

Consider the model:

$$y_{it} = \beta x_{it} + u_{it}, \quad i = 1, \dots, n, \quad t = 1, \dots, T. \quad (1)$$

x can be defined as strictly exogenous if

$$E(u_{it} | x_{i1}, \dots, x_{iT}) = 0, \quad (2)$$

x can be defined as weakly exogenous if

$$E(u_{it} | x_{i1}, \dots, x_{it}) = 0, \quad (3)$$

x can be defined as endogenous if neither (2) nor (3) is true, i.e.

$$E(u_{it} | x_{it}) \neq 0.$$

Notice that (2) implies also that $\text{cov}(x_{is}, u_{it}) = 0$ for all s and t , while (3) implies also that $\text{cov}(x_{is}, u_{it}) = 0$ for $s \leq t$.

As an example, suppose that y_{it} is consumption of individual i at time t and x is income. We live in period t . Suppose that individual i gets news that his income the next time period ($t + 1$) is going to increase because the individual will be promoted. This means that perhaps individual i is going to consume more than what his current income at time t , times the coefficient β , dictates. That is, if you know you will have a higher income next year, you might consume more this year based on the fact that you can borrow more etc. But this would mean that u_{it} would be positive (anything that is not explained by x_{it} is attributed to the error term.). Now at period $t + 1$ x increases (because i gets the promotion). This effectively means that $\text{cov}(x_{it+1}, u_{it}) > 0$, and therefore (2) is violated but not necessarily (3).

Typically, under (2) standard least-squares estimators are unbiased and consistent, under (3) they are only consistent and if the regressors are endogenous then least-squares are both biased and inconsistent.