EDUR 8131
Chat 10

Notes 8b Multiple Regression

1. Regression Equation

New components due to use of ***multiple*** regression, rather than ***simple*** regression, in green

Y = b0 + b1 X1 + b2 X2 + e
Y' = b0 + b1 X1 + b2 X2 (prediction equation, used to obtain predicted value of Y)

b0 = predicted value of Y when both X1 and X2 take the value of 0.00

b1 = indicates how much mean change in Y is expected for a 1 unit change in X1, controlling for X2

b2 = indicates how much mean change in Y is expected for a 1 unit change in X2, controlling for X1

e = error or residual term – deviation between Y and Y', i.e., Y-Y'

Y' = predicted Y using the regression equation

2. Literal Interpretation of Coefficients and Predicted Values

b0 = predicted value of Y when X1 = 0.00 and X2 = 0.00

b1 = for each 1 unit increase in X1, the mean of Y is expected to change by b1 controlling for X2

b2 = for each 1 unit increase in X2, the mean of Y is expected to change by b2 controlling for X1

Examples

(a) X and Y Interpretation

b0 = 9.00
b1 = -0.33
b2 = 1.45

Prediction Equation

Y' = b0 + b1 X1 + b2 X2
Y' = 9.00 + -0.33 (X1) + 1.45 (X2)

Interpretation of Coefficients

b0 = 9.00: Y is expected to be 9.00 when both X1 and X2 are 0.00
b1 = -0.33: for each 1 point increase in X1, Y is expected to change by -.33 controlling for X2
b2 = 1.45: for each 1 point increase in X2, Y is expected to change by 1.45 controlling for X1

(b) Math Achievement and Test Anxiety and Hours Studied

IV 1 = Test Anxiety

IV 2 = Hours Studied

DV = Math Achievement

Prediction Equation

Math Achievement' = b0 + b1 (Test Anxiety) + b2 (Hours Studied)

Math Achievement' = 9.00 + -0.33 (Test Anxiety) + 1.45 (Hours Studied)

Literal Interpretation of Coefficients

b0 = 9.00:

when both test anxiety and hours studied are 0.00, math achievement is expected to be 9.00

b1 = -0.33 (test anxiety):

for each 1 point increase in test anxiety, math achievement changes by -.33 controlling for hours studied

b2 = 1.45 (hours studied):

for each 1 hour increase in study time (hours studied), math achievement is expected to change (increase) by 1.45 controlling for test anxiety

Another example for interpretation of coefficients

DV = money earned
IV = hours worked per week

Money earned' = b0 + b1(hours worked)

Coefficient values
b0 = $0.00
b1 = $10

Money earned' = b0 + b1(hours worked)
Money earned' = $0.00 + $10(hours worked)

Literal Interpretation
b0 = if you don't work any hours, you money earned would be $0.00 (no work, no pay)

b1 = for each additional hour worked, money earned increases by $10

Predicted Values

If Test Anxiety is 12 and Hours Studied = 3.5, what is the predicted value of Math Achievement?

Math' = 9.00 + -0.33 (Test Anxiety) + 1.45 (Hours Studied)

Math' = 9.00 + -0.33 (12) + 1.45 (3.5)

= 9.00 + (-3.96) + (5.075)
= 10.115

If Test Anxiety is 5 and Hours Studied is 6.3, what is the predicted value of Math Achievement?

Math' = 9.00 + -0.33 (Test Anxiety) + 1.45 (Hours Studied)
Math' = 9.00 + -0.33 (5) + 1.45 (6.3)
= 9.00 + (-1.65) + (9.135)
= 16.485

3. Predicted Values vs. Expected Change

Predicted values obtained from prediction equation:

Prediction Equation
Math' = b0 + b1 (Test Anxiety) + b2 (Hours Studied)
Math' = 9.00 + -0.33 (Test Anxiety) + 1.45 (Hours Studied)

Example:
See examples above

Expected change is obtained from the slope coefficient:

Expected change in Y = (b1) (Change in Test Anxiety)

Examples

What change is expected in math achievement for someone who has anxiety level that increases by 3 points (controlling for hours studied)?

Expected Change = -.33 (change in anxiety)
-.33 (+3)
= -.99 point change in math achievement

What change would be expected in math achievement for someone who studies an additional 6 hours (controlling for test anxiety)?

Expected Change = 1.45 (change in Hours Studied)
1.45 (6)
= 8.7 point increase in math achievement

4. Obtaining Regression Estimates

See chat notes 11 for continuation of Multiple Regression.