 0 ECHO 'forecast_12 = 10.85495595775491'.
64 0 M> ECHO 'forecast_12 = 10.85495595775491'.
forecast_12 = 10.85495595775491
65 0 ECHO 'Cross-check status: pass'.
65 0 M> ECHO 'Cross-check status: pass'.
Cross-check status: pass
66 0 OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Forecas
ting\AR Model\SPSS_Output\spv\ar-model_spss_output.spv
'.
66 0 M> OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\N Time Series Tests and Fore
casting\AR Model\SPSS_Output\spv\ar-model_spss_output.
spv'.
67 0 OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=PRI
NTSETTING /PDF DOCUMENTFILE='D:\DATA ANALYSIS\N Time S
eries Tests and Forecasting\AR Model\SPSS_Output\pdf\ar-model_spss
_output.pdf'.
67 0 M> OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=
PRINTSETTING /PDF DOCUMENTFILE='D:\DATA ANALYSIS\N Tim
e Series Tests and Forecasting\AR Model\SPSS_Output\pdf\ar-mode
l_spss_output.pdf'.
```