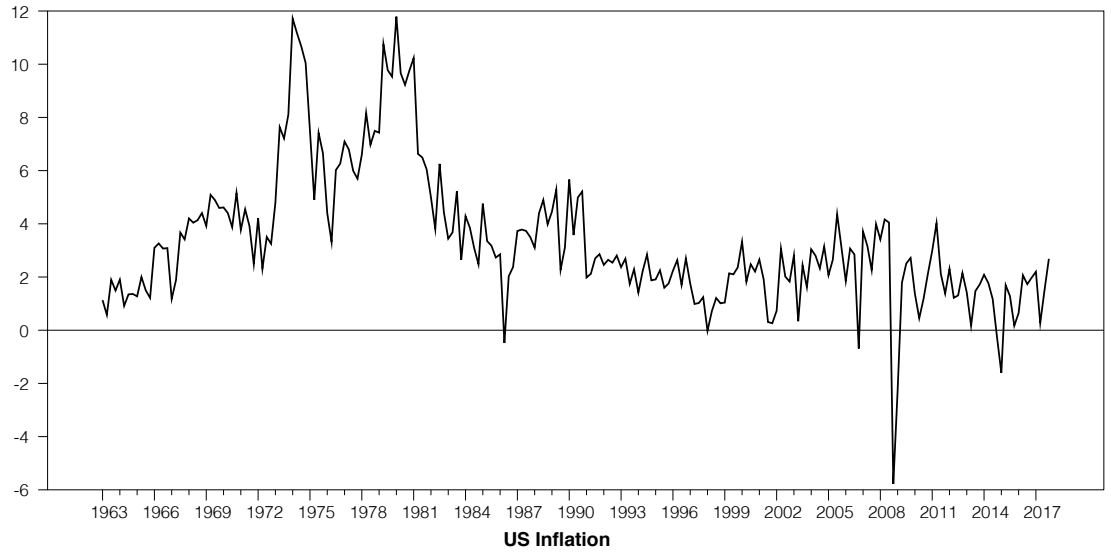
Empirical Exercise 15.1

a. (i) *Infl* is measured in percentage points at annual rate.

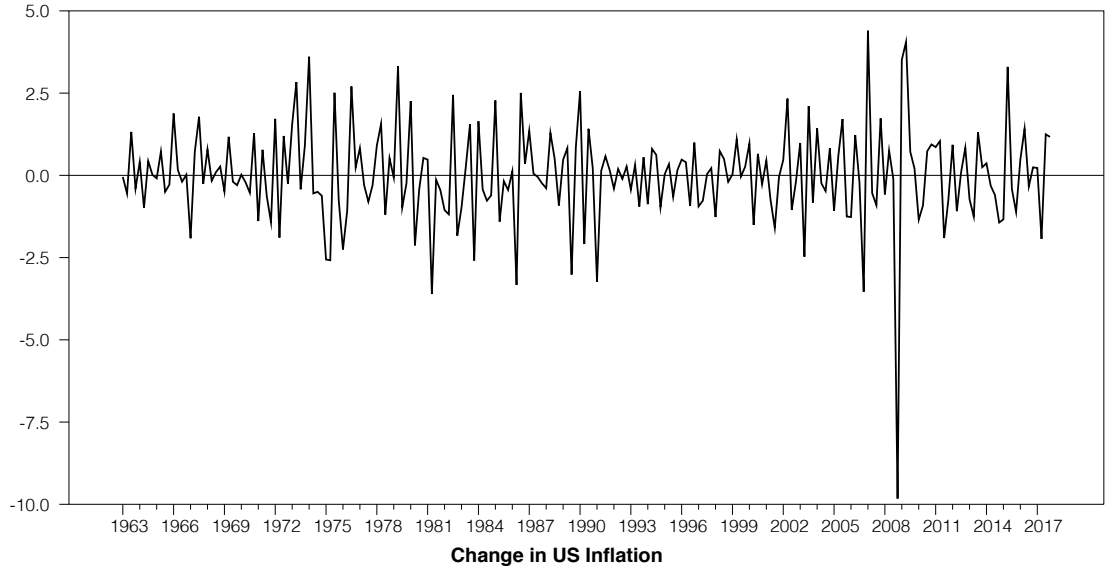
(ii)



Inflation increased over the 20-year period 1960-1980, then declined for a decade and has been reasonably stable since then. It appears to have a stochastic trend.

b. (i) They are -0.25, -0.20, 0.14, and -0.08.

(ii)



The change in inflation is slightly negatively serially correlated (the first autocorrelation is $\hat{\rho}_1$ = -0.25) so that values above the mean tend to be followed by values below the mean.

c. (i) The AR(1) model is

$$\widehat{\Delta Infl}_t = 0.007\,4 - 0.247\,\Delta Infl_{t-1}, \quad \overline{R}^2 = 0.06$$
$$\qquad\qquad (0.0965)\ \ (0.068)$$

The coefficient on lagged inflation is statistically significant, so that lagged inflation helps predict current inflation.

(ii) The AR(2) model is

$$\widehat{\Delta Infl}_t = 0.0061\ - 0.318\,\Delta Infl_{t-1} - 0.284\,\Delta Infl_{t-2}, \quad \overline{R}^2 = 0.13$$
$$\qquad\qquad (0.0926)\ \ (0.064)\qquad\qquad (0.076)$$

The estimated coefficient on $\Delta Infl_{t-2}$ is statistically significant, so the AR(2) model is preferred to the AR(1) model. (Note also that the $\overline{R}^2$ increased from 0.06 in the AR(1) model to 0.13 in the AR(2) model.)

(iii) AIC and BIC values are shown in the table

p	**BIC(*p*)**	**AIC(*p*)**
0	0.8049	0.7895
1	0.7669	0.7360
2	***0.7077***	***0.6614***
3	0.7322	0.6705
4	0.7437	0.6665
5	0.7533	0.6608
6	0.7689	0.6609
7	0.7931	0.6697
8	0.8163	0.6774

Both AIC and BIC select p = 2 lags.

(iv) The predicted change in inflation is -0.72

(v) The predicted level of inflation is 1.96

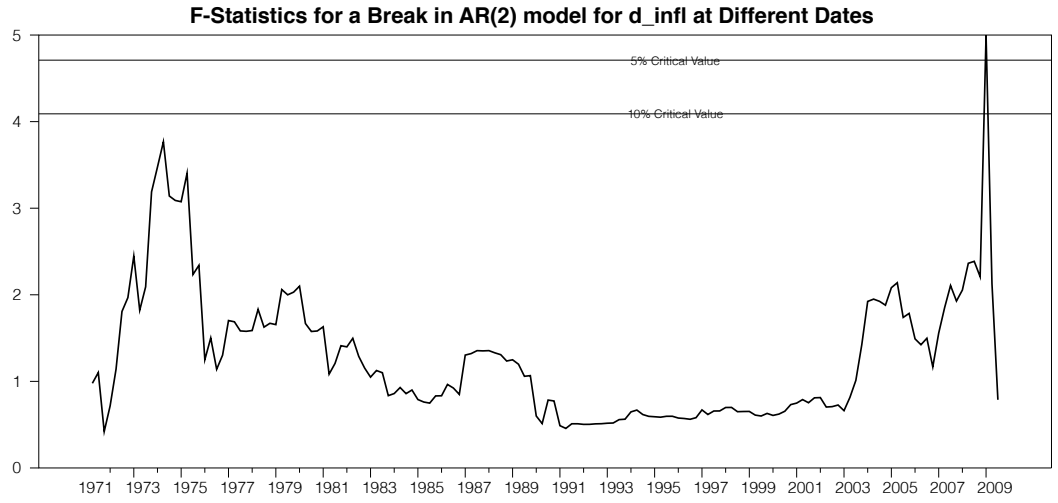
d. (i) The ADF *t* statistic is -2.74. The 10% critical vale is -2.57 and the 5% critical value of -2.86; thus the unit root null hypothesis can be rejected at the 10% but not the 5% significance level.

(ii) Yes, the inflation rate does not exhibit a linear trend, so that the specification that includes an intercept, but no time trend is appropriate.

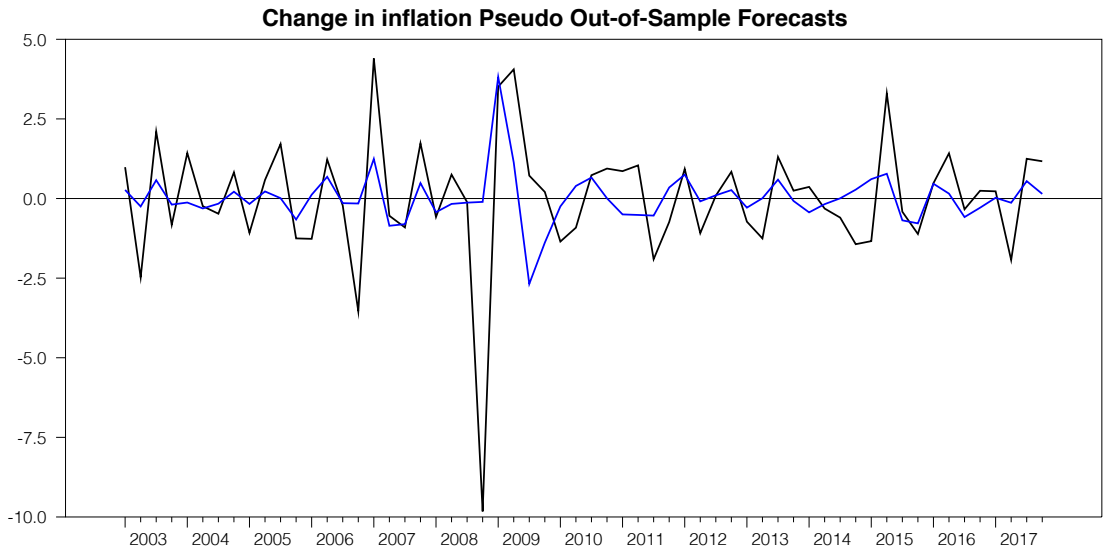
(iii) Both AIC and BIC choose two lags.

(iv) Inflation is highly persistent. It has a largest autoregressive root that is close to 1.0; the null hypothesis that the value is 1.0 cannot be rejected at the 5% significance level, and given the precision of the estimate, this suggests that the true value is close to 1.0. Ideally, the range of reasonable values could be determined by forming a confidence interval for the largest root, although this is somewhat tricky when autoregressive roots are close to 1.0. Methods for construction for confidence intervals in this case go beyond the material covered in the Stock-Watson textbook.

e. The QLR statistics is 5.12 and occurs in 2009:Q1. The 5% critical value is 4.71, so the null of stability is rejected at the 5% significance level. Note that the rejection occurs just following the large change in inflation in the fourth quarter of 2008. (See the discussion below.) This suggests that, absent this single outlier, the model may be stable. You should investigate this conjecture.



f. (i) Black is actual and blue is POOS forecast



(ii) The sample mean of the forecast errors is 0.00 (to two decimal places) with a standard error of 0.23. There is no significant bias.

(iii) The RMSFE is 1.80. The in-sample regression estimated from 1963:Q1 – 2002:Q4 has a standard error of 1.20, so the RMSFE is larger than would be expected based on the in-sample regression. As (iv) suggests, much of this is associated with the outlier in 2008:Q4 which produced a forecast error of -9.7%. Excluding this single observation reduces the RMSFE to 1.29, which is much close to the in-sample SER.

(iv) Oil prices plummeted during the end of 2008. Have a look at the data.