**ECOM90004 – Assignment 1**

Question 1

1. The best\_per\_break\_by\_end object in the attached R Markdown document indicates the selected AR lag order for each GFC break point and each estimation sample. This object indicates two things:
   * The preferred AR lag order is uniformly three across break date and estimation samples according to the AICc information criteria.
   * There is no evidence of autocorrelation by virtue of all model residuals all having very large Ljung-Box test p-values. These large p-values indicate we are unable to reject the null hypothesis of all autocorrelations up to twelve lags being jointly zero. This is a helpful sense-check reinforcing that these are valid model choices.
2. The preferred\_break\_per\_end object in the attached R Markdown document indicates the selected GFC break date for each estimation sample. They uniformly agree on the optimal GFC break date (2007q4). As before, the large p-values do not show evidence of autocorrelation in the chosen model, which is a helpful sense check for our model.

Question 2

The rmses object in the attached R Markdown document indicates the RMSE produced for each of the seven possible GFC break dates across different estimation periods. Interestingly, 2009q2 (2007q4) produces the lowest (highest) RMSE and is hence the most (least) preferred GFC break dates in terms of an out of sample evaluation. This is the opposite outcome as conducted using the in-sample AICc approach in the previous question, where 2009q2 (2007q4) was the worst (best) performing break date.

Question 3

There are several key takeaways from this exercise:

* The forecasts we produce in time series models are very sensitive to all of the subject choices we make when designing them. Therefore, all aspects of its features must be clearly understood and validated empirically.
* A model which generates the best in-sample fit is not guaranteed to produce the best out-of-sample forecasts. In this example the best in-sample GFC break date as selected by model criterion (2007q4) generated the worst forecasts of all. These models are primarily for forecasting: focus on out of sample results.
* Using deterministic trends in time series models makes results very sensitive to whatever that choice is. It’s very possible to incorrectly assume a particular data structure, which has knock on effects for the validity of all other analysis which follows.