Generalized Roll 02.sas:
Simulated generalized Roll model (Ch. 8)
10000 observations with c=1, lambda=2, and std.dev. of u = 1
Start of (simulated) sample

m	t	q	u	p
3.1310	1	1	1.13105	4.1310
7.1400	2	1	2.00893	8.1400
6.6896	3	1	- 2.45036	7.6896
8.6692	4	1	- 0.02043	9.6692
5.1788	5	- 1	- 1.49036	4.1788
1.6576	6	- 1	- 1.52125	0.6576
- 3.7683	7	- 1	- 3.42593	- 4.7683
- 1.3694	8	1	0.39892	- 0.3694
- 3.2336	9	- 1	0.13581	- 4.2336
- 2.2175	10	1	- 0.98391	- 1.2175
- 0.6989	11	1	- 0.48139	0.3011
0.5021	12	1	- 0.79894	1.5021
- 2.3574	13	- 1	- 0.85954	- 3.3574
- 4.3484	14	- 1	0.00900	- 5.3484
- 5.6531	15	- 1	0.69528	- 6.6531
- 8.4250	16	- 1	- 0.77188	- 9.4250
- 10.6604	17	- 1	- 0.23541	- 11.6604
- 8.7257	18	1	- 0.06533	- 7.7257
- 9.5504	19	- 1	1.17532	- 10.5504
- 12.1547	20	- 1	- 0.60428	- 13.1547

Univariate MA analysis of p Input dataset=pq maOrder=1

The ARIMA Procedure

Name of Variable = p	
Period(s) of Differencing	1
Mean of Working Series	0
Standard Deviation	3.310097
Number of Observations	9999
Observation(s) eliminated by differencing	1

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		Std Error
0	10.956740	1.00000	| |********************|		0
1	- 2.860552	- .26108	| *****| |		0.010001
2	- 0.108014	- .00986	| | |		0.010660
3	- 0.027610	- .00252	| | |		0.010661
4	0.061780	0.00564	| | |		0.010661
5	0.151746	0.01385	| | |		0.010662
6	- 0.247448	- .02258	| | |		0.010663
7	0.046133	0.00421	| | |		0.010668
8	0.122235	0.01116	| | |		0.010668
9	0.043863	0.00400	| | |		0.010670
10	- 0.104152	- .00951	| | |		0.010670

"." marks two standard errors

Inverse 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	0.28780	| |****** |
2	0.09127	| |** |
3	0.02694	| |* |
4	0.00003	| | |
5	- 0.00581	| | |
6	0.01347	| | |
7	- 0.00251	| | |
8	- 0.01328	| | |
9	- 0.00677	| | |
10	0.00449	| | |

Univariate MA analysis of p Input dataset=pq maOrder=1

The ARIMA Procedure

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	- 0.26108	| *****| |
2	- 0.08373	| **| |
3	- 0.02936	| *| |
4	- 0.00395	| | |
5	0.01503	| | |
6	- 0.01543	| | |
7	- 0.00510	| | |
8	0.00998	| | |
9	0.01018	| | |
10	- 0.00489	| | |

Autocorrelation Check for White Noise									
To Lag	Chi- Square	DF	Pr > ChiSq	Autocorrelations					
6	690.13	6	<.0001	- 0.261	- 0.010	- 0.003	0.006	0.014	- 0.023

Conditional Least Squares Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MA1,1	0.28834	0.0095735	30.12	<.0001	1

Variance Estimate	10.13235
Std Error Estimate	3.183135
AIC	51531.95
SBC	51539.16
Number of Residuals	9999

* AIC and SBC do not include log determinant.

Univariate MA analysis of p Input dataset=pq maOrder=1

The ARIMA Procedure

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	6.52	5	0.2587	0.003	-0.010	-0.003	0.008	0.011	-0.019
12	10.07	11	0.5239	0.003	0.013	0.006	-0.007	0.004	-0.008
18	17.85	17	0.3987	-0.007	0.012	-0.023	-0.001	0.003	-0.006
24	23.00	23	0.4610	0.014	0.009	-0.003	-0.015	0.002	-0.000
30	24.98	29	0.6794	-0.004	-0.010	-0.001	0.001	0.009	-0.001
36	26.28	35	0.8560	0.006	0.004	-0.004	-0.005	-0.003	-0.005
42	33.58	41	0.7879	0.011	0.004	-0.020	0.013	-0.004	-0.003
48	38.81	47	0.7965	-0.008	-0.006	-0.008	-0.017	0.007	-0.003

Table title: Autocorrelation Check of Residuals

Model for variable p	
Data have been centered by subtracting the value	-0.02005
Period(s) of Differencing	1

No mean term in this model.

Moving Average Factors
Factor 1: 1 - 0.28834 B**(1)

Univariate random- walk analysis

Innovation variance
10.132349

Thetas
1
- 0.288342

Sum of thetas, including theta(0)=1
0.71166

Random- walk variance
5.13159748390164

Random- walk standard deviation
2.26530295631768

Pricing error coefficients
- 0.28834

Pricing error variance (lower bound)
0.8424158508

Pricing error standard deviation (lower bound)
0.917832

Generalized Roll 02.sas:
Simulated generalized Roll model (Ch. 8)
10000 observations with c=1, lambda=2, and std.dev. of u = 0
(Special case of no public information)
Start of (simulated) sample

m	t	q	u	p
2	1	1	0	3
4	2	1	0	5
6	3	1	0	7
8	4	1	0	9
6	5	- 1	0	5
4	6	- 1	0	3
2	7	- 1	0	1
4	8	1	0	5
2	9	- 1	0	1
4	10	1	0	5
6	11	1	0	7
8	12	1	0	9
6	13	- 1	0	5
4	14	- 1	0	3
2	15	- 1	0	1
0	16	- 1	0	- 1
- 2	17	- 1	0	- 3
0	18	1	0	1
- 2	19	- 1	0	- 3
- 4	20	- 1	0	- 5

Univariate MA analysis of p Input dataset=pq maOrder=1

The ARIMA Procedure

Name of Variable = p	
Period(s) of Differencing	1
Mean of Working Series	0
Standard Deviation	3.155479
Number of Observations	9999
Observation(s) eliminated by differencing	1

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	Std Error
0	9.957050	1.00000	| |********************|	0
1	- 2.912645	- .29252	| ******| |	0.010001
2	- 0.071172	- .00715	| | |	0.010822
3	- 0.030768	- .00309	| | |	0.010823
4	0.062856	0.00631	| | |	0.010823
5	0.072457	0.00728	| | |	0.010823
6	- 0.241978	- .02430	| | |	0.010824
7	0.074450	0.00748	| | |	0.010829
8	0.040461	0.00406	| | |	0.010830
9	0.0020427	0.00021	| | |	0.010830
10	- 0.086366	- .00867	| | |	0.010830

"." marks two standard errors

Inverse 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	0.32874	| |******* |
2	0.11497	| |** |
3	0.04012	| |* |
4	0.01003	| | |
5	0.00755	| | |
6	0.02202	| | |
7	0.00466	| | |
8	- 0.00096	| | |
9	0.00267	| | |
10	0.00713	| | |

Univariate MA analysis of p Input dataset=pq maOrder=1

The ARIMA Procedure

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	- 0.29252	| ******| |
2	- 0.10139	| **| |
3	- 0.03873	| *| |
4	- 0.00757	| | |
5	0.00717	| | |
6	- 0.02133	| | |
7	- 0.00622	| | |
8	0.00231	| | |
9	0.00222	| | |
10	- 0.00800	| | |

Autocorrelation Check for White Noise									
To Lag	Chi- Square	DF	Pr > ChiSq	Autocorrelations					
6	863.30	6	<.0001	- 0.293	- 0.007	- 0.003	0.006	0.007	- 0.024

Conditional Least Squares Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MA1,1	0.32912	0.0094426	34.85	<.0001	1

Variance Estimate	8.999207
Std Error Estimate	2.999868
AIC	50346.1
SBC	50353.31
Number of Residuals	9999

* AIC and SBC do not include log determinant.

Univariate MA analysis of p Input dataset=pq maOrder=1

The ARIMA Procedure

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
Autocorrelation Check of Residuals									
6	6.47	5	0.2631	0.003	-0.007	-0.004	0.006	0.002	-0.023
12	8.70	11	0.6499	0.002	0.005	-0.000	-0.006	0.008	-0.009
18	14.50	17	0.6317	-0.011	0.009	-0.018	0.003	0.004	-0.005
24	20.93	23	0.5852	0.012	0.009	-0.002	-0.019	0.007	0.003
30	23.41	29	0.7574	0.005	-0.004	-0.000	-0.010	0.008	-0.007
36	25.35	35	0.8848	0.001	-0.008	-0.004	0.001	-0.006	-0.008
42	35.77	41	0.7019	0.009	-0.005	-0.027	0.014	-0.006	-0.002
48	38.89	47	0.7939	-0.010	-0.009	-0.004	-0.007	-0.003	-0.007

Model for variable p	
Data have been centered by subtracting the value	-0.0186
Period(s) of Differencing	1

No mean term in this model.

Moving Average Factors	
Factor 1:	1 - 0.32912 B**(1)

Univariate random- walk analysis

Innovation variance
8.9992071

Thetas
1
- 0.329118

Sum of thetas, including theta(0)=1
0.67088

Random- walk variance
4.0503838277044

Random- walk standard deviation
2.01255654025033

Pricing error coefficients
- 0.32912

Pricing error variance (lower bound)
0.9747836273

Pricing error standard deviation (lower bound)
0.987311

Generalized Roll 02.sas:
Simulated generalized Roll model (Ch. 8)
10000 observations with c=1, lambda=0, and std.dev. of u = 1
(Special case of no private information)
Start of (simulated) sample

m	t	q	u	p
1.13105	1	1	1.13105	2.13105
3.13998	2	1	2.00893	4.13998
0.68962	3	1	- 2.45036	1.68962
0.66920	4	1	- 0.02043	1.66920
- 0.82116	5	- 1	- 1.49036	- 1.82116
- 2.34241	6	- 1	- 1.52125	- 3.34241
- 5.76834	7	- 1	- 3.42593	- 6.76834
- 5.36942	8	1	0.39892	- 4.36942
- 5.23361	9	- 1	0.13581	- 6.23361
- 6.21752	10	1	- 0.98391	- 5.21752
- 6.69891	11	1	- 0.48139	- 5.69891
- 7.49785	12	1	- 0.79894	- 6.49785
- 8.35739	13	- 1	- 0.85954	- 9.35739
- 8.34839	14	- 1	0.00900	- 9.34839
- 7.65311	15	- 1	0.69528	- 8.65311
- 8.42499	16	- 1	- 0.77188	- 9.42499
- 8.66039	17	- 1	- 0.23541	- 9.66039
- 8.72572	18	1	- 0.06533	- 7.72572
- 7.55040	19	- 1	1.17532	- 8.55040
- 8.15468	20	- 1	- 0.60428	- 9.15468

Univariate MA analysis of p Input dataset=pq maOrder=1

The ARIMA Procedure

Name of Variable = p	
Period(s) of Differencing	1
Mean of Working Series	0
Standard Deviation	1.723524
Number of Observations	9999
Observation(s) eliminated by differencing	1

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	Std Error
0	2.970536	1.00000	| |********************|	0
1	- 0.955313	- .32160	| ******| |	0.010001
2	- 0.029518	- .00994	| | |	0.010986
3	- 0.0069166	- .00233	| | |	0.010987
4	- 0.0053635	- .00181	| | |	0.010987
5	0.057462	0.01934	| | |	0.010987
6	- 0.063592	- .02141	| | |	0.010991
7	0.0059357	0.00200	| | |	0.010995
8	0.031327	0.01055	| | |	0.010995
9	0.022782	0.00767	| | |	0.010996
10	- 0.032818	- .01105	| | |	0.010996

"." marks two standard errors

Inverse 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	0.37387	| |******* |
2	0.14929	| |*** |
3	0.05911	| |* |
4	0.01883	| | |
5	- 0.00147	| | |
6	0.01067	| | |
7	- 0.00273	| | |
8	- 0.01499	| | |
9	- 0.01141	| | |
10	0.00212	| | |

Univariate MA analysis of p Input dataset=pq maOrder=1

The ARIMA Procedure

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	- 0.32160	| ******| |
2	- 0.12644	| ***| |
3	- 0.05281	| *| |
4	- 0.02398	| | |
5	0.01138	| | |
6	- 0.01274	| | |
7	- 0.00823	| | |
8	0.00734	| | |
9	0.01510	| | |
10	- 0.00247	| | |

Autocorrelation Check for White Noise									
To Lag	Chi- Square	DF	Pr > ChiSq	Autocorrelations					
6	1043.85	6	<.0001	- 0.322	- 0.010	- 0.002	- 0.002	0.019	- 0.021

Conditional Least Squares Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MA1,1	0.37440	0.0092725	40.38	<.0001	1

Variance Estimate	2.613018
Std Error Estimate	1.616483
AIC	37981.03
SBC	37988.24
Number of Residuals	9999

* AIC and SBC do not include log determinant.

Univariate MA analysis of p Input dataset=pq maOrder=1

The ARIMA Procedure

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
				Autocorrelation Check of Residuals					
6	6.21	5	0.2867	0.004	-0.010	-0.005	0.001	0.014	-0.016
12	10.21	11	0.5114	0.001	0.014	0.010	-0.007	0.002	-0.007
18	18.66	17	0.3481	0.000	0.019	-0.018	0.001	0.000	-0.012
24	22.83	23	0.4707	0.006	0.006	-0.003	-0.013	0.005	0.012
30	28.11	29	0.5119	-0.002	-0.009	0.000	0.010	0.015	0.011
36	31.26	35	0.6495	0.008	0.005	-0.008	-0.012	0.002	0.001
42	38.24	41	0.5938	0.013	0.008	-0.020	0.006	-0.003	0.004
48	46.95	47	0.4744	0.005	-0.001	-0.006	-0.014	0.024	-0.000

Model for variable p	
Data have been centered by subtracting the value	-0.00145
Period(s) of Differencing	1

No mean term in this model.

Moving Average Factors	
Factor 1:	1 - 0.3744 B**(1)

Univariate random- walk analysis

Innovation variance
2.6130179

Thetas
1
- 0.374397

Sum of thetas, including theta(0)=1
0.62560

Random- walk variance
1.02268060796994

Random- walk standard deviation
1.01127672175816

Pricing error coefficients
- 0.37440

Pricing error variance (lower bound)
0.3662748799

Pricing error standard deviation (lower bound)
0.605206