True: $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + u$

wage — educ. — IQ

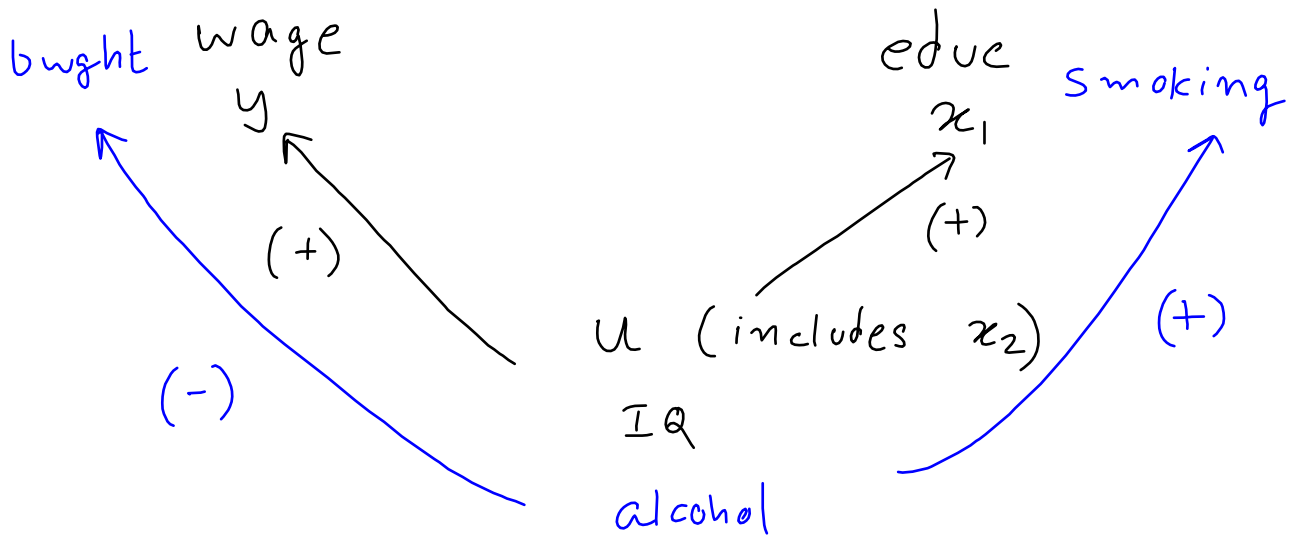
bwght — smoking — alcohol

Estimate: $y = \beta_0 + \beta_1 x_1 + v$

obtain: $\tilde{\beta}_0$ and $\tilde{\beta}_1$ $\rightarrow$ biased

$$E(\tilde{\beta}_j) \neq \beta_j \quad j = 0, 1$$

Bias depends on β_2 and corr. b/w x_2 (omitted) and x_1 (included).



No bias if

$\beta_2 = 0$ or

x_2 uncorr. w/ x_1

More complicated derivation of bias with addl. explanatory vars.

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + u$$

FDI — x_1: env. reg. — x_2: input prices — x_3: infrastructure — u: political activism

if x_1 corr. w/ u

x_2, x_3 not " " u

OLS estimator biased for all β's if x_1 corr. w/ x_2 and x_3.

Other sources of bias

Measurement error in x or y.

(e.g. crime, distance, ...)

simultaneity

$$x \rightleftarrows y$$

police crime

Sample selection

data observed if $y \geq$ threshold

(e.g. trade)

Inclusion of irrelevant regressors:

– exercise caution

e.g. y	x
# accidents	alcohol laws, " consumption, ...
wage	educ., occupation, discrimination