Economics 311 — Fall 2017
Daily Problem #15 — October 27

Consider the "first-order autoregressive" error process $\varepsilon_t = \rho\varepsilon_{t-1} + u_t$, where u_t is a serially-uncorrelated process with mean zero (white noise) and $-1 < \rho < 1$.

Suppose that our regression is $Y_t = \beta_0 + \beta_1 X_t + \varepsilon_t$.

a. Assume first that we know the value of ρ. Show that the regression $Y_t^* = \beta_0^* + \beta_1 X_t^* + \varepsilon_t^*$ has no serial correlation if

$$Y_t^* \equiv Y_t - \rho Y_{t-1}$$
$$X_t^* \equiv X_t - \rho X_{t-1}$$
$$\beta_0^* \equiv \beta_0 (1-\rho).$$

b. Assuming the absence of regression pathologies other than autocorrelation, is the slope estimator from an OLS regression in part a with the starred variables better than OLS using Y and X? How do you know?

c. If we don't know ρ, how might we try to estimate it?