Masters in Finance

FINANCIAL ECONOMETRICS

Spring 2011

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Exam

The points allocated suggest the time that you should spend on a question. You have 120 minutes to complete the exam and 100 total points on the exam.

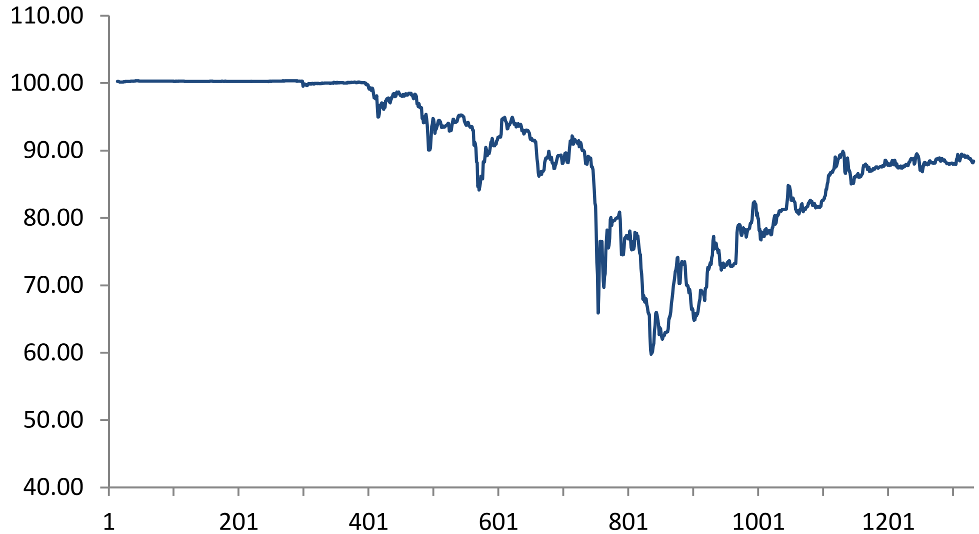
Your grade on all questions will be based solely on your explanation.

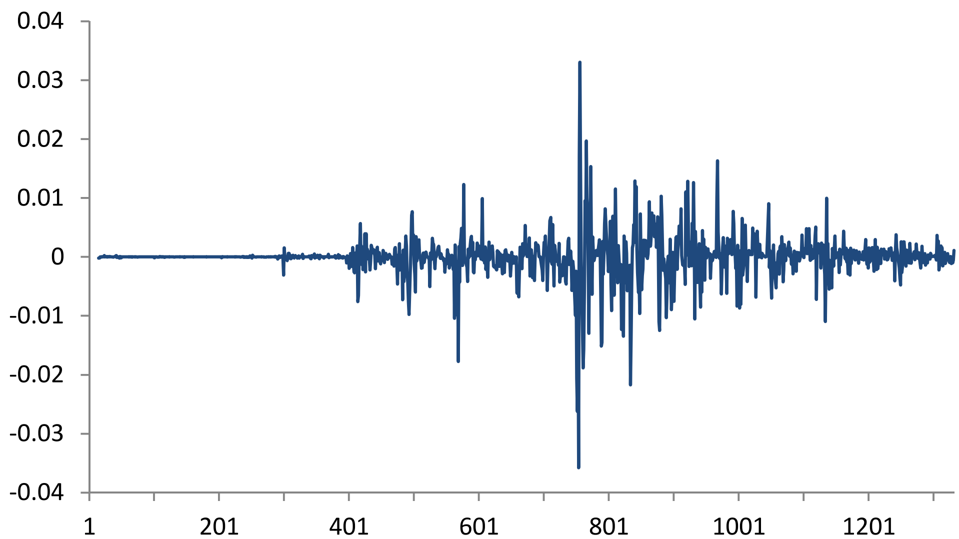
Answer any two questions from questions 1 through 4; I will grade the first two questions you answer if you answer more than two of these questions.

Questions 5 through 8 will be graded on all exams.

1. (15 points) A colleague has collected some data on a time series of daily data -- ABC — and wants to forecast future values. Your colleague shows you the graphs below from Excel – the level and changes in the logarithm of the series. He asks you to tell him a good way to use past values of the series to forecast future values of this ABC series.
   a. Should he just ignore the first 400 observations which seem quite different than everything else? Why or why not? Do you know a statistical method to decide whether or not to include these observations?
   b. Outline the statistical procedures he should use based on your knowledge of univariate time series analysis, and briefly state what he can learn from these procedures.

Graphs for ABC series for question 1.





2. (15 points) You are given a data series that rises over time and asked to determine whether or not the series has a unit root.
   a. What is a unit root? What is the augmented Dickey-Fuller test?
   b. You put the data in EViews. Based on the output below, does XYZ have a unit root? Why or why not?

Null Hypothesis: XYZ has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic based on SIC, MAXLAG=15)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.959176	0.6202
Test critical values:	1% level	-3.994598	
	5% level	-3.427616	
	10% level	-3.137141	

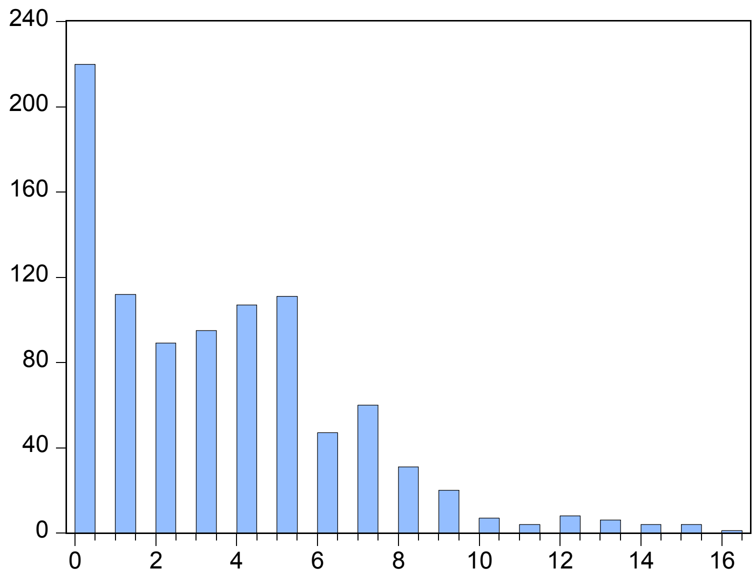
*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(XYZ)
Method: Least Squares
Date: 03/21/11 Time: 13:30
Sample (adjusted): 1 256
Included observations: 254 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
XYZ(-1)	-0.024107	0.012305	-1.959176	0.0512
D(XYZ(-1))	0.372142	0.059276	6.278165	0.0000
C	0.188507	0.092724	2.032997	0.0431
@TREND	0.000184	0.000101	1.821860	0.0697

R-squared	0.157902	Mean dependent var	0.007962
Adjusted R-squared	0.147797	S.D. dependent var	0.009909
S.E. of regression	0.009147	Akaike info criterion	-6.535122
Sum squared resid	0.020918	Schwarz criterion	-6.479415
Log likelihood	833.9604	Hannan-Quinn criter.	-6.512712
F-statistic	15.62585	Durbin-Watson stat	2.084881
Prob(F-statistic)	0.000000		

3. (15 points) A colleague shows you the summary statistics below on a time series she has collected.
She tells you that all of the observations on this series are exact integers from 0 to 16 with the frequency in the figure. She wants to know whether a univariate time-series model for these data which assumes a normal distribution for the innovations would be “applicable” (or “valid” or “useful”). Would it be? Why or why not?



Series: INT
Sample 1 927
Observations 926

Mean	3.356371
Median	3.000000
Maximum	16.00000
Minimum	0.000000
Std. Dev.	3.102640
Skewness	1.033103
Kurtosis	4.138185
Jarque-Bera	214.7037
Probability	0.000000

4. (15 points) Consider the output below for an augmented Dickey-Fuller test whether the series "ser02" has two unit roots.
   a. What does "two unit roots" mean? (in algebra or English). You probably will find it helpful to define "one unit root" first.
   b. Does ser02 have two unit roots? Why or why not. (Note: "D(SER02,2)" is the second difference of Ser02 and "D(SER02(-1),2)" is the first lag of the second difference of ser02.

Null Hypothesis: D(SER02,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.492547	0.8318
Test critical values:	1% level	-3.968012	
	5% level	-3.414685	
	10% level	-3.129498	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SER02,3)
Method: Least Squares
Date: 03/21/11 Time: 14:24
Sample (adjusted): 4 927
Included observations: 924 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SER02(-1),2)	-0.006628	0.004441	-1.492547	0.1359
C	0.000308	0.000259	1.192154	0.2335
@TREND(1)	-1.33E-07	5.24E-07	-0.254438	0.7992

R-squared	0.003546	Mean dependent var	-5.30E-06
Adjusted R-squared	0.001382	S.D. dependent var	0.003808
S.E. of regression	0.003806	Akaike info criterion	-8.301448
Sum squared resid	0.013338	Schwarz criterion	-8.285771
Log likelihood	3838.269	Hannan-Quinn criter.	-8.295467
F-statistic	1.638659	Durbin-Watson stat	1.323426
Prob(F-statistic)	0.194806		

5. (30 points) You collect some data and generate the statistics below for a time series – lser1 – using Eviews.
   a. This information is sufficient to suggest at least one univariate time series model that could be estimated. Suggest one or more such model. Ignore possible ARCH or GARCH aspects of the data. Your grade will be based on your explanation of why the model is plausible.
   b. How would you examine the data and test for ARCH or GARCH?

Serial correlation of level of series

Sample: 1 1069
Included observations: 1033

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
|*******	|*******	1	0.956	0.956	946.80	0.000
|*******	|*** |	2	0.950	0.414	1881.9	0.000
|*******	|** |	3	0.946	0.255	2810.7	0.000
|*******	|* |	4	0.943	0.170	3733.9	0.000
|*******	|* |	5	0.943	0.169	4658.3	0.000
		0.93				
|*******	6	5	0.024	5568.6	0.000	
		0.04				
|*******	.932	0	6473.6	0.000		
		-				
		0.00				
|*******	26	3	7368.8	0.000		
		0.00				
|*******		7	8257.4	0.000		
		913				
|*******	|-0.001	8.9	0.000			
		100				
|*******	| .003	12.	0.000			
		108				
|*******	| 2	84.	0.000			
		117				
|*******	|	40.	0.000			

Serial correlations for additional lags look similar.

Serial correlation of first difference of series

Sample: 1 1069
Included observations: 996

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
*| |	*| |	1	-0.097	-0.097	9.4631	0.002
*| |	*| |	2	-0.079	-0.089	15.662	0.000
| |	3	2	0.000			
| |	.00.000					
		21.0				
| |	0.009	74	0.001			
| |	| |	6	-0.025	-0.033	21.687	0.001
| |	| |	7	-0.006	-0.007	21.722	0.003

| |	| |	8	0.045	0.038	23.747	0.003
| |	| |	9	-0.025	-0.015	24.397	0.004
| |	| |	10	0.007	0.009	24.451	0.006
| |	| |	11	0.049	0.044	26.922	0.005
| |	| |	12	0.005	0.020	26.947	0.008
| |	| |	13	-0.008	-0.001	27.008	0.012

Serial correlations for additional lags look similar.

Unit root test

Null Hypothesis: LSER1 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=21)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.613606	0.4752
Test critical values:	1% level	-3.436696	
	5% level	-2.864230	
	10% level	-2.568255	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LSER1)
Method: Least Squares
Date: 03/21/11 Time: 19:17
Sample (adjusted): 2 1069
Included observations: 996 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LSER1(-1)	-0.005080	0.003148	-1.613606	0.1069
C	-0.000353	0.000627	-0.562454	0.5739

R-squared	0.002613	Mean dependent var	0.000109
Adjusted R-squared	0.001609	S.D. dependent var	0.017616
S.E. of regression	0.017601	Akaike info criterion	-5.239665
Sum squared resid	0.307952	Schwarz criterion	-5.229818
Log likelihood	2611.353	Hannan-Quinn criter.	-5.235921
F-statistic	2.603724	Durbin-Watson stat	2.191499
Prob(F-statistic)	0.106930		

6. (20 points) You run a cointegration test on two series that you think might be cointegrated. The results are below. Are they cointegrated or not? Why or why not?

Sample (adjusted): 7 927
Included observations: 732 after adjustments
Trend assumption: No deterministic trend (restricted constant)
Series: SER1 SER2
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.007047	6.403287	20.26184	0.9312
At most 1	0.001674	1.226690	9.164546	0.9193

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.007047	5.176597	15.89210	0.8725
At most 1	0.001674	1.226690	9.164546	0.9193

**MacKinnon-Haug-Michelis (1999) p-values

7. (10 points) True, false or uncertain. “If two series are cointegrated, then the series don’t have a unit root.”

8. (10 points) It often is said that interest rates cannot have a unit root because interest rates cannot be negative.
   If there were a unit root in an interest rate, would negative values be possible, at least with big enough innovations? Why or why not?