

# Graduate Statistics

## Analysis of Covariance



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## What We Will Cover in This Section

- Overview.
- How it works.
- Steps



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## Sample Problem

Ivanna Dayoff was doing research on the benefits of vacations on the mental health of working adults. Dayoff categorized people by the number of weeks vacation they had a year (0, 1, 2, 3, 4). She then evaluated the mental health of these participants using a standardized occupational stress index. Ivanna realized that the income of the participants could mask the relationship between vacation and stress.

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## Traditional ANOVA

Between Groups Variability  
Within Groups Variability

Between Groups Variability  
Random Variability + Subject Variability + **Income Variability**

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## Terms

- **Covariate**  
A variable that is correlated with the dependent variable.
- **Partialing Out**  
Statistical process of removing the variability associated with a covariate.

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## What Is/Are It?

Statistical technique of conducting an analysis of variance after the effects of one or more covariates have been partialled out.

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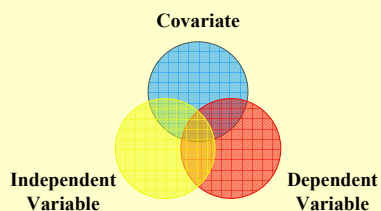
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## Concept



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## When is it used?

1. Increase the sensitivity of the F-test to better evaluate the 'pure' influence of the independent variable.
2. Statistically adjust treatment groups when the assumption of random assignment has been violated.

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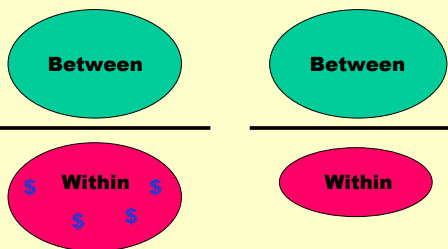
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## Model



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## Selecting Covariates

- The covariate should be significantly correlated with the dependent variable.
- If more than one covariate, they should have low correlations with each other.

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## Number of Covariates

$$\frac{C + (J - 1)}{N} < .10$$

**C** = Desired number of covariates.

**J** = Number of treatment groups.

**N** = Sample size.

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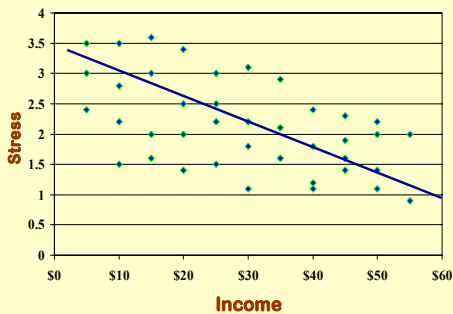
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## Statistical Steps

1. Statistically remove the variability attributed to the covariate
2. Conduct the ANOVA using the remaining variability.
3. Interpret the F as usual.
4. Interpret post hoc tests as usual.
5. Interpret  $\eta^2$  as usual.

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## Assumptions

- Observations are random and independent.
- Distribution of the dependent variable scores are normal
- Equality of variance
- There is a linear relationship between the covariates and the dependent variable.
- The covariate is reliable.
- The slope of the regression lines are similar.

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# The End

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