Problem set 2
607: Applied Macroeconometrics
Fall 2016
Jon Faust

The following is due at the beginning of next class. You can turn in any paper in my mailbox or in class; email me and requested computer work. You may work in groups; hand in a single submission for the group. The submission should list those who contributed.

1. Review. Define...
   (a) Delta method
   (b) Likelihood ratio test
   (c) Two stage least squares estimator (just give formula)

2. Suppose data are generated by,

$$\begin{aligned} w_t &= \rho w_{t-1} + \varepsilon_t \\ x_t &= \nu_t \\ y_t &= w_t + x_t \end{aligned}$$

   where ν_t and ε_t are mutually orthogonal, not serially correlated, have mean zero and constant variance σ_ν^2 and σ_ε^2.
   (a) What is the autocorrelation function for w?
   (b) What is the autocorrelation function for y?
   (c) Suppose $\rho = 1$. The process for $z_t = y_t - y_{t-1}$ is an ARMA(p, q), where p is the order of the AR part and q is the order of the the MA part. What are p and q?

3. Suppose that income follows the process

$$y_t = A(L)\varepsilon_t$$

$$A(L) = \sum_{i=0}^{\infty} a_i L^i, \quad a_0 = 1$$

(a) What is the variance of income?

(b) What effect does a shock, an ε, have on the level of income in the long-run?

(c) Suppose we receive a shock $\varepsilon_t = 3000$. Give a simple expression for the change in the present value of income at t using the discount factor β to discount future income.

(d) Suppose instead that

$$(1 - L)y_t = B(L)\varepsilon_t$$

where $B(1) \neq 0$. In this process, what is the long-run effect of a shock on the level of income?

4. Variance-covariance matrices. In this problem, we have a vector, Y, $(T \times 1)$. $EY = 0$, $EYY' = \Omega$, $Y = (y_1, \ldots, y_T)'$.

(a) Show that the variance of the sample mean is the average value of all elements in Ω.

(b) Suppose that the ys form a Martingale Difference Sequence. What is the structure of Ω. Give an expression for the average element.

(c) Suppose in addition that the ys are covariance stationary. What is the structure of Ω. Give an expression for the average element.

(d) Suppose that we drop the MDS assumption, but maintain covariance stationarity. What is the structure of Ω. Give an expression for the average element.

(e) The ys are covariance stationary. Show that the sample mean can be computed as $\hat{\beta}$ from an OLS regression on a constant. Is OLS an efficient estimator for the population mean?

5. Many macroeconomic data series are heavily revised after they are first released. Series such as GDP are never 'final' and continue to be revised indefinitely.

(Note: For this problem you might want consult, News and Noise in G-7 GDP Announcements, Faust, Rogers, Wright Journal of Money, Credit and Banking, Vol. 37, No. 3 (Jun., 2005), pp. 403-419 http://www.jstor.org/stable/3839161

(a) About how many months following the end of a quarter is GDP growth for that quarter first announced in the United States? In the Euro area? In China?

(b) The Philadelphia Fed's website has a link for downloading the U.S. real GDP (or GNP) data series as it stood in each month since 1965.

Site: http://www.philadelphiafed.org/research-and-data/real-time-center/real-time-data/data-files/ROUTPUT/

Data: http://www.philadelphiafed.org/research-and-data/real-time-center/real-time-data/data-files/ROUTPUT/ROUTPUTQvQd.xls

Note: In the file, the date at the head of the column indicates the date of the data vintage (the date when the data in the column were current). As you look from left to right on any row you see the history of revision for of the data for the quarter whose date is in col. 1.

Plot the history of the revisions to the growth rate for 1957Q3, 1973Q4, and 1997Q2.

(Note: vertical axis is growth rate for the stated quarter, horizontal axis is the date of the data vintage.)

(c) What was the standard deviation of annualized quarterly GDP growth from 1954:1-1959:1 as measured in the 1965Q4 vintage? And in the 1989Q4 vintage? And in the most recent vintage in the file?