STATISTICAL RESEARCH ETHODS

International inter-university postgraduate interdisciplinary doctoral study ENTREPRENEURSHIP AND INNOVATIVENESS

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Jasna Horvat, Ph.D. Josipa Mijoč, Ph.D.

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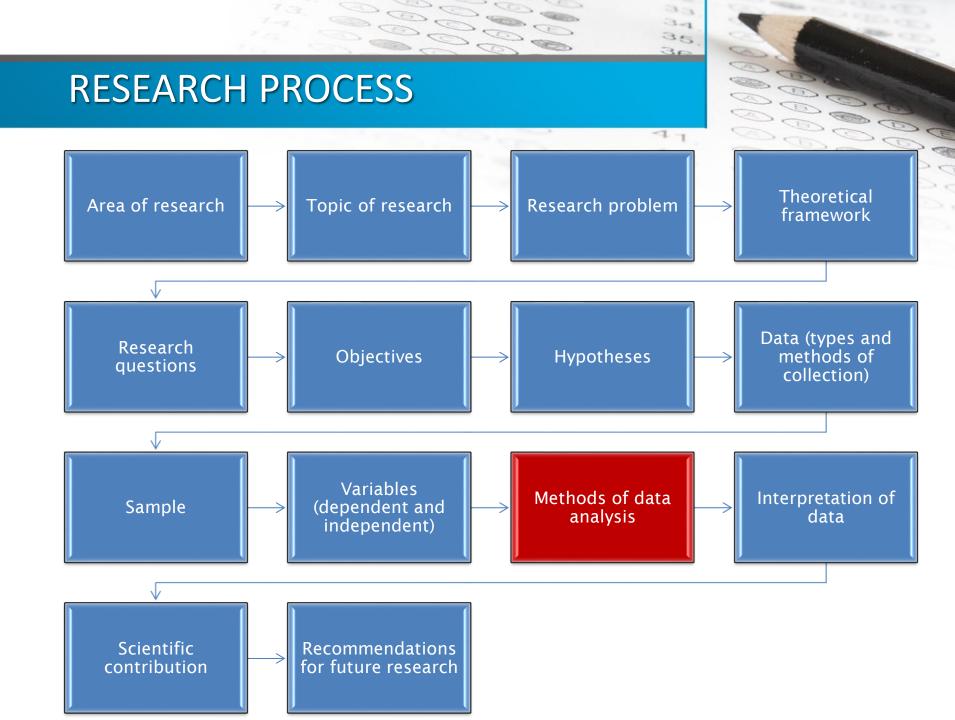
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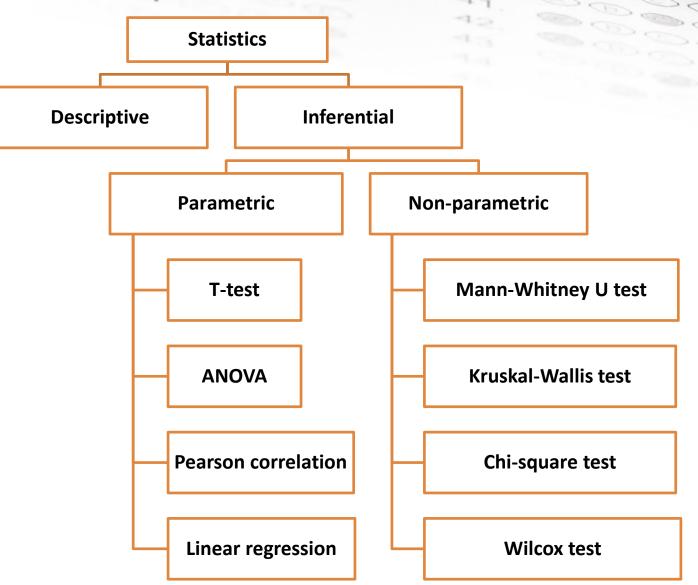


Parametric vs. non-parametric statistics

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Parametric vs. non-parametric tests

- Parametric tests the assumption of normal distribution
- Non-parametric tests does not require the assumption of normality data
 - It can be used on data recorded on a nominal and ordinal measurement scale.

Choosing a statistical test

- Depends on:
 - Research goals
 - Null hypothesis
 - Types of variables (dependent/ independent)
 - The measurement scale (nominal/ ordinal/ ratio scale)

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- Number of samples (of compared group)
- Satisfied the assumptions of each test:
 - The normal distribution of the data
 - approximately equal variance
 - Autocorrelation, heteroskedasticity and multicollinearity ... (multiple regression analysis)
 - Etc.

Types of statistical Analysis

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- Univariate statistical methods
- Bivariate statistical methods
- Multivariate statistical methods

Univariate analysis

- Analysis of <u>ONE</u> variable
- Descriptive statistical methods
 - The arithmetic mean, median, mode, interquartile, variance, standard deviation, etc.

Bivariate statistical methods

- Analysis of the relationship between <u>TWO</u> variables
 - Some of the methods
 - Correlation analysis (Pearson correlation)
 - t test
 - ANOVA
 - Mann Whitney test
 - Chi-square test
 - linear regression

Multivariate statistical methods

- Analysis of the relationship between <u>MORE THAN</u> <u>TWO</u> variables
 - Some of the methods
 - Factor analysis
 - Cluster analysis
 - Multiple regression analysis
 - •

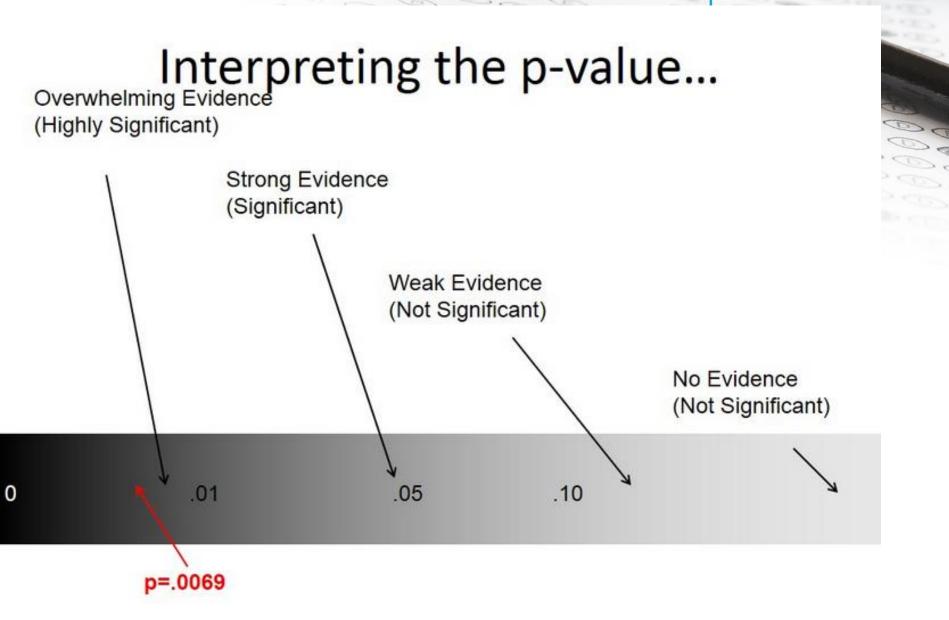
- Univariate analysis
 - Example: How many employees of the company is highly educated?
- Bivariate analysis
 - Example: Is education connected to the amount of salary?
- Multivariate analysis
 - Example: Is it possible to predict a successful manager using different variables such as age, sex, education level, work experience?



If $P \le \alpha$ reject the null hypothesis. F $P > \alpha$ fail to reject the null hypothesis

If $P > \alpha$ fail to reject the null hypothesis.

Fail to reject H1 – THERE IS SIGNIFICANT STATISTICAL DIFFERENCE!!!!



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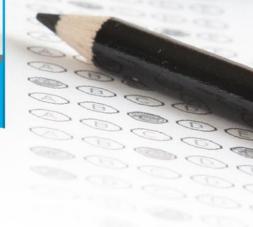
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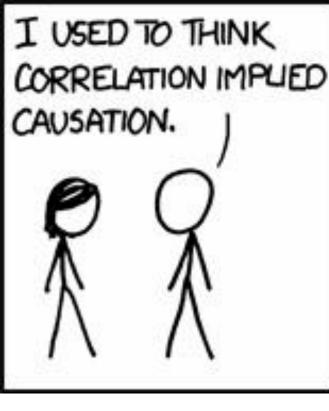
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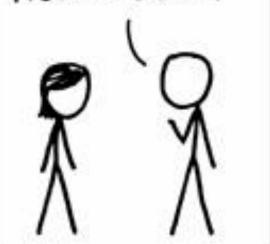


- Bibivariate analysis that *measures* the strengths of association between two variables
- Correlation coefficient
 - most commonly used measure to describe the relationship between variables
 - describes the direction and strength of the correlation of variables which are in a linear relationship
 - it is not possible to draw conclusions about cause and effect relation of observed variable by correlation

- The most known correlation coefficients:
 - Pearson and Spearman correlation coefficient
 - usage depends on the measuring scale on which data was collected
 - Pearson: variables measured at interval or ratio scale of measurement, requires a linear and normal distribution of data and large enough sample
 - Spearman: one or both variables measured by ordinal scale, does not set a condition of linearity, symmetry or sample size.
- Example :
 - Is there a positive correlation between the quality of products and its annual sales



THEN I TOOK A STATISTICS CLASS. NOW I DON'T.





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- Values between -1 and +1
 - -1 Indicates a complete negative connection between two variables, +1 manning a positive connection between two variables, and 0 the absence of connection observed variables.
- Pearson correlation coefficient the connection of two variables measured on the interval or ratio scale
 - linear and normal distribution of data and large enough sample
- Spearman's correlation coefficient one or both of the variables measured by ordinal scale
 - does not set a condition of linearity, symmetry or sample size

- Examples of the hypotheses:
 - The motivation for achievement was positively associated with students career choice
 - Students who spend more time on Facebook are more skilled with the usage of video and audio programming software

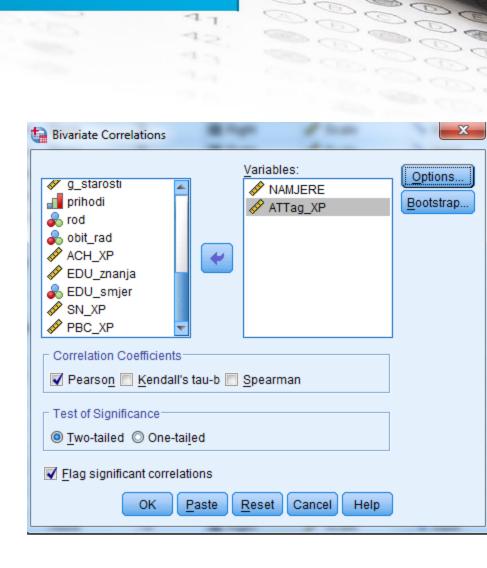


 -H4a: The attitudes towards selfemployment were positively associated with intentions for self-employment.
 » Measurement scale?
 » What coefficient?

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NAMJERE	Pearson Correlation	1	,740 ^{***}					
	Sig. (2-tailed)		,000					
	N	426	426					
ATTag_XP	Pearson Correlation	,740^^	1					
	Sig. (2-tailed)	,000						
	Ν	426	426					
**. Correlation is significant at the 0.01 level (2-tailed).								

Correlations

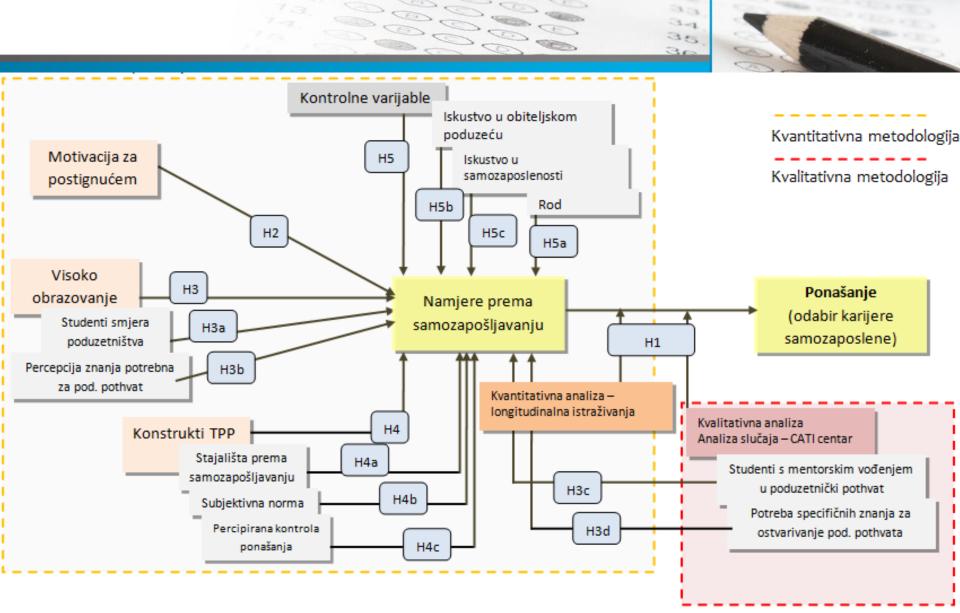
Tablica 64: Hijerarhijski regresijski modeli (n=426)

	Model 1	Model 2	Model 3	Model 4
Kontrolne varijable				
Rod	,036	,023	,036	,030
Iskustvo u obiteljskom poduzeću	,367***	,332 ***	,316***	,155*
Prediktorske varijable				
Motivacija za postignućem		,204**	,147 [▽]	,010
Visoko obrazovanje:				
Percepcija o znanjima i vještima			,064	,027
naučenim tijekom studija				
Studijski smjer			,230**	,127*
Teorija planiranog ponašanja:				
Stajališta prema				,485***
samozapošljavanju				
Subjektivna norma				,198**
Percipirana kontrola ponašanja				,155*
۲²	,136	,176	,238	,650
Korigirani r ^a	,122	,156	,206	,626
Δr²		,040**	,062***	,412 ***
F-omjer	9,53 ^{8***}	8,558***	7,386***	26,725***
∆F-omjer		5,835**	4,813***	45,141***

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Razina statističke značajnosti: *** p < 0,001, ** p < 0,01, * p < 0,05, ∇ p < 0,1



SPSS

- User-friendly program
- Coding questionnaire always with data
- A wide selection of statistical tests
- The possibility of analysis of different groups and subgroups of data
- A simple " import " of data from Excel

Hypotheses

- H4a: <u>Attitudes towards self-employment are positively</u> associated with self-employment intentions.
- Variables
 - H4a
 - V1: Attitudes towards self-employment (scale)
 - V1a: Attitudes towards self-employment (scale)
 - V2: Self-employment intentions (measuring construct)
- Methods of data analysis
 - H4a: factor analysis, reliability testing of the measurement instrument, correlation analysis

2nd approach Creating a composite variable

- I can not imagine working for someone else.
- The idea of an own business for me is very attractive.
- Work in my own company for me would be a personal satisfaction.

IBM SPSS Statistics

- Korisnički orijentiran program
- Kodiranje upitnika koje je uvijek uz podatke
- Velik izbor statističkih testova
- Mogućnost analiza različitih skupina i podskupina podataka

Vetode

• Jednostavan "uvoz" podataka iz Excela

IBM SPSS Statistics

 najčešće korišten statistički program u društvenim znanostima

SPSS softver u ponudi



IBM SPSS Statistics

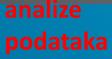
Predviđanje: Upotrijebite snagu naprednih statističkih analiza za razumijevanje podataka, identificiranje trendova i izradu točnih predviđanja.

Metode

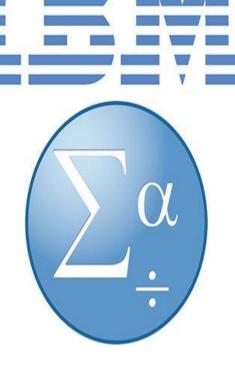
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Program za uređivanje podataka, analizu podataka i pripremu prezentacija podataka i rezultata.



Primjer izgleda izbornika Deskriptivna statistika

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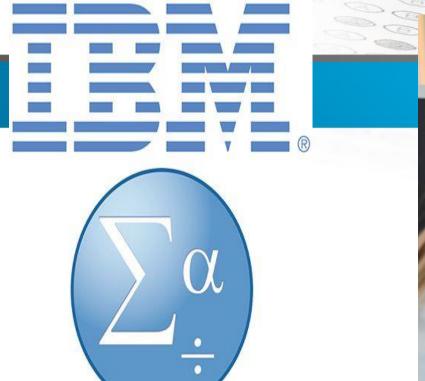
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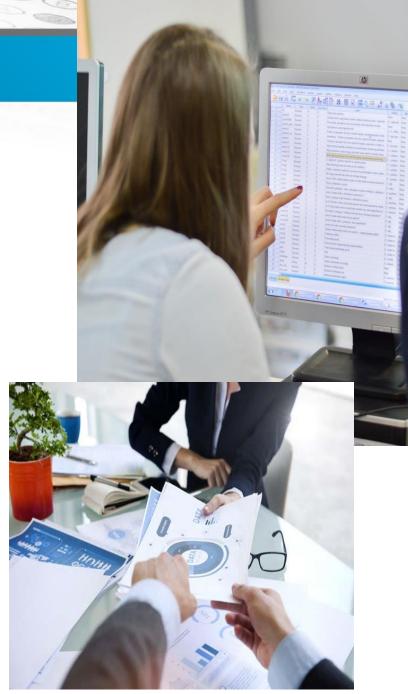
Metode

analize

podata







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Preporuke

- Temeljem teorijskog i empirijskog istraživanja analizirane teme
- Preporuke
 - Budućim istraživačima
 - Gospodarstvenicima
 - Nositeljima politika

Course research project - Example

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Hypotheses

- H5a1: Personal experience of respondents the family business depends on the respondents' gender.
- Variables
 - H5a1
 - V1: Experience in the family business (yes, no
 - V2: Gender (male, female)
- Methods of data analysis
 - H5a1: chi-square test

Chi-square test

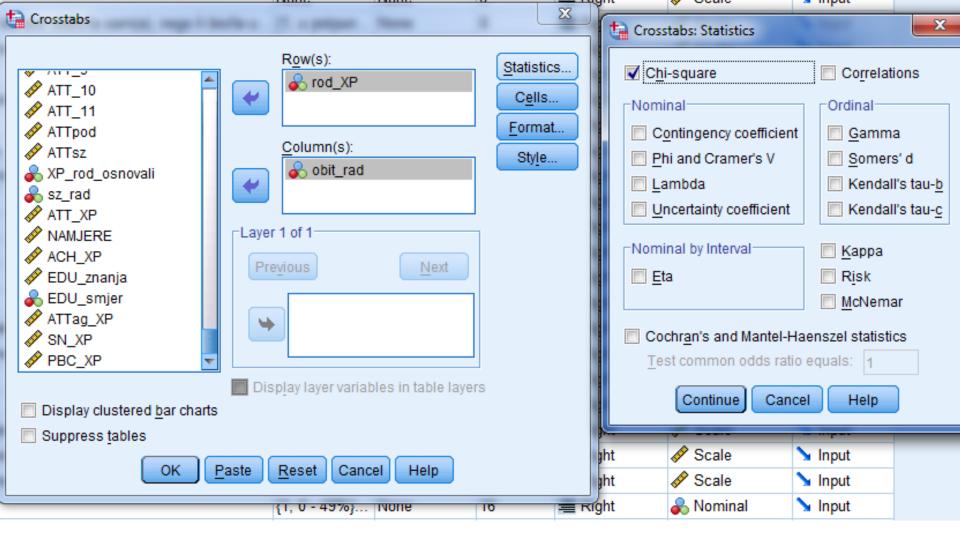
- Non-parametric statistical test
 - Nominal/ordinal measurement scale
 - Does not require normality of distribution
- The likelihood of connection between two variables
- Decision: comparing the chi-square value of the tested sizes



If $P \leq \alpha$ reject the null hypothesis.

If $P > \alpha$ fail to reject the null hypothesis.

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	1,00 muški	Count	23	25	48
		% within rod_XP Model XP - Rod	47,9%	52,1%	100,0%
Total		Count	59	65	124
		% within rod_XP Model XP - Rod	47,6%	52,4%	100,0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2- sided)	Exact Sig. (1- sided)
Pearson Chi-Square	,004 ^a	1	,953		
Continuity Correction ^b	,000,	1	1,000		
Likelihood Ratio	,004	1	,953		
Fisher's Exact Test				1,000	,549
Linear-by-Linear Association	,004	1	,953		
N of Valid Cases	124				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 22,84.

Hypotheses

- *H5a:* The gender characteristic distinguishes respondents in their choice of career of self-employment.
- Variables
 - H5a
 - V1: Gender (male, female)
 - V2: Self-employment intentions (scale)
- Methods of data analysis
 - H5a: t-test of independent samples



Self-employment intetntions Construct

Mjerenje namjera za samozapošljavanje (zavisna varijabla)

- Mjeriti jednim pitanjem ili konstruktom?
 - Kojom mjernom ljestvicom?
- Meta analiza
- Pregled korištenih mjernih ljestvica za mjerenje namjera za samozapošljavanjem (poduzetničkih namjera)

		Likerto		Dihotomna	Procjena	
	4-	5-	(nominalna	vjerojatno		
	stupnjevana	stupnjevana	stupnjevana	stupnjevana	mjerna ljestvica)	sti
Broj radova	1	7	1	13	5	5
Ukupan broj					5	5
radova				22		

<u>Mjerni konstrukt namjere za samozap</u>osljavanjem

5 izjava:

- Kolvereid (1996b)
 - NS1 Ukoliko biste mogli birati između vođenja vlastitog posla i zaposlenja kod poslodavca, što biste radije odabrali?
 - 5 stupnjevana Likertova ljestvica, 1 radije zaposlen/a kod poslodavca, 5 radije samozaposlen/a
 - NS2 Procijenite vjerojatnost da ćete postati samozaposlena osoba.
 - Procjena vjerojatnosti u postotku (0% 100%)
 - NS3 Koliko je vjerojatno da ćete ostvariti karijeru samozaposlene osobe?
 - 5 stupnjevana Likertova ljestvica, 1 nije vjerojatno, 5 vrlo je vjerojatno
- Zhao i suradnici (2005), Krueger i suradnici (2000)
 - NS4 U sljedećih 5 godina započet ću vlastiti posao.
 - 5 stupnjevana Likertova ljestvica, 1 *nije vjerojatno, 5 vrlo je vjerojatno*
 - NS5 U sljedećih 10 godina započet ću vlastiti posao.
 - 5 stupnjevana Likertova ljestvica, 1 *nije vjerojatno, 5 vrlo je vjerojatno*
- Mjerne ljestvice?
 - Standardizacija



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2	7	NS1		Numeric	ROC (Cur <u>v</u> e			e mog	gli birati izm	neđu v	ođenja vlastitog posla i zaposlenja u poduzeću koje je u t {	1,		
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3)	NS3		Numeric	2	0	Koliko	o je vje	erojatn	o da ćete o	stvarit	ti karijeru samozaposlene osobe. {	1,		
3	1	NS4		Numeric	2	0	U slje	dećih	5 god	ina započe	t ću vla	astiti posao. {	1,		
32	2	NS5		Numeric	2	0	U slje	dećih	10 go	dina započ	et ću v	vlastiti posao. {	1,		
33	3	SN1		Numeric	2	0	Vjeruj	jem da	a moja	i najbliža ol	oitelj s	matra da bih trebao/la odabrati karijeru samozaposlene o {	1,		
34	4	SN2		Numeric	2	0	Vjeruj	jem da	a moj(a	a) najbolji(a) prijat	telj(ica) smatra da bih trebao/la odabrati karijeru samozap {	1,		
3	5	SN3		Numeric	2	0	Vjeruj	em da	a ljudi	koji su mi v	ažni s	smatraju da bih trebao/la odabrati karijeru samozaposlene {	1,		
-					-										

Frequency Table

		Frequency	Percent	Valid Percent	Cumulative Percent								
Valid	1 radije bih bio zaposlen/a za nekog drugoga	23	5,4	5,4	5,4								
	2	63	14,8	14,8	20,2								
	3	112	26,3	26,4	46,6								
	4	117	27,5	27,5	74,1								
	5 radije bih bio/la samozaposlen/a	110	25,8	25,9	100,0								
	Total	425	99,8	100,0									
Missing	System	1	,2										
Total		426	100,0										

NS1 Ukoliko biste mogli birati između vođenja vlastitog posla i zaposlenja u poduzeću koje je u tuđem vlasništvu, što biste odabrali



Surger and Personnel Statements

DC

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NS2 Procijenite vjerojatnost da ćete postati samozaposlena osoba

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	,00,	2	,5	,5	,5
	1,00	1	,2	,2	,7
	2,00	2	,5	,5	1,2
	5,00	6	1,4	1,5	2,7
	10,00	19	4,5	4,7	7,4
	15,00	6	1,4	1,5	8,8
	20,00	26	6,1	6,4	15,2
	22,00	1	,2	,2	15,4
	23,00	1	,2	,2	15,7
	25,00	5	1,2	1,2	16,9
	30,00	44	10,3	10,8	27,7
	32,00	1	,2	,2	27,9
	35,00	5	1,2	1,2	29,2
	37,00	1	,2	,2	29,4
	40,00	35	8,2	8,6	38,0
	45,00	3	,7	,7	38,7
	49,00	1	,2	,2	39,0
	50,00	96	22,5	23,5	62,5
	55,00	7	1,6	1,7	64,2
	60,00	30	7,0	7,4	71,6
	62,00	1	,2	,2	71,8

♦

	Dese	criptive Stati	stics		
	Ν	Minimum	Maximum	Mean	Std. Deviation
NS1 Ukoliko biste mogli birati između vođenja vlastitog posla i zaposlenja u poduzeću koje je u tuđem vlasništvu, što biste odabrali	425	1	5	3,54	1,179
NS2 Procijenite vjerojatnost da ćete postati samozaposlena osoba	408	,00,	100,00	49,9020	23,67190
NS3 Koliko je vjerojatno da ćete ostvariti karijeru samozaposlene osobe.	424	1	5	3,06	,960
NS4 U sljedećih 5 godina započet ću vlastiti posao.	423	1	5	2,45	1,148
NS5 U sljedećih 10 godina započet ću vlastiti posao.	424	1	5	3,16	1,201

The self-employment intentions (measuring construct)

- How to be written as one variable ?
 - How much are we convinced that the statements (particles) from the measuring construction measures precisely measured concept - intentions for self-employment ???
 - Step 1. Reliability analysis
 - Step 2. Check the psychometric characteristics

Operationalization of variables

- The process by which we empirically validate the theoretical assumptions using indicators relating to a given theory
- What variables (questions) should we use in the testing of hypotheses process
 - What variables measure researched terms
 - Eg . How to measure self-employment intentions?

Statistical reliability

- Consistency of the respondent's answers in an identical or similar question (Milas , 2005)
 - Researchers are trying to answer the question
 - does a set of items measure the same construct
- Cronbach alpha generalized form which measures the internal consistency of the *measuring construct*
- Nunnally (1979)
 - acceptable reliability
 - Results of Cronbach alpha higher than 0.7
 - Advisable to weigh coefficients above 0.8

The psychometric characteristics of the

Item-Total Correlation

- relationship of each item to the scale (construct)
- how are individual particles associated with the measuring construct (scale)
- in the reliable scales, all the particles should be linked to the measuring construct by the correlation values greater than 0.5
- low correlation to the scale
 - Exclude item from analysis?

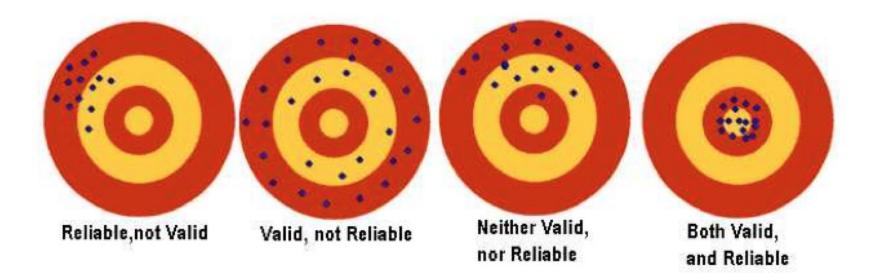
The psychometric characteristics of the

- Inter-item correlation
 - measures how much is each item of scale (construct) interacting with other item of the same construct.
 - acceptable correlation
 - values greater than 0.3

Statistical validity

- The measuring instrument is valid if it measures what we consider to be measured
 - What instrument measures ?
 - How well an instrument measures what we consider to be measured?
 - -content validity
 - -construct validity
 - -criterion validity

Scale



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SPSS and recommended values

- Reliability
 - Cronbach Alpha
 - Inter -item correlation (correlation between particles) > 0.3

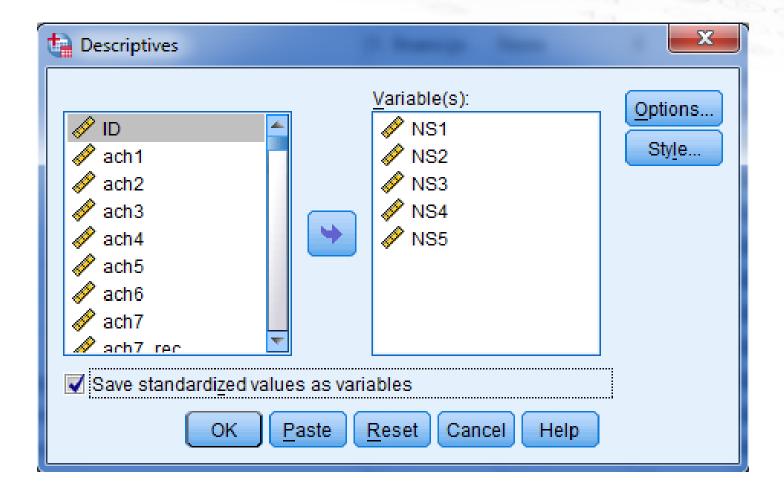
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- Iter -total correlation (correlation of particles according to measuring construct) > 0.5
- Dimensionality
 - KMO > 0.7
 - Bartlett's test (p < 0.05)
 - A number of factors
 - % Explanation of the variance
- Normality
 - z-values ± 3 standard deviations
 - Measure of asymmetry (around zero)
 - Kurtosis (around zero)
 - Kolmogorov-Smirnov test!

Met the assumptions?

- Creating composite (aggregate) variables
 - Measuring construct: self-employment intention
 - ONE VARIABLE (aggregate variable)

1. Standardization



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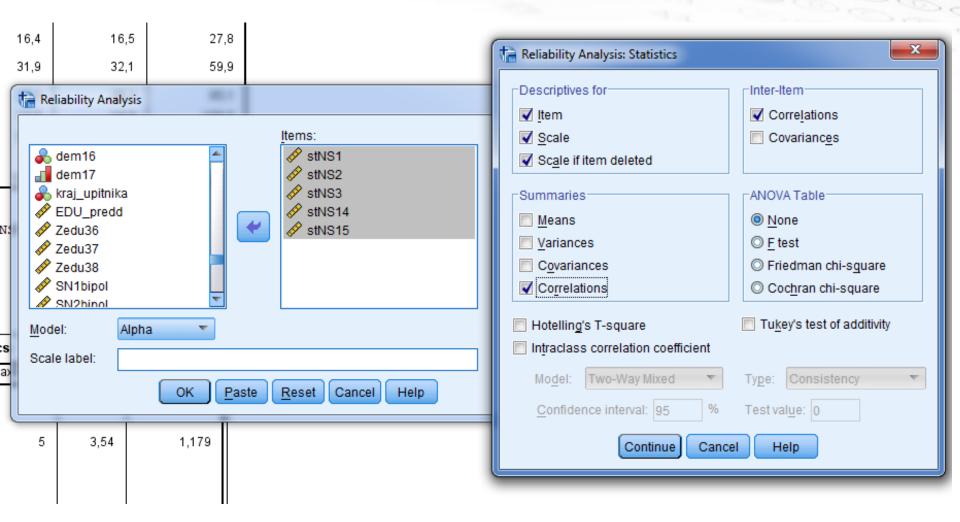
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2. Reliability



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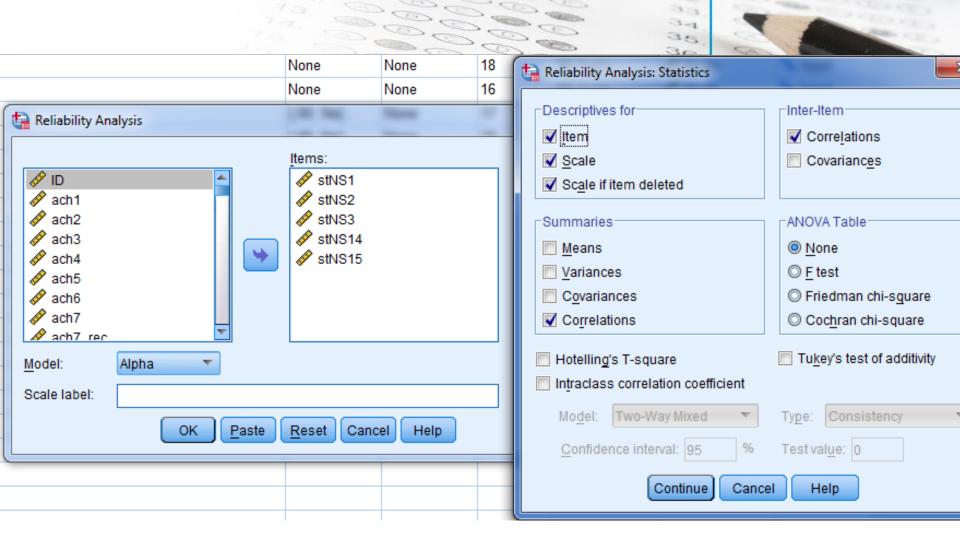
	Reli	ability Statistics	
+	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
	,895	,895	5

Inter-Item Correlation Matrix

	stNS1 Zscore: Ukoliko biste mogli birati između vođenja vlastitog posla i zaposlenja u poduzeću koje je u tuđem vlasništvu, što biste odabrali	stNS2 Zscore: Procijenite vjerojatnost da ćete postati samozaposle na osoba	stNS3 Zscore: Koliko je vjerojatno da ćete ostvariti karijeru samozaposle ne osobe.	stNS14 Zscore: U sljedećih 5 godina započet ću vlastiti posao.	stNS15 Zscore: U sljedećih 10 godina započet ću vlastiti posao.
stNS1 Zscore: Ukoliko biste mogli birati između vođenja vlastitog posla i zaposlenja u poduzeću koje je u tuđem vlasništvu, što biste odabrali	1,000	,699	,674	,541	,527
stNS2 Zscore: Procijenite vjerojatnost da ćete postati samozaposlena osoba	,699	1,000	,802	,605	,604
stNS3 Zscore: Koliko je vjerojatno da ćete ostvariti karijeru samozaposlene osobe.	,674	,802	1,000	,661	,620
stNS14 Zscore: U sljedećih 5 godina započet ću vlastiti posao.	,541	,605	,661	1,000	,572
stNS15 Zscore: U sliedećih 10 godina	527	604	620	572	1 000



			73.	00	000	0	000		200		1	~	10.0	0.6
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16	ach13		Numeric				•	avim z	adacima	za koj	e nisam	sigura	ın(a) mo	gu li i
17	ach14		Numeric				•	aposlen(a) cijelo vrijeme.						
18	ach15		Numeric	Class				lim ka	ıda se s n	ekim r	natječen	n.		
19	ach16		Numeric		-	uction		natjeca	atis drugi	ma				
20	ach17		Numeric	_	nsion Red	uction			oŏto drugi				oni	1
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23	ach20		Numeric	Forec	as <u>t</u> ing		•	ıa) sa	m kada u	čim rad	diti nešt	o što d	lrugi ne	znaju
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25	ach22		Numeric	🖶 Simul	ation			vijam	na temelj	u obav	ljenih za	adataka	a.	
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27	NS1		Numeric	ROC	Cur <u>v</u> e			e mog	gli birati iz	među	vođenja	vlastito	og posla	i zap
28	NS2		Numeric	IBM S	PSS <u>A</u> mos			ijeroja	tnost da d	ćete po	stati sa	mozap	oslena	osoba
29	NS2r		Numeric	8	0	Vjer	ojatnos	t same	ozaposlen	osti				



Scale: ALL VARIABLES

Case Processing Summary								
		Ν	%					
Cases	Valid	401	94,1					
	Excluded ^a	25	5,9					
	Total	426	100,0					

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,895	,895	5

Inter-Item Correlation Matrix

	stNS1 Zscore: Ukoliko biste između vođenja vlastitog posla i zaposlenja u poduzeću koje je u tuđem vlasništvu, što biste odabrali	stNS2 Zscore: Procijenite vjerojatnost da ćete postati samozaposle na osoba	stNS3 Zscore: Koliko je vjerojatno da ćete ostvariti karijeru samozaposle ne osobe.	stNS14 Zscore: U sljedećih 5 godina započet ću vlastiti posao.	stNS15 Zscore: U sljedećih 10 godina započet ću vlastiti posao.
stNS1 Zscore: Ukoliko biste mogli birati između vođenja vlastitog posla i zaposlenja u poduzeću koje je u tuđem vlasništvu, što biste	1,000	,699	,674	,541	,527



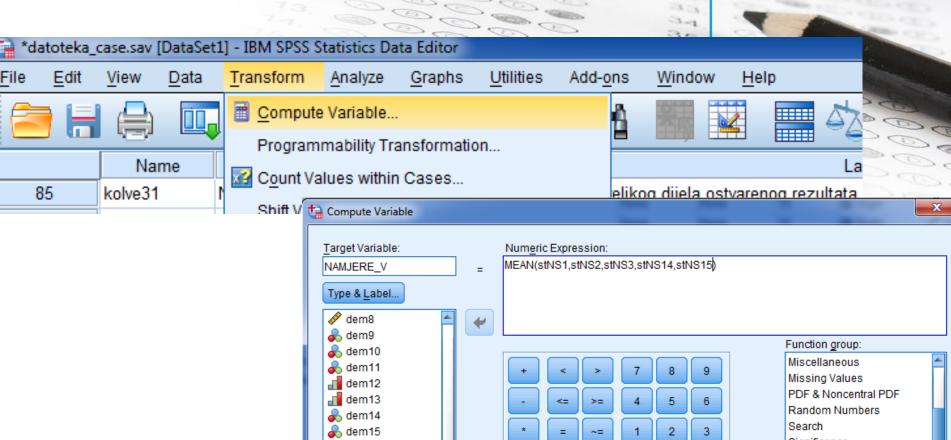
3. Dimensionality

- IBM SPSS S	tatistics Dat	ta Editor						
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50	Re <u>p</u> or D <u>e</u> scr	rts iptive Stati	stics	*	ħ	*		
Туре	Co <u>m</u> p	are Means	6	•				
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Factor Analysis	Factor Analysis: Descriptives
 ♦ dem16 ↓ dem17 ♦ kraj_upitnika ♦ EDU_predd ♦ zedu36 ♦ Zedu37 ♦ SN1bipol ♦ SN2bipol ♦ SN3bipol ♦ SN1x4 ♦ Mathematical Structure ♦ Mathematical Structure ♦ Mathematical Structure ♦ SN1x4 ♦ Mathematical Structure ♦ Mathematical Structure ♦ SN1x4 ♦ Mathematical Structure ♦ Stru	escriptives Extraction Rotation Scores Options Correlation Matrix Coefficients Inverse Significance levels Reproduced Determinant Anti-image KMO and Bartlett's test of sphericity Continue Cancel Help
Factor Analysis: Rotation Method None Quartimax Varimax Equamax Factor Analysis: Rotation Quartimax Factor Oblimin Factor Oblimin Promax Pelta: Display Rotated solution Loading Maximum Iterations for Convergen Continue Cancel H	Indicition Analysis: Options Missing Values © Exclude cases listwise © Exclude cases pairwise © Exclude cases pairwise © Replace with mean Coefficient Display Format Image: Sourced by size Image: Suppress small coefficients Absolute value below:



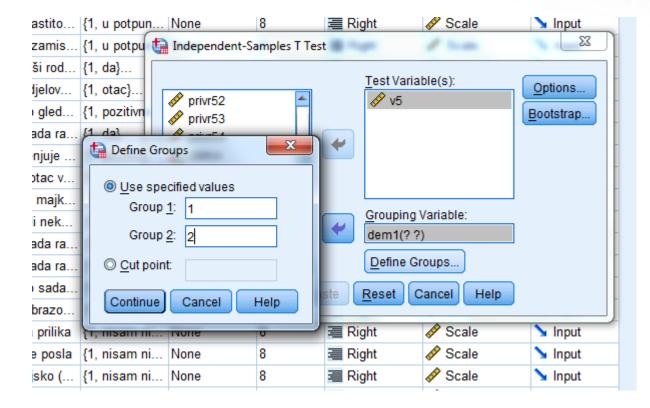
Significance 💑 dem16 Statistical dem17 0 & 💑 kraj_upitnika Functions and Special Variables: Delete ÷ StNS1 Cfvar StNS2 Max StNS3 MEAN(numexpr,numexpr[,..]). Numeric. Returns the Mean 🖋 stNS14 arithmetic mean of its arguments that have valid, nonmissing Median StNS15 values. This function requires two or more arguments, which Min must be numeric. You can specify a minimum number of EDU_predd Sd valid arguments for this function to be evaluated. Zedu36 Sum 🖉 Zedu37 Variance If... (optional case selection condition) OK Paste Reset Cancel Help

			0.000		000	000		30 200		-	Contraction of the second	
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		Name	Туре	Compare Means		•	ММ	eans				
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1	25	ATT_4	Numeric	Corre	late		•					
1	26	ATT_5	Numeric	_				AB In	Idepende	n <u>t</u> -Sam	ples T Test	
1	27	ATT_6	Numeric		Regression		*	<u>а.а.</u> <u>Р</u>	aired-Sar	mples T	Test	
1	28	ATT_7	Numeric	Classify Dimension Reduction			*	<u> </u>	ne-Way A	NOVA		
1	29	ATT_8	Numeric	<u>D</u> imei Scale	ision Real	ICtion	- F - F					
			1	Ocaro			P.					

T-test

- Testing the differences between two arithmetic means
 - $H_0 \dots \mu_1 = \mu_2$
 - $H_1 \dots \mu_1 \neq \mu_2$
 - Example
 - H₀ ... Men and women in equal measure are planning within 5 years to start their own business .
 - H₁ ... There is a difference in the planning of starting their own business within 5 years according to gender

Analyze/compare means/Independent sample t-test



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T-Test

[DataSet1] C:\Users\Mijoc\Dropbox\faks\PhD\nastava\datoteka2.sav

Group Statistics

32 (2)

	dem1 Rod	Ν	Mean	Std. Deviation	Std. Error Mean
v5 U sljedećih 5 godina	1 muški	135	2,58	1,255	,108
započet ću vlastiti posao.	2 ženski	288	2,39	1,092	,064

			Ind	ependent	t Samples	Test				
Levene's Test for Equality of Variances		lity of	t-test for Equality of Means							
						Sig. (2-	Mean	Std. Error Differenc	95% Cor Interval Differ	
		F	Sig.	t	df	tailed)	Difference	e	Lower	Upper
v5 U sljedećih 5 godina	Equal variances assumed	3,769	,053	1,609	421	,108 🔨	,192	,120	-,043	,427
započet ću vlastiti posao.	Equal variances not assumed			1,530	232,38	,127	,192	,126	-,055	,440
p > 0,05								7		
			Equal variances assumed				p >	0,05		
							H ₀	not rejec	t	

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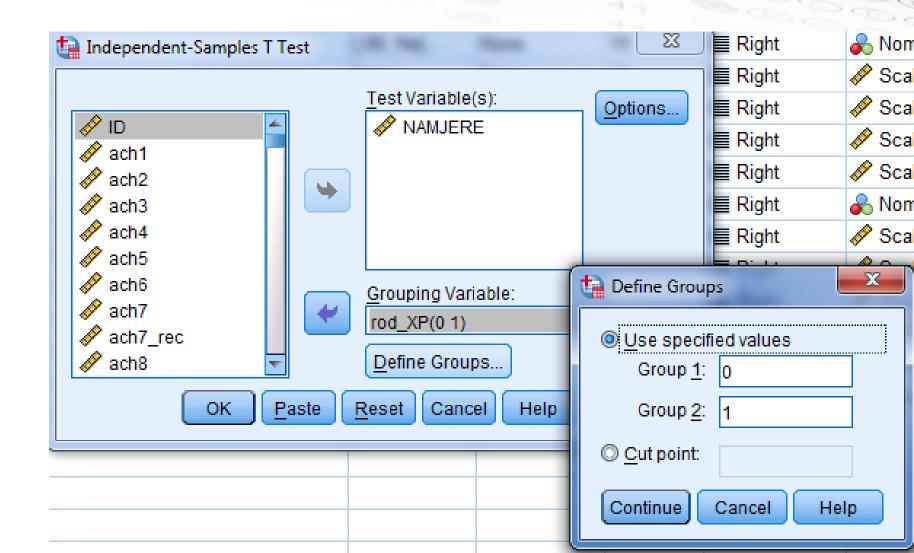
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Our example



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T-Test

Group Statistics

	rod_XP Model XP - Rod	Ν	Mean	Std. Deviation	Std. Error Mean
NAMJERE	,00 žene	290	-,0070	,79535	,04670
	1,00 muški	136	,0535	,91762	,07869

	Independent Samples Test										
Levene's Test for Equality of Variances						t-test for Equality	of Means				
							Mean Std. Error		95% Confidence Interv Difference		
		F	Sig.	t	df	Sig. (2-tailed)	Difference	Difference	Lower	Up	
NAMJERE	Equal variances assumed	4,908	,027	-,696	424	,487	-,06048	,08691	-,23130		
	Equal variances not assumed			-,661	233,351	,509	-,06048	,09150	-,24075		

Hypotheses

- H5b: Personal experience of respondents the family business has a positive effect or self-employment intentions.
- Variables
 - H5a
 - V1: Experience in the family business (yes, no)
 - V2: Self-employment intentions (scale)
- Methods of data analysis
 - H5a: t-test of independent samples



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T-Test

Group Statistics

		obit_rad Model XP - iskustvo u obiteljskom poduzeću	N	Mean	Std. Deviation	Std. Error Mean
ſ	NAMJERE	,00 Ne	59	,0183	,91112	,11862
		1,00 Da	65	,6503	,69681	,08643

Independent Samples Test

Levene's Test for Equality of Variances					t-test for Equality of Means								
							Mean	Std. Error	95% Confidence Interval of th Difference				
		F	Sig.	t	df			Difference	Lower	Upper			
NAMJERE	Equal variances assumed	3,855	,052	-4,362	122	,000	-,63204	,14490	-,91889	-,34520			
	Equal variances not assumed			-4,306	108,276	,000	-,63204	,14677	-,92295	-,34114			



dem1 Rod * v11 Jeste li ikada radili u poduzeću kao zaposlenik?

34 35 36

			v11 Jeste li il poduzeću kao		
			1 da	2 ne	Total
dem1 Rod	1 muški	Count	80	56	136
		% within dem1 Rod	58,8%	41,2%	100,0%
	2 ženski	Count	136	149	285
		% within dem1 Rod	47,7%	52,3%	100,0%
Total		Count	216	205	421
		% within dem1 Rod	51,3%	48,7%	100,0%

Crosstab

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2- sided)	Exact Sig. (1- sided)
Pearson Chi-Square	4,544 ^a	1	,033		
Continuity Correction ^b	4,110	1	,043		
Likelihood Ratio	4,563	1	,033		
Fisher's Exact Test				,037	,021
Linear-by-Linear Association	4,533	1	,033		
N of Valid Cases	421				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 66,22.

b. Computed only for a 2x2 table

More

example

dataset

on existing

Hypotheses

- H4a: <u>Attitudes towards self-employment are</u> positively associated with self-employment intentions.
- Variables
 - H4a
 - V1: Attitudes towards self-employment (scale)
 V1a: Attitudes towards self-employment (scale)
 - V2: Self-employment intentions (measuring construct)
- Methods of data analysis
 - H4a: factor analysis, reliability testing of the measurement instrument, correlation analysis

Measuring attitudes towards self-employ (independent variable) • Two approaches

- Kolvereid (33 items)
 - 11 factors
 - The attitude towards career of employees of the company
 - 5 dimensions (security, workload, social environment, avoiding responsibility, progress)
 - Attitude towards career of self-employed person
 - 6 dimensions (economic opportunities, challenge, autonomy, authority, self-realization, knowledge of the whole process)
 - 29 particles
- Aggregated access
 - 3 items measured at 5 graded Likert scale

2nd approach Creating a composite variable

- I can not imagine working for someone else.
- The idea of an own business for me is very attractive.
- Work in my own company for me would be a personal satisfaction.

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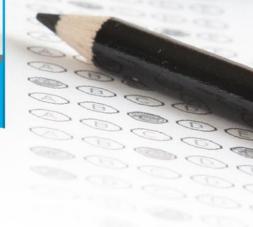
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- Bibivariate analysis that *measures* the strengths of association between two variables
- Correlation coefficient
 - most commonly used measure to describe the relationship between variables
 - describes the direction and strength of the correlation of variables which are in a linear relationship
 - it is not possible to draw conclusions about cause and effect relation of observed variable by correlation

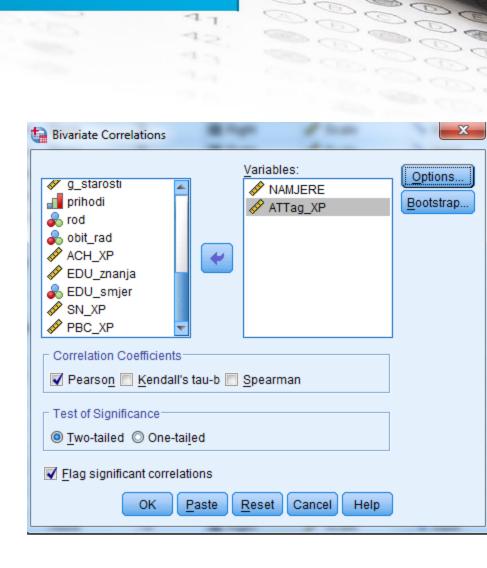
- The most known correlation coefficients:
 - Pearson and Spearman correlation coefficient
 - usage depends on the measuring scale on which data was collected
 - Pearson: variables measured at interval or ratio scale of measurement, requires a linear and normal distribution of data and large enough sample
 - Spearman: one or both variables measured by ordinal scale, does not set a condition of linearity, symmetry or sample size.
- Example :
 - Is there a positive correlation between the quality of products and its annual sales

- Values between -1 and +1
 - -1 Indicates a complete negative connection between two variables, +1 manning a positive connection between two variables, and 0 the absence of connection observed variables.
- Pearson correlation coefficient the connection of two variables measured on the interval or ratio scale
 - linear and normal distribution of data and large enough sample
- Spearman's correlation coefficient one or both of the variables measured by ordinal scale
 - does not set a condition of linearity, symmetry or sample size

- Examples of the hypotheses:
 - The motivation for achievement was positively associated with students career choice
 - Students who spend more time on Facebook are more skilled with the usage of video and audio programming software

- *H*₁...
 - –H4a: The attitudes towards selfemployment were positively associated with intentions for self-employment.
 - -Measurement scale?
 - -What coefficient?

<u>Analyze</u> Dir	rect <u>M</u> arketing	<u>G</u> ra	ph	s <u>U</u> tilities	Add- <u>o</u> ns <u>W</u>
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		NAMJERE	ATTag_XP					
NAMJERE	Pearson Correlation	1	,740**					
	Sig. (2-tailed)		,000					
	N	426	426					
ATTag_XP	Pearson Correlation	,740^^	1					
	Sig. (2-tailed)	,000						
	Ν	426	426					
**. Correlation is significant at the 0.01 level (2-tailed).								

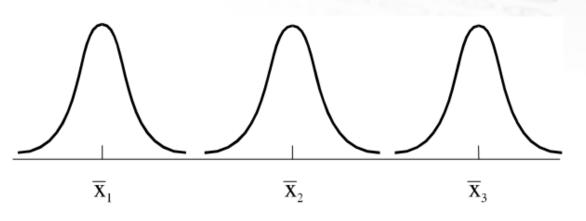
Hypotheses

- H3a: Students with the highest exposure to entrepreneurial education have more pronounced self-employment intentions than other students.
- Variables
 - НЗа
 - V1: Study course (major)
 - V2: Self-employment intentions (scale)
- Methods of data analysis

- H3a: ANOVA (analysis of variance)

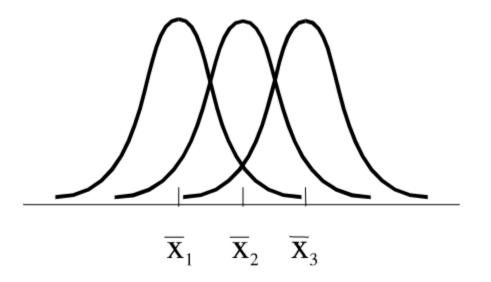
Analysis of variance - ANOVA

- is used to test the differences between three or more arithmetic means
 - testing relationship of variability within and between groups of respondents
- THE BASIC IDEA:
 - determine if the variability between groups is greater than the variability within the group



Variability <u>between</u> groups is greater than the variability within the group

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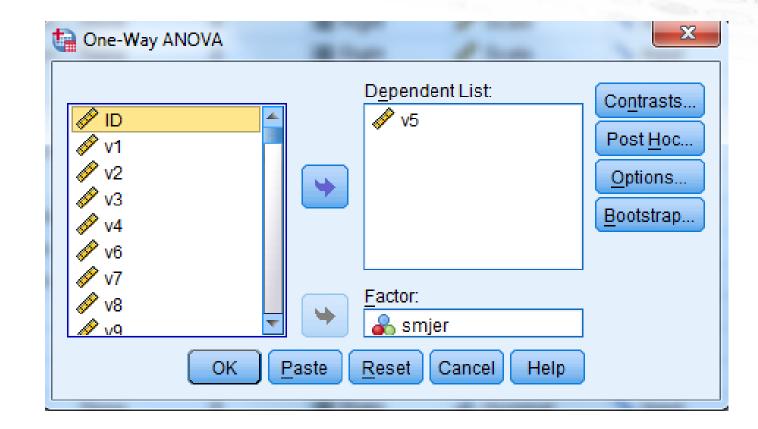


Variability <u>within</u> the group is greater than the variability between groups

Example

- H₀... There is a no difference between study course (major) in planning of starting own business within a period of 5 years
- H₁... There is a difference between study course (major) in planning of starting own business within a period of 5 years
 - Where?
 - ≻Post hoc

Analyze/compare means/One-way AN



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Oneway

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Descriptives

v5 U sljedećih 5 godina započet ću vlastiti posao.

					95% Confidence Interval for Mean			
	Ν	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
1 financijski menadžment	140	2,19	1,083	,092	2,00	2,37	1	5
2 marketing	53	2,45	1,102	,151	2,15	2,76	1	5
3 menadžment	102	2,37	1,052	,104	2,17	2,58	1	5
4 poduzetništvo	71	3,11	1,128	,134	2,85	3,38	1	5
5 poslovna informatika	56	2,38	1,259	,168	2,04	2,71	1	5
Total	422	2,45	1,149	,056	2,34	2,56	1	5

ANOVA

v5 U sljedećih 5 godina započet ću vlastiti posao.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	41,876	4	10,469	8,487	,000
Within Groups	514,370	417	1,234	•	
Total	556,246	421			



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t	One-Way ANO	VA		1		23	}	
	 ID V1 V2 V3 V4 		D <u>ep</u> en	dent Li	P	o <u>n</u> trasts ost <u>H</u> oc)ptions)VA: Post Hoo	: Multiple Com	iparīsons 🔀
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n n	None None	8 8	■ Right ■ Right	8	Signi <u>f</u> icance lev		Continua	
	None	8	≣ Right ≡ Right				Continue	Cancel Help

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Multiple Comparisons

Dependent Variable: v5 U sljedećih 5 godina započet ću vlastiti posao. Bonferroni

		Mean Difference (l-			95% Confide	ence Interval
(I) smjer Smjer studija	(J) smjer Smjer studija	J)	Std. Error	Sig.	Lower Bound	Upper Bound
1 financijski menadžment	2 marketing	-,267	,179	1,000	-,77	,24
	3 menadžment	-,187	,145	1,000	-,59	,22
	4 poduzetništvo	-,927	,162	,000	-1,38	-,47
	5 poslovna informatika	-,189	,176	1,000	-,68	,31
2 marketing	1 financijski menadžment	,267	,179	1,000	-,24	,77
	3 menadžment	,080	,188	1,000	-,45	,61
	4 poduzetništvo	-,660	,202	,012	-1,23	-,09
	5 poslovna informatika	,078	,213	1,000	-,52	,68
3 menadžment	1 financijski menadžment	,187	,145	1,000	-,22	,59
	2 marketing	-,080	,188	1,000	-,61	,45
	4 poduzetništvo	-,740 [*]	,172	,000	-1,22	-,26
	5 poslovna informatika	-,002	,185	1,000	-,52	,52
4 poduzetništvo	1 financijski menadžment	,927	,162	,000	,47	1,38
	2 marketing	,660	,202	,012	,09	1,23
	3 menadžment	,740 [*]	,172	,000	,26	1,22
	5 poslovna informatika	,738 [*]	,198	,002	,18	1,30
5 poslovna informatika	1 financijski menadžment	,189	,176	1,000	-,31	,68
	2 marketing	-,078	,213	1,000	-,68	,52
	3 menadžment	,002	,185	1,000	-,52	,52
	4 poduzetništvo	-,738 [*]	,198	,002	-1,30	-,18

*. The mean difference is significant at the 0.05 level.

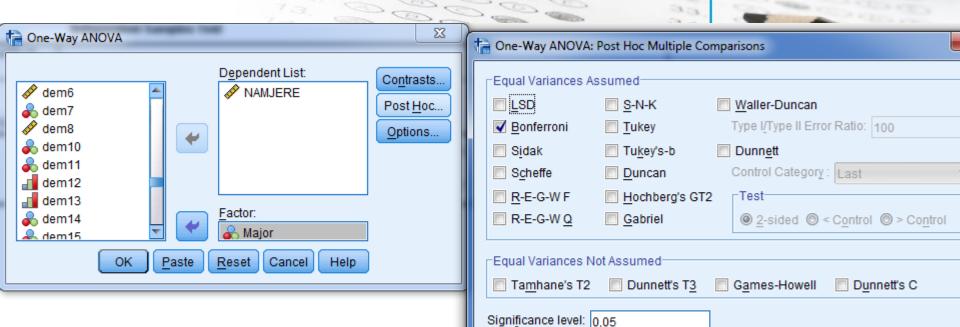
Our example

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1	128	ATT_7	Numeric					<u> </u>	ne-Way AN	IOVA			
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Statistics
✓ Descriptive
Fixed and random effects
Homogeneity of variance test
Brown-Forsythe
Welch
🕅 <u>M</u> eans plot
Missing Values
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ANOVA										
NAMJERE										
	Sum of Squares	df	Mean Square	F	Sig.					
Between Groups	30,503	4	7,626	12,052	,000					
Within Groups	265,757	420	,633							
Total	296,260	424								

Post Hoc Tests

Multiple Comparisons

Dependent Variable: NAMJERE

Bonferroni

		Mean Difference (I-			95% Confidence Interval	
(I) Major Smjer studija	(J) Major Smjer studija	J)	Std. Error	Sig.	Lower Bound	Upper Bound
1 financijski menadžment	2 marketing	-,23632	,12743	,644	-,5959	,1233
	3 menadžment	-,17848	,10298	,838	-,4691	,1121
	4 poduzetništvo	-,79723	,11590	,000	-1,1243	-,4702
	5 poslovna informatika	-,23792	,12577	,592	-,5928	,1170
2 marketing	1 financijski menadžment	,23632	,12743	,644	-,1233	,5959
	3 menadžment	,05783	,13342	1,000	-,3187	,4343
	4 poduzetništvo	-,56091	,14363	,001	-,9662	-,1556
	5 poslovna informatika	-,00160	,15171	1,000	-,4297	,4265
3 menadžment	1 financijski menadžment	,17848	,10298	,838	-,1121	,4691
	2 marketing	-,05783	,13342	1,000	-,4343	,3187
	4 poduzetništvo	-,61875	,12246	,000	-,9643	-,2732
	5 poslovna informatika	-,05944	,13185	1,000	-,4315	,3126
4 poduzetništvo	1 financijski menadžment	,79723	,11590	,000	,4702	1,1243
	2 marketing	,56091	,14363	,001	,1556	,9662
	3 menadžment	,61875	,12246	,000	,2732	,9643
	5 poslovna informatika	,55931 [*]	,14217	,001	,1581	,9605
5 poslovna informatika	1 financijski menadžment	,23792	,12577	,592	-,1170	,5928
	2 marketing	,00160	,15171	1,000	-,4265	,4297
	3 menadžment	05044	12105	1 000	2126	4215



Descriptives NAMJERE 95% Confidence Interval for Mean Std. Deviation Lower Bound Upper Bound Minimum Ν Mean Std. Error Maximum 1 financijski menadžment 140 -,2277 ,06761 -,3613 -,0940 1,91 ,80003 -1,89 2 marketing .77905 1,83 54 ,0087 ,10601 -,2040 ,2213 -1,43 3 menadžment 1.74 104 -.0492 .81477 ,07989 -,2076 .1093 -1.89 4 poduzetništvo 1,83 71 ,5696 ,64286 ,07629 ,4174 ,7217 -,55 5 poslovna informatika 56 ,0103 ,92756 1,83 ,12395 -,2381 ,2587 -1,81 Total 425 .0106 ,83590 .04055 -,0691 .0903 -1,89 1,91

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tat-lex) Frequency,

Statistics made simple...



Discussion