

The University of Western Ontario

SOCIOLOGY 9007

Advanced Multivariate Statistical Analysis Winter 2023

Wednesdays 9:30am-12:30pm Classes in Room 5235

Professor: Dr. Anders Holm

Office Hours: Wednesdays 1-2:30pm, Department of Sociology, Office: SSC 5327 Email: [aholm@uwo.ca](mailto:aholm@uwo.ca)

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### **Course Description**

This course builds on concepts you have learned in your introductory undergraduate or graduate statistics classes. We will cover some of the most common statistical techniques in the practice of quantitative sociology with particular focus on regression models. These include multivariate linear regression, logistic regression, and fixed effects and random effects models for panel data. We will discuss when and how to use these techniques, as well as the assumptions we make when using them. We will also spend time discussing various pitfalls and extensions to these approaches, including outliers, nonlinearity, multicollinearity, and interaction terms. Throughout the course, we will talk about how to develop an answerable research question, how to select the best modeling strategy for that question, and how to interpret the results of quantitative analysis in light of our hypotheses. In particular we will discuss when results are indicative of causal effects and what the concept of causality really means. We will conduct data analysis using STATA, a commonly-used statistical analysis software package. We will talk through basic issues that come up such as dealing with missing data; saving data, code, and output; and making tables. Finally, we will focus on writing about and presenting on a multivariate analysis of your choosing. A major component of being a quantitative social scientist is the ability to clearly communicate what you did, what you found, and why it matters. Your final project, which you should begin thinking about early in the term, will consist of a paper and accompanying poster that includes the introduction, data and methods, findings, and discussion sections of an academic article.

### **Learning Outcomes**

1. Understand the assumptions made when using linear regression and non-linear.
2. Interpret key results from multivariate models.
3. Conduct analyses using Stata.
4. Critically evaluate published sociological research using the methods we cover.
5. Communicate about the results of your analyses.

### **Course Materials**

Readings: There is no required textbook that you must purchase for this course.

Recommendations for reference books you might find useful are listed below.

Note: I am working with the UWO librarians to get as many of the readings available online before the term as possible. It's my goal that you won't have to spend much (any?) money on books.

Books you may already own from Introductory Statistics

- Agresti, Alan and Barbara Finlay. 2009. *Statistical Methods for the Social Sciences*, 5th edition. Pearson Prentice Hall.

Books I recommend

- Allison, Paul D. 1999. *Multiple Regression: A Primer*. Pine Forge Press.
- Treiman, Donald J. 2009. *Quantitative Data Analysis – Doing Social Research to Test Ideas*. Jossey-Bass.
- Angrist, Joshua, D., and Jorn-Steffen Pischke. 2015. *Mastering Metrics – the Path from Cause to Effect*. Princeton University Press.
- Freedman, David A. 2010. *Statistical Models and Causal Inference – a Dialogue with the social Sciences*. Cambridge University Press.
- Murnane, Richard J. and John B. Willett. 2011. *Methods Matter – Improving the Causal Inference in Educational and Social Science Research*. Oxford University Press.
- Andersen, Robert and David A. Armstrong. 2022. *Presenting Statistical Results Effectively*. Sage.
- Aneshensel, Carol S. 2013. *Theory-Based Data Analysis for the Social Sciences*. Second Edition. Sage.

The readings from the above textbooks listed in the course schedule are optional but highly recommended. Lecture slides and other material will be available before lectures on OWL and they are listed on the day by which you need to have them.

Stata: Throughout the course, we will practice using the statistical package Stata. While you are welcome to purchase your own copy of Stata, you should not need to. There are some funds available in the department to purchase statistical software (Contact Sandra). Stata is accessible on your personal computer using MyVLab (follow the set-up instructions at <https://myvlab.uwo.ca/>). While Stata is not on the list of available software at this website, you should have access to it as a Social Science student through a shortcut on the MyVLab Desktop.

### **Methods of Evaluation and Breakdown**

- Lab assignments (25%): Due February 1<sup>st</sup> in class.
- Midterm exam (35%): March 1<sup>st</sup> in class.

- Empirical Research Paper (40%): Due April 24<sup>th</sup> at 4pm.

### **A Note About Attendance**

Because you cannot actively engage with the materials and your colleagues if you are not here, in order to receive a passing grade, students are expected to attend at least 80% of the class meetings for this course. This requirement will only be waived in exceptional circumstances with documentation. While attendance is not an explicit part of the evaluation breakdown, you will see your final grade lowered if you miss an excessive number of class sessions. Please inform me if you are unable to attend a class for medical or personal reasons.

### **How to Contact Me**

If you have questions about the course content or logistics of the course that could be useful to the rest of the class, please post them to the Forum on OWL. If you have specific questions for me, I can be reached via email at [aholm@uwo.ca](mailto:aholm@uwo.ca). Students are encouraged to come to office hours.

### **How to Get Important information**

You will find course content and announcements posted to our OWL website. I will also announce any upcoming deadlines or changes to the course schedule in class.

### **January 11:** Introduction to linear regression

Chapter 5, Quantitative data analysis, chapter 1, Presenting Statistical Results Effectively, Chapter 2, Methods Matter, chapter 9, Statistical Methods for the Social Sciences.

### **January 18:** Measurements of variables

Chapter 1, Theory based Data analysis for the social sciences, chapter 3, Presenting Statistics results effectively, chapter 3 and 4, Statistical Methods for the Social Sciences

### **January 25:** Introduction to Multiple correlation and regression

Chapter 6 and 7, Quantitative data analysis, chapter 11 and 12, Statistical Methods for the Social Sciences, chapter 5 and 6 and 8 and 9, Presenting Statistics results effectively. Chapter 5, Theory-Based Data Analysis for the Social Sciences, Chapter 3, Statistical Models and Causal Inference.

### **February 1:** Mediators and confounders I

Chapter 2, Mastering metrics, chapter 7, Theory-Based Data Analysis for the Social Sciences.

**February 8:** Mediators and confounders II

Chapter 8, 9 and 10, Theory based Data analysis for the social sciences

**February 15:** Causal effects I

Chapter 3 and 4, Methods Matter, chapter 1, Mastering Metrics, chapter 4, Theory-Based Data Analysis for the Social Sciences, Chapter 8, methods matter. Chapter 20, Statistical Models and Causal Inference.

**February 22:** Reading week

**March 1:** Midterm Exam

**March 8:** Causal effects II

Chapter 3, Mastering Metrics, chapter 10, 11 and 12, Methods Matter.

**March 15:** Introduction to non-linear models I

Chapter 15, Statistical Methods for the Social Sciences, chapter 13, quantitative data analysis, chapter 11, Presenting Statistical Results Effectively.

**March 22:** Introduction to non-linear models II

Chapter 14, Quantitative data analysis, chapter 12, Theory-Based Data Analysis for the Social Sciences

**March 29:** Panel data I

Chapter 15, Quantitative Data Analysis, chapter 7, Methods Matter.

**April 5:** Panel data II

Chapter 5, Mastering Metrics.

**Important Policies**

Assignment Deadlines. Students must submit their assignments by the date and time stated in the course outline and on the OWL website. Late final papers will be penalized 5% points for each day they are late.

### **A Note on Plagiarism**

Students must write their assignments in their own words. Whenever students take an idea from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major scholastic offence. See Scholastic Offences (below) for the link to Scholastic Discipline regulations.

### **Plagiarism Checking**

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com:

<http://www.turnitin.com>

### **Scholastic Offences**

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following web site:

[http://www.uwo.ca/univsec/appeals\\_discipline/index.html](http://www.uwo.ca/univsec/appeals_discipline/index.html)

### **Accommodation**

Western is committed to achieving barrier-free accessibility for all its members, including graduate students. As part of this commitment, Western provides a variety of services devoted to promoting, advocating, and accommodating persons with disabilities in their respective graduate program.

Graduate students with disabilities (for example, chronic illnesses, mental health conditions, mobility impairments) are strongly encouraged to register with Accessible Education Western (AEW), a confidential service designed to support graduate and undergraduate students through their academic program. With the appropriate documentation, the student will work with both AEW and their graduate programs (normally their Graduate Chair and/or Course instructor) to ensure that appropriate academic accommodations to program requirements are arranged. These accommodations include individual counselling, alternative formatted literature, accessible campus transportation, learning strategy instruction, writing exams and assistive technology instruction.

### **Copyright of Lectures and Other Course Materials**

Any materials created by the instructor (e.g., notes, handouts, summaries, slide, assignments, exams, etc.) are protected by copyright law and may not be copied or distributed in any form without the

explicit permission of the instructor. Any non-authorized use of these materials constitutes an academic offence.

### **Completion of Course Requirements**

Course requirements must be completed by the end of the term in which the course is offered (Fall-December 31; Winter-April 30, Summer-August 31). Only in exceptional circumstances may a student take additional time to complete the course requirements. In such a case, the student must first meet with the Graduate Chair to request permission to carry the incomplete. Medical documentation, where required, will be kept on file in the Sociology graduate program office. More details regarding incompletes are outlined in the Graduate Handbook:

[http://www.sociology.uwo.ca/graduate\\_handbook/course\\_information.html](http://www.sociology.uwo.ca/graduate_handbook/course_information.html)

### **Mental Health**

Students who are in emotional/mental distress should refer to Health and Wellness Western for a complete list of options to obtain help: [http://uwo.ca/health/mental\\_wellbeing/](http://uwo.ca/health/mental_wellbeing/) Health and Wellness As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate chair), or other relevant administrators in their unit. The Wellness Education Centre (lower level UCC) assists students in finding mental health and other related resources best suited to their needs: <http://se.uwo.ca/wec.html> Western's School of Graduate and Postdoctoral Studies' Living Well website provides tips for thriving at grad school and other helpful information:

[http://grad.uwo.ca/current\\_students/living\\_well/index.html](http://grad.uwo.ca/current_students/living_well/index.html)

Western provides several on-campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western's Campus Recreation Centre: <http://www.westernmustangs.ca/index.aspx?path=ims#> Numerous cultural events are offered throughout the year. Also, we encourage you to check out the Faculty of Music web page <http://www.music.uwo.ca/>, and our own McIntosh Gallery <http://www.mcintoshgallery.ca/>.

### **Standards of Professional Behaviour**

It is the responsibility of all members of the Department of Sociology to adhere to and promote standards of professional behaviour that support an effective learning environment. These include:

- respect for others both in and out of the classroom through words and actions (be professional, fair, and respectful in interactions with people on-line and in-person; understand and respect differences among classmates and colleagues; avoid disrupting the learning environment; respect others' expectations of confidentiality and privacy)
- active engagement in learning and commitment to quality (being prepared for classes; participating and listening actively to other; using technology and social media appropriately, striving to do your best)

- personal integrity (following through on commitments; doing own work) Students should also be aware of the UWO Student Code of Conduct found at <https://www.uwo.ca/univsec/pdf/board/code.pdf>