Week 10 Monday Worksheet

Valentino Aceves

June 3, 2024

Nonlinear Relationships

Polynomial

$$Y = \beta_0 + \beta_1 X + \beta_2 X^2$$

$$\frac{\partial E[Y|X]}{\partial X}|_{X=x} = \beta_1 + 2\beta_2 x$$

Log

Case	Regression Specification	Interpretation of β_1
I	$Y_i = \beta_0 + \beta_1 \ln(X_i) + u_i$	A 1% change in X is associated with a change in Y of $0.01\beta_1$.
II	$\ln(Y_i) = \beta_0 + \beta_1 X_i + u_i$	A change in X by one unit ($\Delta X = 1$) is associated with a $100\beta_1$% change in Y.
III	$\ln(Y_i) = \beta_0 + \beta_1 \ln(X_i) + u_i$	A 1% change in X is associated with a β_1% change in Y, so β_1 is the elasticity of Y with respect to X.

Interaction

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 (X_1 \times X_2)$$

$$\frac{\partial E[Y|X_1, X_2]}{\partial X_1}|_{X_1=x_1, X_2=x_2} = \beta_1 + \beta_3 x_2$$

Example

$$\text{wage} = 10 + \text{exp} + 2\text{exp}^2 + 3\text{male} + 4(\text{exp} \times \text{male}) + 5\log(\text{edu})$$

1) Find and interpret the partial derivative for experience, education, and gender.

2) What is the effect of gender when you have 5 years of experience?

3) What is the marginal effect of 10 years of experience when you are male compared to being female?

4) What is the difference in wage between males and females with 10 years of experience?

5) What is the effect of an increase in education?