ECON 4230 Intermediate Econometric Theory

1 Autocorrelation

What is autocorrelation (AC)?

- Autocorrelation (or serial correlation) refers to correlation across error terms
  - $E(u_i u_j) = cov(u_i, u_j) \neq 0$
  - Draw figure of PRF and autocorrelated errors
  - AC more common with time series data
  - Typically AC is positive; negative AC is rare
  - Example: Keynesian consumption function

OLS estimation in the presence of AC

- $Y_t = \beta_1 + \beta_2 X_t + u_t$
- $\hat{\beta}_2 = \sum_t x_t y_t / \sum_t x_t^2$
- $\hat{\beta}_2$ is still linear and unbiased
- $var(\hat{\beta}_2)$ is not smallest $\Longrightarrow$ $\hat{\beta}_2$ is not efficient
  - To make matters worse, OLS standard errors in STATA are incorrect
  - Solution: OLS with Newey-West (robust) standard errors
- Draw figure of sampling distributions

Generalized Least Squares (GLS)

- GLS estimators transform the data so the classical assumptions hold
- Let $u_t = \rho u_{t-1} + \varepsilon_t$, an AR(1) process
- $Y_t^* = \beta_1^* + \beta_2 X_t^* + u_t^*$, where $Y_t^* = Y_t - \rho Y_{t-1}; \beta_1^* = \beta_1(1-\rho); X_t^* = X_t - \rho X_{t-1}; u_t^* = u_t - \rho u_{t-1} = \varepsilon_t$
- Issues:
  - Lose one observation
  - Need to estimate ρ
- GLS estimator is B.L.U.E.

Detection of AC

- Graphical method
- Test of runs
- Durbin-Watson test
- Breusch-Godfrey test

Solutions

- GLS
- OLS with robust standard errors
- Transform to growth rates
- Add lag-dependent variables

Application: Phillips Curve