Economics

School of Social Sciences

2025-2026

ECON 32252   Econometrics and Data Science

1. Course details

Semesters:	S2
Credit rating:	20
Pre-requisites:	ECON20110 Econometrics (or equivalent)
Lecturer:	Dr Yizhou Kuang, 3.004, Arthur Lewis Building. Questions by email: yizhou.kuang@manchester.ac.uk, or by appointment (see Canvas).
Tutors:	Dr Yizhou Kuang (and teaching team, as advertised on Canvas)
Lecture times and rooms:	2-hour session every week; for details see Canvas
Tutorial times and rooms:	1-hour tutorial session in alternate weeks; for details see Canvas
Practical times and rooms:	1-hour practical/R lab session in alternate weeks; for details see Canvas
Easter break:	30 March 2026 - 19 April 2026
Mode of assessment:	Exam (50%) + Empirical Project (40%) + Homework (10%). Please see Section 4 of this document for important information about assessment.
Deadline for Submission of Assessed Coursework:	See Section 4 below
Examination Periods:	18 May 2026 - 14 June 2026
Re-sit Period:	24 August 2026 - 6 September 2026

2. Aims and Objectives

Aims

The course unit aims to:
    Develop students' understanding of modern empirical methods for causal inference and selected data-science tools used in applied economics.
    Equip students with practical skills for implementing these methods in R and interpreting results responsibly.
    Strengthen students' ability to read, critique, and communicate applied empirical research.

Objectives

By the end of the course, students should be able to:
    Use the potential-outcomes (Neyman-Rubin) framework to define causal estimands and identify assumptions.
    Implement and critically assess common causal-inference designs (matching, RCTs, IV/LATE, and RDD).
    Apply model-selection and regularisation methods (including ridge and lasso) and dimension-reduction tools (PCA).
    Understand the basic logic of binary classification and (introductory) neural-network models and evaluate predictive performance.
    Conduct an empirical project in R, including reproducible code and clear written reporting, and communicate findings to a non-specialist audience.
    Work effectively in a small team, including division of labour, version control practices (where applicable), and peer review.

3. Syllabus and Reading List

Overview of Topics
This is provisional; topics may change somewhat. Some topics may stretch over more than one week.
Indicative topic outline and readings

- Review of causal inference; potential outcomes (Neyman-Rubin) framework. W: 1-4, 3-3a, 3-3b, 9-1, 9-4, 9-5a, 16-2 (review); SC: Ch. 4
- Matching methods. SC: Ch. 5
- Randomised controlled trials (RCTs); instrumental variables (IV) and LATE. AP: Ch. 2 and 4.4
- Regression discontinuity design (RDD). AP: Ch. 6; SC: Ch. 6
- Big data methods: model selection; ridge and lasso; principal component analysis (PCA). JWHT: 6.1 (Model selection), 6.2 (Shrinkage methods: ridge, lasso), 6.3.1 (PCA)
- Binary classification and neural networks. TBC

Recommended reading
Primary readings for the course are the following:

- Scott Cunningham (2021). Causal Inference: The Mixtape. (Yale University Press). (SC)
- Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani (2017). An Introduction to Statistical Learning: With Applications in R, 2nd edition (Springer). (JWHT)
- Angrist, J. D. and J.-S. Pischke (2009). Mostly Harmless Econometrics. (AP)
- Wooldridge, J. (2019). Introductory Econometrics: A Modern Approach. (W)

Intended Learning Outcomes
- understand how empirical data can be used to analyse economic problems and questions;
- understand advantages and limitations of the statistical methods covered in the course unit;
- implement empirical techniques using the statistical software R;
- independently read current empirical research in Applied Economics and communicate it to a non-economist audience;
- critically evaluate applied work in Econometrics and Data Science.

Practical and employability skills developed
- independently identify and assess relevant literature;
- identify suitable empirical techniques for applied research questions in economics and business;
- develop advanced programming skills in R;
- design and implement an empirical project to answer a research question of interest;
- work effectively in a group.

The Use of R

Empirical work with data is central to this unit. The software used is R, an open-source programming language widely used for statistical analysis.

It is assumed that students have a working knowledge of R from prior econometrics/quantitative methods study. Support will be provided through:

> the ECLR online support webpage (as linked on Canvas);
> tutorial and practical sessions where methods are implemented in R;
> drop-in sessions for questions relating to R and empirical work.

Students will be required to use R for the empirical project (40% of the final grade). Early and regular engagement with R is strongly recommended.

Assessments (summary)

The grade for this unit consists of three items:

> Homework (10%) - one group assignment.
> Empirical Project (40%) - group project (1,500 words plus code).
> Exam (50%) - on-campus, 120 minutes; one A4 sheet of handwritten (not photocopied) notes permitted.

Full instructions and submission arrangements will be provided on Canvas.

4. Further information about assessment (Exam + Coursework)

Examinations

Weighting:	50%
Date:	TBA
Length:	2 hours (120 minutes)
Structure:	On-campus, unseen examination. You may bring one A4 sheet of handwritten (not photocopied) notes. Further details (including any permitted materials) will be confirmed on Canvas.
Past examination papers:	Past examination papers (where available) can be accessed via the University past examination papers website. Additional revision materials will be provided on Canvas.

Homework	
Weighting:	10%
Structure:	One homework assignment, to be completed in instructor-assigned groups (the same groups as for the empirical project). The assignment includes conceptual questions and R programming tasks.
Deadline:	2pm on the Friday of Week 6 (exact date/time will be confirmed on Canvas).
Submission:	Submission is via Gradescope (see the Assessment folder on Canvas).
Preparation:	Tutorial exercises are intended as preparation and include both conceptual and coding problems.
Empirical Project	Empirical Project
Weighting:	40%
Structure:	Group project in teams of 3-4. Deliverables: (i) write-up in the format of a short research paper (max 1,500 words); and (ii) reproducible R code. Topics may be original or a replication exercise, subject to instructor approval.
Deadline:	2pm on the Friday of Week 12 (exact date/time will be confirmed on Canvas).

Assessed Coursework

Since assessed coursework must be retained for possible consideration at the Final Examiners' Meeting you should make and keep a copy for yourself. If any possibility of late submission arises through illness or any other good cause, you must inform the relevant lecturer as soon as possible. Penalties, in the form of reduced marks, will be applied for inexcusable lateness in the submission of assessed coursework.

If you submit your course work late there will be a penalty of 10 marks per day (sliding scale) applied for up to 5 days. After which a mark of zero will be awarded for any assessed coursework submitted after the specified date

Assessment criteria

The criteria used by ES in the assessment of examinations and coursework can be found in the following documents.

Degree	**Document**
Undergraduate	Programme Handbooks (available on the SoSS student intranet http://documents.manchester.ac.uk/display.aspx?DocID=35572)

Plagiarism

Plagiarism is presenting the ideas, work or words of other people without proper, clear and unambiguous acknowledgement. It also includes 'self-plagiarism' (which occurs where, for example, you submit work that you have presented for assessment on a previous occasion), and the submission of material from 'essay banks' (even if the authors of such material appear to be giving you permission to use it in this way). Obviously, the most blatant example of plagiarism would be to copy another student's work. Hence it is essential to make clear in your assignments the distinction between:

- the ideas and work of other people that you may have quite legitimately exploited and developed, and

- the ideas or material that you have personally contributed.

Plagiarism is a serious academic offence and the consequences are severe. Guidelines on plagiarism are included in the documents listed above or can be found, together with general guidelines on the university's examinations process, on the Awards and Examinations Office website
http://www.studentnet.manchester.ac.uk/crucial-guide/academic-life/exams//

January exam marks

The marks for January examinations, as issued to undergraduate students by Faculty Office and to graduate students by Programme Directors, are **provisional** marks and are provided for information only.

Students are advised that:

1. these marks may be raised or lowered by the external examiners;
2. once marks have been agreed by the internal examiners and issued to students, they can only be changed via the external examiners;
3. if the mark for a particular exam is both 'marginal' and 'critical' to the overall classification of a student, the exam paper/assessed essay will be referred to the appropriate external examiner;
4. questions of compensation will be dealt with in June, when the full range of results is available;
5. marks are never confirmed until the meeting of the relevant Examinations Board in June;
6. the University does not countenance student appeals against the academic judgements of Examiners;
7. **the grounds on which a student may appeal are specified on the website**
http://www.campus.manchester.ac.uk/ssc/appealspolicies/.