14.462: Problem Set #1

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Consider a small economy which experiences a non-technological shock ε_{dt}, a technological shock ε_{st}, and a terms of trade shock $\varepsilon_{\tau t}$. Terms of trade is independent of demand and supply shocks. Let ΔY_t, u_t, and τ_t represent output growth, unemployment, and terms of trade, respectively.

The true model is :

$$\begin{bmatrix} \Delta Y_t \\ u_t \\ \tau_t \end{bmatrix} = \begin{bmatrix} a_{11}(L) & a_{12}(L) & a_{13}(L) \\ a_{21}(L) & a_{22}(L) & a_{23}(L) \\ 0 & 0 & a_{33}(L) \end{bmatrix} \begin{bmatrix} \varepsilon_{dt} \\ \varepsilon_{st} \\ \varepsilon_{\tau t} \end{bmatrix}. \tag{1}$$

Let $\varepsilon = \begin{bmatrix} \varepsilon_{dt} \\ \varepsilon_{st} \\ \varepsilon_{\tau t} \end{bmatrix}$ and assume that $\mathbf{E}\varepsilon_t\varepsilon_t' = I$ and that the ε_t's are serially uncorrelated. The VAR(p) representation of the system is

$$\begin{bmatrix} \Delta Y_t \\ u_t \\ \tau_t \end{bmatrix} = \begin{bmatrix} c_{11}(L) & c_{12}(L) & c_{13}(L) \\ c_{21}(L) & c_{22}(L) & c_{23}(L) \\ c_{31}(L) & c_{32}(L) & c_{33}(L) \end{bmatrix} \begin{bmatrix} \Delta Y_{t-1} \\ u_{t-1} \\ \tau_{t-1} \end{bmatrix} + \begin{bmatrix} \eta_{1t} \\ \eta_{2t} \\ \eta_{3t} \end{bmatrix}. \tag{2}$$

(a) Write the equation relating the ε_t's to the η_t's.

(b) Can we identify the terms of trade shock $\varepsilon_{\tau t}$ and its dynamic effect on terms of trade, output, and unemployment?

(c) Download the Chilean data on copper price, output, and unemployment from the course webpage. Construct the variables most closely to the variables in the model. Plot them. Do they look stationary? Do they exhibit seasonality? If so, remove it. Then, implement part (b) and plot the impulse responses. Do the results make sense?

(d) If, in the estimation above you assumed that $c_{31}(L) = c_{32}(L) = 0$, then test this restriction by allowing $c_{31}(L)$ and $c_{32}(L)$ to be non-zero and perform an F-test. What do you conclude?

(e) Suppose we want to identify and trace the effects of the two remaining shocks. How can we do it? Suggest plausible, or less plausible, identification restrictions (short run, inequality constraints, long run restrictions). Choose one, and characterize the effects of the two shocks. Do the results make sense?

(f) If you had time, how would you extend the exercise? More time dimension? More shocks?