Spring 2021 Time Series Final Exam

Instructions

- Keep your camera and microphone on.
- Answer all 5 questions.
- Answer each question on a separate page.
- It should not take more than one concisely written and well organized page to answer each question.
- Be neat and concise.
- Show your work where appropriate.
- State and defend any assumptions you make and explain your choices.
- Submit your work as a pdf to the canvas Final Exam assignment.

Background

Employees in the economic base produce output that is readily sold to those outside of the local area where it is produced. Service industries, for example brick and mortar retail establishments and restaurants, support the employees in the economic base. Construction, leisure and hospitality, and manufacturing are all part of Florida's economic base. Construction because serving in-migrant retirees need places to live and shop and pay for it with money earned outside of Florida. Leisure and hospitality because of tourists pay for those things with money not earned in the state. Manufacturing because manufactures produced in Florida may be readily transported anywhere. In the exam you will answer questions about modeling the relationship between these three sectors and total employment and questions about forecasting total employment.

Data

The first three questions refer to an analysis of monthly non-seasonally adjusted data for Florida from January 1990 thru March 2021. The data was obtained from the St. Louis Federal Reserve Economic Database. The following variables were used:

- *date*: Monthly date
- *Construct*: Number of construction employees in Florida
- *Leisure*: Number of leisure and hospitality employees in Florida
- *Manufacture*: Number of manufacturing employees in Florida
- *Total*: Total private employment in Florida

Stata Output

A file with Stata output to be used in answering most of the questions was posted with this exam. The output file comprises three sections:

- Part 1: Data Exploration, pages 1-3
- Part 2: FDL Model Estimates and Hypothesis Tests, pages 4-19
- Part 3: Part 3: Forecast Model Estimation, pages 20-32

Spring 2021 Time Series Final Exam

Question 1

What do you take away from Part 1 of the analysis that is important for modeling total employment? Explain how those conclusions relate to specific parts of the output.

Question 2

Both *Construct* and *Leisure* reflect service and base components, since workers in the base consume housing, places to shop, and leisure. You want to determine whether they are as impactful as *Manufacture* on total private employment. Part 2 of the Stata output presents results for eight different finite distributed lag models. Following each model are tests of the hypotheses that the total effects are equal between each pair of sectors.

2a. Which model is best for conducting these hypothesis tests? Explain why.

2b. For the model you chose, carefully and fully interpret the hypothesis test. What conclusion do you draw about the question of interest?

Question 3

Part 3 of the Stata output presents results for eight potential models for forecasting total employment. Though numbering restarts at Model 1, these models differ from the eight models in Part 2. Do not be confused by the numbering.

3a. All eight of these models use log variables. Why is that most natural here?

3b. Other than not being in log form, why are the models in Part 1 of the output unsuitable for forecasting?

3c. At the end of Part 2 of the output, there is a table of model evaluation measures. Why does it include the number of variables includes, the LOORMSE, and the AIC, and not measures like in sample RMSE or R^2?

3d. Which of the eight models seems best for forecasting total employment? Explain why.

Spring 2021 Time Series Final Exam

Questions 4 and 5 do not refer to the Stata output.

Question 4

Discuss the use of rolling windows estimation in forecasting. At minimum, address each of the following:

- ✧ What is a rolling windows forecast?
- ✧ Why is the RMSE from a rolling window estimation the most appropriate way to estimate forecast accuracy?
- ✧ What is the trade-off implicit in choosing window width?
- ✧ How does the rolling window estimation procedure determine the best window width?

Question 5

Suppose you have determined that the best model to forecast y one period ahead is:

$\Delta\ln(y) = 0.01 + 0.4\Delta\ln(y_{t-1}) - 0.2\Delta\ln(y_{t-2})$.

(Remember Δ means difference.) You estimate the rolling window RMSE is 0.05. The values of y at times (t) -2, -1, and 0 are given in the table to the right.

t	y	Forecast	2 Sigma Bound Upper	Lower
-2	245			
-1	207			
0	238			
1		263	291	238
2		269	310	233
3		269	320	226

5a. Show that the forecast for time t=1, made at time t=0, is 263, and that the ± 2 sigma bounds are 291 and 238 (as in the table).

5b. Show that the dynamic autoregressive forecast for time t=3, made at time t=0, is 269, and that the ± 2 sigma bounds are 320 and 226 (as in the table).

5c. Why is dynamic forecasting with an AR or ARMA model useful for forecasting several variables for many periods when the stakes are low, but generally not the best approach for forecasting a few variables at a few points in time when the stakes are high?