Time Series analysis of Experimental data

```
% cat expseries.data
1 1 11.64
2 1 11.83
3 1 11.69
4 1 10.08
```

Skipping ...

```
148 3 10.48
149 3 8.89
150 3 8.71

/* expseries.sas */
options nodate linesize=79 noovp formdlim=' ';
title 'Experimental data with autocorrelated errors';

data test;
     infile 'expseries.data';
     input time group y;
     if group=1 then g1=1; else g1=0;
     if group=2 then g2=1; else g2=0;

proc glm;
     class group;
     model y = group;
     means group;

proc reg;
     model y = g1 g2 / dw;
     output out=test2 residual = e;

proc arima;
     identify var = e;

proc autoreg;
     model y = g1 g2 / nlag=1 method = ml;
     group: test g1=g2=0;
```

The GLM Procedure

Class Level Information

Class	Levels	Values
group	3	1 2 3

Number of observations 150

The GLM Procedure

Dependent Variable: y

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	6.5766093	3.2883047	4.18	0.0171
Error	147	115.5570740	0.7861025		
Corrected Total	149	122.1336833			

R-Square	Coeff Var	Root MSE	y Mean
0.053848	9.098870	0.886624	9.744333

Source	DF	Type I SS	Mean Square	F Value	Pr > F
group	2	6.57660933	3.28830467	4.18	0.0171

Source	DF	Type III SS	Mean Square	F Value	Pr > F
group	2	6.57660933	3.28830467	4.18	0.0171

The GLM Procedure

Level of group	N	y Mean	y Std Dev
1	50	9.45360000	1.06639151
2	50	9.93840000	0.74053307
3	50	9.84100000	0.82019970

The REG Procedure
Model: MODEL1
Dependent Variable: y

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	6.57661	3.28830	4.18	0.0171
Error	147	115.55707	0.78610		
Corrected Total	149	122.13368			

Root MSE	0.88662	R-Square	0.0538
Dependent Mean	9.74433	Adj R-Sq	0.0410
Coeff Var	9.09887		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	9.84100	0.12539	78.48	<.0001
g1	1	-0.38740	0.17732	-2.18	0.0305
g2	1	0.09740	0.17732	0.55	0.5837

The REG Procedure
Model: MODEL1
Dependent Variable: y

Durbin-Watson D	0.464
Number of Observations	150
1st Order Autocorrelation	0.742

The ARIMA Procedure

Name of Variable = e

Mean of Working Series	-134E-17
Standard Deviation	0.877713
Number of Observations	150

Autocorrelations

Lag	Covariance	Correlation	-1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	0.770380	1.00000	||********************|
1	0.571561	0.74192	||*************** |
2	0.395913	0.51392	||********** |
3	0.258485	0.33553	||******* |
4	0.204559	0.26553	||*****. |
5	0.128356	0.16661	||*** . |
6	0.061202	0.07944	||** . |
7	0.026507	0.03441	||* . |
8	0.023097	0.02998	||* . |
9	0.080783	0.10486	||** . |
10	0.090297	0.11721	||** . |
11	0.094371	0.12250	||** . |
12	0.096083	0.12472	||** . |
13	0.104496	0.13564	||*** . |
14	0.073087	0.09487	||** . |
15	0.059903	0.07776	||** . |
16	0.071046	0.09222	||** . |
17	0.027189	0.03529	||* . |
18	-0.0037552	-.00487	|| . |
19	-0.042520	-.05519	|| *. |
20	-0.046061	-.05979	|| *. |
21	-0.035253	-.04576	|| *. |
22	-0.039347	-.05107	|| *. |
23	-0.029089	-.03776	|| *. |
24	-0.032854	-.04265	|| *. |

"." marks two standard errors

Partial Autocorrelations

Lag	Correlation	-1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
1	0.74192	|. |*************** |
2	-0.08125	|. **| . |
3	-0.03685	|. * | . |
4	0.11498	|. |**. |
5	-0.11479	|. **| . |
6	-0.03894	|. * | . |
7	0.04243	|. |* . |
8	0.01823	|. | . |
9	0.17710	|. |**** |
10	-0.06309	|. * | . |
11	0.02322	|. | . |
12	0.05470	|. |* . |
13	-0.01641	|. | . |
14	-0.06735	|. * | . |
15	0.06857	|. |* . |
16	0.06780	|. |* . |
17	-0.15710	|*** | . |
18	0.01457	|. | . |
19	-0.04774	|. * | . |
20	-0.00633	|. | . |
21	0.05326	|. |* . |
22	-0.08965	|. **| . |
23	0.08299	|. |**. |
24	-0.04418	|. * | . |

The ARIMA Procedure

Autocorrelation Check for White Noise

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	158.75	6	<.0001	0.742	0.514	0.336	0.266	0.167	0.079
12	168.13	12	<.0001	0.034	0.030	0.105	0.117	0.122	0.125
18	175.39	18	<.0001	0.136	0.095	0.078	0.092	0.035	-0.005
24	177.97	24	<.0001	-0.055	-0.060	-0.046	-0.051	-0.038	-0.043

The AUTOREG Procedure

Dependent Variable y

Ordinary Least Squares Estimates

SSE	115.557074	DFE	147
MSE	0.78610	Root MSE	0.88662
SBC	401.582855	AIC	392.550949
Regress R-Square	0.0538	Total R-Square	0.0538
Durbin-Watson	0.4637		

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	9.8410	0.1254	78.48	<.0001
g1	1	-0.3874	0.1773	-2.18	0.0305
g2	1	0.0974	0.1773	0.55	0.5837

Test GROUP

Source	DF	Mean Square	F Value	Pr > F
Numerator	2	3.288305	4.18	0.0171
Denominator	147	0.786103		

Estimates of Autocorrelations

Lag	Covariance	Correlation	-1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	0.7704	1.000000	|********************|
1	0.5716	0.741920	|*************** |

Preliminary MSE 0.3463

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.741920	0.055490	-13.37

Algorithm converged.

The AUTOREG Procedure

Maximum Likelihood Estimates

SSE	48.2614905	DFE	146
MSE	0.33056	Root MSE	0.57494
SBC	276.561592	AIC	264.519051
Regress R-Square	0.0023	Total R-Square	0.6048
Durbin-Watson	1.8478		

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	9.8353	0.3211	30.63	<.0001
g1	1	-0.2100	0.4430	-0.47	0.6363
g2	1	0.0000922	0.3899	0.00	0.9998
AR1	1	-0.7800	0.0520	-15.01	<.0001

Test GROUP

Source	DF	Mean Square	F Value	Pr > F
Numerator	2	0.054820	0.17	0.8473
Denominator	146	0.330558		

Autoregressive parameters assumed given.

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	9.8353	0.3209	30.65	<.0001
g1	1	-0.2100	0.4429	-0.47	0.6361
g2	1	0.0000922	0.3899	0.00	0.9998