A Forecasting Project Requirement

Your task is to analyze a time series data you are interested, makes forecasts, and present your project to a group of business professionals. Your audience is familiar with basic concepts of econometrics and forecasting. Your objective is to make optimal forecasts on the time series of your choice and assess your forecasts using in-sample and out-of-sample evaluations. In the end, you deliever a video presentations of your project. Each group member should take part in the video creation and presentation. The video should take about 10 - 15 minutes.

Step 1. Explore the data and perform in-sample evaluations

For the first step, you should select a univariate time series that captures your interest and comprises a minimum of 100 observations. It is important to choose a series that exhibits sufficient dependence to effectively apply forecasting models in subsequent analyses. For instance, stock prices discussed in chapter 6 might not be suitable for forecasting as they often resemble white noise.

Next, you will load the chosen data into RStudio and plot the time series. It is common for time series to exhibit trends and seasonality, and these components need to be appropriately removed to achieve stationarity. This procedures on handling deterministic and stochastic time trends are explained in chapter 10. The procedures on handlinng deterministic and stochastic seasonality are described in chapter 7. Along the way, you should employ augmented Dickey-Fuller tests to confirm that the resulting time series is stationary. Ensure to plot this series and clearly indicate that it is the series you will utilize for the subsequent analysis. It is not recommend to use

Use the full sample to create ACF (Autocorrelation Function) and PACF (Partial Autocorrelation Function) correlograms of the series. Analyze the patterns observed in the correlograms and employ linear models such as MA (Moving Average), AR (Autoregressive), or ARMA (Autoregressive Moving Average) to model the time series. Use the full sample to estimate the models and present the ACF and PACF correlograms of the residuals obtained from each model. Verify if the residuals resemble white noise by using the Q-Test. Select the three best models obtained thus far, write down the estimated regression equations, summarize the model estimation and evaluation in a table (similar to table 8.2 on page 214 in your textbook), and generate four-step ahead forecasts. Plot the multistep forecasts and their corresponding bands for each specification, and provide comments

on your preferred model and the reasons behind your choice.

Step 2. Perform out-of-sample evaluations

In the second step, you will select the three best models from the in-sample assessment to use in the out-of-sample assessment. You will split the sample into two parts: the first 90% will serve as the estimation sample, and the remaining 10% will be the prediction sample. Let's describe the forecasting environment using the following settings:

1. Forecast Type: you will make multiple steps ahead forecasts, such as h = 4, where you predict the future value based on the current information.

2. Sampling Scheme: you will use the fixed sampling scheme, meaning that you will not modify the way the data is sampled.

3. Loss Function: To choose the optimal forecast, you will utilize the quadratic loss function and Mean Squared Error (MSE).

In addition to the three linear models obtained in step one, you will include a simpler forecast as a benchmark called the "simple average 4 naive model." This model does not require estimation. It simply calculates the forecasts as the average of the last four observations: $f_{t,1} = (y_t + y_{t-1} + y_{t-2} + y_{t-3})/4$. you will conduct forecast optimality tests (MPE and informational efficiency tests) for each model, calculate MSE, and summarize the results in a table.

Next, you will create combined forecasts from the top three to five models, including ARMA models and the simple average 4 naive model. You will use three linear combination schemes:

1. An equal-weighted forecast.

2. A forecast that weights each individual forecast by the inverse of its MSE.

3. An OLS weighted optimal forecast.

You will display the weights and MSE of these three combined forecasts in a table format, similar to Table 9.8 on page 246, and provide comments on which combination scheme we prefer.

Step 3. Create the final video of your project

In the final video, you put the two videos above together and create a complete video. You should provide a one-sentence summary of each group member's contributions to the project. Your submission should include

1. A video presentation in .mp4 format
2. presentation slides
3. R code
4. data file

Please name your video , Group <#> Final Project - Step3.

A note of reminder:

1. Do not use any functions in R such as decompose() to decompose the seriese for you.