

Analysis of Variance (ANOVA)

BUS 735: Business Decision Making and Research

Goals

- Specific goals:
 - Learn how to compare means and medians among more than two groups.
- Learning objectives:
 - LO1: Be able to construct and test hypotheses using a variety of bivariate statistical methods to compare characteristics between two populations.
 - LO3: Be able to construct and use analysis of variance and analysis of covariance models to construct and test hypotheses considering complex relationships among multiple variables.
 - LO6: Be able to use standard computer packages such as R to conduct the quantitative analyses described in the learning objectives above.

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One-Way ANOVA

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- Testing for differences among means: two or more groups
- Extension of independent samples t-test for differences in means
- Uses measures of *variance* to measure for differences in *means*.
- Variance Decomposition:
 - **Among-group variation:** variability due to differences among groups, aka **explained variation**.
 - **Within-group variation:** variability within each of the groups, aka **unexplained variation**.

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Assumptions behind One-way ANOVA F-test

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- Randomness: random assignment to groups independently of the outcome
- Independence: individuals in each group are independent from individuals other groups
- Sufficiently large (?) sample size, or else population has normal distribution.
- Homogeneity of variance: the variances of each of the K groups must be equal ($\sigma_1^2 = \sigma_2^2 = \dots \sigma_K^2$).

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Non-parametric One-way ANOVA

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- Kruskal-Wallis Rank Test: non-parametric technique for differences in the *medians* among two or more groups
- Like Mann-Whitney U-test: uses ranks
- Null hypothesis: All groups have the same center of distribution
- Alternative hypothesis: At least one of the groups has a different center of distribution

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