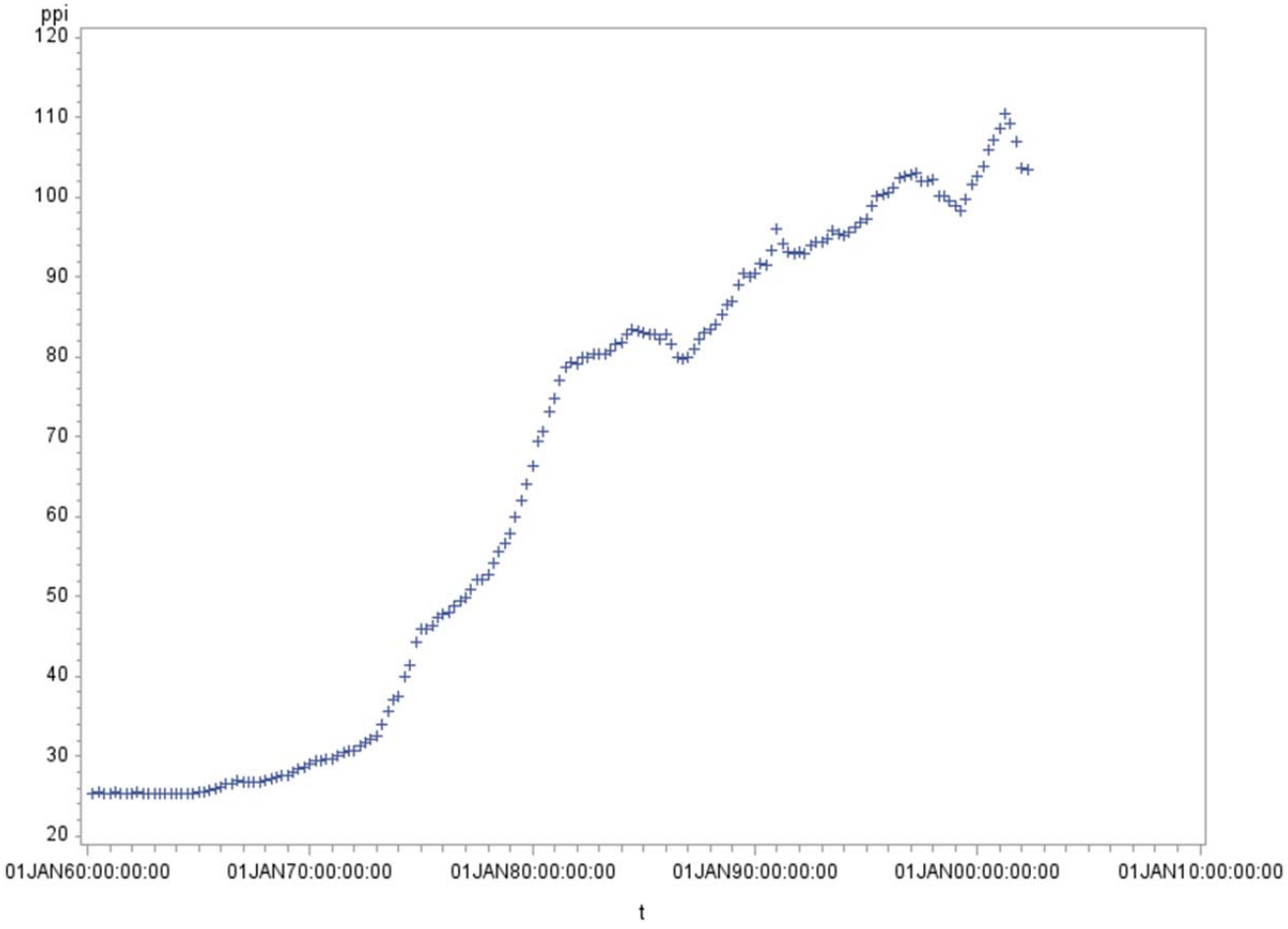
```
* Time Series ARIMA Models in SAS;
* Copyright 2013 by Ani Katchova;

proc import out= work.data
datafile= "C:\Econometrics\Data\timeseries_ppi.csv"
dbms=csv replace; getnames=yes; datarow=2;
run;

* Creating a differenced variable;
data data;
set data;
dppi=dif(ppi);
lppi=lag(ppi);
ldppi=lag(dppi);
run;

%let ylist = ppi;
%let dylist = dppi;
%let time = t;
%let lylist = lppi;
%let trend=trend;
%let xlist = cpi gdp;

proc means data=data;
var &ylist &dylist &time;
run;

* Plotting the data;
proc gplot data=data;
plot &ylist*&time;
plot &dylist*&time;
run;

* ARIMA identification;
proc arima data=data;
identify var=&ylist stationarity=(adf);
run;

* Dickey-Fuller test regressions;
proc reg data=data;
model &dylist = &lylist;
model &dylist = &lylist &trend;
run;

* ARIMA for differenced variable;
proc arima data=data;
identify var=&ylist(1) stationarity=(adf);
run;


* ARIMA(1,0,0) or AR(1);
proc arima data=data;
identify var=&ylist;
estimate p=1 method=ml;
run;
```

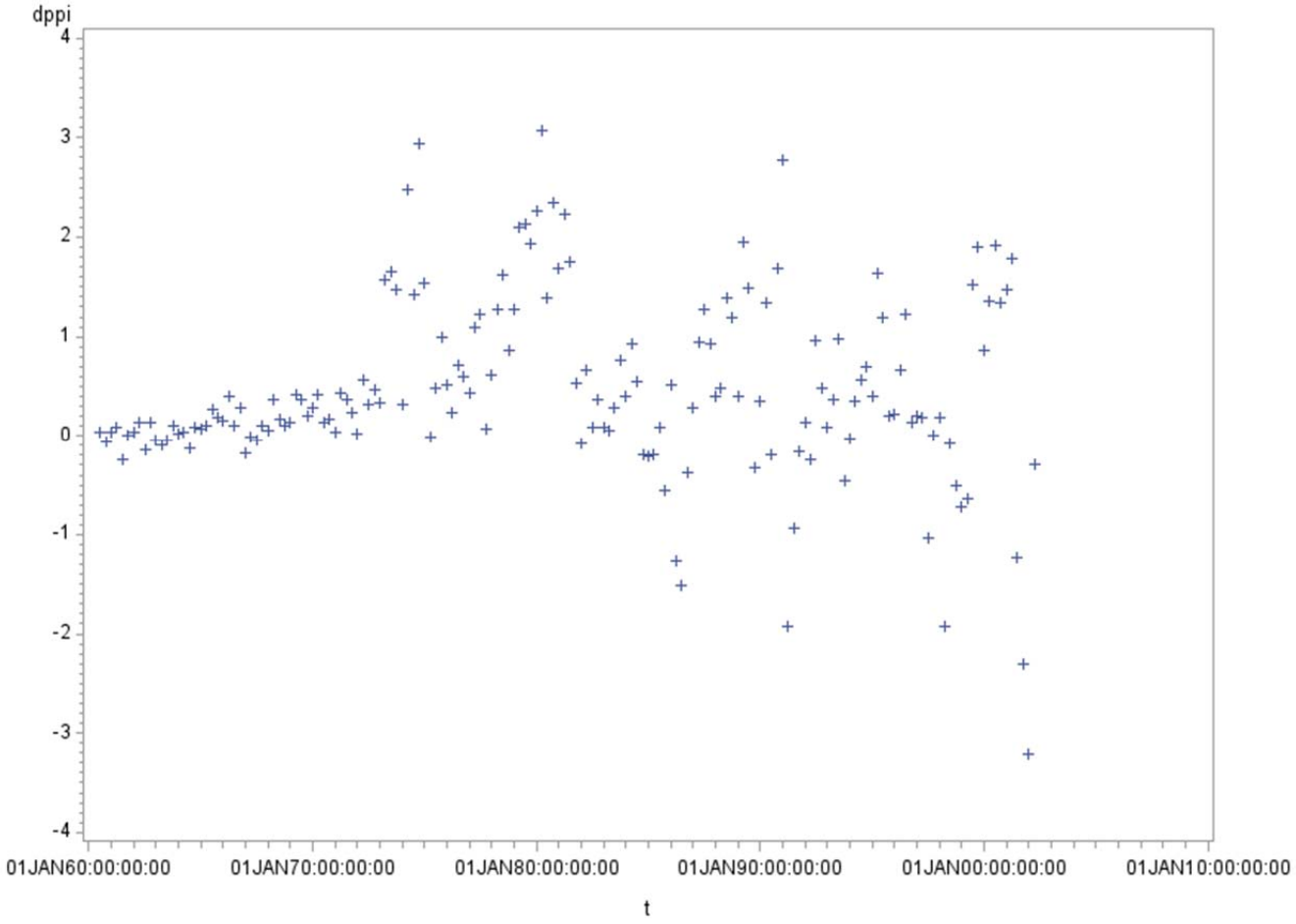
```
* ARIMA(2,0,0) or AR(2);
proc arima data=data;
identify var=&ylist;
estimate p=2;
run;

* ARIMA(0,0,1) or MA(1);
proc arima data=data;
identify var=&ylist;
estimate q=1;
run;

* ARIMA(1,0,1) or ARMA(1,1);
proc arima data=data;
identify var=&ylist;
estimate p=1 q=1;
run;

* ARIMA(1,1,0);
proc arima data=data;
identify var=&dylist;
estimate p=1;
run;

* ARIMA(0,1,1);
proc arima data=data;
identify var=&dylist;
estimate q=1;
run;

* ARIMA(1,1,1);
proc arima data=data;
identify var=&dylist;
estimate p=1 q=1;
run;

* ARIMA(1,1,3);
proc arima data=data;
identify var=&dylist;
estimate p=1 q=3;
run;

* ARIMA(2,1,3);
proc arima data=data;
identify var=&dylist;
estimate p=2 q=3;
run;

* ARIMA(2,0,1) with independent variables;
proc arima data=data;
identify var=&ylist crosscorr=(&xlist);
estimate input=(&xlist) p=2 q=1 plot;
run;
```

```
* ARIMA (1,0,1) forecasting;
proc arima data=data;
identify var=&ylist;
estimate p=1 q=1;
forecast lead=12;
run;

* ARIMA (1,1,1) forecasting;
proc arima data=data;
identify var=&dylist;
estimate p=1 q=1;
forecast lead=12;
run;
```

The MEANS Procedure

Variable	N	Mean	Std Dev	Minimum	Maximum
ppi	169	64.6815385	30.2659545	25.2400000	110.4300000
dppi	168	0.4642857	0.9207450	-3.2100000	3.0800010
t	169	670564715	386030145	7862400.00	1333238400


ppi
120
110
100
90
80
70
60
50
40
30
20
01JAN60:00:00:00
01JAN70:00:00:00
01JAN80:00:00:00
01JAN90:00:00:00
01JAN00:00:00:00
01JAN10:00:00:00
t


dppi
4
3
2
1
0
-1
-2
-3
-4
01JAN60:00:00:00
01JAN70:00:00:00
01JAN80:00:00:00
01JAN90:00:00:00
01JAN00:00:00:00
01JAN10:00:00:00
t

The ARIMA Procedure

Name of Variable = ppi

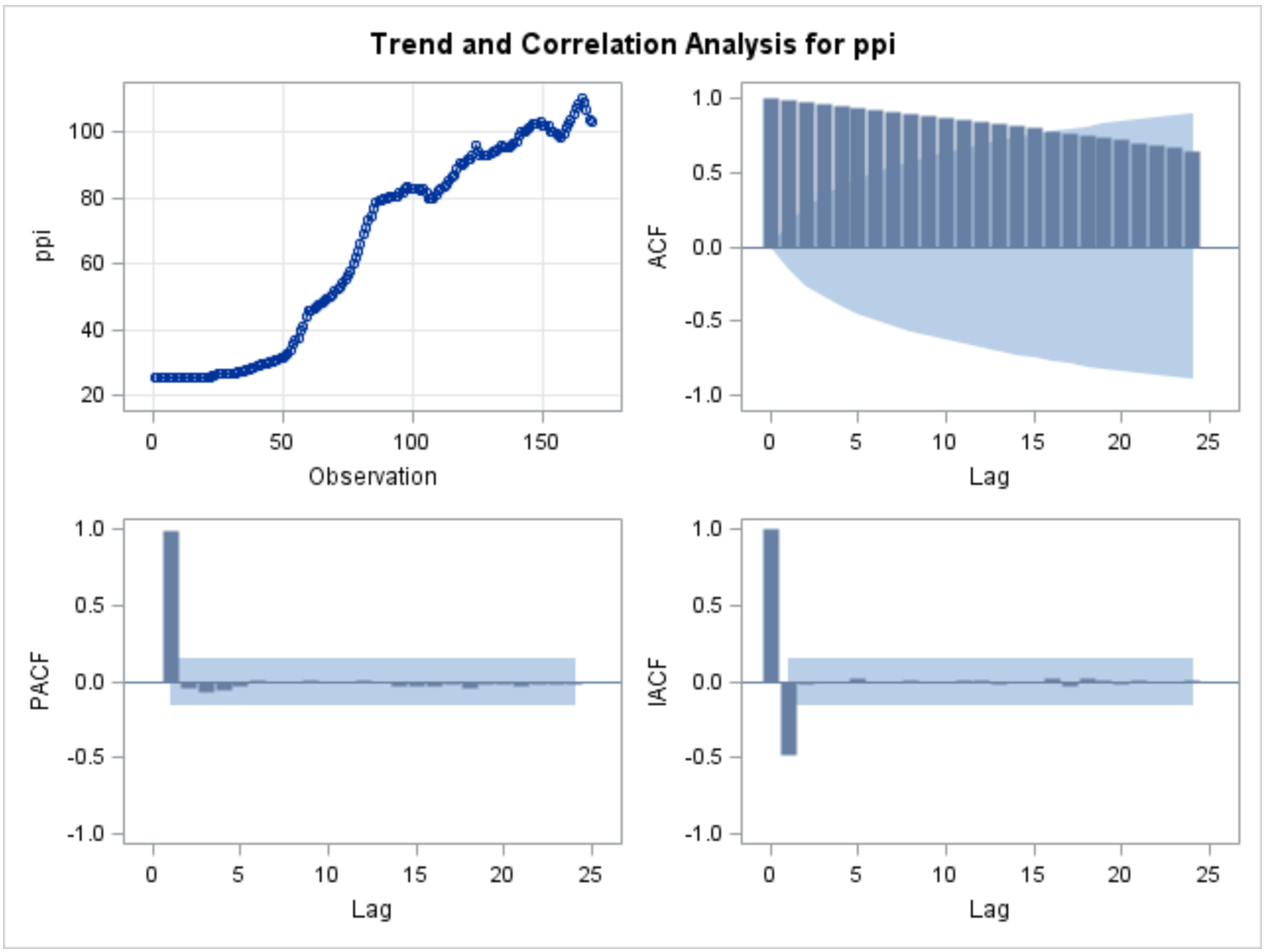
Mean of Working Series	64.68154
Standard Deviation	30.17628
Number of Observations	169

Autocorrelation Check for White Noise

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	960.86	6	<.0001	0.990	0.978	0.966	0.952	0.937	0.923
12	1789.38	12	<.0001	0.908	0.894	0.880	0.866	0.852	0.838
18	2489.96	18	<.0001	0.824	0.810	0.795	0.780	0.765	0.749
24	3048.92	24	<.0001	0.732	0.716	0.698	0.681	0.663	0.645

Augmented Dickey-Fuller Unit Root Tests

Type	Lags	Rho	Pr < Rho	Tau	Pr < Tau	F	Pr > F
Zero Mean	**0**	0.9750	0.9071	5.66	0.9999		
	1	0.9132	0.8965	2.47	0.9969		
	2	0.8823	0.8908	2.10	0.9916		
Single Mean	**0**	-0.1024	0.9513	-0.26	0.9272	21.27	0.0010
	1	-0.3804	0.9346	-0.51	0.8853	4.88	0.0425
	2	-0.4918	0.9269	-0.61	0.8643	3.96	0.0911
Trend	**0**	-1.4094	0.9819	-0.79	0.9635	0.32	0.9900
	1	-4.9336	0.8221	-1.45	0.8407	1.08	0.9570
	2	-5.4808	0.7807	-1.47	0.8348	1.13	0.9503


Trend and Correlation Analysis for ppi
ppi
Observation
ACF
Lag
PACF
Lag
IACF
Lag

The REG Procedure
Model: MODEL1
Dependent Variable: dppi

Number of Observations Read	169
Number of Observations Used	168
Number of Observations with Missing Values	1

Analysis of Variance

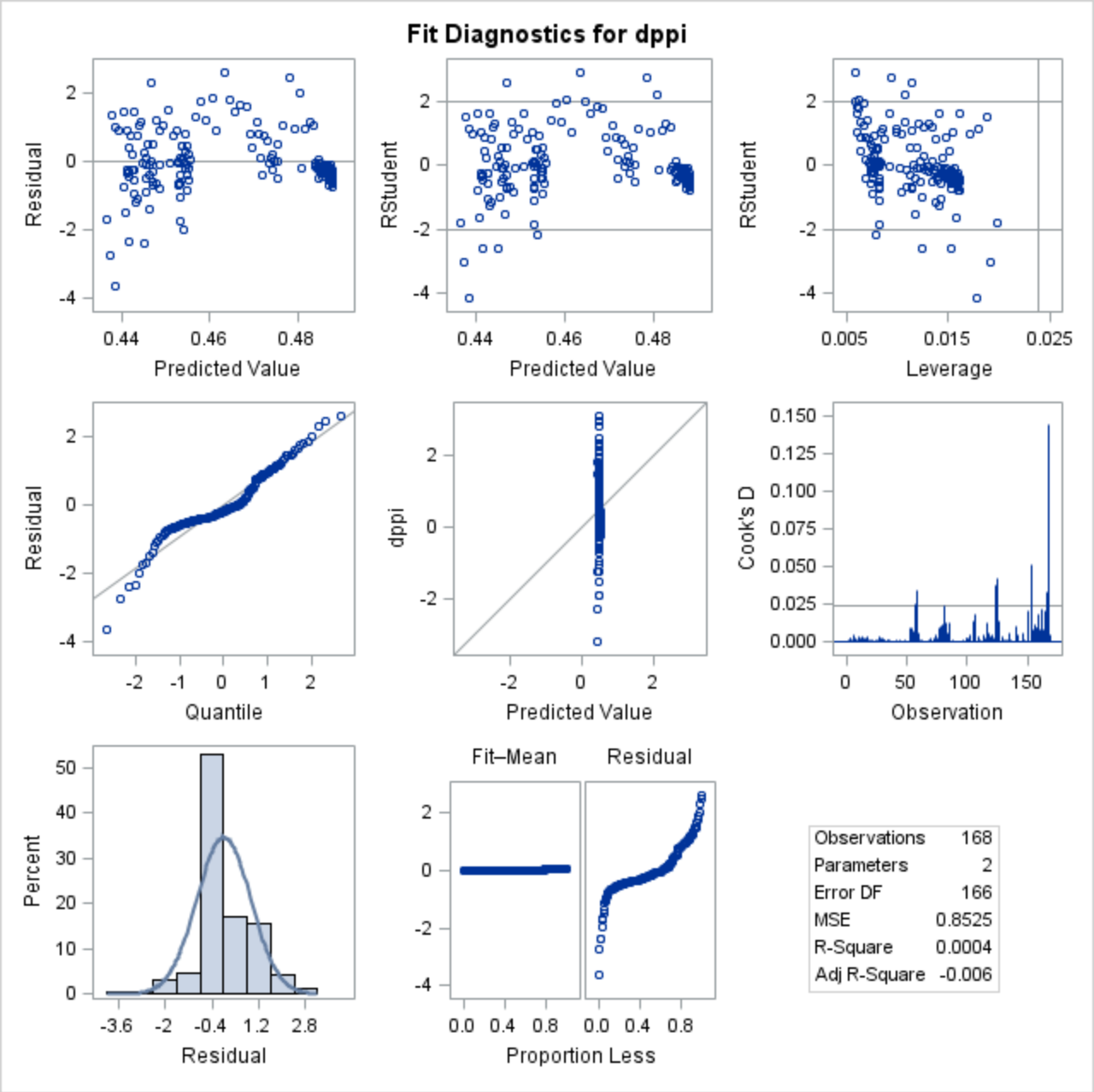
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.05661	0.05661	0.07	0.7970
Error	166	141.52119	0.85254		
Corrected Total	167	141.57780			

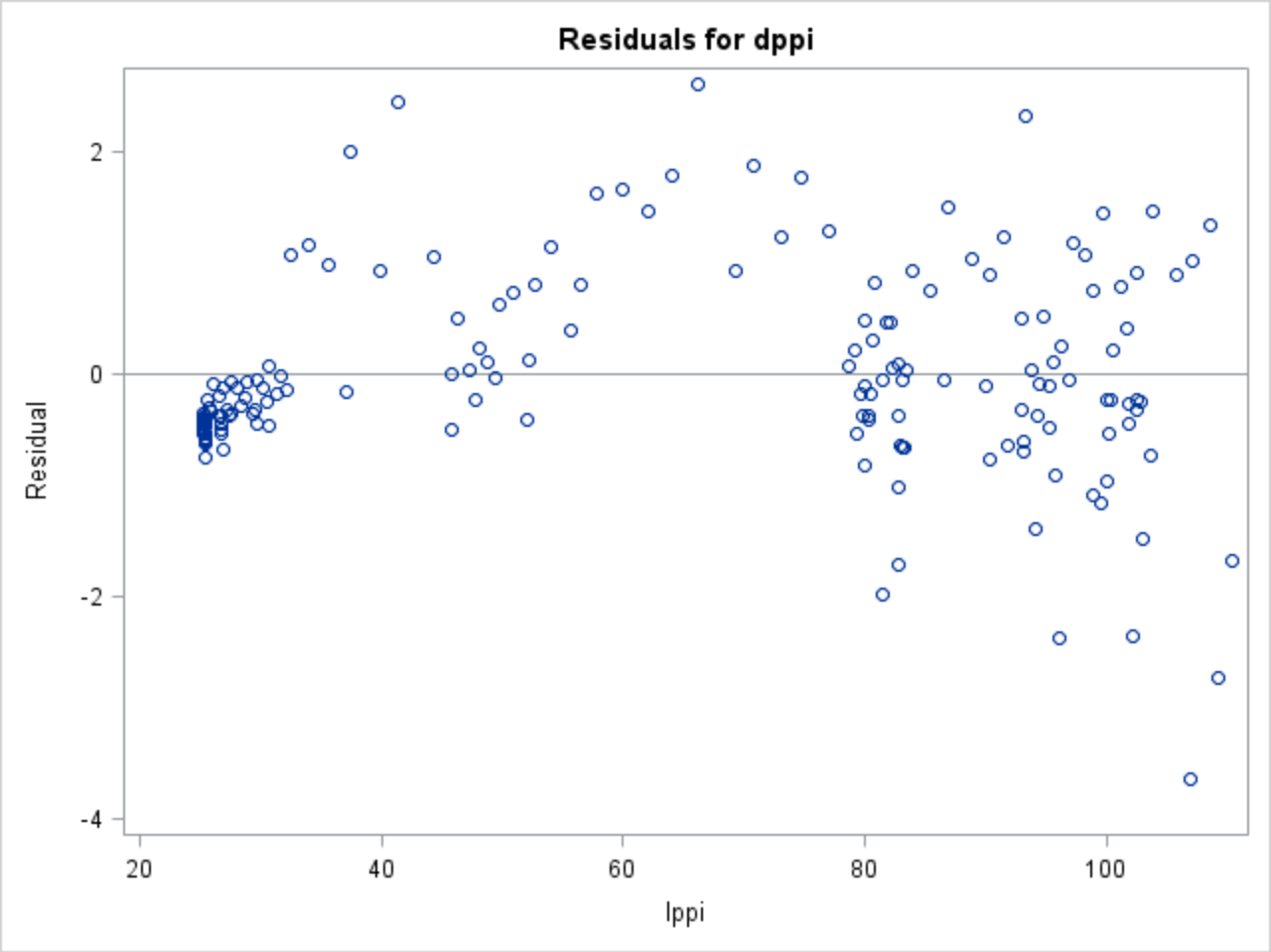
Root MSE	0.92333	**R-Square**	0.0004
Dependent Mean	0.46429	**Adj R-Sq**	-0.0056
Coeff Var	198.87096		

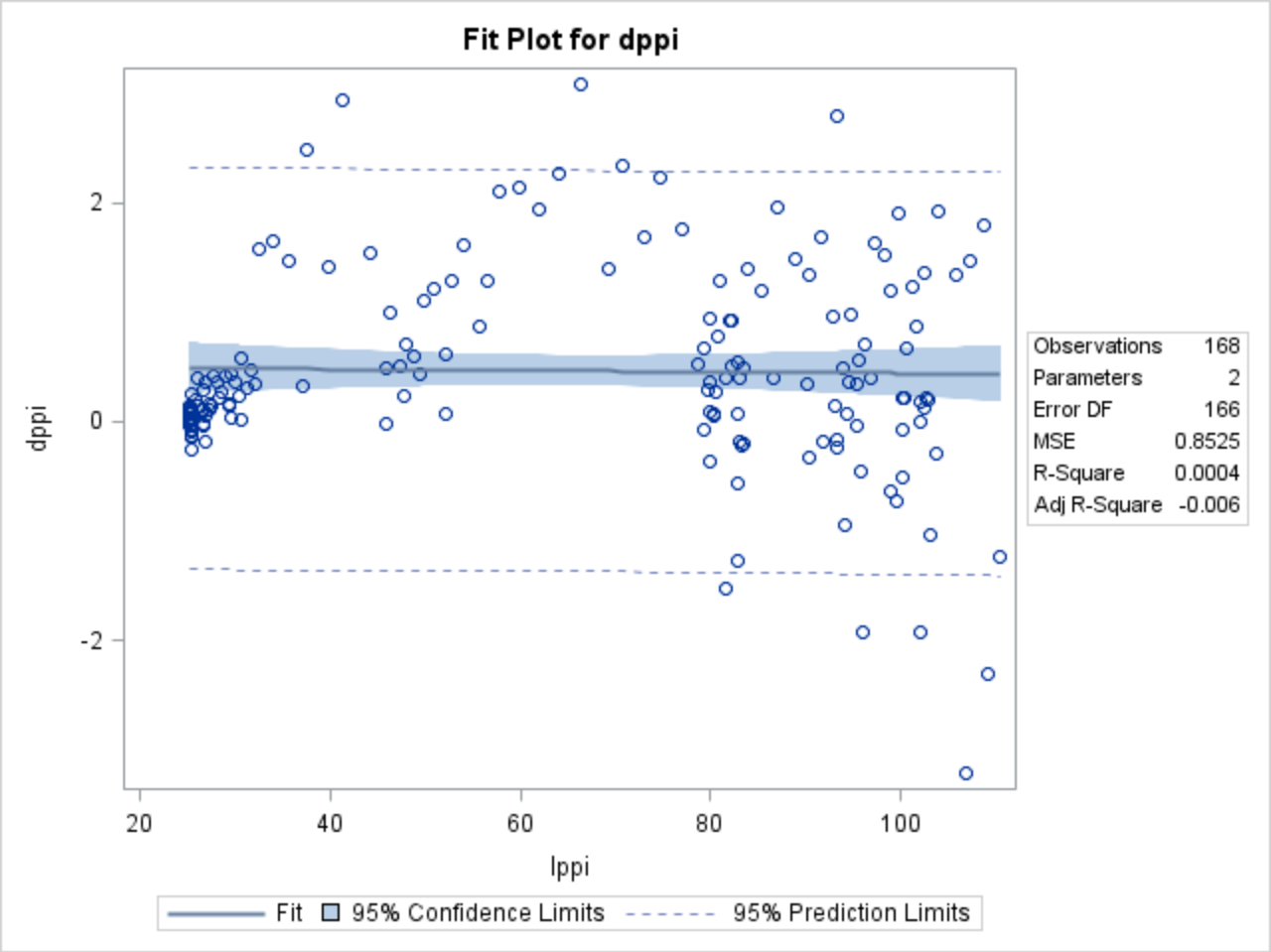
Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	0.50357	0.16827	2.99	0.0032
lppi	1	-0.00060951	0.00237	-0.26	0.7970

The REG Procedure
Model: MODEL1
Dependent Variable: dppi




Residuals for dppi
Residual
2
0
-2
-4
20
40
60
80
100
lppi


Fit Plot for dppi
dppi
lppi
2
0
-2
20
40
60
80
100
Observations 168
Parameters 2
Error DF 166
MSE 0.8525
R-Square 0.0004
Adj R-Square -0.006
Fit
95% Confidence Limits
95% Prediction Limits

The REG Procedure
Model: MODEL2
Dependent Variable: dppi

Number of Observations Read	169
Number of Observations Used	168
Number of Observations with Missing Values	1

Analysis of Variance

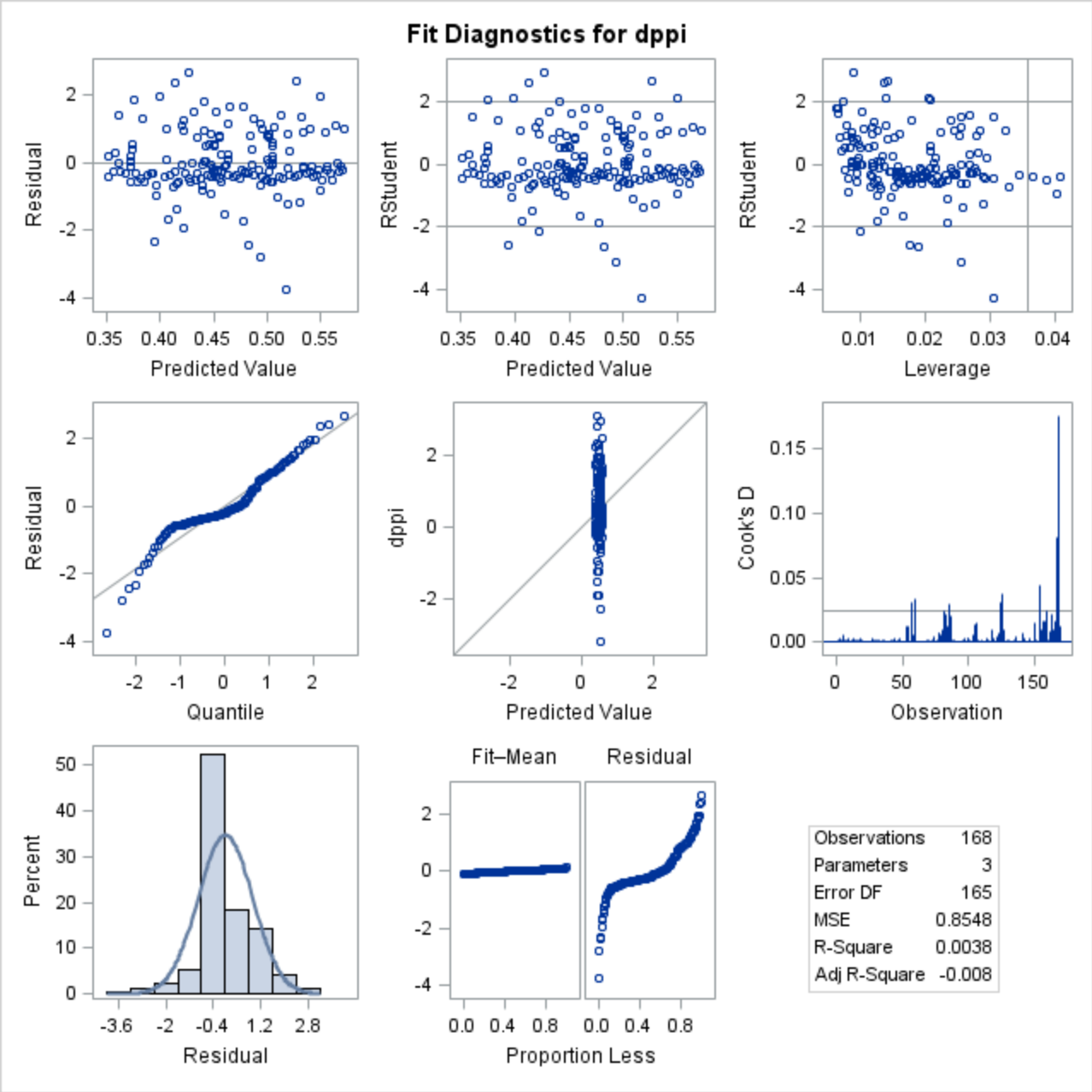
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.54332	0.27166	0.32	0.7282
Error	165	141.03448	0.85475		
Corrected Total	167	141.57780			

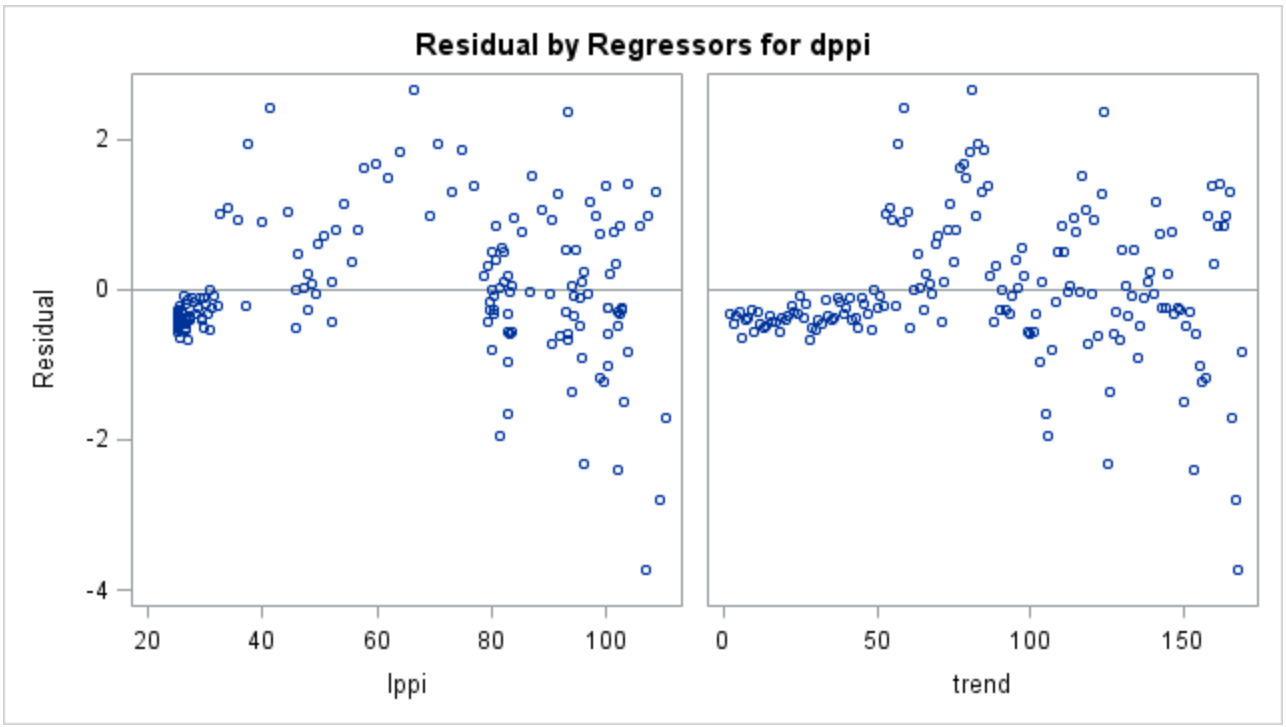
Root MSE	0.92453	**R-Square**	0.0038
Dependent Mean	0.46429	**Adj R-Sq**	-0.0082
Coeff Var	199.12939		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	**1**	0.58114	0.19737	2.94	0.0037
lppi	**1**	-0.00839	0.01058	-0.79	0.4289
trend	**1**	0.00496	0.00657	0.75	0.4516

The REG Procedure
Model: MODEL2
Dependent Variable: dppi




Residual by Regressors for dppi
Residual
2
0
-2
-4
20
40
60
80
100
lppi
0
50
100
150
trend

The ARIMA Procedure

Name of Variable = ppi

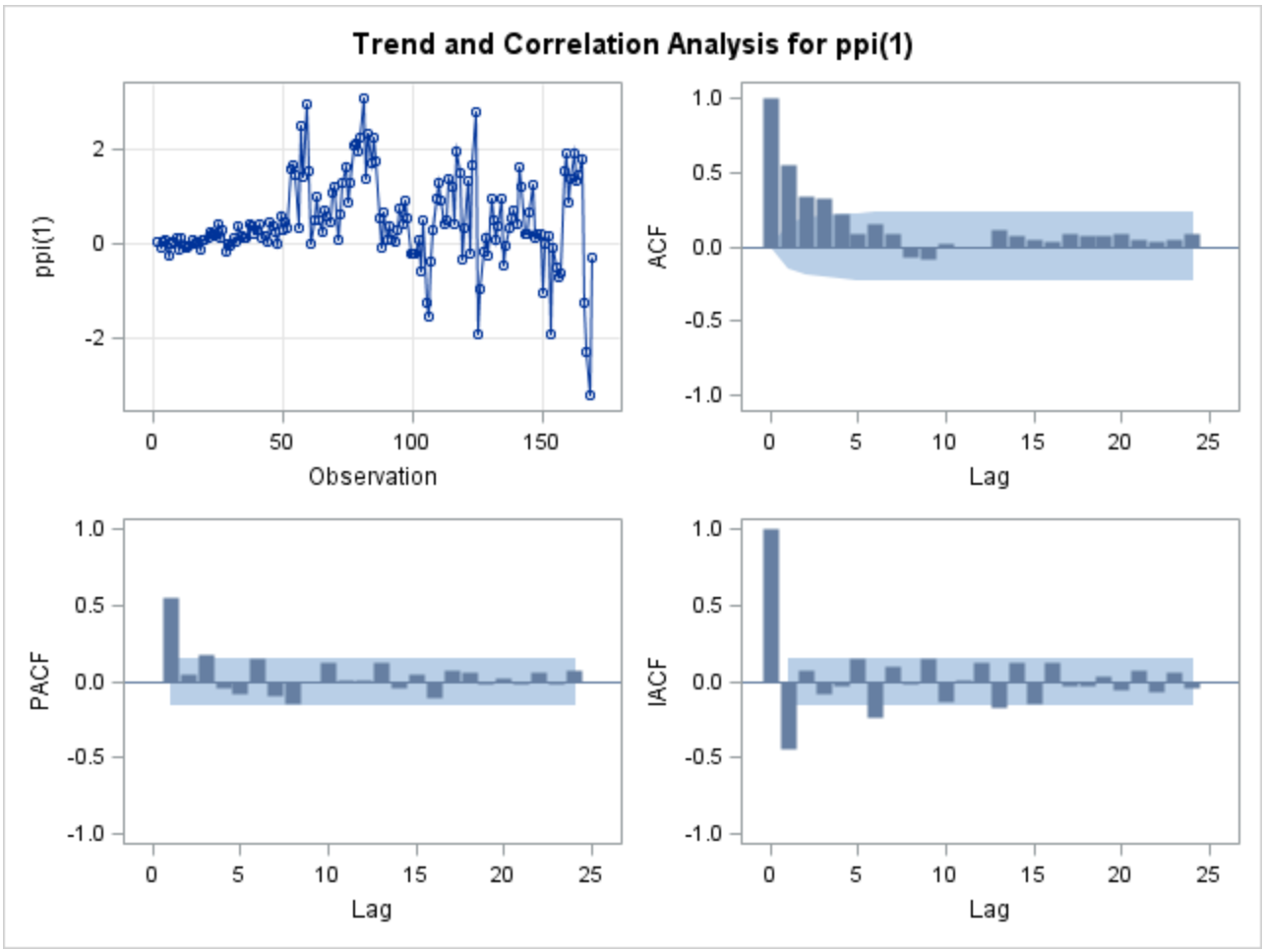
Period(s) of Differencing	1
Mean of Working Series	0.464286
Standard Deviation	0.918001
Number of Observations	168
Observation(s) eliminated by differencing	1

Autocorrelation Check for White Noise

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	102.82	6	<.0001	0.553	0.335	0.319	0.216	0.086	0.153
12	106.35	12	<.0001	0.082	-0.078	-0.080	0.023	-0.008	-0.006
18	112.72	18	<.0001	0.112	0.069	0.048	0.039	0.084	0.077
24	117.91	24	<.0001	0.076	0.085	0.049	0.033	0.047	0.089

Augmented Dickey-Fuller Unit Root Tests

Type	Lags	Rho	Pr < Rho	Tau	Pr < Tau	F	Pr > F
Zero Mean	**0**	-59.1439	<.0001	-5.97	<.0001		
	1	-45.1897	<.0001	-4.66	<.0001		
	2	-25.1469	0.0002	-3.27	0.0012		
Single Mean	**0**	-74.3553	0.0013	-6.86	<.0001	23.53	0.0010
	1	-64.7748	0.0013	-5.49	<.0001	15.08	0.0010
	2	-38.7515	0.0013	-3.85	0.0031	7.45	0.0010
Trend	**0**	-74.3509	0.0005	-6.84	<.0001	23.41	0.0010
	1	-64.5966	0.0005	-5.47	<.0001	15.03	0.0010
	2	-38.2834	0.0008	-3.81	0.0184	7.51	0.0197


Trend and Correlation Analysis for ppi(1)
ppi(1)
Observation
ACF
Lag
PACF
Lag
IACF
Lag

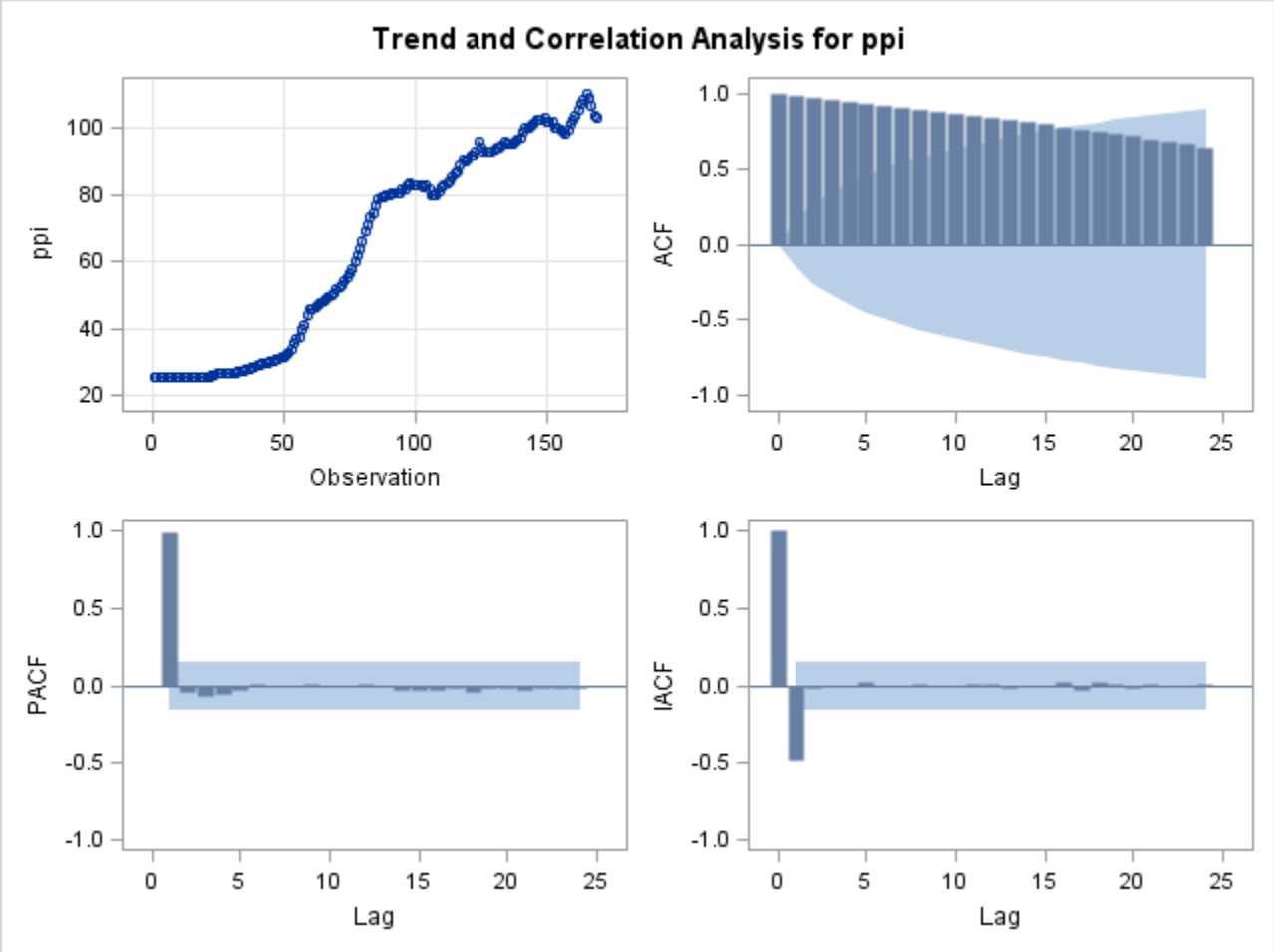
The ARIMA Procedure

Name of Variable = ppi

Mean of Working Series	64.68154
Standard Deviation	30.17628
Number of Observations	169

Autocorrelation Check for White Noise

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	960.86	6	<.0001	0.990	0.978	0.966	0.952	0.937	0.923
12	1789.38	12	<.0001	0.908	0.894	0.880	0.866	0.852	0.838
18	2489.96	18	<.0001	0.824	0.810	0.795	0.780	0.765	0.749
24	3048.92	24	<.0001	0.732	0.716	0.698	0.681	0.663	0.645



Maximum Likelihood Estimation

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	64.26332	125.46111	0.51	0.6085	0
AR1,1	0.99964	0.0022454	445.21	<.0001	1

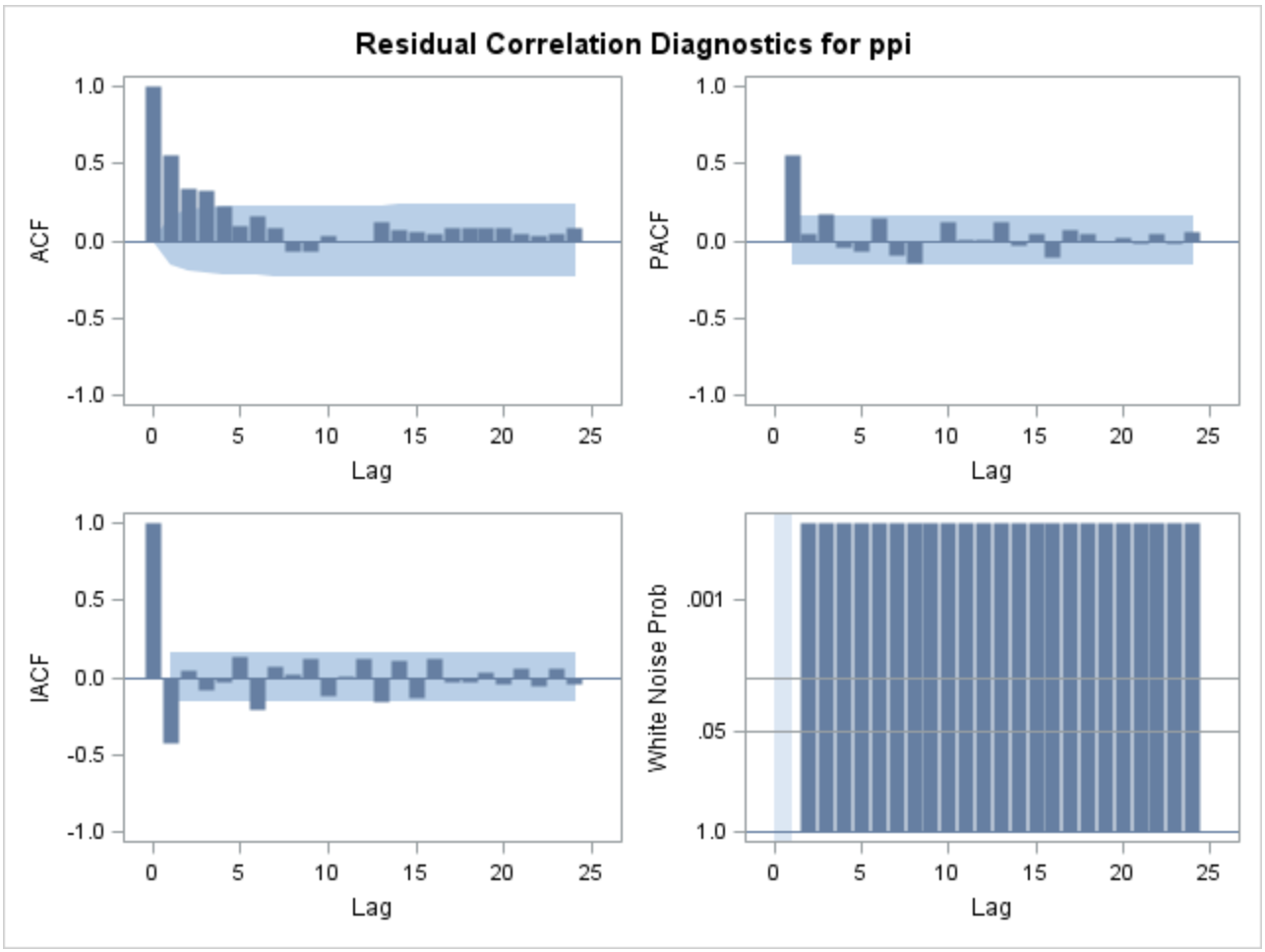
Constant Estimate	0.022905
Variance Estimate	1.070851
Std Error Estimate	1.034819
AIC	500.4044
SBC	506.6642
Number of Residuals	169

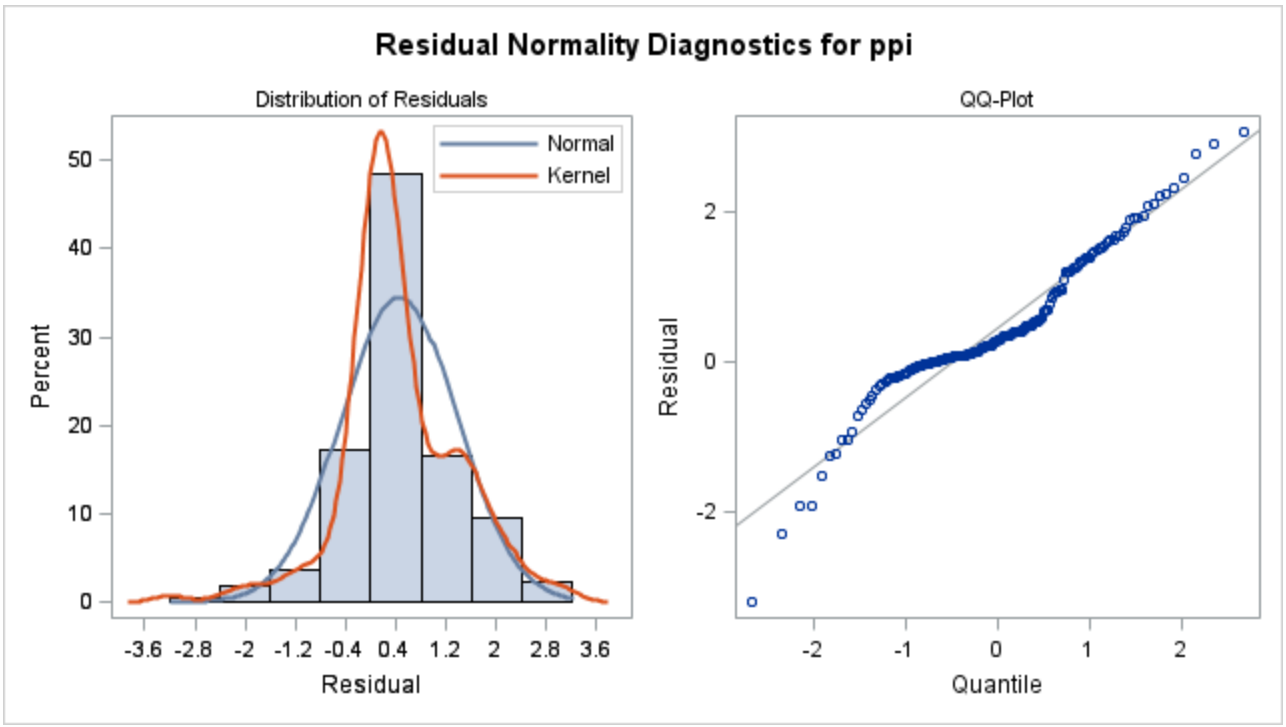
Correlations of Parameter Estimates

Parameter	MU	AR1,1
MU	1.000	0.955
AR1,1	0.955	1.000

Autocorrelation Check of Residuals

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	213.28	5	<.0001	0.642	0.480	0.474	0.397	0.293	0.342
12	259.75	11	<.0001	0.283	0.151	0.149	0.228	0.200	0.199
18	342.65	17	<.0001	0.296	0.264	0.250	0.244	0.287	0.281
24	430.76	23	<.0001	0.282	0.292	0.262	0.251	0.263	0.291
30	498.16	29	<.0001	0.239	0.232	0.228	0.282	0.200	0.219


Residual Correlation Diagnostics for ppi
ACF
PACF
IACF
White Noise Prob
Lag
1.0
0.5
0.0
-0.5
-1.0
0
5
10
15
20
25
.001
.05
1.0


Residual Normality Diagnostics for ppi
Distribution of Residuals
Normal
Kernel
Percent
Residual
50
40
30
20
10
0
-3.6
-2.8
-2
-1.2
-0.4
0.4
1.2
2
2.8
3.6
QQ-Plot
Residual
Quantile
2
0
-2
-1
1

Model for variable ppi

Estimated Mean 64.26332

Autoregressive Factors

Factor 1: 1 - 0.99964 B**(1)

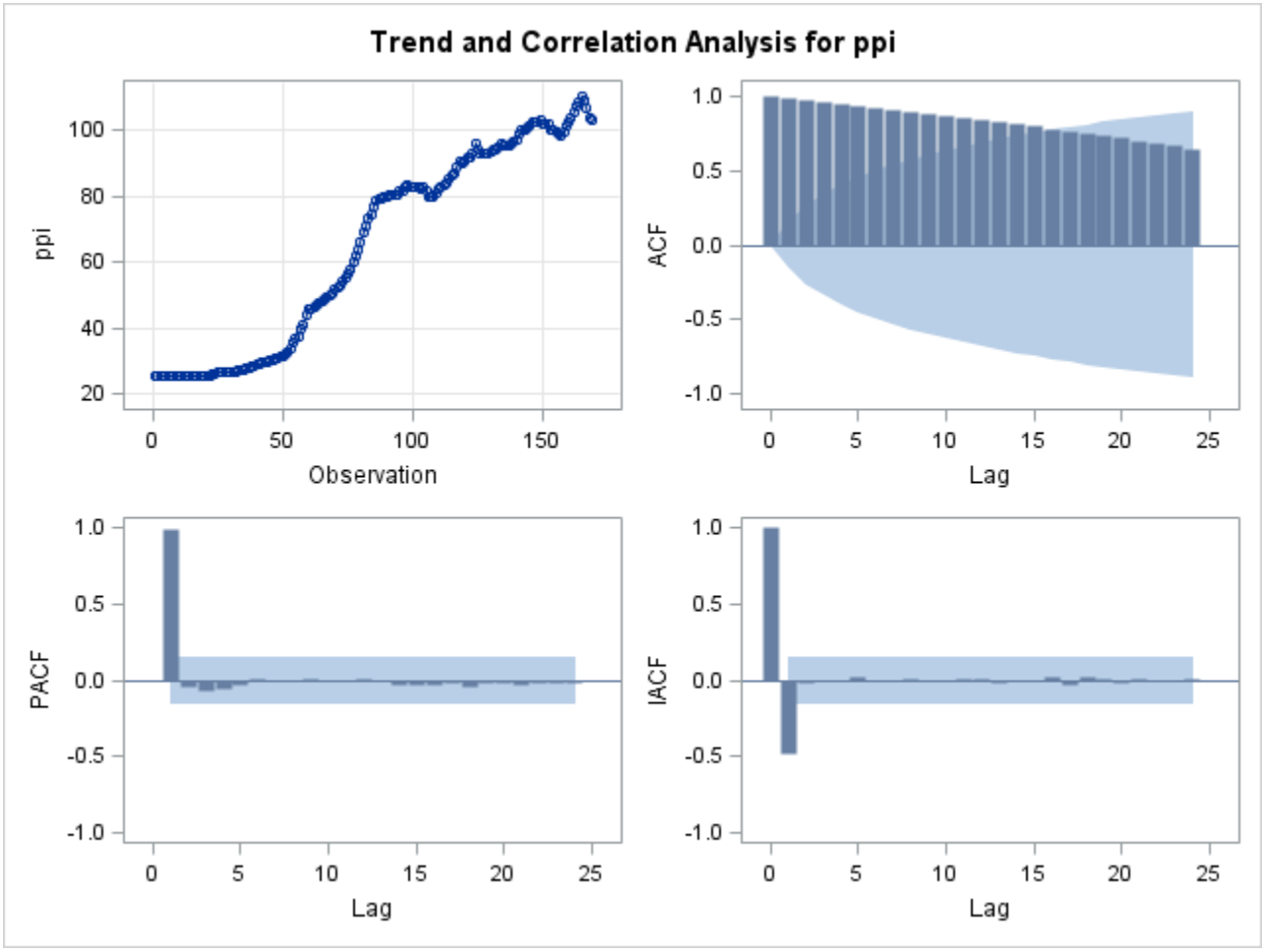
The ARIMA Procedure

Name of Variable = ppi

Mean of Working Series	64.68154
Standard Deviation	30.17628
Number of Observations	169

Autocorrelation Check for White Noise

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	960.86	6	<.0001	0.990	0.978	0.966	0.952	0.937	0.923
12	1789.38	12	<.0001	0.908	0.894	0.880	0.866	0.852	0.838
18	2489.96	18	<.0001	0.824	0.810	0.795	0.780	0.765	0.749
24	3048.92	24	<.0001	0.732	0.716	0.698	0.681	0.663	0.645



Warning: The model defined by the new estimates is unstable. The iteration process has

been terminated.

Warning: Estimates may not have converged.

ARIMA Estimation Optimization Summary

Estimation Method	Conditional Least Squares
Parameters Estimated	3
Termination Criteria	Maximum Relative Change in Estimates
Iteration Stopping Value	0.001
Criteria Value	1.016656
Maximum Absolute Value of Gradient	1971.95
R-Square Change from Last Iteration	0.442814
Objective Function	Sum of Squared Residuals
Objective Function Value	126.1675
Marquardt's Lambda Coefficient	1E-6
Numerical Derivative Perturbation Delta	0.001
Iterations	18
Warning Message	Estimates may not have converged.

Conditional Least Squares Estimation

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	26.24523	0.83602	31.39	<.0001	0
AR1,1	1.29638	0.06963	18.62	<.0001	1
AR1,2	-0.29638	0.07017	-4.22	<.0001	2

Constant Estimate	4.013E-7
Variance Estimate	0.760045
Std Error Estimate	0.871806
AIC	436.2045
SBC	445.5942
Number of Residuals	169

* AIC and SBC do not include log determinant.

Correlations of Parameter Estimates

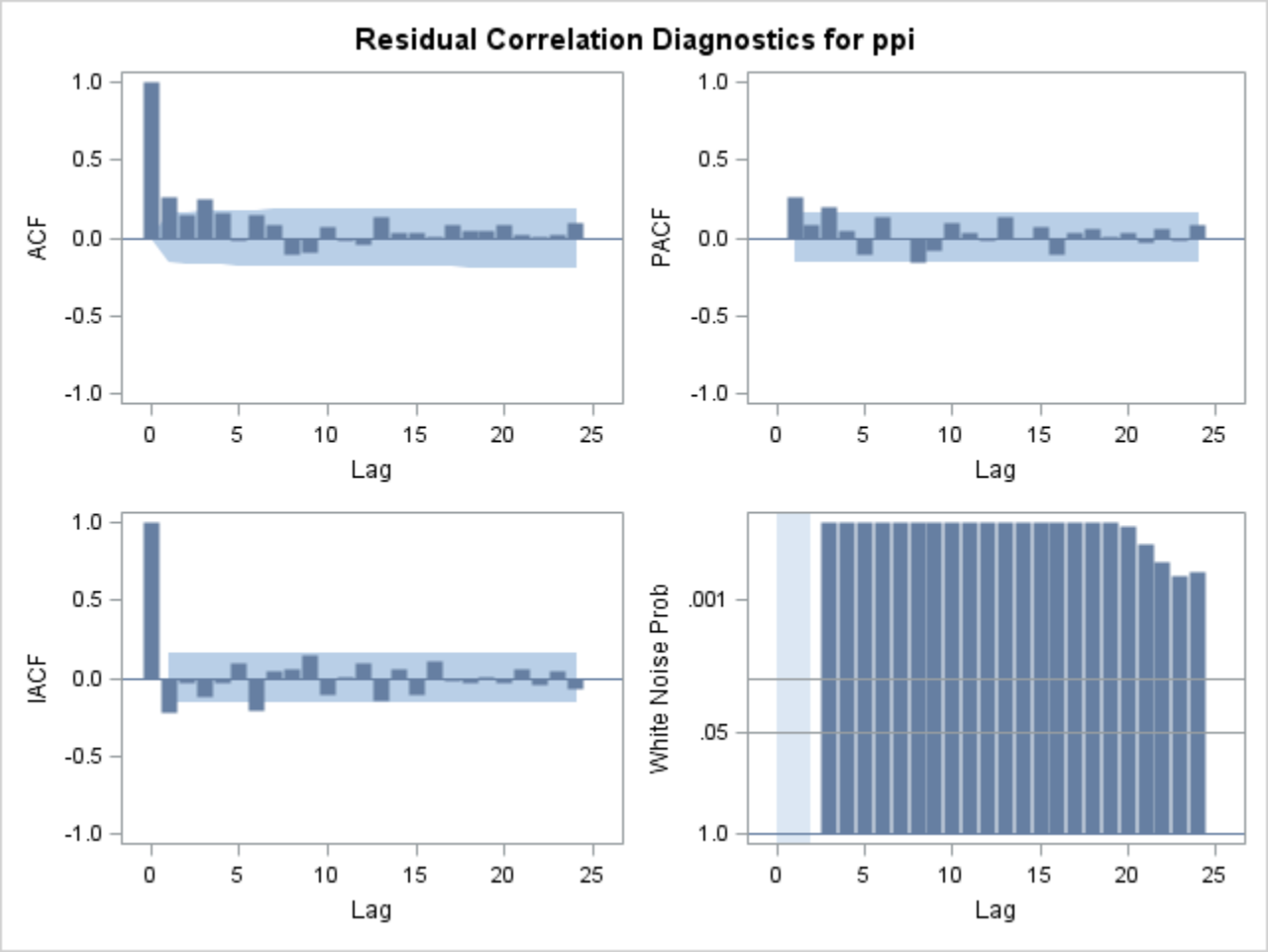
Parameter	MU	AR1,1	AR1,2
MU	1.000	-0.019	0.019
AR1,1	-0.019	1.000	-1.000

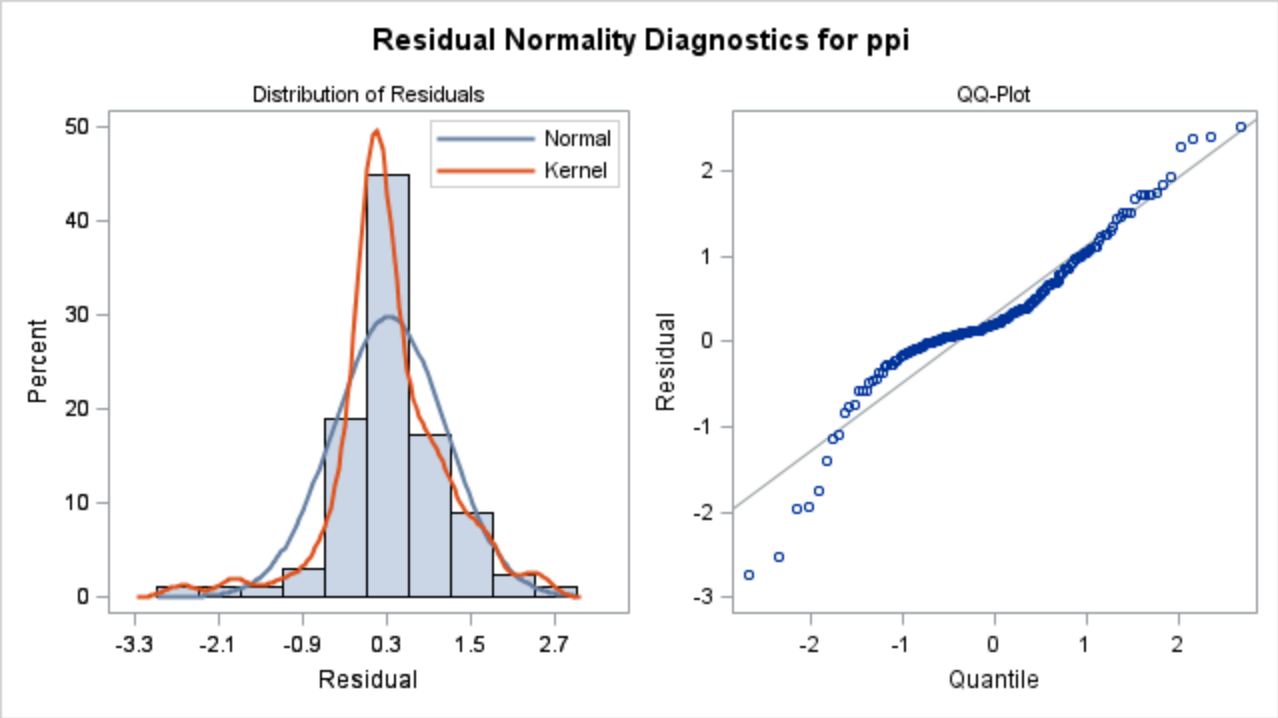
Correlations of Parameter Estimates

Parameter	MU	AR1,1	AR1,2
AR1,2	0.019	-1.000	1.000

Autocorrelation Check of Residuals

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	91.79	4	<.0001	0.368	0.273	0.364	0.291	0.139	0.284
12	114.78	10	<.0001	0.228	0.051	0.070	0.204	0.129	0.098
18	159.96	16	<.0001	0.262	0.178	0.173	0.150	0.223	0.195
24	205.75	22	<.0001	0.193	0.222	0.177	0.166	0.177	0.238
30	238.76	28	<.0001	0.149	0.162	0.135	0.254	0.097	0.145





Model for variable ppi

Estimated Mean 26.24523

Autoregressive Factors

Factor 1: 1 - 1.29638 B**(1) + 0.29638 B**(2)

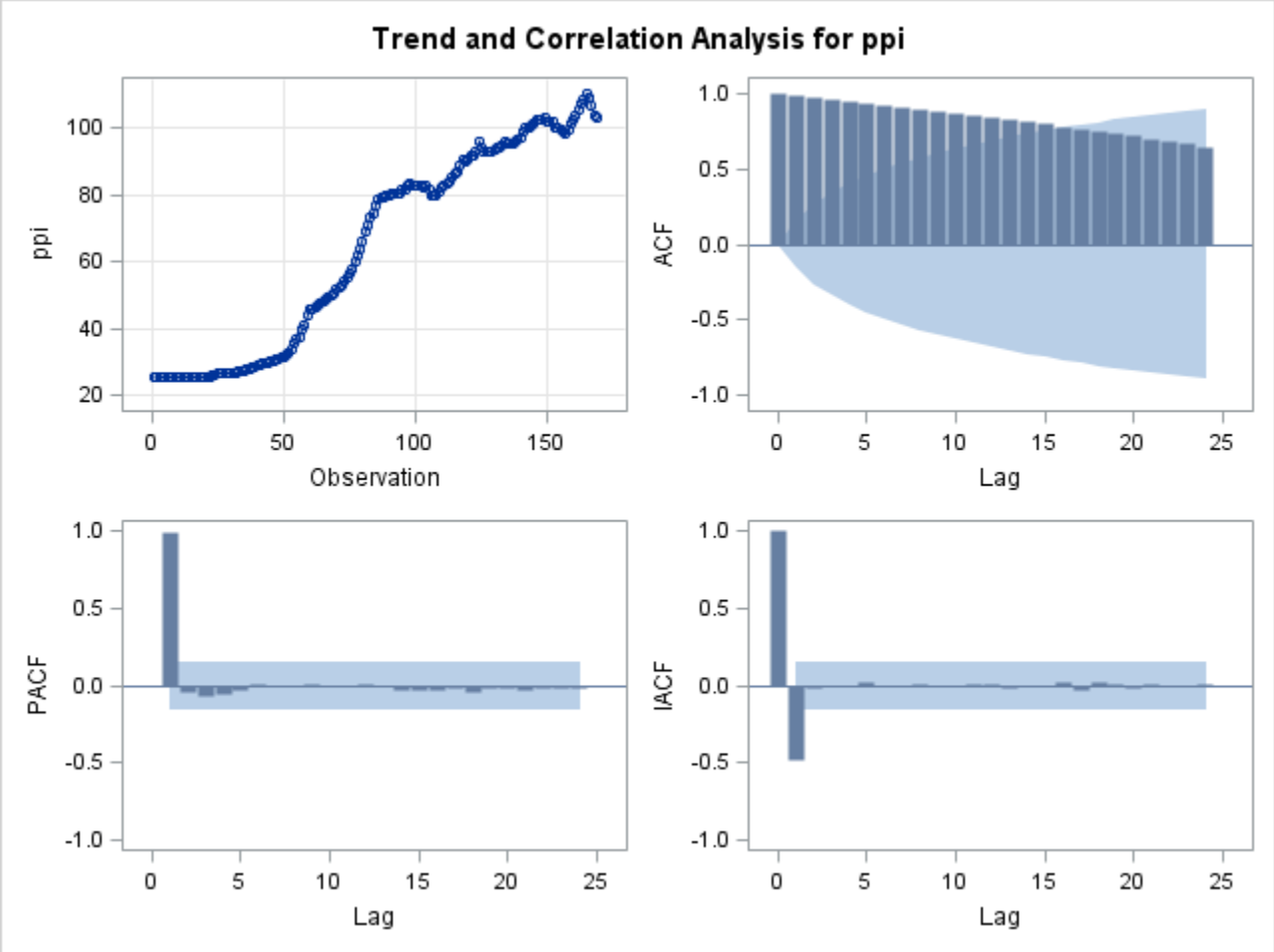
The ARIMA Procedure

Name of Variable = ppi

Mean of Working Series	64.68154
Standard Deviation	30.17628
Number of Observations	169

Autocorrelation Check for White Noise

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	960.86	6	<.0001	0.990	0.978	0.966	0.952	0.937	0.923
12	1789.38	12	<.0001	0.908	0.894	0.880	0.866	0.852	0.838
18	2489.96	18	<.0001	0.824	0.810	0.795	0.780	0.765	0.749
24	3048.92	24	<.0001	0.732	0.716	0.698	0.681	0.663	0.645



Conditional Least Squares Estimation

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	63.10136	2.39720	26.32	<.0001	0
MA1,1	-0.93793	0.02740	-34.23	<.0001	1

Constant Estimate	63.10136
Variance Estimate	264.9198
Std Error Estimate	16.27636
AIC	1424.512
SBC	1430.772
Number of Residuals	169

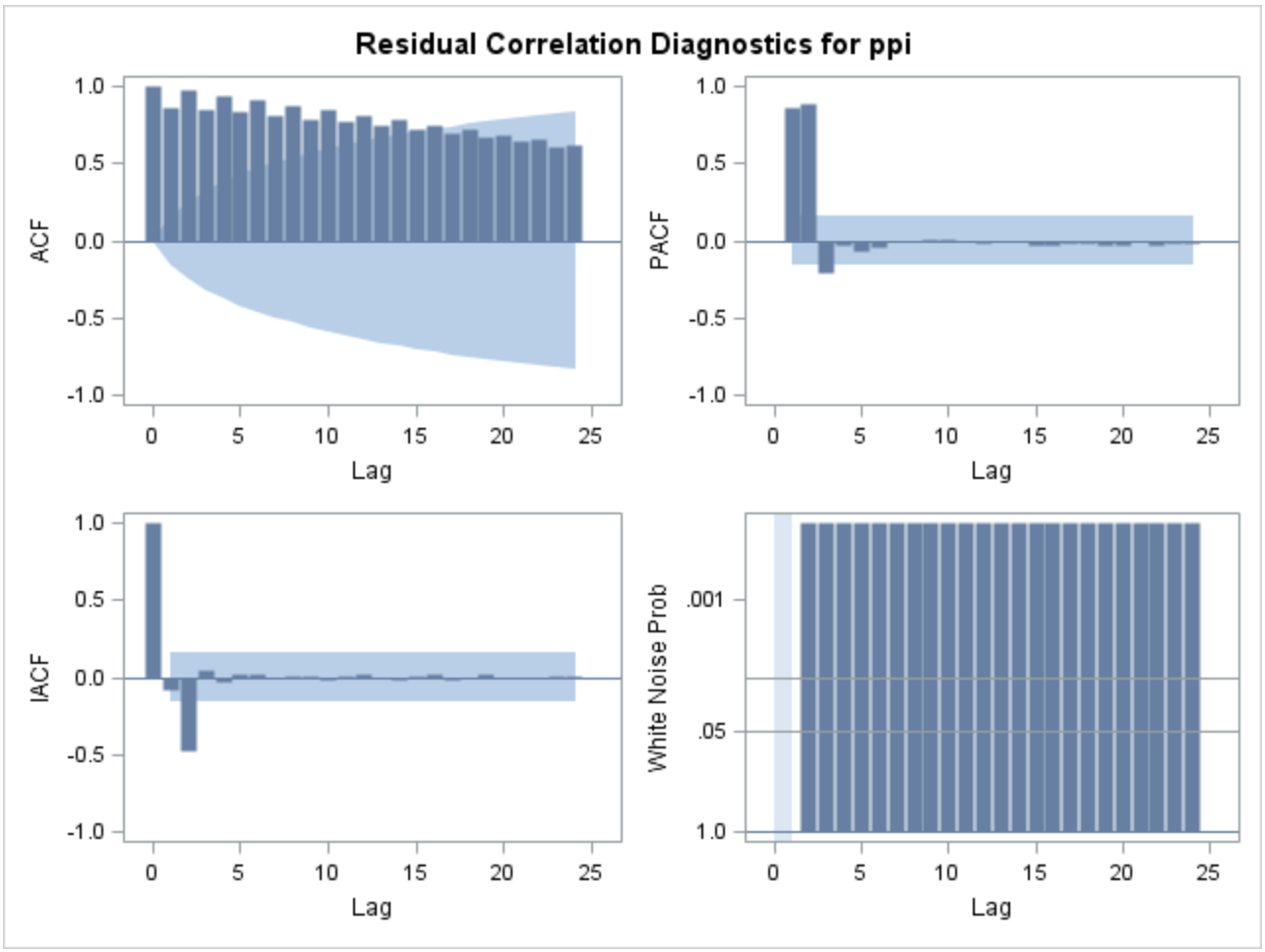
* AIC and SBC do not include log determinant.

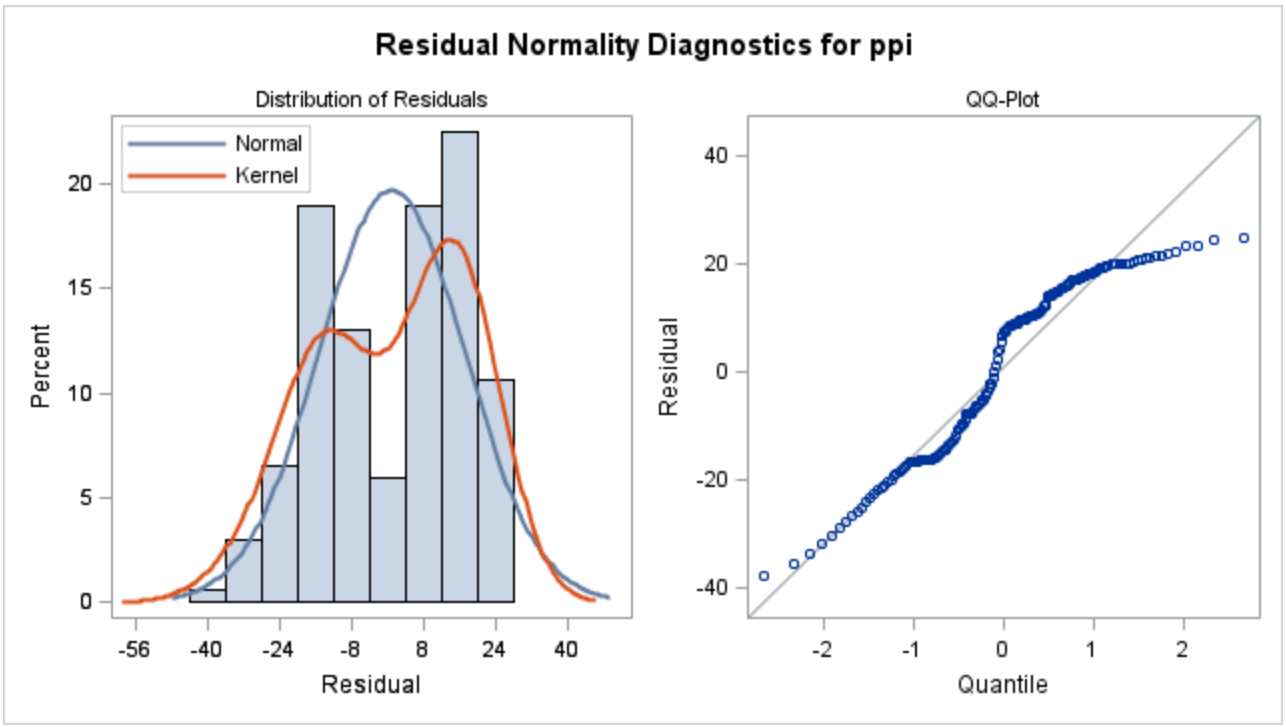
Correlations of Parameter Estimates

Parameter	MU	MA1,1
MU	1.000	0.153
MA1,1	0.153	1.000

Autocorrelation Check of Residuals

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	838.19	5	<.0001	0.862	0.972	0.849	0.940	0.829	0.906
12	1560.24	11	<.0001	0.808	0.873	0.786	0.842	0.765	0.811
18	2171.65	17	<.0001	0.743	0.782	0.721	0.751	0.696	0.719
24	2661.17	23	<.0001	0.668	0.686	0.639	0.651	0.609	0.616
30	3026.09	29	<.0001	0.577	0.581	0.546	0.545	0.513	0.509


Residual Correlation Diagnostics for ppi
ACF
PACF
IACF
White Noise Prob
Lag
1.0
0.5
0.0
-0.5
-1.0
0
5
10
15
20
25
.001
.05
1.0


Residual Normality Diagnostics for ppi
Distribution of Residuals
Normal
Kernel
Percent
Residual
-56
-40
-24
-8
8
24
40
0
5
10
15
20
QQ-Plot
Residual
Quantile
-40
-20
0
20
40
-2
-1
0
1
2

Model for variable ppi

Estimated Mean 63.10136

Moving Average Factors

Factor 1: 1 + 0.93793 B**(1)

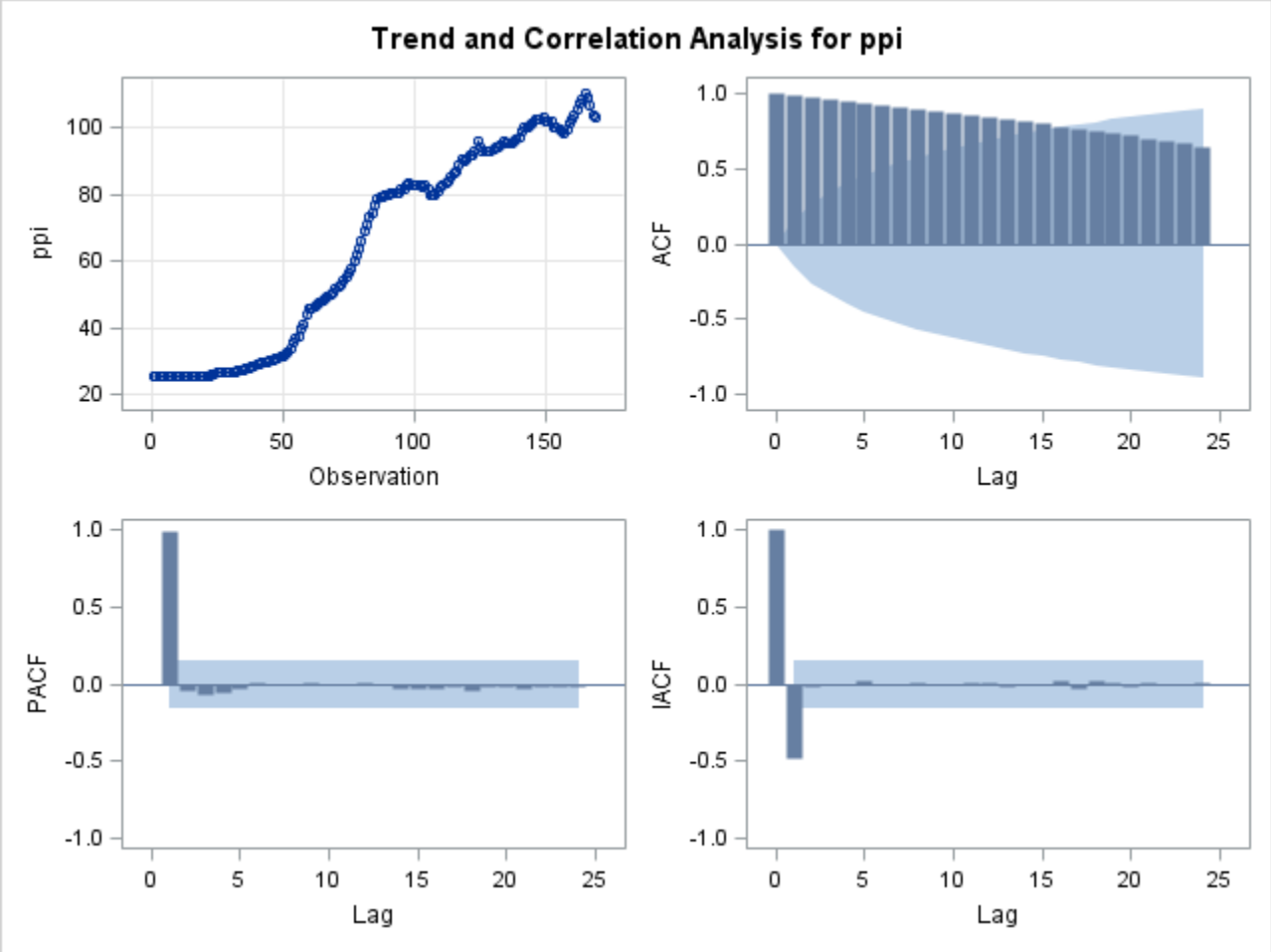
The ARIMA Procedure

Name of Variable = ppi

Mean of Working Series	64.68154
Standard Deviation	30.17628
Number of Observations	169

Autocorrelation Check for White Noise

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	960.86	6	<.0001	0.990	0.978	0.966	0.952	0.937	0.923
12	1789.38	12	<.0001	0.908	0.894	0.880	0.866	0.852	0.838
18	2489.96	18	<.0001	0.824	0.810	0.795	0.780	0.765	0.749
24	3048.92	24	<.0001	0.732	0.716	0.698	0.681	0.663	0.645



Warning: The model defined by the new estimates is unstable. The iteration process has

been terminated.

Warning: Estimates may not have converged.

ARIMA Estimation Optimization Summary

Estimation Method	Conditional Least Squares
Parameters Estimated	3
Termination Criteria	Maximum Relative Change in Estimates
Iteration Stopping Value	0.001
Criteria Value	0.97506
Maximum Absolute Value of Gradient	1672.52
R-Square Change from Last Iteration	0.415385
Objective Function	Sum of Squared Residuals
Objective Function Value	132.5082
Marquardt's Lambda Coefficient	1E-6
Numerical Derivative Perturbation Delta	0.001
Iterations	12
Warning Message	Estimates may not have converged.

Conditional Least Squares Estimation

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	26.23885	0.84942	30.89	<.0001	0
MA1,1	-0.31130	0.08578	-3.63	0.0004	1
AR1,1	1.00000	0.0019167	521.73	<.0001	1

Constant Estimate	1.628E-6
Variance Estimate	0.798242
Std Error Estimate	0.893444
AIC	444.4913
SBC	453.881
Number of Residuals	169

* AIC and SBC do not include log determinant.

Correlations of Parameter Estimates

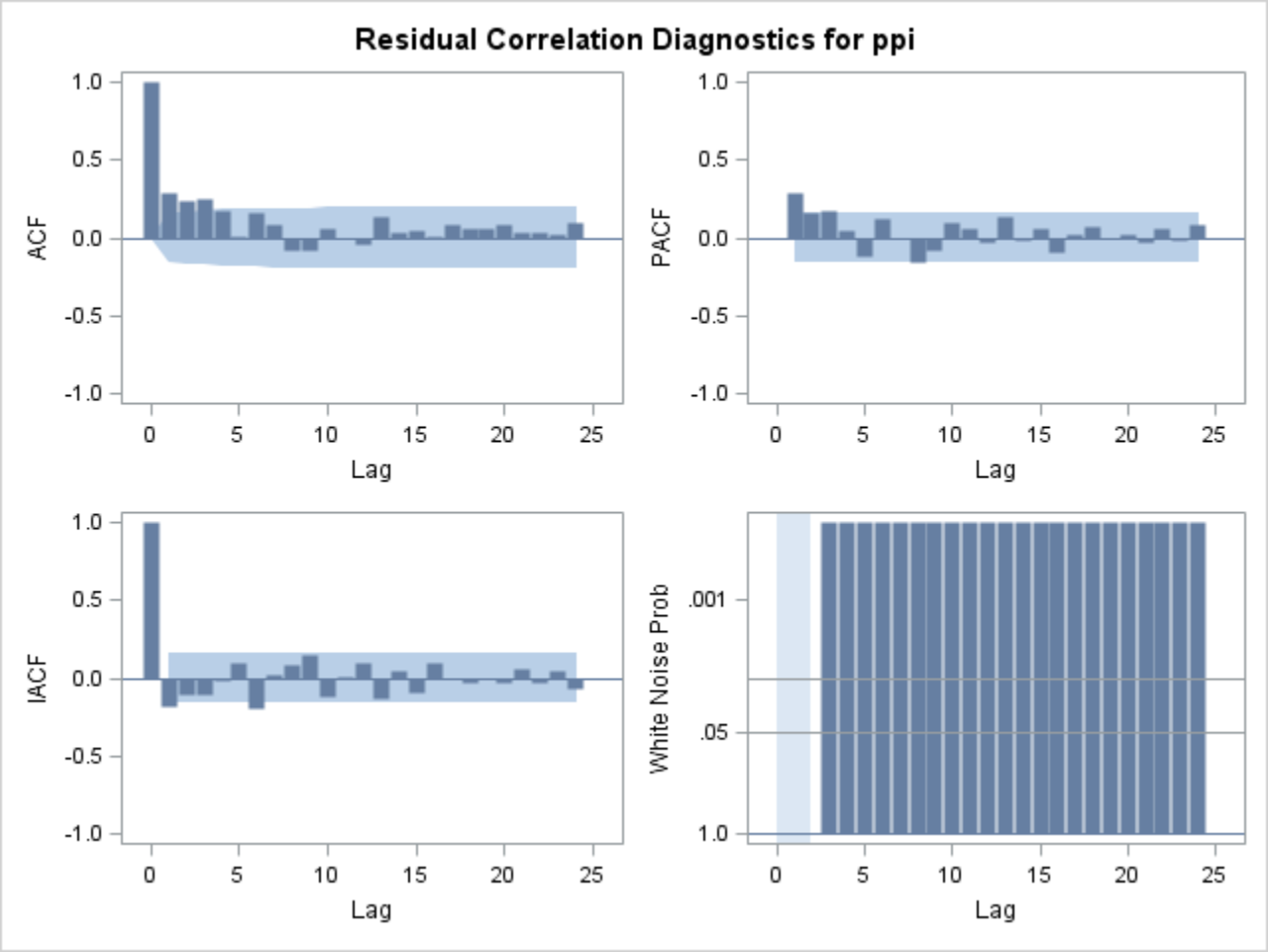
Parameter	MU	MA1,1	AR1,1
MU	1.000	0.030	0.007
MA1,1	0.030	1.000	0.253

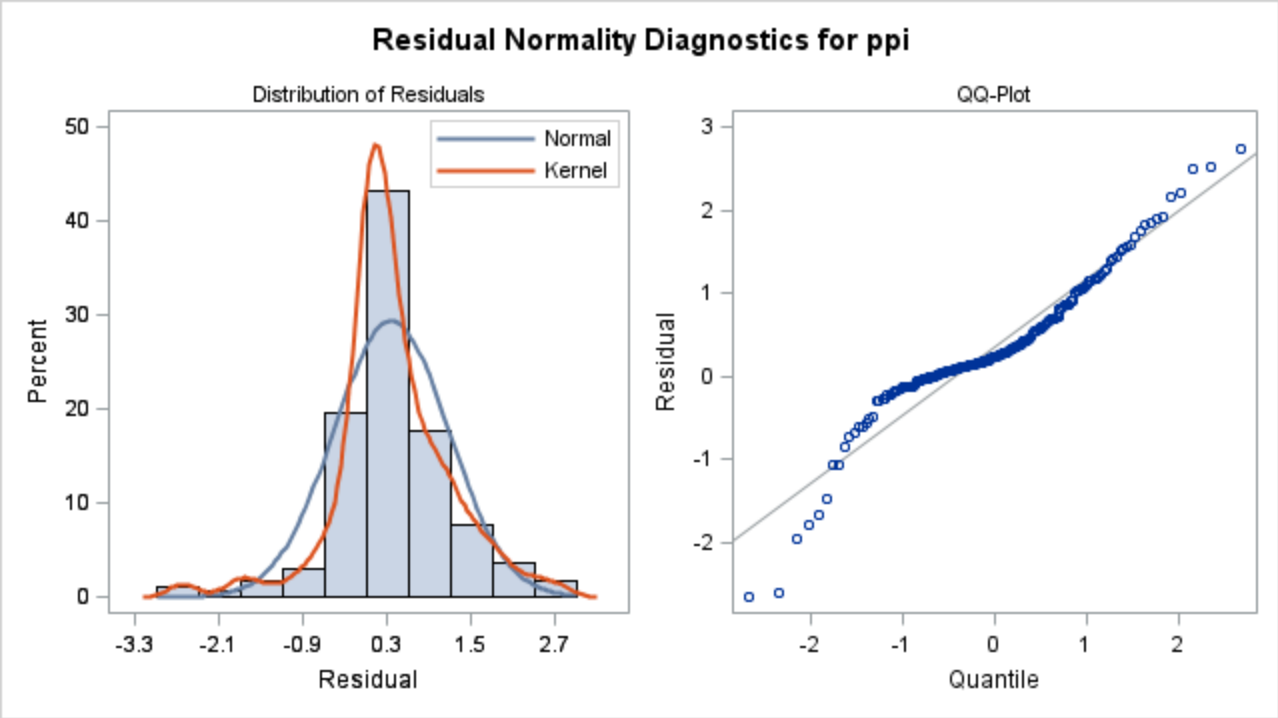
Correlations of Parameter Estimates

Parameter	MU	MA1,1	AR1,1
AR1,1	0.007	0.253	1.000

Autocorrelation Check of Residuals

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	117.10	4	<.0001	0.402	0.363	0.385	0.325	0.183	0.303
12	145.64	10	<.0001	0.237	0.093	0.099	0.210	0.154	0.126
18	199.65	16	<.0001	0.274	0.188	0.204	0.174	0.240	0.217
24	255.98	22	<.0001	0.217	0.240	0.199	0.197	0.194	0.258
30	298.38	28	<.0001	0.166	0.197	0.147	0.272	0.121	0.176





Model for variable ppi

Estimated Mean 26.23885

Autoregressive Factors

Factor 1: 1 - 1 B**(1)

Moving Average Factors

Factor 1: 1 + 0.3113 B**(1)

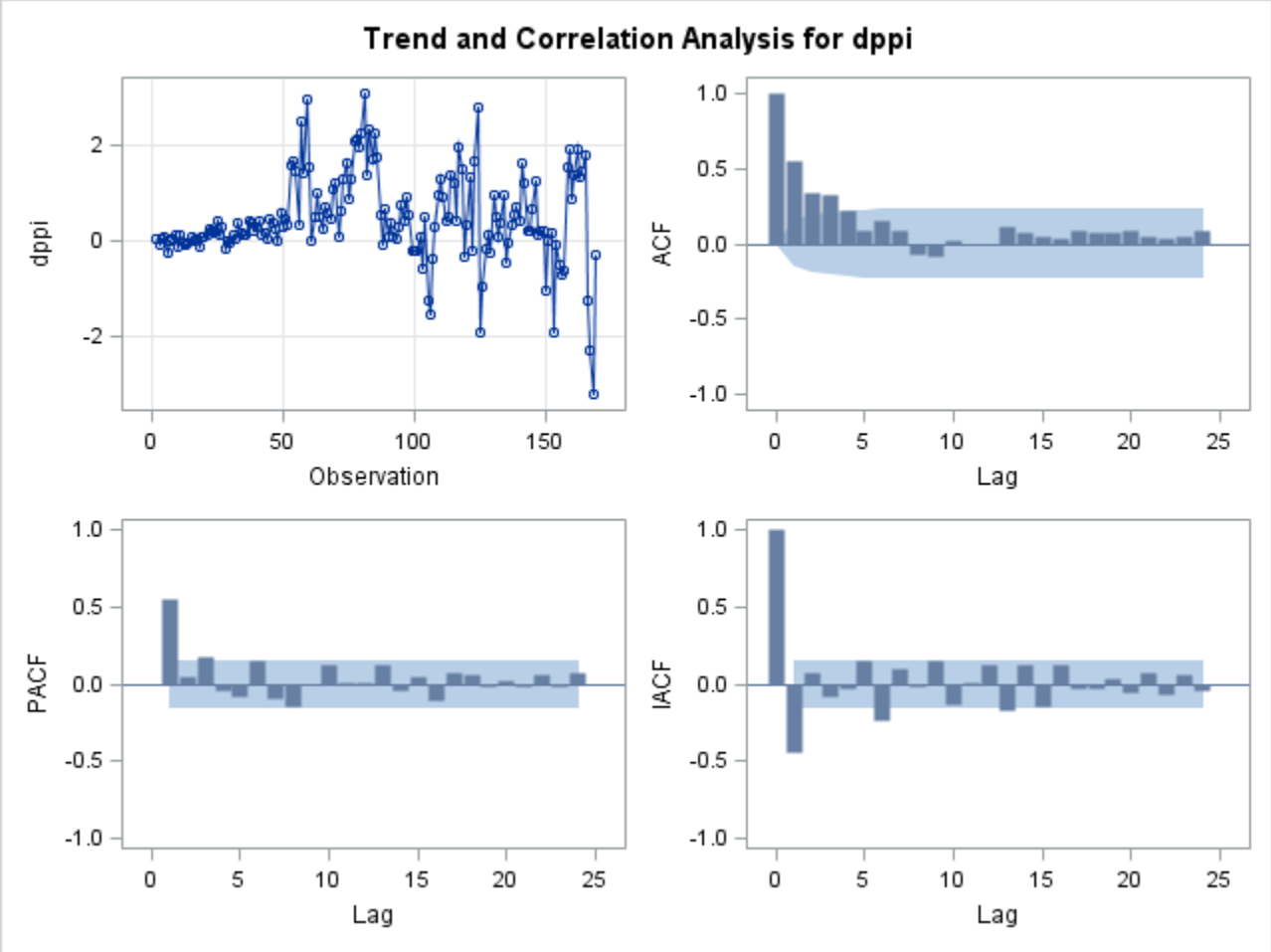
The ARIMA Procedure

Name of Variable = dppi

Mean of Working Series	0.464286
Standard Deviation	0.918001
Number of Observations	168

Autocorrelation Check for White Noise

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	102.82	6	<.0001	0.553	0.335	0.319	0.216	0.086	0.153
12	106.35	12	<.0001	0.082	-0.078	-0.080	0.023	-0.008	-0.006
18	112.72	18	<.0001	0.112	0.069	0.048	0.039	0.084	0.077
24	117.91	24	<.0001	0.076	0.085	0.049	0.033	0.047	0.089



Conditional Least Squares Estimation

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	0.45192	0.13171	3.43	0.0008	0
AR1,1	0.55487	0.06476	8.57	<.0001	1

Constant Estimate	0.201162
Variance Estimate	0.591422
Std Error Estimate	0.76904
AIC	390.5135
SBC	396.7614
Number of Residuals	168

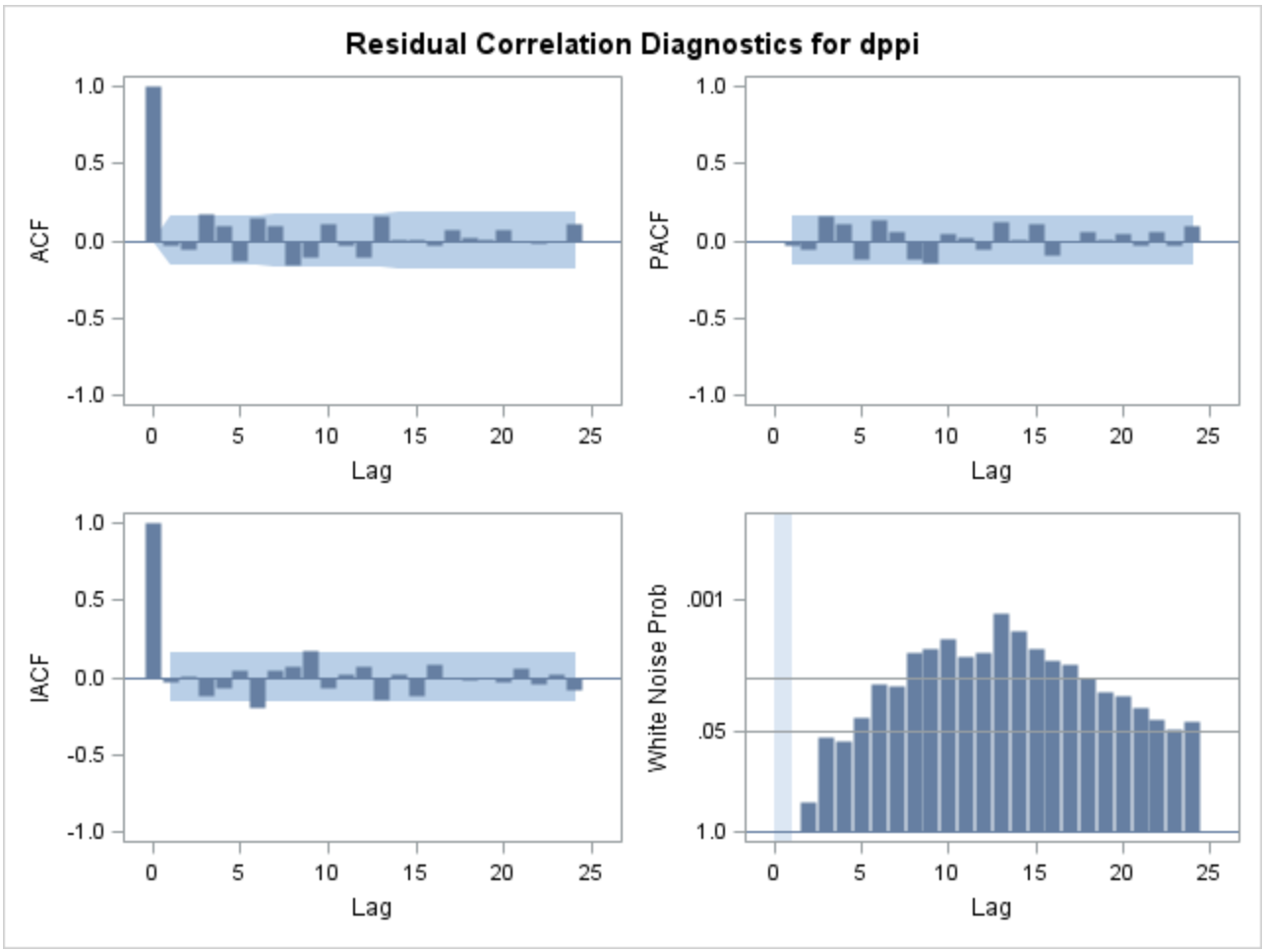
* AIC and SBC do not include log determinant.

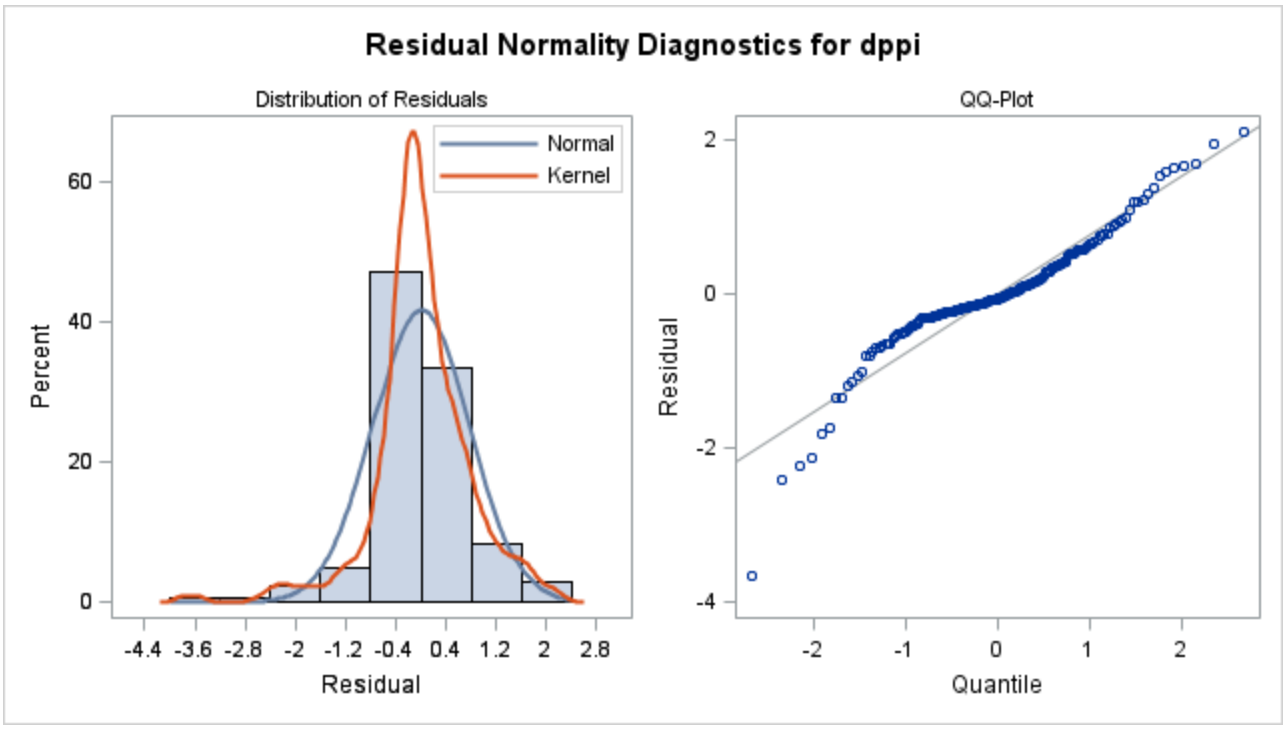
Correlations of Parameter Estimates

Parameter	MU	AR1,1
MU	1.000	-0.018
AR1,1	-0.018	1.000

Autocorrelation Check of Residuals

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	14.59	5	0.0123	-0.032	-0.056	0.169	0.095	-0.137	0.153
12	26.96	11	0.0047	0.094	-0.153	-0.109	0.116	-0.032	-0.102
18	33.26	17	0.0104	0.163	0.005	0.007	-0.036	0.075	0.018
24	36.58	23	0.0360	0.013	0.066	-0.002	-0.014	-0.005	0.110
30	45.44	29	0.0267	-0.041	0.007	-0.061	0.159	-0.111	-0.019


Residual Correlation Diagnostics for dppi
ACF
PACF
IACF
White Noise Prob
Lag
1.0
0.5
0.0
-0.5
-1.0
0
5
10
15
20
25
.001
.05
1.0


Residual Normality Diagnostics for dppi
Distribution of Residuals
Normal
Kernel
Percent
Residual
60
40
20
0
-4.4
-3.6
-2.8
-2
-1.2
-0.4
0.4
1.2
2
2.8
QQ-Plot
Residual
Quantile
2
0
-2
-4
-2
-1
0
1
2

Model for variable dppi

Estimated Mean 0.451917

Autoregressive Factors

Factor 1: 1 - 0.55487 B**(1)

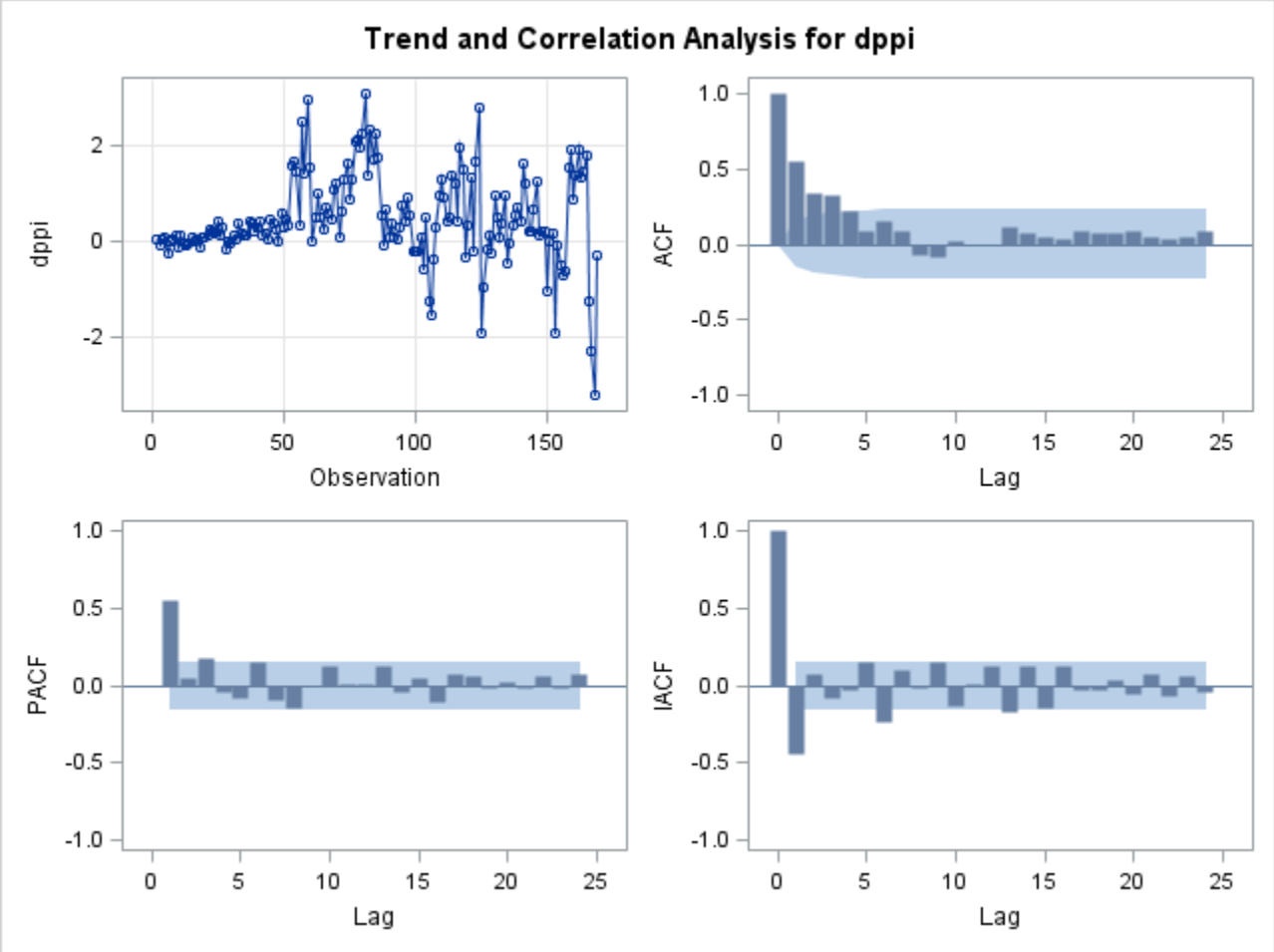
The ARIMA Procedure

Name of Variable = dppi

Mean of Working Series	0.464286
Standard Deviation	0.918001
Number of Observations	168

Autocorrelation Check for White Noise

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	102.82	6	<.0001	0.553	0.335	0.319	0.216	0.086	0.153
12	106.35	12	<.0001	0.082	-0.078	-0.080	0.023	-0.008	-0.006
18	112.72	18	<.0001	0.112	0.069	0.048	0.039	0.084	0.077
24	117.91	24	<.0001	0.076	0.085	0.049	0.033	0.047	0.089



Conditional Least Squares Estimation

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	0.46466	0.09139	5.08	<.0001	0
MA1,1	-0.48912	0.06889	-7.10	<.0001	1

Constant Estimate	0.464664
Variance Estimate	0.636118
Std Error Estimate	0.79757
AIC	402.753
SBC	409.0009
Number of Residuals	168

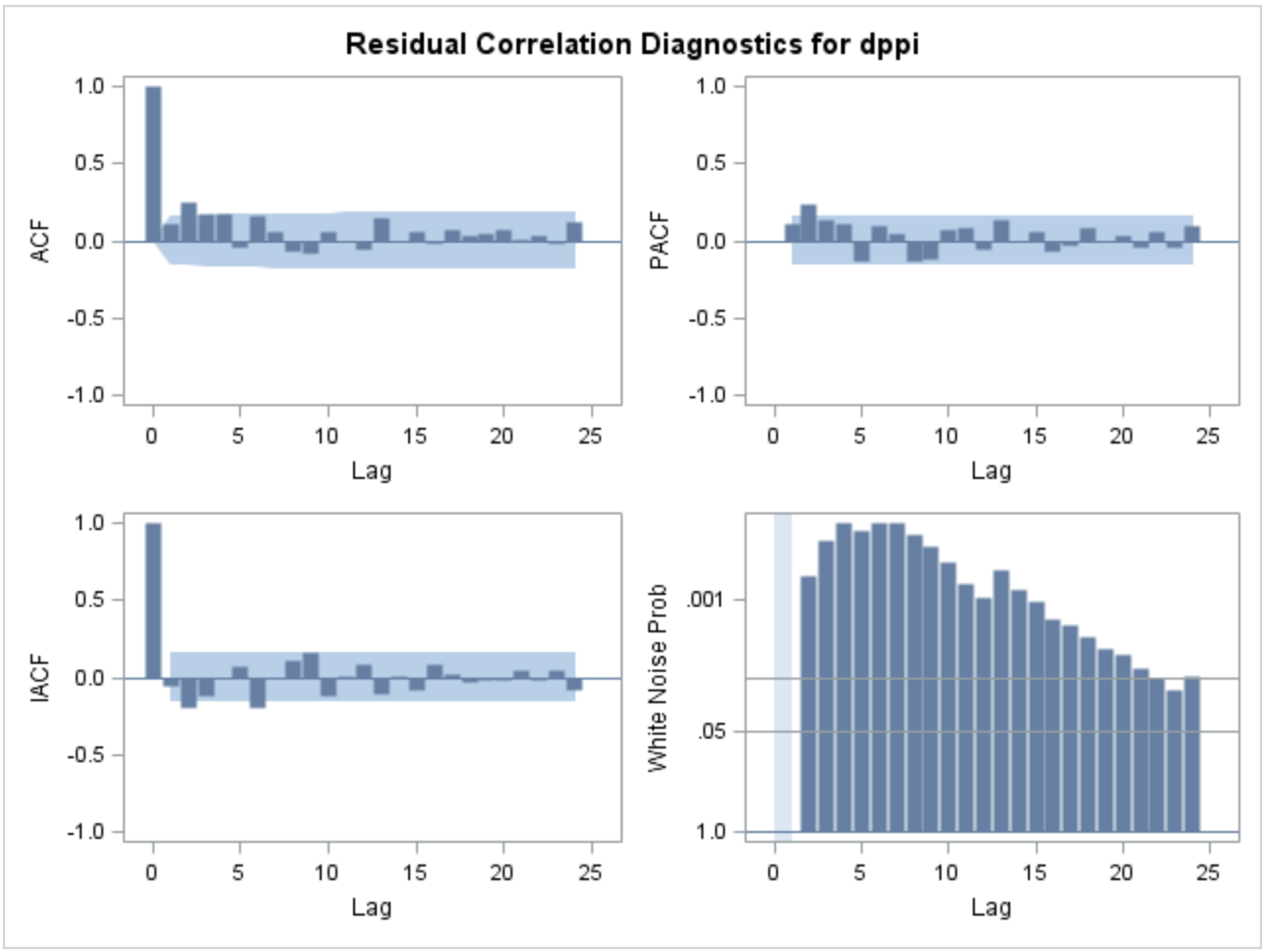
* AIC and SBC do not include log determinant.

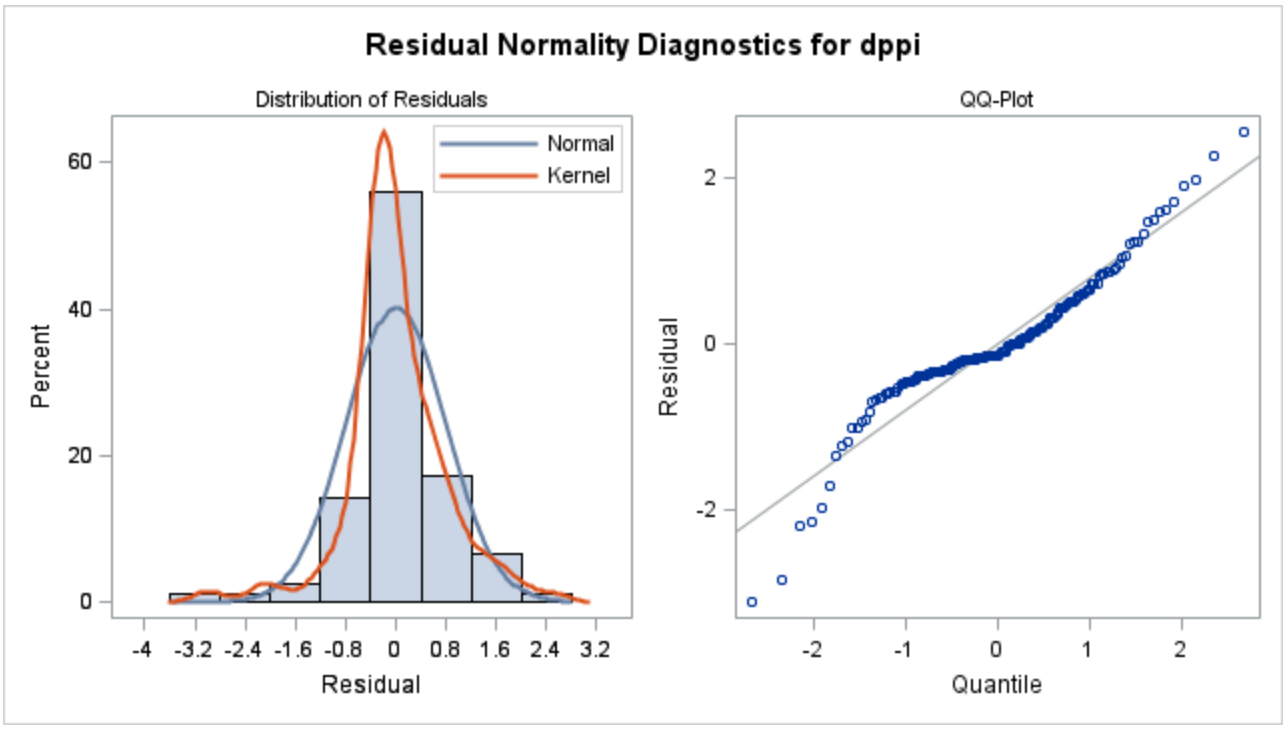
Correlations of Parameter Estimates

Parameter	MU	MA1,1
MU	1.000	-0.007
MA1,1	-0.007	1.000

Autocorrelation Check of Residuals

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	27.59	5	<.0001	0.105	0.245	0.173	0.177	-0.037	0.161
12	31.46	11	0.0009	0.055	-0.071	-0.079	0.059	-0.005	-0.060
18	37.34	17	0.0030	0.146	-0.008	0.057	-0.012	0.074	0.038
24	41.85	23	0.0095	0.040	0.068	0.011	0.036	-0.012	0.123
30	51.80	29	0.0057	-0.051	0.069	-0.085	0.156	-0.096	0.032


Residual Correlation Diagnostics for dppi
ACF
PACF
IACF
White Noise Prob
Lag
1.0
0.5
0.0
-0.5
-1.0
0
5
10
15
20
25
.001
.05
1.0


Residual Normality Diagnostics for dppi
Distribution of Residuals
Normal
Kernel
Percent
Residual
60
40
20
0
-4
-3.2
-2.4
-1.6
-0.8
0
0.8
1.6
2.4
3.2
QQ-Plot
Residual
Quantile
2
0
-2
-1
1

Model for variable dppi

Estimated Mean 0.464664

Moving Average Factors

Factor 1: 1 + 0.48912 B**(1)

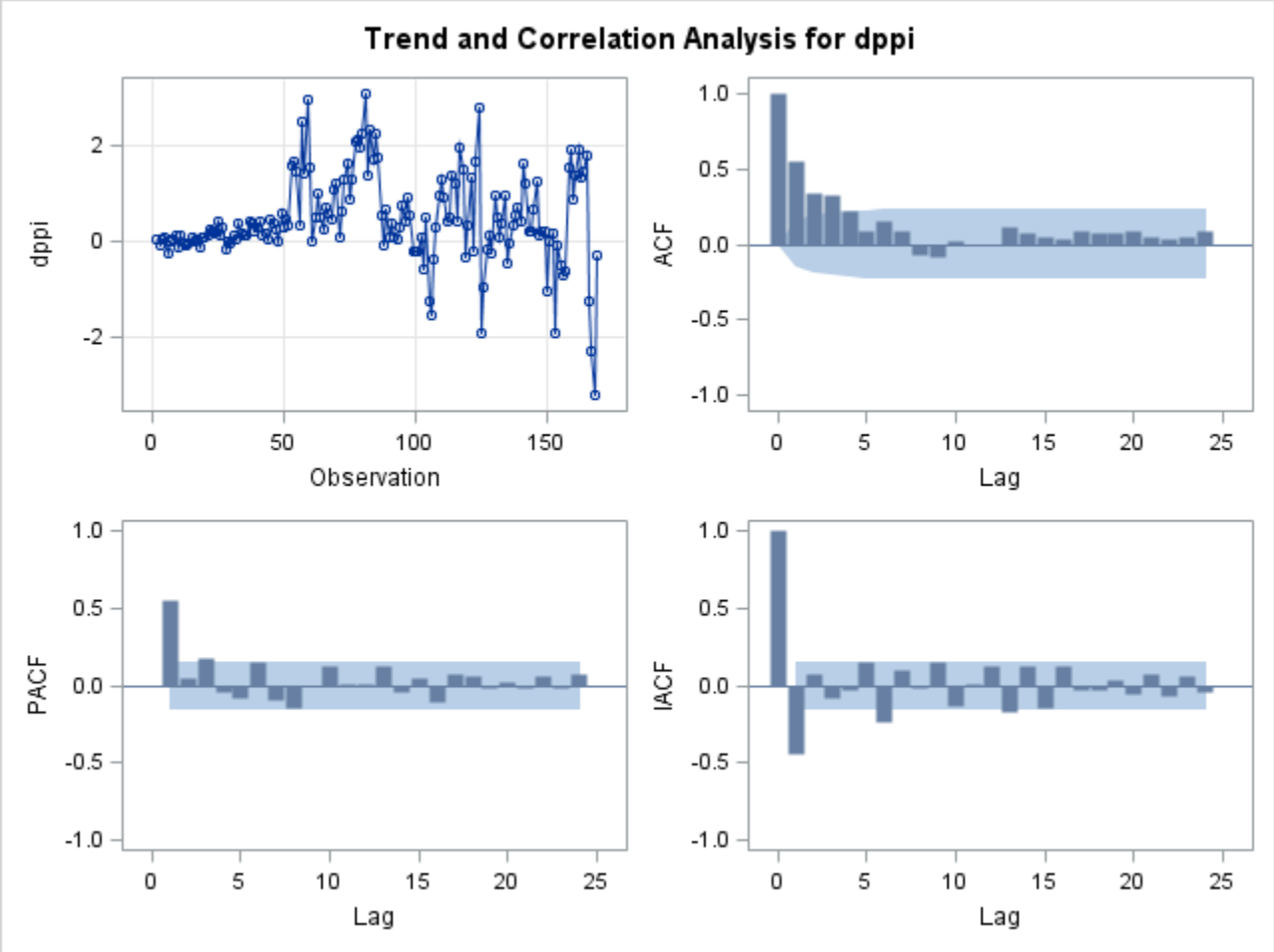
The ARIMA Procedure

Name of Variable = dppi

Mean of Working Series	0.464286
Standard Deviation	0.918001
Number of Observations	168

Autocorrelation Check for White Noise

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	102.82	6	<.0001	0.553	0.335	0.319	0.216	0.086	0.153
12	106.35	12	<.0001	0.082	-0.078	-0.080	0.023	-0.008	-0.006
18	112.72	18	<.0001	0.112	0.069	0.048	0.039	0.084	0.077
24	117.91	24	<.0001	0.076	0.085	0.049	0.033	0.047	0.089



Conditional Least Squares Estimation

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	0.43146	0.15913	2.71	0.0074	0
MA1,1	0.25590	0.13981	1.83	0.0690	1
AR1,1	0.72813	0.10089	7.22	<.0001	1

Constant Estimate	0.117299
Variance Estimate	0.589302
Std Error Estimate	0.76766
AIC	390.8951
SBC	400.267
Number of Residuals	168

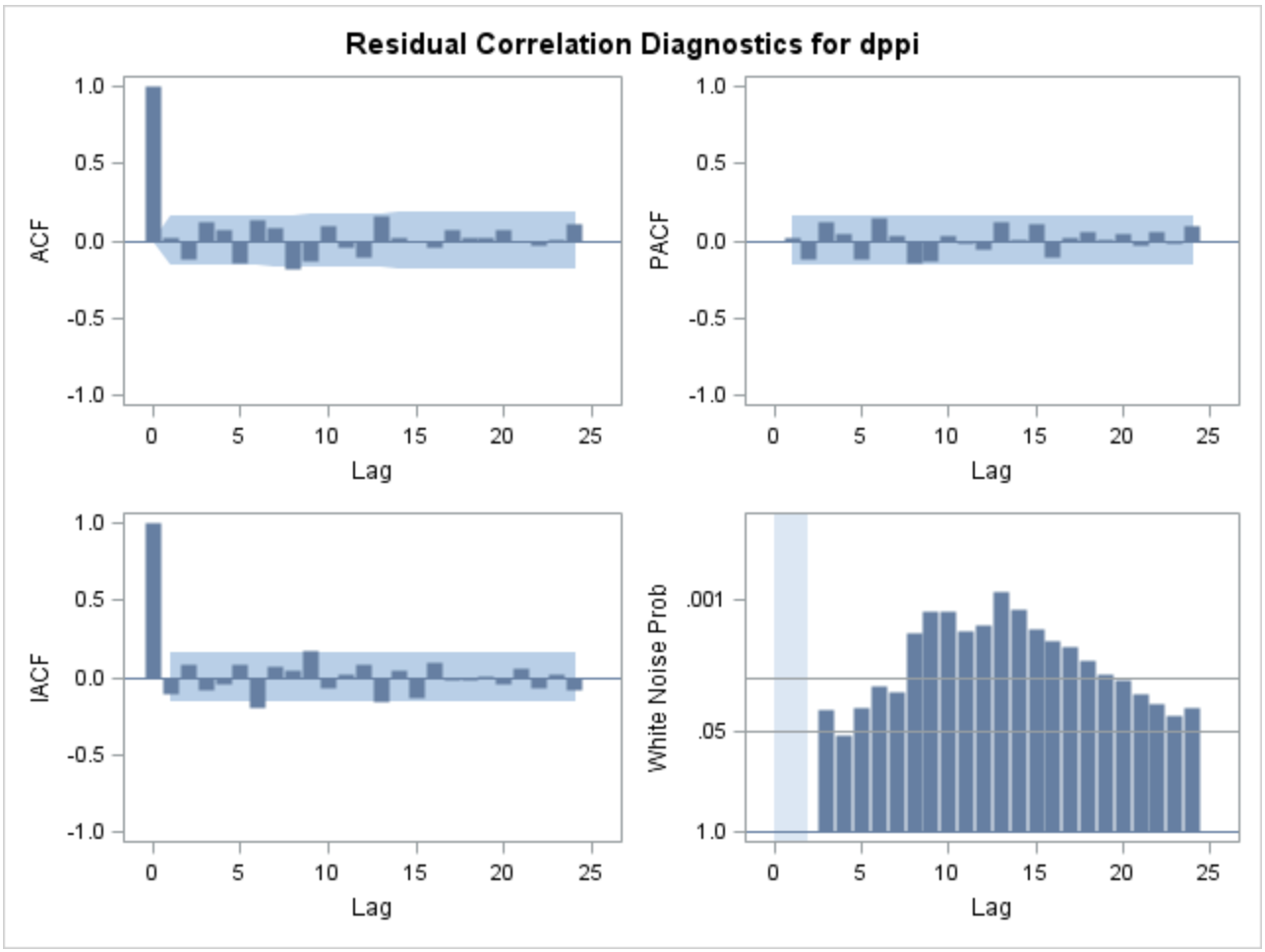
* AIC and SBC do not include log determinant.

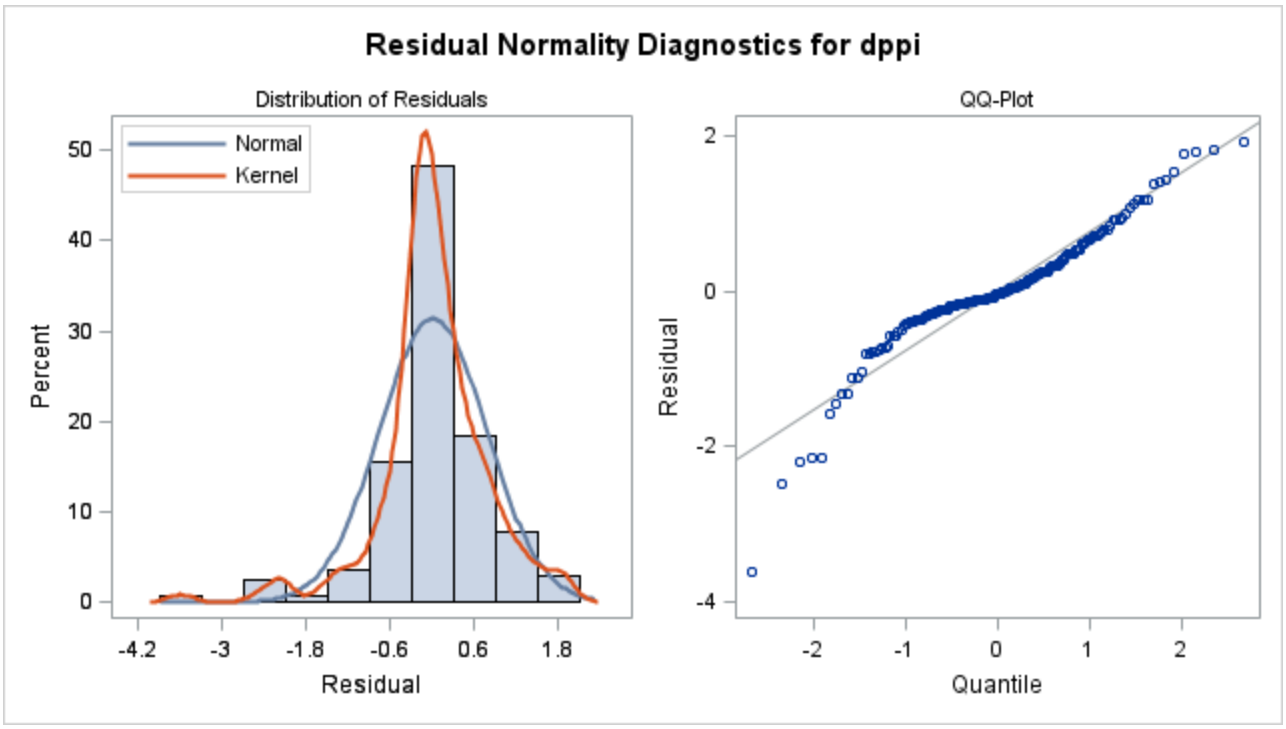
Correlations of Parameter Estimates

Parameter	MU	MA1,1	AR1,1
MU	1.000	-0.079	-0.094
MA1,1	-0.079	1.000	0.842
AR1,1	-0.094	0.842	1.000

Autocorrelation Check of Residuals

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	12.67	4	0.0130	0.022	-0.118	0.120	0.067	-0.144	0.137
12	27.53	10	0.0021	0.087	-0.184	-0.137	0.099	-0.040	-0.105
18	33.60	16	0.0062	0.155	0.025	-0.006	-0.044	0.074	0.023
24	36.80	22	0.0249	0.015	0.068	-0.005	-0.026	0.004	0.104
30	44.22	28	0.0264	-0.037	-0.014	-0.043	0.143	-0.108	-0.026


Residual Correlation Diagnostics for dppi
ACF
PACF
IACF
White Noise Prob
Lag
1.0
0.5
0.0
-0.5
-1.0
0
5
10
15
20
25
.001
.05
1.0


Residual Normality Diagnostics for dppi
Distribution of Residuals
Normal
Kernel
Percent
Residual
50
40
30
20
10
0
-4.2
-3
-1.8
-0.6
0.6
1.8
QQ-Plot
Residual
Quantile
2
0
-2
-4
-2
-1
0
1
2

Model for variable dppi

Estimated Mean 0.431456

Autoregressive Factors

Factor 1: 1 - 0.72813 B**(1)

Moving Average Factors

Factor 1: 1 - 0.2559 B**(1)

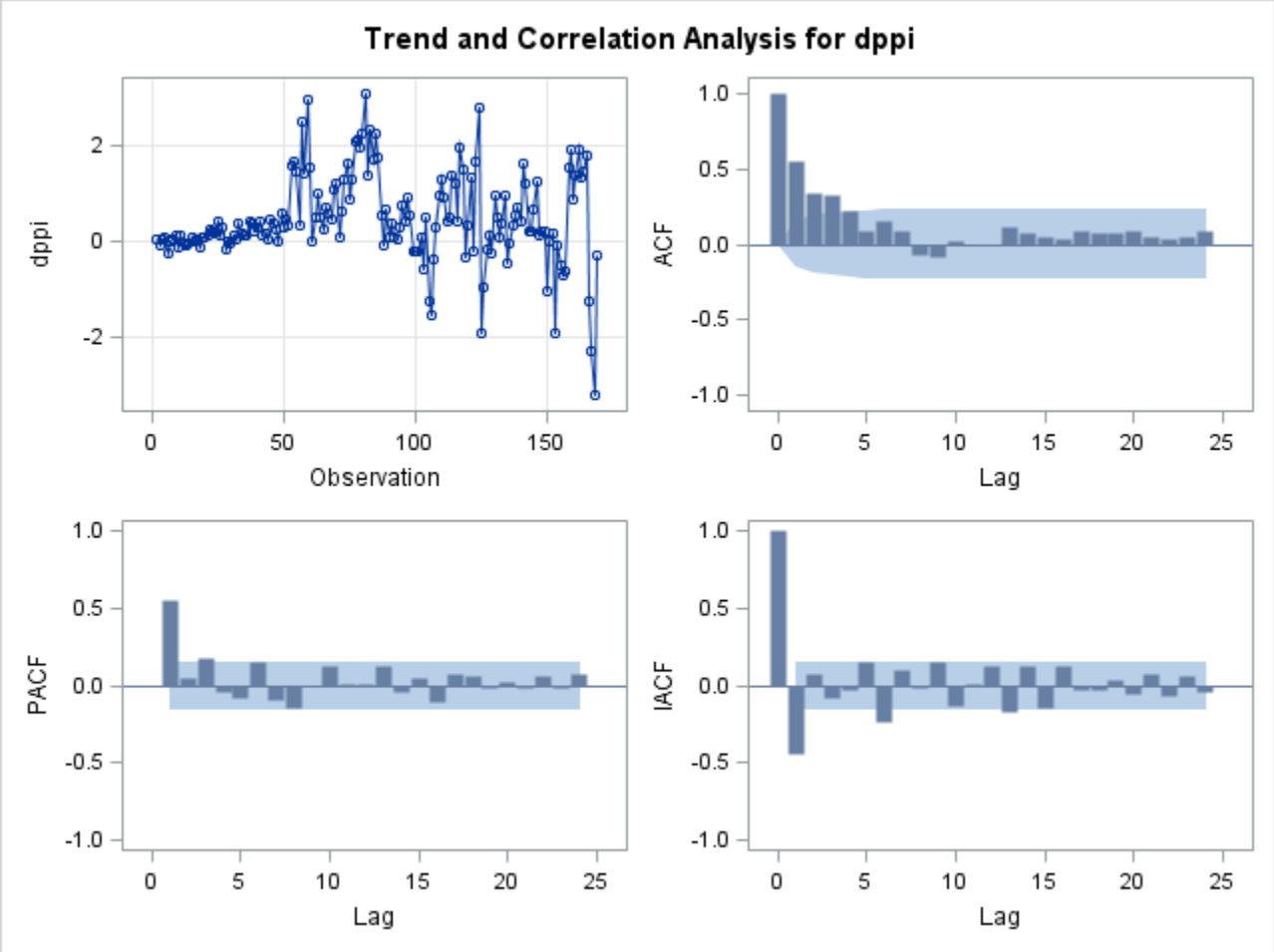
The ARIMA Procedure

Name of Variable = dppi

Mean of Working Series	0.464286
Standard Deviation	0.918001
Number of Observations	168

Autocorrelation Check for White Noise

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	102.82	6	<.0001	0.553	0.335	0.319	0.216	0.086	0.153
12	106.35	12	<.0001	0.082	-0.078	-0.080	0.023	-0.008	-0.006
18	112.72	18	<.0001	0.112	0.069	0.048	0.039	0.084	0.077
24	117.91	24	<.0001	0.076	0.085	0.049	0.033	0.047	0.089



Conditional Least Squares Estimation

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	0.42181	0.16964	2.49	0.0139	0
MA1,1	0.24281	0.16925	1.43	0.1533	1
MA1,2	0.10888	0.11683	0.93	0.3527	2
MA1,3	-0.12407	0.10101	-1.23	0.2211	3
AR1,1	0.73735	0.15570	4.74	<.0001	1

Constant Estimate	0.110789
Variance Estimate	0.581535
Std Error Estimate	0.762585
AIC	390.6174
SBC	406.2373
Number of Residuals	168

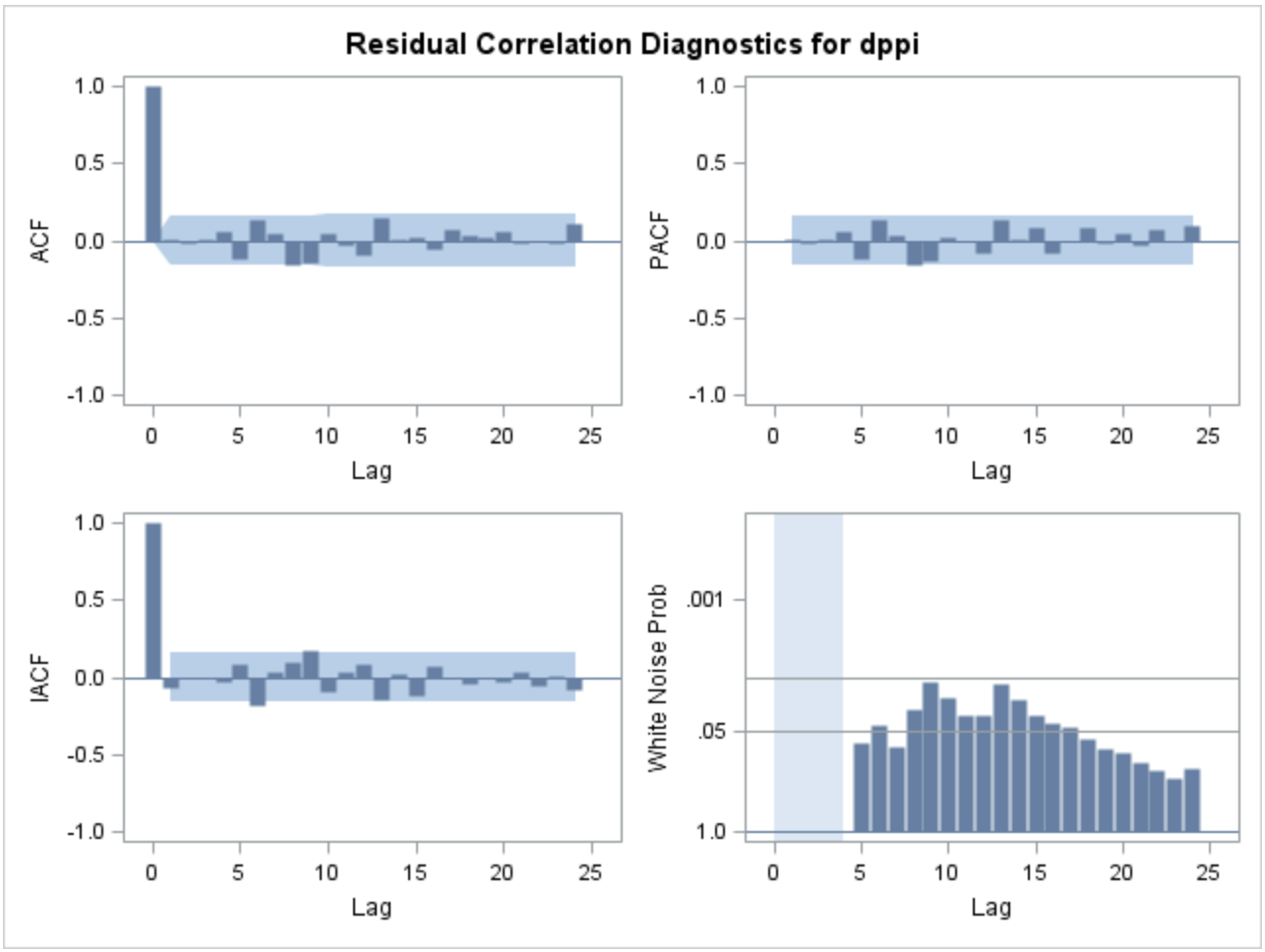
* AIC and SBC do not include log determinant.

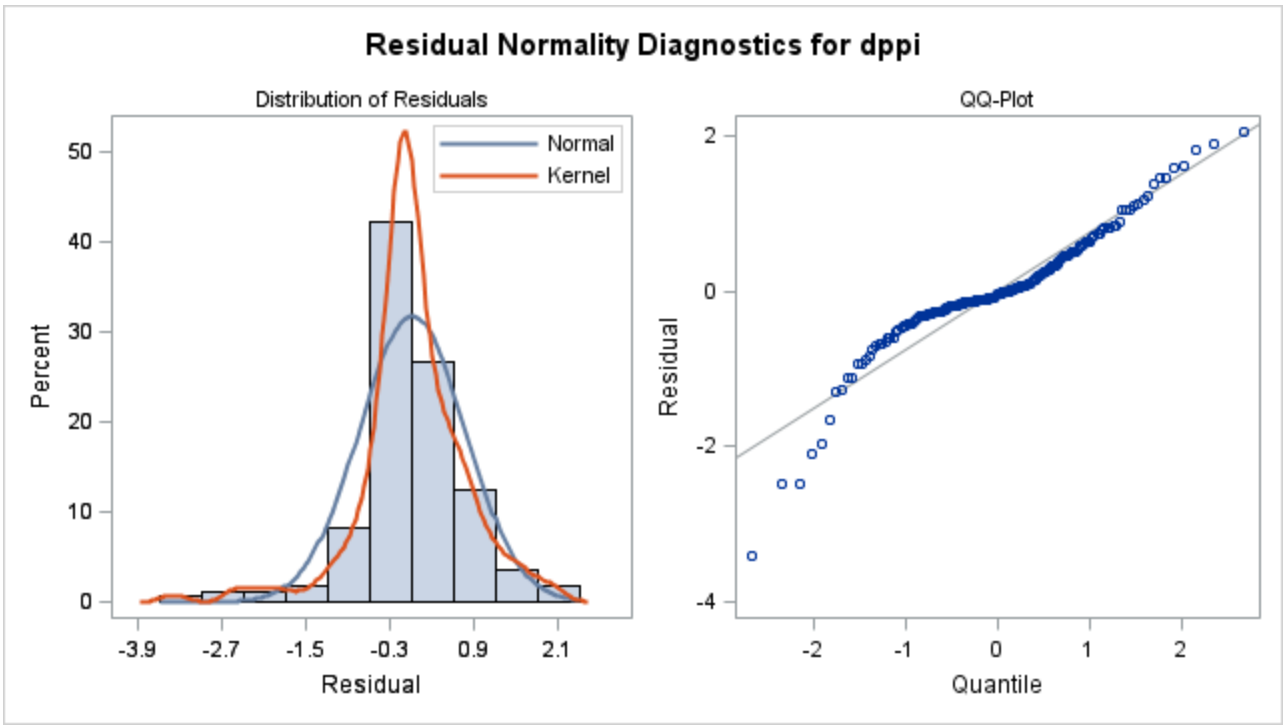
Correlations of Parameter Estimates

Parameter	MU	MA1,1	MA1,2	MA1,3	AR1,1
MU	1.000	-0.109	-0.065	-0.020	-0.115
MA1,1	-0.109	1.000	0.517	0.418	0.884
MA1,2	-0.065	0.517	1.000	0.251	0.686
MA1,3	-0.020	0.418	0.251	1.000	0.526
AR1,1	-0.115	0.884	0.686	0.526	1.000

Autocorrelation Check of Residuals

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	6.40	2	0.0408	0.008	-0.015	0.008	0.061	-0.120	0.134
12	16.92	8	0.0309	0.048	-0.153	-0.146	0.052	-0.026	-0.091
18	22.88	14	0.0623	0.152	0.007	0.024	-0.056	0.066	0.031
24	26.35	20	0.1546	0.022	0.062	-0.012	-0.006	-0.012	0.114
30	35.87	26	0.0940	-0.063	0.024	-0.075	0.150	-0.118	0.010


Residual Correlation Diagnostics for dppi
ACF
PACF
IACF
White Noise Prob
Lag
1.0
0.5
0.0
-0.5
-1.0
0
5
10
15
20
25
.001
.05
1.0


Residual Normality Diagnostics for dppi
Distribution of Residuals
Normal
Kernel
Percent
Residual
50
40
30
20
10
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-3.9
-2.7
-1.5
-0.3
0.9
2.1
QQ-Plot
Residual
Quantile
2
0
-2
-4
-2
-1
0
1
2

Model for variable dppi

Estimated Mean 0.42181

Autoregressive Factors

Factor 1: 1 - 0.73735 B**(1)

Moving Average Factors

Factor 1: 1 - 0.24281 B**(1) - 0.10888 B**(2) + 0.12407 B**(3)

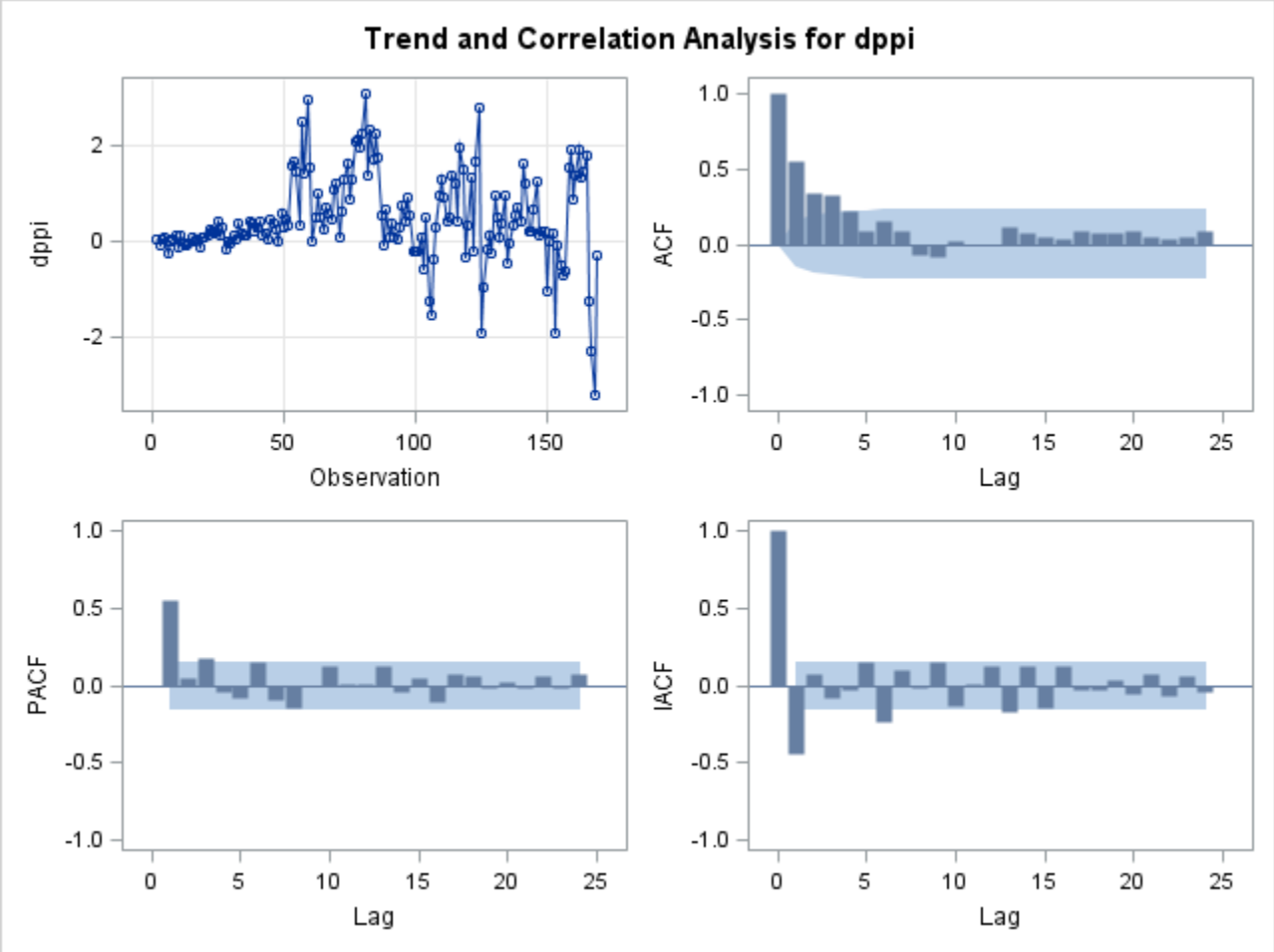
The ARIMA Procedure

Name of Variable = dppi

Mean of Working Series	0.464286
Standard Deviation	0.918001
Number of Observations	168

Autocorrelation Check for White Noise

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	102.82	6	<.0001	0.553	0.335	0.319	0.216	0.086	0.153
12	106.35	12	<.0001	0.082	-0.078	-0.080	0.023	-0.008	-0.006
18	112.72	18	<.0001	0.112	0.069	0.048	0.039	0.084	0.077
24	117.91	24	<.0001	0.076	0.085	0.049	0.033	0.047	0.089



Conditional Least Squares Estimation

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	0.43244	0.14612	2.96	0.0035	0
MA1,1	1.04754	0.18112	5.78	<.0001	1
MA1,2	-0.21287	0.14771	-1.44	0.1515	2
MA1,3	-0.32823	0.09138	-3.59	0.0004	3
AR1,1	1.51747	0.17595	8.62	<.0001	1
AR1,2	-0.71168	0.16096	-4.42	<.0001	2

Constant Estimate	0.083983
Variance Estimate	0.568152
Std Error Estimate	0.753759
AIC	387.6722
SBC	406.416
Number of Residuals	168

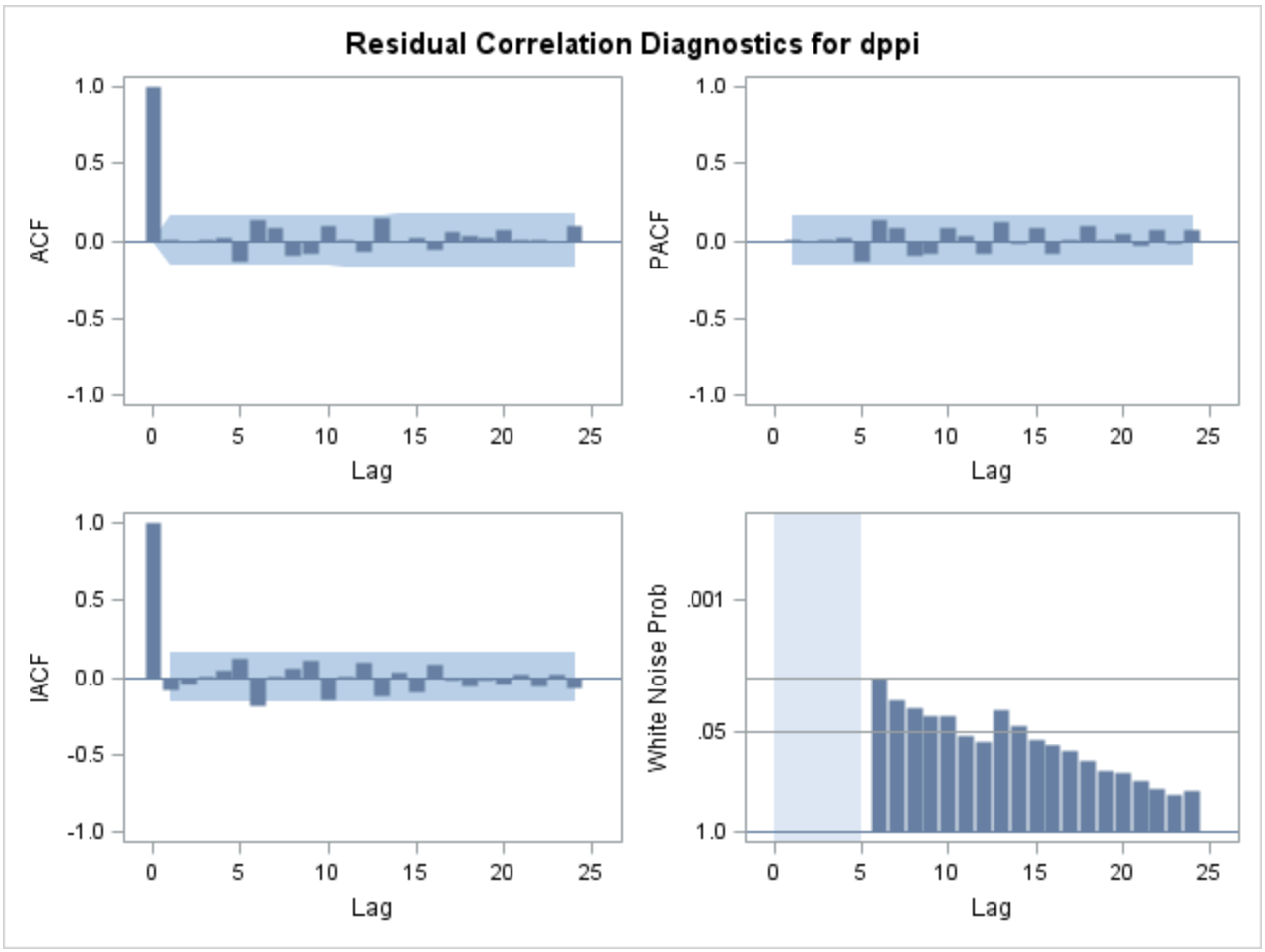
* AIC and SBC do not include log determinant.

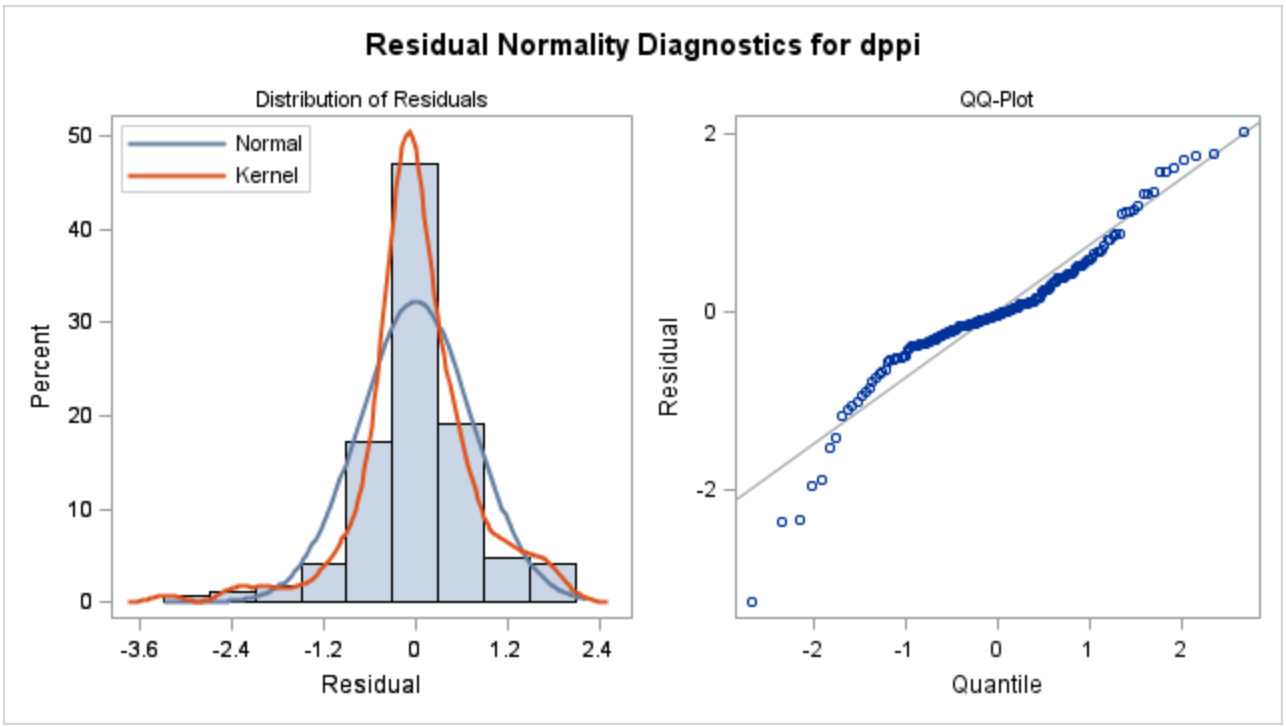
Correlations of Parameter Estimates

Parameter	MU	MA1,1	MA1,2	MA1,3	AR1,1	AR1,2
MU	1.000	0.039	-0.040	-0.006	0.048	-0.072
MA1,1	0.039	1.000	-0.818	0.359	0.906	-0.871
MA1,2	-0.040	-0.818	1.000	-0.595	-0.590	0.621
MA1,3	-0.006	0.359	-0.595	1.000	0.186	-0.038
AR1,1	0.048	0.906	-0.590	0.186	1.000	-0.946
AR1,2	-0.072	-0.871	0.621	-0.038	-0.946	1.000

Autocorrelation Check of Residuals

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	6.64	1	0.0100	0.005	-0.002	0.002	0.022	-0.136	0.137
12	13.27	7	0.0657	0.084	-0.090	-0.085	0.095	0.003	-0.075
18	19.11	13	0.1196	0.151	-0.008	0.022	-0.062	0.059	0.028
24	22.08	19	0.2804	0.024	0.071	0.006	0.007	-0.011	0.096
30	31.79	25	0.1643	-0.078	0.009	-0.090	0.149	-0.103	0.025


Residual Correlation Diagnostics for dppi
ACF
PACF
IACF
White Noise Prob
Lag
1.0
0.5
0.0
-0.5
-1.0
0
5
10
15
20
25
.001
.05
1.0


Residual Normality Diagnostics for dppi
Distribution of Residuals
Normal
Kernel
Percent
Residual
50
40
30
20
10
0
-3.6
-2.4
-1.2
0
1.2
2.4
QQ-Plot
Residual
Quantile
2
0
-2
-1
1

Model for variable dppi

Estimated Mean 0.432437

Autoregressive Factors

Factor 1: 1 - 1.51747 B**(1) + 0.71168 B**(2)

Moving Average Factors

Factor 1: 1 - 1.04754 B**(1) + 0.21287 B**(2) + 0.32823 B**(3)

The ARIMA Procedure

Name of Variable = ppi

Mean of Working Series	64.68154
Standard Deviation	30.17628
Number of Observations	169

Autocorrelation Check for White Noise

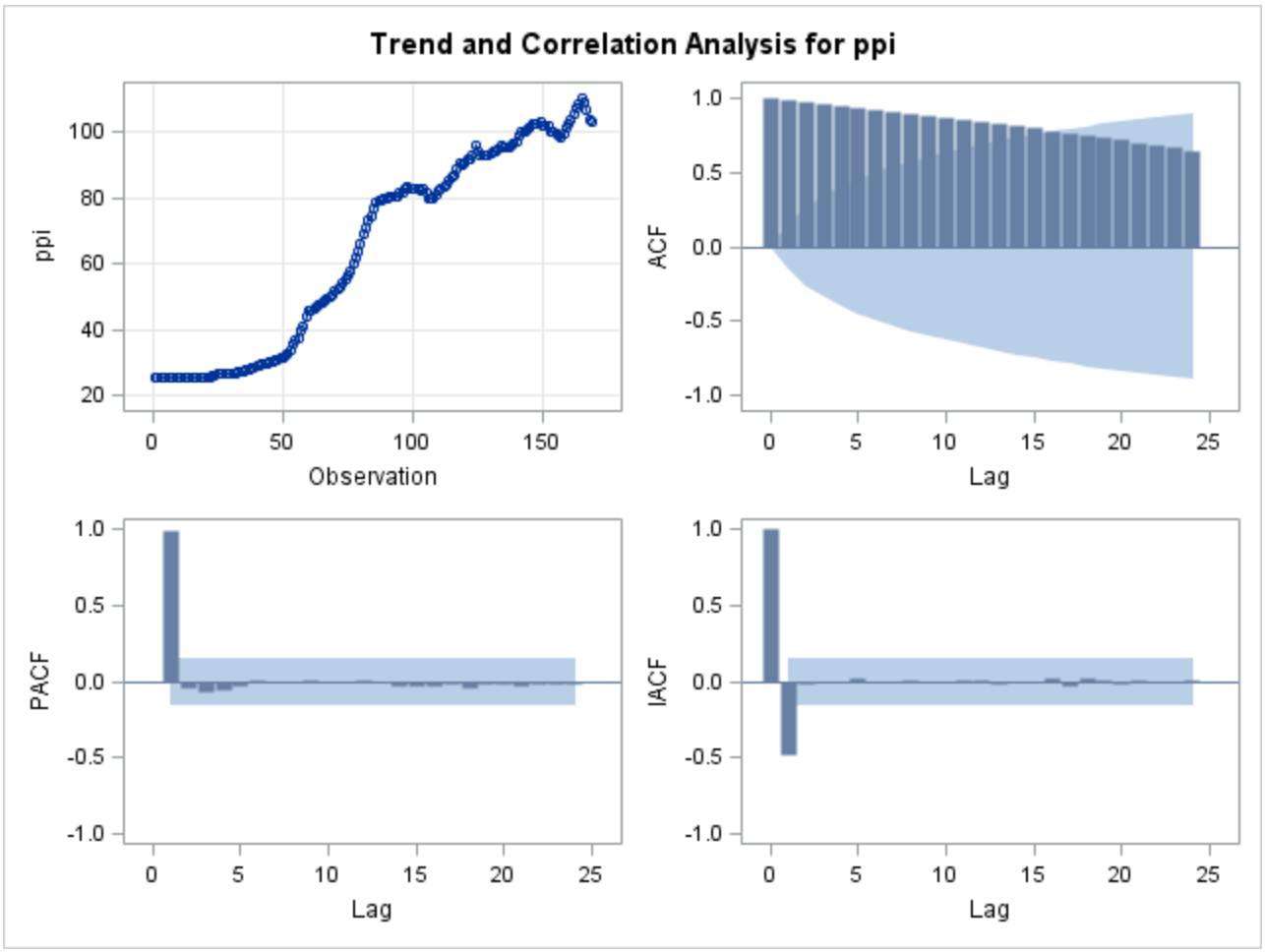
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	960.86	6	<.0001	0.990	0.978	0.966	0.952	0.937	0.923
12	1789.38	12	<.0001	0.908	0.894	0.880	0.866	0.852	0.838
18	2489.96	18	<.0001	0.824	0.810	0.795	0.780	0.765	0.749
24	3048.92	24	<.0001	0.732	0.716	0.698	0.681	0.663	0.645

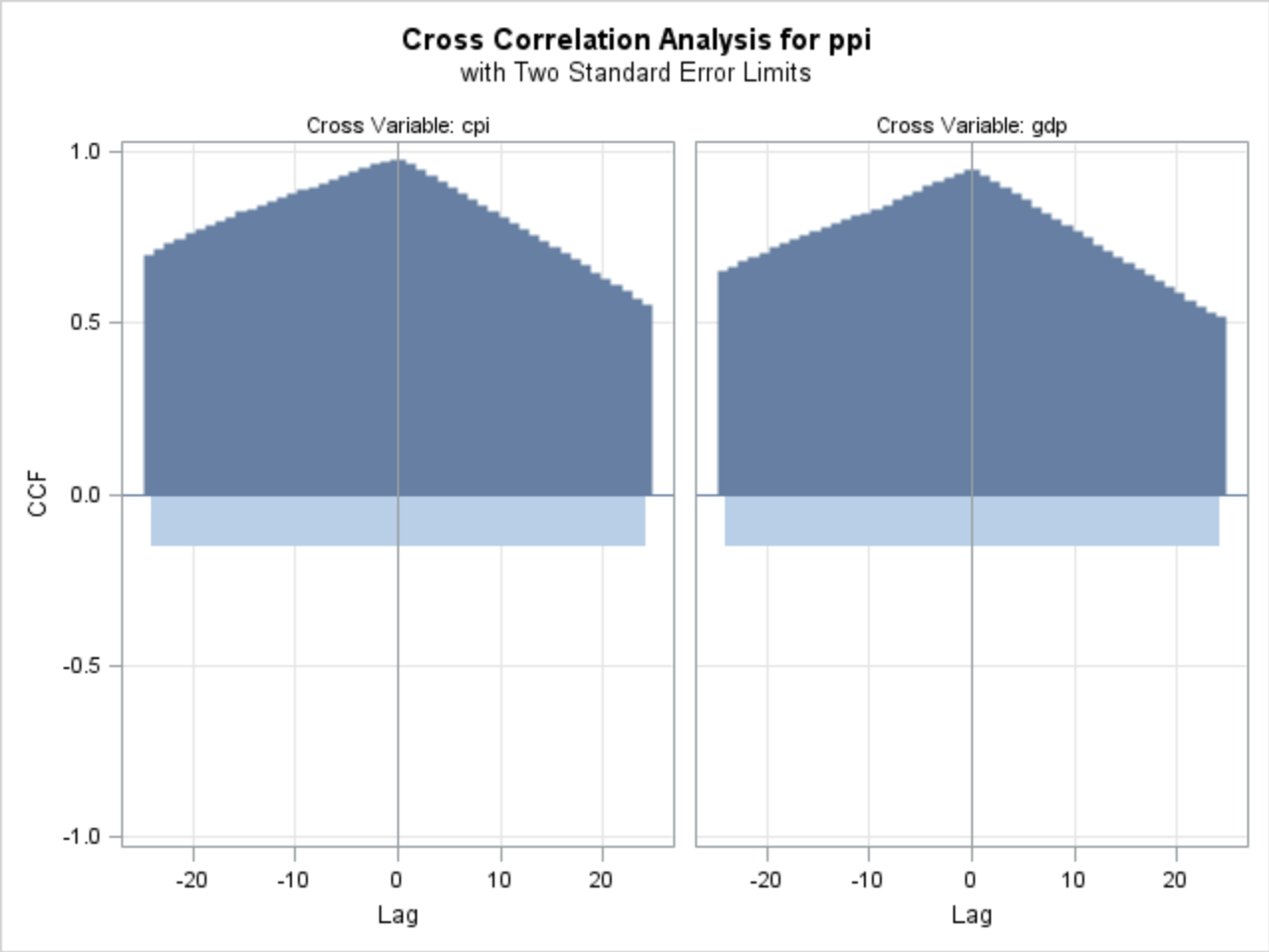
Correlation of ppi and cpi

Variance of input =	1081.227
Number of Observations	169

Correlation of ppi and gdp

Variance of input =	3962848
Number of Observations	169


Trend and Correlation Analysis for ppi
ppi
Observation
ACF
Lag
PACF
Lag
IACF
Lag



Warning: **The model defined by the new estimates is unstable. The iteration process has been terminated.**

Warning: **Estimates may not have converged.**

ARIMA Estimation Optimization Summary

Estimation Method	Conditional Least Squares
Parameters Estimated	6
Termination Criteria	Maximum Relative Change in Estimates
Iteration Stopping Value	0.001
Criteria Value	0.36856
Maximum Absolute Value of Gradient	254.7273
R-Square Change from Last Iteration	0.248226
Objective Function	Sum of Squared Residuals
Objective Function Value	72.66322

ARIMA Estimation Optimization Summary

Marquardt's Lambda Coefficient	1E-6
Numerical Derivative Perturbation Delta	0.001
Iterations	12
Warning Message	Estimates may not have converged.

Conditional Least Squares Estimation

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag	Variable	Shift
MU	6.88945	2.78279	2.48	0.0143	0	ppi	0
MA1,1	0.32485	0.35592	0.91	0.3628	1	ppi	0
AR1,1	1.51868	0.31257	4.86	<.0001	1	ppi	0
AR1,2	-0.51868	0.31350	-1.65	0.1000	2	ppi	0
NUM1	1.12185	0.10818	10.37	<.0001	0	cpi	0
NUM2	-0.0012860	0.0012160	-1.06	0.2918	0	gdp	0

Constant Estimate	4.796E-7
Variance Estimate	0.445787
Std Error Estimate	0.667673
AIC	348.9545
SBC	367.7339
Number of Residuals	169

* AIC and SBC do not include log determinant.

Correlations of Parameter Estimates

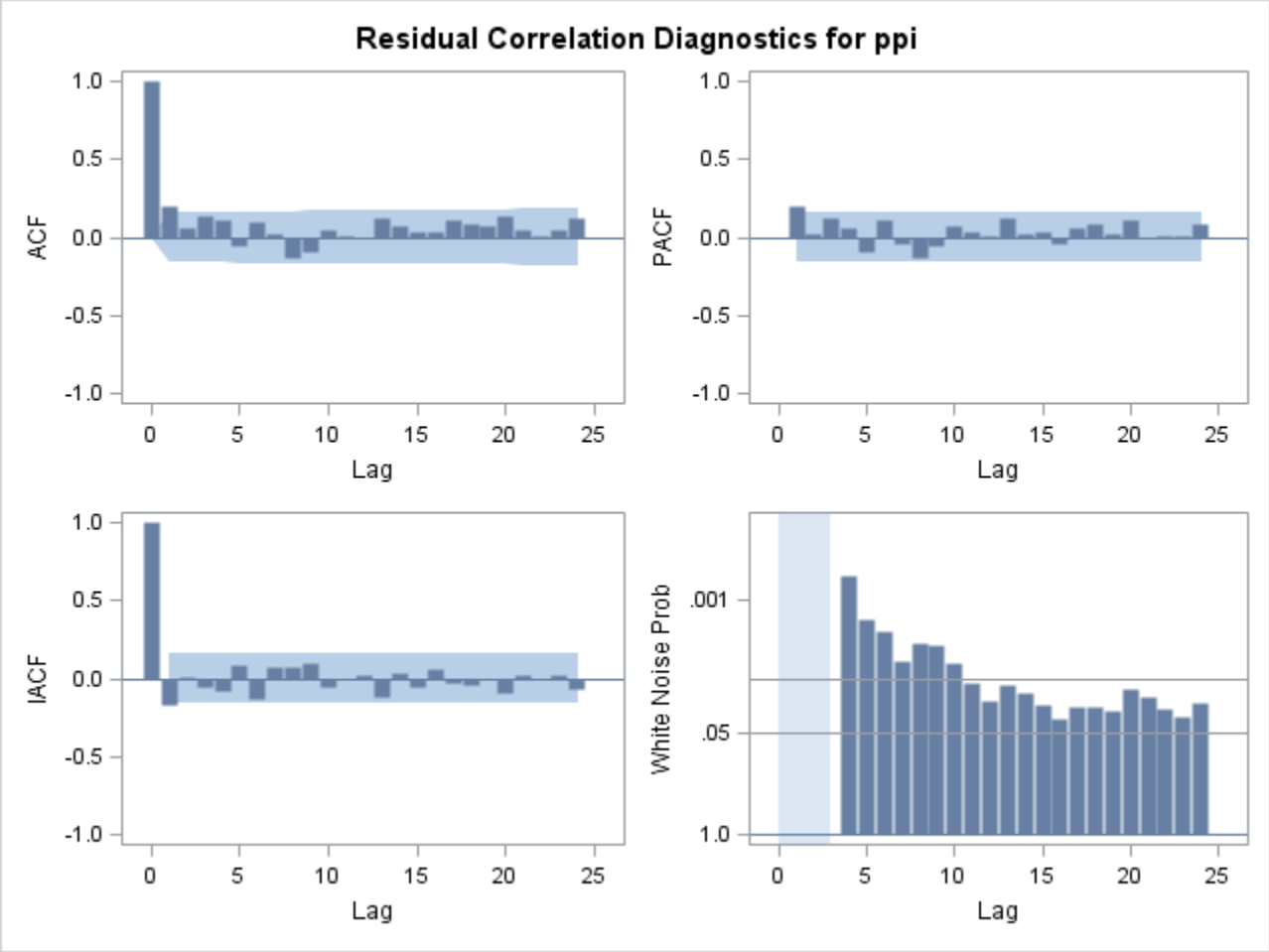
Variable / Parameter	ppi MU	ppi MA1,1	ppi AR1,1	ppi AR1,2	cpi NUM1	gdp NUM2
ppi MU	1.000	-0.221	-0.241	0.238	-0.275	-0.707
ppi MA1,1	-0.221	1.000	0.980	-0.979	-0.009	0.218
ppi AR1,1	-0.241	0.980	1.000	-1.000	-0.031	0.253
ppi AR1,2	0.238	-0.979	-1.000	1.000	0.030	-0.249
cpi NUM1	-0.275	-0.009	-0.031	0.030	1.000	-0.453
gdp NUM2	-0.707	0.218	0.253	-0.249	-0.453	1.000

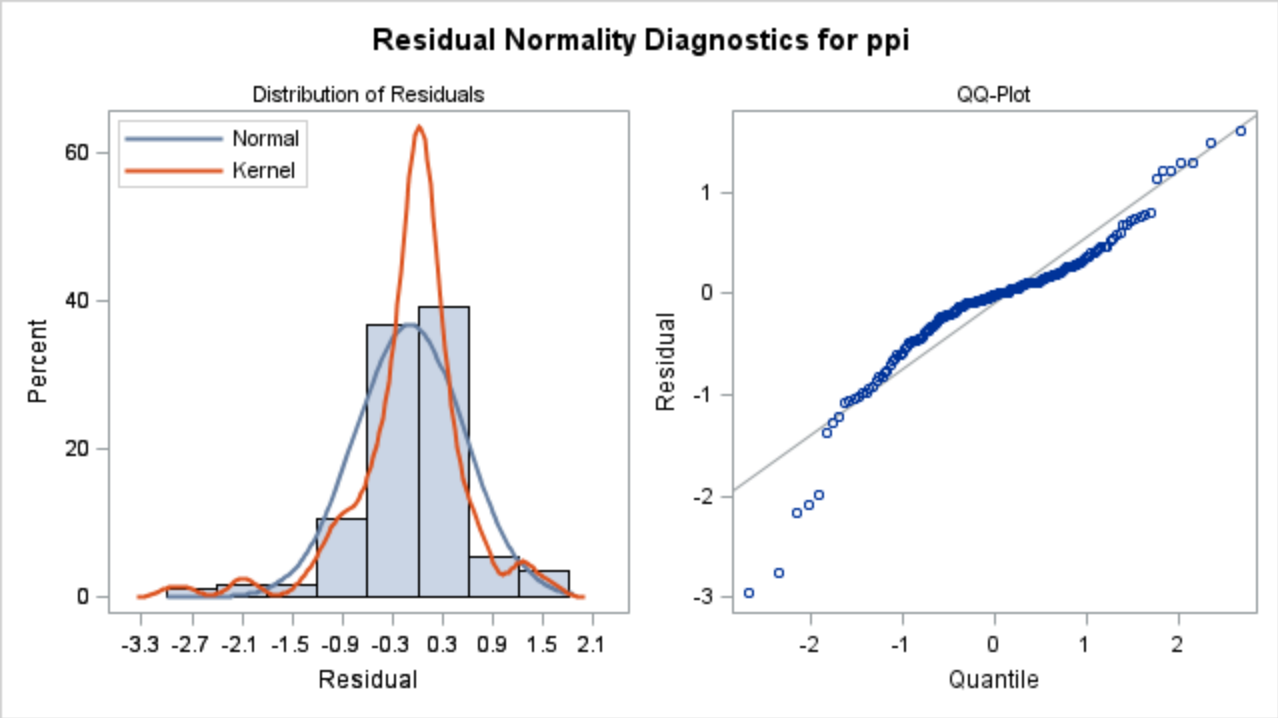
Autocorrelation Check of Residuals

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations				
6	17.28	3	0.0006	0.212	0.076	0.148	0.115	-0.042	0.108
12	21.72	9	0.0098	0.028	-0.114	-0.076	0.066	0.023	0.008

Autocorrelation Check of Residuals

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
18	32.52	15	0.0055	0.142	0.083	0.048	0.045	0.125	0.101
24	42.84	21	0.0033	0.080	0.148	0.063	0.015	0.057	0.130
30	47.68	27	0.0083	0.014	0.059	0.002	0.134	-0.024	0.038





Model for variable ppi

Estimated Intercept 6.889449

Autoregressive Factors

Factor 1: 1 - 1.51868 B**(1) + 0.51868 B**(2)

Moving Average Factors

Factor 1: 1 - 0.32485 B**(1)

Input Number 1

Input Variable cpi

Overall Regression Factor 1.121855

Input Number 2

Input Variable gdp

Overall Regression Factor -0.00129

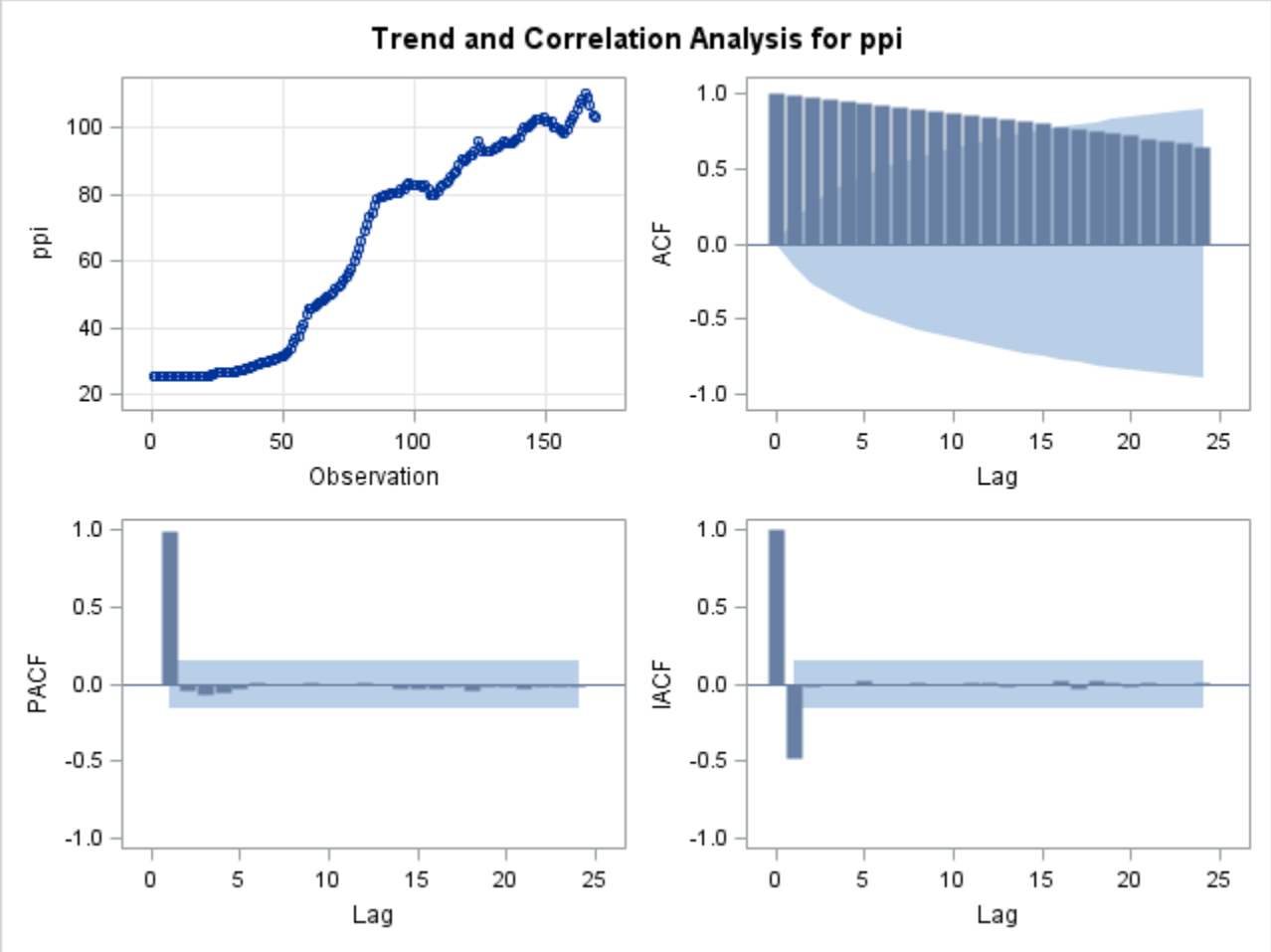
The ARIMA Procedure

Name of Variable = ppi

Mean of Working Series	64.68154
Standard Deviation	30.17628
Number of Observations	169

Autocorrelation Check for White Noise

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	960.86	6	<.0001	0.990	0.978	0.966	0.952	0.937	0.923
12	1789.38	12	<.0001	0.908	0.894	0.880	0.866	0.852	0.838
18	2489.96	18	<.0001	0.824	0.810	0.795	0.780	0.765	0.749
24	3048.92	24	<.0001	0.732	0.716	0.698	0.681	0.663	0.645



Warning: The model defined by the new estimates is unstable. The iteration process has

been terminated.

Warning: Estimates may not have converged.

ARIMA Estimation Optimization Summary

Estimation Method	Conditional Least Squares
Parameters Estimated	3
Termination Criteria	Maximum Relative Change in Estimates
Iteration Stopping Value	0.001
Criteria Value	0.97506
Maximum Absolute Value of Gradient	1672.52
R-Square Change from Last Iteration	0.415385
Objective Function	Sum of Squared Residuals
Objective Function Value	132.5082
Marquardt's Lambda Coefficient	1E-6
Numerical Derivative Perturbation Delta	0.001
Iterations	12
Warning Message	Estimates may not have converged.

Conditional Least Squares Estimation

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	26.23885	0.84942	30.89	<.0001	0
MA1,1	-0.31130	0.08578	-3.63	0.0004	1
AR1,1	1.00000	0.0019167	521.73	<.0001	1

Constant Estimate	1.628E-6
Variance Estimate	0.798242
Std Error Estimate	0.893444
AIC	444.4913
SBC	453.881
Number of Residuals	169

* AIC and SBC do not include log determinant.

Correlations of Parameter Estimates

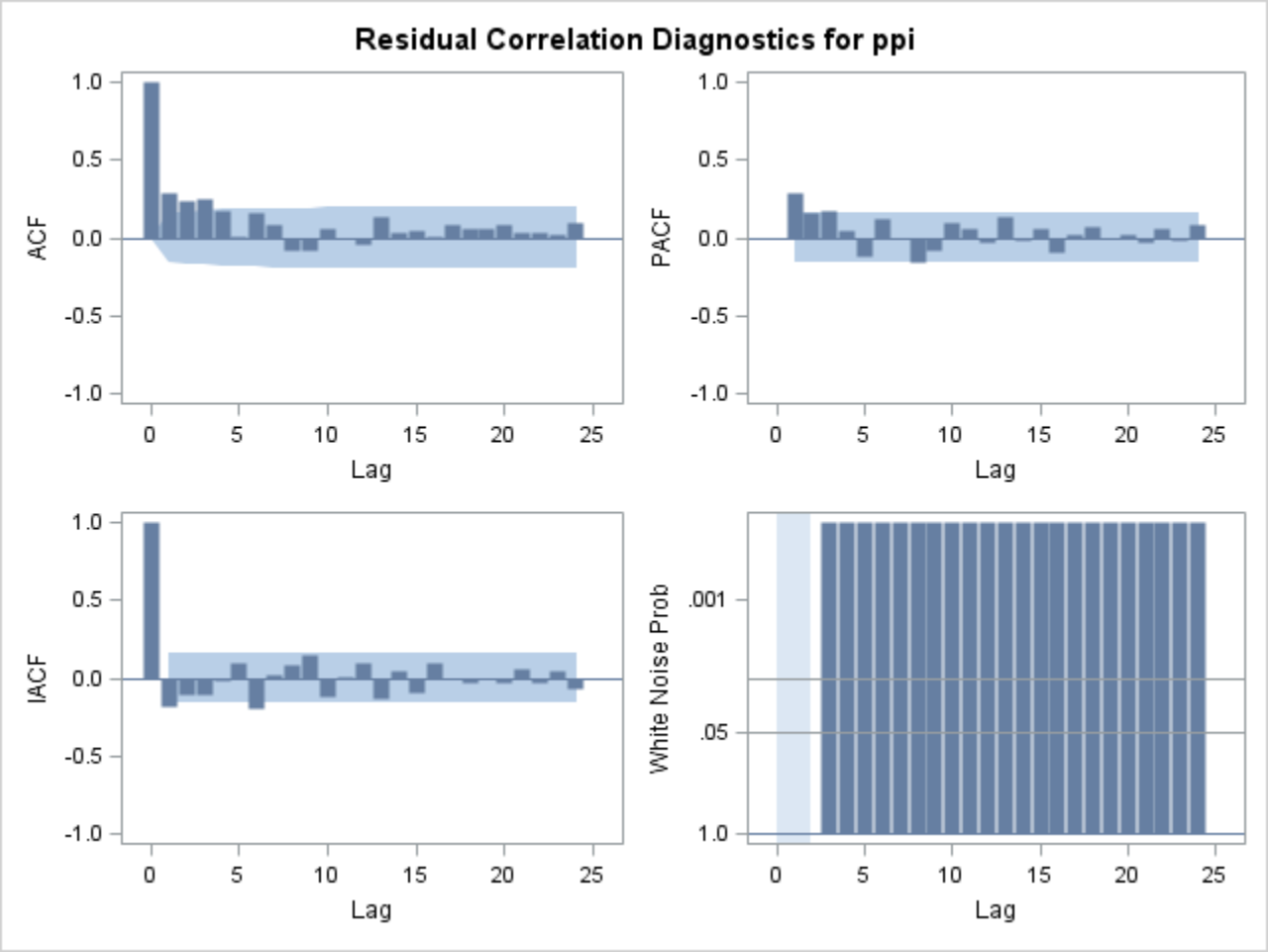
Parameter	MU	MA1,1	AR1,1
MU	1.000	0.030	0.007
MA1,1	0.030	1.000	0.253

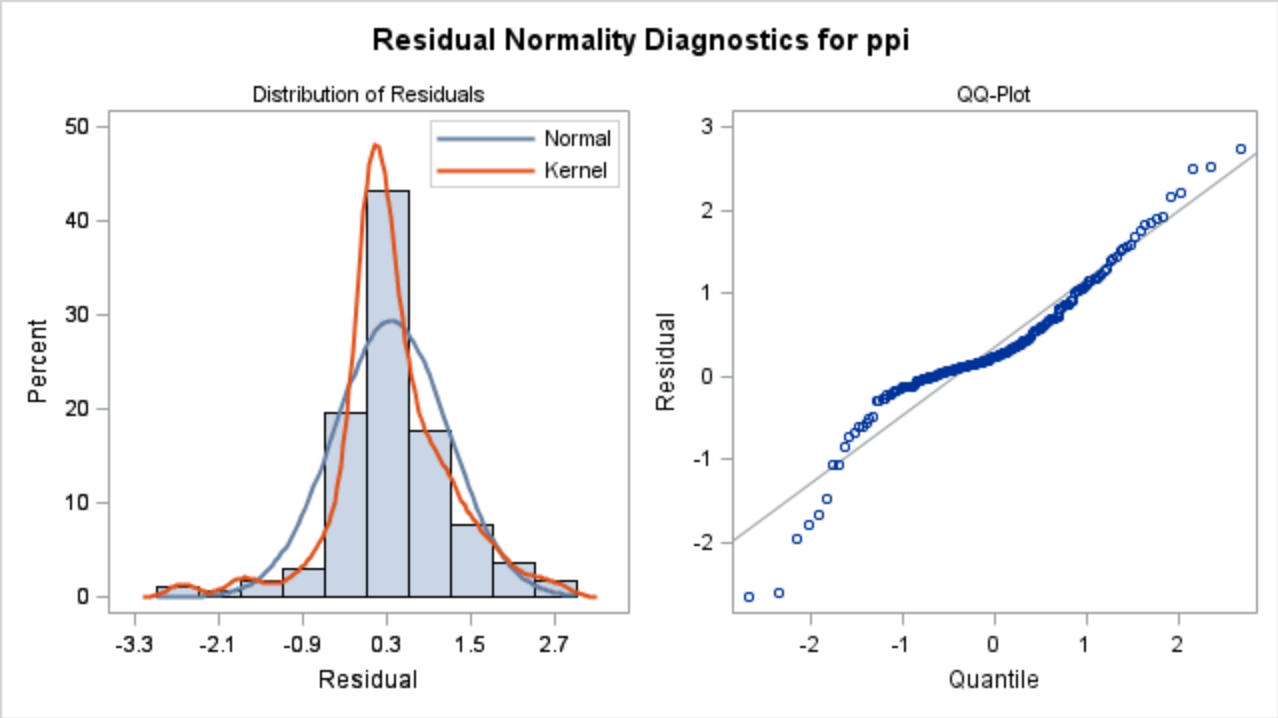
Correlations of Parameter Estimates

Parameter	MU	MA1,1	AR1,1
AR1,1	0.007	0.253	1.000

Autocorrelation Check of Residuals

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	117.10	4	<.0001	0.402	0.363	0.385	0.325	0.183	0.303
12	145.64	10	<.0001	0.237	0.093	0.099	0.210	0.154	0.126
18	199.65	16	<.0001	0.274	0.188	0.204	0.174	0.240	0.217
24	255.98	22	<.0001	0.217	0.240	0.199	0.197	0.194	0.258
30	298.38	28	<.0001	0.166	0.197	0.147	0.272	0.121	0.176





Model for variable ppi

Estimated Mean 26.23885

Autoregressive Factors

Factor 1: 1 - 1 B**(1)

Moving Average Factors

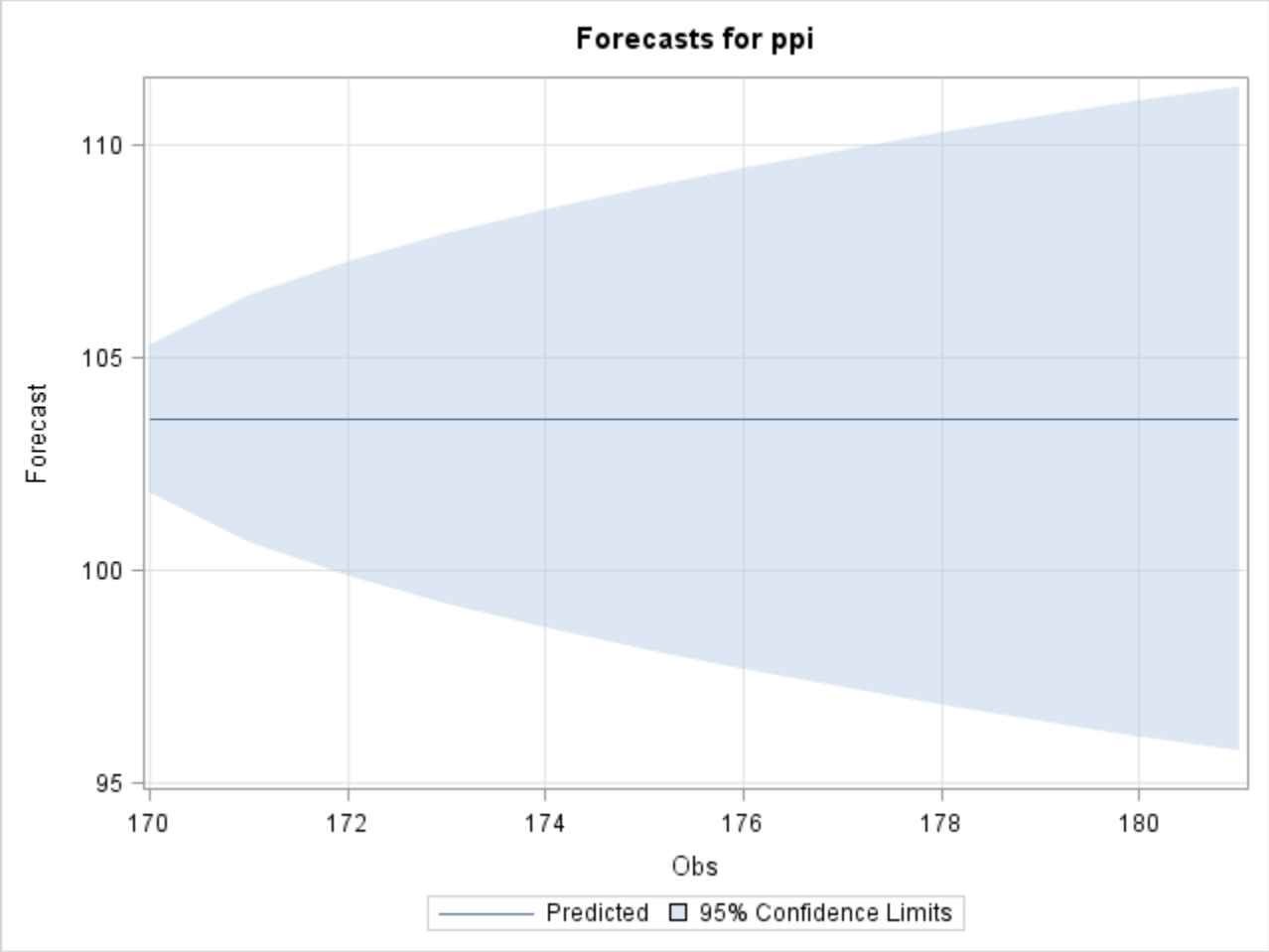
Factor 1: 1 + 0.3113 B**(1)

Forecasts for variable ppi

Obs	Forecast	Std Error	95% Confidence Limits	
170	103.5671	0.8934	101.8160	105.3182
171	103.5671	1.4734	100.6793	106.4549
172	103.5671	1.8824	99.8777	107.2565
173	103.5671	2.2172	99.2214	107.9127
174	103.5671	2.5077	98.6521	108.4821
175	103.5671	2.7679	98.1421	108.9920
176	103.5671	3.0056	97.6762	109.4580
177	103.5671	3.2259	97.2444	109.8897
178	103.5671	3.4321	96.8404	110.2938
179	103.5671	3.6265	96.4592	110.6749
180	103.5671	3.8111	96.0975	111.0366

Forecasts for variable ppi

Obs	Forecast	Std Error	95% Confidence Limits	
181	103.5671	3.9871	95.7525	111.3816



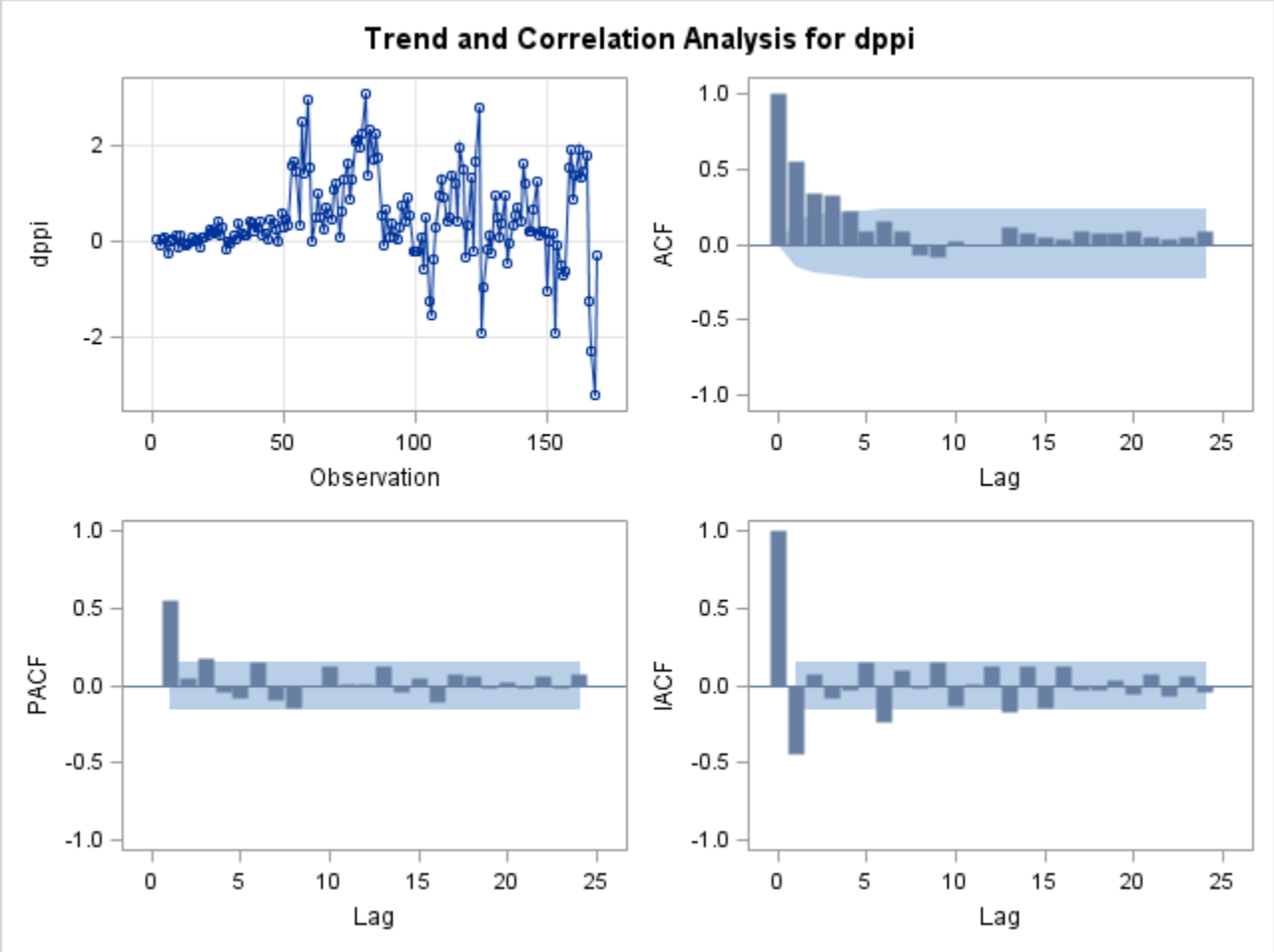
The ARIMA Procedure

Name of Variable = dppi

Mean of Working Series	0.464286
Standard Deviation	0.918001
Number of Observations	168

Autocorrelation Check for White Noise

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	102.82	6	<.0001	0.553	0.335	0.319	0.216	0.086	0.153
12	106.35	12	<.0001	0.082	-0.078	-0.080	0.023	-0.008	-0.006
18	112.72	18	<.0001	0.112	0.069	0.048	0.039	0.084	0.077
24	117.91	24	<.0001	0.076	0.085	0.049	0.033	0.047	0.089



Conditional Least Squares Estimation

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	0.43146	0.15913	2.71	0.0074	0
MA1,1	0.25590	0.13981	1.83	0.0690	1
AR1,1	0.72813	0.10089	7.22	<.0001	1

Constant Estimate	0.117299
Variance Estimate	0.589302
Std Error Estimate	0.76766
AIC	390.8951
SBC	400.267
Number of Residuals	168

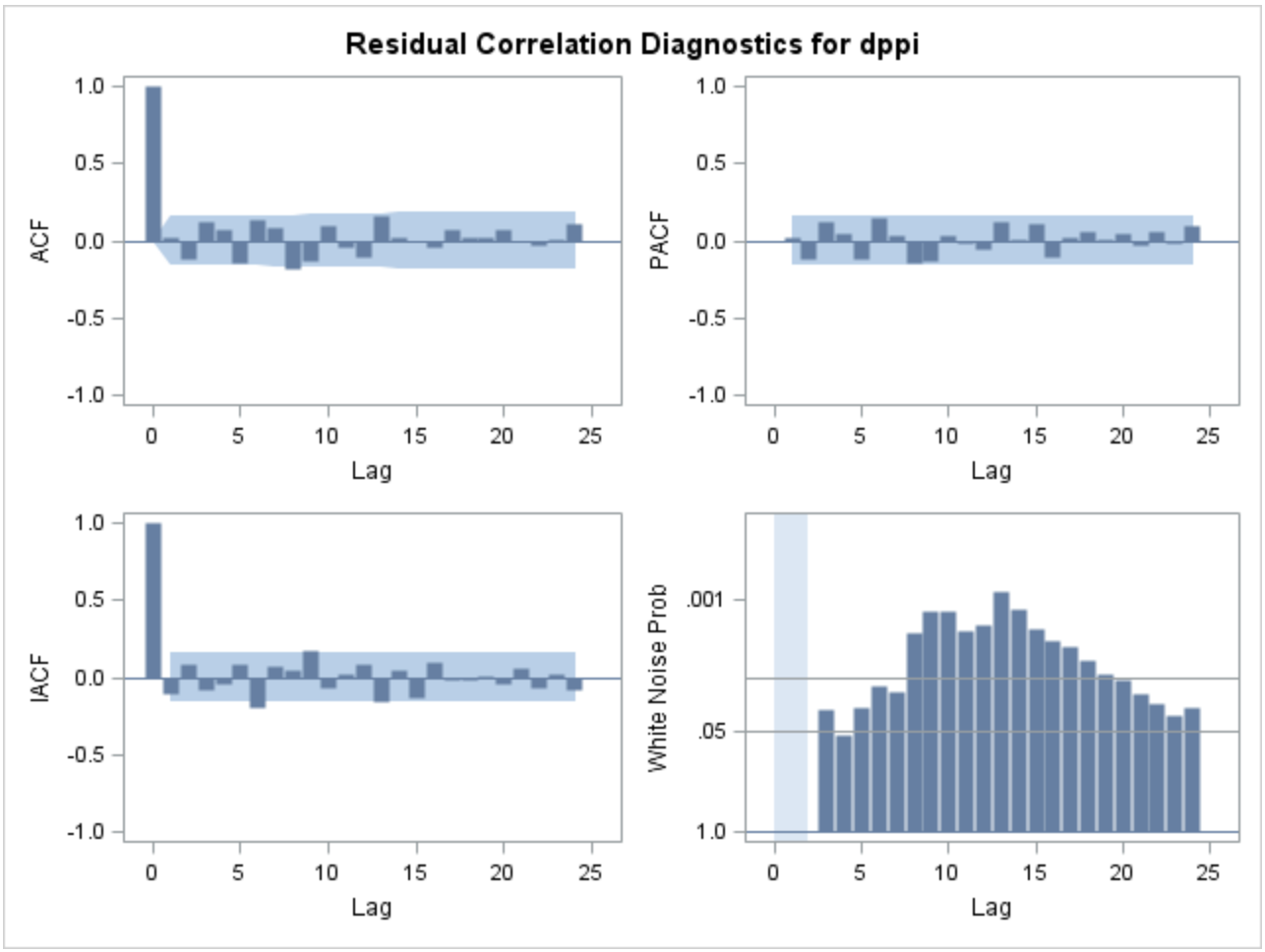
* AIC and SBC do not include log determinant.

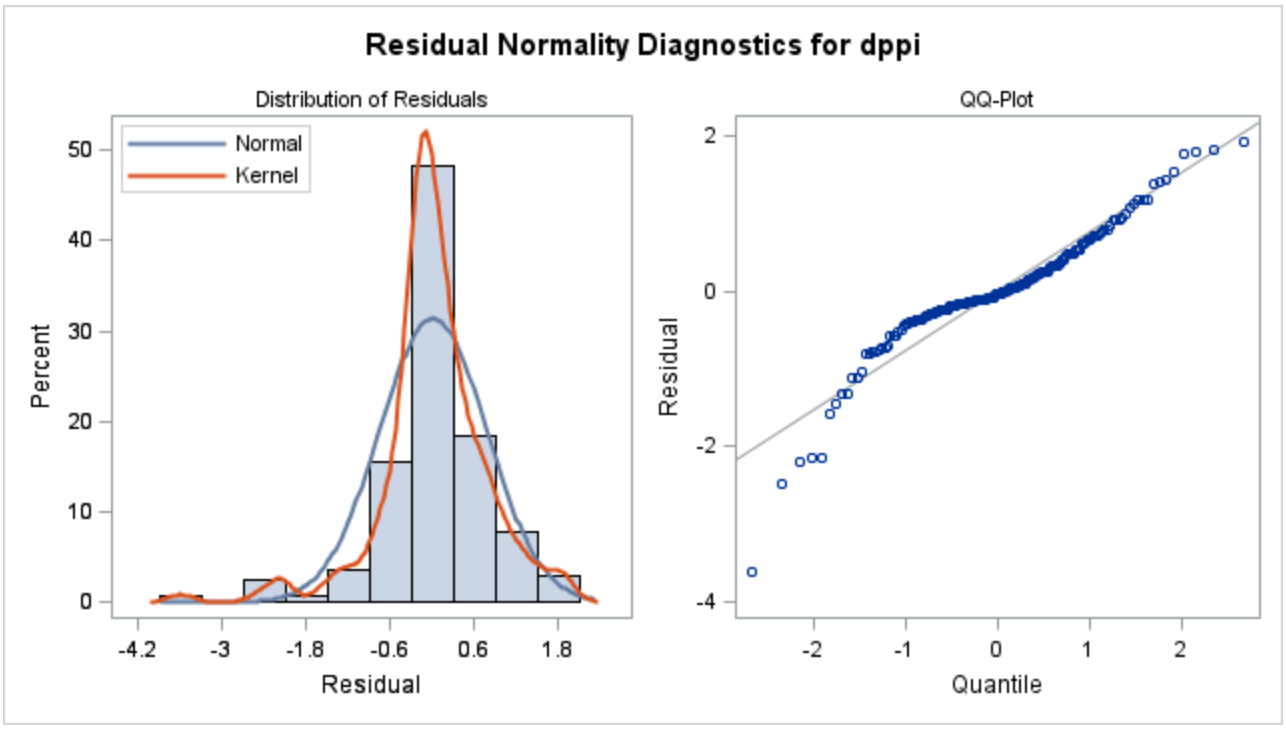
Correlations of Parameter Estimates

Parameter	MU	MA1,1	AR1,1
MU	1.000	-0.079	-0.094
MA1,1	-0.079	1.000	0.842
AR1,1	-0.094	0.842	1.000

Autocorrelation Check of Residuals

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	12.67	4	0.0130	0.022	-0.118	0.120	0.067	-0.144	0.137
12	27.53	10	0.0021	0.087	-0.184	-0.137	0.099	-0.040	-0.105
18	33.60	16	0.0062	0.155	0.025	-0.006	-0.044	0.074	0.023
24	36.80	22	0.0249	0.015	0.068	-0.005	-0.026	0.004	0.104
30	44.22	28	0.0264	-0.037	-0.014	-0.043	0.143	-0.108	-0.026


Residual Correlation Diagnostics for dppi
ACF
PACF
IACF
White Noise Prob
Lag
1.0
0.5
0.0
-0.5
-1.0
0
5
10
15
20
25
.001
.05
1.0


Residual Normality Diagnostics for dppi
Distribution of Residuals
Normal
Kernel
Percent
Residual
50
40
30
20
10
0
-4.2
-3
-1.8
-0.6
0.6
1.8
QQ-Plot
Residual
Quantile
2
0
-2
-4
-2
-1
0
1
2

Model for variable dppi

Estimated Mean 0.431456

Autoregressive Factors

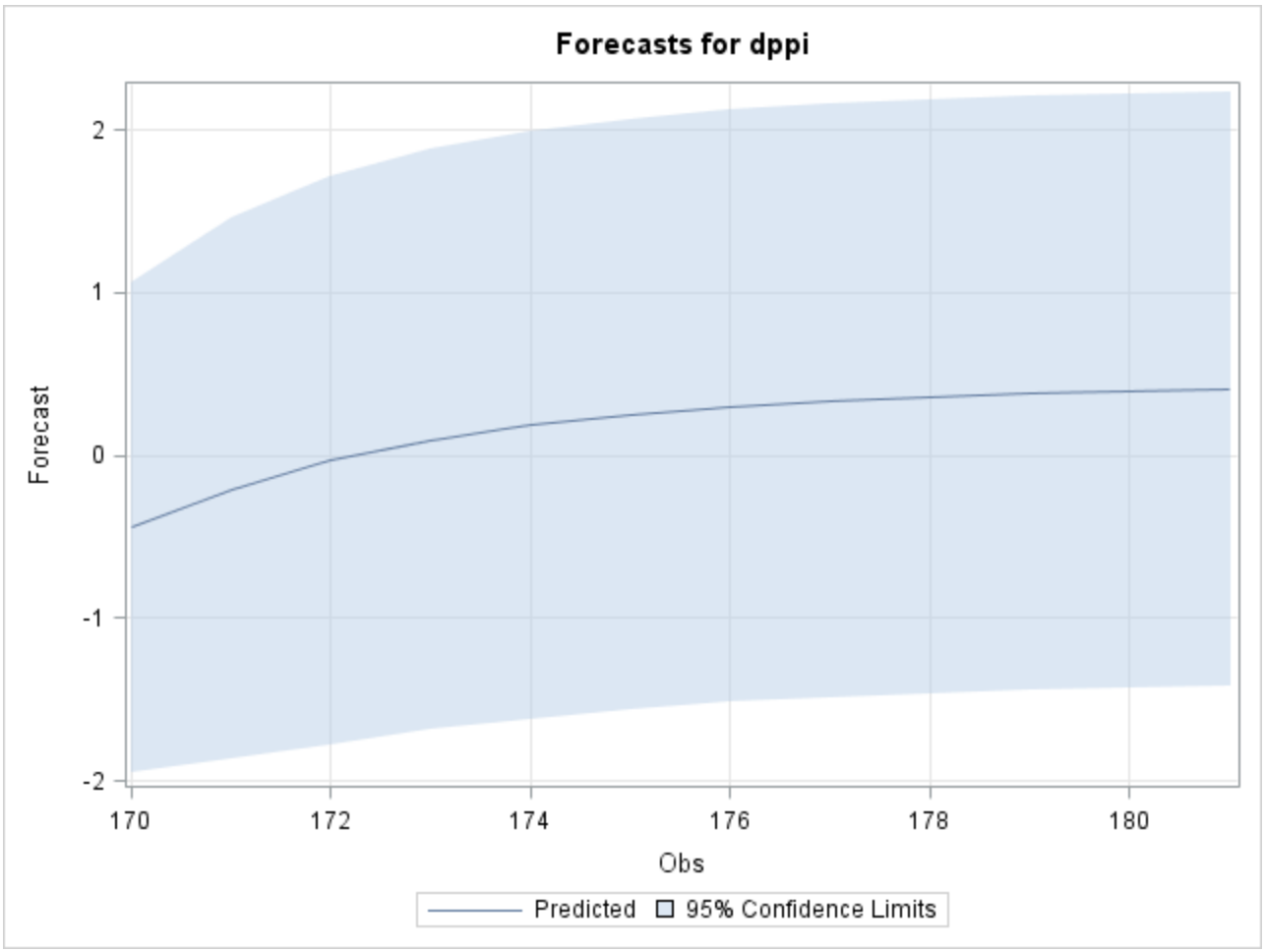
Factor 1: 1 - 0.72813 B**(1)

Moving Average Factors

Factor 1: 1 - 0.2559 B**(1)

Forecasts for variable dppi

Obs	Forecast	Std Error	95% Confidence Limits	
170	-0.4434	0.7677	-1.9480	1.0612
171	-0.2056	0.8490	-1.8695	1.4583
172	-0.0324	0.8890	-1.7749	1.7101
173	0.0937	0.9096	-1.6890	1.8765
174	0.1855	0.9203	-1.6182	1.9893
175	0.2524	0.9259	-1.5623	2.0671
176	0.3011	0.9289	-1.5195	2.1216
177	0.3365	0.9304	-1.4871	2.1602
178	0.3623	0.9313	-1.4629	2.1876
179	0.3811	0.9317	-1.4450	2.2073
180	0.3948	0.9319	-1.4318	2.2214
181	0.4048	0.9321	-1.4221	2.2316


Forecasts for dppi
Forecast
2
1
0
-1
-2
170
172
174
176
178
180
Obs
Predicted
95% Confidence Limits