Problem Set 4

Due Wednesday February 5, 4pm

Data Exercises

(1) Extract data on the aggregate level of U.S. quarterly imports, seasonally adjusted, in real 2017 chained dollars, currently available for 1947Q1 through 2024Q4.[1] The FRED label is IMPGSC1. Create a time index.

(a) For the period $1947-2005$, plot the level of imports, and its natural log, against time.

(b) By inspection, determine if the imports series is better represented using a linear or exponential trend.

(c) Estimate an exponential trend model using the estimation period $1947-2005$. Report results.

(d) Generate point and 90% interval forecasts for the log-level of imports for 2006Q1-2024Q4. Plot the data (log-levels) up to 2005Q4 and your forecast for 2006Q1-2024Q4. Comment.

(e) Plot your forecasts against the actual data (log-levels) for 2006Q1-2024Q4. How did the forecast perform?

(f) Generate point and 90% interval forecasts for the level of imports for $2006-$ 2024Q4. Plot the data (levels) up to 2005Q4 and your forecast for 2006Q1-2024Q4. Comment.

(g) Plot your forecasts against the actual data for 2006Q1-2024Q4. How did the forecast perform?

(h) Now re-estimate using the full sample $1947-2024$Q4. Report results. Generate point and 90% interval forecasts for the level of imports for the next 16 quarters (4 years).

(i) Do the forecasts appear reliable or unreliable?

[1] In matlab you can do this via fred(...) and fetch(.,.) commands.

Theoretical Questions

(2) *Although this problem can be solved on a computer, try to solve it with a pen and paper (and maybe a calculator) to get a better feel for what is behind trend estimation.* Your friend has a knitting business and she want to estimate a linear trend model without an intercept for her annual profit. She has five years of data:

Time	Profit
2020	300
2021	350
2022	630
2023	780
2024	1020

(a) Estimate a model

$$y_t = \beta \cdot t + \varepsilon_t,\ t = 1, \ldots, 5$$

by minimizing the sum of squared residuals (i.e., by OLS) based on observed data.

(b) Make a 5-year-ahead point forecast of your friend's profit.

(3) In the trend model

$$y_t = T_t + \varepsilon_t, \quad T_t = \beta_0 + \beta_1 Time_t$$

suppose $\beta_1 > 0$.

(a) Does this mean that the series y_t is expected to grow or decline in subsequent periods?

(b) Does this mean that the series y_t will grow with certainty in every period?