Unbiased Estimation

Recall from last class that:

$$\hat{\beta}_2 = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sum(x_i - \bar{x})^2}$$

It can further be shown that

$$\hat{\beta}_2 = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sum(x_i - \bar{x})^2} = \beta_2 + \sum a_i u_i,$$

where $u_i = \frac{x_i - \bar{x}}{\sum(x_i - \bar{x})^2}$

Thus, under the **zero conditional mean assumption**
$E(\hat{\beta}_2 | x_1, x_2, ...) = \beta_2 + \sum a_i E(u_i | x_1, x_2, ...) = \beta_2$