



**POLS3004 – 2017-2018  
Causal Analysis**

<b>Lecturer:</b>	Dr. Tom O’Grady
<b>Office Hours:</b>	Mondays, 9-11am (29/30 Tavistock Square, B.13)
<b>Teaching Assistant:</b>	Philipp Broniecki
<b>Teaching:</b>	20 hours of lectures, 10 hours of seminars/computer tutorials
<b>Credits:</b>	0.5 Course Units/ 4 US Credits/ 7.5 ECTS Credits
<b>Assessment Method:</b>	One 3,000 word essay (100%)
<b>Essay Deadlines:</b>	Tuesday 9 <sup>th</sup> January, 2pm
<b>Attendance:</b>	Attendance is compulsory at all lectures and seminars for which students are timetabled. Attendance will be monitored and no student will be entered for assessment unless they have attended and pursued the module to the satisfaction of the department.

**USEFUL LINKS**

**Lecture and Seminar Times:**

Online Timetable at [www.ucl.ac.uk/timetable](http://www.ucl.ac.uk/timetable)

**UG Student Intranet**

<http://www.ucl.ac.uk/political-science/intranet/ug>

**Extenuating Circumstances**

<http://www.ucl.ac.uk/political-science/intranet/ug/pastoral/extenuating-circumstances>

**Penalties for Late Submission and Overlength Essays**

<http://www.ucl.ac.uk/political-science/intranet/ug/essays/lateness-word-penalties>

**Essay Submission Information**

<http://www.ucl.ac.uk/political-science/intranet/ug/essays/submission-return>

**Essay Writing, Plagiarism and TurnItIn**

<http://www.ucl.ac.uk/political-science/intranet/ug/essays/writing-skills>

<http://www.ucl.ac.uk/political-science/intranet/ug/policies/plagiarism>

<http://www.ucl.ac.uk/Library/CitationPlagiarism.doc>

## Content

This module introduces the rapidly-growing field of causal inference. Increasingly, social scientists are no longer willing to merely establish correlations and assert that these patterns are causal. Instead, there is a new focus on *design-based inference*, designing research studies in advance so that they yield causal effects. We will begin by asking what it means for  $X$  to cause  $Y$ , using the framework of potential outcomes. We will then look at the most popular research designs in causal analysis, including experiments (also known as randomised control trials), natural experiments that we can analyse with instrumental variables and regression discontinuity techniques, and causal inference over time with difference-in-differences and synthetic control. We will also evaluate 'observational' methods -- regression and the related technique of matching -- from the standpoint of causal inference. This course has a hands-on, practical emphasis. Students will learn to design effective studies and implement these methods in R, and will become critical consumers and evaluators of cutting-edge research. Examples will be drawn from economics, political science, public health and public policy. By the end of the module, students will be able to:

- Understand the concept of causation in the social sciences
- Distinguish between observational and causal analysis
- Design research studies that can yield causal effects
- Implement a range of techniques of causal analysis including experiments, matching, instrumental variables, regression discontinuity, difference-in-differences and synthetic control
- Evaluate the advantages and disadvantages of different research designs and methods
- Critically read and evaluate quantitative journal articles in the social sciences

## Lectures and tutorials

Each week there will be an introductory lecture followed by a tutorial. The lecture will last two hours and the tutorial will last one hour. The lectures will introduce students to many of the ideas and issues relating to the various topics. The tutorials will be largely computer-based, learning to implement the techniques in R.

Lectures: Birkbeck Malet Street B29, Thursdays 2pm - 4pm

Tutorials: Thursdays 4-5pm (Group 1, with Philipp), Bedford Way (26) 316

Thursdays 5-6pm (Group 2, with Tom), Chadwick Building 2.23

## Assessment

The module is assessed through the completion of one essay, consisting of a combination of secondary data analysis and written exercises that test your knowledge of research design and ability to critique research papers. It accounts for 100% of the marks on the module. The essay must be a **maximum of 3,000 words**. Please include the word count at the top of the essay. The deadline is **Tuesday 9<sup>th</sup> January 2018, 2pm**

You will find useful guidance for writing and presenting essays on the SPP student website. These guidelines are designed to help you, and you should read them carefully and do your best to follow them. Good essays give clear and focused answers to the question asked, they have clear structures, and they will be adequately and appropriately referenced. They do not provide a vague and unstructured discussion of the topic. Plagiarism is taken extremely seriously and can disqualify you from the module (for details of what constitutes plagiarism see <http://www.ucl.ac.uk/current-students/guidelines/plagiarism>). If you are in doubt about any of this, ask the tutor.

## Other non-assessed work

The tutorials will allow students to apply and test their knowledge of the material covered on the module. You will be assigned problem sets, which may take longer to complete than the one-hour slot. If you do not finish during class time, you are recommended to finish them in your own time. Full solutions will be posted on the

course Moodle page. Towards the middle of term, there will also be an opportunity to hand in a practice evaluation of published research for assessment. This will enable feedback that will help with performance on the final essay.

## Reading list

In order to fully understand of the concepts and techniques taught in this module, students will need to do background reading. Causal analysis is a relatively new and rapidly-evolving field. As such, there is no single textbook that covers the whole course, although we will read much of Gerber and Green's book on experiments and Angrist and Pischke's textbook on causal inference, both listed below. Other required readings on the techniques that we cover are drawn from a variety of other textbooks and journal articles. In addition, students must also read applied journal articles that implement the methods we learn about. Required articles are listed for each week. It is strongly advisable to get into the habit of reading these, since the final essay will involve (in part) a critical analysis of published research. It is not always necessary to read and understand every detail of each article; focus on how and why they apply the methods we learn about, and whether or not they do a good job.

The main textbooks for this course are:

- Alan S. Gerber and Donald P. Green. *Field Experiments: Design, Analysis and Interpretation*, WW Norton and Co., 2012
- Joshua D. Angrist and Jorn-Steffen Pischke. *Mastering Metrics: The Path from Cause to Effect*, Princeton University Press, 2015

Many other textbooks cover parts of the course, often in a more advanced fashion. Here's a list of works to consult for more information on certain topics; we'll also read individual chapters from some of them:

- Joshua D. Angrist and Jorn-Steffen Pischke. *Mostly Harmless Econometrics: An Empiricist's Companion*, Princeton University Press, 2009
- James Druckman, Donald Green, James Kuklinski and Arthur Lupia (eds.). *Cambridge Handbook of Experimental Political Science*, Cambridge University Press, 2011
- Thad Dunning. *Natural Experiments in the Social Sciences: A Design-Based Approach*. Cambridge University Press, 2012
- Guido Imbens and Donald Rubin. *Causal Inference for Statistics, Social and Biomedical Sciences: An Introduction*. Cambridge University Press, 2015
- Peter John. *Field Experiments in Political Science and Public Policy: Practical Lessons in Design and Delivery*. Routledge, 2017
- Stephen L. Morgan and Christopher Winship. *Counterfactuals and Causal Inference: Methods and Principles for Social Research 2<sup>nd</sup> ed.* Cambridge University Press, 2014
- Rebecca Morton and Kenneth Williams. *Experimental Political Science and the Study of Causality: from Nature to the Lab*. Cambridge University Press, 2010

## Weekly Outline

### Week 1. Causation and Randomised Experiments

We'll develop a counterfactual model of causation that explains the distinction between correlation and causation, illustrated by epidemiological debates about diets and health outcomes. We'll use the model to examine why randomised experiments offer a solution to the "fundamental problem of causal inference", and we'll learn how to analyse experiments using average treatment effects.

#### Required Reading:

- Gerber and Green, Chapters 1 and 2.1-2.6
- Gary Taubes, "Do We Really Know What Makes Us Healthy?", *New York Times Magazine*, 16<sup>th</sup> September 2007. Available at: <http://www.nytimes.com/2007/09/16/magazine/16epidemiology-t.html>

**Supplementary Reading:**

- Angrist and Pischke, Chapter 1
- Imbens and Rubin, Chapters 1-2

**Week 2. Randomised Experiments: Internal Validity**

Experiments are statistically simple, but complex to administer in practice. We'll cover the concept of internal validity: does an experiment truly uncover a causal effect? We'll learn how to use balance tests to detect failures of randomisation, as well as how to cope with attrition. A famous experiment on class size reduction in primary schools provides a key example of the challenges of achieving internal validity in practice.

**Required Reading:**

- Gerber and Green, Chapters 2.7, 4.3-4.4 and 7
- Alan Krueger (1999). "Experimental estimates of education production functions." *Quarterly Journal of Economics* 114 (2): 497-532 [focus on pp. 497-517]

**Supplementary Reading:**

- Gerber and Green, Chapter 8
- Morton and Williams, Chapter 7.1-7.2

**Week 3. Randomised Experiments: External Validity**

The aim of experiments is to learn about causal effects in the real world, but they may take place in artificial settings or on samples that differ from the populations that we care about. We'll ask how much we can hope to learn from experiments, how policy-makers can use experimental results in practice, and what the advantages and disadvantages are of different types of experiments such as lab or field experiments.

**Required Reading:**

- Rose McDermott, "Internal and External Validity", Ch.3 in Druckman *et al* [second half, p. 34 on]
- Dani Rodrik (2008). "The new development economics: we shall experiment, but how shall we learn?" *Harvard Kennedy School Research Paper*
- Brian E. Roe and David R. Just (2009). "Internal and external validity in economics research: trade-offs between experiments, field experiments, natural experiments and field data." *American Journal of Agricultural Economics* 91 (5): 1266-1271
- Jason Barabas and Jennifer Jerit. "Are survey experiments externally valid?" *American Political Science Review* 104 (2): 226-242

**Supplementary Reading:**

- Gerber and Green, Chapter 11
- Morton and Williams, Chapters 7.3-9

**Week 4. Observational Studies and Causal Inference: Matching, Propensity Scores and Regression**

In many cases it is impossible to carry out experiments. Matching, often using propensity scores, offers a close analogy to experiments in an observational setting and involves a similar set of assumptions to regression. We'll learn how to do matching, asking how closely observational methods can approximate experiments. Examples are drawn from literature on smoking and health, and violence in civil wars.

**Required Reading:**

- Angrist and Pischke, Chapter 2 [including Appendix pp. 82-5]
- Elizabeth Stuart (2010). "Matching methods for causal inference: a review and look forward." *Statistical Science* 25 (1), pp. 1-21
- Donald Rubin (2007). "The design versus the analysis of observational studies for causal effects: parallels with the design of randomized trials." *Statistics in Medicine* 26 (1): 20-36

**Supplementary Reading:**

- Angrist and Pischke, *Mostly Harmless Econometrics* Chapter 3
- Imbens and Rubin, Chapters 12-18
- Jason Lyall (2010). "Are co-ethnics more effective counterinsurgents? Evidence from the second Chechen war." *American Political Science Review* 104 (1): 1-20

**Week 5. Compliance, Instrumental Variables and Natural Experiments**

Instrumental variables is a powerful technique that has been used in two different settings. We'll first learn how to use instrumental variables to analyse randomised experiments where some units fail to comply with the experiment. Second, natural experiments - where an outcome occurs randomly without the intervention of the analyst - have become increasingly popular in the social sciences. We'll define natural experiments and learn how to analyse them using the method of instrumental variables.

**Required Reading:**

- Gerber and Green, Chapters 5 and 6
- Angrist and Pischke, Chapter 3

**Supplementary Reading:**

- Angrist and Pischke, *Mostly Harmless Econometrics*, Chapter 4
- Dunning, Chapters 1 and 4

**Week 6. Instrumental Variables and Natural Experiments in Practice**

We'll use recent studies to illustrate how instrumental variables can work when applied to natural experiments and how they can go wrong. We'll discuss studies on the effect of western TV on support for communism in East Germany, the relationship between police numbers and crime, the political impact of the US 'Tea Party' protest movement, and how participation in the Hajj pilgrimage alters the beliefs of Muslims.

**Required Reading:**

- Jens Hainmueller and Holger L. Kern (2009). "Opium for the masses: how foreign media can stabilize authoritarian regimes." *Political Analysis* 17 (4): 377-399
- Steven D. Levitt (1997). "Using electoral cycles in police hiring to estimate the effects of police on crime." *American Economic Review* 87 (3): 270-290
- Madestam *et al* (2014). "Do political protests matter? Evidence from the tea party movement." *Quarterly Journal of Economics* 128 (4): 1633-1685

**Supplementary Reading:**

- David Clingingsmith, Asim Ijaz Khwaja and Michael Kremer (2009). "Estimating the impact of the Hajj: religion and tolerance in Islam's global gathering." *Quarterly Journal of Economics* 124 (3): 1133-1170
- Dunning, Chapters 7-10

**Week 7. Regression Discontinuity Designs**

Regression discontinuity analysis involves a natural experiment where treatment is assigned based on an arbitrary rule, like exceeding a threshold. We'll learn how to do the analysis, looking at a paper on whether British MPs are able to use office to enrich themselves.

**Required Reading:**

- Angrist and Pischke, Chapter 4
- Dunning, Chapter 3
- Andy Eggers and Jens Hainmueller (2009). "MPs for Sale? Returns to Office in Postwar British Politics." *American Political Science Review* 103 (4): 513-533

**Supplementary Reading:**

- Angrist and Pischke, *Mostly Harmless Econometrics*, Chapter 6

**Week 8. Causal Inference over Time: Difference-in-Differences and Fixed Effects**

Difference-in-differences or fixed effects can be used for causal inference with panel data, when a treatment varies over time in some units but not others. We'll look at a very famous example that over-turned economists' thinking on minimum wages.

**Required Reading:**

- Angrist and Pischke, Chapter 5
- David Card and Alan Krueger (1994). "Minimum wages and employment: a case study of the fast food industry in New Jersey and Pennsylvania." *American Economic Review* 84 (4): 772-793

**Supplementary Reading:**

- Angrist and Pischke, *Mostly Harmless Econometrics*, Chapter 5

**Week 9. Synthetic Control Analysis**

The new method of synthetic control is useful for causal inference over time with a small number of units, particularly when the treatment occurs in only one unit. We'll learn how to create a synthetic control case to compare to the treated unit, based on an optimal combination of untreated units. We'll look at applications including the impact of tobacco control measures, German reunification, and deforestation in the Amazon.

**Required Reading:**

- Alberto Abadie, Alexis Diamond and Jens Hainmueller (2015). "Comparative politics and the synthetic control method." *American Journal of Political Science* 59 (2): 495-510
- Alberto Abadie, Alexis Diamond and Jens Hainmueller (2010). "Synthetic control methods for comparative case studies: estimating the effect of California's tobacco control program." *Journal of the American Statistical Association* 105 (490): 493-505
- Sills *et al* (2015). "Estimating the impacts of local policy innovation: the synthetic control method applied to tropical deforestation." *Plos One* 10 (7)

**Week 10. Wrap Up and Revision**

We'll use this week to go back over any outstanding questions from the term, and to help students prepare for the final essay.