Homework 2

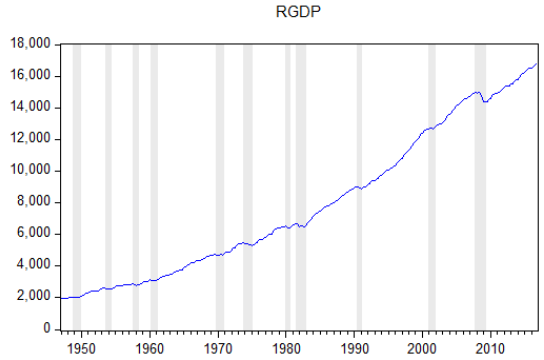
Eco 4306 Economic and Business Forecasting
Spring 2018
Due: Thursday, February 8, before the class

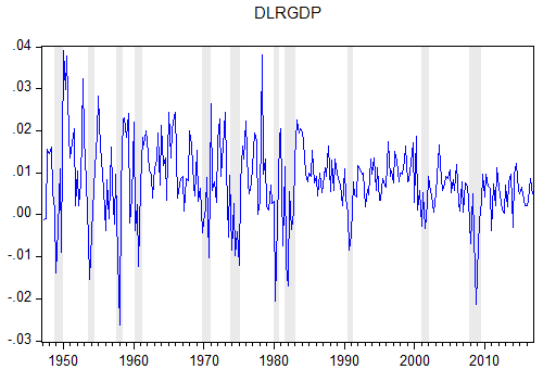
Problem 1 (70 points)

Visit again the website of the Federal Reserve Bank in St. Louis (http://research.stlouisfed.org) and download the following data:

(a) (10 points) U.S. real GDP., time series `GDPC1`:

- definition: real gross domestic product is the inflation adjusted value of the goods and services produced by labor and property located in the United States
- units: billions of chained 2009 dollars, seasonally adjusted annual rate
- frequency: quarterly

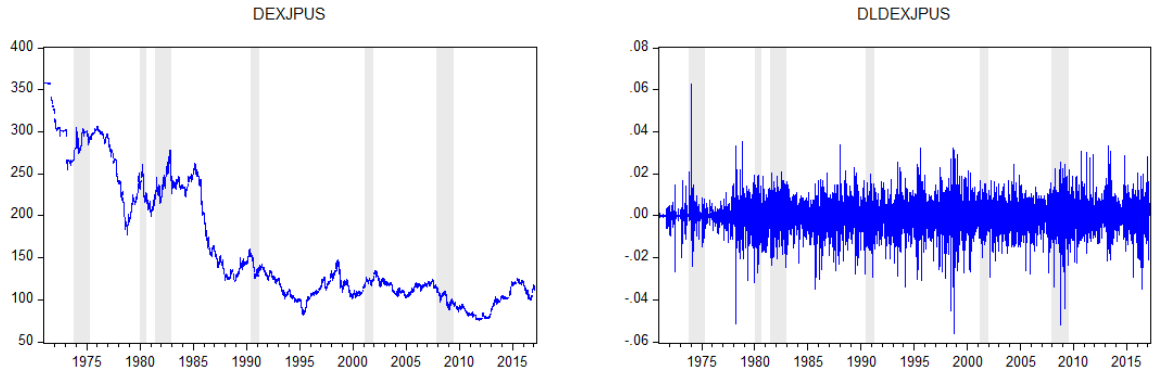




Time series is not weakly stationary, because it is growing over time, so mean and variance can not be constant. To obtain weakly stationary data we transform the time series by taking log and then calculating the first differences. The resulting series approximates the growth rate (percentage change) and fluctuates around mean with roughly same volatility over the sample period.

(b) (10 points) The exchange rate of the Japanese yen against the U.S. dollar., time series DEXJPUS:

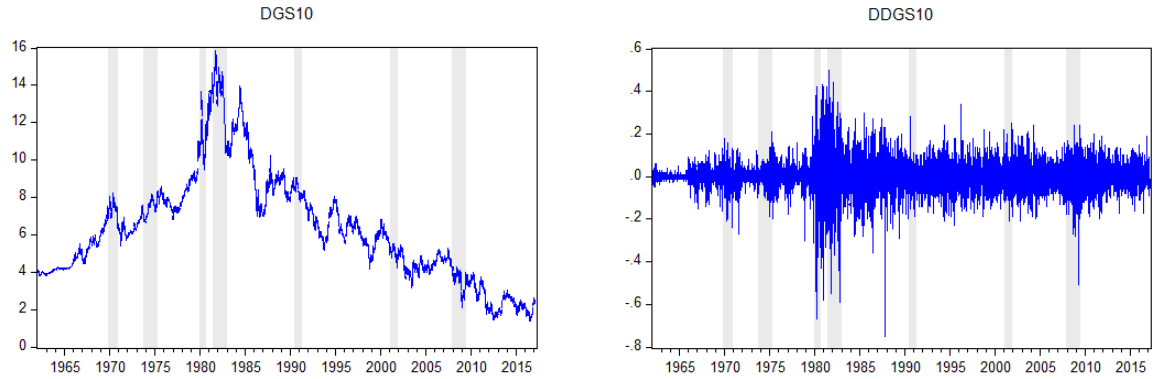
- definition: Noon buying rates in New York City for cable transfers payable in foreign currencies.
- units: Japanese yen to one U.S. dollar, not seasonally adjusted
- frequency: daily



Time series might be weakly stationary, if we only consider the period since 1990, but before that it was gradually declining in 1970s and 1980s. To obtain weakly stationary data we transform the time series by taking log and then calculating the first differences. The resulting series approximates the growth rate (percentage change) and fluctuates around its mean, though the volatility appears to be changing, with calmer periods interrupted by period of larger volatility.

(c) (10 points) The 10-year U.S. Treasury constant maturity yield., time series DGS10:

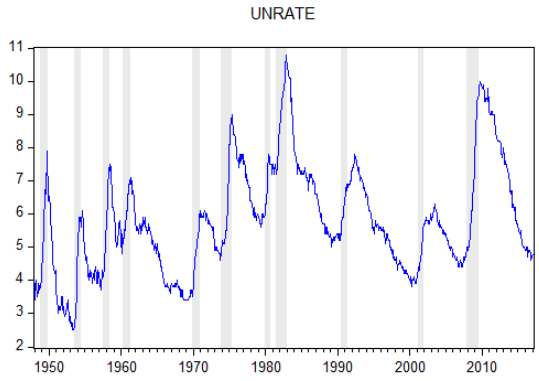
- definition:
- units: percent, not seasonally adjusted
- frequency: daily

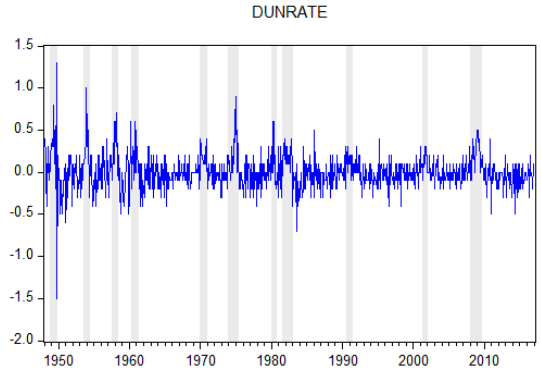


Time series was gradually growing in 1960s and 1970s, but was since then gradually declining, so it is hard to tell whether it is weakly stationary or not.

(d) (10 points) The U.S. unemployment rate., time series UNRATE:

- definition: Number of unemployed as a percentage of the labor force. Labor force data are restricted to people 16 years of age and older, who do not reside in institutions (e.g., penal and mental facilities, homes for the aged), and who are not on active duty in the Armed Forces.
- units: percent, seasonally adjusted
- frequency: monthly

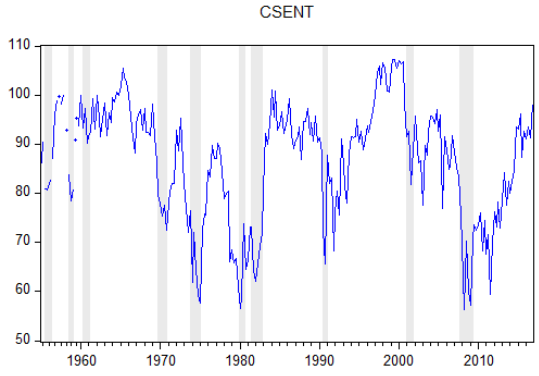


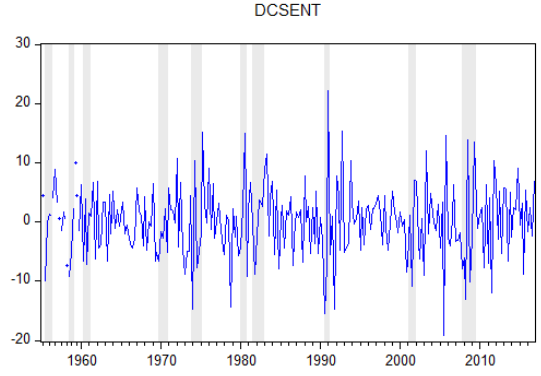


Time series might be weakly stationary, since it is not growing and instead it fluctuates around its mean, but it shows a lot of persistence. The time series for first differences also fluctuates around its mean, with roughly constant volatility, and with much smaller persistence.

(e) (10 points) Index of Consumer Sentiment:, time series UMICH/SOC1

- definition:
- units: index, 1966Q1=100, not seasonally adjusted
- frequency:

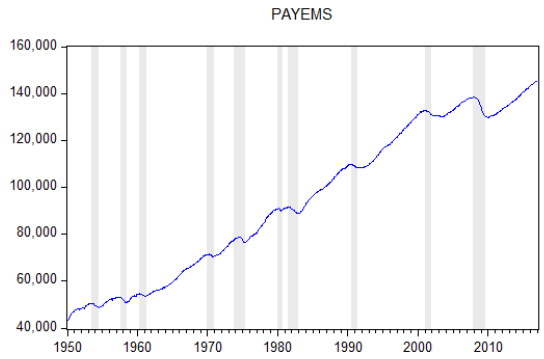


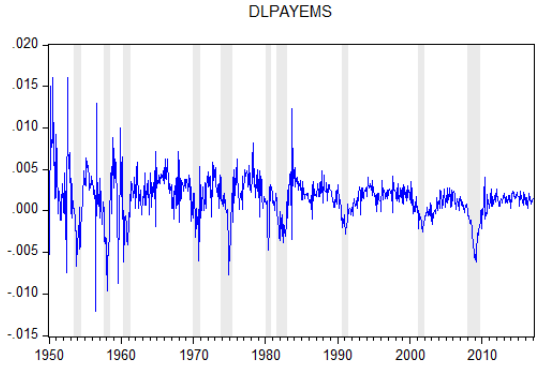


Time series appears to be weakly stationary, since it fluctuates around its mean, but this time series also shows high persistence. The time series for first differences also fluctuates around its mean, with roughly constant volatility, and with much smaller persistence.

(f) (10 points) All Employees, Total Nonfarm Payrolls, time series FRED/PAYEMS

- definition: Total Nonfarm Payroll, is a measure of the number of U.S. workers in the economy that excludes proprietors, private household employees, unpaid volunteers, farm employees, and the unincorporated self-employed. This measure accounts for approximately 80 percent of the workers who contribute to Gross Domestic Product (GDP).
- units: thousands of persons, seasonally adjusted
- frequency: monthly

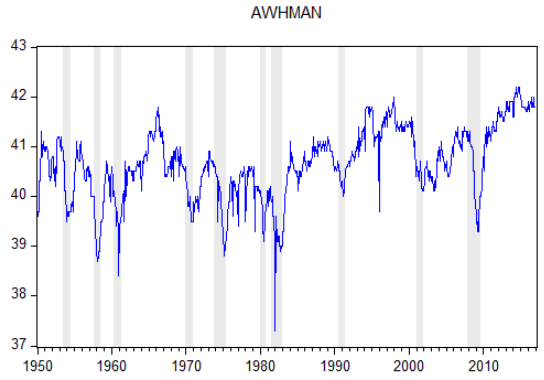


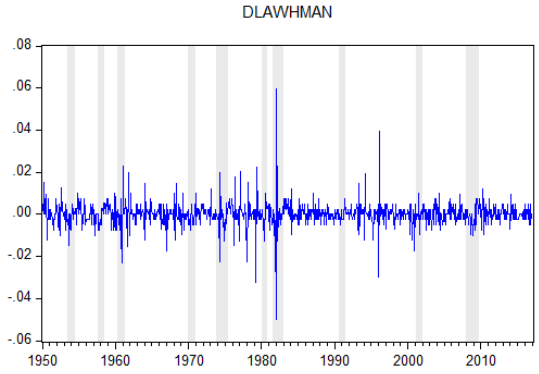


Time series is not weakly stationary, because it is growing over time, so mean and variance can not be constant. To obtain weakly stationary data we transform the time series by taking log and then calculating the first differences. The resulting series approximates the growth rate (percentage change) and fluctuates around mean with roughly same volatility over the sample period.

(g) (10 points) Average Weekly Hours of Production and Nonsupervisory Employees: Manufacturing:, time series FRED/AWHMAN

- definition: Average weekly hours are the total weekly hours divided by the employees paid for those hours. Nonsupervisory employees include individuals who are not above the working-supervisor level.
- units: hours, seasonally adjusted
- frequency: monthly





Time series appears to be weakly stationary, since it fluctuates around its mean. The time series for first differences also fluctuates around its mean.

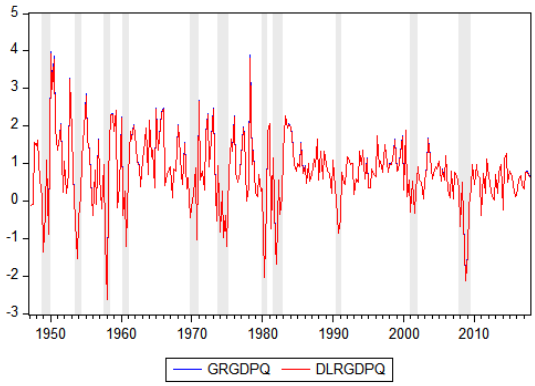
Problem 2 (30 points)

(a) (10 points) There is almost no noticeable difference between the the quarter-over-quarter growth rate (percentage change) of the real GDP

$$grGDPQ_t = 100 \times \frac{Y_t - Y_{t-1}}{Y_{t-1}}$$

and the first log-differences of the real GDP

$$dlrGDPQ_t = 100 \times (y_t - y_{t-1}) = 100 \times (\log Y_t - \log Y_{t-1})$$

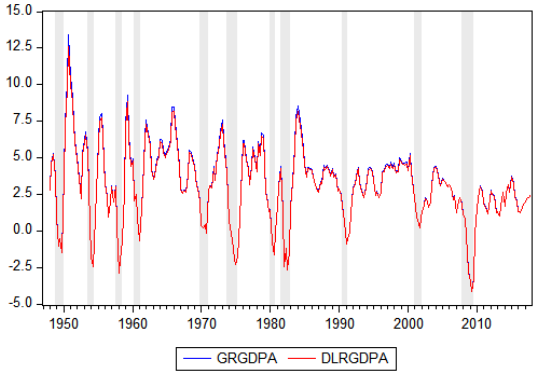


(b) (10 points) There is almost no noticeable difference between the year-over-year growth rate (percentage change) of the real GDP

$$grGDPA_t = 100 \times \frac{Y_t - Y_{t-4}}{Y_{t-4}}$$

and the first log-differences at lag 4 of the real GDP

$$dlrGDPA_t = 100 \times (y_t - y_{t-4}) = 100 \times (\log Y_t - \log Y_{t-4})$$

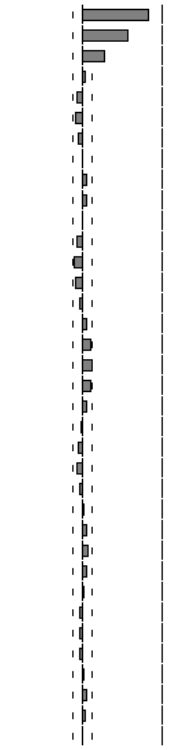


(c) (10 points) The ACF and PACF for $dlrGDPA_t$ show that there is more linear dependence (higher autocorrelation coefficients) than in $dlrGDPQ_t$. The AC coefficients are statistically different from zero for first two lags in case of $dlrGDPQ_t$ and for first three lags in case of $dlrGDPA_t$.

Date: 02/15/18 Time: 16:03 Time Series: DLRGDPQ
Sample: 1947Q1 2017Q4
Included observations: 283

	AC	PAC	Q-Stat	Prob
1	0.372	0.372	39.611	0.000
2	0.218	0.092	53.247	0.000
3	0.031	-0.090	53.528	0.000
4	-0.058	-0.073	54.506	0.000
5	-0.117	-0.071	58.448	0.000
6	-0.042	0.052	58.949	0.000
7	-0.032	-0.005	59.246	0.000
8	-0.011	-0.013	59.281	0.000
9	0.083	0.096	61.323	0.000
10	0.084	0.026	63.387	0.000
11	0.033	-0.039	63.703	0.000
12	-0.106	-0.151	67.043	0.000
13	-0.104	-0.018	70.265	0.000
14	-0.060	0.063	71.340	0.000
15	-0.067	-0.043	72.710	0.000
16	0.056	0.089	73.654	0.000
17	0.063	0.010	74.872	0.000
18	0.095	0.041	77.628	0.000
19	0.070	-0.001	79.128	0.000
20	0.072	0.010	80.703	0.000
21	-0.065	-0.084	81.993	0.000
22	-0.054	0.017	82.903	0.000
23	-0.085	-0.022	85.137	0.000
24	-0.020	0.036	85.257	0.000
25	0.038	0.041	85.700	0.000
26	0.019	-0.048	85.817	0.000
27	0.067	0.038	87.243	0.000
28	0.085	0.062	89.550	0.000
29	0.052	-0.003	90.413	0.000
30	-0.104	-0.158	93.839	0.000
31	-0.049	0.061	94.614	0.000
32	-0.047	0.056	95.334	0.000
33	0.029	0.051	95.604	0.000
34	0.061	-0.006	96.818	0.000
35	0.044	-0.043	97.439	0.000
36	0.025	-0.002	97.636	0.000

Date: 02/15/18 Time: 16:03 Time Series: DLRGDPA
Sample: 1947Q1 2017Q4
Included observations: 280



	AC	PAC	Q-Stat	Prob
1	0.853	0.853	205.74	0.000
2	0.590	-0.500	304.76	0.000
3	0.292	-0.178	329.13	0.000
4	0.031	-0.019	329.41	0.000
5	-0.078	0.372	331.16	0.000
6	-0.093	-0.135	333.68	0.000
7	-0.053	-0.080	334.50	0.000
8	0.007	-0.011	334.51	0.000
9	0.050	0.152	335.24	0.000
10	0.044	-0.197	335.80	0.000
11	0.001	-0.059	335.80	0.000
12	-0.067	-0.041	337.11	0.000
13	-0.101	0.296	340.16	0.000
14	-0.091	-0.108	342.63	0.000
15	-0.041	-0.016	343.13	0.000
16	0.043	0.015	343.67	0.000
17	0.106	0.137	347.07	0.000
18	0.130	-0.161	352.13	0.000
19	0.110	-0.026	355.77	0.000
20	0.051	-0.016	356.56	0.000
21	-0.020	0.130	356.67	0.000
22	-0.058	-0.025	357.70	0.000
23	-0.067	-0.072	359.10	0.000
24	-0.038	0.038	359.54	0.000
25	0.016	0.114	359.62	0.000
26	0.059	-0.047	360.71	0.000
27	0.079	-0.123	362.66	0.000
28	0.065	0.045	364.00	0.000
29	0.022	0.056	364.15	0.000
30	-0.028	0.005	364.39	0.000
31	-0.040	0.053	364.89	0.000
32	-0.025	-0.044	365.09	0.000
33	0.014	0.005	365.16	0.000
34	0.048	-0.085	365.89	0.000
35	0.040	-0.052	366.40	0.000
36	0.003	0.001	366.40	0.000