

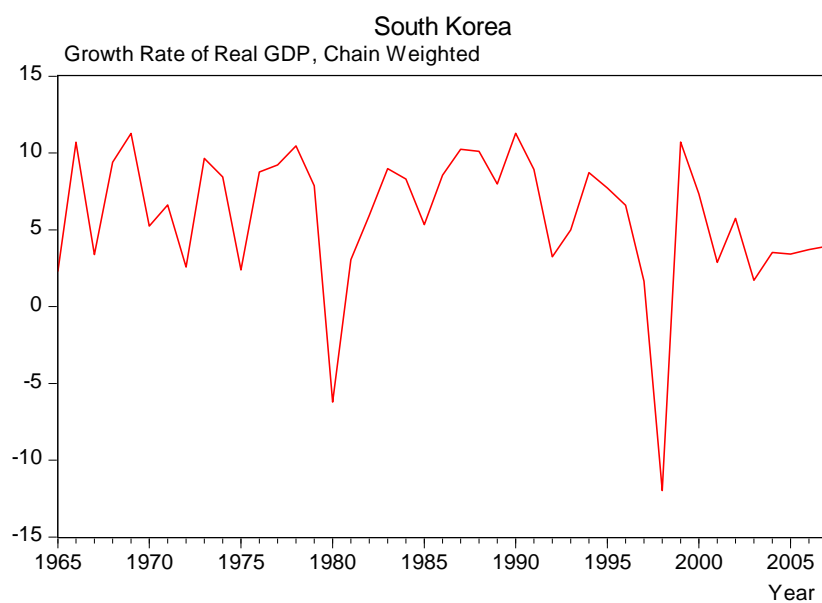
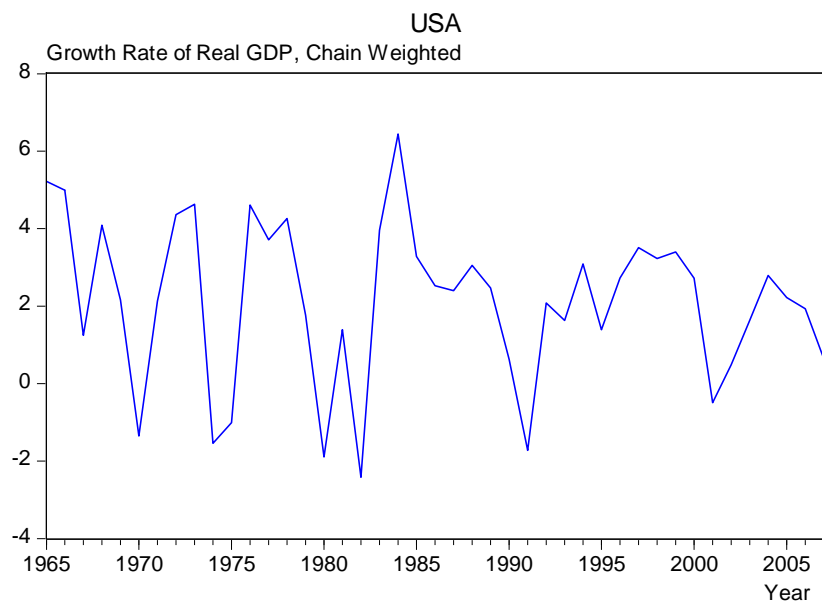
## I. Time Series Plot

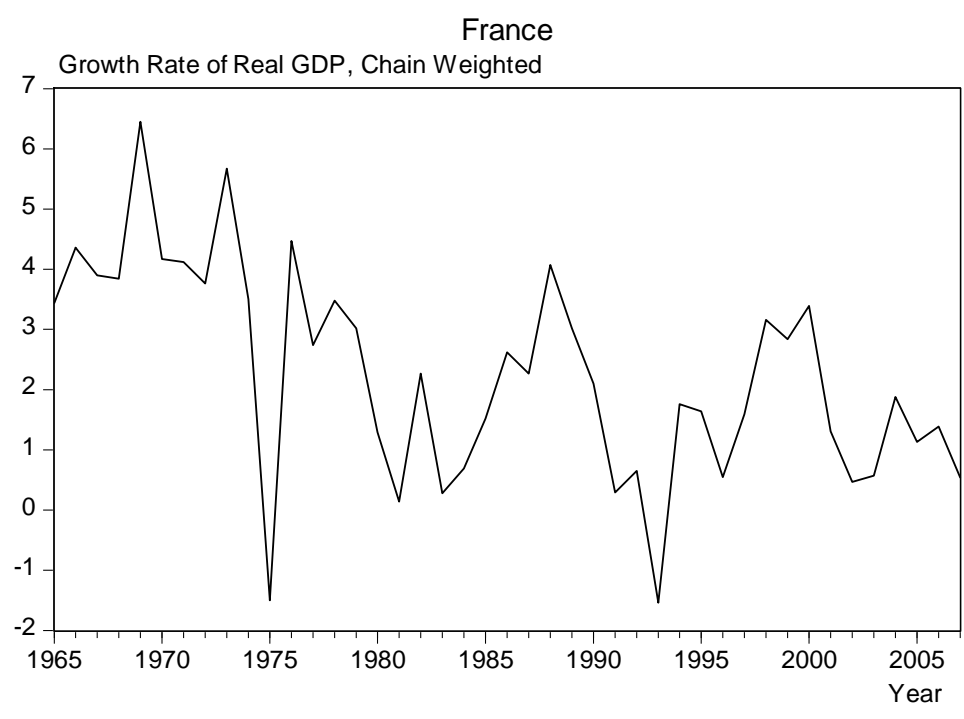
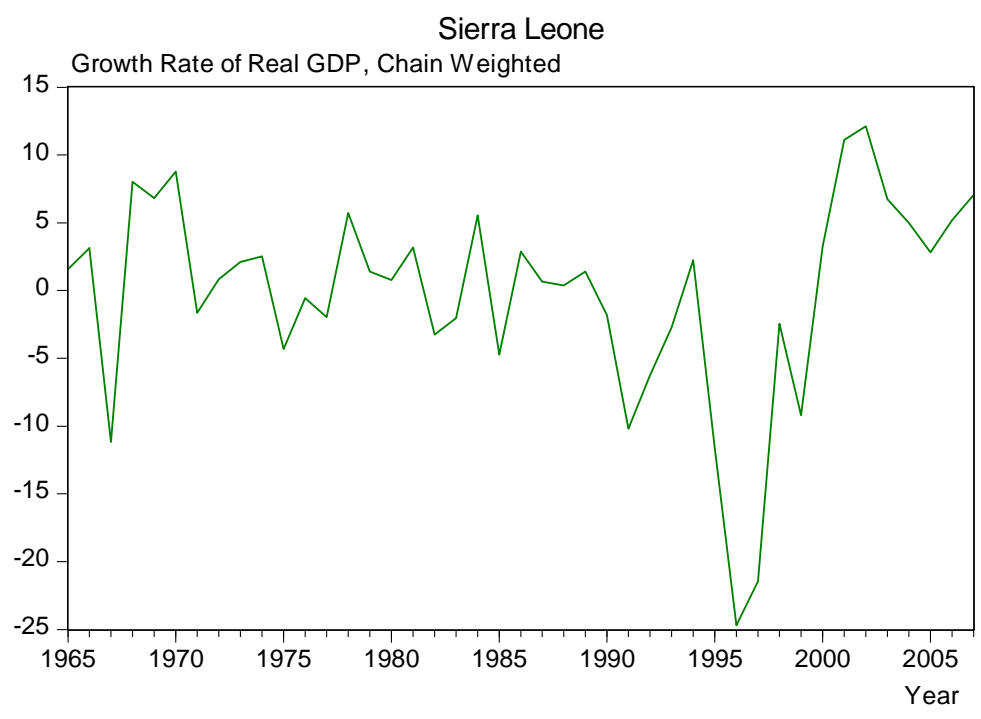
### Individual Plots

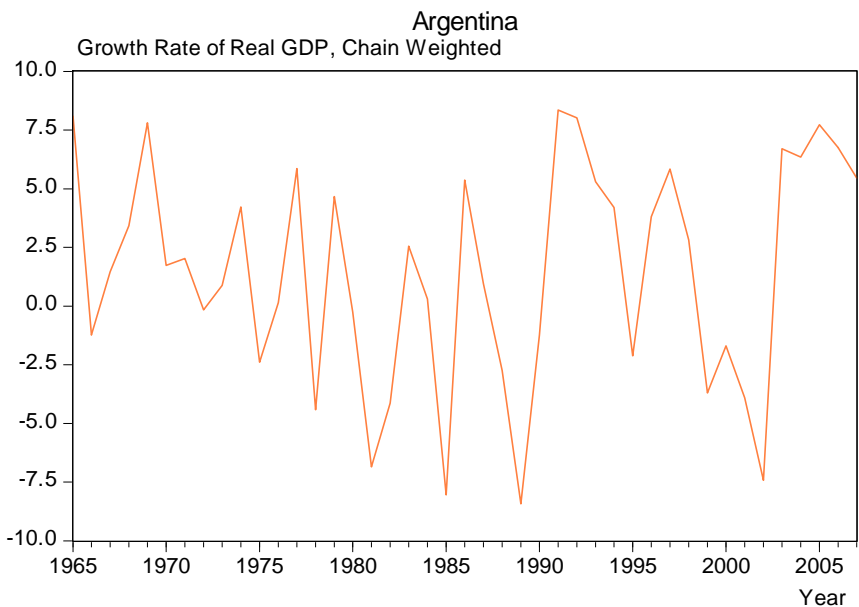
EViews

Quick → Graph...

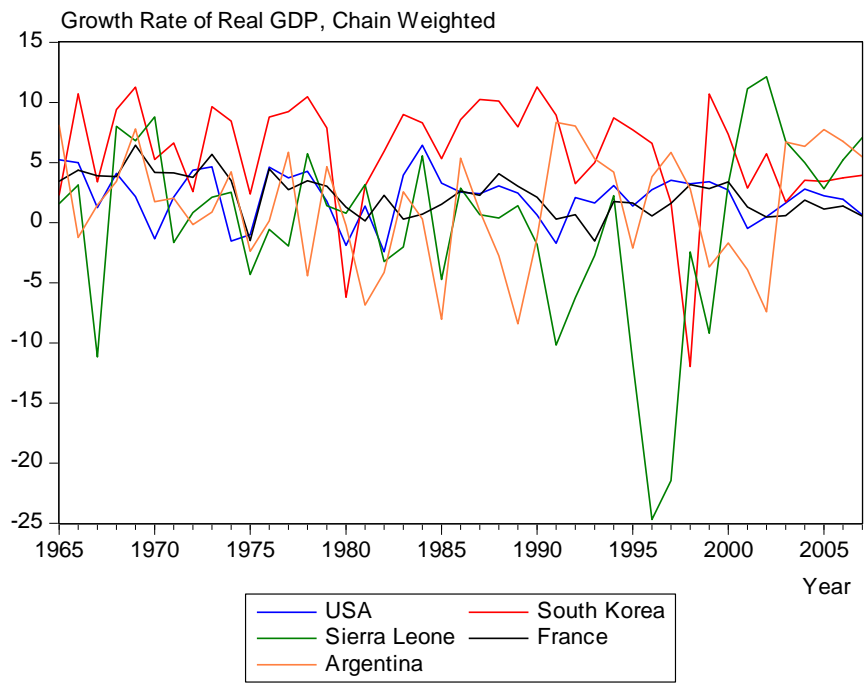
Enter in "Series List" Dialog Box: (country name)







**Group Plot**



*EViews*

*Quick → Graph...*

*Enter in "Series List" Dialog Box: usa southkorea argentina sierraleone france*

## II. Descriptive Statistics

### Sample Average

$$\bar{y} = \frac{1}{T} \sum_{t=1}^T y_t$$

### Sample Standard Deviation

$$\hat{\sigma} = \sqrt{\hat{\sigma}^2} = \left( \frac{1}{T-1} \sum_{t=1}^T (y_t - \bar{y})^2 \right)^{1/2}$$

	USA	SOUTH KOREA	SIERRA LEONE	FRANCE	ARGENTINA
Mean	2.148837	5.922326	-0.203721	2.263023	1.443488
Median	2.400000	6.610000	1.400000	2.270000	1.730000
Maximum	6.440000	11.28000	12.12000	6.450000	8.350000
Minimum	-2.420000	-11.97000	-24.69000	-1.540000	-8.420000
Std. Dev.	2.075279	4.518947	7.520704	1.747147	4.761297
Skewness	-0.451849	-1.790331	-1.283877	0.023830	-0.384213
Kurtosis	2.735808	7.616008	5.156516	2.780975	2.191939
Jarque-Bera Probability	1.588256 0.451975	61.14721 0.000000	20.14537 0.000042	0.090020 0.955988	2.227831 0.328271
Sum	92.40000	254.6600	-8.760000	97.31000	62.07000
Sum Sq. Dev.	180.8848	857.6772	2375.562	128.2059	952.1378
Observations	43	43	43	43	43

### EViews

Quick → Group Statistics → Descriptive Statistics → Common Sample

Enter in "Series List" Dialog Box: usa argentina france sierraleone southkorea

## Sample Covariance

$$\hat{\sigma}_{XY} = \frac{1}{T-1} \sum_{t=1}^T (x_t - \bar{x})(y_t - \bar{y})$$

EViews

= @cov(argentina, france, sierraleone, southkorea, usa)

Or

Quick → Group Statistics → Covariances

Enter “argentina france sierraleone southkorea usa” in the dialog box. This shows the following covariance matrix (note that the diagonals represent the variances):

	ARGENTINA	FRANCE	SIERRALEONE	SOUTHKOREA	USA
ARGENTINA	22.14274	-0.103643	-3.550975	-2.230466	0.593041
FRANCE	-0.103643	2.981533	2.489809	2.210142	1.106685
SIERRALEONE	-3.550975	2.489809	55.24562	1.923406	-0.206221
SOUTHKOREA	-2.230466	2.210142	1.923406	19.94598	2.041575
USA	0.593041	1.106685	-0.206221	2.041575	4.206624

## Sample Correlation Coefficient

$$\hat{\rho}_{XY} = \frac{\hat{\sigma}_{XY}}{\hat{\sigma}_X \hat{\sigma}_Y} = \frac{\sum_{t=1}^T (x_t - \bar{x})(y_t - \bar{y})}{(\sum_{t=1}^T (x_t - \bar{x})^2)^{1/2} (\sum_{t=1}^T (y_t - \bar{y})^2)^{1/2}}$$

Both covariance and the correlation coefficient measure the *linear* dependence between the variables.

Notes: A correlation coefficient of 0 does not imply independence. Both covariance and correlation coefficient have the same sign.

EViews

= @cor(argentina, france, sierraleone, southkorea, usa)

Or

Quick → Group Statistics → Correlations

Enter “argentina france sierraleone southkorea usa” in the dialog box. This shows the following correlation matrix (the diagonals are unity because each variable is perfectly correlated with itself):

	ARGENTINA	FRANCE	SIERRALEONE	SOUTHKOREA	USA
ARGENTINA	1.000000	-0.012756	-0.101527	-0.106133	0.061447
FRANCE	-0.012756	1.000000	0.193998	0.286598	0.312491
SIERRALEONE	-0.101527	0.193998	1.000000	0.057942	-0.013527
SOUTHKOREA	-0.106133	0.286598	0.057942	1.000000	0.222880
USA	0.061447	0.312491	-0.013527	0.222880	1.000000

### III. Correlogram

$$\rho_j = \frac{\gamma_j}{\gamma_0} \text{ where } \gamma_j = \text{cov}(y_t, y_{t-j}), \gamma_0 = V(y_t)$$

EViews

Quick → Series Statistics → Correlogram...

Enter in “Series List” Dialog Box: (country name)

Correlogram of USA

Included observations: 43						
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	
		1	0.202	0.202	1.8826	0.170
		2	-0.252	-0.305	4.8774	0.087
		3	-0.252	-0.143	7.9574	0.047
		4	-0.176	-0.187	9.5018	0.050
		5	0.062	0.035	9.6985	0.084
		6	-0.042	-0.230	9.7924	0.134
		7	-0.034	-0.029	9.8530	0.197
		8	-0.005	-0.111	9.8544	0.275
		9	-0.199	-0.303	12.107	0.207
		10	0.077	0.081	12.452	0.256
		11	0.295	0.132	17.713	0.088
		12	0.194	0.065	20.060	0.066
		13	-0.007	0.005	20.064	0.094
		14	-0.267	-0.087	24.832	0.036
		15	-0.066	0.093	25.135	0.048
		16	0.063	0.003	25.420	0.063
		17	-0.130	-0.180	26.685	0.063
		18	-0.087	-0.103	27.270	0.074
		19	0.044	0.076	27.423	0.095
		20	0.127	0.069	28.788	0.092

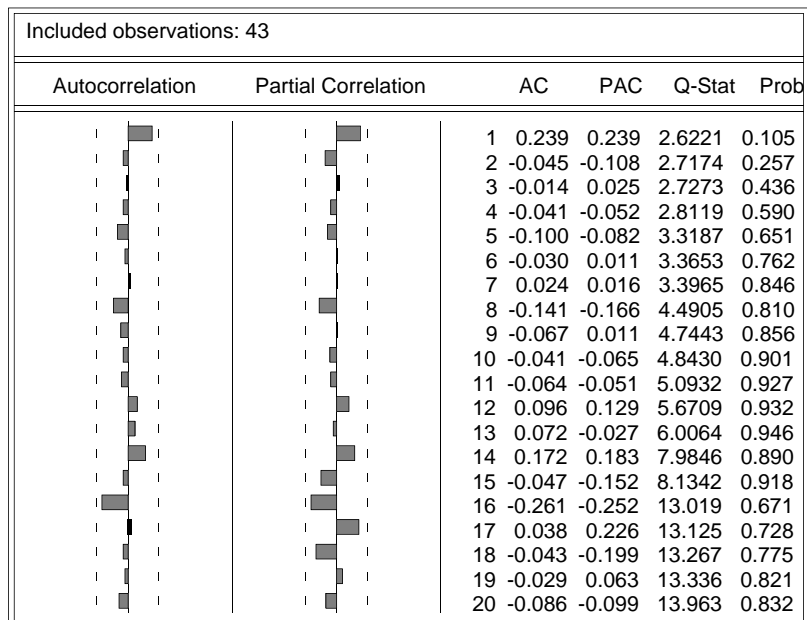
## Correlogram of SOUTHKOREA

Included observations: 43						
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	
		1	0.096	0.096	0.4211	0.516
		2	-0.091	-0.101	0.8141	0.666
		3	-0.007	0.012	0.8167	0.845
		4	-0.059	-0.070	0.9905	0.911
		5	0.284	0.305	5.0843	0.406
		6	0.018	-0.072	5.1018	0.531
		7	-0.110	-0.045	5.7497	0.569
		8	-0.021	-0.026	5.7734	0.673
		9	0.003	0.047	5.7740	0.762
		10	-0.046	-0.161	5.8974	0.824
		11	-0.147	-0.134	7.2082	0.782
		12	-0.020	0.050	7.2334	0.842
		13	0.044	0.041	7.3594	0.883
		14	-0.176	-0.258	9.4155	0.804
		15	-0.082	0.003	9.8792	0.827
		16	-0.020	0.074	9.9072	0.871
		17	0.140	0.153	11.365	0.837
		18	0.229	0.102	15.434	0.632
		19	-0.179	-0.113	18.009	0.522
		20	-0.105	0.004	18.937	0.526

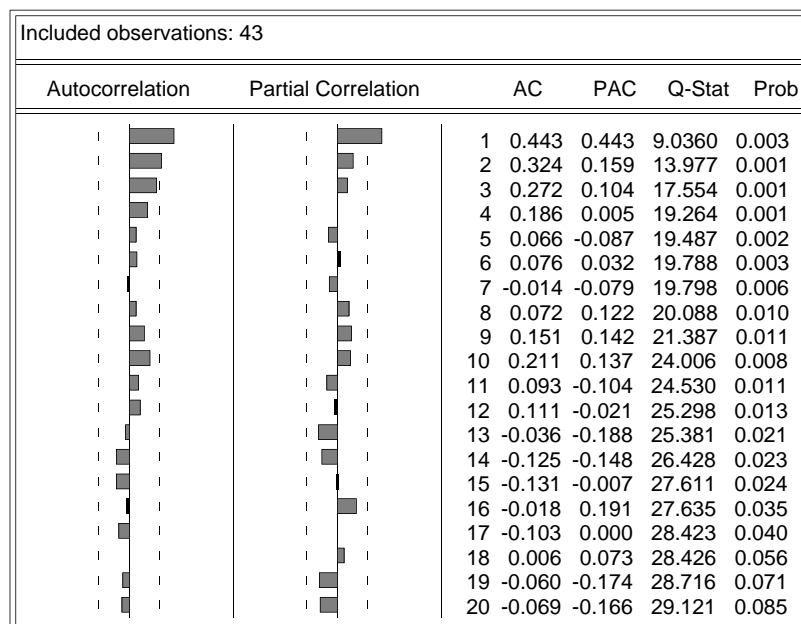
## Correlogram of SIERRALEONE

Date: 10/10/12 Time: 14:08 Sample: 1965 2007 Included observations: 43						
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	
		1	0.506	0.506	11.796	0.001
		2	0.258	0.002	14.935	0.001
		3	0.100	-0.043	15.415	0.001
		4	0.088	0.072	15.798	0.003
		5	-0.044	-0.144	15.895	0.007
		6	-0.094	-0.041	16.358	0.012
		7	-0.206	-0.156	18.639	0.009
		8	-0.081	0.127	19.000	0.015
		9	-0.178	-0.198	20.796	0.014
		10	-0.198	-0.069	23.089	0.010
		11	-0.211	-0.045	25.792	0.007
		12	-0.110	-0.001	26.542	0.009
		13	-0.076	0.001	26.912	0.013
		14	0.009	0.026	26.918	0.020
		15	-0.040	-0.061	27.026	0.029
		16	-0.013	-0.063	27.039	0.041
		17	-0.072	-0.095	27.428	0.052
		18	-0.035	-0.002	27.521	0.070
		19	-0.065	-0.063	27.861	0.086
		20	0.042	0.087	28.007	0.109

## Correlogram of ARGENTINA



## Correlogram of FRANCE



## IV. Estimating Equations

*EViews*

*Quick* → *Estimate Equation*

*Enter in Equation Dialog Box: (country name) c ar(p) ma(q)*



ARMA(0,0):  
sierraleone c

Dependent Variable: SIERRALEONE

Method: Least Squares

Date: 10/18/12 Time: 13:32

Sample: 1965 2007

Included observations: 43

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.203721	1.146897	-0.177628	0.8599
R-squared	0.000000	Mean dependent var		-0.203721
Adjusted R-squared	0.000000	S.D. dependent var		7.520704
S.E. of regression	7.520704	Akaike info criterion		6.896178
Sum squared resid	2375.562	Schwarz criterion		6.937136
Log likelihood	-147.2678	Hannan-Quinn criter.		6.911282
Durbin-Watson stat	0.964448			

ARMA(1,0):  
sierraleone c ar(1)

Dependent Variable: SIERRALEONE

Method: Least Squares

Date: 10/15/12 Time: 14:28

Sample (adjusted): 1966 2007

Included observations: 42 after adjustments

Convergence achieved after 3 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.105672	2.117496	-0.049904	0.9604
AR(1)	0.517651	0.137288	3.770549	0.0005
R-squared	0.262225	Mean dependent var		-0.245952
Adjusted R-squared	0.243780	S.D. dependent var		7.606705
S.E. of regression	6.614859	Akaike info criterion		6.662962
Sum squared resid	1750.255	Schwarz criterion		6.745708
Log likelihood	-137.9222	Hannan-Quinn criter.		6.693292
F-statistic	14.21704	Durbin-Watson stat		1.997013
Prob(F-statistic)	0.000527			
Inverted AR Roots	.52			

ARMA(0,1):  
sierraleone c ma(1)

Dependent Variable: SIERRALEONE

Method: Least Squares

Date: 10/15/12 Time: 14:29

Sample: 1965 2007

Included observations: 43

Convergence achieved after 17 iterations

MA Backcast: 1964

Variable	Coefficient	Std. Error	t-Statistic	Prob.
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C	-0.161463	1.449729	-0.111375	0.9119
MA(1)	0.407105	0.142434	2.858207	0.0067
R-squared	0.204922	Mean dependent var		-0.203721
Adjusted R-squared	0.185529	S.D. dependent var		7.520704
S.E. of regression	6.787287	Akaike info criterion		6.713375
Sum squared resid	1888.758	Schwarz criterion		6.795291
Log likelihood	-142.3376	Hannan-Quinn criter.		6.743583
F-statistic	10.56724	Durbin-Watson stat		1.749410
Prob(F-statistic)	0.002304			
Inverted MA Roots	-.41			

ARMA(1,1):  
sierraleone c ar(1) ma(1)

Dependent Variable: SIERRALEONE  
Method: Least Squares  
Date: 10/15/12 Time: 14:30  
Sample (adjusted): 1966 2007  
Included observations: 42 after adjustments  
Convergence achieved after 9 iterations  
MA Backcast: 1965

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.104062	2.166690	-0.048028	0.9619
AR(1)	0.530569	0.267171	1.985878	0.0541
MA(1)	-0.017524	0.312264	-0.056118	0.9555
R-squared	0.262298	Mean dependent var		-0.245952
Adjusted R-squared	0.224467	S.D. dependent var		7.606705
S.E. of regression	6.698795	Akaike info criterion		6.710482
Sum squared resid	1750.080	Schwarz criterion		6.834601
Log likelihood	-137.9201	Hannan-Quinn criter.		6.755976
F-statistic	6.933439	Durbin-Watson stat		1.986613
Prob(F-statistic)	0.002653			
Inverted AR Roots	.53			
Inverted MA Roots	.02			

ARMA(1,2):  
sierraleone c ar(1) ma(1) ma(2)

Dependent Variable: SIERRALEONE  
Method: Least Squares  
Date: 10/15/12 Time: 14:31  
Sample (adjusted): 1966 2007  
Included observations: 42 after adjustments  
Convergence achieved after 23 iterations  
MA Backcast: 1964 1965

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.146900	1.721198	-0.085347	0.9324
AR(1)	-0.892852	0.046086	-19.37350	0.0000
MA(1)	1.782075	0.075863	23.49063	0.0000

MA(2)	0.864941	0.068822	12.56777	0.0000
R-squared	0.462343	Mean dependent var	-0.245952	
Adjusted R-squared	0.419896	S.D. dependent var	7.606705	
S.E. of regression	5.793612	Akaike info criterion	6.441782	
Sum squared resid	1275.506	Schwarz criterion	6.607274	
Log likelihood	-131.2774	Hannan-Quinn criter.	6.502441	
F-statistic	10.89234	Durbin-Watson stat	1.927905	
Prob(F-statistic)	0.000027			
Inverted AR Roots	-.89			
Inverted MA Roots	-.89-.27i		-.89+.27i	

## Tables of Coefficients

Where  $\Phi$  is the coefficient of AR and  $\Theta_j$  is the coefficient of MA(j)

Country	$\phi$	$\theta_1$	$\theta_2$	$\theta_3$
<b>Argentina</b>				
ARMA(0,0)	-	-	-	-
ARMA(1,0)	0.2421	-	-	-
ARMA(0,1)	-	0.3348	-	-
ARMA(1,1)	-0.6739	0.949137	-	-
<b>France</b>				
ARMA(0,0)	-	-	-	-
ARMA(1,0)	0.4541	-	-	-
ARMA(0,1)	-	0.3464	-	-
ARMA(1,1)	0.8961	-0.9688	-	-
ARMA(1,3)	0.8833	-0.7837	-0.1449	-0.0381
<b>Sierra Leone</b>				
ARMA(0,0)	-	-	-	-
ARMA(1,0)	0.5177	-	-	-
ARMA(0,1)	-	0.4071	-	-
ARMA(1,1)	0.5306	-0.0175	-	-
ARMA(1,2)	-0.8929	1.7821	0.8649	-
<b>South Korea</b>				
ARMA(0,0)	-	-	-	-
ARMA(1,0)	0.0959	-	-	-
ARMA(0,1)	-	0.1276	-	-
ARMA(1,1)	-0.5484	0.7855	-	-
<b>USA</b>				

ARMA(0,0)	-	-	-	-
ARMA(1,0)	0.2054	-	-	-
ARMA(0,1)	-	0.3596	-	-
ARMA(1,1)	-0.4675	0.7659	-	-

Where adj.  $R^2$  is the adjusted  $R^2$ ,  
 $\hat{\sigma}$  is the S.E. of Regression, A.I.C.  
is the Akaike Info Criterion, and  
S.C. is the Schwarz Criterion

Country	adj. $R^2$	$\hat{\sigma}$	A.I.C.	S.C.
<b>Argentina</b>				
ARMA(0,0)	0.0000	4.7613	5.9819	6.0229
ARMA(1,0)	0.0370	4.6154	5.9431	6.0259
ARMA(0,1)	0.0572	4.6232	5.9455	6.0274
ARMA(1,1)	0.0775	4.5173	5.9225	6.0466
<b>France</b>				
ARMA(0,0)	0.0000	1.7471	3.9768	4.0178
ARMA(1,0)	0.1836	1.5889	3.8104	3.8932
ARMA(0,1)	0.1267	1.6327	3.8638	3.9457
ARMA(1,1)	0.3615	1.4051	3.5869	3.7110
ARMA(1,3)	0.3486	1.4193	3.6496	3.8565
<b>Sierra Leone</b>				
ARMA(0,0)	0.0000	7.5207	6.8962	6.9371
ARMA(1,0)	0.2438	6.6149	6.6630	6.7457
ARMA(0,1)	0.1855	6.7873	6.7134	6.7953
ARMA(1,1)	0.2245	6.6988	6.7105	6.8346
ARMA(1,2)	0.4199	5.7936	6.4418	6.6073
<b>South Korea</b>				
ARMA(0,0)	0.0000	4.5189	5.8774	5.9184
ARMA(1,0)	-0.0155	4.5729	5.9246	6.0074
ARMA(0,1)	-0.0120	4.5461	5.9118	5.9937
ARMA(1,1)	0.0407	4.4447	5.8900	6.0142
<b>USA</b>				
ARMA(0,0)	0.0000	2.0753	4.3210	4.3620
ARMA(1,0)	0.0201	2.0230	4.2935	4.3762
ARMA(0,1)	0.0587	2.0134	4.2829	4.3648
ARMA(1,1)	0.0523	1.9894	4.2823	4.4064

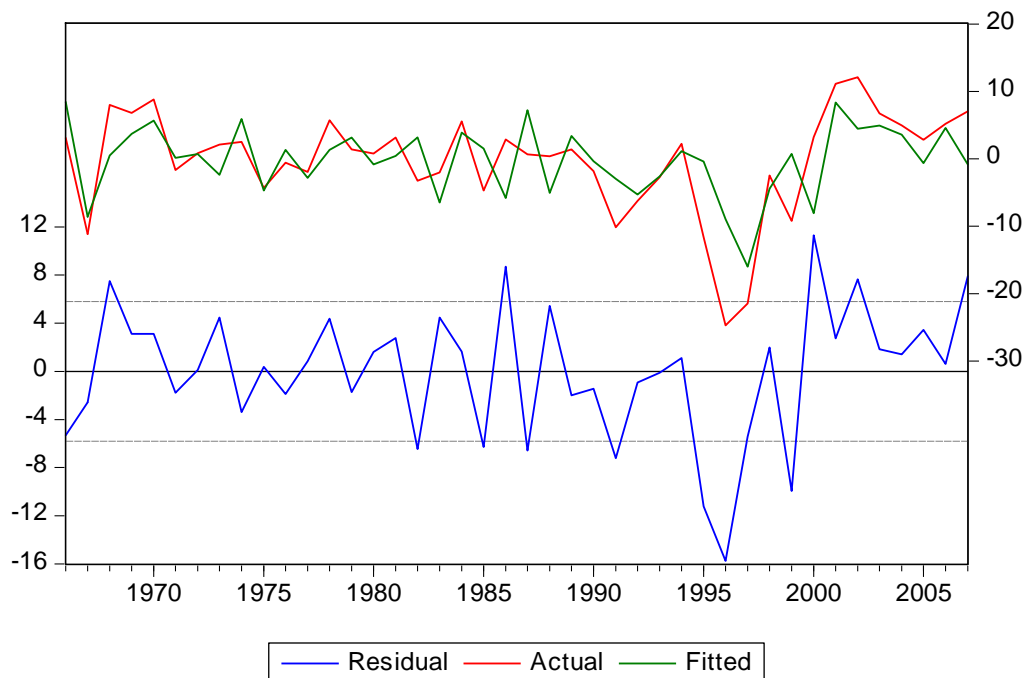
## V. Forecasting

### In-Sample Forecast

EViews

Estimated Equation Forecast Window →View →Actual, Fitted, Residual →Actual, Fitted Residual  
Table

obs	Actual	Fitted	Residual	Residual Plot
1966	3.13000	8.43905	-5.30905	
1967	-11.1700	-8.59214	-2.57786	
1968	801000	0.50914	7.50086	
1969	6.82000	3.70760	3.11240	
1970	8.79000	5.66703	3.12297	
1971	-1.65000	0.13118	-1.78118	
1972	0.83000	0.72213	0.10787	
1973	2.11000	-2.36751	4.47751	
1974	2.52000	5.91058	-3.39058	
1975	-4.32000	-4.69753	0.37753	
1976	-0.56000	1.31920	-1.87920	
1977	-1.95000	-2.80040	0.85040	
1978	5.73000	1.35307	4.37693	
1979	1.41000	3.14145	-1.73145	
1980	0.78000	-0.83678	1.61678	
1981	3.17000	0.40913	2.76087	
1982	-3.25000	3.21010	-6.46010	
1983	-2.03000	-6.50068	4.47068	
1984	5.55000	3.91391	1.63609	
1985	-4.73000	1.54913	-6.27913	
1986	2.87000	-5.82962	8.69962	
1987	0.66000	7.23175	-6.57175	
1988	0.39000	-5.05404	5.44404	
1989	1.40000	3.39123	-1.99123	
1990	-1.81000	-0.36781	-1.44219	
1991	-10.1800	-2.95439	-7.22561	
1992	-6.25000	-5.31281	-0.93719	
1993	-2.73000	-2.61760	-0.11240	
1994	2.25000	1.14851	1.10149	
1995	-11.6400	-0.42126	-11.2187	
1996	-24.6900	-8.92518	-15.7648	
1997	-21.4600	-160312	-5.42881	
1998	-2.44000	-4.42765	1.98765	
1999	-9.20000	0.74704	-9.94704	
2000	3.24000	-8.07099	11.3110	
2001	11.1300	8.38252	2.74748	
2002	12.1200	4.46405	7.65595	
2003	6.75000	4.92046	1.82954	
2004	4.99000	3.57751	1.41249	
2005	2.82000	-0.63379	3.45379	
2006	5.20000	4.58072	0.61928	
2007	7.06000	-0.82997	7.88997	

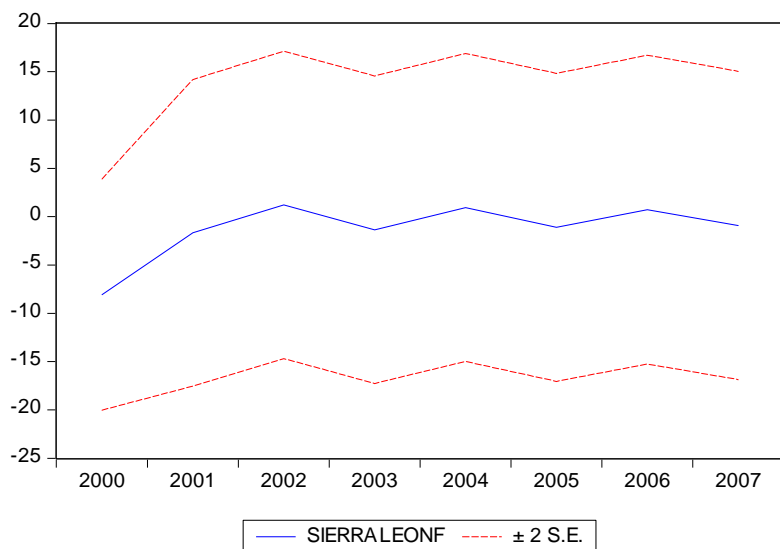


### Out of Sample Forecast

EViews

*Estimated Equation Window → Forecast*

*Enter in Forecast Sample box desired range: [in ARMA(1,2) for Sierra Leone] 2000 2007*



Forecast:	SIERRALEONF
Actual:	SIERRALEONE
Forecast sample:	2000 2007
Included observations:	8
Root Mean Squared Error	8.604553
Mean Absolute Error	7.947763
Mean Abs. Percent Error	136.7913
Theil Inequality Coefficient	0.823797
Bias Proportion	0.853165
Variance Proportion	0.002306
Covariance Proportion	0.144528

Year	Actual	Forecast	Forecast Error
2000	3.24	-8.0709852	11.31098522
2001	11.13	-1.675466	12.80546601
2002	12.12	1.2178836	10.90211642
2003	6.75	-1.3654489	8.115448913
2004	4.99	0.9410842	4.048915761
2005	2.82	-1.1183081	3.938308117
2006	5.2	0.7204241	4.479575874
2007	7.06	-0.9212913	7.981291331

## Multivariate Time Series Models

*EViews*

*Quick → Estimate Equation*

*Enter in Equation Dialog Box: (country name x) c ar(p) ma(q) (country name y)*

sierraleone c ar(1) ma(1) ma(2) usa:

Dependent Variable: SIERRALEONE

Method: Least Squares

Date: 11/07/12 Time: 15:07

Sample (adjusted): 1966 2007

Included observations: 42 after adjustments

Convergence achieved after 19 iterations

MA Backcast: 1964 1965

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.643118	1.809104	-0.908250	0.3696
USA	0.683088	0.424314	1.609864	0.1159
AR(1)	-0.974880	0.014647	-66.55651	0.0000
MA(1)	1.863633	0.025916	71.90952	0.0000
MA(2)	0.871291	0.024272	35.89767	0.0000
R-squared	0.521232	Mean dependent var		-0.245952
Adjusted R-squared	0.469473	S.D. dependent var		7.606705
S.E. of regression	5.540516	Akaike info criterion		6.373396
Sum squared resid	1135.801	Schwarz criterion		6.580261
Log likelihood	-128.8413	Hannan-Quinn criter.		6.449220
F-statistic	10.07042	Durbin-Watson stat		1.463250
Prob(F-statistic)	0.000013			
Inverted AR Roots	-0.97			
Inverted MA Roots	-0.93-0.05i	-0.93+0.05i		

sierraleone c ar(1) ma(1) ma(2) usa(-1):

Dependent Variable: SIERRALEONE  
 Method: Least Squares  
 Date: 11/07/12 Time: 15:08  
 Sample (adjusted): 1967 2007  
 Included observations: 41 after adjustments  
 Convergence achieved after 14 iterations  
 MA Backcast: 1965 1966

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.064665	1.788424	0.595309	0.5554
USA(-1)	-0.377356	0.356067	-1.059791	0.2963
AR(1)	-0.977561	0.028075	-34.81987	0.0000
MA(1)	1.869178	0.016284	114.7866	0.0000
MA(2)	0.908420	0.015958	56.92711	0.0000

R-squared	0.531289	Mean dependent var	-0.328293
Adjusted R-squared	0.479210	S.D. dependent var	7.682229
S.E. of regression	5.543942	Akaike info criterion	6.377138
Sum squared resid	1106.470	Schwarz criterion	6.586110
Log likelihood	-125.7313	Hannan-Quinn criter.	6.453234
F-statistic	10.20159	Durbin-Watson stat	1.647104
Prob(F-statistic)	0.000013		

Inverted AR Roots	-.98	
Inverted MA Roots	-.93-.19i	-.93+.19i

## VI. Diagnostic Checking

### Residual Diagnostics

#### i. Correlogram of Residual

EViews

Estimated Equation Window → View → Residual Diagnostics → Correlogram - Q-Statistics...

Date: 11/07/12 Time: 15:13						
Sample: 1967 2007						
Included observations: 41						
Q-statistic probabilities adjusted for 3 ARMA term(s)						
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	
		1	0.145	0.145	0.9217	
		2	0.161	0.143	2.0936	
		3	0.132	0.095	2.9041	
		4	-0.038	-0.092	2.9735	0.085
		5	0.122	0.110	3.7017	0.157
		6	-0.116	-0.148	4.3843	0.223
		7	-0.021	-0.002	4.4067	0.354
		8	-0.096	-0.097	4.9038	0.428
		9	-0.075	0.002	5.2141	0.517
		10	-0.160	-0.173	6.6685	0.464

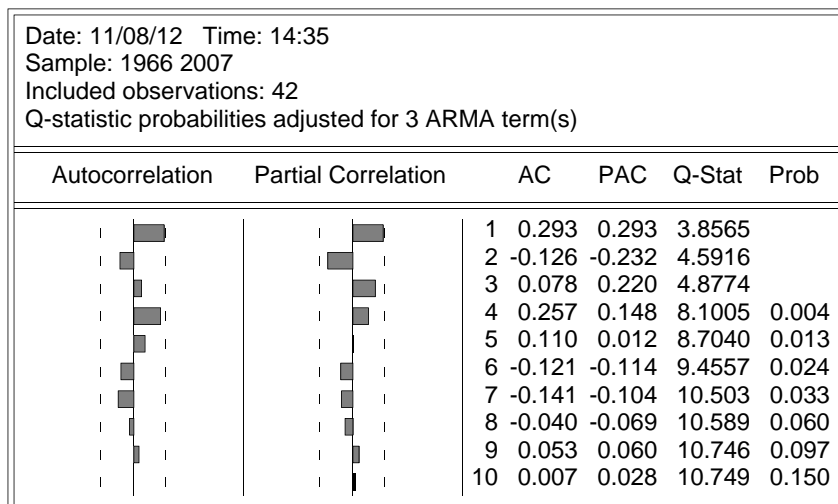


## ii. Correlogram of Residuals Squared

EViews

Estimated Equation Window → View → Residual Diagnostics → Correlogram Squared Residuals

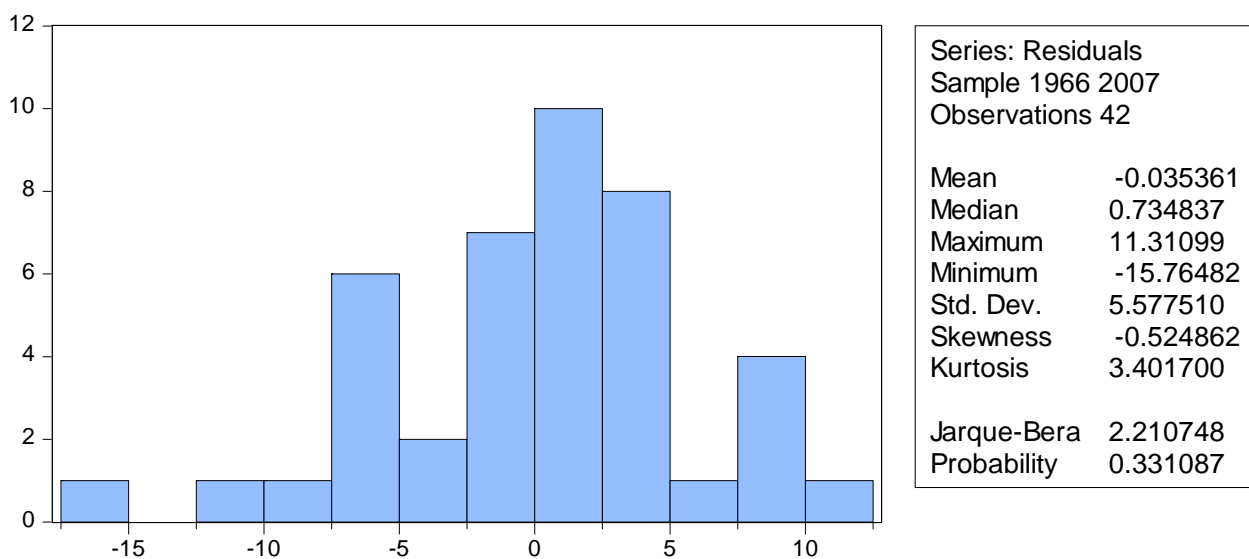
Correlogram of Residuals Squared



## iii. Histogram

EViews

Estimated Equation Window → View → Residual Diagnostics → Histogram – Normality Test



#### iv. Breusch-Godfrey Serial Correlation LM Test

EViews

*Estimated Equation Window* → View → Residual Diagnostics → Serial Correlation LM Test

F-statistic	1.048594	Prob. F(2,36)	0.3609
Obs*R-squared	2.310397	Prob. Chi-Square(2)	0.3150

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 11/08/12 Time: 14:45

Sample: 1966 2007

Included observations: 42

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.179066	1.723599	0.103891	0.9178
AR(1)	0.020374	0.049809	0.409046	0.6849
MA(1)	0.062960	0.094192	0.668424	0.5081
MA(2)	0.053123	0.084274	0.630365	0.5324
RESID(-1)	-0.080609	0.200050	-0.402942	0.6894
RESID(-2)	0.281797	0.194590	1.448160	0.1562

R-squared	0.055009	Mean dependent var	-0.035361
Adjusted R-squared	-0.076239	S.D. dependent var	5.577510
S.E. of regression	5.786218	Akaike info criterion	6.480398
Sum squared resid	1205.291	Schwarz criterion	6.728637
Log likelihood	-130.0884	Hannan-Quinn criter.	6.571388
F-statistic	0.419124	Durbin-Watson stat	1.961471
Prob(F-statistic)	0.832298		

#### v. Heteroskedasticity Tests

EViews

*Estimated Equation Window* → View → Residual Diagnostics → Heteroskedasticity Tests

*For Breusch-Pagan-Godfre, enter the fitted value and its square into the regressors window: c sierraleonf sierraleonf^2*

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	16.21249	Prob. F(2,39)	0.0000
Obs*R-squared	19.06685	Prob. Chi-Square(2)	0.0001
Scaled explained SS	18.84775	Prob. Chi-Square(2)	0.0001

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 11/09/12 Time: 16:17

Sample: 1966 2007

Included observations: 42

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	17.82654	6.069164	2.937231	0.0055
SIERRALEONF	-1.204864	1.325730	-0.908831	0.3690
SIERRALEONF^2	0.217443	0.076838	2.829894	0.0073
R-squared	0.453973	Mean dependent var		30.36919
Adjusted R-squared	0.425971	S.D. dependent var		47.76798
S.E. of regression	36.19126	Akaike info criterion		10.08426
Sum squared resid	51082.49	Schwarz criterion		10.20838
Log likelihood	-208.7695	Hannan-Quinn criter.		10.12976
F-statistic	16.21249	Durbin-Watson stat		1.921093
Prob(F-statistic)	0.000008			

Heteroskedasticity Test: ARCH

F-statistic	3.694793	Prob. F(1,39)	0.0619
Obs*R-squared	3.548126	Prob. Chi-Square(1)	0.0596

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 11/08/12 Time: 14:50

Sample (adjusted): 1967 2007

Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	21.66867	8.612824	2.515861	0.0161
RESID^2(-1)	0.295819	0.153898	1.922184	0.0619
R-squared	0.086540	Mean dependent var		30.42243
Adjusted R-squared	0.063118	S.D. dependent var		48.36013
S.E. of regression	46.80907	Akaike info criterion		10.57758
Sum squared resid	85452.47	Schwarz criterion		10.66117
Log likelihood	-214.8404	Hannan-Quinn criter.		10.60802
F-statistic	3.694793	Durbin-Watson stat		1.836092
Prob(F-statistic)	0.061910			

Heteroskedasticity Test: White

F-statistic	1.248118	Prob. F(14,27)	0.3000
Obs*R-squared	16.50175	Prob. Chi-Square(14)	0.2837
Scaled explained SS	16.31213	Prob. Chi-Square(14)	0.2947

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 11/08/12 Time: 14:54

Sample: 1966 2007  
Included observations: 42

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1802.021	2946.613	-0.611557	0.5459
GRADF_01	7290.355	11374.92	0.640915	0.5270
GRADF_01^2	-7233.711	10958.06	-0.660127	0.5148
GRADF_01*GRADF_02	-77.10269	28.75841	-2.681049	0.0124
GRADF_01*GRADF_03	-48.43900	64.92470	-0.746080	0.4621
GRADF_01*GRADF_04	-58.74093	62.31353	-0.942667	0.3542
GRADF_02	39.78315	14.98812	2.654312	0.0132
GRADF_02^2	0.033801	0.029506	1.145572	0.2620
GRADF_02*GRADF_03	-0.099884	0.069257	-1.442217	0.1607
GRADF_02*GRADF_04	-0.183934	0.085205	-2.158709	0.0399
GRADF_03	24.43326	33.61746	0.726803	0.4736
GRADF_03^2	-0.084143	0.080978	-1.039078	0.3080
GRADF_03*GRADF_04	-0.137648	0.147369	-0.934032	0.3586
GRADF_04	29.55963	32.18464	0.918439	0.3665
GRADF_04^2	-0.082607	0.074184	-1.113552	0.2753
R-squared	0.392899	Mean dependent var		30.36919
Adjusted R-squared	0.078106	S.D. dependent var		47.76798
S.E. of regression	45.86458	Akaike info criterion		10.76172
Sum squared resid	56796.11	Schwarz criterion		11.38231
Log likelihood	-210.9960	Hannan-Quinn criter.		10.98919
F-statistic	1.248118	Durbin-Watson stat		1.382477
Prob(F-statistic)	0.299966			

## Coefficient Diagnostics

EViews

*Estimated Equation Window* → *View* → *Coefficient Diagnostics* → *Wald Test – Coefficient Restrictions...*

*Enter into coefficient restrictions window: c(4)=0*

Note: This tests whether  $ma(2)=0$  as  $c(4)$  corresponds to  $ma(2)$

Wald Test:  
Equation: SIERRALEONEEQ4

Test Statistic	Value	df	Probability
t-statistic	12.56777	38	0.0000
F-statistic	157.9488	(1, 38)	0.0000
Chi-square	157.9488	1	0.0000

Null Hypothesis:  $C(4)=0$   
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
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C(4)	0.864941	0.068822
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Restrictions are linear in coefficients.

## VII. Nonstationary Models

### Detrending

$$y_t = a_0 + a_1 t + a_2 t^2 + z_t$$

$$\hat{z}_t = y_t - \hat{a}_0 - \hat{a}_1 t - \hat{a}_2 t^2$$

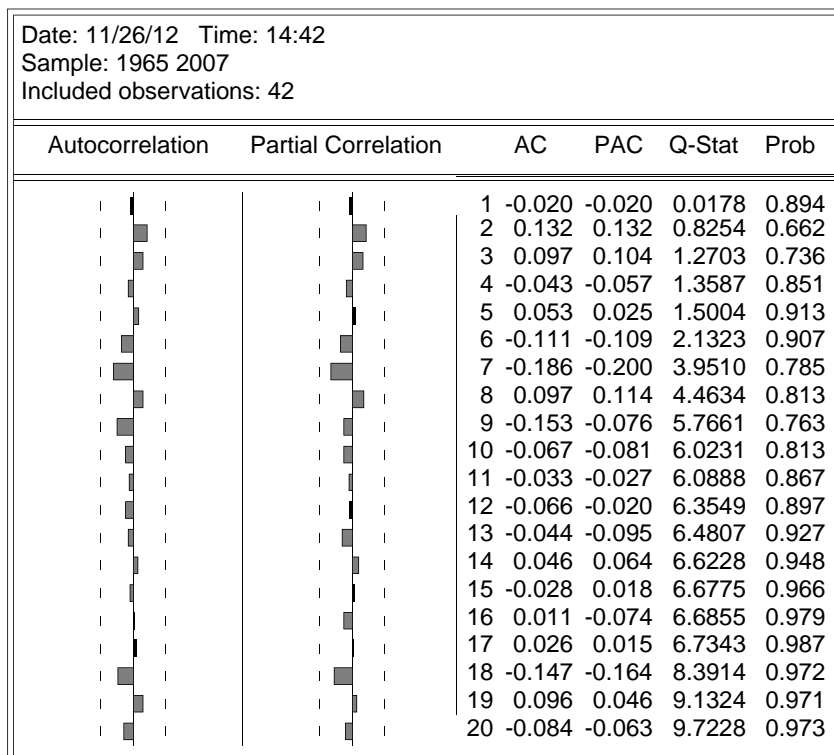
EViews

*genr detrendedseries = series - residuals*

*i.e. genr detrendsierraleone = sierraleone - resid*

Correlogram of detrended series

Correlogram of DETRENDSIERRALEONE



## Differencing

$$y_t = \alpha + \beta x_t + \varepsilon_t$$

$$y_{t-1} = \alpha + \beta x_{t-1} + \varepsilon_{t-1}$$

Differency Series =  $y_t - y_{t-1}$

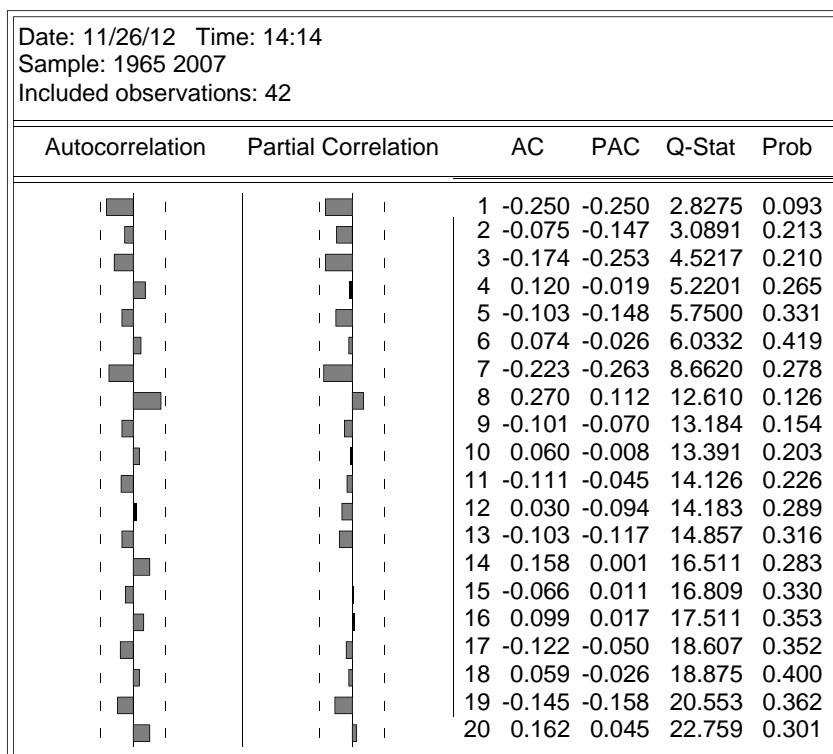
### EViews

*genr differencyseries = series - series(-1)*

*i.e. genr diffsierraleone = sierraleone - sierraleone(-1)*

### Correlogram of differency series

Correlogram of DIFFSIERRALEONE



## Unit Root Test

### Augmented Dickey-Fuller Test

EViews

Series →View →Unit Root Test...

Test Type is Augmented Dickey-Fuller. Test for unit root in level

Null Hypothesis: SIERRALEONE has a unit root  
 Exogenous: Constant  
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.513415	0.0124
Test critical values:		
1% level	-3.596616	
5% level	-2.933158	
10% level	-2.604867	

\*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation  
 Dependent Variable: D(SIERRALEONE)  
 Method: Least Squares  
 Date: 11/26/12 Time: 13:54  
 Sample (adjusted): 1966 2007  
 Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SIERRALEONE(-1)	-0.482349	0.137288	-3.513415	0.0011
C	-0.050971	1.022004	-0.049873	0.9605
R-squared	0.235826	Mean dependent var		0.130714
Adjusted R-squared	0.216721	S.D. dependent var		7.474162
S.E. of regression	6.614859	Akaike info criterion		6.662962
Sum squared resid	1750.255	Schwarz criterion		6.745708
Log likelihood	-137.9222	Hannan-Quinn criter.		6.693292
F-statistic	12.34409	Durbin-Watson stat		1.997013
Prob(F-statistic)	0.001114			

## Dickey-Fuller Test

EViews

Series →View →Unit Root Test...

Test Type is Dickey-Fuller GLS. Test for unit root in level.

Null Hypothesis: SIERRALEONE has a unit root  
 Exogenous: Constant  
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic
--	-------------

Elliott-Rothenberg-Stock DF-GLS test statistic	-3.512458
Test critical values:	
1% level	-2.621185
5% level	-1.948886
10% level	-1.611932

\*MacKinnon (1996)

DF-GLS Test Equation on GLS Detrended Residuals

Dependent Variable: D(GLSRESID)

Method: Least Squares

Date: 11/26/12 Time: 14:00

Sample (adjusted): 1966 2007

Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GLSRESID(-1)	-0.470159	0.133855	-3.512458	0.0011
R-squared	0.231067	Mean dependent var		0.130714
Adjusted R-squared	0.231067	S.D. dependent var		7.474162
S.E. of regression	6.554004	Akaike info criterion		6.621551
Sum squared resid	1761.154	Schwarz criterion		6.662924
Log likelihood	-138.0526	Hannan-Quinn criter.		6.636716
Durbin-Watson stat	2.009179			

## Phillips-Perron Test

EViews

Series →View →Unit Root Test...

Test Type is Phillips-Perron. Test for unit root in level.

Null Hypothesis: SIERRALEONE has a unit root

Exogenous: Constant

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-3.533131	0.0118
Test critical values:		
1% level	-3.596616	
5% level	-2.933158	
10% level	-2.604867	

\*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	41.67273
HAC corrected variance (Bartlett kernel)	42.45138

Phillips-Perron Test Equation



Dependent Variable: D(SIERRALEONE)  
 Method: Least Squares  
 Date: 11/27/12 Time: 10:31  
 Sample (adjusted): 1966 2007  
 Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SIERRALEONE(-1)	-0.482349	0.137288	-3.513415	0.0011
C	-0.050971	1.022004	-0.049873	0.9605
R-squared	0.235826	Mean dependent var		0.130714
Adjusted R-squared	0.216721	S.D. dependent var		7.474162
S.E. of regression	6.614859	Akaike info criterion		6.662962
Sum squared resid	1750.255	Schwarz criterion		6.745708
Log likelihood	-137.9222	Hannan-Quinn criter.		6.693292
F-statistic	12.34409	Durbin-Watson stat		1.997013
Prob(F-statistic)	0.001114			

## VIII. Structural Breaks

### Quandt-Andrews Breakpoint Test

*EViews*

*ARMA(1,1) model: View → Stability Diagnostics → Quandt-Andrews Breakpoint Test...*

Quandt-Andrews unknown breakpoint test  
 Null Hypothesis: No breakpoints within 15% trimmed data

Equation Sample: 1966 2007  
 Test Sample: 1973 2001  
 Number of breaks compared: 29

Statistic	Value	Prob.
Maximum LR F-statistic (1996)	20.65072	0.0000
Maximum Wald F-statistic (1999)	42.42625	0.0000
Exp LR F-statistic	6.975614	0.0002
Exp Wald F-statistic	17.95342	0.0001
Ave LR F-statistic	5.536663	0.0000
Ave Wald F-statistic	13.37303	0.0002

WARNING: the MA backcasts differ for the original and test equation. Under the null hypothesis, the impact of this difference vanishes asymptotically.

WARNING: some sub-sample estimations did not fully converge using previous estimates for ARMA starting values - OLS values used instead

Note: probabilities calculated using Hansen's (1997) method

## Chow Breakpoint Test

EViews

ARMA(1,2) model: View → Stability Diagnostics → Chow Breakpoint Test...  
Enter in "Breakpoint date" Dialog Box: 1994

Chow Breakpoint Test: 1994

Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 1966 2007

F-statistic	0.024683	Prob. F(4,34)	0.9988
Log likelihood ratio	0.121786	Prob. Chi-Square(4)	0.9982
Wald Statistic	19.99818	Prob. Chi-Square(4)	0.0005

WARNING: the MA backcasts differ for the original and test equation. Under the null hypothesis, the impact of this difference vanishes asymptotically.

## IX. Vector Auto Regression

EViews

Quick → Estimate VAR...

Enter in "Endogenous variables" Dialog Box: usa france argentina sierraleone southkorea

Vector Autoregression Estimates

Date: 11/27/12 Time: 10:48

Sample (adjusted): 1967 2007

Included observations: 41 after adjustments

Standard errors in ( ) & t-statistics in [ ]

	USA	FRANCE	ARGENTINA	SIERRALEONE	SOUTHKOREA
USA(-1)	0.445683 (0.19720) [ 2.26011]	0.421740 (0.15594) [ 2.70451]	-0.132181 (0.50433) [-0.26209]	0.510401 (0.75083) [ 0.67978]	0.188163 (0.50323) [ 0.37391]
USA(-2)	-0.321019 (0.16792) [-1.91172]	-0.144850 (0.13279) [-1.09082]	-0.220926 (0.42946) [-0.51442]	0.025354 (0.63937) [ 0.03965]	-0.145318 (0.42853) [-0.33911]
FRANCE(-1)	-0.136444 (0.22943) [-0.59471]	0.246753 (0.18143) [ 1.36005]	0.195999 (0.58677) [ 0.33403]	-0.310965 (0.87357) [-0.35597]	0.097793 (0.58549) [ 0.16703]
FRANCE(-2)	0.096822 (0.21830) [ 0.44352]	0.417780 (0.17263) [ 2.42007]	-0.564116 (0.55832) [-1.01039]	1.087619 (0.83120) [ 1.30848]	0.185543 (0.55710) [ 0.33305]
ARGENTINA(-1)	-0.009070 (0.06842)	-0.034975 (0.05411)	0.300778 (0.17499)	0.259761 (0.26052)	-0.247388 (0.17461)

		[-0.13257]	[-0.64642]	[ 1.71885]	[ 0.99710]	[-1.41683]
ARGENTINA(-2)	0.019253 (0.06914) [ 0.27847]	0.041614 (0.05467) [ 0.76114]	-0.027854 (0.17682) [-0.15752]	-0.334356 (0.26325) [-1.27012]	0.009921 (0.17644) [ 0.05623]	
SIERRALEONE(-1)	-0.114114 (0.04834) [-2.36050]	-0.026793 (0.03823) [-0.70085]	-0.152181 (0.12364) [-1.23085]	0.496502 (0.18407) [ 2.69736]	0.129251 (0.12337) [ 1.04768]	
SIERRALEONE(-2)	0.059765 (0.05433) [ 1.09999]	0.015345 (0.04296) [ 0.35715]	0.152182 (0.13896) [ 1.09519]	0.056333 (0.20687) [ 0.27231]	-0.040292 (0.13865) [-0.29060]	
SOUTHKOREA(-1)	-0.110374 (0.07868) [-1.40291]	-0.038216 (0.06222) [-0.61426]	0.163674 (0.20121) [ 0.81343]	-0.277792 (0.29956) [-0.92733]	0.073149 (0.20078) [ 0.36433]	
SOUTHKOREA(-2)	0.074330 (0.07257) [ 1.02421]	-0.032135 (0.05739) [-0.55995]	-0.089267 (0.18561) [-0.48094]	-0.141874 (0.27633) [-0.51343]	-0.034155 (0.18520) [-0.18442]	
C	2.043102 (0.76970) [ 2.65440]	0.489213 (0.60867) [ 0.80374]	2.213070 (1.96854) [ 1.12422]	-0.406878 (2.93070) [-0.13883]	5.238556 (1.96424) [ 2.66696]	
R-squared	0.341093	0.451807	0.222110	0.342324	0.151416	
Adj. R-squared	0.121457	0.269076	-0.037186	0.123098	-0.131446	
Sum sq. resids	107.0909	66.96832	700.4746	1552.554	697.4217	
S.E. equation	1.889364	1.494081	4.832096	7.193871	4.821555	
F-statistic	1.552995	2.472523	0.856587	1.561515	0.535300	
Log likelihood	-77.85864	-68.23476	-116.3593	-132.6752	-116.2698	
Akaike AIC	4.334568	3.865110	6.212649	7.008547	6.208281	
Schwarz SC	4.794307	4.324849	6.672387	7.468286	6.668019	
Mean dependent	2.004634	2.183171	1.346341	-0.328293	5.894146	
S.D. dependent	2.015738	1.747583	4.744683	7.682229	4.532839	
Determinant resid covariance (dof adj.)		137815.3				
Determinant resid covariance		28905.77				
Log likelihood		-501.4542				
Akaike information criterion		27.14411				
Schwarz criterion		29.44280				

## Granger Causality/Block Exogeneity Wald Tests

EViews

View → Lag Structure → Granger Causality/Block Exogeneity Tests

VAR Granger Causality/Block Exogeneity Wald Tests

Date: 11/27/12 Time: 10:52

Sample: 1965 2007

Included observations: 41

Dependent variable: USA

Excluded	Chi-sq	df	Prob.
FRANCE	0.395435	2	0.8206
ARGENTINA	0.081845	2	0.9599
SIERRALEONE	5.600826	2	0.0608
SOUTHKOREA	2.755034	2	0.2522
All	9.957324	8	0.2680

Dependent variable: FRANCE

Excluded	Chi-sq	df	Prob.
USA	7.683497	2	0.0215
ARGENTINA	0.802498	2	0.6695
SIERRALEONE	0.491398	2	0.7822
SOUTHKOREA	0.768162	2	0.6811
All	12.67073	8	0.1237

Dependent variable: ARGENTINA

Excluded	Chi-sq	df	Prob.
USA	0.395702	2	0.8205
FRANCE	1.035069	2	0.5960
SIERRALEONE	1.790846	2	0.4084
SOUTHKOREA	0.822344	2	0.6629
All	5.208949	8	0.7350

Dependent variable: SIERRALEONE

Excluded	Chi-sq	df	Prob.
USA	0.489817	2	0.7828
FRANCE	1.769452	2	0.4128
ARGENTINA	2.108945	2	0.3484
SOUTHKOREA	1.232279	2	0.5400
All	3.707074	8	0.8825

Dependent variable: SOUTHKOREA

Excluded	Chi-sq	df	Prob.
USA	0.215715	2	0.8978
FRANCE	0.231551	2	0.8907
ARGENTINA	2.100248	2	0.3499
SIERRALEONE	1.192495	2	0.5509
All	4.457932	8	0.8136

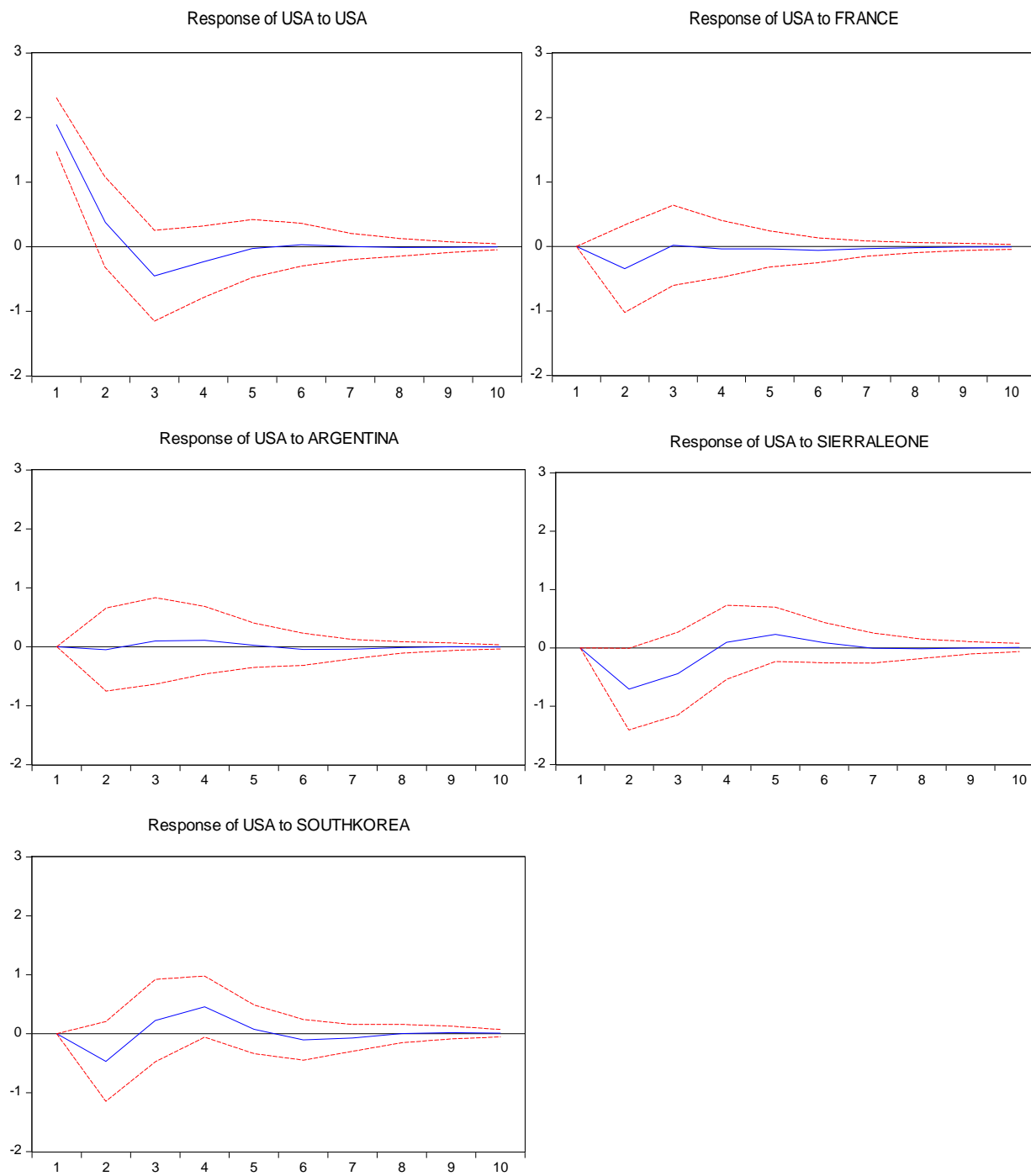
## Impulse Graphs

EViews

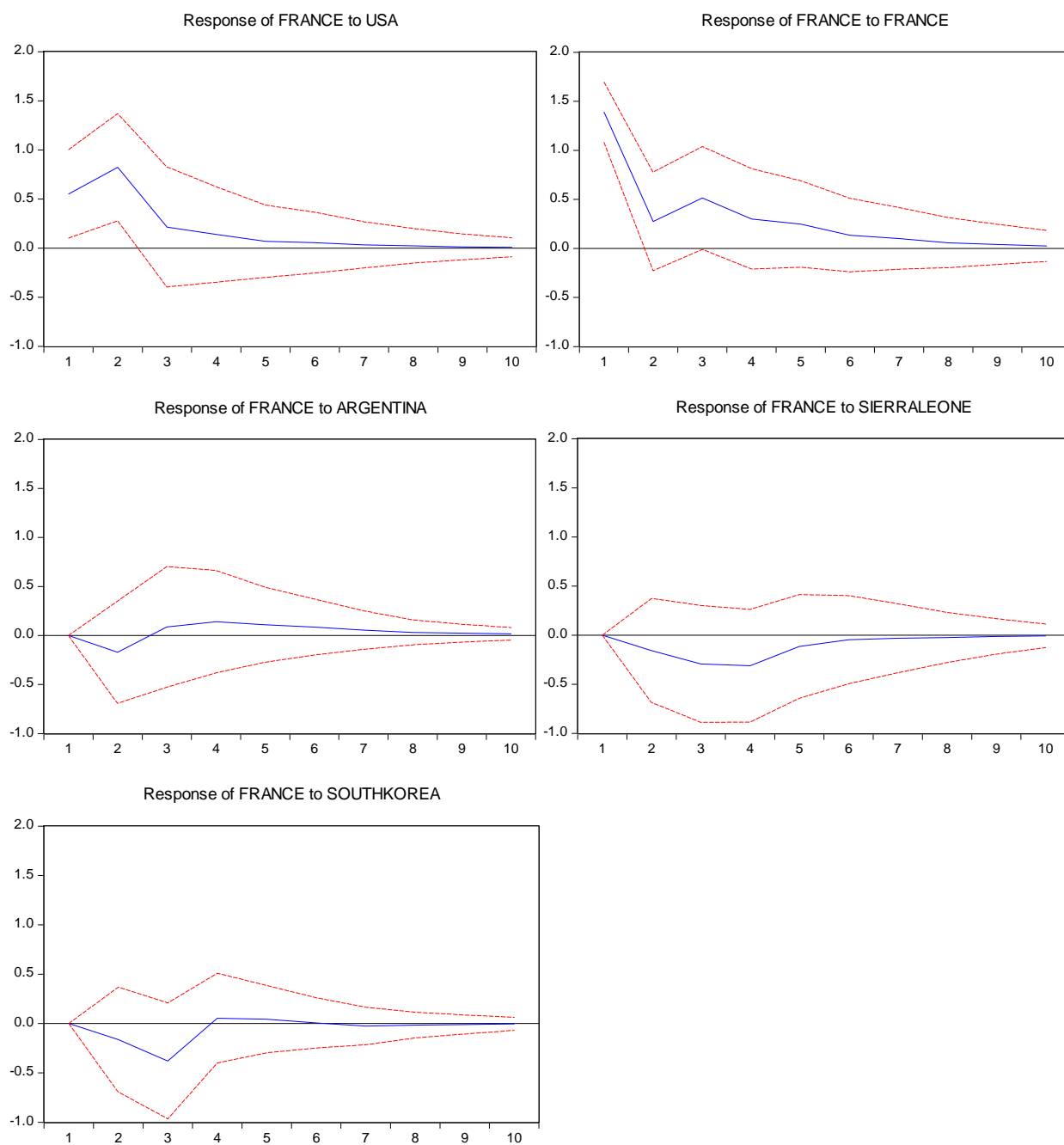
View → Impulse Responses...

Enter in "Impulses" Dialog Box: usa france argentina sierraleone southkorea

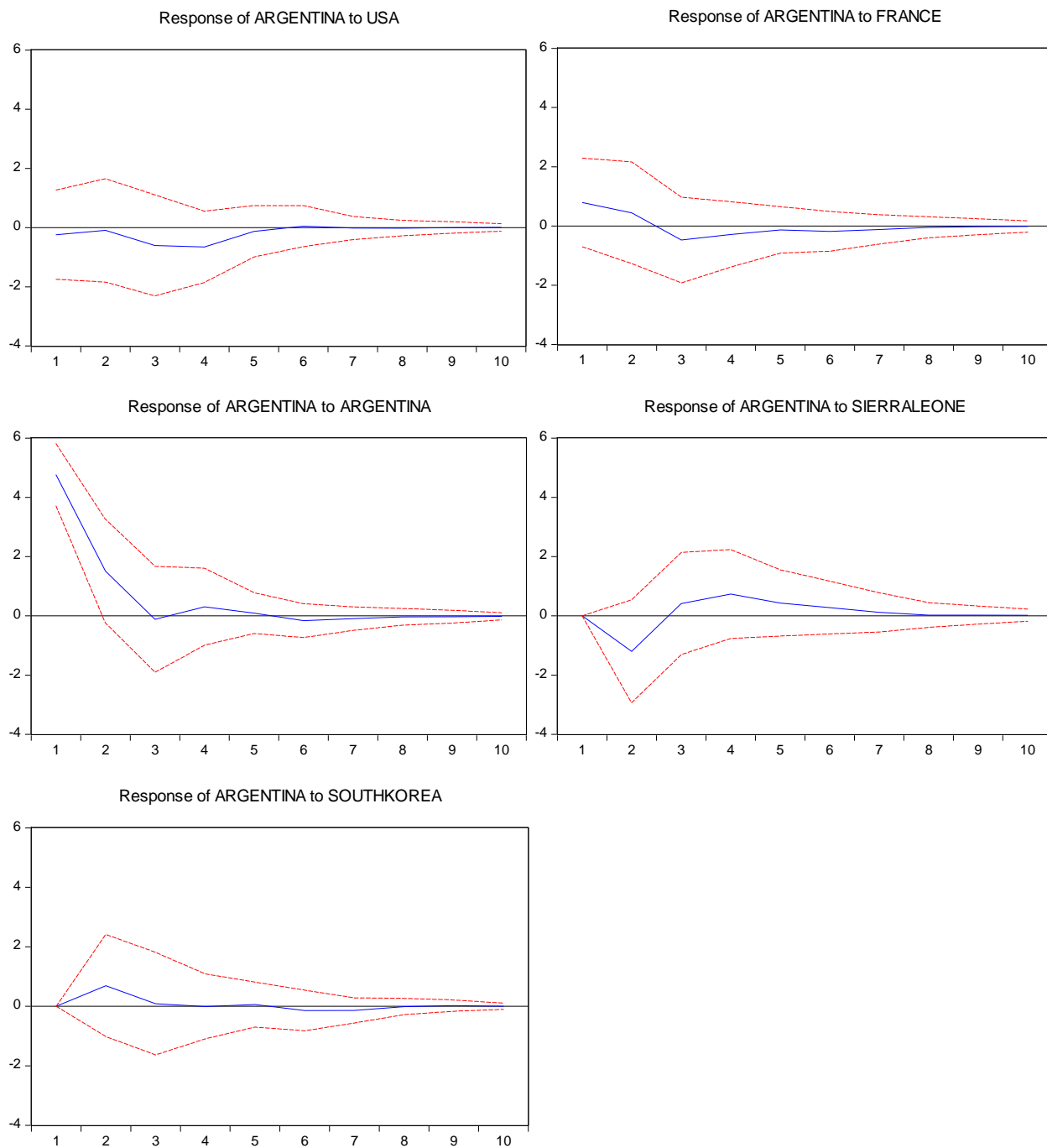
### Response of USA



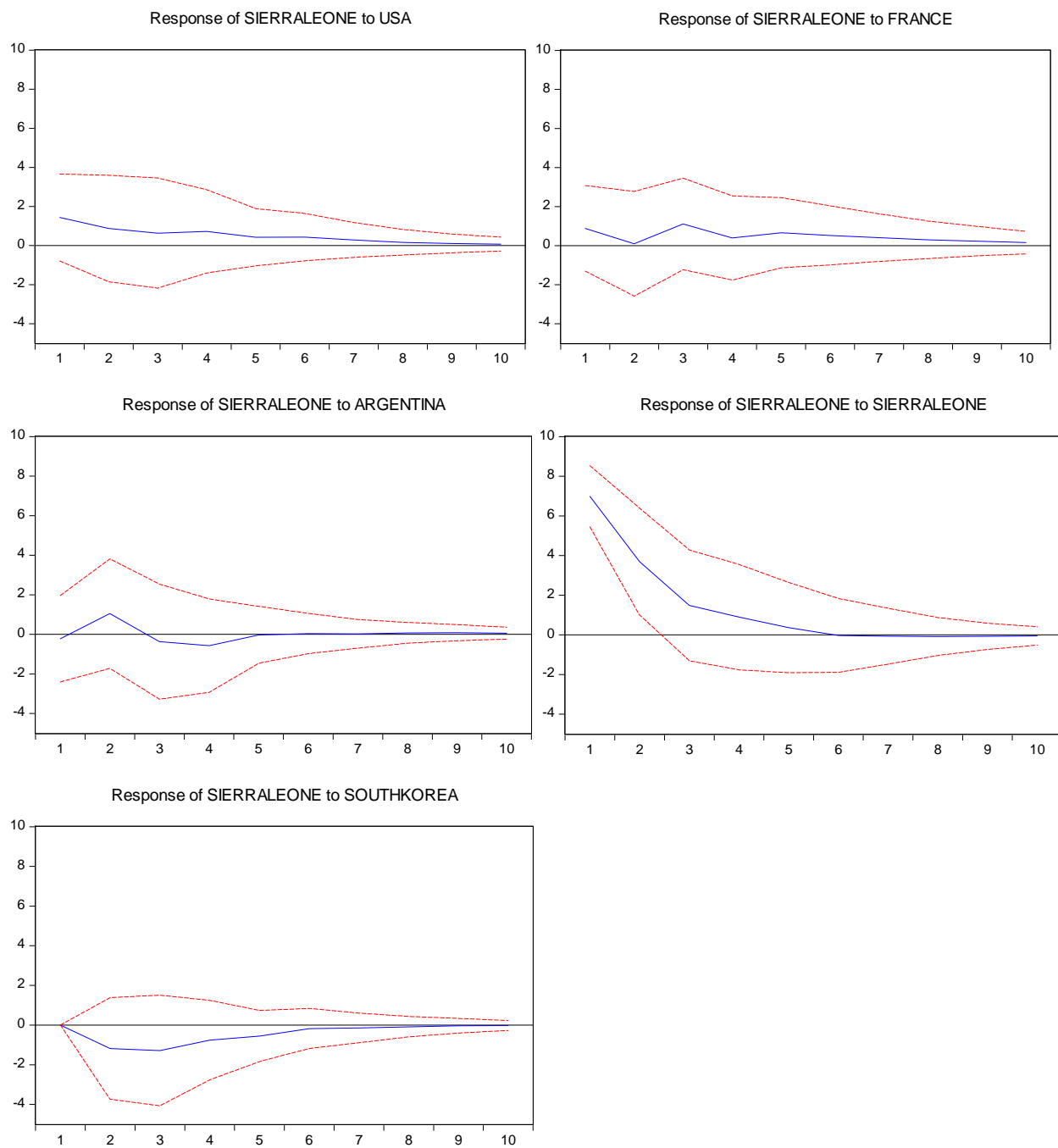
## Response of France



## Response of Argentina



## Response of Sierra Leone





## Response of South Korea

