Course syllabus for PhD course

Course part of the research school: People, Society and Sustainability

Department of Economics

Open Quantitative Social Science

Öppen kvantitativ samhällsvetenskap

Higher education credits
5 HEC

Subject
Economics

Course type
Methods course

Language
English

Prerequisites
Accepted as a PhD student in social science/business studies/economics

Course period
27 January 2025 – 28 February 2025

Objective

Upon successful completion of the course, students are expected to:

(i) understand why and how common (mal)practices in scholarly research translate into low levels of replicability and low reliability;

(ii) understand the virtue of confirmatory research and transparent research practices regarding the credibility of research findings;

(iii) establish a thorough understanding of the statistical concepts related to hypothesis testing (error rates, significance, power, etc.);

(iv) be able to undertake a priori power calculations and sensitivity analysis, and to devise pre-analysis plans for research projects; and

(v) be able to critically assess scientific projects and results with respect to malpractices, research integrity, and ethical aspects.

Content and structure

The ultimate goal of scientific research is to accumulate knowledge. Researchers generate hypotheses and collect data in order to investigate whether or not empirical observations are consistent with these hypotheses. However, even though science aspires toward accuracy in this process, errors are inevitable (e.g., Simmons et al., 2011). A fundamental characteristic that sets empirical science apart from other sources of knowledge is the ability to self-correct; any empirical observation is subject to validation and may be shown to be wrong (Merton, 1973; Ioannidis, 2012).

The reproducibility of empirical results constitutes a cornerstone of the scientific method. But as a consequence of accumulative evidence emphasizing low levels of replicability, there is increasing concern that a considerable fraction—or even a majority—of published research claims might be simply false (Ioannidis, 2005). The drivers of this "credibility crisis" are just as manifold as the institutions (researchers, universities, funding agencies, journals, etc.) involved in the academic enterprise: the file drawer effect (Rosenthal, 1979), insufficient statistical power (e.g., Ioannidis et al., 2017), publication bias (e.g., Franko et al. 2014), confirmation bias (Sterling et al., 1995), dodgy incentives in the publication process (e.g., Nosek et al., 2012), p-hacking (e.g., Simmons et al., 2011), etc.

This course aims to provide a critical view on the "rules of a game named science" and provides an introduction to remedies to the manifold issues jeopardizing the credibility of scientific results: power calculations, confirmatory research (pre-registration), and open and transparent research practices (see, e.g., Wagenmakers et al., 2012; Miguel et al., 2014; Munafo et al., 2017).

The course will span five days. Each day will feature a three-hour session in the morning and a three-hour session in the afternoon. The sessions will involve lectures, hands-on exercises, and group discussions.

Examination

The learning outcomes of the lecture part will be assessed based on course participation (i.e., contribution to discussions) and a final exam administered on Friday, February 14, 2025. The seminar part will involve an individual homework assignment (to be handed in by February 28, 2025). Successful completion of both parts will be recognized with 5 credit points.

Contact for application and further information

Felix Holzmeister, Felix.Holzmeister@uibk.ac.at for course content

Jens Rommel, jens.rommel@slu.se for organizational aspects and course registration

Literature (preliminary)

Bishop, D. (2019). Rein in the four horsemen of irreproducibility. Nature, 568(7753).

Christensen, G., Freese, J., & Miguel, E. (2019). Transparent and reproducible social science research: How to do open science. University of California Press.
Ioannidis, J.P.A. (2005). Why Most Published Research Findings Are False. PLoS Medicine, 2(8): e124.

Munafo, M.R., Nosek, B.A., Bishop, D.V.M., Button, K.S., Chambers, C.D., Percie du Sert, N., Wagenmakers, E.-J., Ware, J.J., & Ioannidis, J.P.A. (2017). A Manifesto for Reproducible Science. Nature Human Behaviour, 1: 0021

Additional Information
This course is part of the research school People, Society and Sustainability, a joined research school between the Department of Economics and the Department of Urban and Rural Development.

Tentative Course Schedule

Monday, 10 February 2025, 9-12

Welcome, introduction, a crisis of confidence, modes of "reproducibility", roadblocks to credibility

Monday, 10 February 2025, 13-16

Scientific (behavioral) norms and practices, a dysfunctional research culture, incentives

Tuesday, 11 February 2025, 9-12

Statistical inference (p-values, power, etc.), error control in null hypothesis significance testing

Tuesday, 11 February 2025, 13-16

Power failure (false negative rate, false discovery rate, exaggeration of effect size estimates, etc.)

Wednesday, 12 February 2025, 9-12

Questionable research practices (publication bias, p-hacking, multiple testing, HARKing, etc.)

Thursday, 13 February 2025, 9-12

Targeting threats to credibility, preregistration, registered reports, integrating open science

Thursday, 13 February 2025, 13-16

Research data management, open data, open materials, transparency, reporting guidelines

Friday, 14 February 2025, 9-12

Wrap-up, concluding remarks, final exam, course evaluation, closing ceremony