Tutorial Exercises – Week 11

Question 1 (Textbook 10.2):

Let $gGDP_t$ denote the annual percentage change in gross domestic product and let $int_t$ denote a short-term interest rate. Suppose that $gGDP_t$ is related to interest rates by

$$gGDP_t = \alpha_0 + \delta_0 int_t + \delta_1 int_{t-1} + \epsilon_t$$

where $\epsilon_t$ is uncorrelated with $int_t$, $int_{t-1}$, and all other past values of interest rates. Suppose that the Federal Reserve follows the policy rule:

$$int_t = \gamma_0 + \gamma_1 (gGDP_{t-1} - 3) + \nu_t$$

where $\gamma_1 > 0$. (When last year’s GDP growth is above 3%, the Fed increases interest rates to prevent an “overheated” economy.) If $\nu_t$ is uncorrelated with all past values of $int_t$ and $\epsilon_t$, argue that $int_t$ must be correlated with $int_{t-1}$. (Hint: Lag the first equation for one time period and substitute for $gGDP_{t-1}$ in the second equation.) Which Gauss-Markov assumption does this violate?

Question 2 (Textbook 11.5):

For the U.S. economy, let $gprice$ denote the monthly growth in the overall price level and let $gwage$ be the monthly growth in hourly wages. [These are both obtained as differences of logarithms: $gprice = \Delta \log \text{(price)}$ and $gwage = \Delta \log \text{(wage)}$.] Using the monthly data in WAGEPRC.RAW, we estimate the following distributed lag model:

$$gprice = -0.00093 + 0.119 gwage + 0.097 gwage_{t-1} + 0.04 gwage_{t-2} + 0.038 gwage_{t-3} + 0.081 gwage_{t-4} + 0.107 gwage_{t-5} + 0.095 gwage_{t-6} + 0.104 gwage_{t-7} + 0.103 gwage_{t-8} + 0.159 gwage_{t-9} + 0.11 gwage_{t-10} + 0.09 gwage_{t-11} + 0.016 gwage_{t-12} + 0.03 gwage_{t-13} + 0.03 gwage_{t-14} + 0.03 gwage_{t-15} + 0.03 gwage_{t-16} + 0.03 gwage_{t-17} + 0.03 gwage_{t-18} + 0.03 gwage_{t-19} + 0.03 gwage_{t-20} + 0.03 gwage_{t-21} + 0.03 gwage_{t-22} + 0.03 gwage_{t-23} + 0.03 gwage_{t-24} + 0.03 gwage_{t-25} + 0.03 gwage_{t-26} + 0.03 gwage_{t-27}$$

$$n = 273, R^2 = 0.317, \bar{R}^2 = 0.283$$
(i) Given the lag plot below, for which lags are the $t$ statistics less than two?
(ii) What is the estimated long-run propensity? Is it much different than one? Explain what the LRP tells us in this example.

![Lag Plot Graph](image)

**Question 3 (Textbook C10.3):**

Based on the example 10.9 on page 366, the estimated model is given as

$$
\log (\text{prepop}_{it}) = -8.70 - 0.169 \log (\text{minc}_{it}) + 1.06 \log (\text{usgnp}_{it}) - 0.032 t
$$

$$(1.30) (0.044) \quad (0.18) \quad (0.005)$$

$n = 38, \ R^2 = 0.847, \ \bar{R}^2 = 0.834$

When we add the variable $\log (\text{prgnp})$ to the minimum wage equation above, the estimated regression model becomes

$$
\log (\text{prepop}_{it}) = -6.66 - .212 \log (\text{minc}_{it}) + .486 \log (\text{usgnp}_{it}) + .285 \log (\text{prgnp}_{it}) - .027 t
$$

$$(1.26) \quad (0.040) \quad (.222) \quad (.080) \quad (0.005)$$

$n = 38, \ R^2 = .889, \ \bar{R}^2 = .876.$

Is this variable significant? Interpret the coefficient. How does adding $\log (\text{prgnp})$ affect the estimated minimum wage effect?