# Welcome

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# What is ANCOVA

▶ It is an extension of ANOVA ,This is also comes under the family of Mean differences.

▶ Combining Quantitative and Qualitative Predictors

▶ In an ANCOVA we try to adjust for differences

# Example,

- Suppose that we were to compare men's average faculty income, Asst. professor, Associate prof. and prof.

- women's average faculty income, via assistant, associate and professor– Looking for a differences involves an ANOVA

• **In trying to explain the differences among different category  we may want to control for certain variables:**

▶ **– Experience**

▶ **– Rank**

▶ **– Performance record**

▶ **– Etc.**

• **That is, we would like to show that the difference is due to relevant performance criteria.**

**If we can't show that this is the case, then we have a serious discrimination problem.**

# What does ANCOVA do?

▶ In research not always possible to control for all possible confounding variables that influence the dependent variables, then ANCOVA will allow you to rid of the effects of this variable.

▶ Reduce the error variance  and adjust the means on the dependent variables

# Basic requirements

▶ 1 DV (Interval, Ratio) – continuous

▶

  1 IV (Nominal, Groups) – discrete

▶ The above two variables are as it is ANOVA, no change, and a new variable is called covariate

▶ 1 CV (Interval, Ratios) – continuous

# Basic requirements

▶A covariate is a variable that is related to the DV, which you can't manipulate, but you want to account for it's relationship with the DV

# Assumptions

- ▶ **Normality**

- ▶ **Homogeneity of variance**

- ▶ **Random of independent variables**

- ▶ **For each IV , the relationships between the DV (Y) and covariate (X)linear**

- ▶ **DV and c are correlated**

# ANCOVA Example

- Does Teaching Method affect Academic Achievement after controlling for motivation?
- IV = teaching method
- DV = academic achievement
- CV = motivation
- Experimental design – assume students randomly allocated to different teaching methods.
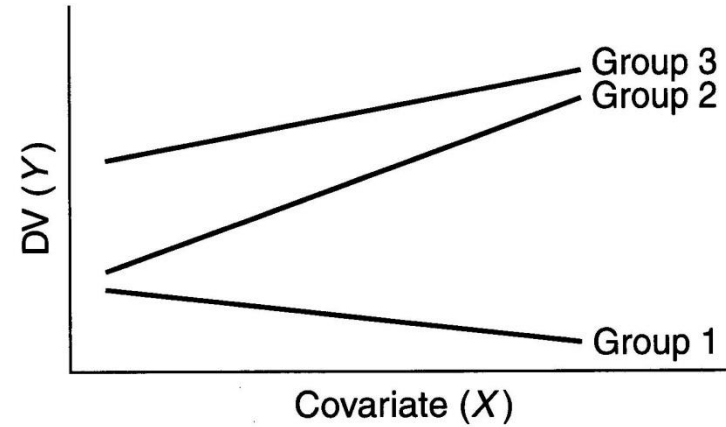
# Assumptions

▶ Homogeneity of Regression

  ▶ The relationship between each CV and the DV should be the same for each level of the IV
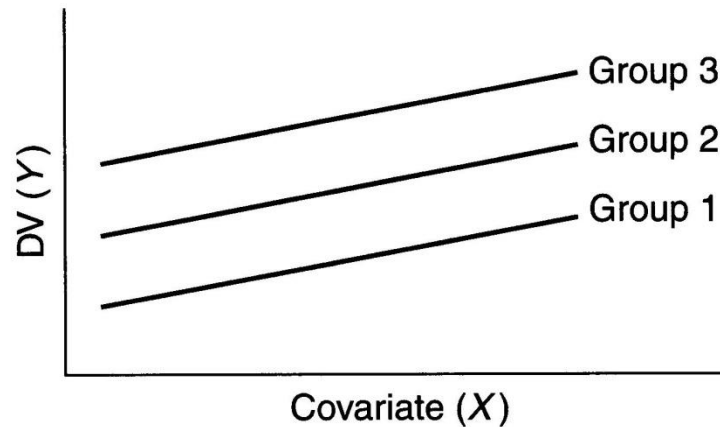


(a) Homogeneity of regression (slopes)          (b) Heterogeneity of regression (slopes)

# Hypothesis

▶ Null: There is no relationship between the IV and the DV, controlling for the CV. The means are equal. Mean 1 = mean 2 = mean 3 ….. F = 0.

▶ Research: There is a relationship between the IV and the DV, controlling for the CV. The means are not equal. Mean 1 ≠ mean 2 ≠ mean 3 …. F ≠ 0.

- **Exercise**

- Does social class influence the number of hours worked controlling for number of children?

- Identify

- DV

- IV

- Covariate

# Hypothesis

- Ho:  Social class does not influence the number of hours worked controlling for number of children.  Mean1 = mean2 = mean3 = mean4

- 
  H1:  Social class does influence the number of hours worked controlling for number of children.  Mean1 ≠ mean2 ≠ mean3 ≠ mean4

# Methodology reasoning

- Does wearing a condom influence the number of children that people have, controlling for income?

- Identify

- Dependent variable

- Independent variable and

- covariate

# Hypotheses:

▶ Ho: Wearing a condom does not influence the number of children that people have, controlling for income. Mean1 = Mean2, or Mean # of children among people who did not use a condom = Mean # of children among people who did use a condom

▶ H1: Wearing a condom does influence the number of children that people have, controlling for income. Mean1 ≠ Mean2, or Mean # of children among people who did not use a condom ≠ Mean # of children among people who did use a condom

# Selected variables

- DV

- IV

- Covariate

- Name of the test : One way ANCOVA

# Variables/ Indicators

▶ **Dependent variable: Reading scores**

▶ **Independent variable: status of the family (low middle and high)**

▶ **Income**

# Identify the covariate

- **Depression: dependent variable**
- **Gender: Factor**

  - AGE
  - Loneliness
  - Social support

- Income

- Group, male and female

- Experience
- Rank
- Performance record

# Identify the covariate

▶**Factor or independent variable :Gender**

▶**Dependent variable :Cranial capacity**

▶**Body height**

▶**Wrist size**

▶**Weight**

- Dependent variables : Education
- Independent variable : Race : whites, Black and others
- Identify the covariates

- **Age**
- **Income**

- **Ho: whites, Black and others are getting equal education after controlling by age. or**

- **Mean Education of Whites = Mean Education of Blacks = Mean Education of "Others" after controlling by age**

- **H1: whites, Black and others are getting not equal education after controlling by age. or**

- **Mean Education of Whites ≠ Mean Education of**

# Identify the  covariate-Foreign exchange exposure

► **Factor or Independent variable**

► **Three groups (Small medium and large scale industry)**

► **Dependent variable**

► **Likert scale (five levels)**

# covariate

- **Sales**
- **Foreign sales**