Simplified Exposition Bias if LDV w/Corr Errs

$$Y_t = X_t\beta + \gamma Y_{t-1} + \varepsilon_t$$

$$\varepsilon_t = \rho\varepsilon_{t-1} + \omega_t$$

$$Cov(Y_{t-1}, \varepsilon_t) = Cov(Y_{t-1}, \rho\varepsilon_{t-1} + \omega_t)$$

$$= Cov(X_{t-1}\beta + \underline{\gamma Y_{t-2}} + \underline{\varepsilon_{t-1}}, \underline{\rho}\,\underline{\varepsilon_{t-1}} + \omega_t)$$

$$= \rho Cov(\varepsilon_{t-1}, \varepsilon_{t-1}) + \rho\gamma Cov(Y_{t-2}, \varepsilon_{t-1})$$

$$Cov(Y_{t-1}, \varepsilon_t) = \rho\frac{\sigma_\omega^2}{1-\rho^2} + \rho\gamma Cov(Y_{t-1}, \varepsilon_t)$$

$$\Rightarrow (1-\rho\gamma)Cov(Y_{t-1}, \varepsilon_t) = \rho\frac{\sigma_\omega^2}{1-\rho^2}$$

$$\Rightarrow Cov(Y_{t-1}, \varepsilon_t) = \frac{\rho\sigma_\omega^2}{(1-\rho^2)(1-\rho\gamma)} \neq 0$$

UNLESS $\rho = 0$