Masters in Finance

FINANCIAL ECONOMETRICS

Spring 2010

Gerald P. Dwyer

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.

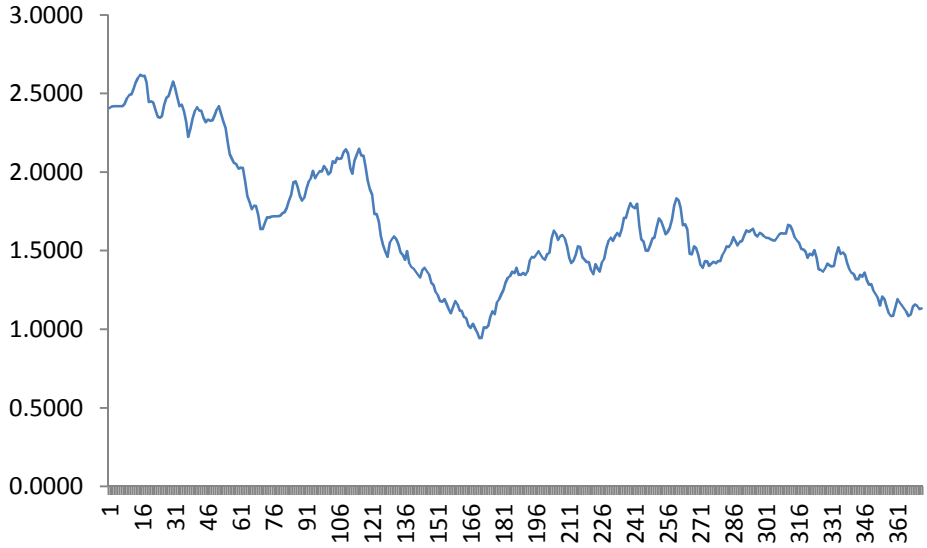
Your grade on all questions will be based solely on your explanation.

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.

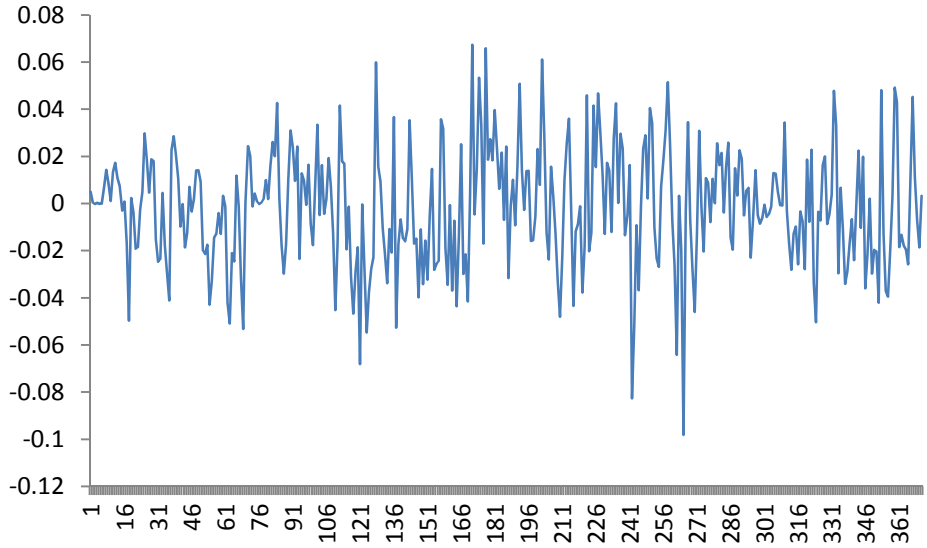
Questions 5 through 8 will be graded on all exams.

1. (15 points) The graphs below show the level and changes in the logarithms of a time series. You are asked to forecast the next twelve values using a statistical analysis of these data. Outline how you would analyze the series to obtain informative forecasts of the series. Include brief statements of what you can learn from each piece of the analysis.

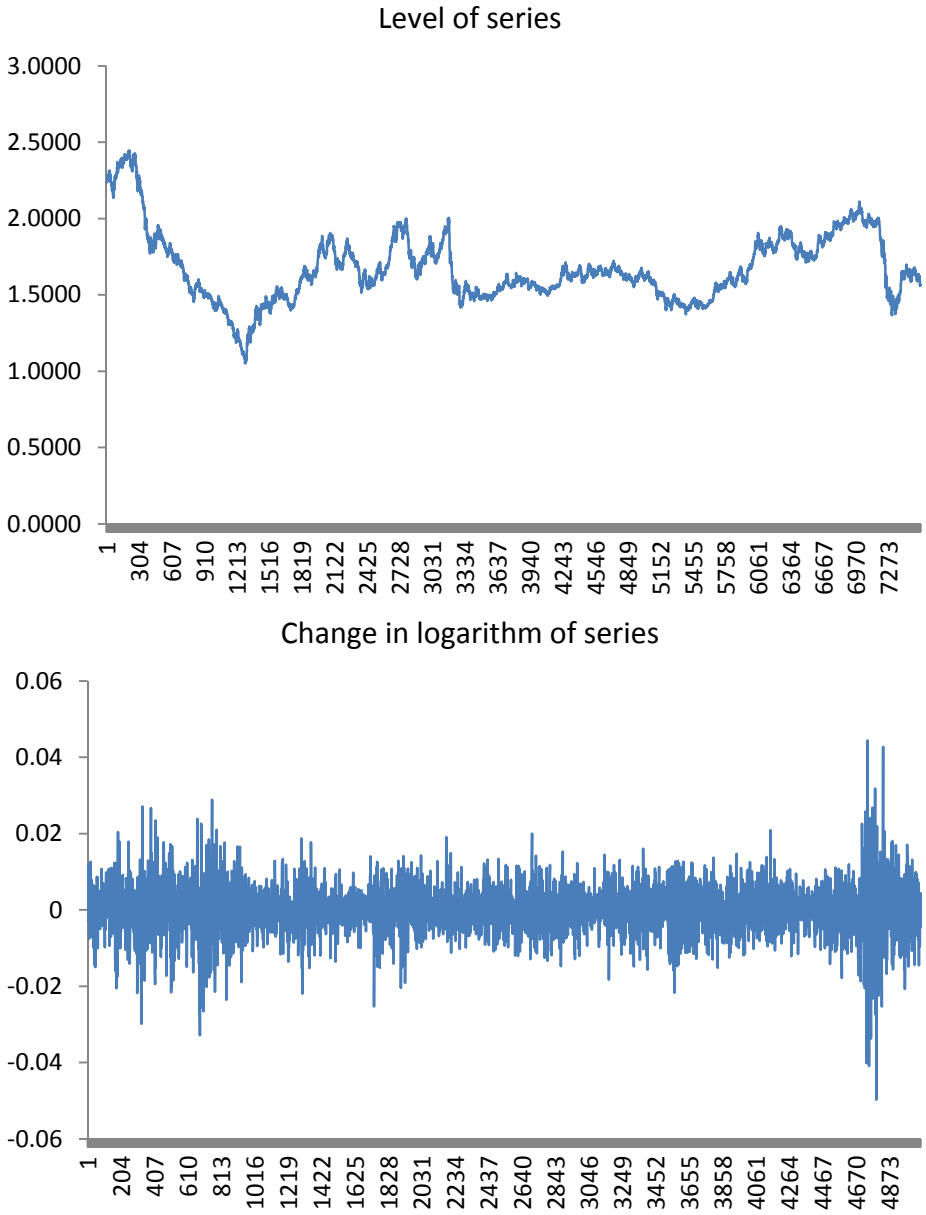
Level of series



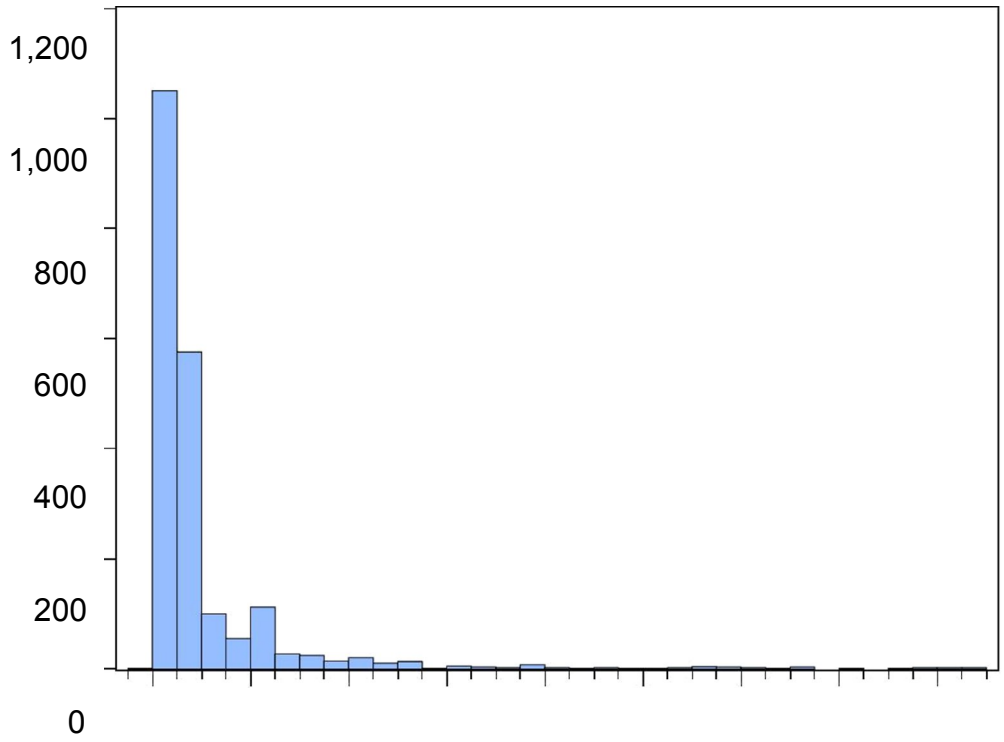
Change in logarithm of series



2. (15 points) A colleague shows you the following series and tells you that it looks like a random walk: a series with serially uncorrelated changes and a constant variance. Does it look that way to you? Very briefly, why or why not? Less briefly, how would you examine whether or not the series is a random walk using statistical analysis?



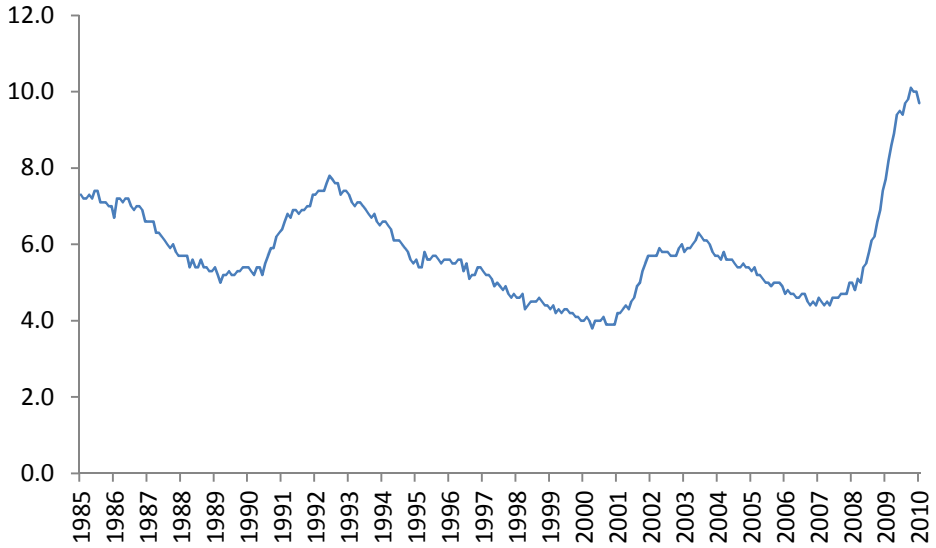
3. (15 points) You are analyzing a time series “X”, which has the following histogram of values and sample statistics. Explain the implications of the graph and sample statistics for the distribution of X including, but not limited to, whether X has a normal distribution.



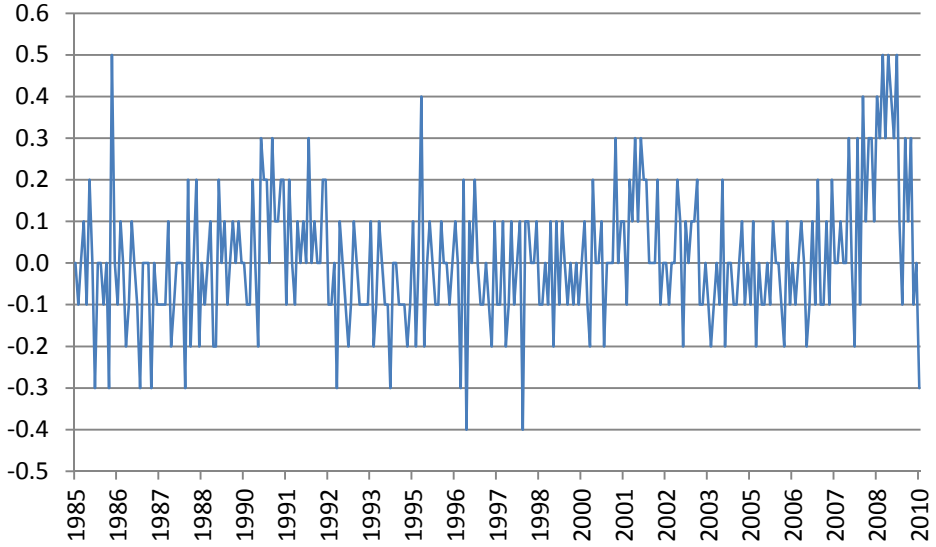
Series: X
Sample 1 2108
Observations 2049
Mean 20.60
Median 9.70
Maximum 337.75
Minimum -2.150
Std. Dev. 35.19
Skewness 5.09
Kurtosis 34.78
Jarque-Bera 95047.62
Probability 0.000000

4. (15 points) The graphs below show the level of the unemployment rate in the U.S. and changes in its level. In the U.S., the unemployment rate is measured to tenths of a percent, e.g., 9.5 percent and never 9.52 percent. This implies that changes in the unemployment rate always are one or more tenths of a percent. It is common to estimate linear autoregressions for changes in the series. Given that unemployment is measured to the nearest tenth of a percent and has the changes below, is there a problem with estimating an autoregression for changes in the unemployment rate and assuming that coefficient estimates have a normal or t-distribution?

Unemployment rate



Change in unemployment rate



5. (20 points) A test for a unit root in the series "XXXXXX" produces the statistical results below in EViews. Are these results consistent with XXXXXX having a unit root? Why or why not? Briefly explain the role of the autoregression in producing the test results, especially why there are levels and changes in XXXXXX on the right-hand size of the regression estimated.

Null Hypothesis: XXXXXX has a unit root
Exogenous: Constant
Lag Length: 5 (Automatic based on SIC, MAXLAG=19)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.167105	0.0008
Test critical values:	1% level	-3.438972	
	5% level	-2.865235	
	10% level	-2.568793	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(XXXXXX)
Method: Least Squares
Date: 02/24/10 Time: 10:19
Sample (adjusted): 1948M07 2010M01
Included observations: 739 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
XXXXXX(-1)	-0.020389	0.004893	-4.167105	0.0000
D(XXXXXX(-1))	0.006305	0.036447	0.173004	0.8627
D(XXXXXX(-2))	0.248498	0.036179	6.868498	0.0000
D(XXXXXX(-3))	0.176544	0.036920	4.781769	0.0000
D(XXXXXX(-4))	0.096828	0.036635	2.643030	0.0084
D(XXXXXX(-5))	0.114118	0.036630	3.115399	0.0019
C	0.118510	0.028559	4.149639	0.0000

R-squared	0.166360	Mean dependent var	0.008254
Adjusted R-squared	0.159527	S.D. dependent var	0.215961
S.E. of regression	0.197987	Akaike info criterion	-0.391803
Sum squared resid	28.69358	Schwarz criterion	-0.348180
Log likelihood	151.7712	Hannan-Quinn criter.	-0.374983
F-statistic	24.34622	Durbin-Watson stat	1.997260
Prob(F-statistic)	0.000000		

6. (30 points) A colleague tries various estimation options in Eviews and brings you the following sets of results for the series DLYYYYYY and asks for help concerning whether the autoregression, the autoregression with GARCH or autoregression with IGARCH is a better model. Assume that one lag of DLYYYYYY (the variable DLYYYYYY(-1)) is the only lag that is statistically significant in the autoregression.

   Is the autoregression, the autoregression with GARCH or the autoregression with IGARCH a better model?

   a. Provide as much of an answer as you can given the statistics provided.
   b. If you would like to see additional statistical results before drawing a firmer conclusion, explain what you need and why in enough detail that your colleague, who foolishly did not take this course, can provide you with the necessary statistics.

Least Squares autoregression
Dependent Variable: DLYYYYYY
Method: Least Squares
Date: 02/24/10 Time: 10:26
Sample (adjusted): 1971M03 2001M12
Included observations: 370 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001383	0.001223	-1.131569	0.2586
DLYYYYYY(-1)	0.326499	0.049269	6.626839	0.0000

R-squared	0.106612	Mean dependent var	-0.002052
Adjusted R-squared	0.104184	S.D. dependent var	0.024763
S.E. of regression	0.023438	Akaike info criterion	-4.663551
Sum squared resid	0.202152	Schwarz criterion	-4.642397
Log likelihood	864.7569	Hannan-Quinn criter.	-4.655148
F-statistic	43.91500	Durbin-Watson stat	1.956258
Prob(F-statistic)	0.000000		

Autoregression with GARCH
Dependent Variable: DLYYYYYY
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 02/24/10 Time: 10:28
Sample (adjusted): 1971M03 2001M12
Included observations: 370 after adjustments
Convergence achieved after 41 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.
C	-0.000838	0.001166	-0.718745	0.4723
DLYYYYYY(-1)	0.351602	0.052024	6.758462	0.0000
Variance Equation				
C	1.18E-05	2.91E-06	4.039039	0.0001
RESID(-1)^2	0.009355	0.012908	0.724716	0.4686
GARCH(-1)	0.971956	0.015197	63.95666	0.0000

R-squared	0.105583	Mean dependent var	-0.002052
Adjusted R-squared	0.103152	S.D. dependent var	0.024763
S.E. of regression	0.023451	Akaike info criterion	-4.720513
Sum squared resid	0.202385	Schwarz criterion	-4.667628
Log likelihood	878.2949	Hannan-Quinn criter.	-4.699507
F-statistic	10.86025	Durbin-Watson stat	2.001729
Prob(F-statistic)	0.000000		

Autoregression with IGARCH

Dependent Variable: DLYYYYYY
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 02/24/10 Time: 10:29
Sample (adjusted): 1971M03 2001M12
Included observations: 370 after adjustments
Convergence achieved after 14 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3)*RESID(-1)^2 + (1 - C(3))*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.003035	0.000485	-6.260960	0.0000
DLYYYYYY(-1)	0.331737	0.044957	7.378971	0.0000
Variance Equation				
RESID(-1)^2	0.082246	0.011827	6.954060	0.0000
GARCH(-1)	0.917754	0.011827	77.59767	0.0000

R-squared	0.102065	Mean dependent var	-0.002052
Adjusted R-squared	0.099625	S.D. dependent var	0.024763
S.E. of regression	0.023497	Akaike info criterion	-4.636493
Sum squared resid	0.203181	Schwarz criterion	-4.604762
Log likelihood	860.7512	Hannan-Quinn criter.	-4.623889
F-statistic	20.91462	Durbin-Watson stat	1.956114
Prob(F-statistic)	0.000000		

7. (10 points) “Factor models of returns are based on historical data and therefore have no value for portfolio allocation, which is forward looking.”
   True, false or uncertain. Your grade will be based on your explanation.

8. (10 points) “A vector autoregression can summarize the dynamic relationship between variables.”
   True, false or uncertain. Your grade will be based on your explanation.