Statistics II
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Office Hours: TBD

This is designed as a 6 week course. 6 ECTS.

Description:

This course is aimed at introducing the basic tools of statistical inference and their applications to economics and business. Students will learn how to use statistical methods to draw scientifically valid conclusions from data and to support decision making under uncertainty. We begin with the foundations of inferential statistics, including random sampling, the distribution of sample statistics, and the Central Limit Theorem. We then study point and interval estimation, with emphasis on the properties of estimators and the main methods of estimation. In the second half of the course we turn to statistical testing and applied empirical tools. We study parametric hypothesis tests, analysis of variance, goodness-of-fit tests, and the analysis of relationships between variables. Finally, we introduce the linear regression model, estimation by Ordinary Least Squares, model testing, and forecasting.

Course Material:

- Lectures will be based on the instructor's lecture notes
- Complementary readings
- Textbook References:
    1. (LMW) Lind Marchal Wathen, Statistical Techniques in Business and Economics. McGraw-Hill (2012).
    2. (NTB) Newbold, Carlson and Thorne, Statistics for Business and Economics. Pearson-Prentice Hall (2005).
    3. (GC) George Canavos, Applied Probability and Statistical Methods. McGraw-Hill (1998).

Grading:

20% Problem sets and short assignments
30% Midterm Exam
50% Final Exam

TA sessions:

Practice Problems, Problem Set Solutions, Review Sessions, Empirical Applications in R and Python

Overview

1. Introduction to Inferencial Statistics

1.1. Inferential Statistics: Definition and Inference Methods.
1.2. Simple Random Sampling.
1.3. Distribution of Sample Statistics: mean, variance and proportion.
1.4. Central Limit Theorem.

Readings:
- GC, Chapter 7: Random Samples and Sampling Distributions.
- NTB, Chapter 6: Sampling and Sampling Distributions.
- LMW, Chapter 8: Sampling Methods and the Central Limit Theorem.

2. Estimation

2.1. Objective of statistical estimation.
2.2. Definition and characteristics of estimators.
2.3. Properties of estimators: bias, efficiency and consistency.
2.4. Methods of point estimation: maximum likelihood and method of moments.
2.5. Methods of interval estimation.

Readings:
- GC, Chapter 8: Point and Interval Estimation.
- NTB, Chapter 7: Estimation: Single Population.
- NTB, Chapter 8: Estimation: Additional Topics.
- LMW, Chapter 9: Estimation and Confidence Intervals.

3. Parametric Hypothesis Tests

3.1. Null and alternative hypotheses.
3.2. Test statistics and Type I / Type II errors.
3.3. Tests on the population mean, variance and proportion.
3.4. Tests of differences.
3.5. Analysis of Variance.

Readings:
- GC, Chapter 9: Statistical Hypothesis Testing.
- NTB, Chapter 9: Hypothesis Testing: Single Population.
- NTB, Chapter 10: Hypothesis Testing: Additional Topics.
- LMW, Chapter 10: One-Sample Tests of Hypothesis; Chapter 11: Two-Sample Tests of Hypothesis; Chapter 12: Analysis of Variance.

4. Goodness-of-Fit and Relationship Between Variables

4.1. Goodness-of-fit tests.
4.2. Types of relationships between variables.
4.3. Test of independence between qualitative variables.
4.4. Correlation between quantitative variables.
4.5. Testing for correlation.

Readings:
- GC, Chapter 10: Goodness-of-Fit Tests and Contingency Tables.
- NTB, Chapter 14: Analysis of Categorical Data.
- LMW, Chapter 13: Correlation and Linear Regression.

- LMW, Chapter 15: Nonparametric Methods: Nominal Level Hypothesis Tests.

5. Introduction to the Regression Model

5.1. Objectives of the regression model.
5.2. Assumptions of the model.
5.3. Estimation by Ordinary Least Squares (OLS).
5.4. Properties of OLS estimators.
5.5. Model testing.
5.6. Goodness-of-fit in the regression model.
5.7. Relationship between correlation and regression.
5.8. Forecasting.

Readings:
- GC, Chapter 13: Regression Analysis: The Simple Linear Model.
- NTB, Chapter 11: Simple Regression.
- LMW, Chapter 13: Correlation and Linear Regression.
- NTB, Chapter 16: Time-Series Analysis and Forecasting.

Class Schedule

Day	Topic	Assignments
1	Introduction to Inferential Statistics: inference methods	
2	Simple Random Sampling and sample statistics	
3	Central Limit Theorem	
4	Estimation: objectives and estimator properties	
5	Point Estimation: maximum likelihood and method of moments	HW1 Due
6	Interval Estimation	
7	Parametric Hypothesis Tests: concepts and errors	
8	Tests on the mean, variance and proportion	
9	Tests of differences and Analysis of Variance	
10	Goodness-of-fit tests	HW2 Due
11	Independence tests for qualitative variables	
	MIDTERM	
12	Introduction to the Regression Model	
13	OLS estimation and properties	
14	Model testing, Goodness-of-fit and interpretation	HW3 Due
15	Relationship between correlation and regression	
16	Forecasting with regression models	
17	Review of inferential methods, hypothesis testing, regression	HW4 Due
18	Final Review, practice session and empirical applications	
	FINAL	