

Economics 312

Daily Problem #33

Spring 2020
April 13

At the beginning of the course, we discussed how OLS estimators can be derived using the method of moments. We now return to this analysis to examine that case of endogenous regressors.

1. In the basic linear regression model, $y_i = \beta_0 + \beta_1 x_i + u_i$, we assume that $E(u_i | x) = 0$, which implies both that $E(u_i) = 0$ and that $E(u_i x_i) = 0$. These are population moment conditions. Explain the logic of the following corresponding sample moment conditions:

- $\frac{1}{n} \sum_{i=1}^n (y_i - \hat{\beta}_0 - \hat{\beta}_1 x_i) = 0$
- $\frac{1}{n} \sum_{i=1}^n (y_i - \hat{\beta}_0 - \hat{\beta}_1 x_i) x_i = 0$

2. We use these two equations to solve for the OLS estimators $\hat{\beta}_0$ and $\hat{\beta}_1$. Explain why these OLS estimators are inappropriate if the assumption $E(u_i x_i) = 0$ fails to hold.

3. The instrumental-variables (IV) estimator is computed from

- $\frac{1}{n} \sum_{i=1}^n (y_i - \hat{\beta}_0^{IV} - \hat{\beta}_1^{IV} x_i) = 0$
- $\frac{1}{n} \sum_{i=1}^n (y_i - \hat{\beta}_0^{IV} - \hat{\beta}_1^{IV} x_i) z_i = 0$

where z is an “instrument” with the properties that $E(z_i u_i) = 0$ and $E(z_i x_i) \neq 0$. Why is this the second equation an appropriate moment condition to use for estimation?