QUANTITATIVE RESEARCH METHODS

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Lecture 6

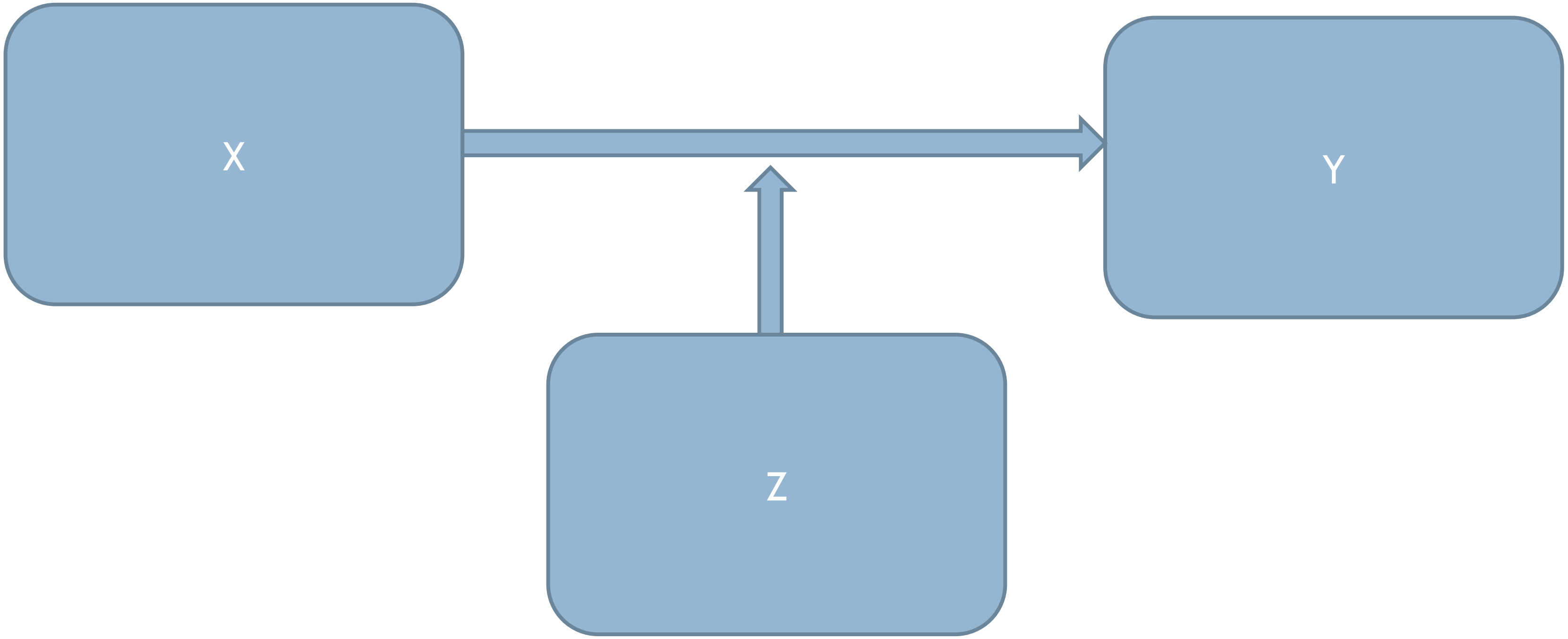
contents

- Interaction / moderation analysis
- Mediation analysis

INTERACTION

Interaction effect

= moderation



Interaction effect

- Is the realtionship between X and Y different for different values of Z?

1. Calculate an interaction term of X and Z (multiply X with Z)
2. Include main and interaction effects in equation
3. Center variables to be able to interpret the intercept (constant)

Interaction equation

$$Y_i = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_1 x_2 + \varepsilon_i$$

Example: interaction effect

1. First create interaction term
2. Add interaction term to independent variables
3. Solve equation
4. Check with lm function

Compare models

	Model without interaction	Model with interaction
Constant	37.227***	49.808***
Horsepower	-.0318**	-.120***
Weight	-3.878***	-8.216***
Weight * Horsepower		.027***
R2	.815	.873

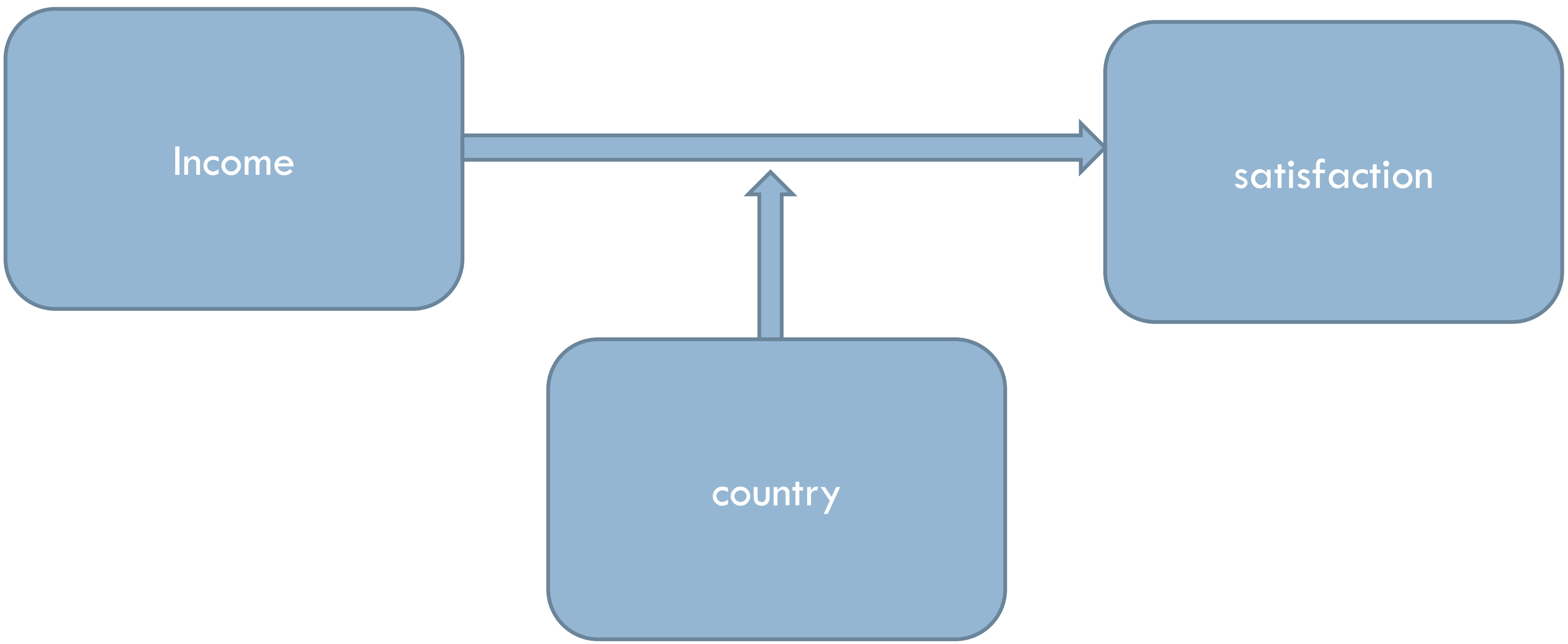
Interpretation

- Holding constant changes meaning when a moderation effect is added
- The main effects can only be interpreted as the other variables (i.e. interaction effect) is held constant
- This only happens when the main effects are zero (if they are not, the interaction effect changes as well)

- These zero values do not always have meaning!

Exercise 6_1.r

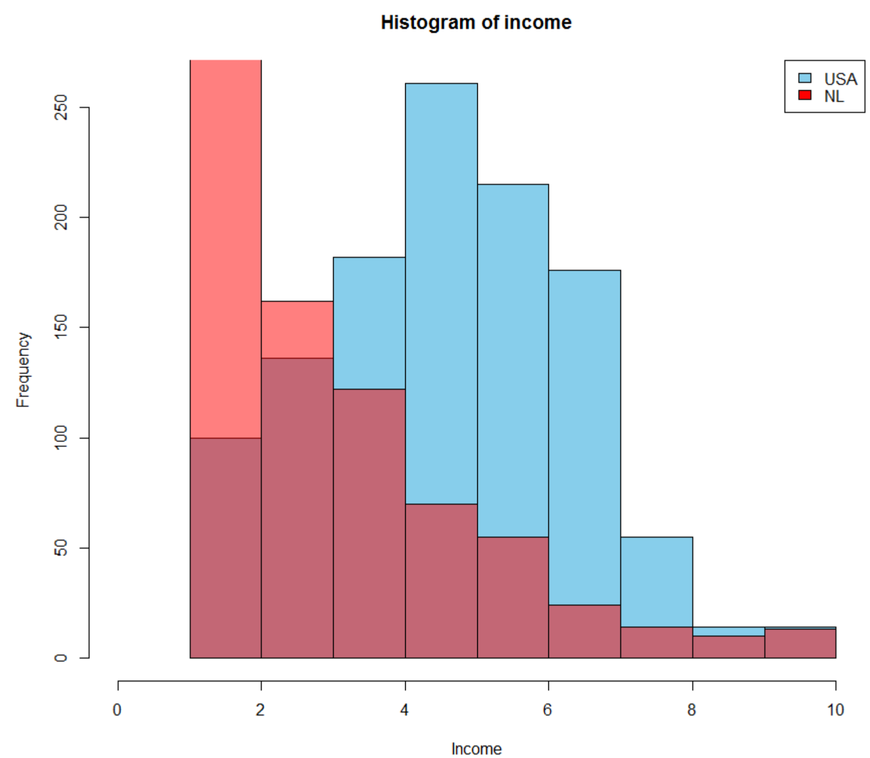
Test & interpret the interaction effect:



Exe 6_1.r

- Use plots:

```
plot(incUSA, col='skyblue', xlab="Income",
      main="Histogram of income", xlim=c(0,10))
plot(incNL, col=rgb(1,0,0,1/2), xlim=c(0,10), add=T)
legend("topright",
      c("USA", "NL"),
      fill=c("skyblue",
      "red"))
```



Exe 6_1.r

- Explore differences between countries
- Calculate interaction term
- Solve multiple regression with interaction term
  - Check with lm function
  - Interpret effects
- Assess model fit

INTERACTION

Mean centering

Interaction equation

$$Y_i = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_1 x_2 + \varepsilon_i$$

An increase of 1 in X1 leads to an increase of b1 in Y when X2 is zero

Interaction equation

$$Y_i = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_1 x_2 + \varepsilon_i$$

An increase of 1 in X2 leads to an increase of b2 in Y when X1 is zero

Interaction equation

$$Y_i = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_1 x_2 + \varepsilon_i$$

An increase of 1 in X1 and X2 leads to an increase of b3 in Y

Example: house with rooms

- Y = price
- X1 = number of rooms
- X2 = square meters

$$Y_i = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_1 x_2 + \varepsilon_i$$

B3 = increase in rooms for house of zero square meters

Example taken from Woolridge

Example: house with rooms

- Therefore mean center:

$$Y_i = b_0 + \delta_1 x_1 + \delta_2 x_2 + b_3(x_1 - \mu_1)(x_2 - \mu_2) + \varepsilon_i$$

$$\delta_1 = b_1 + b_3 \mu_2$$

B3 now describes an increase in rooms for an house of average square meters

Example taken from Woolridge

Exe 6_2.r

- Center your variables around the mean or another meaningful value (NOT the dummy variable)
- Calculate the interaction term using centered variables & add to the model
- Test the model using the lm function
  - Interpret the results (compare to uncentered solution, solution without interaction term)
- Assess model fit

ASSIGNMENT

Assignment 2

Use the same countries as in assignment 1

- Think of a reasonable model to explain green behavior (measured by willingness to pay)
- Include at least two variables
  - *Select two item scales that you think are interesting (both at interval level)*
  - *Calculate the mean scores for each of the scales using the apply function*

Assignment 2 (continued)

- Ad a moderator variable to explore country effects
- Center the variables
- Estimate the regression coefficients with lm function
- Interpret the coefficients and model fit

Next lecture

- GLM
- Tablet dataset

General linear model vs Generalized linear model

	General linear model	Generalized linear model
Typical estimation method	Least squares. best linear unbiased prediction	Maximum likelihood or Bayesian
Special cases	ANOVA. ANCOVA. MANOVA. MANCOVA. linear regression. mixed model	linear regression. logistic regression. Poisson regression