

# Final Project-2

## Lecture 8

L8- Statistical Analysis- P4

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## Session Outline

- Hypotheses Testing
- Findings` Discussion

# Hypotheses Testing

اختبار الفرضيات



# SIMPLE AND MULTIPLE LINEAR REGRESSION

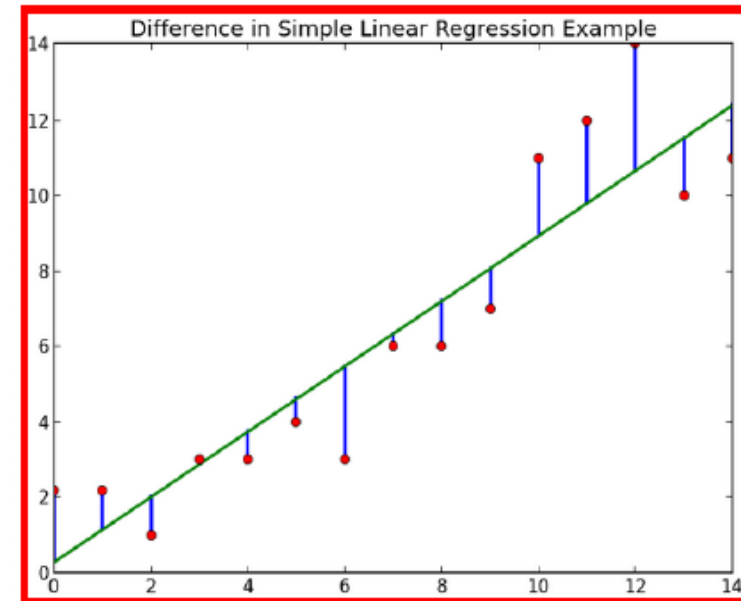
## ❑ INTRODUCTION TO REGRESSION ANALYSIS

### ❖ Regression analysis is used to:

- Predict the value of a dependent variable based on the value of at least one independent variable
- Explain the impact of changes in an independent variable on the dependent variable
- **Dependent variable:** the variable we wish to predict or explain. (Usually Y)
- **Independent variable:** the variable used to predictor explain the dependent variable. (Usually X)

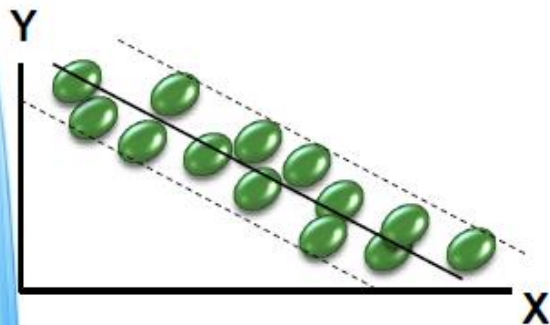
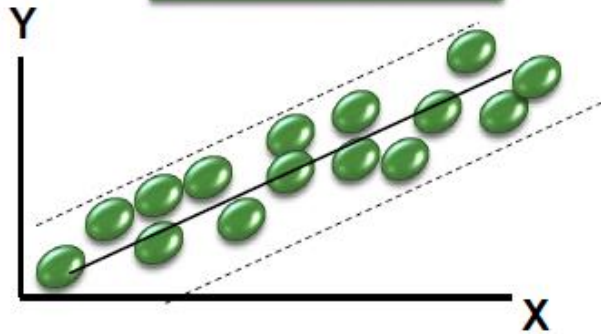
# SIMPLE LINEAR REGRESSION MODEL

- ▶ Only **one independent variable**,  $X$ .
- ▶ Relationship between  $X$  and  $Y$  is described by a linear function.
- ▶ Changes in  $Y$  are assumed to be related to changes in  $X$ .

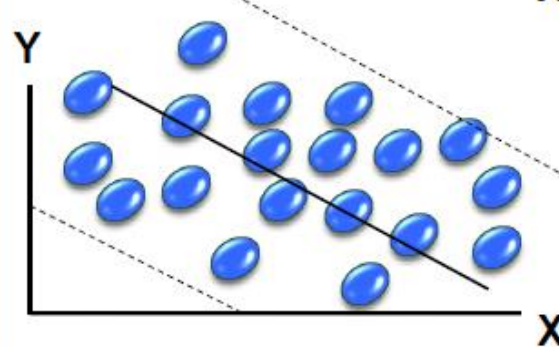
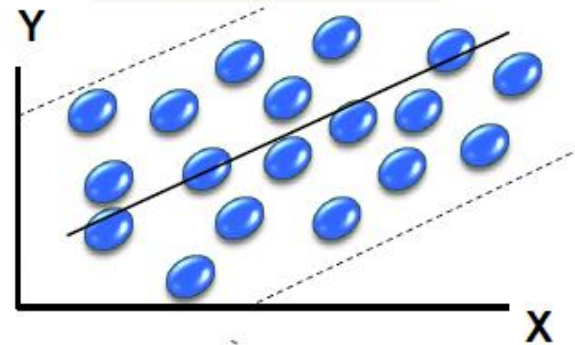


# TYPES OF RELATIONSHIPS

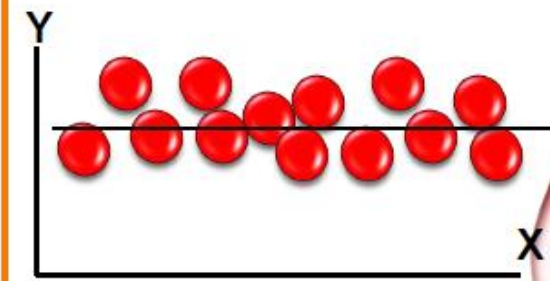
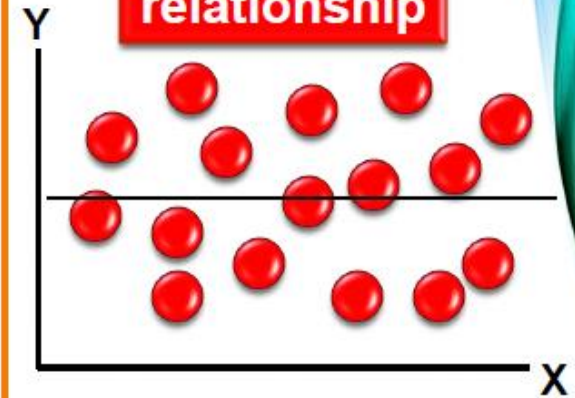
**Strong relationships**



**Weak relationships**



**No relationship**



# SIMPLE LINEAR REGRESSION MODEL

The diagram illustrates the Simple Linear Regression Model equation,  $Y_i = \beta_0 + \beta_1 X_i + \epsilon_i$ , with the following components labeled:

- Dependent Variable:**  $Y_i$
- Population Y intercept:**  $\beta_0$
- Population Slope Coefficient:**  $\beta_1$
- Independent Variable:**  $X_i$
- Random Error term:**  $\epsilon_i$

The equation is presented in a green box. A yellow bracket under  $\beta_0 + \beta_1 X_i$  is labeled "Linear components". A yellow bracket under  $\epsilon_i$  is labeled "Random Error component".

## SIMPLE LINEAR REGRESSION EQUATION (PREDICTION LINE)

The simple linear regression equation provides an estimate of the population regression line

Estimated (or predicted) Y value for observation i

Estimate of the regression intercept

Estimate of the regression slope

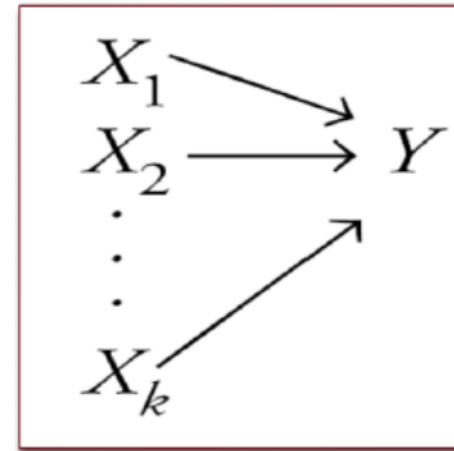
Value of X for observation i

$$\hat{Y}_i = b_0 + b_1 X_i$$

## ❑ MULTIPLE LINEAR REGRESSION MODEL

Multiple regression simultaneously considers the influence of multiple explanatory variables on a response variable  $Y$

- The intention is to look at the independent effect of each variable while "adjusting out" for other variables



# THE MULTIPLE REGRESSION MODEL

Relationship between one dependent & 2 or more independent variables is a linear function

Population Y-intercept      Population slopes      Random error

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki} + \varepsilon_i$$

Linear components      Random Error component

**Y** is the dependent (Response) variable

**X<sub>1</sub>, X<sub>2</sub>, ..., X<sub>k</sub>** are the independent (Explanatory) variables

## □ R square estimate

- R-squared is a statistical measure of how close the data are to the fitted regression line. It is also known as the coefficient of determination, or the coefficient of multiple determination for multiple regression.
- R-squared is always between 0 and 100%
- 0% indicates that the model explains none of the variability of the response data around its mean.
- 100% indicates that the model explain all the variability of the response data around its mean.
- In general, the higher the R-squared, the better the model fits your data.

## □ P value

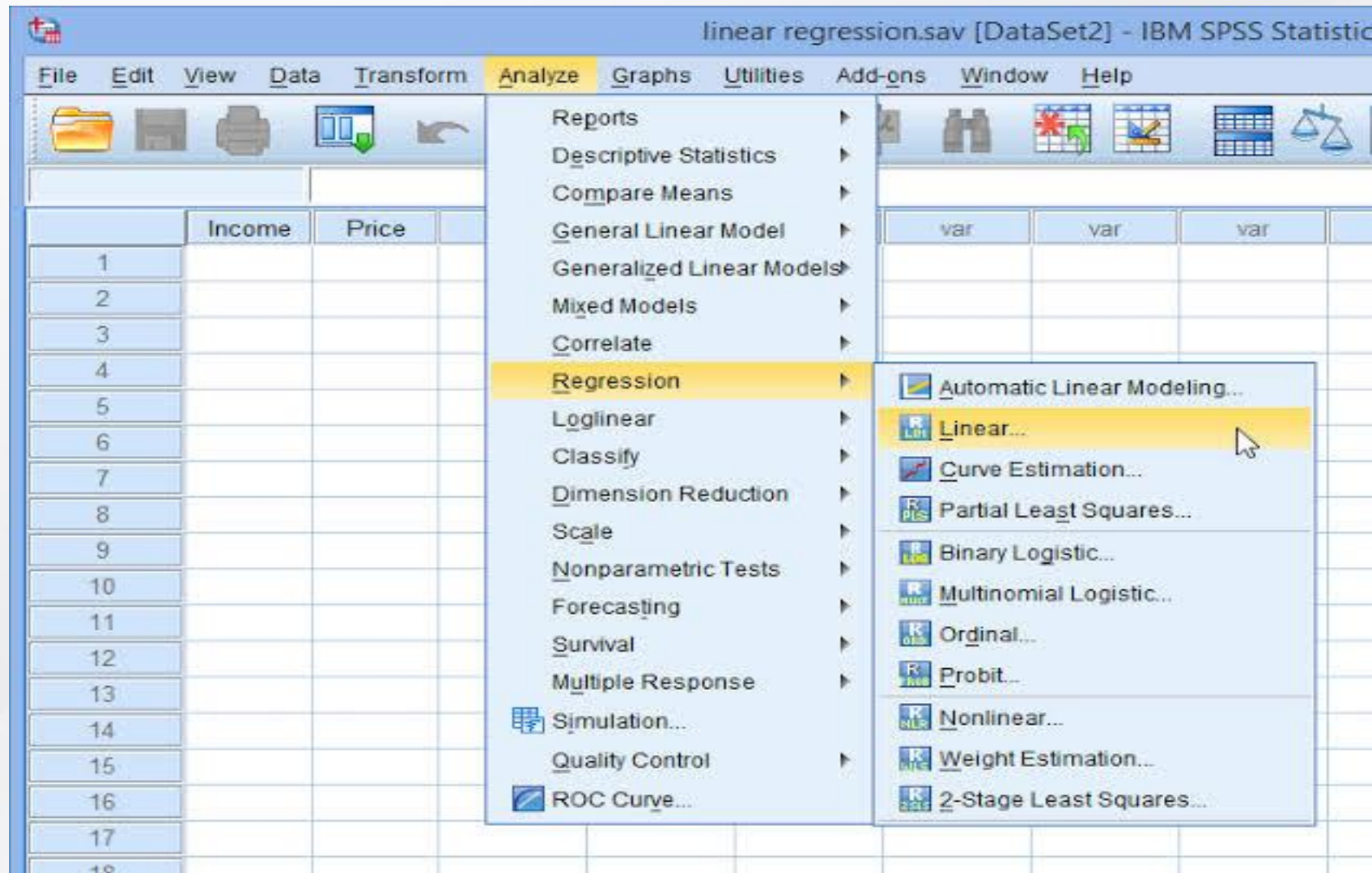
- The p-value for each term tests the null hypothesis that the coefficient is equal to zero (no effect).
- A low p-value ( $<0.05$ ) indicates that you can reject the null hypothesis. In other words, a predictor that has a low p-value is likely to be a meaningful addition to your model because changes in the predictor's value are related to changes in the response variable.
- Conversely, a larger (insignificant) p-value suggests that changes in the predictor are not associated with changes in the response.

## □ Beta coefficient

- A standardized beta coefficient compares the strength of the effect of each individual independent variable to the dependent variable.
- The higher the absolute value of the beta coefficient, the stronger the effect.

# SPSS

# Regression in SPSS



**Linear Regression**

Dependent: Price

Block 1 of 1

Previous Next

Independent(s): Income

Method: Enter

Selection Variable: Rule...

Case Labels:

WLS Weight:

OK Paste Reset Cancel Help

Income

Statistics... Plots... Save... Options...

SPSS Statistics File Edit View Data Transform Insert Format Analyze Direct Marketing Graphs Utilities Add-ons Window Help Sat 7:50 AM David L

Multiple Linear Regression.sav [DataSet2] - IBM SPSS Statistics Data Editor

Output3 [Document3] - IBM SPSS Statistics Viewer

Output

- Log
- Regression
  - Time
  - Notes
  - Active Dataset
  - Variables Entered/Removed
  - Model Summary
  - ANOVA
  - Coefficients

[DataSet2] /Users/davidlongstreet/Documents/SPSS Examples/Multiple Linear Regression .sav

**Variables Entered/Removed<sup>a</sup>**

| Model | Variables Entered           | Variables Removed | Method |
|-------|-----------------------------|-------------------|--------|
| 1     | Study_Time, IQ <sup>1</sup> |                   | Enter  |

a. Dependent Variable: GPA  
b. All requested variables entered.

**Model Summary**

| Model | R                 | R Square | Adjusted R Square | Sd. Error of the Estimate |
|-------|-------------------|----------|-------------------|---------------------------|
| 1     | .954 <sup>a</sup> | .910     | .890              | .2654                     |

a. Predictors: (Constant), Study\_Time, IQ

**ANOVA<sup>a</sup>**

| Model |            | Sum of Squares | df | Mean Square | F      | Sig.              |
|-------|------------|----------------|----|-------------|--------|-------------------|
| 1     | Regression | 6.389          | 2  | 3.194       | 45.353 | .000 <sup>b</sup> |
|       | Residual   | .634           | 9  | .070        |        |                   |
|       | Total      | 7.023          | 11 |             |        |                   |

a. Dependent Variable: GPA  
b. Predictors: (Constant), Study\_Time, IQ

**Coefficients<sup>a</sup>**

| Model | Unstandardized Coefficients |           | Standardized Coefficients | t | Sig. |
|-------|-----------------------------|-----------|---------------------------|---|------|
|       | B                           | Sd. Error | Beta                      |   |      |
| 1     |                             |           |                           |   |      |

IBM SPSS Statistics Processor is ready

# Testing Mediation Effect via SPSS

**There are two methods in testing indirect effect (mediation):**

- 1– Baron and Kenny method
- 2- Hayes method (macro- process)

# Baron & Kenny method

## □ Baron and Kenny mediation steps

- ❖ The above steps of mediation is based on the four step mediation analysis test proposed by Baron and Kenny (1986), Judd and Kenny (1981), and James and Brett (1984).
- ❖ Thus, to indicate mediation four steps are to be analyzed-

**Step 1:** Show that the causal variable is correlated with the outcome. Use Y as the criterion variable in a regression equation and X as a predictor (estimate and test path c in the above figure). This step establishes that there is an effect that may be mediated.

**Step 2:** Show that the causal variable is correlated with the mediator. Use Mas the criterion variable in the regression equation and X as a predictor (estimate and test path a). This step essentially involves treating the mediator as if it were an outcome variable.

## □ Baron and Kenny mediation steps

**Step 3:** Show that the mediator affects the outcome variable. Use Y as the criterion variable in a regression equation and X and M as predictors (estimate and test path b). It is not sufficient just to correlate the mediator with the outcome because the mediator and the outcome may be correlated because they are both caused by the causal variable X. Thus, the causal variable must be controlled in establishing the effect of the mediator on the outcome.

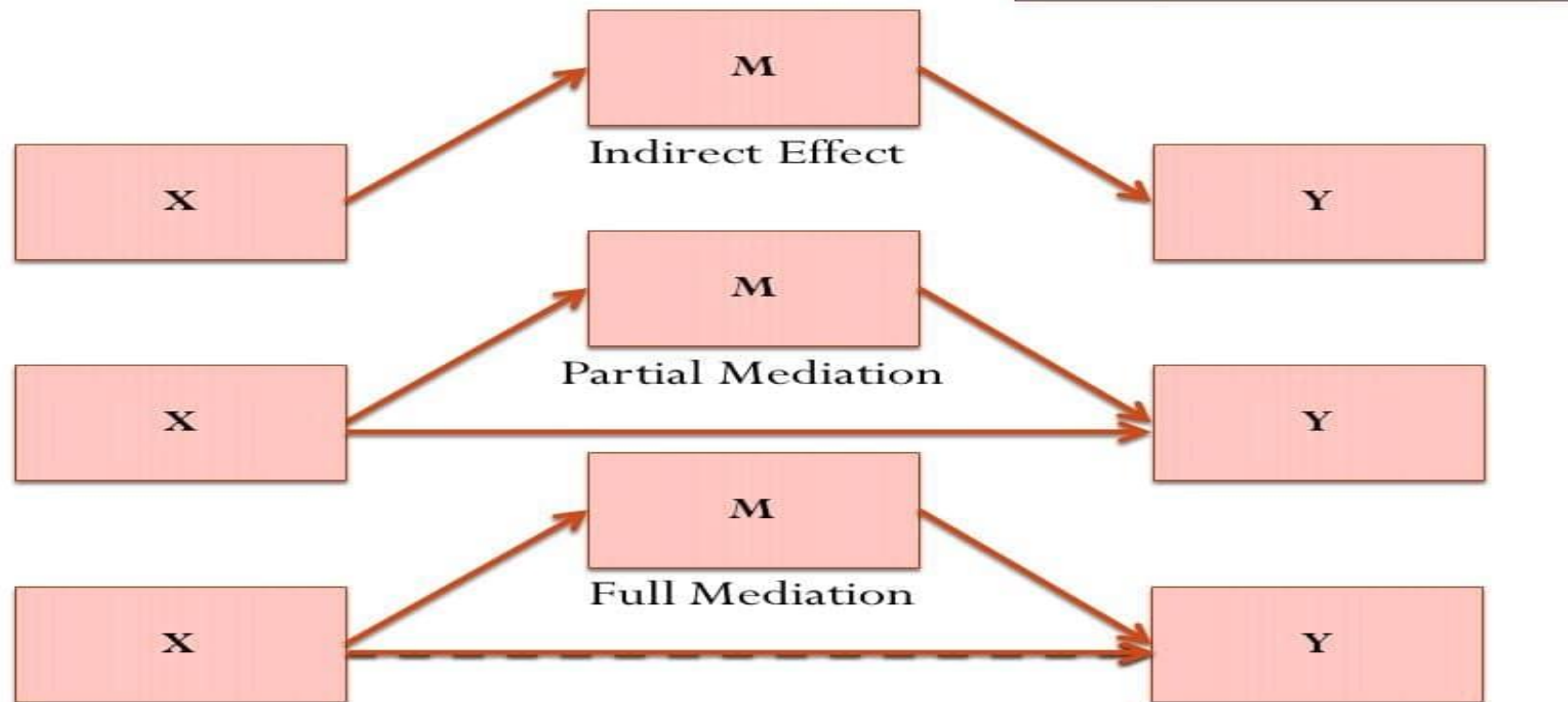
**Step 4:** To establish that M completely mediates the X-Y relationship, the effect of X on Y controlling for M (path c) should be zero (see discussion below on significance testing). The effects in both Steps 3 and 4 are estimated in the same equation.

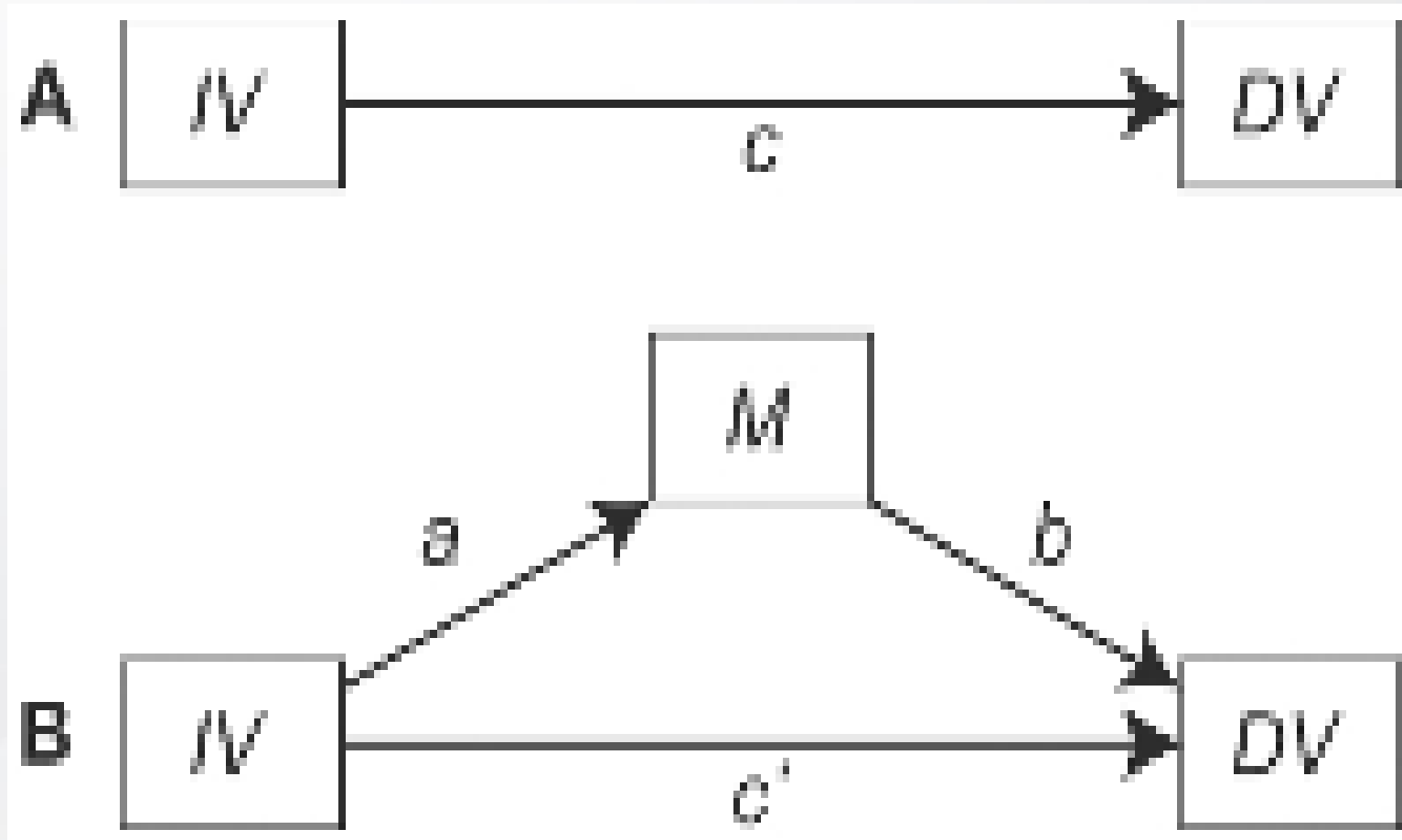
## □ Baron and Kenny mediation steps

### ❖ Final mediation decision

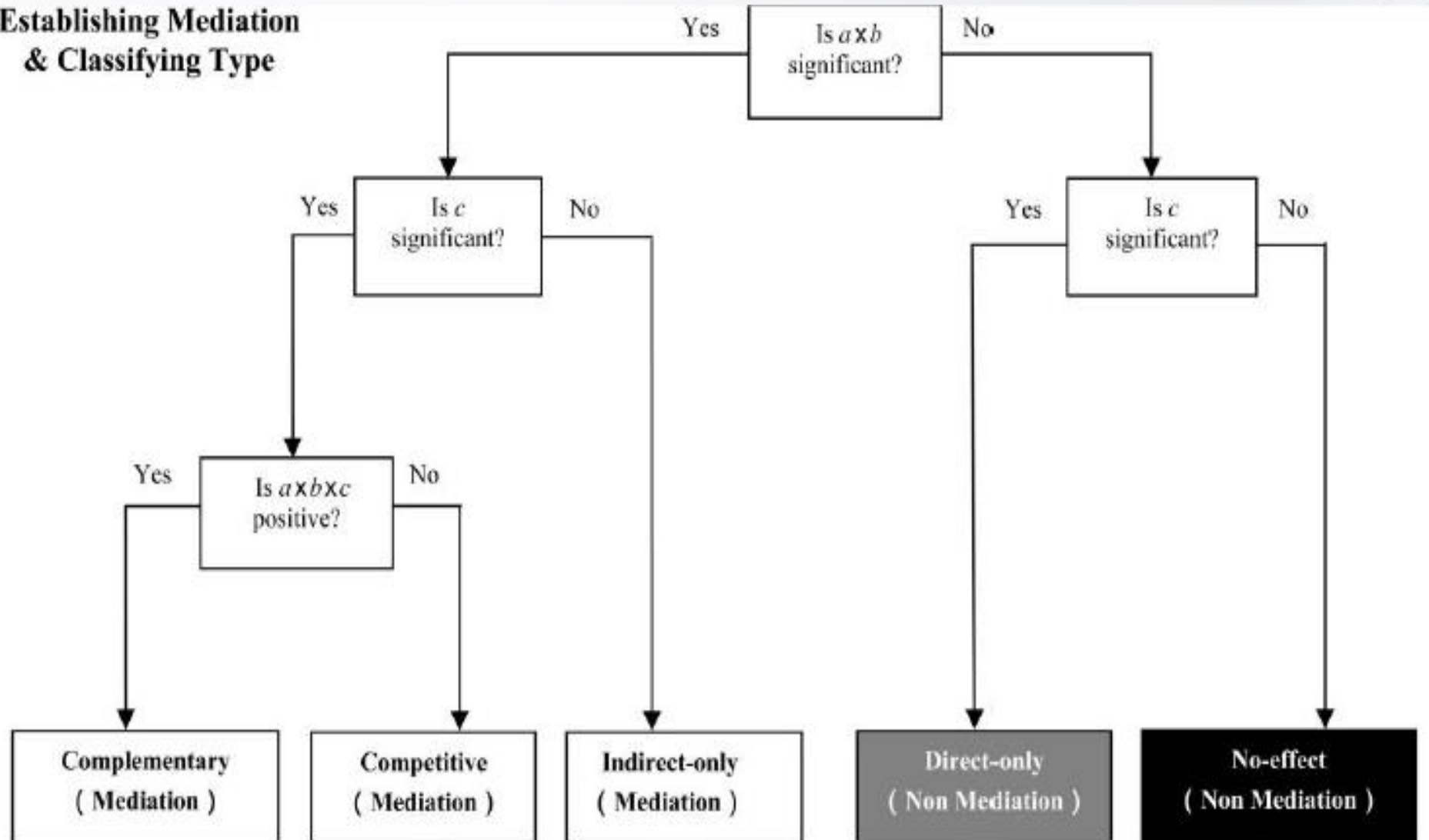
- If all four of these steps are met, then the data are consistent with the hypothesis that variable M completely mediates the X-Y relationship
- If the first three steps are met but the Step 4 is not, then partial mediation is indicated.
- Meeting these steps does not, however, conclusively establish that mediation has occurred because there are other (perhaps less plausible) models that are consistent with the data.
- Some of these models are considered later in the Specification Error section.

## Types of Mediation





## Establishing Mediation & Classifying Type



## □ References:

- Hayes, A.F., 2009. Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. Communication monographs, 76(4), pp.408-420.
- Shrout, P.E. and Bolger, N., 2002. Mediation in experimental and nonexperimental studies: new procedures and recommendations. Psychological methods, 7(4), p.422.
- Zhao, X., Lynch Jr, J.G. and Chen, Q., (2010). Reconsidering Baron and Kenny: Myths and truths about mediation analysis. Journal of consumer research, 37(2), pp.197-206.

The screenshot shows the SPSS software interface. The 'Analyze' menu is open, displaying various statistical analysis options. A sub-menu for 'Regression' is also visible, listing specific regression techniques. In the background, a data table is partially visible with columns A1, A2, M2, M3, M4, M5, O1, O2, O3, and O4.

|  | A1 | A2 | M2 | M3 | M4 | M5 | O1 | O2 | O3 | O4 |
|--|----|----|----|----|----|----|----|----|----|----|
|  | 4  |    | 4  | 3  | 4  | 2  | 3  | 3  | 4  | 3  |
|  | 4  |    | 3  | 2  | 4  | 3  | 3  | 3  | 4  | 4  |
|  | 3  |    | 2  | 2  | 4  | 2  | 3  | 3  | 4  | 3  |
|  | 1  |    | 1  | 1  | 4  | 1  | 1  | 1  | 1  | 2  |
|  | 2  |    |    |    |    | 2  | 1  | 2  | 2  | 2  |
|  | 3  |    |    |    |    | 2  | 2  | 4  | 4  | 4  |
|  | 2  |    |    |    |    | 1  | 1  | 1  | 1  | 1  |
|  | 2  |    |    |    |    | 1  | 1  | 1  | 3  | 2  |
|  | 5  |    |    |    |    | 4  | 4  | 4  | 2  | 2  |
|  | 4  |    |    |    |    | 1  | 3  | 3  | 4  | 3  |
|  | 5  |    |    |    |    | 3  | 2  | 2  | 2  | 1  |
|  | 5  |    |    |    |    | 3  | 3  | 3  | 4  | 4  |
|  | 5  |    |    |    |    | 5  | 5  | 2  | 2  | 2  |
|  | 4  |    |    |    |    | 2  | 3  | 2  | 3  | 2  |
|  | 3  |    |    |    |    | 2  | 2  | 3  | 4  | 4  |
|  | 2  |    |    |    |    | 1  | 1  | 2  | 2  | 2  |
|  | 4  |    |    |    |    | 2  | 1  | 3  | 5  | 3  |
|  | 4  |    |    |    |    | 2  | 4  | 4  | 5  | 3  |
|  | 1  |    |    |    |    | 2  | 2  | 3  | 4  | 4  |
|  | 4  |    |    |    |    | 3  | 3  | 4  | 3  | 3  |
|  |    |    |    |    |    | 5  | 5  | 5  | 4  | 4  |

| A3 | M1 | M2 | M3 | M4 | M5 | O1 | O2 | O3 | O4 | SQ1 |
|----|----|----|----|----|----|----|----|----|----|-----|
| 3  | 3  |    |    |    |    |    |    |    | 4  | 3   |
| 3  | 4  |    |    |    |    |    |    |    | 4  | 4   |
| 3  | 2  |    |    |    |    |    |    |    | 4  | 3   |
| 2  | 1  |    |    |    |    |    |    |    | 1  | 2   |
| 2  | 2  |    |    |    |    |    |    |    | 2  | 2   |
| 4  | 4  |    |    |    |    |    |    |    | 4  | 4   |
| 4  | 1  |    |    |    |    |    |    |    | 1  | 1   |
| 4  | 2  |    |    |    |    |    |    |    | 3  | 2   |
| 5  | 4  |    |    |    |    |    |    |    | 2  | 2   |
| 2  | 3  |    |    |    |    |    |    |    | 4  | 3   |
| 5  | 4  |    |    |    |    |    |    |    | 2  | 1   |
| 4  | 3  |    |    |    |    |    |    |    | 4  | 4   |
| 5  | 5  |    |    |    |    |    |    |    | 2  | 2   |
| 4  | 5  |    |    |    |    |    |    |    | 3  | 2   |
| 3  | 4  |    |    |    |    |    |    |    | 4  | 4   |
| 2  | 2  |    |    |    |    |    |    |    | 2  | 2   |
| 1  | 4  |    |    |    |    |    |    |    | 5  | 3   |
| 4  | 4  |    |    |    |    |    |    |    | 5  | 3   |
| 3  | 3  |    |    |    |    |    |    |    | 4  | 4   |
| 4  | 3  |    |    |    |    |    |    |    | 3  | 3   |
|    |    |    |    |    |    |    |    |    | 4  | 4   |

Linear Regression

Dependent:

OA

Block 1 of 1

Previous

Next

Independent(s):

HPWS

KMS

Method:

Enter

Selection Variable:

Rule...

Case Labels:

WLS Weight:

OK

Paste

Reset

Cancel

Help

Statistics...

Plots...

Save...

Options...

Bootstrap...

SVQ4

SVQ5

OA1

OA2

OA3

OA4

OA5

OA6

OA7

OA8

Ability

Motivation

Opportunity

SQ

IQ

SVQ

KMS

HPWS

Active Dataset  
Variables Entered  
Model Summary  
ANOVA  
Coefficients

**Model Summary**

| Model | R                 | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1     | .665 <sup>a</sup> | .442     | .404              | .698                       |

a. Predictors: (Constant), KMS, HPWS

**ANOVA<sup>a</sup>**

| Model |            | Sum of Squares | df | Mean Square | F      | Sig.              |
|-------|------------|----------------|----|-------------|--------|-------------------|
| 1     | Regression | 11.561         | 2  | 5.780       | 11.862 | .000 <sup>b</sup> |
|       | Residual   | 14.619         | 30 | .487        |        |                   |
|       | Total      | 26.180         | 32 |             |        |                   |

a. Dependent Variable: OA

b. Predictors: (Constant), KMS, HPWS

**Coefficients<sup>a</sup>**

| Model |            | Unstandardized Coefficients |            | Standardized Coefficients | t     | Sig. |
|-------|------------|-----------------------------|------------|---------------------------|-------|------|
|       |            | B                           | Std. Error | Beta                      |       |      |
| 1     | (Constant) | 2.115                       | .709       |                           | 2.984 | .006 |
|       | HPWS       | .188                        | .162       | .180                      | 1.158 | .256 |
|       | KMS        | .823                        | .228       | .560                      | 3.610 | .001 |

a. Dependent Variable: OA

# Hayes Method Macro- PROCESS

- Macro- PROCESS method is originated by Hayes, (2012), as it is most flexible and effective tool in testing the indirect effect (the mediation effect) (MacKinnon, Fairchild, and Fritz, 2007; Hayes, 2009).
- The advantage with using PROCESS tests that the mediation effect is assessed with the aid of bootstrapping.
- Indirect effect to be tested, bootstrapping steps (n= 5000 resample) and confidence interval at 95%.
- The mediation effect can be considered statistically significant only when (zero) doesn't exist between their range of confidence intervals, namely: BootLLCI "Bootstrap Lower Limit Confidence Interval" and BootULCI "Bootstrap Upper Limit Confidence Interval" (Hayes, 2012; Vinod, et al., 2015).

- **In Macro- PROCESS, select the number of the model as follows:**
  - ✓ Model 4 for mediation
  - ✓ Model 1 for moderation
  - ✓ Model 5 for mediation/ moderation

View Data Transform **Analyze** Direct Marketing Graphs Utilities Add-ons Window Help

Reports  
Descriptive Statistics  
Tables  
Compare Means  
General Linear Model  
Generalized Linear Models  
Mixed Models  
Correlate  
**Regression**  
Loglinear  
Neural Networks  
Classify  
Dimension Reduction  
Scale  
Nonparametric Tests  
Forecasting  
Survival  
Multiple Response  
Missing Value Analysis...  
Multiple Imputation  
Complex Samples  
Quality Control

Automatic Linear Modeling...  
Linear...  
Curve Estimation...  
Partial Least Squares...  
**PROCESS v3.5 by Andrew F. Hayes**  
Binary Logistic...  
Multinomial Logistic...  
Ordinal...  
Probit...  
Nonlinear...  
Weight Estimation...  
2-Stage Least Squares...  
Optimal Scaling (CATREG)...

|   | M2 | M3 | M4 | M5 | O1 | O2 | O3 | O4 |
|---|----|----|----|----|----|----|----|----|
| 4 | 4  | 3  | 4  | 2  | 3  | 3  | 4  | 3  |
| 4 | 3  | 2  | 4  | 3  | 3  | 3  | 4  | 4  |
| 3 | 2  | 2  | 4  | 2  | 3  | 3  | 4  | 3  |
| 1 | 1  | 1  | 4  | 1  | 1  | 1  | 1  | 2  |
| 2 |    |    |    | 2  | 1  | 2  | 2  | 2  |
| 3 |    |    |    | 2  | 2  | 4  | 4  | 4  |
| 2 |    |    |    | 1  | 1  | 1  | 1  | 1  |
| 2 |    |    |    | 1  | 1  | 1  | 3  | 2  |
| 5 |    |    |    | 4  | 4  | 4  | 2  | 2  |
| 4 |    |    |    | 1  | 3  | 3  | 4  | 3  |
| 5 |    |    |    | 3  | 2  | 2  | 2  | 1  |
| 5 |    |    |    | 3  | 3  | 3  | 4  | 4  |
| 5 |    |    |    | 5  | 5  | 2  | 2  | 2  |
| 4 |    |    |    | 2  | 3  | 2  | 3  | 2  |
| 3 |    |    |    | 2  | 2  | 3  | 4  | 4  |
| 2 |    |    |    | 1  | 1  | 2  | 2  | 2  |
| 4 |    |    |    | 2  | 1  | 3  | 5  | 3  |
| 4 |    |    |    | 2  | 4  | 4  | 5  | 3  |
| 1 |    |    |    | 2  | 2  | 3  | 4  | 4  |
|   |    |    |    | 3  | 3  | 4  | 3  | 3  |

PROCESS\_v3.5

|   | A3 | M |
|---|----|---|
| 4 | 3  |   |
| 4 | 3  |   |
| 2 | 3  |   |
| 3 | 2  |   |
| 2 | 2  |   |
| 4 | 4  |   |
| 3 | 4  |   |
| 3 | 4  |   |
| 5 | 5  |   |
| 3 | 2  |   |
| 4 | 5  |   |
| 5 | 4  |   |
| 5 | 5  |   |
| 5 | 4  |   |
| 2 | 3  |   |
| 2 | 2  |   |
| 2 | 1  |   |
| 4 | 4  |   |
| 4 | 3  |   |
| 4 | 4  |   |
| 5 | 4  |   |
| 4 | 4  |   |

Variables:

- A1
- A2
- A3
- M1
- M2
- M3
- M4
- M5
- O1
- O2
- O3
- O4
- SQ1
- SQ2

Model number: 4

Confidence intervals: 95

Number of bootstrap samples: 5000

☐ Save bootstrap estimates

☐ Bootstrap inference for model coefficients

Y variable: OA

X variable: HPWS

Mediator(s) M: KMS

Covariate(s):

Moderator variable W:

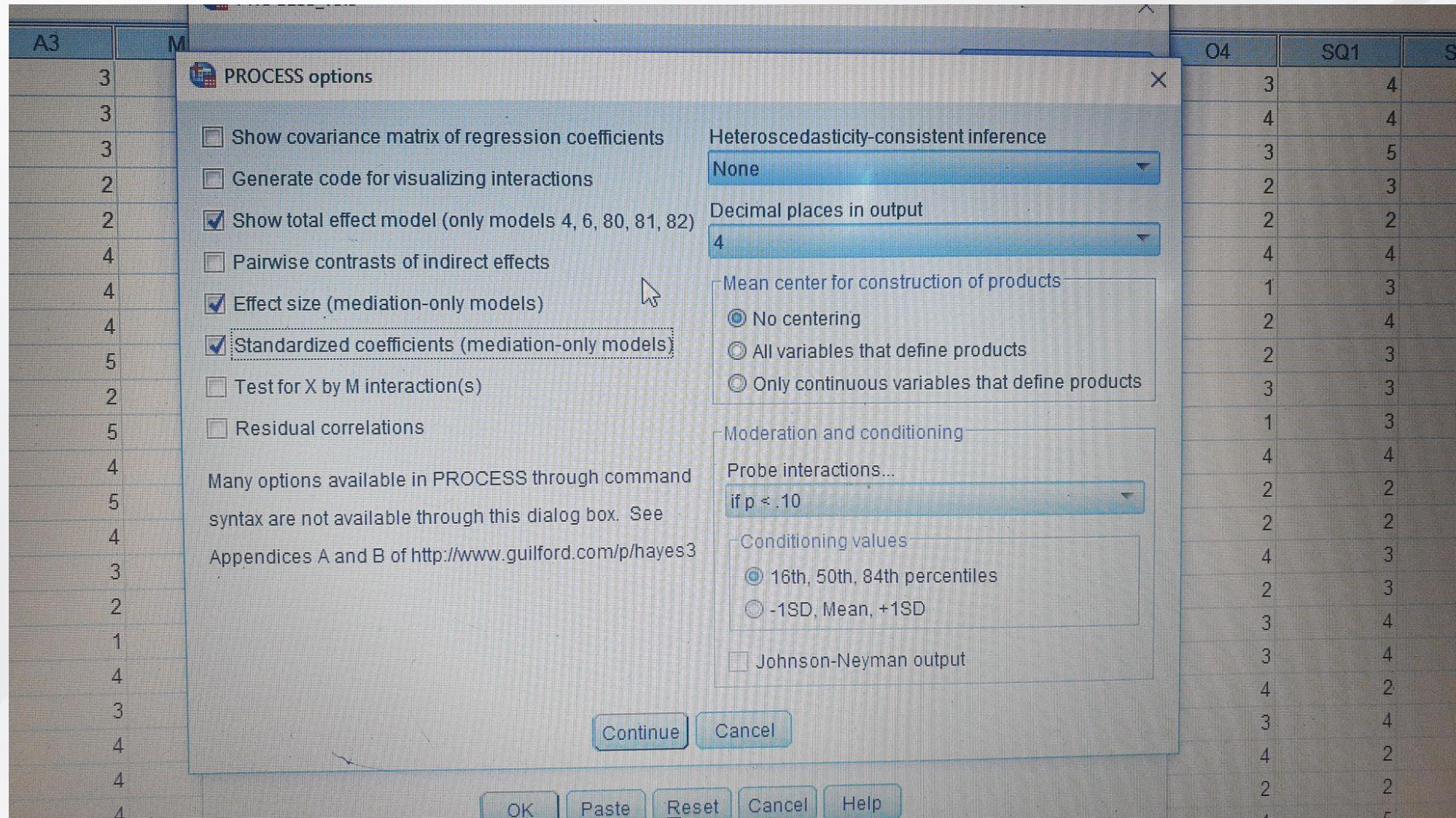
Moderator variable Z:

Do not use PASTE button

About  
Options  
Multicategorical  
Long variable names

|  | O4 | SQ1 |
|--|----|-----|
|  | 3  | 4   |
|  | 4  | 4   |
|  | 3  | 5   |
|  | 2  | 3   |
|  | 2  | 2   |
|  | 4  | 4   |
|  | 1  | 3   |
|  | 2  | 4   |
|  | 2  | 3   |
|  | 3  | 3   |
|  | 1  | 3   |
|  | 4  | 4   |
|  | 2  | 2   |
|  | 2  | 2   |
|  | 4  | 3   |
|  | 2  | 3   |
|  | 3  | 4   |
|  | 3  | 4   |
|  | 4  | 2   |
|  | 3  | 4   |
|  | 4  | 2   |
|  | 2  | 2   |

OK Paste Reset Cancel Help



Matrix

Title

Notes

Active Dataset

Text Output

Log

Matrix

Title

Notes

Active Dataset

Text Output

KMS

Model Summary

|  | R     | R-sq  | MSE   | F      | df1    | df2     | p     |
|--|-------|-------|-------|--------|--------|---------|-------|
|  | .4760 | .2265 | .3027 | 9.0796 | 1.0000 | 31.0000 | .0051 |

Model

|          | coeff  | se    | t      | p     | LLCI   | ULCI   |
|----------|--------|-------|--------|-------|--------|--------|
| constant | 2.2740 | .3810 | 5.9679 | .0000 | 1.4968 | 3.0511 |
| HPWS     | .3390  | .1125 | 3.0132 | .0051 | .1096  | .5685  |

Standardized coefficients

|      | coeff |
|------|-------|
| HPWS | .4760 |

\*\*\*\*\*

OUTCOME VARIABLE:

OA

Model Summary

|  | R     | R-sq  | MSE   | F       | df1    | df2     | p     |
|--|-------|-------|-------|---------|--------|---------|-------|
|  | .6645 | .4416 | .4873 | 11.8616 | 2.0000 | 30.0000 | .0002 |

Model

|          | coeff  | se    | t      | p     | LLCI   | ULCI   |
|----------|--------|-------|--------|-------|--------|--------|
| constant | 2.1145 | .7087 | 2.9837 | .0056 | .6672  | 3.5619 |
| HPWS     | .1880  | .1623 | 1.1580 | .2560 | -.1435 | .5195  |
| KMS      | .8225  | .2279 | 3.6095 | .0011 | .3571  | 1.2879 |

IBM

IBM SPSS

|                                                           |        |          |          |        |        |         |       |
|-----------------------------------------------------------|--------|----------|----------|--------|--------|---------|-------|
| OUTCOME VARIABLE:                                         |        |          |          |        |        |         |       |
| OA                                                        |        |          |          |        |        |         |       |
| Model Summary                                             |        |          |          |        |        |         |       |
|                                                           | R      | R-sq     | MSE      | F      | df1    | df2     | p     |
|                                                           | .4462  | .1991    | .6764    | 7.7047 | 1.0000 | 31.0000 | .0093 |
| Model                                                     |        |          |          |        |        |         |       |
|                                                           | coeff  | se       | t        | p      | LLCI   | ULCI    |       |
| constant                                                  | 3.9849 | .5696    | 6.9964   | .0000  | 2.8233 | 5.1466  |       |
| HPWS                                                      | .4668  | .1682    | 2.7757   | .0093  | .1238  | .8099   |       |
| Standardized coefficients                                 |        |          |          |        |        |         |       |
|                                                           | coeff  |          |          |        |        |         |       |
| HPWS                                                      | .4462  |          |          |        |        |         |       |
| ***** TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y ***** |        |          |          |        |        |         |       |
| Total effect of X on Y                                    |        |          |          |        |        |         |       |
| Effect                                                    | se     | t        | p        | LLCI   | ULCI   | c_ps    | c_cs  |
| .4668                                                     | .1682  | 2.7757   | .0093    | .1238  | .8099  | .5161   | .4462 |
| Direct effect of X on Y                                   |        |          |          |        |        |         |       |
| Effect                                                    | se     | t        | p        | LLCI   | ULCI   | c'_ps   | c'_cs |
| .1880                                                     | .1623  | 1.1580   | .2560    | -.1435 | .5195  | .2078   | .1796 |
| Indirect effect(s) of X on Y:                             |        |          |          |        |        |         |       |
| Effect                                                    | BootSE | BootLLCI | BootULCI |        |        |         |       |
| KMS                                                       | .2789  | .1012    | .0966    | .4982  |        |         |       |

# Moderation Effect via SPSS

## □ Terminology

- Criterion Variable (dependant variable)
- Predictor Variable (Independent variable)

$$y = a + b_1x$$

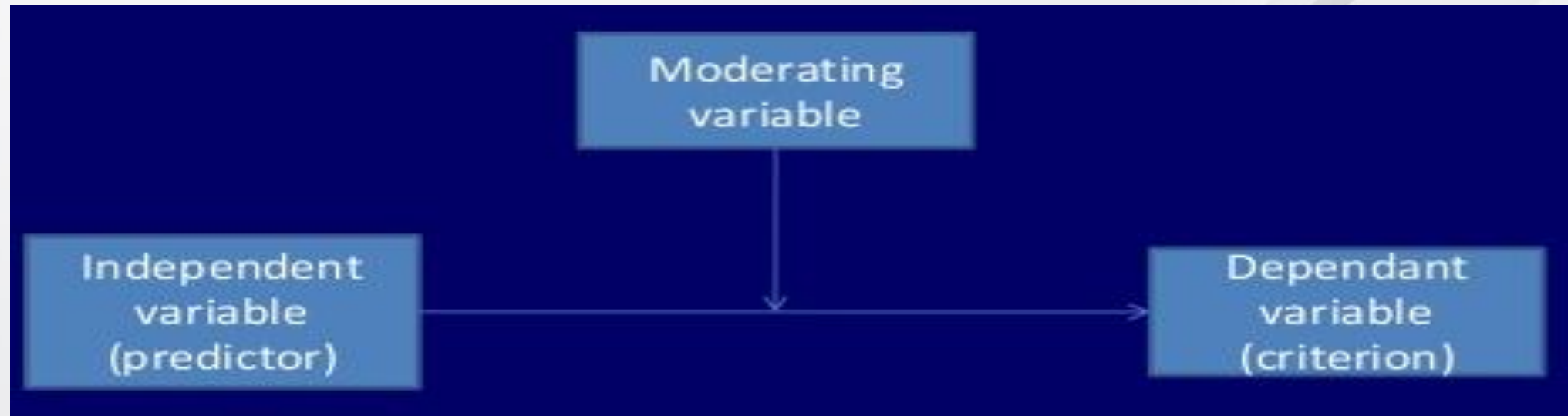
y = criterion variable      x = predictor variable

## □ Moderation

- A third variable changes the relationship between two related variable

In other words

- Relationship between two variables changes with the level of another variable of construct



## ❑ Moderator v/s Mediation

- Mediator variable is consequent of predictor variable.



## ❑ Moderator v/s Mediation

- Moderator variable is at same level as predictor variable.



## □ Aiken and West Approach

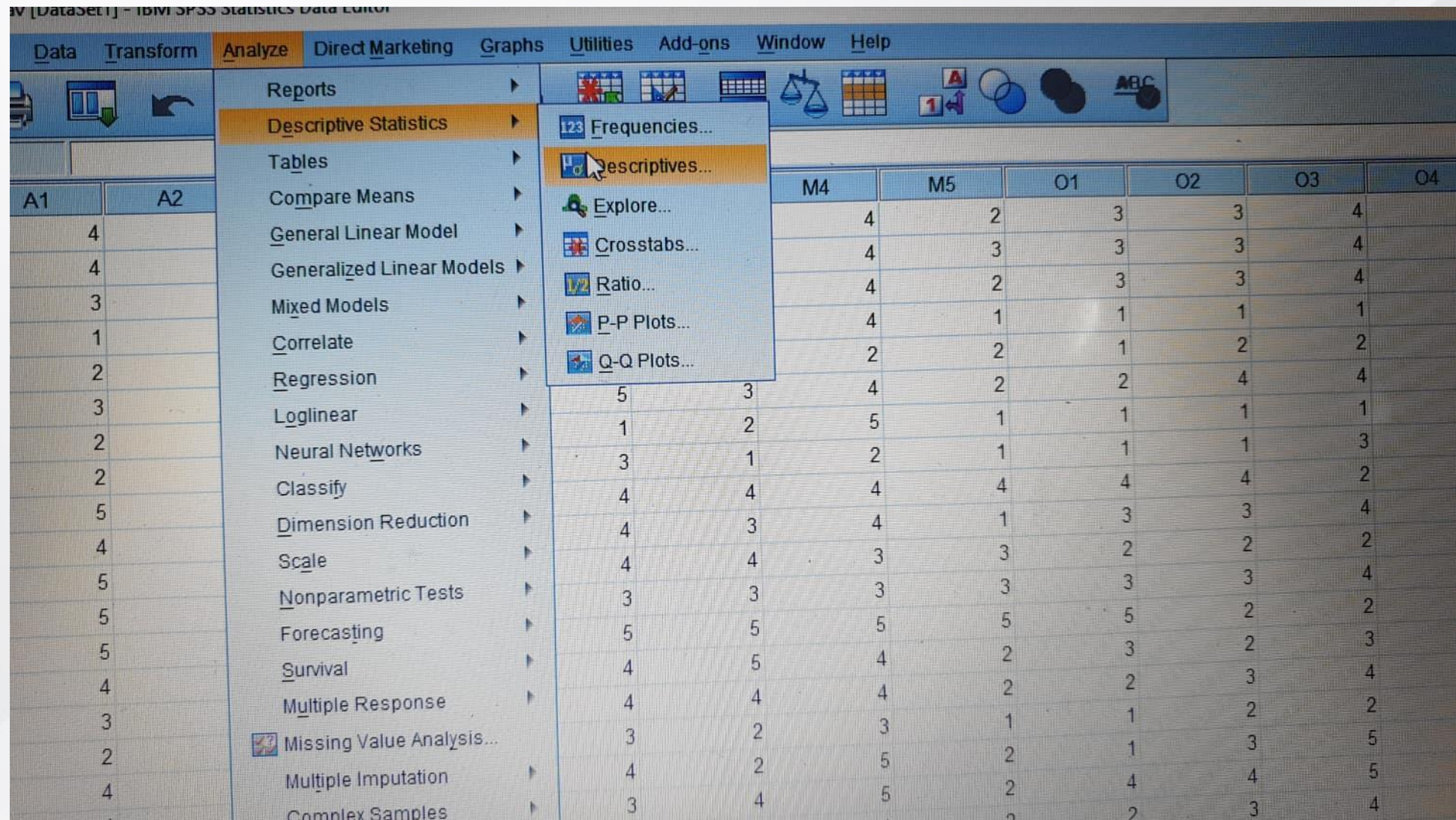
- **Step1:** Regress on dependent variable the independent variable and moderator variable
- **Step2:** Center all the continuous variables
- **Step3:** Multiply the independent and moderator variable and create interaction variable
- **Step 4:** Regress on dependent variable the independent variable, moderator variable and Interaction variable

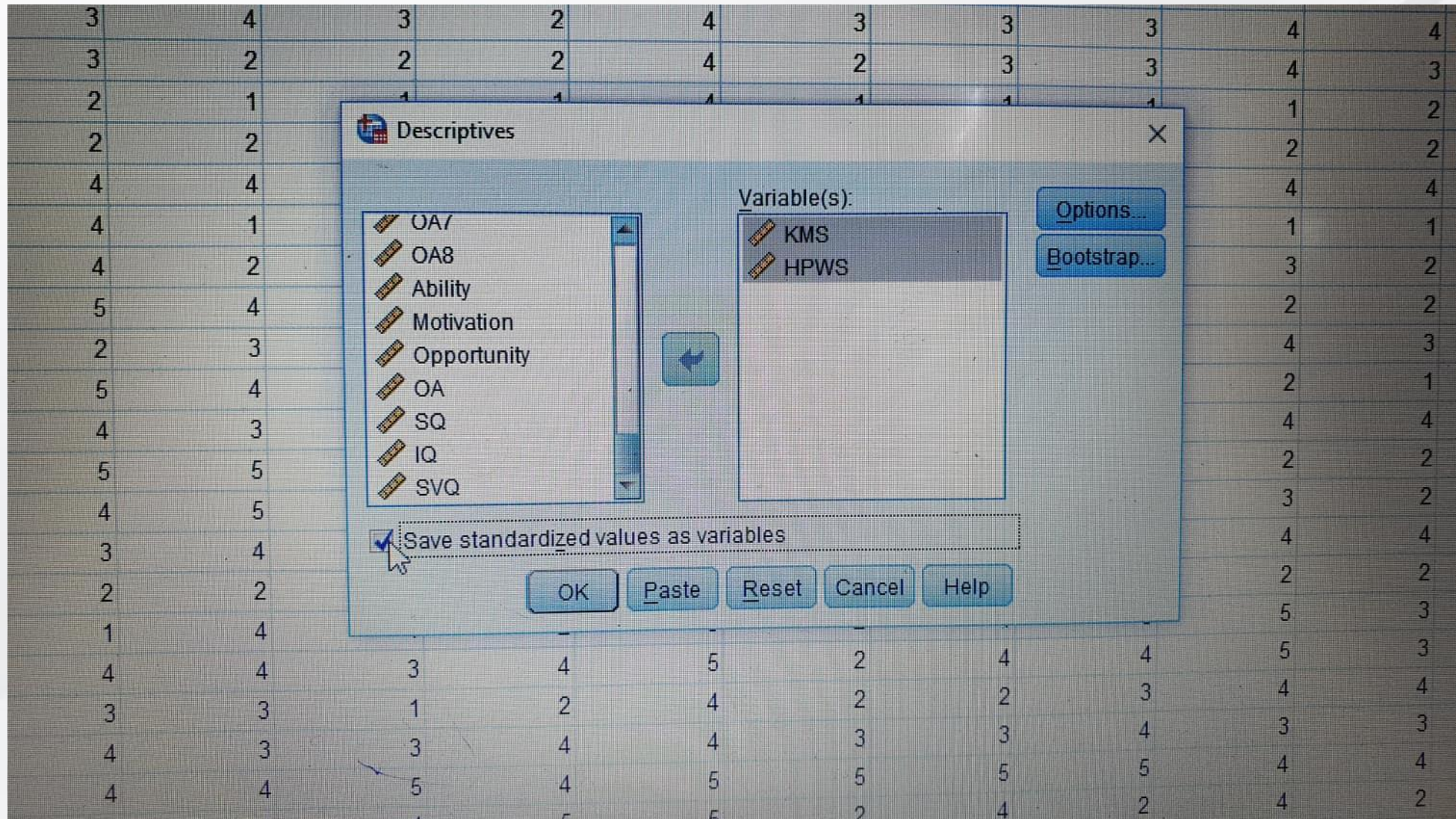
Aiken, L. S., & West, S. G. (1991). Multiple regression: Testing and interpreting interactions. Sage.

## □ Aiken and West Approach

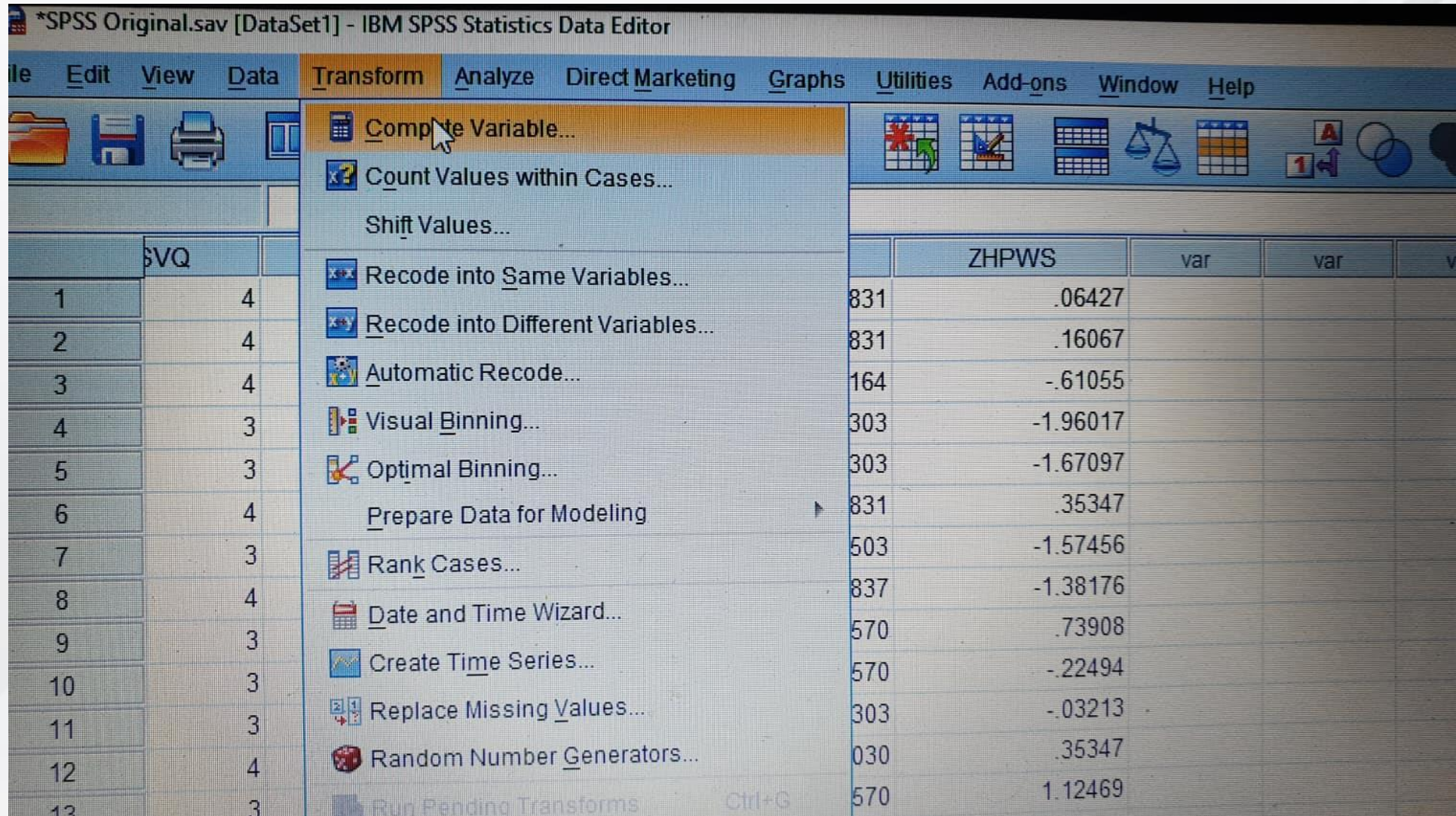
- **Step 5:** Check whether interaction variable is significant else no Moderation
- **Step 6:**  $\Delta R^2$
- **Step 7:** If moderator is continuous variable classify into meaning full groups or classify the same based at  $+ \geq 1 \sigma$  level
- **Step 8:** Plot Graphs and interpret the same with significant slopes

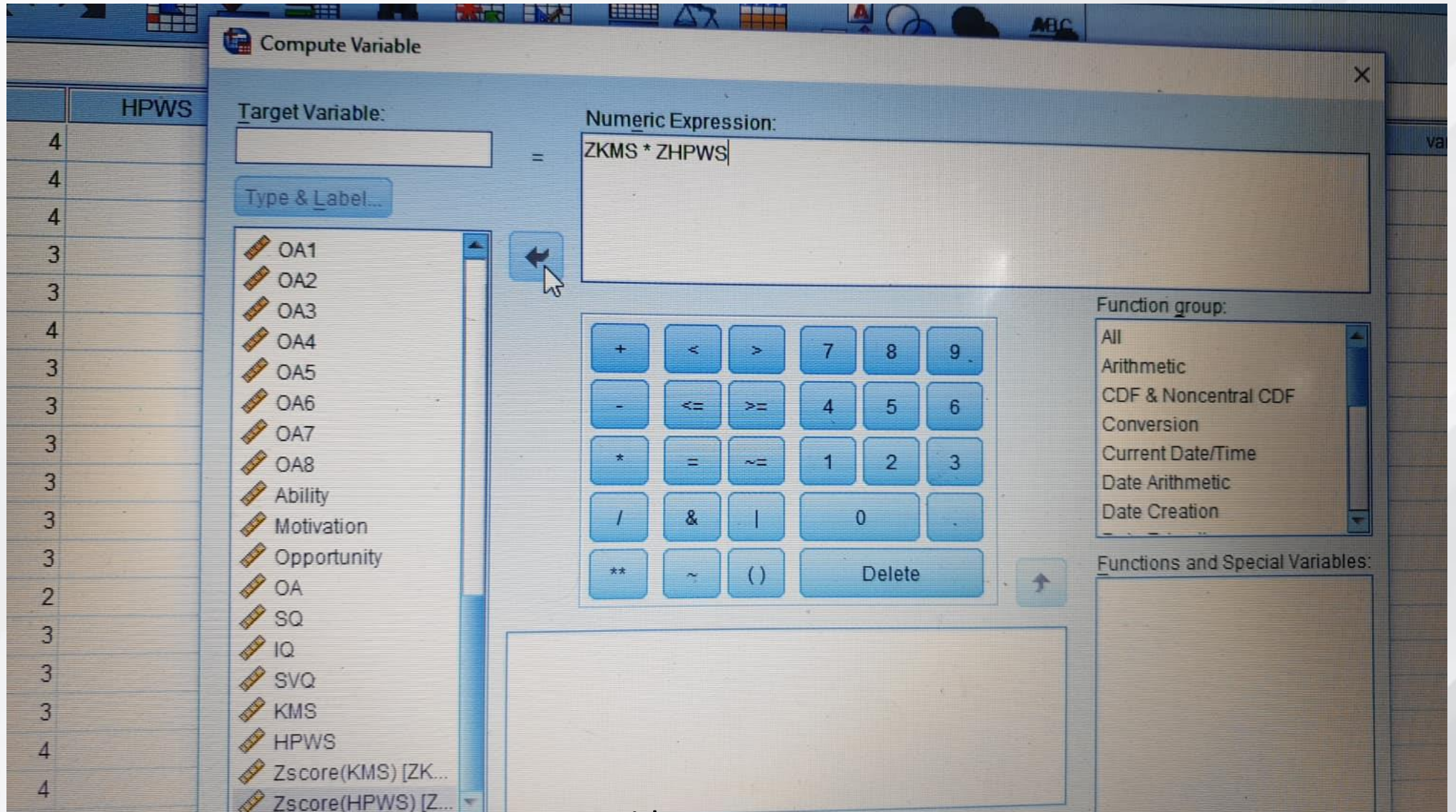
| Independent Variable | Moderation Variable | Interaction Variable | Moderation Effect |
|----------------------|---------------------|----------------------|-------------------|
| Significant          | Significant         | Significant          | Yes               |
| Significant          | Significant         | Not Significant      | No                |
| Significant          | Not Significant     | Not Significant      | No                |
| Not Significant      | Significant         | Significant          | Yes               |

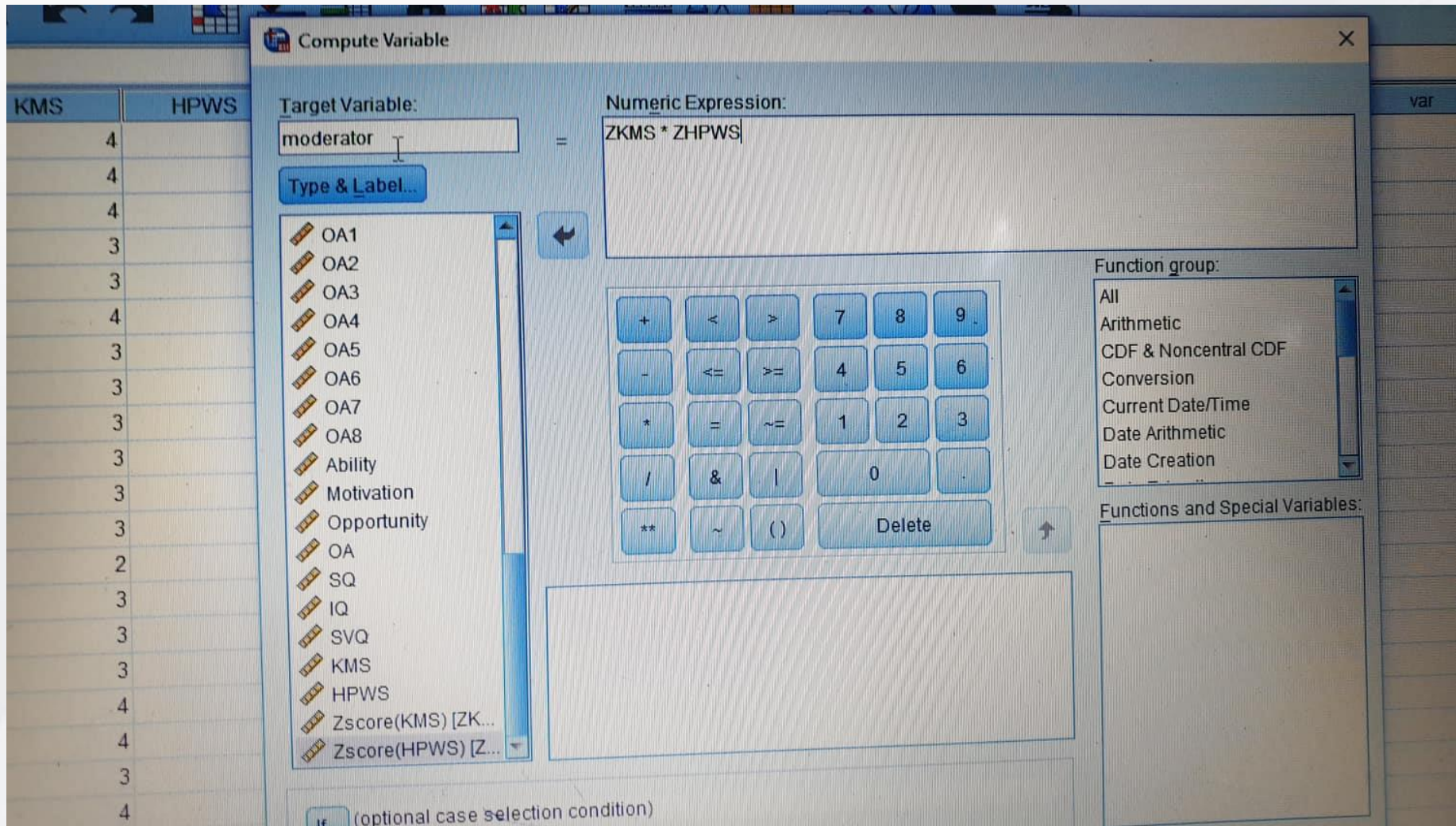




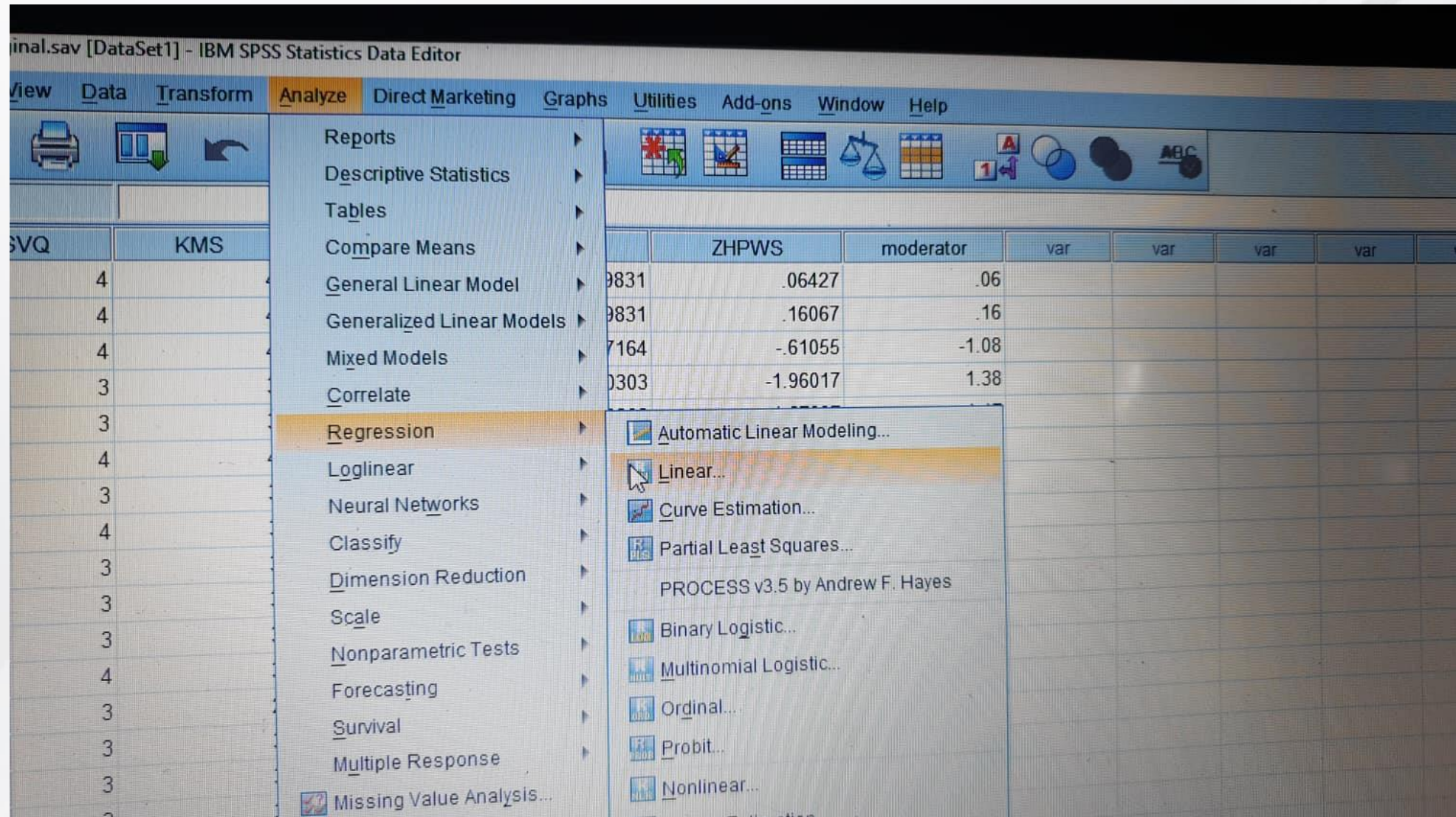
| KMS | HPWS | ZKMS     | ZHPWS    | var | var | var | var | var |
|-----|------|----------|----------|-----|-----|-----|-----|-----|
| 4   | 3    | .99831   | .06427   |     |     |     |     |     |
| 4   | 3    | .99831   | .16067   |     |     |     |     |     |
| 4   | 3    | 1.77164  | -.61055  |     |     |     |     |     |
| 3   | 2    | -.70303  | -1.96017 |     |     |     |     |     |
| 3   | 2    | -.70303  | -1.67097 |     |     |     |     |     |
| 4   | 4    | .99831   | .35347   |     |     |     |     |     |
| 3   | 2    | -.93503  | -1.57456 |     |     |     |     |     |
| 3   | 2    | -.54837  | -1.38176 |     |     |     |     |     |
| 3   | 4    | -.62570  | .73908   |     |     |     |     |     |
| 3   | 3    | -.62570  | -.22494  |     |     |     |     |     |
| 3   | 3    | -.70303  | -.03213  |     |     |     |     |     |
| 3   | 4    | .07030   | .35347   |     |     |     |     |     |
| 2   | 4    | -1.78570 | 1.12469  |     |     |     |     |     |
| 3   | 4    | -.70303  | .35347   |     |     |     |     |     |
| 3   | 3    | -.93503  | -.03213  |     |     |     |     |     |
| 3   | 2    | -.70303  | -1.47816 |     |     |     |     |     |
| 4   | 3    | .30230   | -.32134  |     |     |     |     |     |
| 4   | 4    | 1.30764  | .64268   |     |     |     |     |     |
| 3   | 3    | -.70303  | -.61055  |     |     |     |     |     |

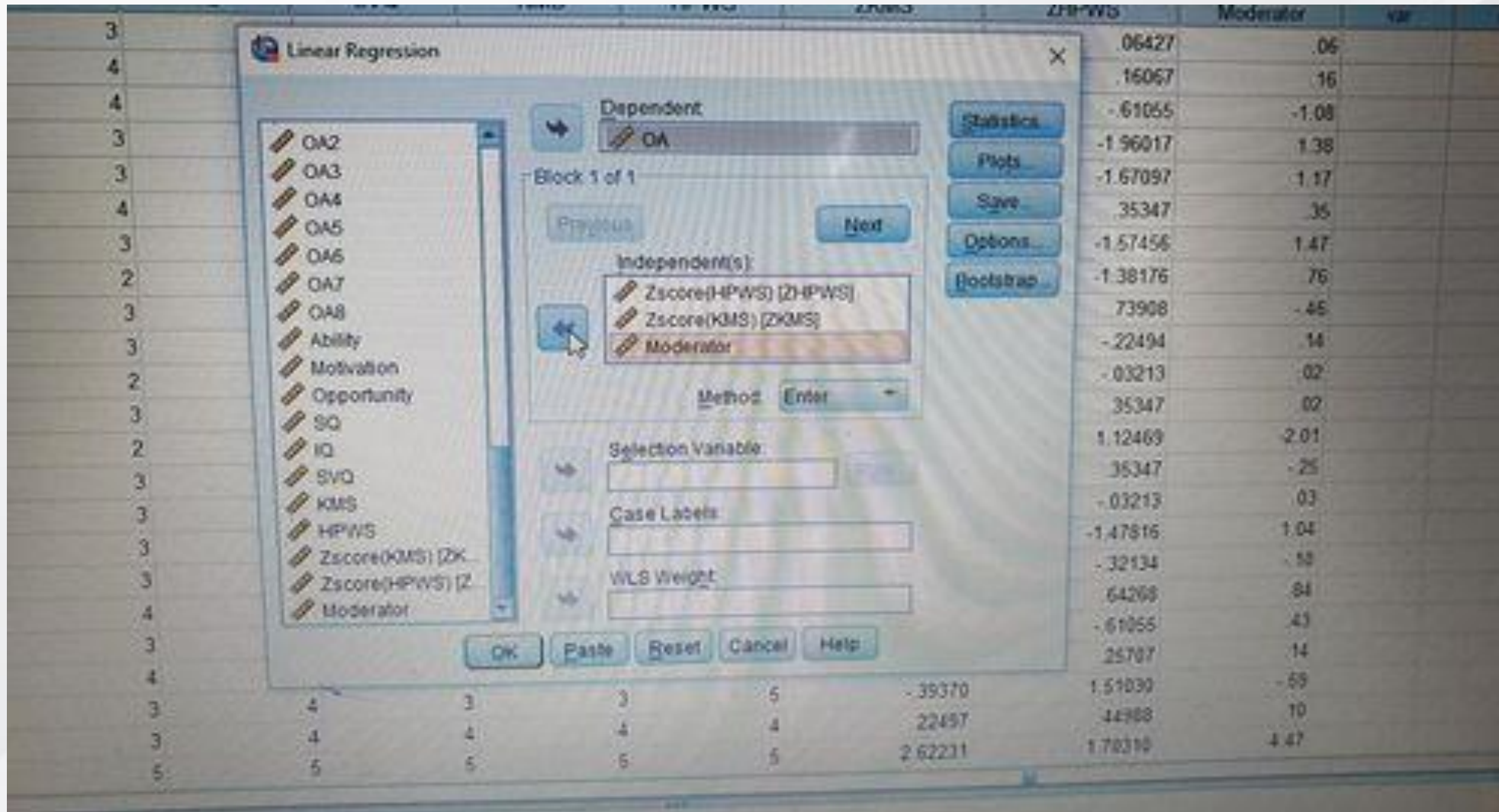






|   | KMS | HPWS | ZKMS     | ZHPWS    | moderator | var | var | var | va |
|---|-----|------|----------|----------|-----------|-----|-----|-----|----|
| 4 | 4   | 3    | .99831   | .06427   | .06       |     |     |     |    |
| 4 | 4   | 3    | .99831   | .16067   | .16       |     |     |     |    |
| 4 | 4   | 3    | 1.77164  | -.61055  | -1.08     |     |     |     |    |
| 3 | 3   | 2    | -.70303  | -1.96017 | 1.38      |     |     |     |    |
| 3 | 3   | 2    | -.70303  | -1.67097 | 1.17      |     |     |     |    |
| 4 | 4   | 4    | .99831   | .35347   | .35       |     |     |     |    |
| 3 | 3   | 2    | -.93503  | -1.57456 | 1.47      |     |     |     |    |
| 4 | 3   | 2    | -.54837  | -1.38176 | .76       |     |     |     |    |
| 3 | 3   | 4    | -.62570  | .73908   | -.46      |     |     |     |    |
| 3 | 3   | 3    | -.62570  | -.22494  | .14       |     |     |     |    |
| 3 | 3   | 3    | -.70303  | -.03213  | .02       |     |     |     |    |
| 4 | 3   | 4    | .07030   | .35347   | .02       |     |     |     |    |
| 3 | 2   | 4    | -1.78570 | 1.12469  | -2.01     |     |     |     |    |
| 3 | 3   | 4    | -.70303  | .35347   | -.25      |     |     |     |    |
| 3 | 3   | 3    | -.93503  | -.03213  | .03       |     |     |     |    |
| 3 | 3   | 2    | -.70303  | -1.47816 | 1.04      |     |     |     |    |
| 4 | 4   | 3    | .30230   | -.32134  | -.10      |     |     |     |    |
| 4 | 4   | 4    | 1.30764  | .64268   | .84       |     |     |     |    |
| 3 | 3   | 3    | -.70303  | -.61055  | .43       |     |     |     |    |
| 3 | 4   | 4    | .53431   | .25707   | .14       |     |     |     |    |





ANOVA<sup>a</sup>

| Model |            | Sum of Squares | df | Mean Square | F     | Sig.              |
|-------|------------|----------------|----|-------------|-------|-------------------|
| 1     | Regression | 11.771         | 3  | 3.924       | 7.898 | .001 <sup>b</sup> |
|       | Residual   | 14.408         | 29 | .497        |       |                   |
|       | Total      | 26.180         | 32 |             |       |                   |

a. Dependent Variable: OA  
b. Predictors: (Constant), Moderator, Zscore(HPWS), Zscore(KMS)

Coefficients<sup>a</sup>

| Model |              | Unstandardized Coefficients |            | Standardized Coefficients | t      | Sig. |
|-------|--------------|-----------------------------|------------|---------------------------|--------|------|
|       |              | B                           | Std. Error | Beta                      |        |      |
| 1     | (Constant)   | 5.554                       | .136       |                           | 40.782 | .000 |
|       | Zscore(HPWS) | .130 <sup>**</sup>          | .150       | .144                      | .867   | .393 |
|       | Zscore(KMS)  | .550                        | .156       | .608                      | 3.514  | .001 |
|       | Moderator    | -.083                       | .128       | -.100                     | -.652  | .520 |

a. Dependent Variable: OA

## Findings` Discussion



## Understanding the Research Discussion

- ❑ The research discussion chapter is a critical component of a thesis, where the findings are analyzed and interpreted in the context of existing literature.
- ❑ It provides a platform to demonstrate the significance of the research and its implications for the field.

## Structuring Your Discussion

- ❑ Organize your discussion chapter by presenting the research findings, analyzing the results, and discussing their implications.
- ❑ A clear and logical structure enhances the readability and coherence of your thesis

## Analyzing Research Findings

- ❑ Utilize statistical analysis and qualitative interpretation to analyze the research findings.
- ❑ This in-depth analysis provides a comprehensive understanding of the results and their significance within the research context

## Interpreting the Results

- ❑ Interpret the research results within the framework of existing literature and theoretical perspectives.
- ❑ This critical analysis demonstrates a deep understanding of the research outcomes and their implications

## Contextualizing the Findings

- ❑ Place your research findings within the broader context of the field, highlighting their relevance and potential impact.
- ❑ This contextualization strengthens the significance of the research within the academic community.

## Engaging with Literature

- ❑ Engage with relevant literature to support and contextualize the research findings within the broader academic discourse.
- ❑ A comprehensive literature review strengthens the scholarly foundation of the discussion chapter.



# Thank You