

Lab 5

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Power in statistical modeling

- Type I (α) error refers to probability of finding an effect (within a given sample) that does not exist in a population
- Type II (β) error refers to probability of missing an effect (withing a given sample) that does exist in a population
- Power ($1 - \beta$) is a measure of ability to detect ‘true’ effect
- Power is related to effect size and number of participants (e.g. within a cell of the experiemental design)

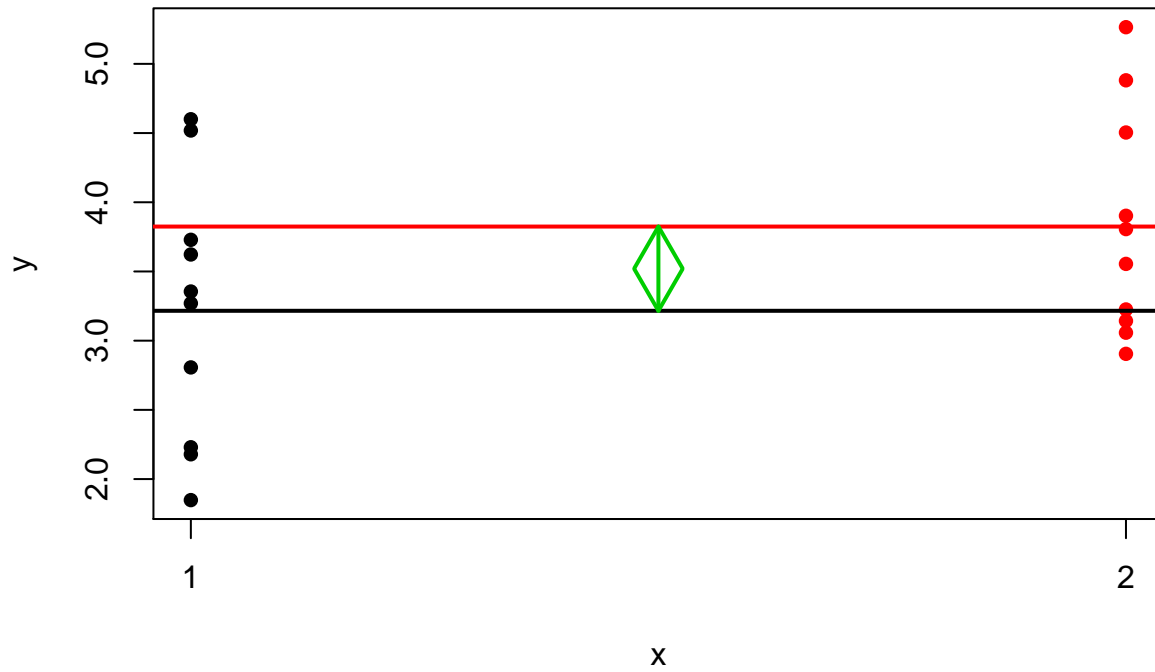
Power in statistical modeling

- Lets say you want to compare 2 groups, and treat difference with $p < 0.05$ as statistically significant; moreover you would like to obtain recommended power $(1 - \beta) = 0.80$
- If your expected effect size is large (very rare in psych. science), you would require $2 \times 26 = 52$ participants in total
- In the case of medium effect size (sometimes happen in psych. science), $2 \times 64 = 128$ participants
- In the case of small effect size (very common in psych. science), $2 \times 393 = 786$ participants

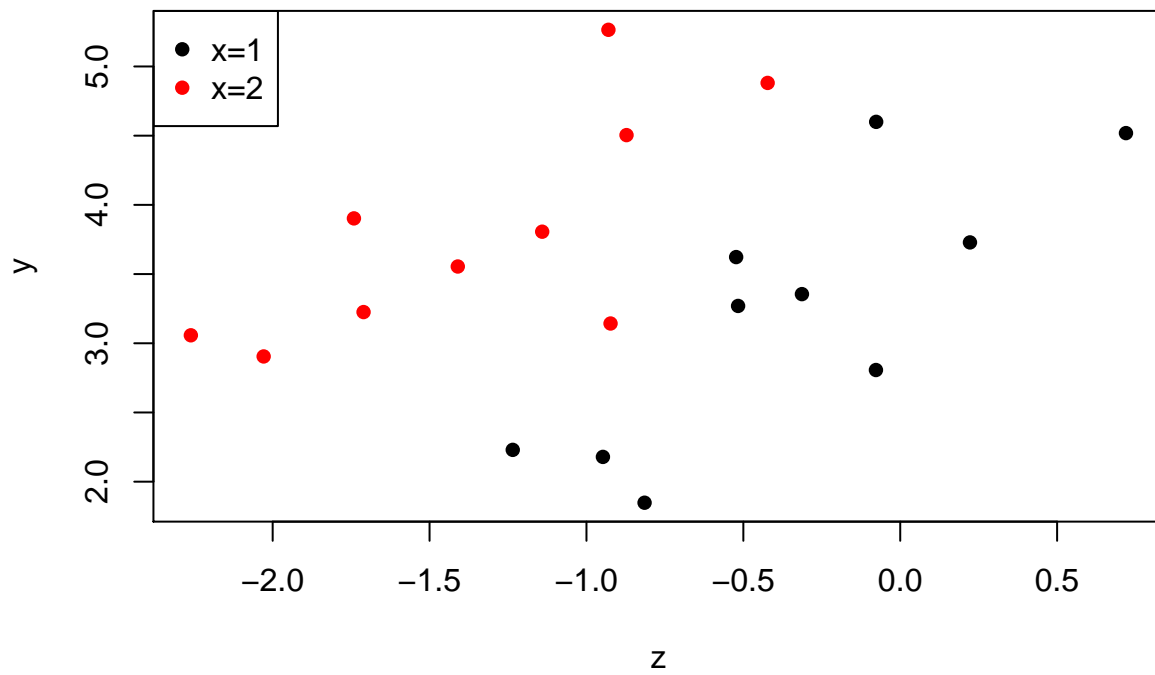
Power in statistical modeling

- Most of the psychological studies are underpowered
- Required sample size grows with the model complexity
- One way to increase power without increasing sample size is to use covariates

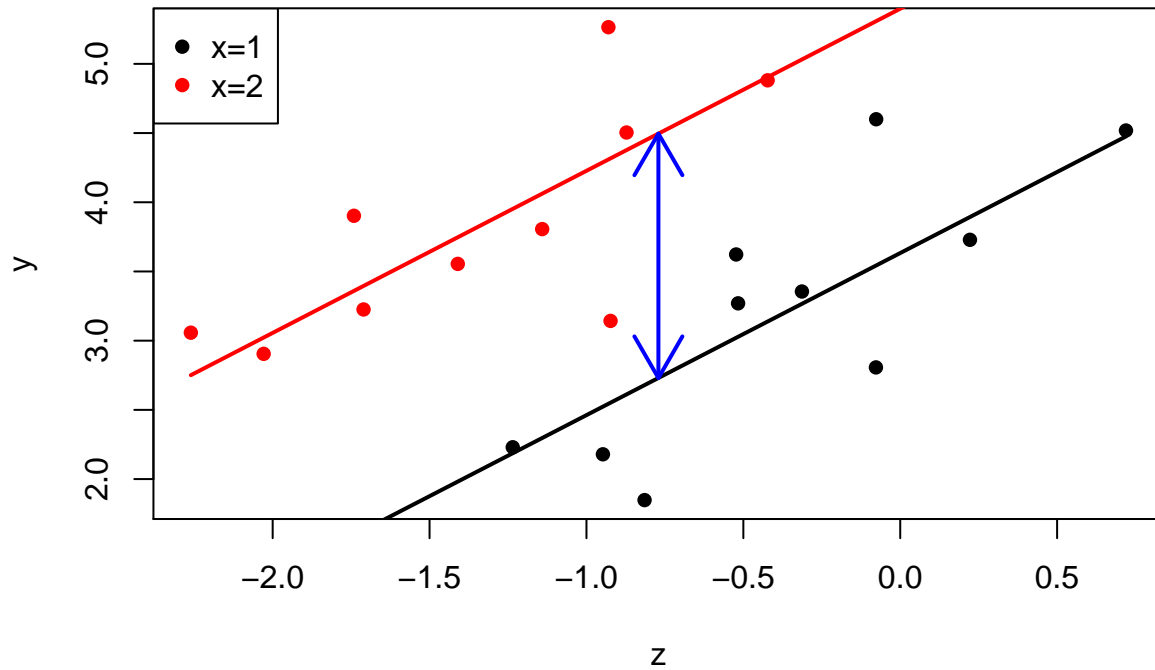
Comparing 2 means without covariate



Dependent value vs covariate among 2 groups of independent variable

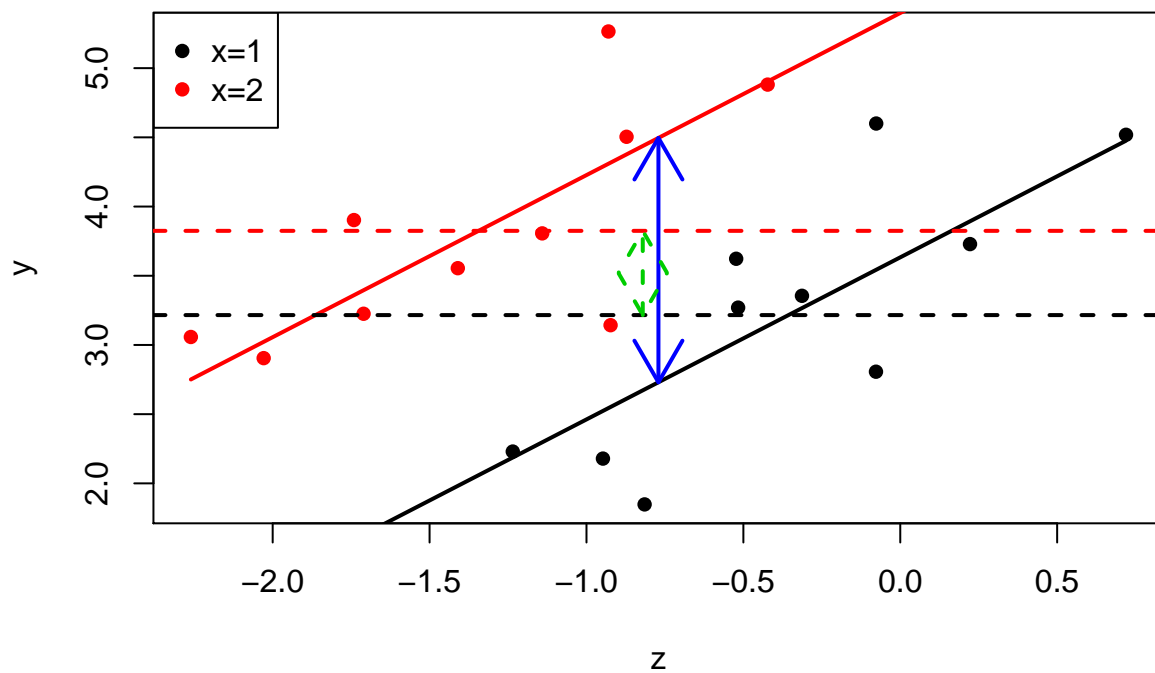


Comparing 2 means with covariate



Mean comparison with and without covariate

Difference between ANOVA and ANCOVA



Accounting for covariates

- Adding additional covariates to the model may result in observing greater differences between group means - suppression effect
- But also, adding covariates to the model may result in observing smaller differences between group means - confounder effect
- In general choosing to use additional covariates should be preceded by careful analysis of theoretical importance of the covariates.
- Using covariates ad hoc or post hoc is sometimes viewed as an example of p-hacking

Some assumptions in ANCOVA

1. Covariate variables on continuous scale; you can also use nominal variables, but such analysis is usually not called ANCOVA
2. The covariate should be linearly related to the dependent variable at each level of the independent variable
3. There needs to be homogeneity of regression slopes, which means that there is no interaction between covariate and the independent variable