Module Manual

for the

M.Sc. Survey Statistics

04. Juli 2016
Key Skills Qualifications in the Master in Survey Statistics

The Master in Survey Statistics aims at educating the students in the subject matter, as well as in the key skills. Whilst all modules cover the key skills Communication, Application of Number and Problem solving, special focus is laid in each module group on special key skills.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Problem formulation and formalization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Survey Statistics: Basics</strong></td>
<td>Programming skills, presentations skills for scientific research poster presentations, ICT skills for preparing the presentation, interpersonal skills by working in groups, target-setting for and planning and conducting of a small research agenda</td>
</tr>
<tr>
<td><strong>Statistical Programming and Computer-intensive Methods</strong></td>
<td>Problem formulation and formalization, literacy and numeracy in complex data situation, interpersonal skills by working in groups, presentation skills</td>
</tr>
<tr>
<td><strong>Survey Statistics</strong></td>
<td>Problem formulation and formalization, literacy and numeracy in sophisticated problem settings, interpersonal skills by working in groups and finding, exploring, developing and presenting cutting edge scientific research</td>
</tr>
<tr>
<td><strong>Statistics</strong></td>
<td>Problem formulation and formalization, cross-disciplinary transfer of scientific methodology, see also the description of imported modules</td>
</tr>
<tr>
<td><strong>Statistics: Applications</strong></td>
<td>ICT skills for preparing the presentation, interpersonal skills by working in groups, target-setting for and planning and conducting of a large research agenda</td>
</tr>
<tr>
<td><strong>Research Project</strong></td>
<td>ICT skills for preparing the presentation, target-setting for and planning and conducting of a large research agenda, self-organization, presentation of scientific research to experts and defend the work against in depth questions</td>
</tr>
<tr>
<td><strong>Master's thesis</strong></td>
<td>ICT skills for preparing the presentation, target-setting for and planning and conducting of a large research agenda, self-organization, presentation of scientific research to experts and defend the work against in depth questions</td>
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</tbody>
</table>
Topic *Survey Statistics: Basics*

**Learning Objectives / Competences**
The modules gathered under the heading *Survey Statistics: Basics* aim at providing basic knowledge in Statistics, Econometrics and, in particular, Survey Statistics. Thereby, the foundation for an in-depth understanding of the contents of all subsequent courses is laid. Students get familiarized with the specific way of thinking as well as with the central problems and topics in the field of Survey Statistics. The inclusion of numerous examples provides insight into both theoretical and practical issues, that have to be considered when dealing with problems of Survey Statistics. Furthermore, students are introduced to and trained in working with the statistical software R.

**Contents**
The modules deal with central elements, methods and problems of Survey Statistics. Students acquire theoretical knowledge and get familiarized with central fields of application of Survey Statistics. Furthermore, they gain insight into typical problems of practical applications. Real data applications and the implementation in R are also part of the curriculum.

**Further information**
All modules under this heading are mandatory.
## Survey Sampling

<table>
<thead>
<tr>
<th>ID</th>
<th>Workload</th>
<th>CP</th>
<th>Semester</th>
<th>scheduled</th>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>150</td>
<td>5</td>
<td>1</td>
<td>annually</td>
<td>1 semester</td>
</tr>
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</table>

### Courses
- Lecture + Tutorial *Survey Sampling (Bamberg/Berlin/Trier)*

<table>
<thead>
<tr>
<th>Contact time</th>
<th>Self-study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 + 0.5 h/week (30 h)</td>
<td>120 h</td>
</tr>
</tbody>
</table>

### Course size
- 20 students

### Learning Objectives
- The module aims at providing basic knowledge in Survey Statistics. Therewith, it lays the foundation for an in-depth understanding of the contents of all subsequent courses.
- Students get to know the basic stages of the sampling process, central concepts and sample selection mechanisms as well as point and variance estimators.
- In the course of that, both theory and practice of survey sampling are considered.

### Competences
- Students will learn to design appropriate sampling schemes, to draw samples and to assess the impact of sampling on statistical methods.

### Content
- Process and basic concepts of survey sampling
- Central sampling designs such as stratified sampling, cluster sampling and sampling with unequal probabilities
- Design-based and model-assisted estimation methods
- Both theoretical foundation and practical application of all methods considered

### Type of courses
- Lecture and tutorial

### Requirements
- **Formal:** /  
- **Prerequisites:** Solid knowledge of basics in descriptive and inferential statistics

### Assessment
- Written exam

### Requirements for CPs
- Passing the written exam

### Contact person
- Prof. Dr. Ralf Münnich
Elements of statistics and econometrics

<table>
<thead>
<tr>
<th>ID</th>
<th>Workload</th>
<th>CP</th>
<th>Semester</th>
<th>scheduled</th>
<th>Duration</th>
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<tbody>
<tr>
<td></td>
<td>300</td>
<td>10</td>
<td>1</td>
<td>annually</td>
<td>1 semester</td>
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</table>

1 Courses
Lecture + Tutorial *Elements of statistics and econometrics*

Contact time
4+2 h/week (90 h)

Self-study
210 h

Course size
20 students

2 Learning Objectives
The module aims at providing basic knowledge in Statistics and Econometrics. Therewith, it lays the foundation for an in-depth understanding of the contents of all subsequent courses. The course provides a basic knowledge of mathematical statistics, which is essential for the understanding of complex statistical and econometrical methods.

Competences
Students will learn the elementary mathematical and statistical methods that are necessary for most methods in statistics and econometrics. This toolbox shall enable students to understand the proofs in empirical research and to develop proofs for own theorems in the field of statistics and econometrics.

3 Inhalt
- Basic knowledge on multivariate random variables and their distribution
- In-depth knowledge on properties of the multivariate normal distribution
- Tools like transformation theorems, generating and characteristic functions
- Important sampling distributions
- Concepts of convergence
- Estimation and statistical testing

4 Type of courses
Lecture and tutorial

5 Requirements
Formal: / Prerequisites: Solid Knowledge of basics in descriptive and inferential statistics

6 Assessment
Written exam

7 Requirements for CPs
Passing the written exam

8 Contact person
Prof. Dr. Ralf Münich
Topic *Statistical Programming and Computer-intensive Methods*

**Learning Objectives/ Competences**
The modules in the field of statistical programming and computer-intensive methods aim at providing in-depth skills in statistical programming and at providing basic insight into computer-intensive statistical methods. They, therewith, prepare students for research and applications in the field of statistics – tasks that nowadays require fundamental programming skills.

**Content**
The modules deal with statistical programming with R and with central methods of computer-intensive statistics.

**Further information**
The module Monte-Carlo simulation methods is mandatory.
Monte-Carlo simulation methods

<table>
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<tr>
<th>ID</th>
<th>Workload</th>
<th>CP</th>
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<th>Scheduled</th>
<th>Duration</th>
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<tr>
<td>1</td>
<td>300</td>
<td>10</td>
<td>1</td>
<td>annually</td>
<td>1 semester</td>
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<table>
<thead>
<tr>
<th>Courses</th>
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</thead>
<tbody>
<tr>
<td>Compact one-week lecture Statistical Programming with R</td>
</tr>
<tr>
<td>Lecture + Tutorial  Monte-Carlo methods</td>
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<table>
<thead>
<tr>
<th>Contact time</th>
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<tbody>
<tr>
<td>6 h/day (30 h)</td>
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<td>2+1 h/week (60 h)</td>
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<table>
<thead>
<tr>
<th>Self-study</th>
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<tbody>
<tr>
<td>210 h</td>
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<table>
<thead>
<tr>
<th>Course size</th>
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<tbody>
<tr>
<td>20 students</td>
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</tbody>
</table>

2 Learning Objectives
The module covers theoretical and practical aspects of simulation methods (Monte-Carlo methods), computational statistics and statistical programming with R.

The compact one-week lecture Statistical Programming with R will introduce the students to the art of programming with R. The Student learns to implement standard statistical and computational methods, to visualize statistical content and to produce reusable programming code in R.

Competences
The lecture and tutorial on Monte-Carlo methods enables the student to plan and conduct a simulation study and to illustrate and interpret the results. Further, the presentation of research results will be trained.

3 Content
- Statistical Programming with R
  - Basic principles and central commands
  - Graphics
  - Programming style / Programming tools, e.g., git version control
- Monte-Carlo methods
  - Generation of random numbers
  - Planning and conducting simulation studies
  - Monte-Carlo methods
  - Types of simulation studies

4 Type of courses
Lecture and tutorial

5 Requirements
Formal: /
Prerequisites: Solid Knowledge of basics in descriptive and inferential statistics

6 Assessment
Thesis/Poster + Presentation

7 Requirements for CPs
Poster presentation
| 8 | **Contact person** |
|   | Prof. Dr. Ralf Münich |
Topic Survey Statistics

Learning Objectives/ Competences
Aim of the modules gathered under the heading Survey Statistics is to provide an in-depth insight into methods and problems of different specific subareas of Survey Statistics. Students acquire profound methodological knowledge and are, therewith, prepared to thoroughly understand and judge statistical methods from a theoretical, as well as from a practical, point of view. Usually the implementation of the considered methods in the statistical software R is part of the course.

Content
The courses deal with specific methods and problems of Survey Statistics. The selection of topics covered is guided by the requirements that are posed by the practical process of planning, conducting and analysing a complex survey. These topics are, therewith, also subject to modern statistical research. Courses cover theoretical aspects as well as possible areas of application and the specific challenges of applying the elaborate statistical methods in practice. Selected data sets are used and the implementation in R is trained in regular computer tutorials.

Further information
All modules are semi-elective. Students can choose from the modules described on the following pages.
# Weighting and calibration

<table>
<thead>
<tr>
<th>ID</th>
<th>Workload</th>
<th>CP</th>
<th>Semester</th>
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<td>1</td>
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<td>1-3</td>
<td>irregularly</td>
<td>1 semester</td>
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<table>
<thead>
<tr>
<th>1</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lecture + Tutorial <em>Weighting and Calibration (Berlin)</em></td>
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<table>
<thead>
<tr>
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<td>1.5 + 0.5 h/week (30 h)</td>
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<table>
<thead>
<tr>
<th>1</th>
<th>Self-Study</th>
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<tbody>
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<td></td>
<td>120 h</td>
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</table>

<table>
<thead>
<tr>
<th>1</th>
<th>Course size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20 students</td>
</tr>
</tbody>
</table>

## Learning Objectives
The courses provide in-depth methodological knowledge on sampling designs and weighting methods. Students acquire profound methodological knowledge and are, therewith, prepared to thoroughly understand and judge respective methods from a theoretical, as well as from a practical, point of view. The courses also teach students how to implement the considered methods in R.

### Competences
Students will be able to construct calibration weights appropriately due to different sources of survey errors and to apply them in a survey estimation context.

## Content
- Theory and practice of weighting and calibration in complex surveys
- Design weights
- Weighting in the case of outliers
- Weighting in the case of unit-nonresponse

## Type of courses
Lecture and tutorial

## Requirements
**Formal:** /
**Prerequisites:** Solid Knowledge of basics in descriptive and inferential statistics

## Assessment
Exam or thesis

## Requirements for CPs
Passing the assessment

## Contact person
Prof. Dr. Ralf Münich
### Variance Estimation

<table>
<thead>
<tr>
<th>ID</th>
<th>Workload</th>
<th>CP</th>
<th>Semester</th>
<th>Scheduled</th>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>150</td>
<td>5</td>
<td>1-3</td>
<td>irregularly</td>
<td>1 semester</td>
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</tbody>
</table>

#### Courses
Lecture + Tutorial Variance Estimation

#### Contact time
- 1.5 + 0.5 h/week (30 h)
- Self-Study: 120 h

#### Course size
- 20 students

### Learning Objectives
Aim of the module is to provide an in-depth insight into methods and problems of variance estimation in survey statistics. Students acquire profound methodological knowledge and are, therewith, prepared to thoroughly understand and judge respective methods from a theoretical, as well as from a practical, point of view. The courses also teach students how to implement the considered methods in R.

### Competences
Students will be enabled to assess the quality of survey estimates in complex survey designs.

### Content
- Methods of variance estimation
- Linearisation (e.g. Taylor-linearisation or Woodruff-linearisation)
- Resampling methods (Bootstrap, Jackknife)
- Special topics
  - Variance estimation for measures of change
  - Variance estimation in the case of missing values

### Type of courses
Lecture and tutorial

### Requirements
**Formal:** /
**Prerequisites:** Solid Knowledge of basics in descriptive and inferential statistics

### Assessment
Oral exam or thesis

### Requirements for CPs
Passing the assessment

### Contact person
Prof. Dr. Ralf Münnich
# Introduction to Bayes statistics

<table>
<thead>
<tr>
<th>ID</th>
<th>Workload</th>
<th>CP</th>
<th>Semester</th>
<th>Scheduled annually (winter semester)</th>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>150</td>
<td>5</td>
<td>1-3</td>
<td></td>
<td>1 semester</td>
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</table>

## Courses
Lecture + Tutorial *Introduction to Bayes statistics (Bamberg)*

## Contact time
1.5 + 0.5 h/week (30 h)

## Self-Study
120 h

## Course size
20 students

## Learning Objectives
The module provides an introduction to Bayesian Statistics and Empirical Bayes Methods.

### Competences
Students will be able to apply Bayes methods in a variety of contexts.

## Content
Introduction to Bayes-Statistics using conjugate priors and MCMC-methods.

## Type of courses
Lecture and tutorial

## Requirements
**Formal:** /

**Prerequisites:** Solid Knowledge of basics in descriptive and inferential statistics

## Assessment
Exam or thesis

## Requirements for CPs
Passing the assessment

## Contact person
Prof. Dr. Ralf Münnich
### Statistical analysis of incomplete data

<table>
<thead>
<tr>
<th>ID</th>
<th>Workload</th>
<th>CP</th>
<th>Semester</th>
<th>Scheduled annually (summer semester)</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>150</td>
<td>5</td>
<td>1-3</td>
<td></td>
<td>1 semester</td>
</tr>
</tbody>
</table>

#### Contact person
Prof. Dr. Ralf Münnich

#### Learning Objectives
The courses provide an introduction to the statistical analysis of incomplete data. They especially focus on multiple imputation methods for missing data.

#### Competences
Students will be taught how to properly handle missing values in a data set and how to derive correct estimation results from this completed data set.

#### Content
- Theoretical and practical aspects of methods for dealing with missing values in surveys
- Mostly methods based on Bayes Statistics
- Focus on multiple imputation

#### Type of courses
Lecture and tutorial

#### Requirements
**Formal:** /
**Prerequisites:** Solid Knowledge of basics in statistics and survey statistics; Knowledge of basics in Bayes statistics

#### Assessment
Exam or thesis

#### Requirements for CPs
Passing the assessment

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| Lecture + Tutorial Statistical analysis of incomplete data (Bamberg) |
| Contact time 1.5 + 0.5 h/week (30 h) |
| Self-Study 120 h |
| Course size 20 students |
## Panel Surveys

<table>
<thead>
<tr>
<th>ID</th>
<th>Workload</th>
<th>CP</th>
<th>Semester</th>
<th>Scheduled</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>150</td>
<td>5</td>
<td>1-3</td>
<td>irregularly</td>
<td>1 semester</td>
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</table>

**Courses**
Lecture + Tutorial Panel Surveys (Berlin)

**Contact time**
1.5 + 0.5 h/week (30 h)

**Self-Study**
120 h

**Course size**
20 students

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## Learning Objectives
The courses cover complex methods of survey sampling. With this module, students acquire methodological and practical skills to understand and deal with current research problems in panel estimation in the field of survey methodology. The methods considered are applied to the Socio-economic Panel.

**Competences**
Students will learn how to correctly deduce results from panel surveys under a complex survey design.

## Content
- Weighting methods for non-proportional samples
- Weighting methods for dealing with missing values

## Type of courses
Lecture and tutorial

## Requirements
**Formal:** /  
**Prerequisites:** Solid Knowledge of basics statistics and survey statistics

## Assessment
Exam or thesis

## Requirements for CPs
Passing the assessment

## Contact person
Prof. Dr. Ralf Münnich
## Indicators of Economic and Social Statistics

<table>
<thead>
<tr>
<th>ID</th>
<th>Workload</th>
<th>CP</th>
<th>Semester</th>
<th>Scheduled</th>
<th>Duration</th>
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<tbody>
<tr>
<td>1</td>
<td>150</td>
<td>5</td>
<td>1-3</td>
<td>irregularly</td>
<td>1 semester</td>
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</tbody>
</table>

### Courses
Lecture + Tutorial *Indicators of Economic and Social Statistics (Trier)*

### Contact time
1.5 + 0.5 h/week (30 h)

### Self-Study
120 h

### Course size
20 students

## Learning Objectives
The courses cover methodological and practical aspects of important indicators of economic and social statistics.

### Competences
Students learn to properly handle and use indicators. Further, they learn to implement respective methods in R and to visualize, present and interpret indicators.

## Content
- Central economic and social indicators (price indices, measures of inequality, composite indicators…)
- Theoretical aspects: Theoretical requirements, properties, mathematical foundations
- Important areas of application
- Implementation in R
- Visualization and presentation of indicators

## Type of courses
Lecture and tutorial

## Requirements
Formal: /  
Prerequisites: Solid Knowledge of basics statistics and survey statistics

## Assessment
Exam or thesis

## Requirements for CPs
Passing the assessment

## Contact person
Prof. Dr. Ralf Münnich
### Statistical Disclosure Control

<table>
<thead>
<tr>
<th>ID</th>
<th>Workload</th>
<th>CP</th>
<th>Semester</th>
<th>Scheduled</th>
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<tbody>
<tr>
<td>1</td>
<td>150</td>
<td>5</td>
<td>1-3</td>
<td>irregularly</td>
<td>1 semester</td>
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<table>
<thead>
<tr>
<th>Courses</th>
<th>Contact time</th>
<th>Self-Study</th>
<th>Course size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seminar Statistical Disclosure Control</td>
<td>1.5 + 0.5 h/week (30 h)</td>
<td>120 h</td>
<td>20 students</td>
</tr>
</tbody>
</table>

### Learning Objectives

Aim of the courses is to convey an understanding of the importance and implementation of data protection.

**Competences**

Students get to know innovative methods of data protection and learn to implement them. They acquire the knowledge to evaluate respective methods and to judge the disclosure risk for a given data set.

### Content

- Stochastic and deterministic approaches to disclosure control for micro and macro data
- Methods of information reduction and perturbative protection methods
- Pre- and posttabular methods for tabular data
- Comparison of methods and approaches
- Case studies

### Type of courses

Seminar

### Requirements

**Formal:** /  
**Prerequisites:** Solid Knowledge of basics statistics and survey statistics

### Assessment

Exam or thesis

### Requirements for CPs

Passing the assessment

### Contact person

Prof. Dr. Ralf Münnich
## Small Area Estimation

<table>
<thead>
<tr>
<th>ID</th>
<th>Workload</th>
<th>CP</th>
<th>Semester</th>
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<tbody>
<tr>
<td>1</td>
<td>150</td>
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<td>1-3</td>
<td>irregularly</td>
<td>1 semester</td>
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</tbody>
</table>

### Courses
- Lecture + Tutorial *Small Area Estimation*
- Contact time: 1.5 + 0.5 h/week (30 h)
- Self-Study: 120 h
- Course size: 20 students

### Learning Objectives
The module covers theoretical and practical aspects of small area statistics. Students acquire advanced methodological knowledge and are, therewith, prepared to thoroughly understand and judge respective methods from a theoretical, as well as from a practical, point of view.

#### Competences
Students will be enabled to use and implement small area estimation methods in R.

### Content
- Foundations: design-based, model-based and synthetic estimators
- Standard methods of small area estimation
- Current developments
- Implementation in R

### Type of courses
Lecture and tutorial

### Requirements
- Formal: /
- Prerequisites: Solid Knowledge of basics statistics and survey statistics

### Assessment
Oral exam or exam or thesis

### Requirements for CPs
Passing the assessment

### Contact person
Prof. Dr. Ralf Münnich
<table>
<thead>
<tr>
<th>ID</th>
<th>Workload</th>
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<th>Semester</th>
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<tbody>
<tr>
<td>1</td>
<td>150</td>
<td>5</td>
<td>1-3</td>
<td>irregularly scheduled</td>
<td>1 semester</td>
</tr>
</tbody>
</table>

### 1 Courses
Lecture + Tutorial *Survey Econometrics*

### 2 Learning Objectives
The courses teach students how methods of survey statistics can be applied and in which situations they have to be considered when dealing with practical economic research questions.

**Competences**
Students will be able to apply survey statistical methods to econometric applications.

### 3 Content
- Process of obtaining micro data for economic models/economic analyses
- Consequences of the survey process for the estimation of econometric models
- Application of considered methods (case studies with selected data sets)
- Implementation in R

### 4 Type of courses
Lecture and tutorial

### 5 Requirements
**Formal:** / 
**Prerequisites:** Solid Knowledge of basics statistics, basic knowledge in econometrics, survey sampling and MC-methods recommended

### 6 Assessment
Exam or electronic exam

### 7 Requirements for CPs
Passing the assessment

### 8 Contact person
Prof. Dr. Ralf Münnich
## Modern Methods in Survey Statistics

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<thead>
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<th>CP</th>
<th>Semester</th>
<th>Scheduled</th>
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<tbody>
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<td>1-3</td>
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<table>
<thead>
<tr>
<th>1</th>
<th>Courses</th>
<th>Contact time</th>
<th>Self-Study</th>
<th>Course size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lecture + Tutorial <em>Modern Methods in Survey Statistics</em></td>
<td>1.5 + 0.5 h/week (30 h)</td>
<td>120 h</td>
<td>20 students</td>
</tr>
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<table>
<thead>
<tr>
<th>2</th>
<th>Learning Objectives</th>
<th>Competences</th>
<th>Content</th>
<th>Type of courses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The courses deal with cutting-edge methods and problems of survey statistics. They, therewith, provide up-to-date in-depth knowledge in specific, highly advanced subareas of the discipline and permit insight into topics of modern statistical research.</td>
<td>Students will get deeper insight into hot topics in survey statistics and learn to decide on which method to apply in a specific situation.</td>
<td>Specific up-to-date problems and methods of survey statistics</td>
<td>Lecture and tutorial</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>3</th>
<th>Requirements</th>
<th>Formal: / Prerequisites: Solid Knowledge of basics statistics and survey statistics; Depending on the topics covered, possible further prerequisites will be communicated</th>
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<table>
<thead>
<tr>
<th>4</th>
<th>Assessment</th>
<th>Oral exam or Exam or thesis</th>
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<table>
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<tr>
<th>5</th>
<th>Requirements for CPs</th>
<th>Passing the assessment</th>
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<tr>
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<th>Prof. Dr. Ralf Münnich</th>
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## Methods of Survey Statistics

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<th>Semester</th>
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<th>Duration</th>
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<tbody>
<tr>
<td>1</td>
<td>150</td>
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<td>1-3</td>
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<td>1 semester</td>
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</tbody>
</table>

### Courses
Seminar *Methods of Survey Statistics*

### Contact time
2h/week (30 h), 120 h

### Self-Study
120 h

### Course size
20 students

## Learning Objectives
Aim of the module is to provide an in-depth insight into cutting-edge methods and problems of survey statistics.

### Competences
Students learn to autonomously acquire and present the current state of research in a specific area. Furthermore, they gain advanced methodological knowledge in a topical research field.

## Content
Specific up-to-date problems and methods in selected areas of survey statistics

## Type of courses
Seminar

## Requirements
**Formal:** /  
**Prerequisites:** Solid Knowledge of basics statistics and survey statistics

## Assessment
Presentation and thesis

## Requirements for CPs
Passing the assessment

## Contact person
Prof. Dr. Ralf Münnich
# Survey Methodology

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<td>1 semester</td>
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<table>
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<th>Courses</th>
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<th>Course size</th>
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</thead>
<tbody>
<tr>
<td>Lecture + Tutorial</td>
<td>2h/week (30 h)</td>
<td>120 h</td>
<td>20 students</td>
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## Learning Objectives
Aim of the module is to provide relevant basic competences in survey research and methodology. It studies the associated survey data collections techniques, for example questionnaire design and other aspects of survey methodology, such as interviewer effect, nonresponse handling, and follow-up techniques.

**Competences**
Students will be able to handle survey methodological issues and to decide on which method to use in a specific situation.

## Content
- Cognitive and perceptual psychological basics of data collection
- Questionnaire design
- Different data collection forms (observation, non-reactive measuring methods, evaluations, quasi-experiments, cohort studies, etc.)
- Development of different instruments for data collection
- Evaluate and test questions
- Handling problems like interviewer effect, nonresponse, and other

## Type of courses
Lecture + Tutorial

## Requirements
**Formal:**
**Prerequisites:** Solid Knowledge of basics statistics and survey statistics

## Assessment
Oral Exam or Exam or Thesis

## Requirements for CPs
Passing the assessment

## Contact person
Prof. Dr. Johannes Kopp
# Optimization in Survey Statistics

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<table>
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<tr>
<th>Courses</th>
<th>Contact time</th>
<th>Self-Study</th>
<th>Course size</th>
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</thead>
<tbody>
<tr>
<td>Lecture + Tutorial</td>
<td>2h/week (30 h)</td>
<td>120 h</td>
<td>20 students</td>
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</table>

## Learning Objectives
Modern survey statistics has a strong need for computational methods allowing for, e.g., design efficient surveys under constraints and estimation of model parameters in a high dimensional parameter space. Solutions to such problems are generally computationally complex and time demanding. Hence, mathematical optimization methods are needed to speed up computations or make them feasible at all. This course provides insights in different optimization methods used in modern survey statistics.

### Competences
Students will be able to optimize computational algorithms and to decide on which method to use in a specific situation.

## Content
Different up to date optimization methods in survey statistics. E.g., optimal allocation of a given sample size under constraints and machine learning algorithms.

## Type of courses
Lecture and tutorial

## Requirements
**Formal:** /  
**Prerequisites:** Solid Knowledge of survey statistics and mathematics and a strong interest in optimization. Depending on the topics covered, possible further prerequisites will be communicated.

## Assessment
Thesis/Poster or oral exam

## Requirements for CPs
Passing the assessment

## Contact person
Prof. Dr. Ralf Münnich
Use of Non-sampling Data

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<tr>
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<td>150</td>
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<td>1-3</td>
<td>irregularly</td>
<td>1 semester</td>
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</tbody>
</table>

**Courses**
Lecture + Tutorial

**Contact time**
2h/week (30 h)

**Self-Study**
120 h

**Course size**
20 students

2 Learning Objectives
The module covers theoretical and practical aspects of dealing with data not obtained via classical sampling. Since increasingly more data is acquired via non-probability sampling techniques, especially in the big data context, new methodology has to be employed. The course includes a considerable amount of exercises to convey the theoretical knowledge taught into practice.

**Competences**
Students will learn to use non-sampling data and to overcome the herewith linked statistical challenges.

3 Content
- Data mining vs. data sampling
- Determining the sampling universe
- Overcoming the lack of representativity
- Practical considerations for the use of non-probability samples

4 Type of courses
Lecture/Seminar

5 Requirements
**Formal:** /
**Prerequisites:** Solid Knowledge of basics statistics and survey statistics; Depending on the topics covered, possible further prerequisites will be communicated

6 Assessment
Thesis/Poster or presentation or oral exam

7 Requirements for CPs
Passing the assessment

8 Contact person
Prof. Dr. Ralf Münnich
**Topic Statistics**

**Learning Objectives/ Competences**
Aim of the modules gathered under the heading Statistics is to provide an in-depth insight into methods and problems in different specific subareas of the discipline Statistics. Students acquire profound methodological knowledge and are, therewith, prepared to thoroughly understand and judge statistical methods from a theoretical, as well as from a practical, point of view. Usually the implementation of the considered methods in the statistical software R is part of the course.

**Content**
The courses deal with specific methods and problems of Statistics. They provide in-depth knowledge of complex methods. The selection of topics covered is guided by the current state of research in the respective area. Courses cover theoretical aspects as well as possible areas of application and the specific challenges of applying the elaborate statistical methods in practice. Selected data sets are used and the implementation in R is trained in regular computer tutorials.

**Further information**
All modules are semi-elective. Students can choose from the modules described on the following pages. Additionally, students can select the modules *Applied time series analysis* and *Financial Econometrics* (further information in the module guide of the MSc. Economics).
### Multivariate Statistics

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<td>300</td>
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<td>2</td>
<td>irregularly</td>
<td>1 semester</td>
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</tbody>
</table>

#### 1 Courses
- Lecture + Tutorial *Multivariate Verfahren*
- Seminar

#### 2 Contact time
- 2+1 h/week (45 h)
- 2 h week/ (30 h)

#### 3 Self-study
225 h

#### 4 Course size
20 students

#### 2 Learning Objectives
Aim of the module is to provide an in-depth insight into methods and problems of multivariate statistics. Students acquire advanced methodological knowledge. The courses also teach students how to implement the considered methods in R.

#### Competences
Students are prepared to thoroughly understand and judge respective methods from a theoretical, as well as from a practical, point of view. They learn to condense the vast amount of literature within a short thesis.

#### 3 Content
- Statistical methods for multidimensional problems
- Structure detection methods (Principal component analysis, factor analysis, cluster analysis)
- Tests for multivariate structure (Conjoint analysis, confirmatory factor analysis)
- Graphical tools for analysing multidimensional data

#### 4 Type of courses
- Lecture and Tutorial
- Seminar

#### 5 Requirements
- **Formal:** /  
- **Prerequisites:** Solid Knowledge of basics statistics and survey statistics

#### 6 Assessment
- “Prüfungsvorleistung” and thesis

#### 7 Requirements for CPs
- Passing the assessment

#### 8 Contact person
- Prof. Dr. Ralf Münnich
## Statistical Modeling

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<th>CP</th>
<th>Semester</th>
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<td>300</td>
<td>10</td>
<td>2</td>
<td>irregularly</td>
<td>1 semester</td>
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</tbody>
</table>

### Courses
- Lecture + Tutorial *Statistical Modeling*
- Seminar

### Contact time
- 2+1 h/week (45 h)
- 2 h week/ (30 h)

### Self-study
- 225 h

### Course size
- 20 students

### Learning Objectives
Aim of the module is to provide an in-depth insight into methods and problems of statistical modelling. Students acquire advanced methodological knowledge. The courses also teach students how to implement the considered methods in R.

### Competences
Students are prepared to thoroughly understand and judge respective methods from a theoretical, as well as from a practical, point of view. Further, they learn how to write empirical or methodological articles and prepare these formally ready for submission to a journal.

### Content
- Different statistical models for economic and social research problems
- Generalized linear regression models
- Mixed models
- Robust methods
- Taking account of the survey design in statistical modelling

### Type of courses
- Lecture and Tutorial
- Seminar

### Requirements
**Formal:** /
**Prerequisites:** Solid Knowledge of basics statistics and survey statistics

### Assessment
"Prüfungsvorleistung" and thesis

### Requirements for CPs
- Passing the assessment

### Contact person
- Prof. Dr. Ralf Münnich
# Experimental Design

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<tr>
<th>ID</th>
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<td>300</td>
<td>10</td>
<td>2</td>
<td>irregularly</td>
<td>1 semester</td>
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</tbody>
</table>

## 1 Courses
- Lecture + Tutorial *Experimental Design*
- Seminar

## 2 Contact time
- 2+1 h/week (45 h)
- 2 h week/ (30 h)

## 3 Self-study
- 225 h

## 4 Course size
- 20 students

## 2 Learning Objectives
Aim of the module is to provide an in-depth insight into methods and problems of experimental design. Students acquire advanced methodological knowledge. The courses also teach students how to implement the considered methods in R.

### Competences
Students are prepared to thoroughly understand and judge respective methods from a theoretical, as well as from a practical, point of view.

## 3 Content
- Different designs for experimental analysis in economics and social sciences
- Methodological issues and applications

## 4 Type of courses
- Lecture and Tutorial
- Seminar

## 5 Requirements
**Formal:** /
**Prerequisites:** Solid Knowledge of basics statistics and survey statistics

## 6 Assessment
"Prüfungsvorleistung" and thesis

## 7 Requirements for CPs
Passing the assessment

## 8 Contact person
Prof. Dr. Ralf Münnich
## Modern Methods in Statistics

<table>
<thead>
<tr>
<th>ID</th>
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<th>CP</th>
<th>Semester</th>
<th>Scheduled</th>
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<td>10</td>
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<td>irregularly</td>
<td>1 semester</td>
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</tbody>
</table>

1. **Courses**
   - Lecture + Tutorial *Modern Methods of Statistics*
   - Seminar

2. **Contact time**
   - 2+1 h/week (45 h)
   - 2 h week/ (30 h)

3. **Self-study**
   - 225 h

4. **Course size**
   - 20 students

### Learning Objectives

Aim of the module is to provide an in-depth insight into cutting-edge methods and problems of statistics. Students learn to autonomously acquire and present the current state of research in a specific area. They furthermore gain advanced methodological knowledge in a topical research field.

#### Competences

Students are prepared to thoroughly understand and judge respective methods from a theoretical, as well as from a practical, point of view.

### Content

Specific up-to-date problems and methods in selected areas of statistics

### Type of courses

Lecture and Tutorial

Seminar

### Requirements

**Formal:** /

**Prerequisites:** Solid Knowledge of basics statistics and survey statistics

### Assessment

“Prüfungsvorleistung” and thesis

### Requirements for CPs

Passing the assessment

### Contact person

Prof. Dr. Ralf Münnich
## Optimization Methods in Statistics

<table>
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<tr>
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<td>300</td>
<td>10</td>
<td>2-3</td>
<td>irregularly</td>
<td>1 semester</td>
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</tbody>
</table>

### Courses
- Lecture + Tutorial
- Seminar

### Contact time
- 2+1 h/week (45 h)
- 2 h week/ (30 h)

### Self-study
- 225 h

### Course size
- 20 students

### Learning Objectives
The course aims at providing insights in different optimization methods used in modern statistics. Statistical methods become more and more sophisticated. Often, closed form solutions are not easily attainable anymore. This module covers different optimizations methods and algorithms used in practice to find numerical solutions in such cases.

### Competences
Students are prepared to thoroughly understand and judge respective methods from a theoretical, as well as from a practical, point of view.

### Content
Different up to date optimization methods in statistics used for, e.g., Support Vector Machines, and LASSO regression.

### Type of courses
- Lecture and Tutorial
- Seminar

### Requirements
**Formal:** /
**Prerequisites:** Solid Knowledge of basic statistics and mathematics and a strong interest in optimization. Depending on the topics covered, possible further prerequisites will be communicated.

### Assessment
“Prüfungsvorleistung” and Thesis/Poster

### Requirements for CPs
Passing the assessment

### Contact person
Prof. Dr. Ralf Münnich
### Statistical Literacy

<table>
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#### Courses
- Lecture + Tutorial
- Seminar

<table>
<thead>
<tr>
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<th>Self-study</th>
<th>Course size</th>
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<td>2+1 h/week (45 h)</td>
<td>225 h</td>
<td>20 students</td>
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<tr>
<td>2 h week/ (30 h)</td>
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#### Learning Objectives/Competences

Aim of this module is the ability to present elaborate statistical results in an appropriate and understandable manner. Students learn to process, express and visualize methods and findings of state-of-the-art research. It also aims at strengthening the ability to read and critically judge published statistical findings.

**Competences**

Students are prepared to thoroughly understand and judge respective methods from a theoretical, as well as from a practical, point of view. They learn to condense the vast amount of literature within a short thesis.

#### Content

Specific up-to-date methods and visualization techniques in selected areas of statistics.

#### Type of courses

- Lecture and Tutorial
- Seminar

#### Requirements

Formal: /  
Prerequisites: Solid Knowledge of basics statistics and survey statistics

#### Assessment

“Prüfungsvorleistung” and Thesis/Poster

#### Requirements for CPs

Passing the assessment

#### Contact person

Prof. Dr. Ralf Münnich
Topic Statistics: Applications

Learning Objectives/Competences
All modules under the heading Statistics: Applications are elective. They provide the opportunity to set a specific individual focus.

Content
Students can select from a range of different courses so that they can set a specific focus depending on their individual interests and carrier plans. They have the opportunity to further deepen and broaden their methodological knowledge by opting for additional modules from the topic Statistics. Alternatively, they can select courses from an area of application such as social sciences, economics or geography. Finally, there is the opportunity to specialize in methods and problems of official statistics in Europe by electing the module Official Statistics.

Further information
All modules are elective modules. Students can choose from the modules on the following pages. Alternatively, they can select a further module from the topic Statistics.
### Application

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<td>Depends on the courses elected</td>
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<table>
<thead>
<tr>
<th>Learning Objectives</th>
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<tbody>
<tr>
<td>This module gives students the opportunity to set a specific focus depending on their individual interests and carrier plans. They have the opportunity to further deepen and broaden their methodological knowledge by opting for additional modules from the topic Statistics. Alternatively, they can select courses from an area of application such as social sciences, economics or geography.</td>
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<table>
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<td>Prof. Dr. Ralf Münnich, N.N.</td>
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EMOS

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<td>10</td>
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<td>irregularly</td>
<td>1 semester</td>
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</table>

1 Courses
   Different lectures

   Contact time
   2 h/week
   or
   EMOS summer/spring school

   Self-study
   120 h

2 Learning Objectives
   The EMOS core module covers topics of European Official Statistics and aims at providing a broad overview on the ESS, the data production process as well as on methods for analysing the data and presenting respective results.

   Competences
   Students are prepared to thoroughly understand and judge respective methods from a theoretical, as well as from a practical, point of view.

3 Content

4 Type of courses
   Weekly lecture or EMOS summer/spring school

5 Requirements
   Formal: /
   Prerequisites: Solid Knowledge of basics statistics

6 Assessment

7 Requirements for CPs
   Passing the assessment

8 Contact person
   Prof. Dr. Ralf Münnich, N.N.

9 Further information
   Courses are provided in cooperation of the Bamberg/Berlin/Trier network and Official Statistics. The module can be substituted by an EMOS spring or summer school.
# Modul Research Project

## Survey Statistics: Research Project

<table>
<thead>
<tr>
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<th>Workload</th>
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<th>Semester</th>
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<td>annually</td>
<td>1 semester</td>
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</table>

### Courses
- Colloquium/Seminar

<table>
<thead>
<tr>
<th>Contact time</th>
<th>Self-study</th>
<th>Course size</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 h/week (30 h)</td>
<td>270 h</td>
<td>Up to 5 students</td>
</tr>
</tbody>
</table>

2. **Learning Objectives/Competences**

   In this module, students can either participate in an existing research project or autonomously pursue and answer a specific research question in an individual project. They, therewith, gain experiences in planning and conducting statistical research.

   **Competences**
   
   Students practice the intensive engagement with a complex statistical problem, the implementation of respective methods in R, and the writing of a scientific thesis. Alternatively, in the EMOS context, the students are expected to conduct a research project and an internship in official statistics.

3. **Content**

   The topic is chosen after consultation with the individual advisor.

4. **Type of courses**

   Individual counselling, meetings in small groups, seminar, colloquium

5. **Requirements**

   **Formal:** /
   
   **Prerequisites:** Solid Knowledge of basic survey statistics

6. **Assessment**

   Presentation of intermediate and final results; research report

7. **Requirements for CPs**

   Passing the assessment

8. **Contact person**

   Prof. Dr. Ralf Münnich, N.N.

9. **Further information**

   This module is mandatory.

   Upon request, the module can be substituted by an internship or by the assistance in a research project (at least 3 month). In this case the assessment is a report, which contains an adequate statistical-methodological part.
## Modul Master’s thesis

### Master's thesis

<table>
<thead>
<tr>
<th>ID</th>
<th>Workload</th>
<th>CP</th>
<th>Semester</th>
<th>Scheduled</th>
<th>Duration</th>
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<td>Annualy</td>
<td>1 semester</td>
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- **Courses**
  - Research Colloquium
  - Master's thesis

- **Contact time**
  - 1 h week/ (15 h)
  - 1 h week/ (15 h)

- **Self-study**
  - 720 h

- **Course size**
  - 15 students
  - 1 student

### 2 Learning Objectives/Competences
Writing of a scientific thesis. Presentation skills.

### 3 Content
The topic is chosen after consultation with the individual advisor.

### 4 Lehrformen
Individual counselling, colloquium

### 5 Requirements
**Formal:** Survey Statistics: Basis and Monte-Carlo-Methods plus 30CP
**Prerequisites:** /

### 6 Assessment
Presentation of immediate results, thesis

### 7 Requirements for CPs
Passing the assessment

### 8 Contact person
Prof. Dr. Ralf Münnich, N.N.

### 9 Further information
This module is mandatory.
Possibility of cooperating with a statistical institution (e.g. Eurostat, ESS).