Course syllabus: Causal Inference in Sociology

1. General information
The course consists of 7.5 ECTS credit and is at advanced level in Sociology

2. Popular description
Correlation is not causation, this has since long been known to analysts in the social sciences. The ultimate method to obtain causal estimates is to conduct an experiment with treatment and control groups. In the social sciences, experiments may be used in some contexts, but often this alternative is not applicable or even inappropriate because the experimental situation in itself is too synthetic and deviates from normal life. Analysts thus have to work with observational data, which often miss information crucial for making causal interpretations of statistical associations. However, under some circumstances and subject to specific assumptions, one can interpret estimated associations as casual with substantially higher confidence. This course deals with methods that can be used under such circumstances and subject to the specific assumptions. The course offers practical skills in implementing these methods and the theoretical skills needed to understand and value evidence from them.

3. Decision
2013-01-31

4. Entrance qualifications
Course applicants should have completed the advanced level courses Quantitative Methods in the Social Sciences, or the equivalent. Equivalent knowledge must be verified to the course manager at the time of the application. Admitted students can expect only limited practical help with the computer-based assignments in the course. NB: We use the statistical software Stata for all instructions and assignments. The support we are able to offer is dedicated to learning new routines, not managing basic programming.

5. Course contents
The course deals with counterfactual models in quantitative social science. By counterfactual models we mean models that include attempts to handle endogeneity, selection and/or reverse causation through research design. The models can be described as special cases of an overarching counterfactual framework which is inspired by the lingua of experimental research. The course deals with the following methods:

1. Experiments, the ideal-typical reference
2. Instrumental variables (the Wald estimator and 2SLS)
3. Difference in differences (DD) and its variants, and fixed effects methods (FE)
4. Regression discontinuity (classical and fuzzy)

Each of these methods is built on assumptions in order to identify the supposedly causal effect. These assumptions are critical to the interpretation of quantitative estimates, and not
empirically testable. A great deal of the course revolves around the different assumptions invoked when using counterfactual models.

6. Expected learning outcomes
The course has two different expected learning outcomes. After the course, the student is expected to be able to
a. Conduct analyses based on a counterfactual design, i.e., use, and interpret output from, counterfactual models
b. Describe and explain the counterfactual designs work, including:
   – Understand the motivation for and the theoretical underpinnings of common counterfactual designs
   – Critically examine and discuss internal and external validity in relation to common counterfactual models
   – Discuss merits and limitations of counterfactual designs for specific research topics

7. Course organization and instruction
The course is provided at half time during 10 weeks. The course is organized around 4 mandatory assignments, with introductory and thematic lectures and voluntary computer laboratories as supplementary learning resources.

7.1. Course assignments
There are four mandatory written assignments. Three computer assignments deal with methods 2-4 listed under Course contents, where students perform estimation on a provided dataset, write a short report, and write a summary of a published work using the design/methodology focused on. The assignment report may contain a maximum of 2,000 words, and are to be handed in by teams with two students in each team. The composition of the student teams are changed for each assignment and decided by the teacher. In addition to handing in assignments, groups are expected to contribute to a critical discussion of the methodology of a specified published work using the design/methodology in focus.

The assignments are organized around peer review: for the computer assignments, teams are paired and shall provide constructive comments and, if applicable, also practical help during the work with the assignments.

Assignments 1-3 are graded according to the following scale: Pass (P) Fail (F).

The fourth assignment is to individually write a critical examination of published work in a research field of the student’s choice. The review should identify gaps in the literature with regard to the causal effect of some variable X on Y, and thereby identify opportunities to contribute to research in this field with a research design employing a design (or possibly a combination of designs) covered in the course. The assignment should contain a description of the design’s logic and indentifying assumptions, a realistic plan to collect/find real data using this design, and a discussion of strengths and weaknesses of such a research endeavor in relation to its potential contribution to the accumulated knowledge in the research field. The focus of this assignment should be on the application of a design on a specific case. In
other words – the research design, its identifying assumptions, and how reasonable these assumptions are – should NOT be described in generic terms but be related to the specific case. The maximum number of words is 3,000. This individual assignment is presented orally and discussed at a seminar well in advance of the final deadline. As for the computer assignments, students are organized in peer-review groups and shall provide constructive comments during the work with it.

Assignment 4 is graded according to the scale A-F (cf. grading criteria below), and forms the main basis for the individual grades on the course. In order to receive at least grade E on the entire course, assignments 1-3 all have to be graded P, and assignment 4 needs to receive at least grade E.

In sum, each assignment involves giving peer-review during the work with the assignment, writing a report, and contributing to a critical discussion on the seminars.

All assignments are to be uploaded to the Mondo course site no later than 10.00, June 7, 2017. If a student fails to meet this deadline or submits at least one assignment with substantial errors, s/he may (re)submit a (revised) assignment no later than 10.00, December 7, 2017. At this point in time the course teachers will assess the grading of the student’s revised assignments. If a student fails yet again on this occasion, assessment of revised assignments will take place the next time the course is given.

7.2. Instruction
Introductory meetings and seminars for course assignments
Instructions for the assignments (1) through (4) are given at the assignment preparations, where student teams and peer-review team-pairs are organized. These student teams will change across assignments. The assignments are additionally presented at seminars where the course instructors give feedback.

Lectures
The course offers four lectures:
1. Lecture 0
   a. Introduction to counterfactual models
   b. Orientation on the course structure
2. Lecture 1: Difference in differences and fixed effects methods
3. Lecture 2: Instrumental variables
4. Lecture 3: Regression discontinuity
5. Lecture 4: The history of counterfactual modeling and some of the critique it has been subject to.

Computer laboratories
We offer five different computer laboratories with a focus in practical skills needed in order to conduct assignments (1) to (3). The topics of the laboratories are:
1. Difference in differences (DD) and fixed effects regressions
2. Instrumental variables
3. Regression discontinuity
The laboratories are semi-interactive, with a mix of teacher provided instruction and work on assignments.

Course schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Room</th>
<th>Content</th>
<th>Teacher(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tue March 21</td>
<td>13-15</td>
<td>B900</td>
<td>Lecture 0</td>
<td>MB</td>
</tr>
<tr>
<td>Wed March 22</td>
<td>10-12</td>
<td>B900</td>
<td>Lecture 1+Lab prep</td>
<td>MH</td>
</tr>
<tr>
<td>Tue March 28</td>
<td>12-14</td>
<td>B397</td>
<td>Self managed lab 1</td>
<td>-</td>
</tr>
<tr>
<td>Wed March 29</td>
<td>10-12</td>
<td>B397</td>
<td>Lab feedback+Assignment 1 prep</td>
<td>MH</td>
</tr>
<tr>
<td>Wed April 5</td>
<td>13-15</td>
<td>B397</td>
<td>Reserved time for student peer review, Assignment 1</td>
<td>-</td>
</tr>
<tr>
<td>Fri April 7</td>
<td>10.00</td>
<td>-</td>
<td>Deadline Assignment 1</td>
<td>-</td>
</tr>
<tr>
<td>Tue April 11</td>
<td>13-15</td>
<td>B900</td>
<td>Lecture 2+Lab prep</td>
<td>MB</td>
</tr>
<tr>
<td>Wed April 12</td>
<td>10-13</td>
<td>B900</td>
<td>Seminar on Assignment 1 + article seminar</td>
<td>MH</td>
</tr>
<tr>
<td>Wed April 12</td>
<td>13-15</td>
<td>B397</td>
<td>Self managed lab 2</td>
<td>-</td>
</tr>
<tr>
<td>Thur April 13</td>
<td>13-15</td>
<td>B397</td>
<td>Lab feedback + Assignment 2 prep</td>
<td>MB</td>
</tr>
<tr>
<td>Wed April 19</td>
<td>13-15</td>
<td>B397</td>
<td>Reserved time for student peer review, Assignment 2</td>
<td>-</td>
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<tr>
<td>Fri April 21</td>
<td>10.00</td>
<td>-</td>
<td>Deadline Assignment 2</td>
<td>-</td>
</tr>
<tr>
<td>Tue April 25</td>
<td>13-16</td>
<td>B900</td>
<td>Seminar on Assignment 2 + article presentations</td>
<td>MB</td>
</tr>
<tr>
<td>Wed April 26</td>
<td>10-12</td>
<td>B900</td>
<td>Lecture 3+Lab prep</td>
<td>MH</td>
</tr>
<tr>
<td>Wed April 26</td>
<td>13-15</td>
<td>B397</td>
<td>Self managed lab 3</td>
<td>-</td>
</tr>
<tr>
<td>Fri April 28</td>
<td>13-15</td>
<td>B397</td>
<td>Lab feedback+Assignment 3 prep</td>
<td>MH</td>
</tr>
<tr>
<td>Wed May 3</td>
<td>13-15</td>
<td>B397</td>
<td>Reserved time for student peer review, Assignment 3</td>
<td>-</td>
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<tr>
<td>Fri May 5</td>
<td>10.00</td>
<td>-</td>
<td>Deadline Assignment 3</td>
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<tr>
<td>Tue May 9</td>
<td>13-15</td>
<td>B900</td>
<td>Lecture 4 + Assignment 4 prep</td>
<td>MB</td>
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<td>Wed May 10</td>
<td>10-13</td>
<td>B900</td>
<td>Seminar on Assignment 3 + article presentations</td>
<td>MH</td>
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<tr>
<td>Tue May 16</td>
<td>13-15</td>
<td>B900</td>
<td>Reserved time for student peer review, Assignment 4</td>
<td>-</td>
</tr>
<tr>
<td>Fri May 19</td>
<td>10.00</td>
<td>-</td>
<td>Deadline for Assignment 4 drafts</td>
<td>-</td>
</tr>
<tr>
<td>Wed May 24</td>
<td>13-17</td>
<td>B800</td>
<td>Seminar on Assignment 4</td>
<td>MB, MH</td>
</tr>
<tr>
<td>Wed June 7</td>
<td>10.00</td>
<td>-</td>
<td>Final submission deadline for all assignments</td>
<td>-</td>
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8. Examination

The grading criteria are hierarchical (to receive a higher valued grade, all requirements of the lower levels need to be fulfilled for a higher grade), and are qualitatively different.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Expected learning outcome (a): Describe and explain counterfactual research designs</th>
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<tbody>
<tr>
<td>A</td>
<td>The student can independently identify opportunities for unexploited counterfactual research designs for a specific research topic, and discuss and weight merits and limitations of these.</td>
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<tr>
<td>B</td>
<td>The student can independently discuss issues of internal and external validity of counterfactual designs for a specific research topic.</td>
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<tr>
<td>C</td>
<td>The student can provide a clear account of the theoretical underpinnings of counterfactual designs for a specific research topic.</td>
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<tr>
<td>D</td>
<td>The student can give a clear account of the problems involved in the estimation of causal effects using observational data and motivate the use of counterfactual research designs for a specific research topic.</td>
</tr>
<tr>
<td>E</td>
<td>The student can use, and interpret output from, counterfactual research designs. The student can describe and explain the basics of counterfactual research designs. The student has completed all mandatory assignments and has provided peer review feedback on other students' assignment drafts.</td>
</tr>
<tr>
<td>Fx</td>
<td>The student makes errors in describing, or explaining, counterfactual research designs. The student makes errors in the use, or the interpretation of output from, counterfactual research designs.</td>
</tr>
<tr>
<td>F</td>
<td>The student cannot describe and explain counterfactual research designs. The student cannot use, or interpret, output from counterfactual research designs. The course has to be taken in its entirety at a later point in time.</td>
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</tbody>
</table>
9. Literature

There is one course book that is required reading. In addition to the book, articles some of which are listed below will have to be read in advance of lectures/seminars. The teachers will give reading instructions during the course.

Course book (required reading)


Articles (this list may be subject to change)

**Diff-in-Diff and Fixed Effects**


**Instrumental Variables**

[http://asr.sagepub.com/content/74/3/484.short](http://asr.sagepub.com/content/74/3/484.short)


**Regression Discontinuity**


Reference literature