

# ECONOMIC STATISTICS

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## Week 5

### Hypothesis testing, summary

# $\beta = 0$ hypothesis

- Examples:
  - Does advertising influence the sales?
  - Does education level influence the earnings?
- Null hypothesis vs. Alternative hypothesis
$$H_0 : \beta = 0$$
$$H_1 : \beta \neq 0$$
- Two-sided hypothesis
- Significance of intercept can also be tested – interpretation?

## Hypothesis testing

- Relationship to confidence interval

- Does it include the zero?
- Significance level: 100%-confidence level
  - "Probability of mistake"
- t-test:

$$t = \frac{\hat{\beta}}{s_b}$$

- "Large" absolute value – significantly different from zero
- P-value: "probability that the coefficient equals zero" (not precise definition)

## Procedure of hypothesis testing

- Hypothesis to test
- Statistical test
- Decision
  
- Regression table of Excel: t-value, P-value presented
  
- If P-value<5%:  $\beta=0$  hypothesis is rejected at 5% significance level
- If P-value<1%:  $\beta=0$  hypothesis is rejected at 1% significance level

## Example 1: age – earnings

Wage tariff (2003) subsample

Y: ln(earnings), X: age

	<i>Coeff.</i>	<i>Standard dev.</i>	<i>t-stat.</i>	<i>p-value</i>	<i>Bottom 95%</i>	<i>Top 95%</i>
Intercept	11,543	0,133	86,905	0,000	11,281	11,804
X variable	0,013	0,003	4,768	0,000	0,008	0,018

## Example 2: KSH county level data

Y: unemployment rate (%),

X: number of registered enterprises

	<i>Coeff.</i>	<i>Standard dev.</i>	<i>t-stat.</i>	<i>p-value</i>	<i>Bottom 95%</i>	<i>Top 95%</i>
Intercept	9,621	1,172	8,208	1,7E-07	7,159	12,084
X variable	-1,2E-05	1,04E-05	-1,120	0,277	-3,3E-05	1,02E-05

# Indicators of significance

- Estimated coefficient and its standard deviation
- t-statistic (large – significant)
- P-value (small – significant)
- Confidence interval (does it include zero?)

## F-test

- Test  $R^2=0$  hypothesis
- Does the regression have explanatory power?
  - Simple regression: equivalent to testing  $\beta=0$
- F-test:

$$F = \frac{(N - 2)R^2}{1 - R^2}$$

- Accept or reject null hypothesis based on the P-value ("significance of F")

## Age – earnings example, cont.

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### Regression statistics

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r-squared      0,9

### ANALYSIS OF VARIANCE

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	df	SS	MS	F	F significance
Regression	1	4,50	4,50	22,74	3,27E-06
Residual	234	46,32	0,20		
Total	235	50,82			

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	Coeff.	Standard dev.	t-stat.	p-value	Bottom 95%	Top 95%
Intercept	11,54	0,13	86,91	0,00	11,28	11,80
X variable	0,01	0,00	4,77	0,00	0,01	0,02

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## KSH example, cont.

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### Regression statistics

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r-squared      0,065

### ANALYSIS OF VARIANCE

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	df	SS	MS	F	F significance
Regression	1	15,988	15,988	1,254	0,277
Residual	18	229,400	12,744		
Total	19	245,388			

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	Coeff.	Standard dev.	t-stat.	p-value	Bottom 95%	Top 95%
Intercept	9,621	1,172	8,208	1,7E-07	7,159	12,084
X variable	-1,2E-05	1,04E-05	-1,120	0,277	-3,35E-05	1,02E-05

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# Summary

- Data types
- Graphical analysis
  - Histogram
  - Point diagram
- Descriptive statistics, indices
- Correlation
- Simple (univariate) regression
  - Estimation, interpretation of coefficients
  - Confidence interval, hypothesis testing