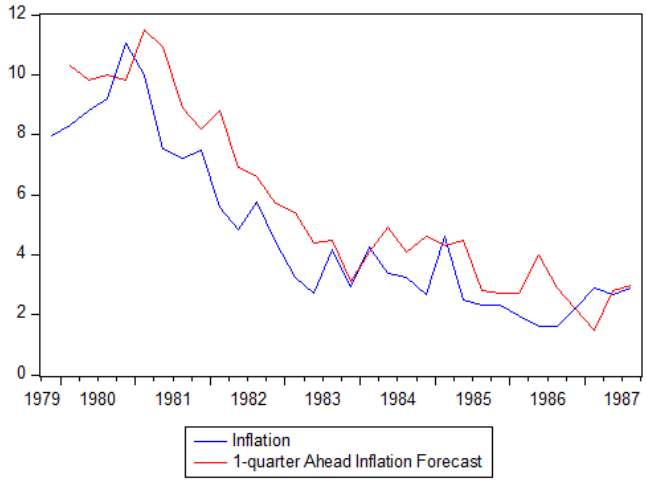
Homework 3

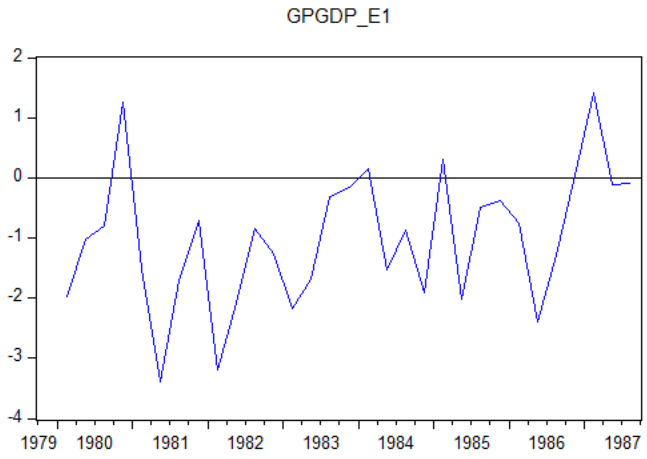
Eco 4306 Economic and Business Forecasting
Spring 2019
Due: Wednesday, February 20, before the class

Problem 1

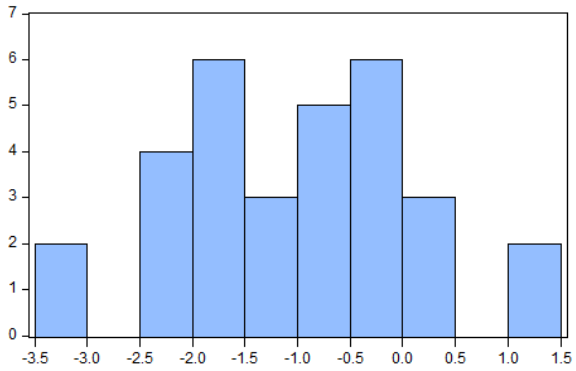
(a) Figure below shows the time series plot with actual inflation rate measured using GDP deflator, and the Fed's 1-step ahead forecasts for this inflation. There is a clear downward trend visible in the plot - inflation and its forecast dropped from around 11% in early 1980s to around 2% in late 1980s. During the 1979Q4-1987Q3 period the one quarter ahead forecast for inflation was consistently above the actual inflation.



(b) Figure below shows the time series plot for the one quarter ahead forecast errors. Consistent with our finding in (a) these errors are not distributed symmetrically around zero, instead they are negative most of the time.



(c) The histogram and the descriptive statistics for forecast errors shown below suggest that these forecast errors are normally distributed - skewness is close to 0, kurtosis close to 3; Jarque-Berra statistic is thus low and its p-value very high so we do not reject the hypothesis that forecast errors are normally distributed.



Series: GPGDP_E1	
Sample 1979Q4 1987Q3	
Observations 31	
Mean	-1.017073
Median	-0.856972
Maximum	1.404120
Minimum	-3.399364
Std. Dev.	1.128708
Skewness	0.023725
Kurtosis	2.847372
Jarque-Bera	0.032998
Probability	0.983636

(d) Estimated coefficient $\hat{\beta}_0$ is highly statistically significantly different from zero - the p-value for the hypothesis $H_0 : \beta_0 = 0$ is essentially zero. This provides a formal result for our insight from (b) that the forecast errors are not zero on average, $E(e_{t,1}) \neq 0$, but instead are negative.

Dependent Variable: GPGDP_E1
Method: Least Squares
Date: 02/19/19 Time: 18:00
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		

(e) The results for the regression $y_{t+1} = \beta_0 + \beta_1 f_{t,1} + \varepsilon_{t+1}$ where y_{t+1} is the actual value and $f_{t,1}$ is the 1-quarter-ahead forecast are below.

Dependent Variable: GPGDP
Method: Least Squares
Date: 02/19/19 Time: 18:00
Sample (adjusted): 1980Q1 1987Q3
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.117978	0.408818	-0.288582	0.7750
GPGDP_F1(-1)	0.841547	0.064037	13.14155	0.0000

R-squared	0.856222	Mean dependent var	4.657121
Adjusted R-squared	0.851265	S.D. dependent var	2.704839
S.E. of regression	1.043155	Akaike info criterion	2.984717
Sum squared resid	31.55698	Schwarz criterion	3.077232
Log likelihood	-44.26311	Hannan-Quinn criter.	3.014875
F-statistic	172.7004	Durbin-Watson stat	1.657865
Prob(F-statistic)	0.000000		

The test statistic of F-test for the joint hypothesis $H_0 : \beta_0 = 0, \beta_1 = 1$ is 17.79 and the associated p-value is essentially zero. We thus strongly reject the hypothesis at all conventional levels, which implies that the forecast is not unbiased.

Wald Test:
Equation: EQ_GPGDP_F1

Test Statistic	Value	df	Probability
F-statistic	17.79592	(2, 29)	0.0000
Chi-square	35.59184	2	0.0000

Null Hypothesis: C(1)=0, C(2)=1
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(1)	-0.117978	0.408818
-1 + C(2)	-0.158453	0.064037

Restrictions are linear in coefficients.

(f) The components of the AC and PAC functions are within the 95% confidence interval around zero, so there does not appear to be any time dependence in the forecast error.

Date: 02/19/19 Time: 18:00
Sample: 1979Q4 1987Q3
Included observations: 31

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.195	0.195	1.3028	0.254
		2	-0.106	-0.149	1.6959	0.428
		3	-0.106	-0.057	2.1096	0.550
		4	0.234	0.271	4.1904	0.381
		5	-0.084	-0.246	4.4654	0.485
		6	-0.013	0.134	4.4726	0.613
		7	0.018	0.020	4.4857	0.722
		8	0.123	0.003	5.1611	0.740
		9	-0.118	-0.058	5.8047	0.759
		10	-0.166	-0.170	7.1473	0.711
		11	-0.097	-0.012	7.6282	0.746
		12	0.143	0.107	8.7363	0.725
		13	0.295	0.319	13.667	0.398
		14	0.025	-0.122	13.704	0.472
		15	-0.149	-0.077	15.117	0.443
		16	-0.097	-0.067	15.763	0.470

(g) Fed's forecasts for inflation during the period 1979Q4-1987Q3 do not appear to be optimal under symmetric quadratic loss function - forecast errors are a white noise with no time dependence as shown in (f), but they are not unbiased, with zero mean. They are instead negative on average, as shown in (a) and (b), and this bias is statistically significant, as documented in (d) and (e). Fed under Paul Volcker was producing forecasts which are more consistent with an asymmetric loss function, where under-predicting inflation is more costly that over-predicting it. This makes sense - if the Fed's primary goal in he 1980s was to bring down the inflation because it got too high in the late 1970s, it was optimal for Fed to set it's interest rate more aggressively. Actual future inflation lower than the forecast were then more acceptable than actual future inflation higher than the forecast.