Texas Tech University

Department of Economics

Spring 2018

Eco 4306: Economic and Business Forecasting

Midterm 1

Name:

ID:

Short questions (45 points)

Q1. 7.5 points
Q2. 7.5 points
Q3. 7.5 points
Q4. 7.5 points
Q5. 7.5 points
Q6. 7.5 points

Applied problems (60 points)

Q7. 10 points
Q8. 10 points
Q9. 10 points
Q10. 10 points
Q11. 10 points
Q12. 10 points

Good luck!

Question 1 (7.5 points)

Explain the concepts of point forecast, interval forecast, density forecast.

See slides 27 and 28 in lec01_02slides.pdf.

Question 2 (7.5 points)

Explain what loss function is.

See slides 19 to 23 in lec06slides.pdf.

Question 3 (7.5 points)

Give two examples of loss function, one symmetric, one asymmetric. Draw their graphs.

See slides 24 an 25 in lec06slides.pdf.

Question 4 (7.5 points)

Consider Fed forecasting inflation. Is it likely to have (1) a symmetric loss function, or (2) an asymmetric loss function with larger losses for negative forecast errors, or (3) an asymmetric loss function with larger losses for positive forecast errors? Explain.

See HW3 part (g) hw03sol.pdf.

Question 5 (7.5 points)

Define an AR(1) model (write its equation) and describe how its AC and PAC functions look like.

See slides 6 and 9 in lec09slides.pdf.

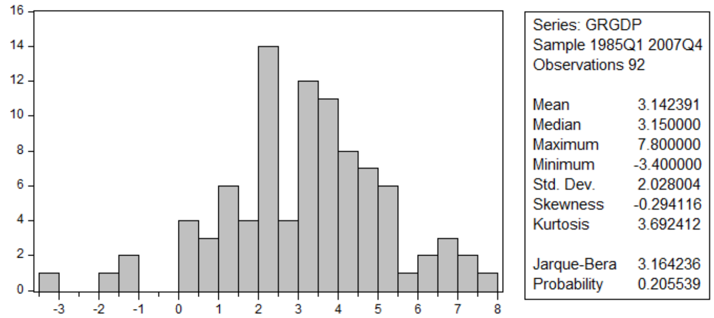
Question 6 (7.5 points)

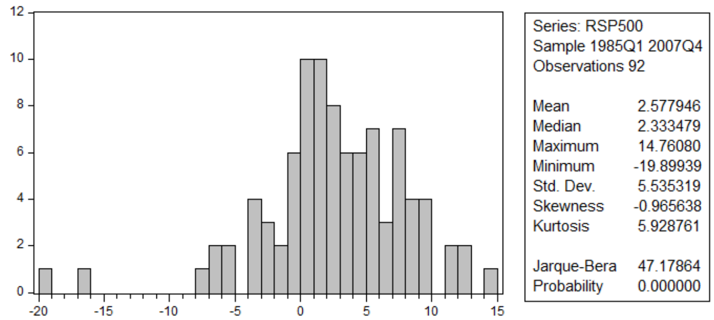
Define an MA(2) model (write its equation) and describe how its AC and PAC functions look like.

See slides 24 and 26 in lec07slides.pdf.

Question 7 (10 points)

Figure below shows the histograms for the real GDP growth rate and the quarterly return for S&P500 Index during the period 1985Q1-2007Q4. Is the GDP growth rate normally distributed in this sample? How about the returns for S&P500 Index?

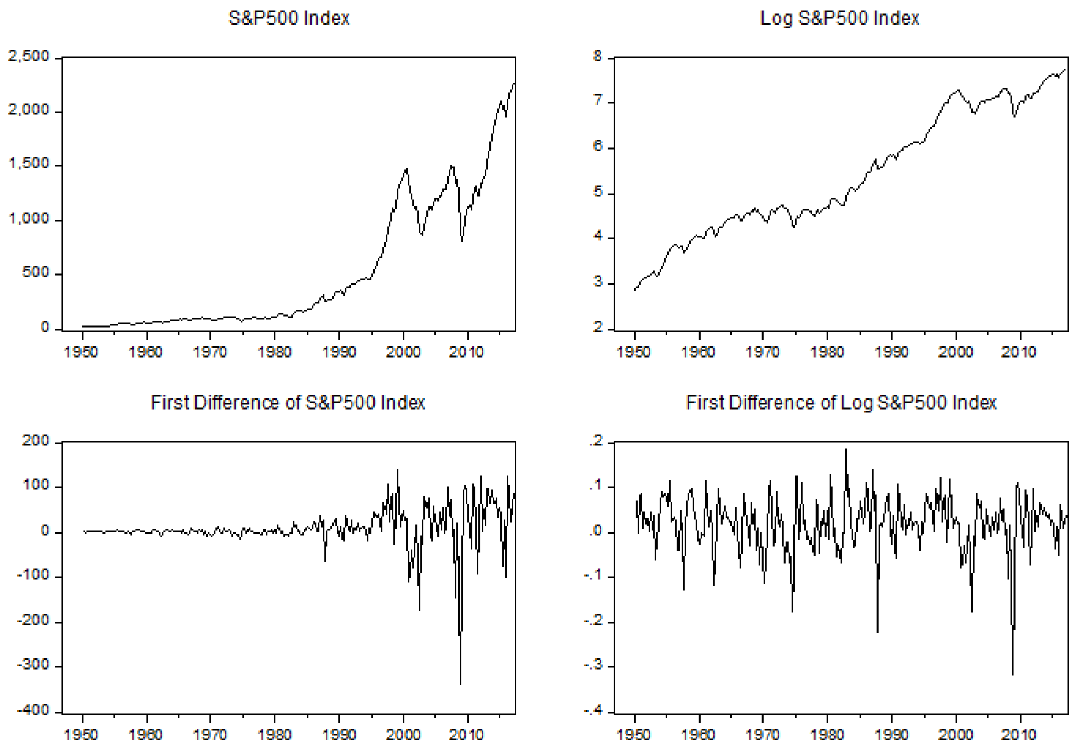




- GDP: p-value for Jarque-Bera statistic is 0.20, since it is larger than 0.1 we can not reject hypothesis that this time series is normally distributed
- SP500: p-value for Jarque-Bera statistic is 0.00, so we can strongly reject hypothesis that this time series is normally distributed - this is mainly because of kurtosis much larger than 3 (fat tails)

Question 8 (10 points)

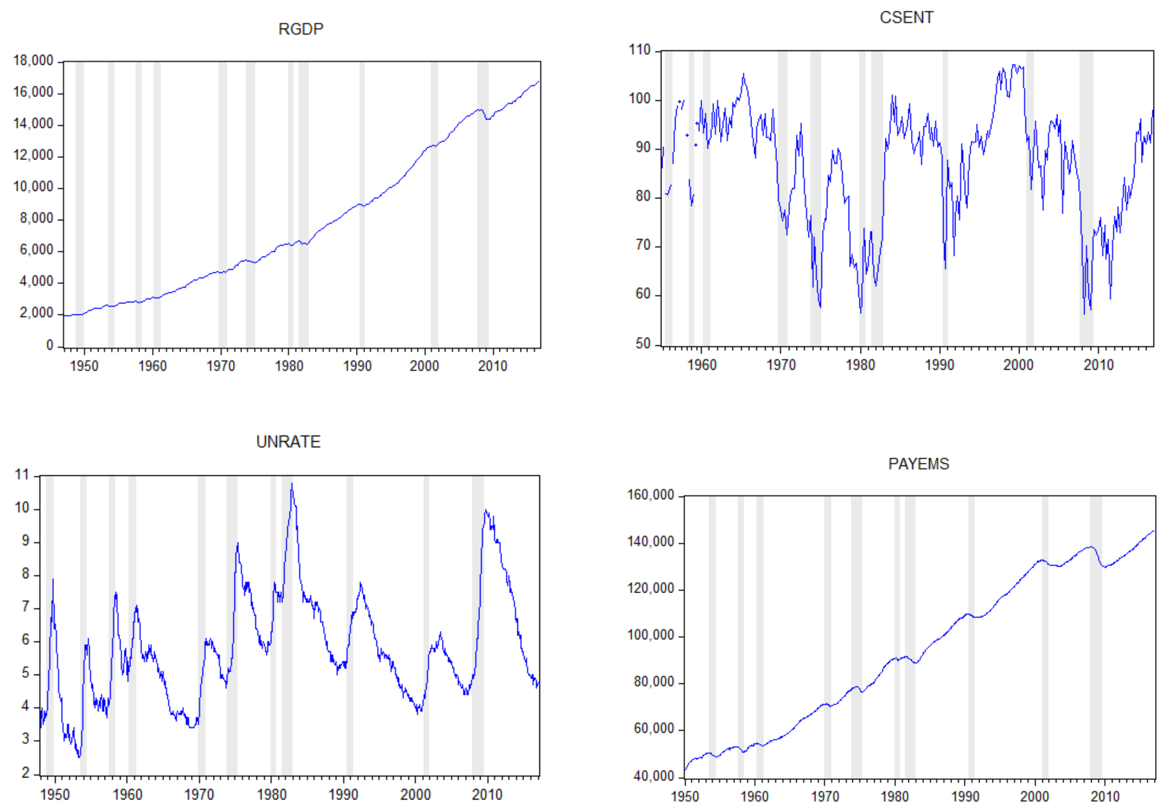
Figure below shows the time series for the S&P500 Index, the log transformed S&P500 Index, and also their first differences. Explain which of the four series are nonstationary, first order weakly stationary, second order weakly stationary.



- SP500: it is nonstationary, because it is growing and thus mean is not constant over time
- log og SP500: it is nonstationary, because it is growing and thus mean is not constant over time
- first difference of SP500: it is first order weakly stationary stationary, it fluctuates around a constant mean, but its variance is not constant over time, with larger fluctuations toward the end of the sample
- first difference of log of SP500: it may be first order weakly stationary or second order weakly nonstationary - mean does not appear to be growing over time, whether variance is constant over time or not would need to be further tested

Question 9 (10 points)

Figure below shows the time series for U.S. real GDP., `RGDP`, Index of Consumer Sentiment `CSENT`, U.S. unemployment rate. `UNRATE` and Employment (Total Nonfarm Payrolls) `PAYEMS`. Explain which of the four series are nonstationary, first order weakly stationary, second order weakly stationary.



- ‘RGDP0‘: it is nonstationary, because it is growing and thus mean is not constant over time
- ‘CSENT‘: it appears to be stationary since the mean does not grow over time, and there does not seem to be any change in volatility over time
- ‘UNRATE‘: it appears to be stationary, the mean does not appear to be growing over time, and there does not seem to be any significant change in volatility over time
- ‘PAYEMS‘: it is nonstationary, because it is growing and thus mean is not constant over time

Question 10 (10 points)

Figure below show the correlogram for the percentage change in the house price index in San Diego MSA during 1975Q1-2008Q3. Discuss which AR/MA/ARMA models would you consider as plausible candidates for this time series and explain why.

Date: 02/25/17 Time: 13:30
Sample: 1975Q1 2008Q3
Included observations: 134

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.487	0.487	32.436	0.000
		2	0.487	0.328	65.201	0.000
		3	0.403	0.123	87.756	0.000
		4	0.466	0.225	118.26	0.000
		5	0.258	-0.142	127.65	0.000
		6	0.277	-0.001	138.56	0.000
		7	0.265	0.075	148.65	0.000
		8	0.185	-0.093	153.61	0.000
		9	0.114	-0.041	155.51	0.000
		10	0.049	-0.115	155.86	0.000
		11	0.011	-0.090	155.88	0.000
		12	-0.065	-0.062	156.51	0.000
		13	-0.073	-0.024	157.32	0.000
		14	-0.124	-0.041	159.65	0.000
		15	-0.157	-0.056	163.41	0.000
		16	-0.164	0.006	167.55	0.000
		17	-0.123	0.077	169.90	0.000
		18	-0.176	-0.027	174.75	0.000
		19	-0.227	-0.097	182.90	0.000
		20	-0.117	0.123	185.07	0.000

Since ACF declines very slowly in an oscillating way, and in addition only lags 1, 2, and 4 are statistically significant in PACF, two good candidate models are AR(2) and AR(4).

Question 11 (10 points)

Figure below shows the correlogram for the residuals from AR(2) and AR(4) models for the percentage change in the house price index in San Diego MSA. For a good model, the residuals should be white noise with no time dependence. Do the residuals from AR(2) and AR(4) model satisfy this property? Explain why yes or why no.

Date: 02/25/17 Time: 13:32
Sample: 1975Q1 2008Q3
Included observations: 134
residuals from AR(2) model

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.060	-0.060	0.4987	
		2	-0.157	-0.162	3.9233	
		3	0.081	0.062	4.8320	0.028
		4	0.272	0.265	15.227	0.000
		5	-0.106	-0.053	16.821	0.001
		6	0.002	0.065	16.822	0.002
		7	0.161	0.116	20.544	0.001
		8	0.061	0.030	21.086	0.002
		9	-0.004	0.080	21.089	0.004
		10	-0.001	-0.028	21.089	0.007
		11	0.022	-0.047	21.158	0.012
		12	-0.054	-0.078	21.599	0.017
		13	0.005	-0.036	21.602	0.028
		14	-0.033	-0.068	21.765	0.040
		15	-0.074	-0.103	22.599	0.047
		16	-0.013	-0.024	22.625	0.067
		17	0.053	0.034	23.056	0.083
		18	-0.105	-0.070	24.778	0.074
		19	-0.182	-0.146	30.055	0.026
		20	0.092	0.063	31.394	0.026

Date: 02/25/17 Time: 13:31
Sample: 1975Q1 2008Q3
Included observations: 134
residuals from AR(4) model

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.032	0.032	0.1413	
		2	0.031	0.030	0.2749	
		3	0.034	0.032	0.4337	
		4	0.069	0.066	1.0957	
		5	-0.077	-0.083	1.9315	0.165
		6	0.036	0.036	2.1155	0.347
		7	0.149	0.149	5.2995	0.151
		8	0.043	0.032	5.5614	0.234
		9	0.046	0.044	5.8654	0.320
		10	-0.005	-0.031	5.8696	0.438
		11	0.002	-0.017	5.8700	0.555
		12	-0.078	-0.063	6.7815	0.560
		13	-0.021	-0.027	6.8510	0.653
		14	-0.038	-0.048	7.0708	0.719
		15	-0.041	-0.052	7.3252	0.772
		16	-0.023	-0.024	7.4099	0.829
		17	0.034	0.036	7.5912	0.869
		18	-0.078	-0.071	8.5350	0.860
		19	-0.161	-0.143	12.652	0.629
		20	0.052	0.077	13.079	0.667

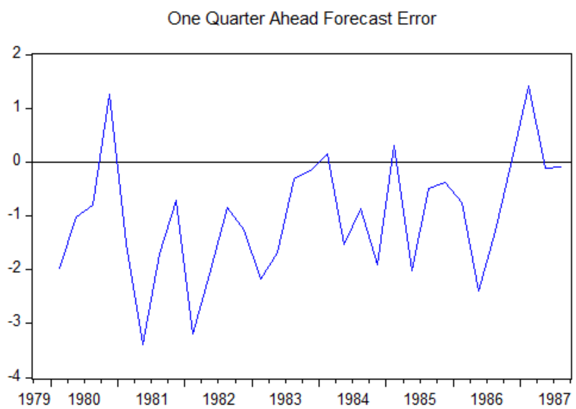
Residuals from the AR(2) model do not appear to be white noise - lag 4 in ACF and PACF is statistically significant, so there is time dependence in residuals. Including two more lags allows in the AR model fixes this problem: residuals from the AR(4) appear to be white noise, there are no statistically significant lags in ACF and PACF, so there does not seem to be any time dependence in residuals of the AR(4) model.

Question 12 (10 points)

Consider the one quarter ahead Fed's forecast for inflation during the 1979Q4-1987Q3 period.

Suppose that we want to test whether the Fed's forecast are optimal under the symmetric quadratic loss function, which would imply that $E(y_{t+1}) = f_{t,1}$ and thus the forecast error $e_{t,1} = y_{t+1} - f_{t,1}$ would have to satisfy $E(e_{t,1}) = 0$, and in the regression $e_{t,1} = \beta_0 + e_t$ coefficient β_0 should be zero. Figure below shows that time series plot for the forecast errors, and the results of that regression.

Interpret these results; what can we say about Fed's loss function during 1979Q4-1987Q3 based on them?



Dependent Variable: GPGDP_E1
Method: Least Squares
Date: 02/24/17 Time: 19:34
Sample (adjusted): 1980Q1 1987Q3
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.017073	0.202722	-5.017080	0.0000

R-squared	0.000000	Mean dependent var	-1.017073
Adjusted R-squared	0.000000	S.D. dependent var	1.128708
S.E. of regression	1.128708	Akaike info criterion	3.111751
Sum squared resid	38.21948	Schwarz criterion	3.158009
Log likelihood	-47.23215	Hannan-Quinn criter.	3.126830
Durbin-Watson stat	1.562466		

Based on on the time series plot the forecast error appears to be negative most of the time, thus the inflation forecast $f_{t,1}$ tends overestimate the true inflation y_{t+1}. This is confirmed by the negative and statistically significant estimate of β_0 in the regression. It suggests that the Fed's loss function is not symmetric quadratic but rather asymmetric, with larger losses associated with underestimating inflation. This makes sense intuitively, since the main goal of Fed in the 1980s was to bring down inflation from double digit levels.