

## POPULATION

$$E[Y|X=x]$$

Think: what is the distribution for only a segment of the population with a given characteristic?

## SAMPLE ESTIMATE<sup>2</sup>

Depends on assumptions, but if simple OLS assumptions,  
 $\hat{\beta}_0 + \hat{\beta}_1 x$

Some rules regarding these:

$$\text{Var}(X+a) = \text{Var}(X)$$

$$\text{Var}(bX) = b^2 \text{Var}(X)$$

$$\text{Cov}(aX+b, Y) = a \text{Cov}(X, Y)$$

$$\text{Corr}(aX+b, Y) = \text{sign}(a) \text{Corr}(X, Y)$$

$$\text{Var}(X+Y) = \text{Var}(X) + \text{Var}(Y) + 2 \text{Cov}(X, Y)$$

$$\text{Var}(X-Y) = \text{Var}(X) + \text{Var}(Y) - 2 \text{Cov}(X, Y)$$

$$E[aX] = a E[X]$$

$$E[X+b] = E[X] + b$$

\* Law of Iterated Expectations:

$$E[Y] = E_x[E[Y|X]]$$

Thinking about this expression:

What is the inside expectation?