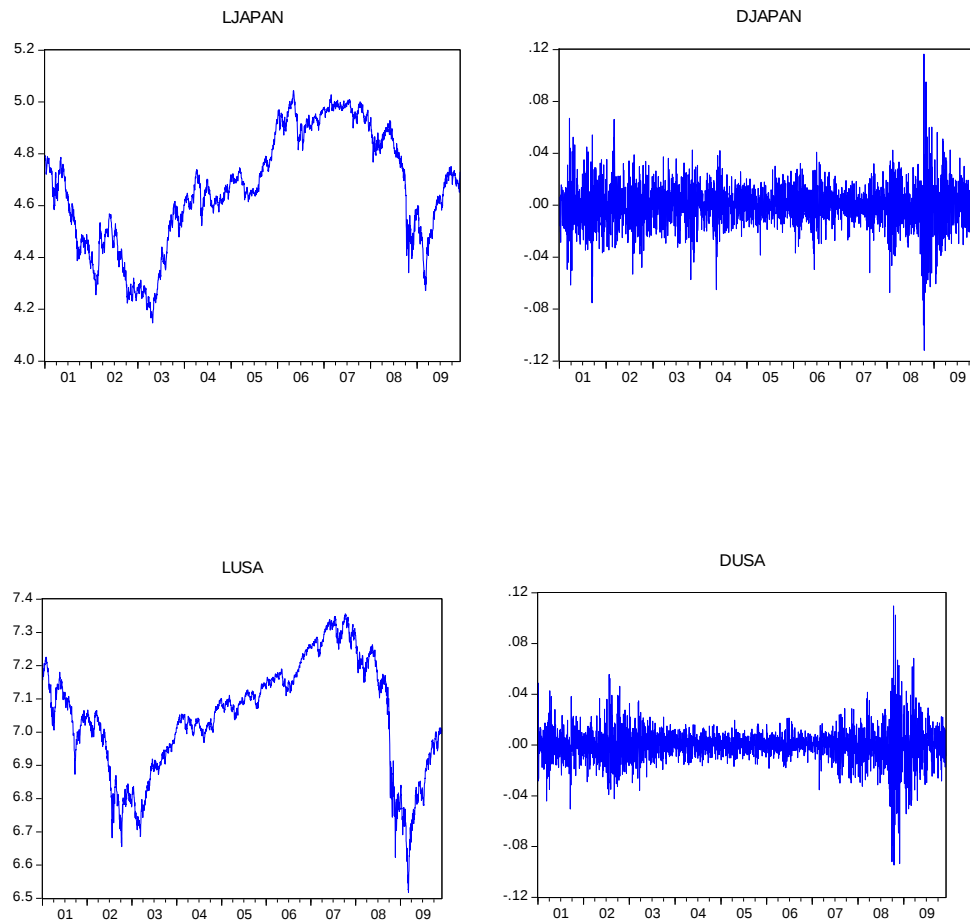


Brief Sketch of Solutions: Tutorial 2

2) graphs



3) unit root tests

Null Hypothesis: LUSA has a unit root

Exogenous: Constant

Lag Length: 2 (Automatic based on SIC, MAXLAG=26)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.713873	0.4241
Test critical values:		
1% level	-3.432965	
5% level	-2.862581	
10% level	-2.567370	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LUSA)

Method: Least Squares

Date: 07/12/11 Time: 09:21

Sample (adjusted): 1/03/2001 12/03/2009

Included observations: 2327 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LUSA(-1)	-0.002881	0.001681	-1.713873	0.0867
D(LUSA(-1))	-0.107790	0.020674	-5.213883	0.0000
D(LUSA(-2))	-0.076238	0.020668	-3.688736	0.0002
C	0.020211	0.011843	1.706606	0.0880
R-squared	0.017499	Mean dependent var	-6.63E-05	
Adjusted R-squared	0.016230	S.D. dependent var	0.013791	
S.E. of regression	0.013679	Akaike info criterion	-5.744243	
Sum squared resid	0.434646	Schwarz criterion	-5.734355	
Log likelihood	6687.426	Hannan-Quinn criter.	-5.740640	
F-statistic	13.79156	Durbin-Watson stat	1.983636	
Prob(F-statistic)	0.000000			

Null Hypothesis: D(LUSA) has a unit root

Exogenous: None

Lag Length: 1 (Automatic based on SIC, MAXLAG=26)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-38.70248	0.0000
Test critical values:		
1% level	-2.565956	
5% level	-1.940960	
10% level	-1.616608	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LUSA,2)

Method: Least Squares

Date: 07/12/11 Time: 09:22

Sample (adjusted): 1/03/2001 12/03/2009

Included observations: 2327 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LUSA(-1))	-1.186700	0.030662	-38.70248	0.0000
D(LUSA(-1),2)	0.077441	0.020659	3.748492	0.0002
R-squared	0.553816	Mean dependent var	8.59E-06	
Adjusted R-squared	0.553624	S.D. dependent var	0.020478	
S.E. of regression	0.013682	Akaike info criterion	-5.744663	
Sum squared resid	0.435211	Schwarz criterion	-5.739719	
Log likelihood	6685.916	Hannan-Quinn criter.	-5.742862	
Durbin-Watson stat	1.983794			

Null Hypothesis: LJAPAN has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 2 (Automatic based on SIC, MAXLAG=26)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.123236	0.5319
Test critical values:		
1% level	-3.961989	
5% level	-3.411739	
10% level	-3.127752	

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

Augmented Dickey-Fuller Test Equation
 Dependent Variable: D(LJAPAN)
 Method: Least Squares
 Date: 07/12/11 Time: 09:23
 Sample (adjusted): 1/03/2001 12/03/2009
 Included observations: 2327 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LJAPAN(-1)	-0.003788	0.001784	-2.123236	0.0338
D(LJAPAN(-1))	-0.089325	0.020719	-4.311233	0.0000
D(LJAPAN(-2))	-0.062482	0.020714	-3.016392	0.0026
C	0.016620	0.008006	2.075905	0.0380
@TREND(12/29/2000)	8.67E-07	5.86E-07	1.479555	0.1391
R-squared	0.013372	Mean dependent var		-2.67E-05
Adjusted R-squared	0.011673	S.D. dependent var		0.016538
S.E. of regression	0.016441	Akaike info criterion		-5.375918
Sum squared resid	0.627660	Schwarz criterion		-5.363558
Log likelihood	6259.881	Hannan-Quinn criter.		-5.371415
F-statistic	7.867862	Durbin-Watson stat		2.001486
Prob(F-statistic)	0.000003			

Null Hypothesis: D(LJAPAN) has a unit root
 Exogenous: None
 Lag Length: 1 (Automatic based on SIC, MAXLAG=26)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-37.85002	0.0000
Test critical values:		
1% level	-2.565956	
5% level	-1.940960	
10% level	-1.616608	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LJAPAN,2)

Method: Least Squares

Date: 07/12/11 Time: 09:27

Sample (adjusted): 1/03/2001 12/03/2009

Included observations: 2327 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LJAPAN(-1))	-1.154893	0.030512	-37.85002	0.0000
D(LJAPAN(-1),2)	0.063874	0.020709	3.084309	0.0021
R-squared	0.544343	Mean dependent var		1.31E-05
Adjusted R-squared	0.544147	S.D. dependent var		0.024360
S.E. of regression	0.016447	Akaike info criterion		-5.376454
Sum squared resid	0.628943	Schwarz criterion		-5.371510
Log likelihood	6257.504	Hannan-Quinn criter.		-5.374652
Durbin-Watson stat	2.001640			

4)

Correlogram dUSA

Date: 07/12/11 Time: 09:31

Sample: 12/29/2000 12/03/2009

Included observations: 2329

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
*	*	1 -0.101	-0.101	23.989	0.000
*	*	2 -0.066	-0.077	34.269	0.000
		3 0.049	0.034	39.765	0.000
		4 -0.020	-0.017	40.707	0.000
		5 -0.023	-0.022	41.988	0.000
		6 -0.009	-0.019	42.196	0.000
		7 -0.022	-0.027	43.285	0.000
		8 0.058	0.053	51.169	0.000
		9 -0.017	-0.008	51.814	0.000
		10 0.018	0.025	52.598	0.000
		11 -0.002	-0.005	52.609	0.000
		12 -0.017	-0.013	53.289	0.000

Dependent Variable: DUSA
Method: Least Squares
Date: 07/12/11 Time: 09:29
Sample (adjusted): 1/03/2001 12/03/2009
Included observations: 2327 after adjustments
Convergence achieved after 3 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AR(1)	-0.109259	0.020659	-5.288614	0.0000
AR(2)	-0.077441	0.020659	-3.748492	0.0002
R-squared	0.016223	Mean dependent var		-6.63E-05
Adjusted R-squared	0.015800	S.D. dependent var		0.013791
S.E. of regression	0.013682	Akaike info criterion		-5.744663
Sum squared resid	0.435211	Schwarz criterion		-5.739719
Log likelihood	6685.916	Hannan-Quinn criter.		-5.742862
Durbin-Watson stat	1.983794			
Inverted AR Roots	-.05-.27i	-.05+.27i		

Residual check

Date: 07/12/11 Time: 09:30
Sample: 1/03/2001 12/03/2009
Included observations: 2327
Q-statistic
probabilities adjusted
for 2 ARMA term(s)

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
		1 0.006	0.006	0.0728	
		2 0.002	0.002	0.0790	
		3 0.029	0.029	1.9817	0.159
		4 -0.024	-0.024	3.3399	0.188
		5 -0.026	-0.025	4.8712	0.181
		6 -0.012	-0.012	5.1831	0.269
		7 -0.019	-0.017	6.0200	0.304
		8 0.056	0.057	13.355	0.038
		9 -0.010	-0.011	13.584	0.059
		10 0.020	0.020	14.552	0.068
		11 -0.000	-0.005	14.552	0.104
		12 -0.012	-0.010	14.888	0.136

Squared residual check

Date: 07/12/11 Time: 09:30
Sample: 1/03/2001 12/03/2009
Included observations: 2327

Q-statistic
probabilities adjusted
for 2 ARMA term(s)

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
*	*	1 0.189	0.189	83.526	
***	***	2 0.392	0.369	441.66	
*	*	3 0.211	0.113	545.38	0.000
**	*	4 0.300	0.150	755.63	0.000
***	**	5 0.359	0.260	1057.0	0.000
**	*	6 0.300	0.138	1267.7	0.000
***	*	7 0.353	0.152	1559.6	0.000
**	*	8 0.270	0.080	1730.3	0.000
**		9 0.302	0.066	1943.0	0.000
**		10 0.267	0.039	2110.1	0.000

Heteroskedasticity Test: ARCH

F-statistic	17.44120	Prob. F(1,2325)	0.0000
Obs*R-squared	17.32623	Prob. Chi-Square(1)	0.0000

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 07/12/11 Time: 09:31

Sample: 1/03/2001 12/03/2009

Included observations: 2327

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000176	1.25E-05	14.13080	0.0000
RESID^2(-1)	0.060923	0.014588	4.176266	0.0000
R-squared	0.007446	Mean dependent var		0.000187
Adjusted R-squared	0.007019	S.D. dependent var		0.000591
S.E. of regression	0.000589	Akaike info criterion		-12.03403
Sum squared resid	0.000808	Schwarz criterion		-12.02908
Log likelihood	14003.59	Hannan-Quinn criter.		-12.03223
F-statistic	17.44120	Durbin-Watson stat		1.772490
Prob(F-statistic)	0.000031			

Correlogram dJapan

Date: 07/12/11 Time: 09:37
Sample: 12/29/2000 12/03/2009
Included observations: 2329

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
*	*	1 -0.085	-0.085	17.033	0.000
		2 -0.056	-0.064	24.358	0.000
		3 -0.012	-0.023	24.709	0.000
		4 0.017	0.011	25.405	0.000
		5 0.029	0.030	27.345	0.000
		6 0.000	0.007	27.345	0.000
		7 -0.007	-0.002	27.449	0.000
		8 0.010	0.010	27.674	0.001
		9 -0.046	-0.047	32.723	0.000
		10 -0.001	-0.010	32.728	0.000

Dependent Variable: DJAPAN
Method: Least Squares
Date: 07/12/11 Time: 09:34
Sample (adjusted): 1/01/2001 12/03/2009
Included observations: 2329 after adjustments
Convergence achieved after 5 iterations
MA Backcast: 12/28/2000 12/29/2000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MA(1)	-0.092585	0.020713	-4.469973	0.0000
MA(2)	-0.055721	0.020713	-2.690169	0.0072
R-squared	0.011551	Mean dependent var		-2.78E-05
Adjusted R-squared	0.011126	S.D. dependent var		0.016531
S.E. of regression	0.016439	Akaike info criterion		-5.377502
Sum squared resid	0.628825	Schwarz criterion		-5.372562
Log likelihood	6264.101	Hannan-Quinn criter.		-5.375702
Durbin-Watson stat	1.998067			
Inverted MA Roots	.29	-.19		

residual check

Date: 07/12/11 Time: 09:35
Sample: 1/01/2001 12/03/2009
Included observations: 2329
Q-statistic
probabilities adjusted
for 2 ARMA term(s)

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
		1	0.000	0.000	0.0002
		2	-0.001	-0.001	0.0014
		3	-0.009	-0.009	0.1942 0.659
		4	0.019	0.019	1.0389 0.595
		5	0.030	0.030	3.1335 0.372
		6	0.003	0.003	3.1615 0.531
		7	-0.007	-0.006	3.2693 0.659
		8	0.005	0.006	3.3385 0.765
		9	-0.045	-0.046	8.0933 0.324
		10	-0.001	-0.003	8.0978 0.424

squared residual check

Date: 07/12/11 Time: 09:35
Sample: 1/01/2001 12/03/2009
Included observations: 2329
Q-statistic
probabilities adjusted
for 2 ARMA term(s)

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
*	*	1	0.134	0.134	41.886
***	***	2	0.399	0.388	413.54
**	*	3	0.235	0.181	542.96 0.000
**	*	4	0.319	0.178	781.21 0.000
*		5	0.156	-0.007	837.83 0.000
**		6	0.243	0.045	975.97 0.000
**	*	7	0.229	0.115	1099.0 0.000
*		8	0.188	0.034	1181.9 0.000
*		9	0.157	-0.013	1239.9 0.000
**	*	10	0.262	0.123	1400.2 0.000

Heteroskedasticity Test: ARCH

F-statistic	42.55847	Prob. F(1,2326)	0.0000
Obs*R-squared	41.82972	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 07/12/11 Time: 09:36

Sample (adjusted): 1/02/2001 12/03/2009
Included observations: 2328 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000234	1.48E-05	15.77810	0.0000
RESID^2(-1)	0.134061	0.020550	6.523686	0.0000
R-squared	0.017968	Mean dependent var		0.000270
Adjusted R-squared	0.017546	S.D. dependent var		0.000669
S.E. of regression	0.000664	Akaike info criterion		-11.79711
Sum squared resid	0.001024	Schwarz criterion		-11.79216
Log likelihood	13733.83	Hannan-Quinn criter.		-11.79531
F-statistic	42.55847	Durbin-Watson stat		2.103783
Prob(F-statistic)	0.000000			

5) and 6) Estimated ARCH and GARCH Models

Dependent Variable: DUSA
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 07/12/11 Time: 09:33
Sample (adjusted): 1/03/2001 12/03/2009
Included observations: 2327 after adjustments
Convergence achieved after 21 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AR(1)	-0.250516	0.010546	-23.75378	0.0000
AR(2)	-0.108498	0.011068	-9.802626	0.0000
Variance Equation				
C	0.000113	2.60E-06	43.49436	0.0000
RESID(-1)^2	0.460919	0.030177	15.27388	0.0000
R-squared	-0.003839	Mean dependent var		-6.63E-05
Adjusted R-squared	-0.005136	S.D. dependent var		0.013791
S.E. of regression	0.013826	Akaike info criterion		-5.889800
Sum squared resid	0.444086	Schwarz criterion		-5.879912
Log likelihood	6856.783	Hannan-Quinn criter.		-5.886197
Durbin-Watson stat	1.702075			
Inverted AR Roots	-.13+.30i	-.13-.30i		

Dependent Variable: DUSA
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 07/12/11 Time: 09:33
Sample (adjusted): 1/03/2001 12/03/2009
Included observations: 2327 after adjustments
Convergence achieved after 15 iterations

Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AR(1)	-0.078021	0.023798	-3.278396	0.0010
AR(2)	-0.039815	0.021548	-1.847737	0.0646
Variance Equation				
C	1.01E-06	1.70E-07	5.937241	0.0000
RESID(-1)^2	0.068783	0.007511	9.157151	0.0000
GARCH(-1)	0.923804	0.007670	120.4508	0.0000
R-squared	0.014066	Mean dependent var		-6.63E-05
Adjusted R-squared	0.012368	S.D. dependent var		0.013791
S.E. of regression	0.013705	Akaike info criterion		-6.276432
Sum squared resid	0.436165	Schwarz criterion		-6.264072
Log likelihood	7307.629	Hannan-Quinn criter.		-6.271929
Durbin-Watson stat	2.046779			
Inverted AR Roots	-.04+.20i	-.04-.20i		

Dependent Variable: DJAPAN
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 07/12/11 Time: 09:34
Sample (adjusted): 1/01/2001 12/03/2009
Included observations: 2329 after adjustments
Convergence achieved after 18 iterations
MA Backcast: 12/28/2000 12/29/2000
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2

Variable	Coefficient	Std. Error	z-Statistic	Prob.
MA(1)	-0.177031	0.015503	-11.41916	0.0000
MA(2)	-0.024248	0.014504	-1.671755	0.0946
Variance Equation				
C	0.000213	5.92E-06	35.91945	0.0000
RESID(-1)^2	0.222687	0.020124	11.06550	0.0000
R-squared	0.004180	Mean dependent var		-2.78E-05
Adjusted R-squared	0.002895	S.D. dependent var		0.016531
S.E. of regression	0.016507	Akaike info criterion		-5.423527
Sum squared resid	0.633514	Schwarz criterion		-5.413646
Log likelihood	6319.697	Hannan-Quinn criter.		-5.419927
Durbin-Watson stat	1.833313			
Inverted MA Roots	.27	-.09		

Dependent Variable: DJAPAN
 Method: ML - ARCH (Marquardt) - Normal distribution
 Date: 07/12/11 Time: 09:34
 Sample (adjusted): 1/01/2001 12/03/2009
 Included observations: 2329 after adjustments
 Convergence achieved after 9 iterations
 MA Backcast: 12/28/2000 12/29/2000
 Presample variance: backcast (parameter = 0.7)
 GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
MA(1)	-0.087007	0.023921	-3.637236	0.0003
MA(2)	-0.017207	0.020603	-0.835179	0.4036
Variance Equation				
C	4.33E-06	1.03E-06	4.223317	0.0000
RESID(-1)^2	0.088672	0.009109	9.734272	0.0000
GARCH(-1)	0.896568	0.010355	86.58149	0.0000
R-squared	0.009937	Mean dependent var	-2.78E-05	
Adjusted R-squared	0.008233	S.D. dependent var	0.016531	
S.E. of regression	0.016463	Akaike info criterion	-5.604880	
Sum squared resid	0.629852	Schwarz criterion	-5.592529	
Log likelihood	6531.883	Hannan-Quinn criter.	-5.600380	
Durbin-Watson stat	2.008033			
Inverted MA Roots	.18	-.09		