NOVA SOUTHEASTERN UNIVERSITY
Abraham S. Fischler School of Education

Module 8: Linear Regression

The Applied Research Center

Module 8 Overview

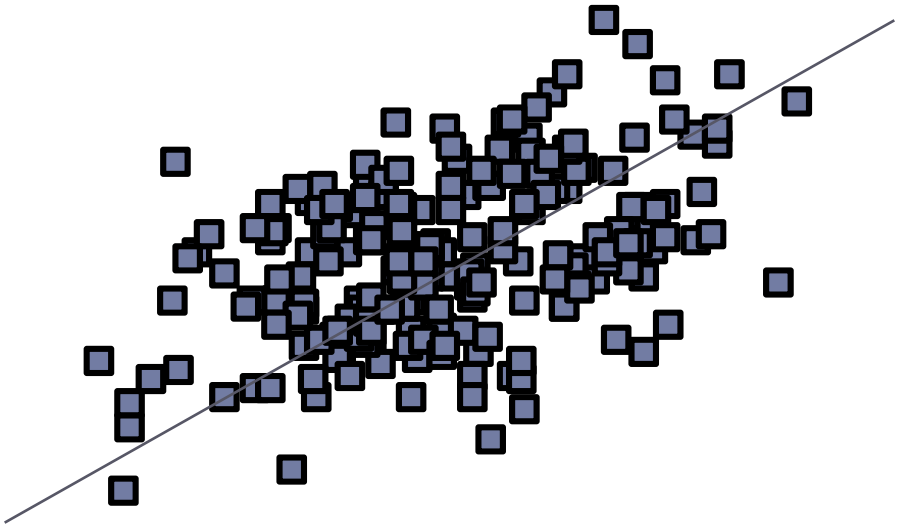
- Purpose of Linear Regression
- Scatter Diagrams
- Regression Equation
- Regression Results
- Example

Purpose

- To **predict** scores on one variable based on information regarding the other variables.
- OR
- To **explain** why the participants scored differently on a particular variable of interest.

Scatter Diagrams

- Regression can best be understood by examining a scatter diagram, which includes the data points and a line of best fit.



Regression Equation

- The slanted line passing through the data points of a scatter diagram is the **regression line or line of best fit,** which is used to make predictions.
- The **regression equation** is the technical way of describing the regression line.
  - $Y' = a + bX$
    - Y' is the predicted score for the dependent variable
    - a is the constant
    - b is the **regression coefficient**
    - X is the known score on the independent variable

$$Y' = a + bX$$

- *a* is the constant, or **intercept**
  - Indicates where the regression line would intersect the y axis (or the vertical axis, also known as the ordinate).
  - It is the value for Y' when $X = 0$
- *b* is the **regression coefficient**, or the slope of the regression line
  - It signifies how many predicted units of change (either positive or negative) in the DV there are for any one unit increase in the IV.

Regression Results

- *r*
  - the degree to which the predicted scores match up to the actual scores.
- r^2
  - Coefficient of determination
  - The proportion of variability in the dependent variable that is explained by the independent variable
  - Reported as a percent

Example

- A stats professor wanted to predict student grades on Assignment 2 based on student grades on Assignment 1.

- Step 1: Write your null and alternate hypotheses:
  - H_0 = There is no relationship between Assignment 1 and Assignment 2.
  - H_a = There is a relationship between Assignment 1 and Assignment 2.

Example (cont'd)

- Step 2: Input the data into SPSS
  - Create a variable for Assignment 1 and a second variable for Assignment 2
  - Input the student grades on Assignment 1 in the Assignment 1 column and enter student grades on Assignment 2 in the Assignment 2 column

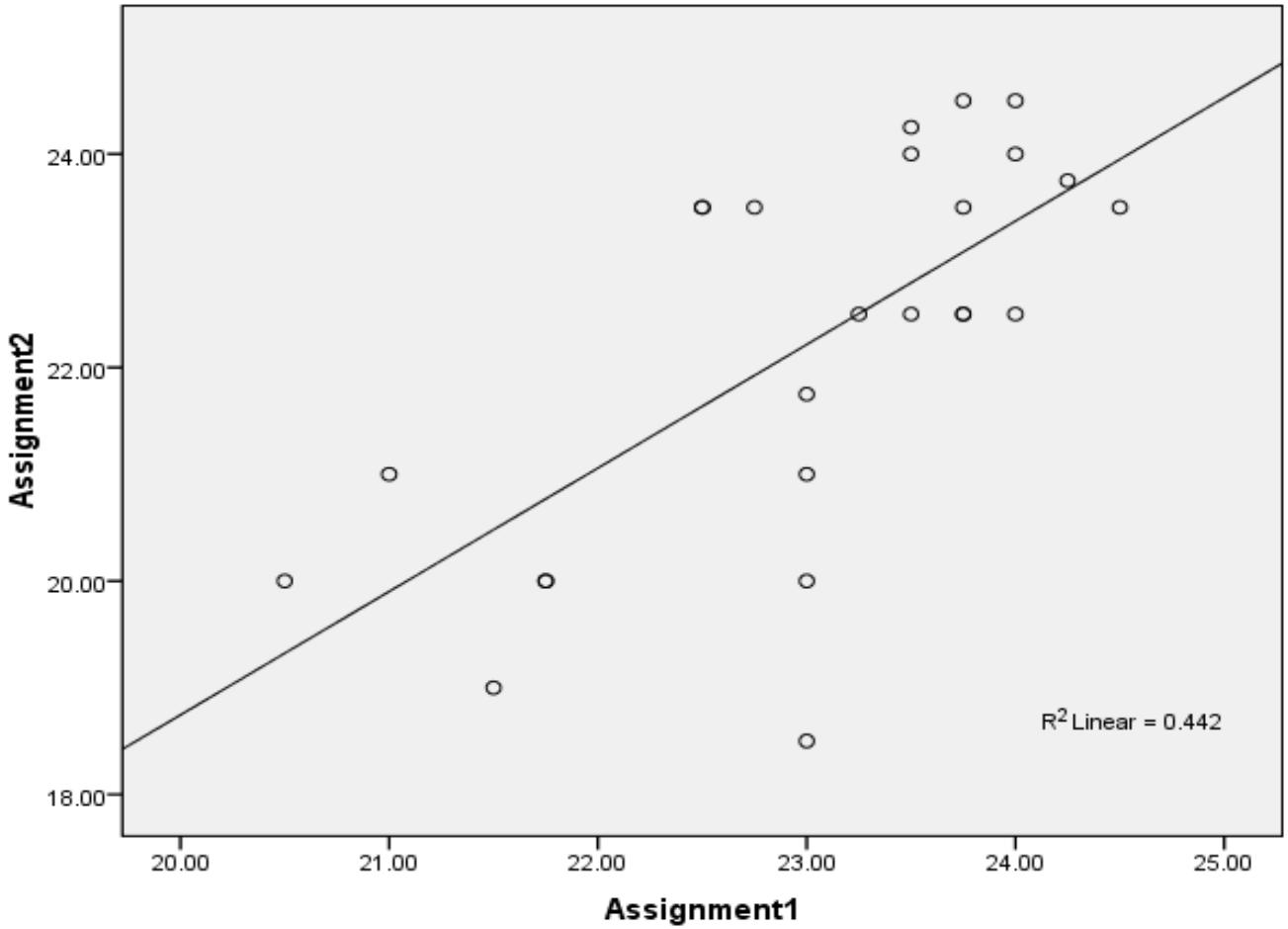
Example (cont'd)

- Step 3: Create a scatter diagram
  - **Graphs → Legacy Dialogues → Scatter/Dot**
  - Click on **Simple Scatter**, then **Define**
  - Assignment 2→ Y-axis box
  - Assignment 1→ X-axis box
  - Click **Ok**

Example (cont'd)

- To add a regression line to the scatter plot
  - Double click on the chart (in the SPSS Output) to select it for editing and maximize the chart editor
  - Click on any of the data points in the scatter plot to highlight the data points
  - Click **Elements** from the main menu bar and click on **Fit Line at Total**
  - Click **Close**

Example (cont'd)



Example (cont'd)

- Step 4: Run the Bivariate Linear Regression
  - Analyze → Regression→ Linear
  - Assignment 2 → **Dependent** box
  - Assignment 1 → **Independent** box
  - Click **Statistics**
  - Click **Confidence Intervals** and **Descriptives** (make sure **Estimates** and **Model fit** are also selected)
  - Click **Continue**
  - Click **OK**

Example (cont'd)

Descriptive Statistics

	Mean	Std. Deviation	N
Assignment2	22.2500	1.81286	25
Assignment1	23.0300	1.04163	25

Correlations

		Assignment2	Assignment1
Pearson Correlation	Assignment2	1.000	.665
	Assignment1	.665	1.000
Sig. (1-tailed)	Assignment2	.	.000
	Assignment1	.000	.
N	Assignment2	25	25
	Assignment1	25	25

Example (cont'd)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.665[a]	.442	.418	1.38351

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	34.851	1	34.851	18.207	.000[a]
	Residual	44.024	23	1.914		
	Total	78.875	24			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-4.393	6.250		-.703	.489	-17.322	8.536
	Assignment1	1.157	.271	.665	4.267	.000	.596	1.718

Example (cont'd)

- Step 5: Write the prediction equation
  - $Y' = -4.39 + 1.16X$
- Step 6: Write up your results
- The hypothesis was tested using a bivariate linear regression to determine whether student grades on Assignment 2 could be predicted based on student grades from Assignment 1. Regression analysis revealed that the model significantly predicted Assignment 2 grades based on Assignment 1 grades, $F(1, 23) = 18.207$, $p < .001$. R^2 for the model was .44, and adjusted R^2 was .42

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Review Activity

- Please complete the review activity at the end of the module.
- All modules build on one another. Therefore, in order to move onto the next module you must successfully complete the review activity before moving on to next module.
- You can complete the review activity and module as many times as you like.

Upcoming Modules

- Module 1: Introduction to Statistics
- Module 2: Introduction to SPSS
- Module 3: Descriptive Statistics
- Module 4: Inferential Statistics
- Module 5: Correlation
- Module 6: *t*-Tests
- Module 7: ANOVAs
- Module 8: Linear Regression
- Module 9: Nonparametric Procedures