Homework 9

Eco 5316 Time Series Econometrics
Spring 2018
Due: Sunday, May 5, 11.55pm

Solve at least one of the following problems.

Problem 1

Obtain monthly data for Consumer Price Index for All Urban Consumers: All Items Less Food and Energy, Not Seasonally Adjusted, from 1960M1 to 2018M3, available on FRED under `CPILFENS` and on Quandl under `FRED/CPILFENS`. Use it to construct the time series for month-over-month inflation rate, $y_t = 100\Delta \log CPI_t$.

(a) Plot the time series for inflation y_t.
(b) Set up and estimate local level model with seasonal component, using sample 1960M1-2015M12

$$\begin{aligned} y_t &= \mu_t + \gamma_t + \varepsilon_t & \varepsilon_t &\sim N(0, \sigma_\varepsilon^2) \\ \mu_{t+1} &= \mu_t + \zeta_t & \zeta_t &\sim N(0, \sigma_\zeta^2) \\ (1 + B + B^2 + \ldots + B^{11})\gamma_{t+1} &= \omega_t & \omega_t &\sim N(0, \sigma_\omega^2) \end{aligned}$$

(c) Plot the smoothed level and smoothed seasonal components $\mu_{t|T}$ and $\gamma_{t|T}$ together with their 90% confidence intervals. Plot the smoothed irregular component $\varepsilon_{t|T}$.
(d) Create a 36 period ahead forecast i.e. a forecast for period 2016M1-2018M12. Plot the forecast together with 90% confidence intervals and actual data for the period 2014M1-2018M3.
(e) Bonus: Create a sequence of 1 step ahead forecasts for period 2016M1-2018M4. Plot the forecast together with 90% confidence intervals and actual data for the period 2014M1-2018M3.

Problem 2

(a) Use `tq_get` with `get = "economic.data"` option to obtain the monthly time series for the annualized 3 month Treasury bill rate `TB3MS` for the period 1980M1-2017M12 from FRED. Then, use `tq_get` with `get = "stock.prices"` to obtain the data for adjusted closing value of S&P 500 Index `^GSPC` and the adjusted closing for the IBM stock price `IBM` for the period 1980-01-01 to 2017-12-31 from Yahoo Finance. Construct the monthly average values of the closing price of S&P 500 Index and the IBM stock price.

(b) Construct the time series for monthly excess returns for S&P 500 index $er_t^{SP500} = r_t^{SP500} - r^{TB3MS}$ and IBM stock price $er_t^{IBM} = r_t^{IBM} - r^{TB3MS}$, where $r_t^{SP500} = 100\Delta \log SP500_t$, $r_t^{IBM} = 100\Delta \log IBM_t$ and $r^{TB3MS} = TB3MS_t/12$.

(c) Estimate a simple OLS relating excess returns for IBM and excess returns for S&P 500

$$er_t^{IBM} = \alpha + \beta er_t^{SP500} + \varepsilon_t$$

to obtain the coefficient α and β of a security characteristic line.

(d) Estimate a CAPM model with time-varying coefficients with time varying coefficient α_t and β_t using Kalman filter. Create a plot showing how the smoothed states α_t and β_t changed over time.

(e) Compare α and β from (b) with α_t and β_t from (c).