Lesson 5

MANOVA AND ANOVA

Alessandra Fermani

ANOVA

- **ANOVA** **is a statistical technique that assesses potential differences in a scale-level dependent variable by a nominal-level variable having 2 or more categories.** For example, an ANOVA can examine potential differences in IQ scores by Country (US vs. Canada vs. Italy vs. Spain). The ANOVA, developed by Ronald Fisher in 1918.

- The null hypothesis for an ANOVA is that there is no significant difference among the groups. The alternative hypothesis assumes that there is at least one significant difference among the groups. After cleaning the data, the researcher must test the assumptions of ANOVA. They must then calculate the F-ratio and the associated probability value (p-value). In general, if the p-value associated with the F is smaller than .05, then the null hypothesis is rejected and the alternative hypothesis is supported. If the null hypothesis is rejected, one concludes that the means of all the groups are not equal. Post-hoc tests tell the researcher which groups are different from each other.

MANOVA

- **Multivariate analysis of variance (MANOVA)** is an extension of the univariate analysis of variance (ANOVA). In an ANOVA, we examine for statistical differences on one continuous dependent variable by an independent grouping variable. The MANOVA extends this analysis by taking into account multiple continuous dependent variables, and bundles them together into a weighted linear combination or composite variable. The MANOVA will compare whether or not the newly created combination differs by the different groups, or levels, of the independent variable. In this way, the MANOVA essentially tests whether or not the independent grouping variable simultaneously explains a statistically significant amount of variance in the dependent variable.

ANOVA & MANOVA

- When you conduct an ANOVA, you are attempting to determine if there is a statistically significant difference among the groups. If you find that there is a difference, you will then need to examine where the group differences lay.

- At this point you could run post-hoc tests which are t tests examining mean differences between the groups. There are several multiple comparison tests that can be conducted that will control for Type I error rate, including the [Bonferroni](#), Scheffe, Dunnet, and [Tukey](#) tests.

- ANOVA (univariate analysis) and MANOVA (multivariate analysis) compare means (variables independent or fix factor (age/gender or e.g. Motivation with variables dependent e.g. « satisfation» «pay more»). More 3 groups «v» on post hoc test-Tukey

- Save as excell or word – copy

- Graph

- Sintax

- Indip. Var. (IV) = factors, Likert
- Dip. Var. (DV)= dummy or categorical (groups)

ANOVA	MANOVA
1 DV	2,3,4…DV
2,3,4…IV	2,3,4…IV
*if I cross only 1 DV with 1 IV I can also use T test	* 3,4,5…groups I use Post Hoc test (Bonferroni o Tukey to reject H_0, eg. Hotel 1= Hotel 2= Hotel3)

ETA

- In SPSS I select effect size (partial eta square) to understand how strong the measured effect is (eg. age impact on memory)
- Eta = r in regression
- This parameter introduced because it does not depend on the sample size (usually, bigger sample size and more significant differences you can find) .
- Eta does not take into account the *error* but the level of significance take into account the *error .*

Indexes sign.: Eta or «d» of Cohen or «r» of Pearson or alpha
Eta: from 0 to 1 (0 the model does not represent my data, 1 the model perfectly reflects my data)

- Conventional values for the interpretation of Eta square indexes (Cohen, 1992b):

1. d (eta index) small effect >.20; medium effect >.50; large effect >.80

2. In SPSS the Eta value : 01 = small effect ;

.06 = medium effect; .14 = large effect (Cohen, 1988)

3. r (regression) small effect >.10; medium effect >.30;
    large effect >.50

SQ Deviance

Variance

The relationship between the two population variance estimates (one in the groups and the other among the groups) has a distribution depicted by the random variable F of Fisher

Tests of Between-Subjects Effects

Dependent Variable: risolti

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Corrected Model	73.733[b]	2	36.867	8.574	.005	.588	17.147	.911
Intercept	426.667	1	426.667	99.225	.000	.892	99.225	1.000
condizio	73.733	2	36.867	8.574	.005	.588	17.147	.911
Error	51.600	12	4.300					
Total	552.000	15						
Corrected Total	125.333	14						

a. Computed using alpha = .05

b. R Squared = .588 (Adjusted R Squared = .520)

Index of power >.80

degrees of freedom
Groups n. minus 1

Effect size (Grandezza dell'effetto): % di variabilità totale attribuibile all'effetto
Index: >.14 large