Time Series Lab 2

1. MA processes.

(1) Simulate the following MA(1) processes,

$$X_t = \varepsilon_t + \beta\varepsilon_{t-1}, \ t = 1, 2, \ldots, n.$$

Let ε_t be i.i.d. $N(0,1)$. Set n=100, and try $\beta = 0.5$ and 1.5. Plot these processes.

(2) Estimate the above processes using conditional MLE.

(3) Estimate the above processes using exact MLE.

2. ARMA processes.

(1) Simulate the following ARMA(1,1) processes,

$$X_t = \alpha X_{t-1} + \varepsilon_t + \beta\varepsilon_{t-1}, \ t = 1, 2, \ldots, n.$$

Let ε_t be i.i.d. $N(0,1)$. Set n=100, $\beta = 0.5$, and $\alpha = 0.4$ and 0.95. Plot these processes.

(2) Estimate the above processes using conditional MLE.

3. Forecasting CPI. (Data file: cpi.xls, which contains monthly Chinese CPI and PPI year-to-year (y2y) changes.)

(1) First difference the y2y CPI data, and try to find an appropriate model for the differenced data.

(2) Make rolling one-step-ahead forecasts based on your model and compare your results with true values (You may set $n_0 = 80$, use $\{X_1, \ldots, X_{n_0}\}$ to forecast X_{n_0+1}, then use $\{X_1, \ldots, X_{n_0+1}\}$ to forecast X_{n_0+2}, and so on.). Also, compare your forecasts with those based on the random walk model.

(3) Make a set of m-step-ahead forecasts, $m \in \{1, 2, \ldots, 12\}$, based on data up to Dec 2010, and compare your results with true values.

(4) (Optional) Construct a confidence band of the CPI y2y changes in 2011 based on data up to Dec 2010. Plot the confidence band along with the above multi-period forecasts.