Problem Set 3
Due: Mon. Feb. 3, 2020.

1 **If the AR(8) is accepted as a good model for this data, do you think the data-model match supports stationarity? Give full numerical support for this based on the reference posterior.**

Prove:

The process is stationary because of 2 reasons:

1. Transition matrix have moduli less than 1 and also $|\phi| < 1$. Thus it is stable.
2. $\mathbb{P}(|\phi_i| > 1|\mathcal{D}) = 0$. Thus, there is no posterior evidence showing that the stationarity is violated.
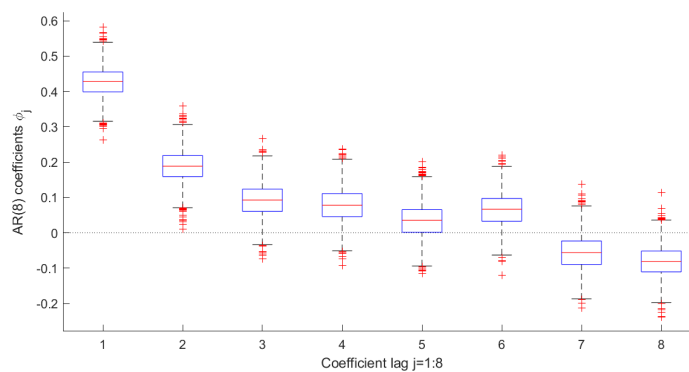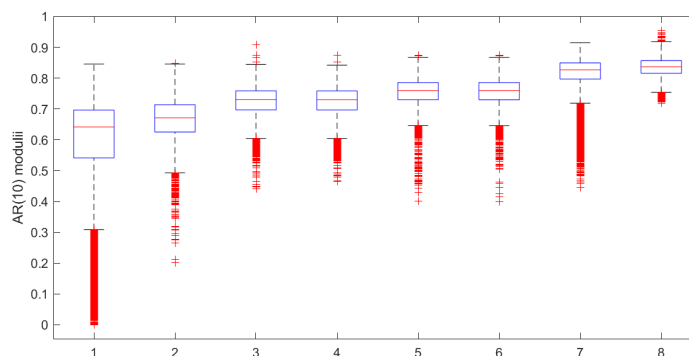

Figure 1: AR ϕ_i value

Figure 2: AR moduli value

2 **Assuming that there is some indication of quasi-periodic behaviour under this posterior, summarise inferences on the maximum wavelength (a.k.a. period) of (quasi-)periodic components.**

PROVE:

There are 4 complex eigenvalue for the transition matrix. Therefore, we should have 4 different periods.

post mean	post - var
18.39	2.280
6.50	0.061
3.01	0.009
2.47	0.004

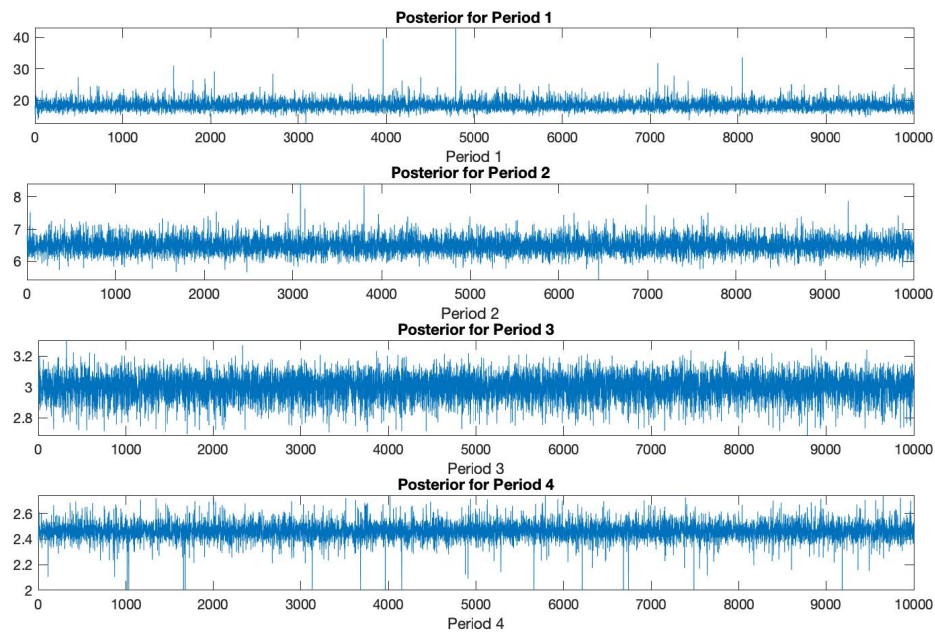Below is the maximum traceplot for 4 different periods.

Figure 3: Maximum Traceplot for 4 periods

3 **Explore and discuss aspects of inference on the implied decomposition of the series into underlying components implied by the eigenstructure of the AR model**
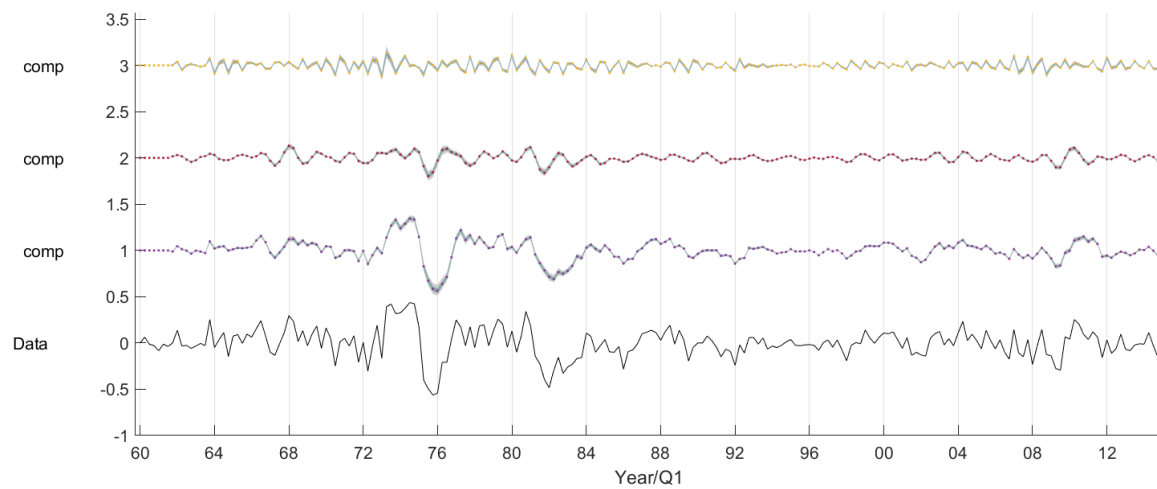
PROVE:

Figure 4: Eigenvalue

4 **Produce and display graphical summaries– in terms of (Monte Carlo based) posterior medians, upper and lower quartiles, and 10% and 90% points of the predictive distributions of actual inflation over the 12 quarters following the end of the data series.**

PROVE:

The following trace plots show great oscillation in the beginning. But later on the predictions stabilizes.
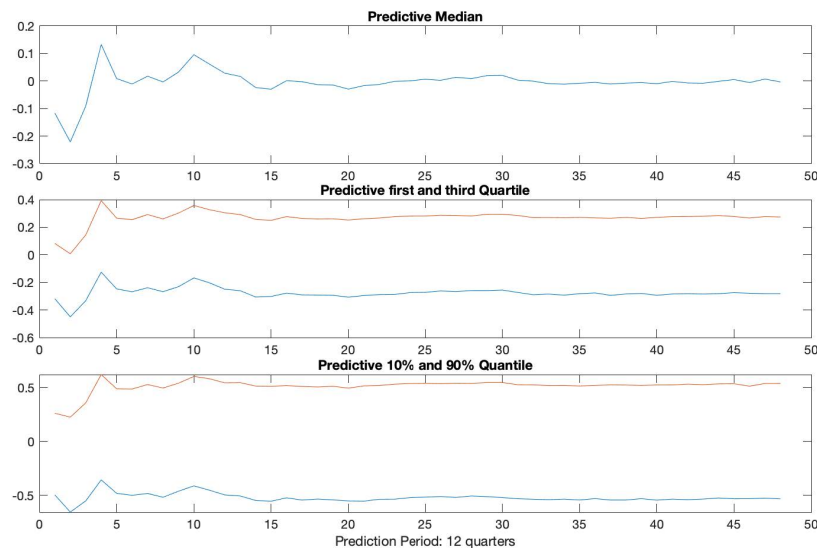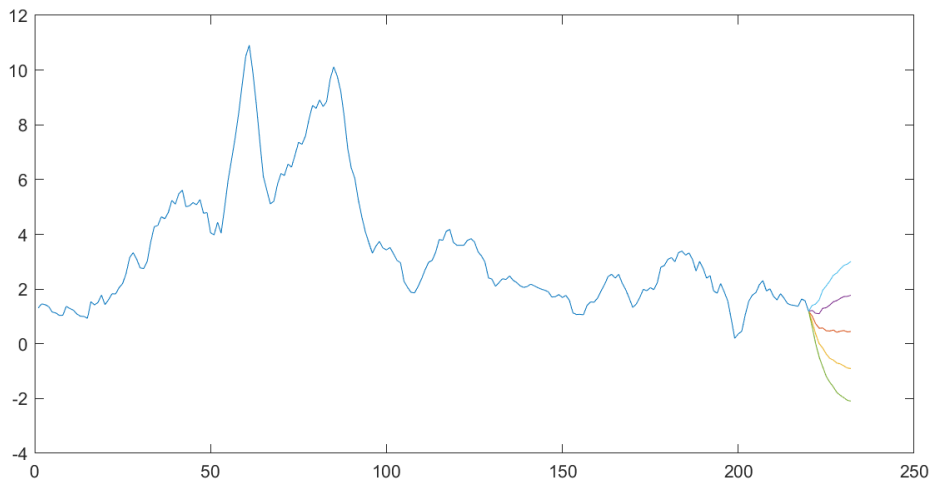

Figure 5: 12 Quarters

3

Figure 6: Observed and Prediction

5 **Assuming an AR(p) model is agreeable, do you think p = 8 makes sense for the differenced inflation series? Consider, for example, features of the fitted residuals from the model. In addition to exploratory and graphical analysis– and all you know about applied evaluation of linear regression model "fits"– the arpcompare.m function (noted and advised to review in Homework 2) may be of interest.**

PROVE:
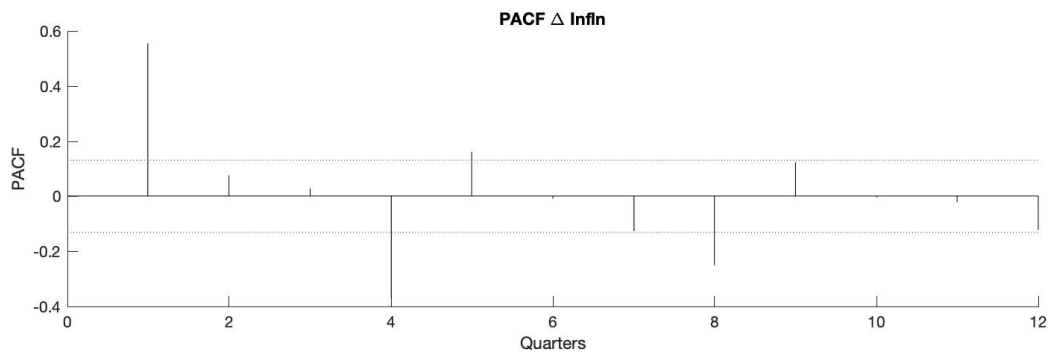
From above, we see that the PACF has significant partial autocorrelation at order 8. By useing the arcompare function, which compares the AIC, BIC and the log maximum reference likelihood of the model with respect to different p (up to 25), we quantifies AIC BIC and therefore generates the following plot.

4
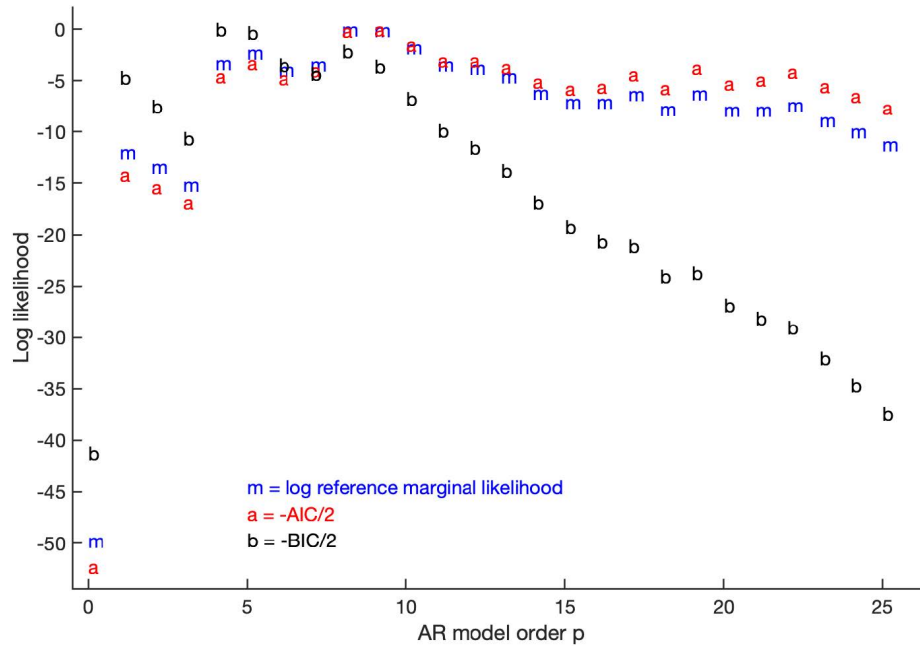
As can be seen from the plot:

    i negative AIC reach maximum at $p = 8$.

    ii log maximum reference likelihood reach maximum at $p = 8$.

    iii Negative BIC maximizes at around $p = 4$,

Therefore, p = 8 should give good results in terms of different model selection criteria, and so it makes sense for the differenced inflation rate.

[Last revised: February 3, 2020]