6.0 The Direction of Omitted Variable Bias

For each of the following regressions, use your background knowledge to estimate whether omitted variable bias will drive your slope coefficient towards zero or away from zero.

6.1 Regression: grade $= \beta_0 + \beta_1$ attendance $+ u$ ~~grade = β0 + β1 attendance + u~~, omitted: time_studying ~~time_studying~~

> First we write down both equations
> $$grade = \beta_0 + \beta_1 * attendance + \beta_2 * time\_studying + u$$
> ~~grade = β0 + β1 attendance + β2 time_studying + u~~
> $$time\_studying = \alpha_0 + \alpha_1 * attendance + u$$
> ~~time_studying = α0 + α1 attendance + u~~

> If $\beta_2 > 0$ ~~β2>0~~ and $\alpha_1 > 0$ ~~α1>0~~ then OMV B $= \beta_2\alpha_1 > 0$ ~~OMVB=β2α1>0~~ and if $\beta_1 > 0$ ~~β1>0~~ then the OLS coefficient on attendance ~~attendance~~ will be scaled away from zero (more positive) gaining statistical significance.

6.2 Regression: lifespan $= \beta_0 + \beta_1$ cigarettes $+ u$ ~~lifespan = β0 + β1 cigarettes + u~~, omitted: exercise ~~exercise~~

> First we write down both equations
> $$lifespan = \beta_0 + \beta_1 * cigarettes + \beta_2 * exercise + u$$
> ~~lifespan = β0 + β1 cigarettes + β2 exercise + u~~
> $$exercise = \alpha_0 + \alpha_1 * cigarettes + u$$
> ~~exercise = α0 + α1 cigarettes + u~~

> If $\beta_2 > 0$ ~~β2>0~~ and $\alpha_1 < 0$ ~~α1<0~~ then OMV B $= \beta_2\alpha_1 < 0$ ~~OMVB=β2α1<0~~ and if $\beta_1 < 0$ ~~β1<0~~ then the OLS coefficient on cigarettes ~~cigarettes~~ will be scaled away from zero (more negative) gaining statistical significance.

6.3 Regression: $lifespan = \beta_0 + \beta_1 cigarettes + u$, omitted: time_socializing

> **Both equations**
> $$lifespan = \beta_0 + \beta_1 * cigarettes + \beta_2 * time\_socializing + u$$
> $$time\_socializing = \alpha_0 + \alpha_1 * cigarettes + u$$

> If $\beta_2 > 0$ and $\alpha_1 > 0$ then OMV B $= \beta_2\alpha_1 > 0$ and if $\beta_1 < 0$ then the OLS coefficient on cigarettes will be scaled toward zero (less negative) losing statistical significance.

6.4 Regression: $wage = \beta_0 + \beta_1 grad\_education + u$, omitted: experience

> **Both Equations**
> $$wage = \beta_0 + \beta_1 * grad\_education + \beta_2 * experience + u$$
> $$experience = \alpha_0 + \alpha_1 * grad\_education + u$$

> If $\beta_2 > 0$ and $\alpha_1 < 0$ then OMV B $= \beta_2\alpha_1 < 0$ and if $\beta_1 > 0$ then the OLS coefficient on attendance will be scaled toward zero (less positive) losing statistical significance.

6.5 Regression: $wage = \beta_0 + \beta_1 grad\_education + u$, omitted: desire to effect social_good

Both equations
$$wage = \beta_0 + \beta_1 * grad\_education + \beta_2 * social\_good + u$$
$$social\_good = \alpha_0 + \alpha_1 * grad\_education + u$$

If $\beta_2 < 0$ and $\alpha_1 > 0$ then OMV $B = \beta_2\alpha_1 < 0$ and if $\beta_1 > 0$ then the OLS coefficient on grad_education will be scaled toward zero (less positive) losing statistical significance.